

## JRC SCIENCE FOR POLICY REPORT

# Renewables in the EU: the support framework towards a single energy market

*EU countries reporting  
under Article 22(1) b, e  
and f of Renewable  
Energy Directive*

Banja M., Jégard M.,  
Monforti-Ferrario F., Dallemand J.-F.,  
Taylor N., Motola V., Sikkema R.

2017

This publication is a Science for Policy report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.

#### Contact information

Name: Manjola Banja

Address: European Commission, Joint Research Centre, Via Enrico Fermi 2749, I-29027 Ispra (VA), Italy

#### JRC Science Hub

<https://ec.europa.eu/jrc>

JRC110415

EUR 29100 EN

PDF	ISBN 978-92-79-79361-5	ISSN 1831-9424	doi:10.2760/521847
Print	ISBN 978-92-79-79362-2	ISSN 1018-5053	doi:10.2760/69943

Luxembourg: Publications Office of the European Union, 2017

© European Union, 2017

Reuse is authorised provided the source is acknowledged. The reuse policy of European Commission documents is regulated by Decision 2011/833/EU (OJ L 330, 14.12.2011, p. 39).

For any use or reproduction of photos or other material that is not under the EU copyright, permission must be sought directly from the copyright holders.

How to cite this report: Banja M., Jégard M., Monforti-Ferrario F., Dallemand J.-F., Taylor N., Motola V., Sikkema R., *Renewables in the EU: the support framework towards a single energy market - EU countries reporting under Article 22(1) b, e and f of Renewable Energy Directive*, EUR 29100 EN, Publication Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-79361-5, doi10.2760/521847, JRC110415

All images © European Union 2017

#### **Renewables in the EU: the support framework towards a single energy market - EU countries reporting under Article 22(1) b, e and f of Renewable Energy Directive**

The development of renewable energy sources (RES) is a priority for the EU. EU Member States are free to decide how they support RES, so long as they comply with the rules of the EU energy market. The most common support mechanisms for renewable electricity have been feed-in tariffs and feed-in premiums, but recently competitive auctions are becoming increasingly popular. The integration of increasing amounts of variable renewables, such as wind and solar, in electricity grids requires better balancing supply and demand, more grid interconnections and energy storage. The focus of support for renewables used to be in electricity sector but it is also broadening in heating/cooling and transport sectors.

# Contents

Acknowledgements .....	1
Executive summary .....	2
1 Introduction .....	5
2 Data source.....	10
3 Features of support schemes on promotion of RES.....	11
4 Renewable energy in the EU – recent trends .....	13
5 A literature review- promotion of renewables in the EU.....	17
5.1 Effectiveness of renewable energy support policies.....	17
5.2 Relative efficiency of the different types of schemes .....	18
5.3 Sustainability schemes for (solid) biomass .....	19
5.4 Recommendations for policy makers.....	20
6 Support schemes and other measures to promote energy from renewable sources – reporting under Article 22(1) b.....	22
6.1 Overview by technology/source .....	26
6.1.1 Hydropower .....	26
6.1.2 Wind .....	36
6.1.3 Solar photovoltaic .....	46
6.1.4 Biomass.....	56
6.1.5 Heat pumps .....	65
6.1.6 Biofuels .....	69
6.2 Overview by EU country.....	79
6.2.1 Belgium .....	79
6.2.2 Bulgaria .....	82
6.2.3 Czech Republic .....	85
6.2.4 Denmark.....	88
6.2.5 Germany.....	91
6.2.6 Estonia .....	95
6.2.7 Ireland .....	97
6.2.8 Greece.....	100
6.2.9 Spain .....	102
6.2.10 France .....	105
6.2.11 Italy .....	109
6.2.12 Cyprus.....	114
6.2.13 Latvia .....	118
6.2.14 Lithuania.....	120
6.2.15 Luxembourg .....	123
6.2.16 Croatia .....	126
6.2.17 Hungary .....	129
6.2.18 Malta.....	132
6.2.19 Netherlands.....	134
6.2.20 Austria .....	138
6.2.21 Poland .....	141
6.2.22 Portugal.....	144
6.2.23 Romania .....	146
6.2.24 Slovenia .....	150
6.2.25 Slovakia.....	153
6.2.26 Finland .....	155
6.2.27 Sweden .....	158
6.2.28 United Kingdom .....	161
7 Administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy – reporting under Article 22(1) e .....	166
8 Transmission and distribution of renewable electricity and rules for bearing and sharing costs to grid connection – reporting under Article 22(1) f.....	175
9 Support for solar photovoltaic and wind in EU countries.....	181
10 Policy Effectiveness Indicator .....	184
References .....	186
List of figures.....	192
List of tables .....	194
Glossary.....	194
Appendix - Support schemes in the main non-EU European countries .....	197

## Acknowledgements

This report is prepared by the Energy Efficiency and Renewables Unit (C.2), Directorate C — Energy, Transport and Climate — of the European Commission's Joint Research Centre (JRC) under the work done in the Work Package RE-PORT "Monitoring Actual and Foreseeable Renewable Energy Deployment".

The report uses established database data, available for download and sourced from EU Member States' reporting under the Renewable Energy Directive.

Manjola Banja (C.2) and Fabio Monforti - Ferrario (C.5) led the work to maintain the renewable energy database used in this report and keep it updated.

Manjola Banja coordinated and co-authored this report together with Martin Jégard (C.2). Martin Jégard worked on (i) completing the database with the information related to the requirements of Article 22 (1) b, e and f of the Renewable Energy Directive; (ii) preparing the main text of Chapter 6 of this report; (iii) preparing the literature review on the promotion of renewables in the EU; (iv) preparing the data for the analysis in sections 9 and 10 of the report.

Fabio Monforti-Ferrario provided additional input on the support schemes for the promotion of renewable energy in the main non-EU European countries.

The report also benefited from the contribution of the following co-authors from the Energy Efficiency and Renewables Unit, who mainly helped by improving the first version of the report: Jean-François Dallemand (C.2) and Nigel Taylor (C.2).

The report was co-authored with Vincenzo Motola (ENEA) and Richard Sikkema (WUR/ Environmental Science Group) which contributed in the chapter of the overview by EU country.



## Executive summary

**Policy context:** Directive 2009/28/EC on the promotion of the use of energy from renewable sources (RED) commits the EU to achieving a 20 % share of renewable energy in its gross final energy consumption (GFE) by 2020 and a 10 % share of renewable energy in transport energy consumption by the same year. The RED lays down legally binding targets for each Member State for the share of renewable energy and also requires them to include information on the measures taken or planned to promote the growth of renewable energy as well as the functioning of support schemes in their biennial progress reports.

### Key conclusions

The need to integrate higher shares of renewables in the EU energy sector brings into discussion the way the renewable technologies/sources have been supported to date. Support schemes are currently the major drivers for investment in the EU electricity sector, while investments in grid assets are driven mainly by regulation that guarantees investors a reasonable return on equity. The support price-based scheme is mainly determined from administrative procedures based on the main indicators such as deployment targets and costs of renewable generation.

Investments in RES are facilitated by a predictable regulatory framework that reduces the risk for investors and hence the cost of capital. However, incentives must be reduced in line with falling technology costs, in order to avoid over-compensation and rising energy prices.

In 2015, when the most recent set of renewable energy progress reports were submitted, more than 1300 support measures (economic, financial, regulatory, administrative, support) for the development of renewables were in place in the EU countries since 2005.

The support schemes based on administrative procedures have been very successful in scaling up renewable energy deployment throughout Europe. Feed-in tariffs (FIT) and feed-in-premiums (FIP) in the form of grants, bonuses, premiums, etc. are the main support schemes for the deployment of renewable technologies in the EU electricity sector; still in 2015 they were applied in 24 EU countries.

Currently the support levels based on levelised cost of energy have been the most widespread design feature for FIT/FIP schemes throughout the EU countries. Depending on the circumstances in individual countries the implementation of these support schemes is still an ongoing process. The support given using the premium awarded on top of energy market prices expose producers to market risks affecting balancing responsibilities<sup>1</sup> and market price.

The introduction of renewables auctions in some EU countries, replacing administratively set feed-in-tariffs/feed-in premiums/quota, has led to considerably lower prices and very high realization rates. The auction experience in some EU countries as Germany, France, UK, Spain shows that this form of support turn out to be faster and more flexible than administrative procedures in adjusting support levels to cost reductions. To meet additional policy goals, the auction design needs to combine the right elements for the specific market context.

The adoption of effective cost regulation measures aiming at a clear bearing and sharing grid transmission and distribution costs seems to be less of the priority of EU countries. Despite the improvements over years of the administrative procedures for removing of regulatory and non-regulatory barriers when promoting renewable energy a bulk of EU countries lack the implementation of online applications and shortening the times regarding to the connections requests.

### Main findings

- The support schemes in heating/cooling sector remain less widespread and aggressive than those in the electricity and transport sectors. The main type of support scheme in this sector is subsidy;
- The most common type of policy to support biofuels is quota obligation, whereby transport fuel suppliers are obliged to blend in a minimum percentage volume of biofuel. This scheme is combined with tax exemption or certificate schemes;
- The average level of support for solar photovoltaic technology has been larger than the average support for wind power technology;

---

<sup>(1)</sup> Balancing responsibility is defined as "the obligation of a power generator to match its forecasted electricity output in real-time".

- A clear pattern has been found in the relationship “support scheme – deployment” for solar photovoltaic technology. The PEI is higher for applied support in the form of feed-in tariff combined with feed-in premium.
- No clear pattern was found in the relationship “support scheme – deployment” for wind power technology;
- Period after 2013 has seen a reduction in the average level of support for solar and wind power technologies as a response to falling unit costs of generation and the unexpectedly large number of request for feed-in tariff contracts (the case of solar photovoltaic in Italy);
- Almost than two-thirds of the measures implemented since 2005 to support renewable energy deployment in EU countries are financial; almost one-third are regulatory measures; there is also a small number of combined financial, regulatory, infrastructure and soft measures;
- More than half of EU countries have specific administrative procedures to remove the regulatory and non-regulatory barriers for deployment of solar photovoltaic and wind power;
- 9 EU countries (Belgium, Germany, Estonia, Greece, France, Croatia, Cyprus, Lithuania and Romania) have specific support for improving administrative procedures to remove regulatory and non-regulatory barriers for biomass deployment;
- 7 EU countries (Belgium, Germany, Lithuania, Poland, Romania, Sweden and UK) has specific support on costs related to the transmission and distribution of renewable electricity from wind;
- 4 EU countries (Belgium, Italy, Romania and Slovakia) applies specific support on the costs related to the transmission and distribution of renewable electricity from solar photovoltaic;
- 12 EU countries (Belgium, Bulgaria, Germany, Denmark, Greece, France, Italy, Luxembourg, Malta, Netherlands, Sweden and UK) apply "one-stop shops" or automatic permission granting if there are no objections within a fixed time period;
- Many support schemes in the EU electricity sector for renewable energy technologies grant technology-specific support. Only four EU countries: Estonia, the Netherlands, Poland, and Sweden. Poland and Sweden support renewable electricity generation by the means of a green certificate system with no banding factors (all technologies are awarded the same number of certificates per MWh produced). However, it seems that the Estonian authority set quotas for different technologies and Netherlands is prompting for specific support;
- Support schemes on biomass are focusing on the following key areas: efficient low-carbon heat in industry, heat networks, heating and cooling for buildings, and grids and infrastructure;
- A number of EU Member States (Germany, France, Italy, Latvia, Lithuania, Netherlands, Austria, Portugal, Romania, Slovenia, Finland and United Kingdom) have introduced specific support schemes for biomass use in both electricity and heating sectors;
- EU countries as Belgium, Estonia, Slovakia and Sweden have promoted through specific measures the biomass use only in electricity or only in heating/cooling sector;
- Only 4 EU countries (Belgium, Germany, Greece and Lithuania) has specific support for the transmission and distribution of renewable electricity from biomass improving the rules for bearing and sharing costs in the grid connection process.
- The vast number of EU countries applies facilitated procedures for small scale producers;
- Main types of barriers are related to the planning time frame, coordination between different authorities, times needed to obtain authorizations, costs for obtaining permission.

## **Related and future JRC work**

The JRC has performed a series of studies of the EU Member State renewable energy progress reports, which provide data for the periods 2009-2010, 2011-2012 and 2013-2014. The 2017 reports i.e. for 2015-2016, are not available yet. A dedicated series of reports on this topic can be found at the EU Science Hub<sup>2</sup> webpage. The analysis of these reports is mainly focused on:

- the **renewable energy deployment** in the EU and EU countries (*Scarlat, Banja, Dallemand, & Monforti-Ferrario, 2013*), (*Banja, Scarlat, Monforti-Ferrario, & Dallemand, 2013*), (*Banja, et al., 2015*), (*Banja, et al., 2017*);
- the **deployment of renewable energy technologies** in line with 2020 and 2030 energy and climate strategy (*Banja, Monforti-Ferrario, & Bodis, 2015*), (*Banja & Jegard, 2017*)
- the **impact of renewable energy deployment on greenhouse gas emissions (GHG) reduction** (*Banja, Monforti-Ferrario, Bodis, Motola, & Ossenbrink, 2015*), (*Banja, et al., 2017*)

EU and Member State policies have played a crucial role in supporting the development of renewable energy sources in our energy mix. The National Renewable Energy Action Plans and subsequent progress reports required under Article 22 (1) b of RED Directive) provide a useful source of information on the support schemes and other measures currently in place to promote energy from renewable sources

The present report covers a new aspect, namely the policy support measures as described in their NREAPs and progress reports complementing the above-mentioned analysis. The report provides a detailed overview of the different support and regulatory frameworks implemented by the Member States since the coming into force of the RED. It is based to a large extent on the information received in the formal reporting process. The report provides a literature review on recent publications covering this topic. The report addresses several specific aspects:

- how the support framework changed over the time and for the main renewable energy technologies/sources in each country;
- how the EU countries deal with regulatory and non-regulatory barriers;
- how the EU countries have developed transmission and distribution grid infrastructure, intelligent networks, storage facilities and the electricity system, in order to allow the secure operation of the electricity system.

## **Quick guide**

The **first part** of the report presents a short overview of the literature available raising different problematics and of the main results concerning support schemes and their efficiency over the years and across countries. The **second part** presents a snapshot of the support schemes in the EU countries for the deployment of renewable energy in three sectors: electricity, heating/cooling and transport together with a description of features of main support schemes. A short overview of renewable energy deployment until 2016 is provided also here. The **third part** describes more in detail the support for each technology in each EU country, including a quantitative presentation of this support. The **fourth part** is an overview of the support for renewable energy deployment in each EU country. The **fifth part** describes the administrative procedures implemented in each EU country to reduce regulatory and non-regulatory barriers in the promotion of renewable energy. The **sixth part** (section 7 & 8) illustrates how the EU countries have developed transmission and distribution grid infrastructure and the rules applied for bearing and sharing the costs of grid connection. **Last part** of the report (section 9 & 10) presents a short analysis on the level of support for solar photovoltaic and wind power and on policy effectiveness indicator.

---

(<sup>2</sup>) EU Science Hub <https://ec.europa.eu/jrc/en/publications-list/banja>

# 1 Introduction

Policy impact analysis is a difficult task. How to appropriately reflect existing policy instruments and their interactions? How to simplify the essence of future policies for policy scenarios? It is here that the "system" component of energy system modelling is most important. For example, a possible future carbon price trajectory resulting from the interplay of the legally determined amount of EU Emission Trading System (ETS) allowances and the changing conditions of energy supply and demand can only be generated by models which cover all these elements (SETIS, Nov.2016).

Three challenges: *First*, energy markets change profoundly. Supply actors have multiplied and electricity market dynamics have changed with the policy-led deployment of renewables, while interconnections are becoming more important. These trends are set to continue and will be reinforced with the rise of energy storage and demand response. This is a challenge in particular for energy system whose basic structures were typically been developed in times of public monopolies or of oligopolistic competition of large suppliers. *Second*, interactions between the energy system and other parts of the economy are of increasing policy relevance. The debate on the sustainability of the increasing use of biomass is only one example. The EU's GHG effort-sharing targets could only be properly analysed by combining energy system models with models covering the agriculture, forestry and waste sectors. How to best to implement such combinations to ensure robust and timely analyses? *Third*, despite significant improvements, combining complex modelling with transparency remains a challenge, and stakeholders' demands are increasing in this respect.

The EU's role in establishing an internal European market and protecting the environment were and are still crucial. Increasing evidence of climate change and growing dependence on energy has underlined the European Union's (EU) determination to become a low-energy economy and that the energy consumed is secure, safe, competitive, locally produced and sustainable. In addition to ensuring that the EU energy market functions efficiently, the energy policy promotes the interconnection of energy networks and energy efficiency. It deals with energy sources ranging from fossil fuels, through nuclear power, to renewables. Stable and predictable regulatory frameworks are crucial for facilitating cost-effective renewables deployment.

The EU focused on frameworks to guide member states in the process towards a single European energy market and cleaner energy markets overall. The progress varies by region: while the north-western member states' electricity markets are reasonably interconnected and liberalised, the eastern and south-eastern markets are still about to catch up (ICIS, 2018).

Recent successful auctions for support to renewable energy supply, for example in Denmark, Germany, the Netherlands, Spain or the UK, have demonstrated investors' confidence in technological progress, good policy design, and electricity market reforms. Lessons should be learned from such good practices and disseminated across the EU. The cost-reductions in renewable energy technologies over the last couple of years are enabling consumers to increasingly produce their own energy and encouraging greater uptake. Member States should continue existing efforts to ensure that self-consumption of renewable energy is not subject to unnecessarily restrictive conditions (EC-COM(2017)688).

## 25 Years of Policy Evolution

First signs of a harmonised European support framework were seen in the (WhitePaper, 1995) "On an energy policy for the EU". This stated that "*market integration is the central, determining factor in the Community's energy policy*" and that "*certain forms of energy like renewables may need to be supported initially through specific programs or subsidies in order for them to find a place in the market*".

The European Commission's (EC) (GreenPaper, 1996) "Energy for the Future" noted that "*while some (EU countries) have completely integrated favourable policies towards renewable sources into their general energy policy and planning framework, others have not adopted the use of renewable energy sources into their strategies for meeting global environmental targets*" and that "*strong policies will have to be implemented at national level and it is necessary to have a mechanism for coordinating efforts at Community level*". In the same paper EC states that "*although, as competition on the energy markets increases, regulatory policy measures have to be phased out and replaced by more market oriented measures...*".

In 1997 the European Parliament (EP) published its opinion on the future support framework for renewable electricity in the EU (EUParliament, 1997). The resolution argued that "*the principles of a model for a Community-wide supply scheme ..... should include that of a minimum payment by*

*the utilities for the electricity supplied from renewable energies, which would at least cover all of the current costs of the producers".*

In the (WhitePaper, 1998) on "Harmonisation requirements for the internal electricity market" the EC concluded that *"a clear need for common rules in this area (renewable energy) can already be identified. The contemporaneous existence of different support schemes appears likely to result in distortions of trade and competition"*. The paper states also that *"whilst the trade and competition distorting effects of different renewable support schemes is rather limited at present, given the limited EU market share of electricity from renewable sources, this negative effect appears likely to significantly increase in the coming years"*.

The (EC, 1999) working paper "Electricity from renewable energy sources and the internal electricity market" stated that *"within a system of competition-related premiums, such systems might well resolve some of the disadvantages of fixed feed-in tariffs"*. The paper found that *"given the shift towards electricity market competition, a move away from the "fixed price" tariff approach towards one based on trade and competition is at some stage inevitable"*.

In 2000 the EC planned to elaborate a proposal for the harmonised support mechanism which had *"to be compatible with the principles of the internal electricity market"* (EC, 2000)

The (Directive, 2001/77/EC) accepted the heterogeneity of support instruments in the short term. The Directive fixed indicative renewable electricity targets for the EU Member States – in line with the principle of subsidiarity – national legislator were free to choose any support instrument to achieve these targets. Under the (Directive, 2001/77/EC), Member States have set up individual RES-E (electricity from renewable energy source) targets. They were free to choose their preferred support mechanism in order to achieve the targets and/or were allowed to continue to do so for a transitional period of at least seven years after a new EU-wide regulatory framework would be adopted.

The (EC, 2005) report assessed that in most countries the support level had been insufficient to attract investment in renewable electricity generation plants. The report states that *"the feed-in-tariffs had been more successful in promoting renewable energy sources. Even though quota-based systems provided significantly higher support levels they had been less successful in triggering an increase in newly installed capacity"*. Nevertheless the report did not propose the harmonisation of this support instrument. The report states that *"more experience had to be gained from different support schemes and that competition among them could be seen as healthy at least over transitional period"*.

On January 2007 the EC presented an "integrated energy and climate change package", the so-called Energy Package (EC, 2007). In March 2007 the European leaders agreed of a binding renewable energy target of 20% of gross final energy consumption by 2020 (EU-Council, 2007). The EC was asked to prepare a new directive in order to *"put in place an integrated policy on energy combining actions at European and member states level"* - implicitly suggesting the need for an *at least partially harmonised support mechanism* (EU-Commission, 2008).

The (EU-Parliament, 2007) report (the so-called Thomsen report) "on the roadmap for renewable energy in Europe" states that *"...harmonisation of support schemes at European level is the ultimate objective"* but for the point of view of Thomsen *"the market at this stage are not ready for this step"*. The report also stated that *"it is important that we should first ensure full implementation of the internal market in electricity and a fair and level playing field for electricity from all energy sources. It is important that we should arrive at a system that ensures technological diversity so that the technologies which are still only at the experimental stage but which have long-term potential are not squeezed out of the market prematurely"*.

The period 2007-2008 saw the debate on the implementation of certificate trading based on guarantees of origin (GOs). Originally the GOs were implemented for electricity disclosure. Then they were intended to be used for the virtual trade of renewable electricity among EU countries. The UK was the first country to internally propose an alternative flexibility mechanism. According to this it favoured a trading scheme *"which does not rely on certificates"*. Instead Member States should be given flexibility for the target achievement by "statistical transfer" or "project-based agreements". The proposal had a substantial impact on the debate for GOs since the UK was formerly one of the strongest proponents of certificate-based flexibility mechanism (Jacobs, 2016).

In April 2009 the Renewable Energy Directive (RED) was published. The RED defines support schemes as *"means any instrument, scheme or mechanism applied by a Member State or a group of Member States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased. This includes, but is not*

*restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments". The final version of the RED did not include the implementation of GOs for target compliance (*The guarantee of origin shall have no function in terms of a Member State's compliance with Article 3.* (Directive(2009/28/EC)).*

In July 2009 the EU's Third Energy Package<sup>3</sup> was adopted by the European Parliament and the Council of the European Union. It entered into force on 3 September 2009. The EU's Third Energy Package is a legislative package for an internal gas and electricity market in the EU. The aim is to make the energy market fully effective and to create a single EU gas and electricity market. This will help to keep prices as low as possible and increase standards of service and security of supply.. The EC's Benchmark Report "Correct implementation of EU energy law and infrastructure investment top priority" states that "*the correct transposition of the European electricity and gas legislation in all Member States is still not complete*" and that "*the challenge the EU faces is to accelerate investments in energy infrastructure to enhance cross border trade, access to diversified sources of energy and in particular from renewable sources* (COM(2010)84) ".

Article 194 of the (Lisbon Treaty, 2009) on the "Functioning of the EU" introduces a specific legal basis for the field of energy based on shared competences between the EU and its member countries stating that "*in the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, Union policy on energy shall aim, in a spirit of solidarity between Member States, to:*

- *ensure the functioning of the energy market;*
- *ensure security of energy supply in the Union;*
- *promote energy efficiency and energy saving and the development of new and renewable forms of energy; and*
- *promote the interconnection of energy networks".*

The Europe 2020 strategy (EC-Communication, 2010) focuses on creating the conditions for smart, sustainable and inclusive growth. To that end, a number of headline targets have been set, including targets for climate change and energy sustainability: (i) a 20 % reduction in Union greenhouse gas emissions when compared to 1990 levels; (ii) raising the share of Union energy consumption produced from renewable resources to 20 %; and (iii) a 20 % improvement in the EU's energy-efficiency compared to 1990 levels. The first two of these nationally binding targets were implemented by 'The climate and energy package'<sup>4</sup>.

The Communication 'Energy 2020 – A strategy for competitive, sustainable and secure energy' (EC-Communication, 2010a), as part of the 'Resource efficient Europe' flagship initiative already concluded that the objectives of a secure, affordable and sustainable energy market will be undermined unless electricity grids are upgraded, obsolete plants are replaced by competitive and cleaner alternatives and energy is used more efficiently throughout the whole energy chain.

In 2013 the EU adopted the guidance document for the designing and reforming renewable energy support schemes (SWD(2013)-439). The guidance document states that "*financial support for renewables should be limited to what is necessary and should aim to make renewables competitive in the market*". The document states also that "*support schemes should be flexible and respond to falling production costs. As technologies mature, schemes should be gradually removed. For instance, feed in tariffs should be replaced by feed in premiums and other support instruments that incentivise producers to respond to market developments*".

In 2014 the EC's *Guidelines on State Aid for Environmental Protection and Energy* (EC, 2014) allow Member States to support renewable energy sources, subject to certain conditions. The guidelines for the first time contain criteria for the Commission to apply when assessing capacity mechanisms. The Guidelines aim to enable Europe to meet its ambitious energy and climate targets whilst minimising distortions of competition in the Single Market and costs for taxpayers. Member States are obliged to notify state aid measures to the Commission for approval ahead of implementation. Only after the Commission's approval can investors rely on the compliance of a measure with EU state aid rules. In order to maintain the global competitiveness of certain sectors, the

---

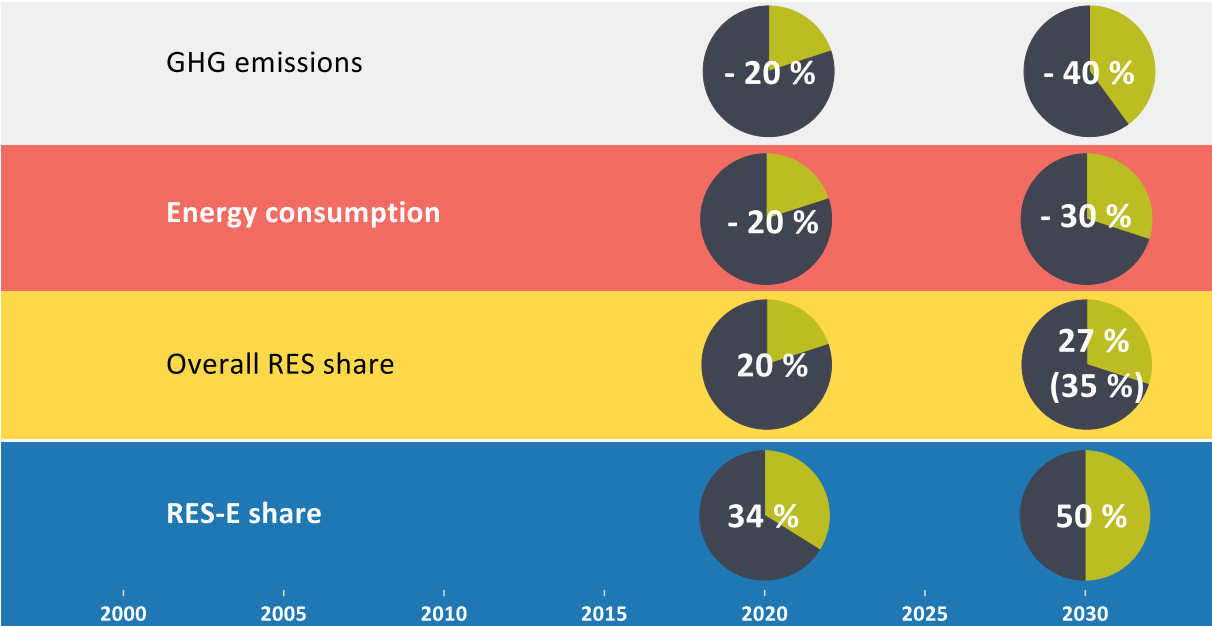
(<sup>3</sup>) This package consist of five new legal acts: Directive 2009/72/EC concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC; Directive 2009/73/EC concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC; Regulation (EC) No 713/2009 establishing an Agency for the Cooperation of Energy Regulators; Regulation (EC) No 714/2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003; Regulation (EC) No 715/2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005.

(<sup>4</sup>) Decision No 406/2009/EC of 23 April 2009 (OJ L 140,5.6.2009, p. 136) and Directive 2009/28/EC of 23 April 2009 (OJ L 140, 5.6.2009, p. 16).

Commission's 2014 Guidelines on State Aid for Environmental Protection and Energy allow Member States to grant reductions from contributions levied on electricity consumption under certain conditions. In particular, this concerns energy-intensive users in sectors that are particularly energy-intensive and/or exposed to international competition.

On 22 January 2014 the Commission proposed the energy and climate objectives to be met by 2030 in a Communication 'A policy framework for climate and energy in the period from 2020 to 2030' (EC-Communication, 2014). The pillars of the 2030 Framework are: i) a reduction in greenhouse gas emissions by 40 % relative to the 1990 level; ii) an EU-wide binding target for renewable energy of at least 27 %; iii) renewed ambitions for energy efficiency policies; and iv) a new governance system and a set of new indicators to ensure a competitive and secure energy system. The framework was adopted by EU leaders in October 2014.

**Figure 1.** The EU policy framework for climate and energy 2020 & 2030



Both the (EuropeanCouncil, 2015-2016) and the (EuropeanParliament, 2016) have repeatedly stressed that a well-functioning integrated energy market is the best tool to guarantee affordable energy prices, secure energy supplies and to allow for the integration and development of larger volumes of electricity produced from renewable sources in a cost efficient manner.

The EU Commission proposed an EU heating and cooling strategy in February 2016 (COM(2016)51, 2016). The EU heating and cooling strategy was a first step in exploring the issues and challenges in this sector, and solving them with EU energy policies.

On 30 November 2016 the European Commission released its "Clean Energy for all Europeans" (EC, 2016)" package<sup>5</sup>. This package consists of numerous legislative proposals together with accompanying documents, aimed at further completing the internal market for electricity and implementing the Energy Union. Part of this package is the recast of RED complementing the Energy Union governance by creating the conditions across the three sectors (electricity, heating/cooling and transport) to make it easier to meet the EU 2030 target collectively. According to the new proposal the minimum target of 27% share of renewable energy in gross final consumption set for 2030 is binding at the EU level, but will not be translated into nationally binding targets (Banja, et al., 2017).

Referred to as the EU's "winter package", the proposed rules will play a key role in meeting the EU's 2030 climate objectives, as well as fleshing out the Energy Union, a common energy system for the EU member states. The Winter Package includes goals and proposed measures for increasing renewable energy in heating and cooling sectors as well as proposals for improving energy efficiency in the heating and cooling. Many EU countries have already started to steadily shift their renewable energy subsidy models away from fixed payments towards market-based models. In the past, feed-in tariffs (FiTs) have traditionally been set well above the prevailing electricity price. Consequently, many member states have recently switched to using competitive

(<sup>5</sup>) "Clean Energy for all Europeans" package of 30<sup>th</sup> November 2016 is called the "Winter Package"



auctions or tenders to determine the level of renewable subsidies to reduce the overall costs (ICIS, 2018).

The Electricity Market regulation establishes a harmonised framework for cross-border exchanges in electricity by taking into account particular characteristics of national and regional markets. It establishes a European network of transmission system operators for electricity (ENTSOE).

The Electricity Directive seeks to introduce common rules for the generation, transmission, distribution and supply of electricity. It also lays down universal service obligations and consumer rights, and clarifies competition requirements.

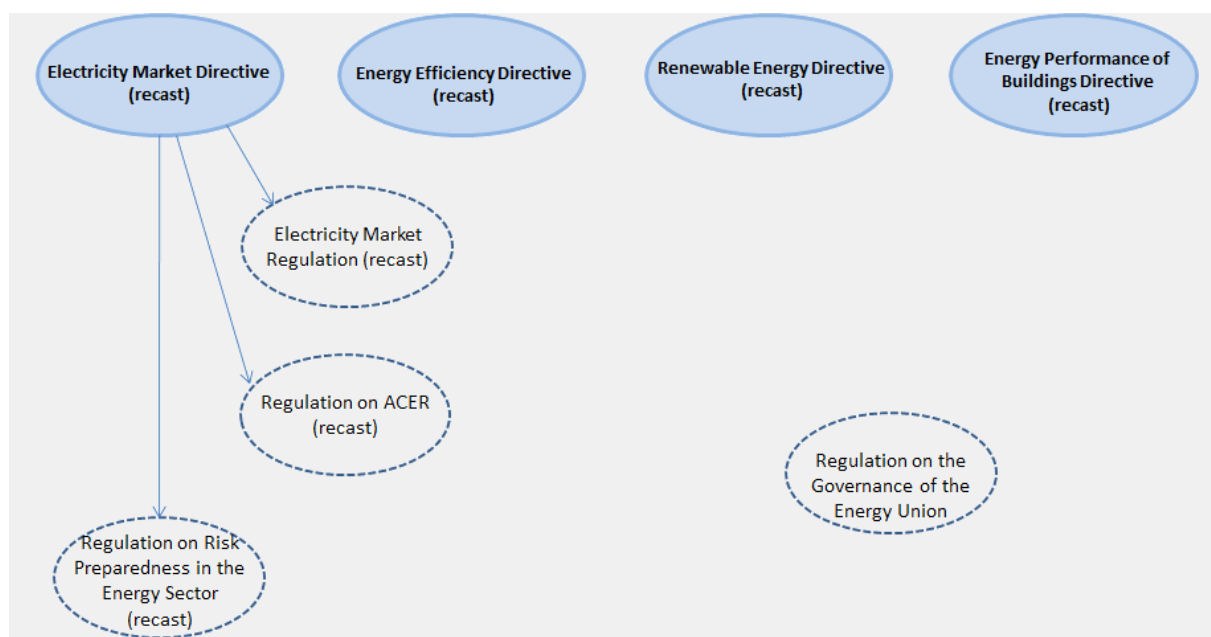
The Electricity Market Regulation, together with the Electricity Directive, aims at developing the "Energy Union" for power markets, which is an integrated, harmonised electricity market and infrastructure across Europe

The Renewable Energy Directive establishes an overall policy for the production and promotion of energy from renewable sources in the EU.

The Energy Efficiency Directive sets EU binding 20% energy efficiency targets by 2020 and EU Member States are required to establish indicative national energy efficiency targets for 2020. The directive also sets legally binding rules for end-users and energy suppliers. The current review extends the target with a 30% EE target for 2030.

The Governance of the Energy Union ensures that policies and measures at various levels are coherent, complementary and sufficiently ambitious.

**Figure 2.** Schematic illustration of "Clean Energy for all Europeans" package<sup>6</sup>



<sup>(6)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

## 2 Data source

**JRC NREAPs and Progress Reports Database** - Under Article 4 of the RED, Member States had to prepare national renewable energy action plans (NREAPs) showing how they were going to reach the renewable energy targets in the electricity, heating/cooling and transport sectors. In their NREAPs, they also had to state the measures they had in place or were planning in order to achieve their national overall renewable energy targets. These followed a harmonised template (NREAPsTemplate, 2009) and comprehensive planning, which would make it possible to compare the data from the different Member States. Article 22 of the RED requires each Member State to submit to the EC every two years a progress report on the developments in renewable energy sources in that country compared with the interim targets in its NREAP. EC drew up a template<sup>7</sup> (PRsTemplate) to ensure that the Member State progress reports were complete, covered all the requirements of Article 22 of the Directive and was comparable with each other and with the NREAPs.

Since 2011, JRC has kept a database of EU countries reporting under the RED, sourced by NREAPs and biennial progress reports. The database is updated each time the next wave of reports is released by EU countries or when an NREAP is updated. JRC updated this database in 2016 following the release of the 2013-2014 progress reports, due for end-2015 but actually completed in mid-2016. The next set of progress reports covering the period 2015-2016, was expected for end-2017.

The JRC renewable energy database is easily accessible to the public through the Data Portal<sup>8</sup> for NREAPs and progress reports, which is an interactive tool for comparing the renewable energy data provided by each EU Member State as required under the RED. Users can access and download more than 30 000 raw data and 60 indicators for each country, covering three sectors: electricity, heating/cooling and transport. The tool also features dashboards on current status and expected developments in each Member State, as well as the impact on greenhouse gas emissions reduction.

In September 2017, the JRC has started the collection of the information related to the requirements of Article 22 (1) a, b, e and f of the RED covering period 2009-2014. The information collected for each EU country includes:

- Overall policies and measures taken or planned at national level to promote the growth of energy from renewable sources taking into account the indicative trajectory for achieving the national RES targets as outlined in each EU country NREAP (Article 22 (1) a of RED);
- Support schemes and other measures currently in place that are applied to promote energy from renewable sources and report on any development in the measures used with respect to those set out in each EU country NREAP (Article 22 (1) b of RED);
- Progress made in evaluating and improving administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy (Article 22(1) e of RED);
- Measures in ensuring the transmission and distribution of electricity produced from renewable energy sources and in improving the framework or rules for bearing and sharing of costs related to grid connections and grid reinforcements. (Article 22(1) f of RED).

To complete the picture for period after 2014 the following data sources are used in this report:

**RES Legal**<sup>9</sup> - information on the important legislation on the support schemes, grid issues and policies for energy from renewable sources covering all three energy sectors: electricity, heating & cooling and transport.

**International Energy Agency/International Renewable Energy Agency**<sup>10</sup> - IEA/IRENA Joint Policies and Measures Database give access to information on energy-related policies and measures taken or planned to reduce greenhouse gas emissions, improve energy efficiency and support renewable energy development and deployment.

**ICIS Power Perspective**<sup>11</sup> - ICIS Power Perspective is an online tool designed to put power market developments into perspective regarding their price impact analysing the cross-border impact of national developments and provide with a roadmap of market drivers throughout Europe.

---

<sup>(7)</sup> The progress reports template is updated in 2017 <https://ec.europa.eu/energy/en/links-member-state-reporting>

<sup>(8)</sup> NREAPs and progress reports Data Portal - <https://ec.europa.eu/jrc/en/scientific-tool/nreap-data-portal>

<sup>(9)</sup> RES-Legal <http://www.res-legal.eu/>

<sup>(10)</sup> IEA/IRENA joint Policies and Measures Database <https://www.iea.org/policiesandmeasures/renewableenergy/>

<sup>(11)</sup> Petrochemical market information provider (<https://www.icis.com/>) part of Reed Business Information

### 3 Features of support schemes on promotion of RES

To provide adequate support, support levels might be differentiated, typically between technologies and even within technologies, as differentiation is able to better adapt to the individual requirements of each technology. However, an increasing level of detail regarding price or volume typically means higher complexity for parameterisation and transaction costs.

Support schemes on the promotion of renewables are intended to cover the gap between costs of energy (electricity or heat) and revenues. General requirements for support schemes are set at the EU guidance document (SWD(2013)-439):

- support schemes should be flexible enough to account for changes in the development of costs and technologies and so minimise the financial support granted;
- support scheme design should also reflect the need to address longer term goals of fostering technological innovation, economies of scale, cost-reductions and spill-over effects that facilitate reaching 2020 targets and reaching 2050 decarbonisation goals sustainably;
- support schemes should adjust to the falling cost of renewables;
- support schemes as well as investment revenues need to be predictable;
- support schemes should be able to incentivise gradually market instruments;
- support schemes should provide stability of regulatory framework;
- support schemes should ensure efficiency of renewable deployment using cooperation mechanism

Different approaches have been used to classify support schemes on the promotion of renewables. The support schemes can be

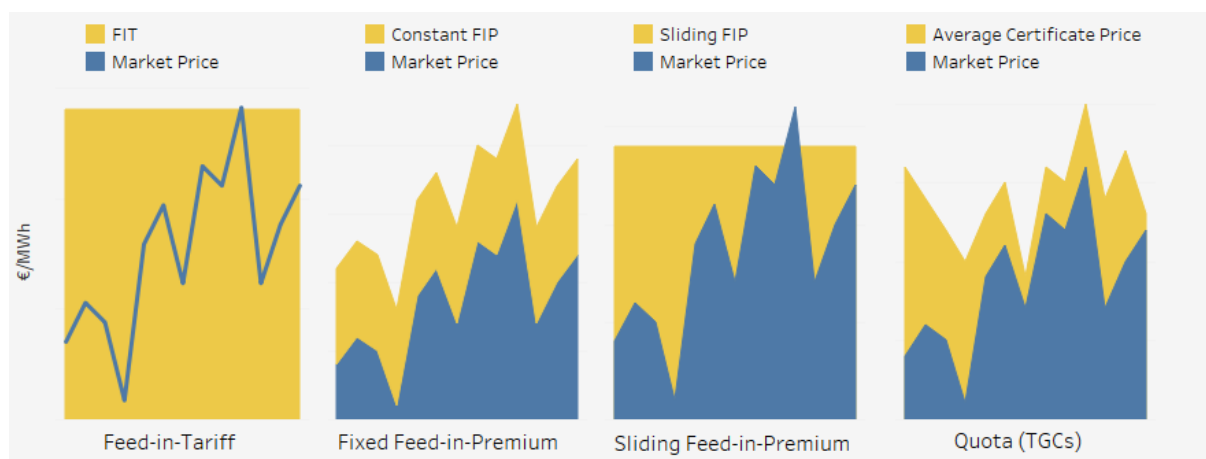
- regulatory (either focussed on investments or generation)
- direct (either focused on investment or generation)
- indirect (environmental taxes)
- voluntary (green tariffs, agreements, contribution shareholders programs)

The most common categorization of support schemes is the one that distinguishes between

- price-based
- quantity-based

Figure 3 illustrates the support mechanism for the 4 main schemes: (i) Feed-in-Tariff (FIT); (ii) Fixed Feed-in-Premium; (iii) Sliding Feed-in-Premium; and (iv) Quota.

**Figure 3.** Schematic illustration of main support schemes on promotion of renewables



This categorization may occur in an administrative procedure, which requires knowledge of the generation costs. This includes the calculation of levelised costs of electricity (LCOE) which in turn is used to either administratively determine support levels (in a FIP or FIT), to set ceiling prices in the case of auctions/tenders or to determine multiplier for a technology-specific quota.

In a **feed-in tariff (FIT)** system, power plant operators receive a fixed payment for each unit of electricity generated independent of the electricity market price. The main advantage of the fixed feed-in system as experienced in practice is its high effectiveness and low risk premiums. However,

if tariffs are not adequately set (reflecting actual production costs), they are not sufficiently cost-effective. Moreover, they are less compatible with the principles of liberalised markets than other policy instruments (Ecofys, 2013).

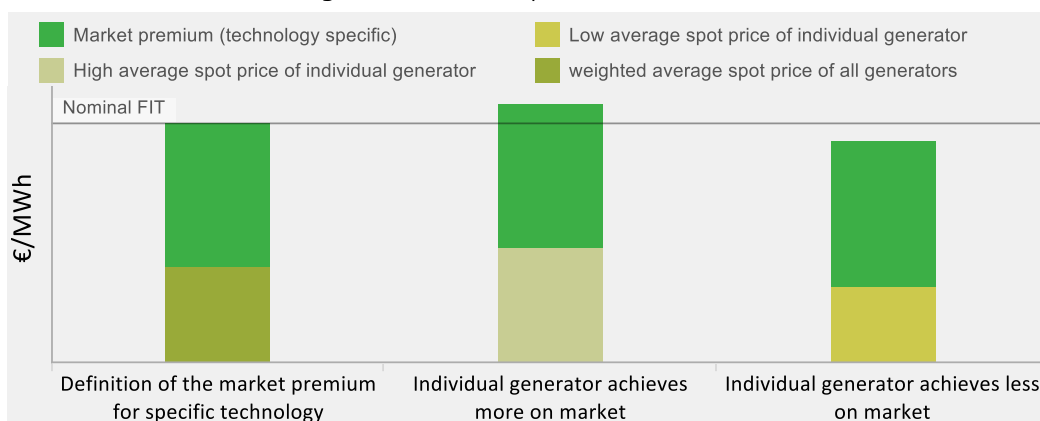
A variety of approaches are used to determine the FIT payments awarded to project developers for the electricity they produce (NREL, 2010). These different approaches can be divided into four basic categories:

- Based on the actual levelized cost of renewable energy generation;
- Based on the “value” of renewable energy generation either to society, or to the utility, generally expressed in terms of “avoided costs”;
- Offered as a fixed-price incentive without regard to levelized cost of renewable energy generation or avoided costs;
- Based on the results of an auction or bidding process, which can help inform price discovery by appealing to the market directly. An auction-based mechanism can be applied and differentiated based on different technologies, project sizes, etc. and is a variant on the cost-based approach (NREL, 2010).

In a **feed-in premium (FIP)**, plant operators have to market the electricity generated directly at the electricity market and receive an additional payment on top of the electricity market price—either as a fixed payment or adapted to changing market prices in order to limit both the price risks for plant operators and the risks of providing windfall profits at the same time (Ecofys, 2013).

The premium is the average difference between spot market prices and FITs for that technology. It is calculated monthly as the nominal FIT less the technology-specific volume-weighted average spot market price in that month.

**Figure 4.** The market premium model<sup>12</sup>



**Quota** obligations constitute a fully distinct support scheme: Power plant operators receive certificates for their green final energy, which they may sell to the actors obliged to fulfil the quota obligation. Selling the certificate provides an additional income on top of the common market price of the final energy sold. The main advantages of the quota obligation with TGC markets are the high compatibility with market principles and the competitive price determination. However, high risk premiums resulting from the uncertain development of the prices of electricity and the certificates typically increase policy costs. Provided that quota obligations are designed in a technology-neutral way, only the most cost-effective technologies are supported, theoretically resulting in a high static efficiency (Ecofys, 2013).

**Tender or auction** schemes do not represent a distinct support category, but they are used to allocate financial support to different renewables technologies and to determine the support level of other types of support schemes, such as feed-in systems, in a competitive bidding procedure. There are different ways to design an auction, but the static sealed-bid and the dynamic descending clock auction or a combination of the two have been used the most to support new RES-E installations (Ecofys, 2013).

In addition to those support schemes, investment support, **low interest loans and tax exemptions** can be used to support renewables (Ecofys, 2013).

<sup>(12)</sup> Adopted from (Oxera, 2014)

## 4 Renewable energy in the EU – recent trends

In 2016, renewables accounted for 17 % of gross final energy consumption in the EU, with the heating/cooling sector accounting for 8.6 %, electricity for 7 % and transport for 1.4 %. Over 2005-2016, the overall renewable energy share increased by an annual average of 0.7 percentage points. In the same period, final renewable energy consumption increased by an average of 7.8 Mtoe per year.

Figure 5 illustrates the progress of overall renewable energy share in the EU over period 2010-2016 comparing with the NREAPs trajectory and the Indicative trajectory<sup>13</sup>.

**Figure 5.** Overall RES share progress (2010-2016) - comparison with NREAP & indicative trajectories

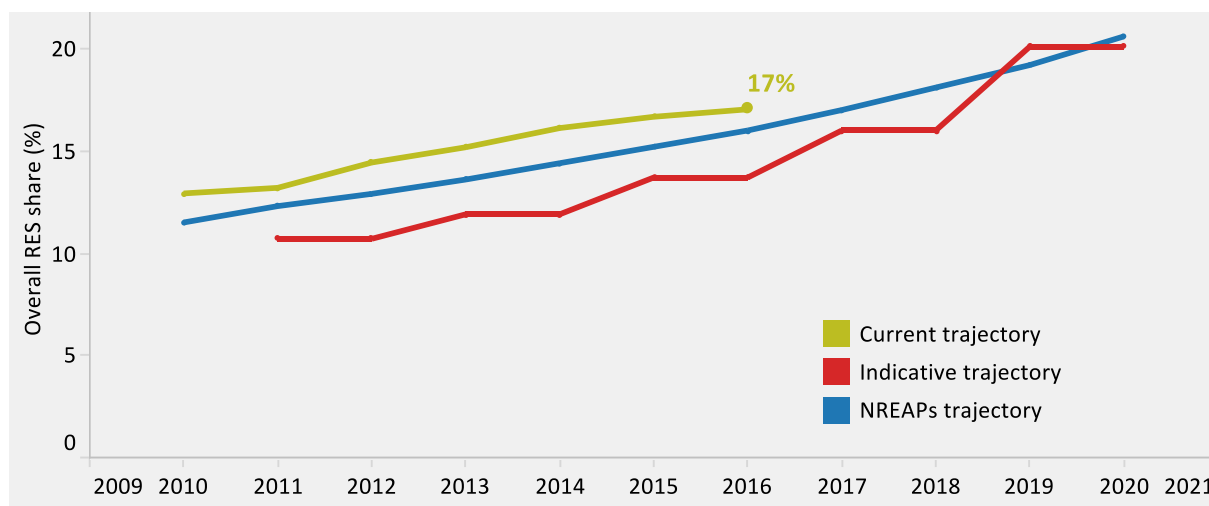
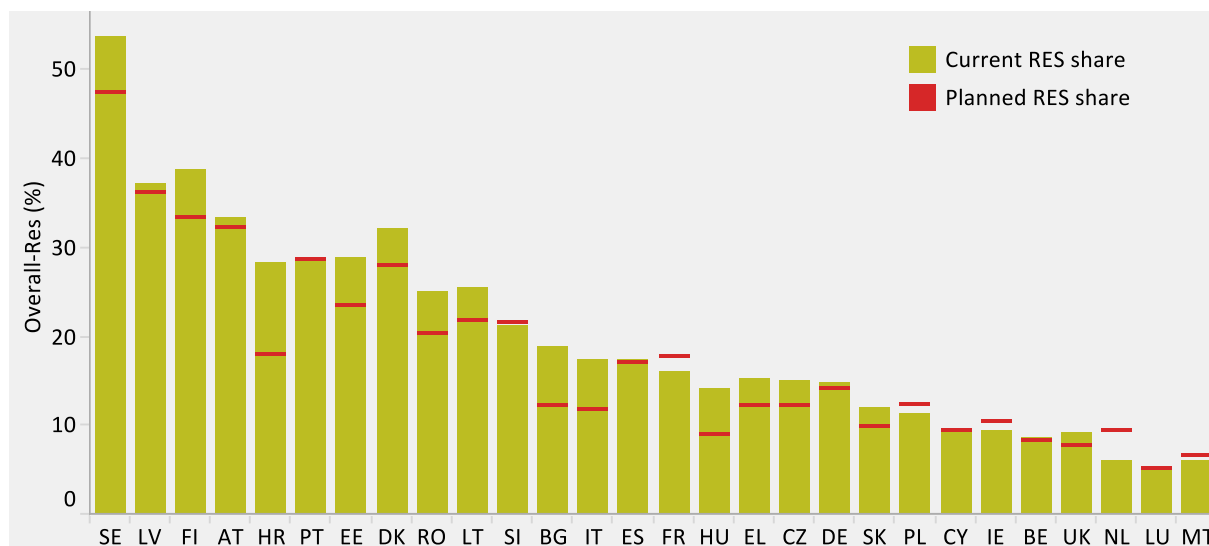


Figure 6 illustrates the achieved overall renewable energy shares in each EU country in 2016 comparing with the planned shares for that year. As shown in this figure 5 EU countries (Ireland, France, Netherlands, Poland and Portugal) missed their plans on overall renewable energy share for year 2016.

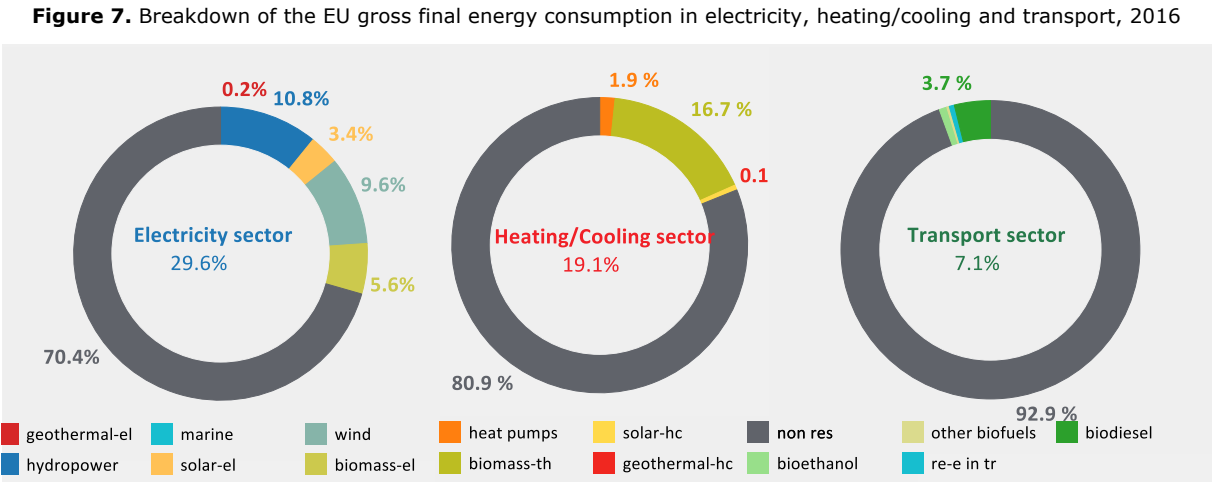
**Figure 6.** Overall renewable energy share in each EU country – comparison with NREAPs plan, 2016



In 2016 biomass remained the main source of renewable energy in the EU. The biomass contribution in three sectors (electricity, heating/cooling and transport) reached more than 116 Mtoe, equal to 59.3% of gross final consumption of renewable energy in the EU.

<sup>(13)</sup> An indicative trajectory for the EU as a whole can be derived using the formula set out in Annex I to the RED, which presents the indicative trajectories for each EU Member State. The indicative trajectory for the EU is presented for illustrative purposes only and has no legal value. This is because the EU as a whole does not have any indicative trajectory under the RED.

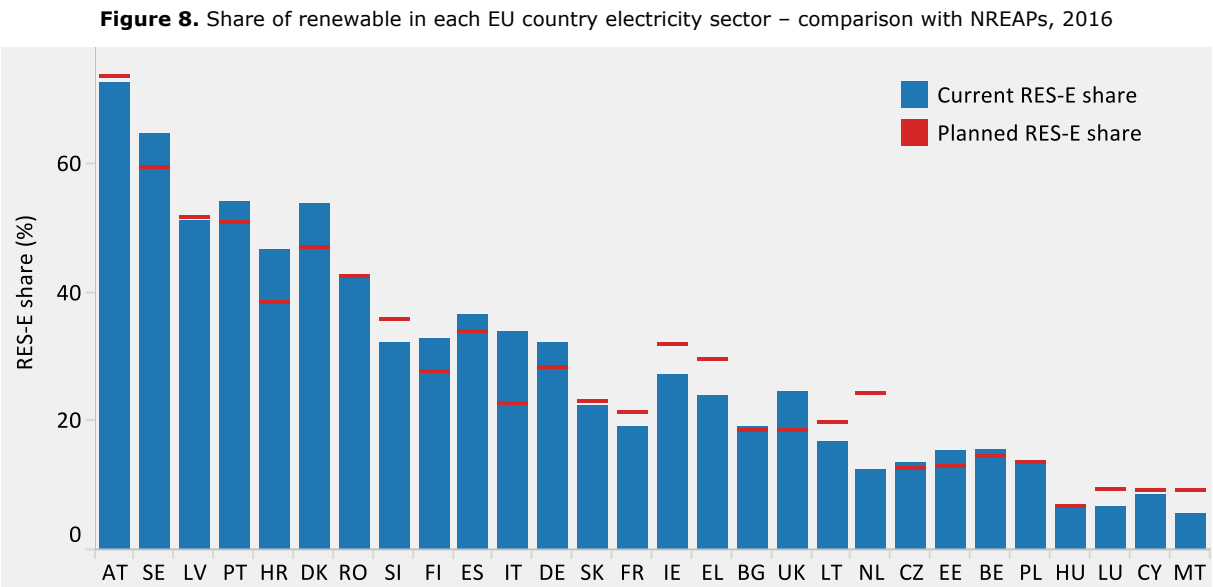
Figure 7 illustrates the breakdown of the EU gross final energy consumption in electricity, heating/cooling and transport sectors in 2016.



Renewables have become one of the mainstays of the electricity sector in the EU. In 2005, the share of renewables in total EU electricity consumption was just above 14 %. Within more than a decade, the share of the EU’s gross electricity consumption derived from renewables more than doubled reaching 29.6 % by 2016.

In the course of 2016, a total of 20.5 GW of renewable electricity was installed in the EU reaching 394 GW by the end of the year. By 2016, wind power accounted for the largest share of final renewable electricity capacity in the EU, at 39 %, covering almost 32 % of global wind installed capacity in that year. Solar photovoltaic reached almost 101 GW in 2016, covering 33% of the global solar photovoltaic installed capacity.

Figure 8 illustrates the achieved renewable energy shares in each EU country electricity sector in 2016 comparing with the planned shares for that year. As shown in this figure 11 EU countries (Latvia, Slovenia, Slovakia, France, Ireland, Greece, Lithuania, Netherlands, Luxembourg, Cyprus and Malta) missed their plans for the share of renewables in electricity sector.

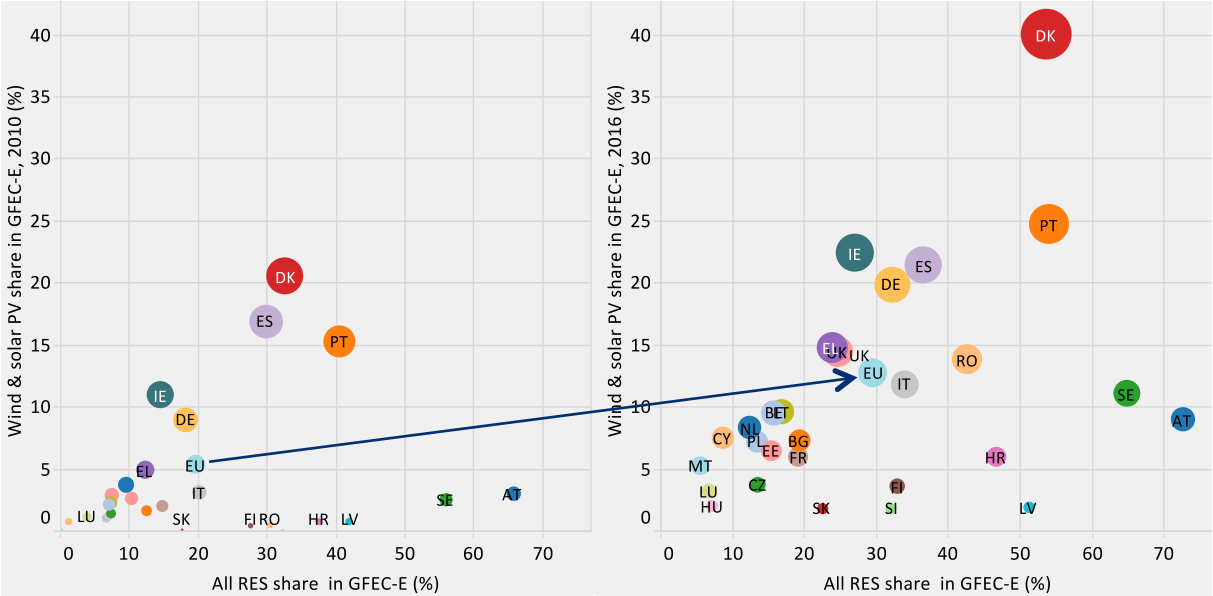


Variable technologies (wind and solar photovoltaic) have become central to the transformation of the EU’s power system. By 2016 wind energy already accounted for 32.4% of the EU gross final renewable electricity and 9.6% of the EU gross final electricity consumption. In the same year the share of solar photovoltaic in the gross final renewable electricity reached almost 11%, sharing 5.6% of the gross final electricity consumption in the EU.

Figure 9 illustrates how the share of variable technologies and the share of all renewable technologies in gross final electricity consumption looked like in 2010 and 2016. EU countries as

Denmark, Portugal, Spain, Germany and Ireland have high shares of both variable and non-variable renewable energy technologies (hydropower, biomass, marine, geothermal and CSP).

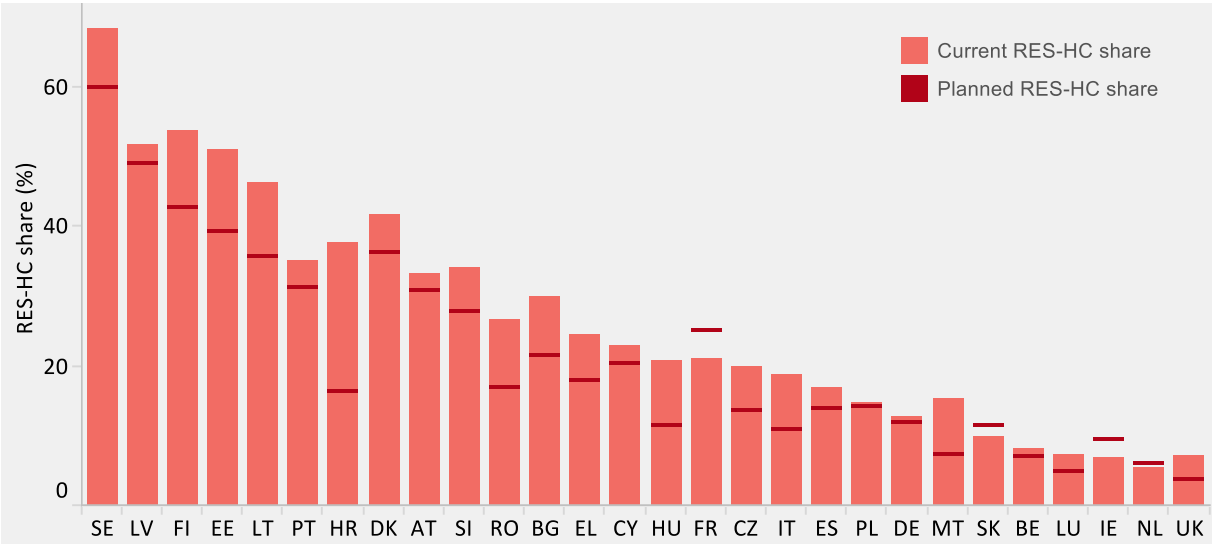
**Figure 9.** Share of variable and all renewables in each EU country electricity sector, 2010 (left) & 2016 (right)



By 2016, 45% of the EU's energy from renewable sources was consumed in the heating/cooling sector. Over 2005 -2016, renewable energy deployment in this sector reached over 50 % (+34.3 Mtoe). More than 19 % of gross final energy consumption for heating/cooling was covered by energy from renewable sources in 2016.

Figure 10 illustrates the achieved renewable energy shares in each EU country heating/cooling sector in 2016 comparing with the planned shares for that year. As shown in the figure 4 EU countries (France, Slovakia, Ireland and Netherlands) missed their plans for the share of renewables in heating/cooling sector.

**Figure 10.** Share of renewable energy in EU country heating/cooling sector – comparison with NREAPs, 2016



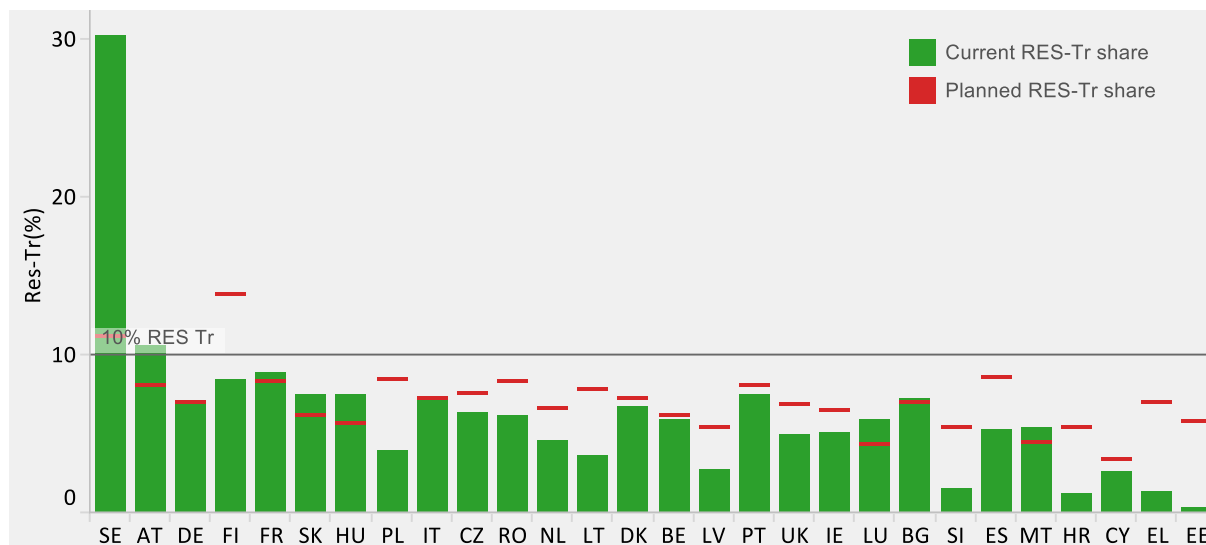
The use of final renewable energy in the transport sector almost 4 folded since 2005 and now accounts for 7.1 % of gross final energy consumption in this sector. Even though its development lags behind the expectations, the part of transport sector covered by renewables has become more electric (almost 12%) with regard to the fuel composition. Luxembourg was the only EU country to use more renewable energy in the form of biofuels (42%).

Figure 11 illustrates the achieved biofuels shares in each EU country transport sector in 2016 comparing with the planned shares for that year and the 10% target for 2020. As shown in the



figure 11 EU countries (Sweden, Austria, France, Slovakia, Hungary, Italy, Luxembourg, Bulgaria and Malta) exceeded their planned shares for renewable energy in this sector.

**Figure 11.** Share of renewable energy in each EU country transport sector – comparison with NREAPs, 2016



Over more than a decade since 2005, Germany remained the largest mature European market for renewables having installed above 90 GW of both wind and solar photovoltaics in 2016. This represents more than 22% of the whole EU's final renewable electricity installed capacity. Denmark shows how it has shifted substantially away from its traditional energy portfolio, having already integrated high shares of variable renewables: the wind contribution to its gross electricity consumption accounted for almost 40%. Italy experienced the fastest deployment of solar photovoltaic which in 2016 covered almost 7% of its electricity needs. By 2016, with an additional capacity of 2.4 GW the UK was home to more than half of new photovoltaic capacity in the EU (52%).

## **5 A literature review- promotion of renewables in the EU**

Since the first implementations of support policies for renewable energies, their efficiency have been under scrutiny, from a target achievement perspective (in terms of energy transition) as well as from a cost-effectiveness point of view. The following paragraphs try to provide a short overview of the literature available raising different problematics and of the main results concerning support schemes and their efficiency over the years and across countries to bring up the energy transition.

### **5.1 Effectiveness of renewable energy support policies**

Various studies have been conducted to investigate the respective effectiveness of the different types of support schemes. For instance, (Bergek & Jacobsson, 2010) focuses on a green certificate scheme in Sweden from 2003 to 2008 and tries to assess its results. The authors first investigate whether this scheme was effective in terms of increase of the supply of renewable electricity, then if it achieved its purpose in a cost-effective manner (both from a social and consumer perspective) and if it "generated an equitable distribution of costs and benefits". They also check whether it drove technological change or not. While they find that the scheme had positive outcomes in terms of effectiveness and social cost, the costs were substantially high for consumers and large rents were generated for the plant owners. They also show that a tradable green certificate scheme cannot be expected to drive technological change, to lower consumer costs or to be equitable. In the end, the authors conclude that green certificate scheme should be chosen only when the main concern is to minimize short-term social costs of reaching a given objective.

Using data from 1992 to 2008 from 26 European countries (Jenner, Groba, & Indvik, 2013) focuses on the effectiveness (for wind and solar energy) of what the authors identify as "one of the most popular policies for supporting renewable electricity generation": feed-in tariffs. Taking into account the design of the policies, that is to say the tariff size, contract duration and degression rate, their analyses show that FIT policies drove PV deployment in the EU but they are not able to establish an effect for wind power. However, they manage to show the greater importance of policy design compared to the existence of the policy itself.

In (Del Río & Mir-Artigues, 2014), the authors explain that across Europe various support schemes are applied simultaneously to the same technologies. The majority of support schemes combinations concern feed-in systems, mixing tariffs and premiums. They also show that principles of exclusion (impossibility to access a type of support for a plant already supported by another instrument) and instrument coordination are not very common.

More recently, (Nicolini & Tavoni, 2016) test if policy support for renewable electricity has been efficient in its promotion of RE sources. It focuses on the five largest EU countries from 2000 to 2010. The data consists in the level of applied tariffs and amount of incentives granted. The authors find a positive correlation between the amount of support and the production of the incentivized energy (1 % increase in the tariff leads to 0.4 % to 1 % increase on the renewable electricity generation). The results also point toward better performance of feed-in-tariffs than of green certificates system.

In a report from the Climate Policy Initiative, (Nelson, O'Connell, De Lorenzo, & Huxham, 2016), the authors conduct a comparison between renewable energy investments in Germany, the UK, Iberia (Spain and Portugal) and the Nordic region. Concerning policy design, they argue that the outcomes of a policy will depend on several factors such as scheme size and sophistication but also on the risk tolerance and knowledge of the industry.

A recurrent criticism of renewable energy support schemes is that their interaction with other climate policies creates inefficiencies. In (Del Río & Dubscha, 2017) the authors show that it is not really the case, using different criteria. They study some of the most relevant interactions between support granted to electricity generated from renewable sources and other policies, for instance the EU ETS, the Energy Taxation Directive and the Effort Sharing Directive in the EU, and manage to show that the results of the policies interactions are not always negative at all levels and that it is a function of the choice of the instruments and the design of the policy. In line with these results, in The Guidelines on State aid for environmental protection and energy 2014–2020, the European Commission justifies the coexistence of policies to address residual market failures not internalised by schemes such as the EU ETS and that "state aid can therefore contribute to the achievement of the related, but distinct, Union objectives for renewable energy."

A broad range of information can be found in the Council of European Energy Regulators 2017 Report, (CEER, 2017), a document focusing on support schemes for 2014 and 2015. It shows that European countries are adapting their support schemes to allow for more market integration of renewable electricity. It also brings out the fact that basic features of the main support schemes in

Europe have not been modified in recent years (funding remains mainly non-tax levies, renewable energy plants continue to be given priority in terms of network connection and electricity dispatching). Furthermore, plants using renewable energy have increasingly the same level of financial of financial responsibility as other plants concerning electricity balancing.

## **5.2 Relative efficiency of the different types of schemes**

In (Meyer, 2003), the author describes the market situation in some European countries (Germany, the UK, Holland and Denmark). His analysis includes feed-in-tariff models, tender models for different generation technologies and green certificates (GC) trading models with obligatory consumer quotas. He explains to what extent some designs are more adapted to certain technologies and situations. For instance, feed-in tariffs and GC systems don't fully follow the principles of market competition. Feed-in tariffs first set the electricity price, and then the quantity is set by the market. This is the contrary to the GC system where the quantity is decided with the consumption quotas. Even if the GC systems system is less costly for the government and the consumers, the paper shows that it brings several uncertainties for investors and also transaction costs can become very high. To reduce the problems related to market competition between technologies at different stages of development the author proposes to combine certificate systems with centralised tender procedures.

In (Palmer & Burtraw, 2005) the authors conduct a cost analysis of different policies supporting renewable energies. They find that the most cost-effective design is the cap-and-trade policy, i.e. a green certificate system. Later, (Butler & Neuhoﬀ, 2008) tries to compare the wind energy promotional policies adopted in the UK and Germany between 1990 and 2000. The authors compare the German feed-in tariff scheme and the British Renewable Obligation (a tradable green certificate scheme). The analysis shows that a feed-in tariff reduces costs to consumers and results in larger deployment of the promoted technology. The authors also tackle the criticism of feed-in tariff that it does not generate enough competition. Their analysis shows that the competition among turbine producers and constructors was stronger under the feed-in tariff than under the entire UK support scheme.

The recurring question of the necessity to design technology neutral support policies for renewable energies production is tackled in (Sandén & Azar, 2011). The authors conclude that it should not be used as an objective when designing policies. The analysis focuses on four policy types: the setting of a carbon price, the public funding of R&D for carbon-efficient energy technologies, the implementation of policies enhancing the deployment and commercialization of such technologies and the introduction of policies for the development of very long-lived infrastructures. Regarding the funding of R&D, the authors argue that technology neutrality is not an option. Indeed, governments are compelled to set a research policy when implementing a budget law. Concerning the support for the development of technology, the neutrality of the policies is a rather elusive concept. Certificates systems are often deemed to be neutral. But this type of measure aims at reducing the emissions of carbon, so in a sense it favours carbon efficient technologies. The debate is clearer when one considers feed-in tariffs. Should these tariffs be set differently across technologies or remain neutral, with a single tariff applied to "electricity from renewable sources"? The danger here is, on one hand, that a currently expensive technology would not be able to access the market, even if it has potential to come down in cost. On the other hand, with a technology-specific tariff, governments also take the risk of supporting the "wrong winner". Hence, in both cases, there is uncertainty regarding the ability of the policy to support efficiently the "right" emerging technology. Government would need to support many emerging technologies to reduce uncertainties regarding the potential of these technologies.

An empirical comparison of the relative efficiency of feed-in tariffs policies and quota systems is conducted in (Dong, 2012). The author uses data for 53 countries over five years (2005 to 2009). The paper shows no significant differences between the effects of the two systems on the annually installed capacity of wind power. A more recent paper, (García-Alvarez, Cabeza-García, & Soares, 2017), also conducts an empirical evaluation of feed-in tariffs and renewable quotas systems for wind power deployment (in the EU over the period 2000 to 2014). Their results indicate that only feed-in tariffs had an impact on the installed capacity. The efficiency of quota systems appears to have been reduced by the lack of the risk-free framework that could ensure investor confidence.

In (Schallenberg-Rodriguez & Haas, 2012), the authors focus on the Spanish system to conduct a comparison of feed-in tariff and feed-in premium schemes (which coexist in the country). In particular, they highlight one advantage of premiums, which is that plants are integrated into the electricity market. However, they show that this can sometime lead to overcompensation.

In (Del Río & Linares, 2014) we find a comparison of the usual support schemes for renewable energies (feed-in tariff and tradable certificates with quotas) with auctions as a third policy instrument. The authors argue that past experiences have shown unsatisfactory outcomes linked to some factors such as too short support period, total costs not capped or absence of banding leading to too little technology diversity, etc. However they note that some of the problems of auctions can be mitigated using appropriate design element.

In (Hajos, Fulcher, Johnson, Strbac, & Pudjianto, 2015), written by experts from Cambridge Economic Policy Associates at the request of the European Commission, EU-, regional- and national-level policy options to support the deployment of renewable energy sources for electricity production were studied in the context of market integration after 2020. The report first argues that if traditional support measures (FITs and priority dispatch of renewable electricity) have successfully accelerated renewable electricity capacity deployment, their efficiency is now called into question. The rapid capacity deployment of certain technologies has resulted in drastic costs reductions but at the same time some Member States have been slow to adjust levels of support. This situation led to support costs higher than necessary.

In (Winkler, Magosch, & Ragwitz, 2018), the authors assess the performance of auctions in comparison to other support scheme design. Using empirical data from Brazil, France, Italy, the Netherlands and South Africa, they find that auctions do not always have a positive effect on the outcomes of the support policies and may be more adapted in countries where previous schemes were characterised by high costs of support or low deployment. They may as well be very suitable in countries where policy makers focus on volume control, by introducing auctioned quotas, and competitive price setting. In (Del Río, 2017) we find an analysis of the drawbacks and advantages of auctions for renewable electricity support. The author highlights that auctions have increasingly been perceived as the most cost-effective alternative to other support instrument. But he shows that if validity of this assumption is strongly dependent on the design of the auction, other external factors are important (programme management, market and banking conditions, existence of advisory services, and coexistence of other support scheme).

### **5.3 Sustainability schemes for (solid) biomass**

The European Union (EU) as a whole aims to utilize 20% renewable energy sources (RES) for its gross energy consumption by 2020 and 27% by 2030. The EU does not differentiate between the types of renewable energy source. EU's Renewable Energy Policy only prescribes the individual country shares of all renewable energy sources to be attained by 2020 as a share of the total gross energy consumption. It is in the National Renewable Action Plans (NREAPs) wherein each EU member State lays out its plans for the current and future development of renewable energy sources. Whereas agricultural biomass is mostly associated with liquid biofuels, woody biomass is playing an important role for the production of heat and electricity. With regards to the latter, each EU Member State needs to import a considerable share in the form of wood pellets, wood chips, wood particles and lower quality logs, in addition to its own domestic forest supplies. Wood pellets shows one of the largest growths for the needs: EU's total pellet consumption has grown from about 1 million tonne in 2000 to more than 20 million tonnes in 2015. About two third of the pellets (230 PJ) is now used for heating and one third (130 PJ) for power production. Introduction of temporary subsidies for wood pellet boilers and stoves for households and district heating, around and after the millennium change, has established and lifted the non-industrial pellet consumption for heating. Also other factors play an important role, like the price of heating oil and gas. Industrial pellets for large scale power (including CHP plants) are mostly sourced from overseas and associated with national biomass support schemes. Those schemes are accompanied by certificates to prove sustainable sourcing ( AEBIOM, 2016), (JRC, 2017), (Flinkman, Sikkema, Spelter, & Jonsson, 2018)

In 2015, the EC issued the Energy Union Strategy and announced that it would only come forward with an updated bioenergy sustainability policy as part of a renewable energy package for the period after 2020. Anticipating possible obligatory sustainability criteria on the EU level, similar to those for liquid biofuels (Directive(2009/28/EC)) some EU Member States have started to develop extensive sustainability schemes with specific sustainability criteria for solid biomass from forests and agriculture for renewable energy purposes. Belgium, Denmark, the Netherlands and the UK are the MS with the most specific legislative criteria. Two studies have extensively analysed the EU Member States' biomass support schemes and their sustainability criteria (Mai Moulin et al 2016) (Sikkema et al 2014). Sustainable forest management (SFM) certificates are actively used to cover the EU's legislation and proposed regulation. Wood pellets, and wood chips are almost completely covered via supplies from North American, European and Russian forests. Although those forests are increasingly certified, a large part is still not certified, due to the costs incurred,

which mostly happens for small forest management units (FMU's) owned by private forest owners. The MS biomass schemes anticipate this discrepancy and allow remaining non-certified wood fibers to be audited via a complementary risk assessment with only a few sustainability criteria. These audits occur on a regional or on a country level, instead on the FMU level. Whereas wood fibers with SFM certificates show the highest level of coverage with EU's possible obligatory criteria for solid biomass, the remaining fibers can have an insufficient coverage (Sikkema et al 2014). The amount of woody biomass that may be sourced from SFM-certified forests at acceptable costs is probably limited. The UK risk-based approach is stated as a kind of temporary solution to demonstrate sustainable biomass use for energy in the EU. The Dutch system allows for such a risk-based assessment, too and has specified a threshold for small forest ownership up to 500 ha for any remaining fibers for bio-energy purposes (Mai Moulin et al 2017). The latest Dutch legal requirements for sustainable biomass use (DutchGovernment, 2017) can be regarded as the most stringent criteria, with the aim to prevent unwanted land use changes, to reckon with carbon debt, to safeguard a right nutrient balance in vulnerable soils and other sustainability criteria.

## **5.4 Recommendations for policy makers**

In (Stockmayer, Finch, Komor, & Mignogna, 2012), the authors try to identify the best way to limit the costs bore by customers in US States that support renewable electricity in the framework of a renewable portfolio standard (minimum percentage of sold electricity deriving for renewable sources of energy). Without being able to tag the best mechanism, experience shows nonetheless that the most important factors for an effective support mechanism are the clarity of the rules, the consistency in their application and the transparency for customers.

(Hajos, Fulcher, Johnson, Strbac, & Pudjianto, 2015) also advocate that the increase of renewable electricity wasn't matched with the appropriate investments in the transmission system. The authors ran various scenarios in a PRIMES model for the European Union. Their results show that if feed-in tariffs and grant schemes may to the lowest economic cost of support, floating feed-in premiums are the most likely to meet renewable electricity targets at least social cost. Results also indicate the beginning of a transition away from having several main technologies subsidized, as their costs become fully competitive. Indeed, if electricity prices and ETS carbon prices increase more investors may find that electricity markets revenues are sufficient to support renewable energy investments. In the end, the report recommends that the primary policy objective be to meet 2030 renewable electricity targets and 2050 decarbonisation objectives at the least social cost. Such objectives could lead to lesser levels of support for technologies not needed to reach the objectives. Also, as policy makers may want to pursue other objectives through renewable energy policies (resource diversity, innovation in emerging renewable technologies or domestic jobs creation), it may increase the overall cost of reaching the energy targets. In this extend, authors advise that the policy should be flexible but without moving away from the primary objective. In the light of these elements and those of simulation results, the authors conclude that the best way of achieving renewable electricity deployment objectives is to implement a technology neutral mechanism and to allocate support through competitive auctions. In this context, feed-in tariffs and fixed feed-in premiums are less efficient than sliding feed-in premiums and green certificates systems. They should be phased out. The report ultimately recommends a transition to floating feed-in premiums as the default support mechanism in Member States that have not yet implemented a green certificate scheme.

In (Gatzert & Vogl, 2016) authors argue that risks concerning the support policies are among the biggest threats to investments in renewable energy generation. (Winkler, Gaio, Pfluger, & Ragwitz, 2016) investigate the impact of support schemes for renewable electricity on the whole electricity market. The authors show that fixed feed-in tariffs have a significant impact on the market whereas more market-oriented schemes, such as market premiums or quota systems, have a lesser impact. However, if such instruments lead to less market distortions, they can also lead to higher support costs and more risks for the investors. They also find that quantity-based instruments can lead to the reduction of electricity production if the system is not flexible enough. In the end, the authors advocate a sliding feed-in premium as a good compromise combining market participation and lowered risks for plant operators.

In January 2016, the Council of European Energy Regulators published a report, (CEER, 2016), on key support elements for renewables. Its conclusions call for a greater coordination between Member States and the implementation of cross-border support schemes. However, such schemes are currently limited by national regulations that encompass technical, investment, environmental, insurance, property and taxation laws. The report also highlights the importance of a competitive environment for electricity producers. Competitive settings for support schemes are deemed to bring down the costs of renewable electricity production. Feed-in premiums schemes are a suitable

framework for integrating renewable electricity producers that are still confronted to short-term market signals but protected from long-term price risks. However, these support schemes should remain an option for small-scale producers. For each renewable energy sources, the report argues that Member States should analyse whether a competitive support scheme is suitable and only if the assessment turns out negative could the Member States fix the level of support through an administrative procedure. Concerning National Regulation Authorities, the reports pins down four responsibilities: to ensure that renewables sources of energy have, first, access to the network, and second, access to all relevant energy markets on a non-discriminatory basis, then that the appropriate balancing rules are defined and finally that the short-term balancing products reflect renewable energy sources needs (e.g. intermittency and reliability on good forecast).

In (Hutington, Rodilla, Herrero, & Battle, 2017), the authors focus on core design features of renewable energy support policies in relation to market compatibility. First they explain that the idea that renewable electricity producers should be insulated from market risks and competitive pressure has become less and less popular over the years. The new consensus is that these producers should participate to the wholesale market. The authors propose that the regulator define capacity payments with ex-post compensation based in reference plants. Then the supported capacity would be allocated through auctions. An advantage of such capacity-based payment is that it cuts the links between production and payment so that only market signals influence operating decision, reducing distortions. Also the use of auctions introduces competition among renewable energy producers, ensuring that investment costs are not inflated in an attempt to secure larger support payments.

## 6 Support schemes and other measures to promote energy from renewable sources – reporting under Article 22(1) b

The EU's role in establishing an internal European market and protecting the environment were and are still crucial. Increasing evidence of climate change and growing dependence on energy has underlined the European Union's (EU) determination to become a low-energy economy and that the energy consumed is secure, safe, competitive, locally produced and sustainable. In addition to ensuring that the EU energy market functions efficiently, the energy policy promotes the interconnection of energy networks and energy efficiency. It deals with energy sources ranging from fossil fuels, through nuclear power, to renewables.

The EU focused on frameworks to guide member states in the process towards a single European energy market and cleaner energy markets overall. The progress varies by region: while the north-western member states' electricity markets are reasonably interconnected and liberalised, the eastern and south-eastern markets are still about to catch up. The Electricity Market Regulation, together with the Electricity Directive, aims at developing the "Energy Union" for power markets, which is an integrated, harmonised electricity market and infrastructure across Europe (ICIS, 2018).

Over the years the EC has continued to express support for the use of technology-neutral support schemes in electricity sector to better promote a cost-effective deployment; it however also acknowledges that in view of the different stage of technological development of renewable energy technologies, technology-specific schemes may also be motivated.

Table 1 illustrates the support schemes for renewable energy deployment in EU countries for the 3 main sectors (electricity production, heating/cooling and transport). For electricity, it also indicates whether this support is technology neutral or technology specific.

**Table 1.** Renewable energy support schemes in EU countries

	RES – E	Technology support in Electricity sector	RES - HC	RES – T
<b>BE</b>	Quota (TGCs)	Specific	Tax deduction	Quota + Tax mechanism
<b>BG</b>	FIT	Specific	Subsidy	Quota
<b>CZ</b>	FIT, FIP	Specific	Subsidy	Quota + Tax mechanism
<b>DK</b>	FIP, Tender	Specific	Tax obligation/FIP	Quota + Tax mechanism
<b>DE</b>	FIT, FIP, Tender	Specific	Loans	Quota + Tax mechanism
<b>EE</b>	FIP	Partially neutral	Subsidy	Subsidies
<b>IE</b>	REFIT	Specific	Tax return, Subsidy	Certificate, Quota
<b>EL</b>	FIT, Tender	Specific	Tax relief/Subsidies	Quota, Subsidy, Tax
<b>ES</b>	FIT, FIP (Tender)	Specific	-	Quota + Tax mechanism
<b>FR</b>	FIT, Tender	Specific	Tax incentives/Subsidy	Quota + Tax mechanism
<b>IT</b>	FIT, FIP, Tender, Quota (TGCs)	Specific	Tax incentives/Subsidy	Quota
<b>CY</b>	FIT, Subsidy, Net metering	Specific	Tax incentives/Subsidy	Quota
<b>LV</b>	FIT, Net metering	Specific	-	Quota + Tax mechanism
<b>LT</b>	FIT (sliding), Tender, Subsidy.	Specific	Subsidy, FIT	Quota, Subsidy, Tax
<b>LU</b>	FIT/FIP/Subsidy	Specific	Subsidy	Quota
<b>HR</b>	FIT, Subsidy	Specific	In progress	Quota
<b>HU</b>	FIT, FIP (Tender)	Specific	Subsidy	Quota, Subsidy, Tax
<b>MT</b>	FIT, Subsidy	Specific	Subsidy	Quota
<b>NL</b>	FIP	Neutral	Individual subsidy	Quota + Tax mechanism
<b>AT</b>	FIT, Subsidy	Specific	Flat rate Subsidy	Quota, Subsidy, Tax
<b>PL</b>	FIT, FIP (Tender)	Neutral	Subsidy	Quota
<b>PT</b>	FIT	Specific	-	Quota + Tax mechanism
<b>RO</b>	Quota (TGCs)	Specific	Grants	Quota
<b>SI</b>	FIT, FIP	Specific	Subsidies	Quota + Tax mechanism
<b>SK</b>	FIT, Subsidy, Tax exemption	Specific	Subsidy	Quota, Tax
<b>FI</b>	FIT, Sliding FIP, Subsidy	Specific	Subsidy, Premium	Quota + Tax mechanism
<b>SE</b>	Green certificates, Subsidy, Tax	Neutral	Tax exemption	Tax mechanism
<b>UK</b>	FIT, FIP, Green certificates, Tax	Specific	Subsidy, Incentive	Quota

Feed-in tariff support schemes for **renewable electricity** are in place in 21 EU countries. This type of support guarantees access to the grid and long-term prices at which power producers can sell



energy generated from renewable sources into the grid or thermal system. In Belgium the support scheme for electricity production from all types of renewables takes the form of annually-increasing quotas combined with a system of tradable certificates. In Bulgaria feed-in tariffs are combined with a preferential price in long terms agreement Czech Republic's feed-in tariffs support schemes go together with green bonuses which depend on the type of renewable energy source used to produce electricity. In Denmark electricity production is supported through a feed-in-premium that depending on the technology used to produce the electricity can either be fixed or sliding. Tendering system is applied for the offshore wind technology. In Germany the support in the electricity sector takes place through feed-in tariffs scheme and market premiums schemes in which the market premium is decided through a tendering process. Applying a feed-in-premium scheme in Estonia producers of electricity from renewable sources of energy receive a premium on top of the market price of electricity. In Ireland, electricity from renewable sources mainly promoted through a feed-in-tariff scheme (REFIT) until 31 December 2015. A public consultation on the development and design of a new Renewable Electricity Support Scheme (RESS) ended on 10 November 2017. In Greece the support to renewables takes place either through a feed-in tariff or through a price premium. As of 1 January 2017, the support to larger installations has been granted through competitive tenders. A price regulation system is applied in Spain to support generation of electricity from renewable sources. In France, electricity from renewable sources is promoted through a feed-in tariff and call for tender scheme. A new support scheme, the 'additional payment' is introduced in 2016 paying a bonus to a renewable electricity producer on top of the market price received for the sale of the electricity. In Italy there are several support mechanisms for RES other than Solar PV. Operators of smaller plants can choose between a fixed feed-in tariff or a market premium. Large operators receive support via a tendering procedure that allows controlling the overall capacity increase. For Solar PV there currently exists only the net-metering for small prosumers. The electrify generation from renewable energy sources in Cyprus is promoted by a feed-in tariff system in combination with a net-metering and a self-consumption scheme. In Latvia a combination of feed-in tariff (on hold since 2014) and a net metering scheme. In Lithuania, electricity from renewable sources is mainly promoted through a sliding feed-in premium. RES plants with the installed capacity exceeding 10 kW acquire the guaranteed purchased tariff rates through tenders. Furthermore, the producers of renewable electricity may apply for subsidies and loans and are exempt from the excise duty. For solar, wind and biomass power installations net-metering is in place. In Luxembourg, electricity from renewable sources is promoted mainly through a feed-in tariff and a premium tariff. In Croatia the production of electricity from renewable energy sources is promoted through a combination of feed-in tariff and loans. The main support for renewable electricity in Hungary is in the form of feed-in tariff and feed-in premium (tender). In Malta the combination of a feed-in tariff and a subsidy is in place to support renewable electricity (mainly PV). In Austria, electricity from renewable sources is supported mainly through a feed-in tariff. In Poland electricity from renewable sources is promoted mainly through a tender system for the definition of support level of a feed-in tariff or premium. In Portugal the support is given through a feed-in tariff scheme. Romania applies the system of green certificates through long-term contracts (15 years). Direct support to renewable energy is the dominant type of support in Austria in which tariff subsidies are used to support the development of renewables. Grant incentives reflecting the market situation are in place in Slovenia together with tariff subsidies that are used to support the development of renewables. In Slovakia, electricity from renewable energy sources is promoted mainly through a feed-in tariff. Subsidies and tax regulation mechanisms are also applied. In Finland the support in electricity sector is given through a feed-in tariff (that is being closed gradually), a sliding feed-in premium and a subsidy. Sweden supports renewable electricity through various incentives, the most important of them being the quota system, which is based on a certificate trading system. Furthermore, tax regulation mechanisms and a subsidy scheme have been introduced. In the United Kingdom, the generation of electricity from renewable sources is supported through a combination of a feed-in tariff system, Contracts for Difference system, a quota system in terms of a quota obligation and a certificate system, and a tax mechanism.

**Renewable energy in heating/cooling** sector is supported through different schemes the EU countries. In Belgium a tax deduction scheme is applied. In Bulgaria the scheme for promoting renewable heat is the subsidy exemption from property tax for building owners. Subsidy is also used as a support scheme for renewable energy in heating/cooling in Czech Republic but a subsidy cohesion programme for 2014-2020 has not yet been adopted there. In Denmark there are several taxes on the production, supply and use of energy sources for heating purposes. Renewable energy sources are exempt from these tax obligations. Moreover, the use of biogas for heating purposes is supported through a direct premium tariff. In Germany the Renewable Energies Heat Act, the Market Incentive Programme and low-interest loans support renewable heating/cooling and numerous support schemes are available for renewable heat at Land level. In Estonia renewable

energy in heating/cooling is supported through various investment subsidies. In Ireland the support is provided through a tax return and a subsidy scheme. In Greece renewable energy sources in heating/cooling sector are supported by two tax relief mechanisms and subsidies. In France the support is given through a subsidy scheme and a tax regulation mechanism. In Italy a price based mechanism is in place to support renewable energy in heating/cooling sector combined with a subsidy and a tax regulation mechanism. In Cyprus the support is provided only to the solar thermal technology through subsidies. In Latvia the support is given through a subsidy system. In Lithuania a feed-in tariff scheme is in place for biogas. The scheme is combined with a price based mechanism, a tax exemption and a subsidy. In Luxembourg, the production of heat from renewable energy sources is promoted through four different subsidy schemes. In Croatia a support scheme for renewable heating from biomass is in progress. In Austria under the Environmental Assistance special investment incentives are in place for biomass heating plants. At the federal level, the support differs according to technology: usually, a flat rate of support is carefully calculated. Another option being a standard reimbursement rate amounting to 25 % of the environment-related investment costs possibly to be increased through awards to a maximum of 30 %. Several regional schemes complement in different ways the federal framework. Hungary provides subsidies in the form of non-refundable aid to entities willing to act for satisfying local heat and cooling demand from renewable energy sources Eligible applicants include businesses, bodies funded from the governmental budget, not-for profit organizations and other economic entities. In Romania the support scheme implies the granting of a non-refundable financing from structural funds for the performance of investments. In the case of application of State aid rules, financial support shall be exclusively granted to economic operators for the performance of initial investments in order to use RES for the production of electricity and thermal energy. Without State aid rules applied, co-financing shall be granted to local authorities and intercommunity development associations. Since 2010 incentives have been updated and extended under the "Green House" Programme to natural persons and legal persons without economic activity. Slovenia supports the renewable energy sources for heating/cooling through soft loans and subsidies. Financial support for RES used in heating and cooling is provided within different streams targeting specific technologies: solar collectors and wood biomass boilers in households, wood biomass and geothermal district heating systems, wood biomass boiler equipment and, since 2010, heat pumps for the preparation of sanitary hot water and heating in households. Moreover, an Energy advice network – EnSVet (Energetsko Svetovanje) – has been organized. In Slovakia, financial measures are planned for supporting the use of RES in households, including the installation of biomass boilers and heat pumps. Specific programs are also planned to support the development of RES based heating and cooling in public building and in all new or deeply renovated buildings. In Finland the support is given a "heat premium" and a subsidy scheme. In Sweden, tax exemptions are the main incentives to support renewable heating. In the United Kingdom, a subsidy and an incentive are available for supporting renewable heat/cold installations.

The main support scheme for renewable energy in **transport sector** in the EU countries is a quota system which is a non-financial measure linked to a specific target. For biofuels, the quota represents the obligatory minimum share of these fuels in petrol and diesel. In Belgium the quota scheme is the main support for biofuels in transport. In Bulgaria, the main support scheme for renewable energy sources used in transport is a quota system. In Czech Republic the main incentive for renewable energy use in transport is a quota system and biofuels are exempt from consumption tax. In Denmark the main incentive for renewable energy use in transport is a quota system. Renewable fuels in Germany are mainly supported by a quota system and through fiscal regulation. In Estonia a subsidy scheme is in place to support renewable energy in transport sector. In Ireland, the support scheme for renewable energy sources used in the transport sector is a quota system. Greece supports biofuels with a quota system, while there is also a tax regulation and a subsidy scheme available. Promotion of biofuels in Spain consists of a quota system and a tax regulation mechanism. In France the main support scheme for renewable energy sources used in transport is a quota system that is combined with a tax exemption scheme. A quota system for biofuels is currently in place in Italy. In Latvia, renewable energy use in the transport sector is promoted through obligation to sell petrol and diesel blended with biofuels and a tax regulation mechanism. In Lithuania the support for biofuel is given through a quota system in combination with subsidy and tax mechanism. In Luxembourg the support for biofuels is given through a quota system. In Croatia the main promotion scheme in the field of renewable energy in transport is a biofuel quota obligation. Additionally, the state provides a subsidy for producers of biofuels as well as a tax regulation mechanism to encourage the usage of biofuels. In Hungary, the main support scheme for the promotion of renewable energy sources in the transport sector is a quota system. The support for biofuels in Malta is given through a quota system. In Netherlands a combination of a quota system and a tax system are in place. In Austria, the main support scheme for renewable energy sources used in transport is a quota system. In Poland, renewable energy in transport is

promoted through a biofuels quota obligation. In Portugal, there are two support schemes for the use of renewable energy sources in the transport sector: a tax exemption to small producers of biofuels (PPDs) and a biofuel quota for companies supplying fuels for consumption in the market. In Romania, renewable energy sources in the transport sector are promoted by a quota system. The main incentive for renewable energy use in transport in Slovenia is a quota system and certain tax exemptions. In Slovakia, the main support scheme for renewable energy sources used in transport is a quota system combined with a tax mechanism. In Finland, the main support scheme for renewable energy sources used in transport is a quota system. Furthermore, the use of biofuels is supported through tax regulation. The main incentive for renewable energy use in transport in Sweden is a tax exemption for biofuels. In the United Kingdom a quota system is in place to support biofuels.



through the Energy Efficiency and Renewable Energy Credit Line which provides grants to companies up to 24.4 M€ and loans up to 151.6 M€.

**Table 2.** FIT Purchase Prices Granted to Hydroelectric Plants in Bulgaria as of July 2014

	Installed Capacity	Support (€/MWh) <sup>14</sup>
<i>Micro HPPs</i>	IC < 200 kW	98.78
<i>Low-thrust run-of-river HPPs with thrust of up to 15 metres, without diversion channel</i>	200 kW < IC < 10 MW	121.14
<i>Low-thrust, run-of-river HPPs, diversion HPPs, reservoir HPPs and diversion HPPs with an annual compensating basin with net thrust of up to 30 metres</i>		96.79
<i>Medium-thrust diversion, reservoir and diversion HPPs with an annual compensating basin with net thrust of 30 to 100 metres</i>		81.37
<i>High-thrust diversion, reservoir and diversion HPPs with an annual compensating basin with net thrust of more than 100 metres</i>		77.90
<i>Diversion tunnels with an annual compensating basin</i>		114.72
<i>Micro HPPs with pumps</i>	IC < 200 kW	49.44

In **Czech Republic**, hydroelectric power plants with an installed capacity of up to 10 MW (since 2012) can choose between a feed-in-tariff and a green bonus (premium tariff received additionally to the market purchase price). The two schemes cannot be combined so the producer has to choose between the two systems. Installations with a higher installed capacity (> 10 MW) are supported by the feed-in premium scheme. In 2014, the operational support for electricity produced using all renewable sources was stopped except for hydroelectricity producers with installed capacity under 10 MW (and also for biomass, wind and geothermal energy) put into operation before the 31th of December 2015.

The following table displays the level of support granted to hydroelectric installations according to their date of commissioning<sup>15</sup>.

**Table 3.** FIT Purchase Prices & Premiums Granted to Hydroelectric Plants in Czech Republic in 2014

Date of Commissioning	Support Level (€/MWh) <sup>16</sup>	
	FIT	Premium
<i>Small hydroelectric plant commissioned:</i>		
<i>Before 2005</i>	72.20	42.42
<i>Between 1 January 2005 and 31 December 2013</i>	92.57	62.79
<i>In 2014</i>	90.75	60.97
<i>Reconstructed small hydroelectric plant commissioned:</i>		
<i>Before 31 December 2013</i>	92.57	62.79
<i>In 2014</i>	90.75	60.97
<i>Small hydroelectric plant in new locations commissioned:</i>		
<i>Between 1 January 2006 and 31 December 2007</i>	102.81	73.03
<i>Between 1 January 2008 and 31 December 2009</i>	108.84	79.06
<i>Between 1 January 2010 and 31 December 2010</i>	118.28	88.50
<i>Between 1 January 2011 and 31 December 2011</i>	115.63	85.85
<i>Between 1 January 2012 and 31 December 2012</i>	120.53	90.75
<i>Between 1 January 2013 and 31 December 2013</i>	119.66	89.88
<i>Between 1 January 2014 and 31 December 2014</i>	117.30	87.52

Also, during the five years following their entry into service, installations producing electricity or heat using hydroelectricity generation (up to 1 MW) are exempted from income tax. Renewable energy projects are also exempted from property tax. The following table shows the actual cost of support for hydroelectricity generation from 2011 to 2014 (for small hydroelectric power plants).

<sup>(14)</sup> Using 1 € = 1.9558 BGN (2014)

<sup>(15)</sup> Following instructions laid in the Progress Reports, the data is extracted from "The Energy Regulatory Office's Price Decision No. 4/2013 of 27 November 2013 Laying down aid for promoted energy sources" downloaded from <http://www.eru.cz/>

<sup>(16)</sup> Using 1 € = 27.536 CZK (2014)

**Table 4.** Actual Support Cost for Hydroelectricity Generation in Czech Republic, 2011-2014

	2011	2012	2013	2014
Support Cost in M€ <sup>16</sup>	52.73	52.59	65.48	67.58

In **Denmark**, electricity produced using hydroelectric power plant can receive support through a sliding premium. It means that hydroelectricity producers get compensated on top on the market price for electricity up to a guaranteed price (the premium varies according to the market price). This guaranteed price is equal to 80.49 €/MWh for the 10 first years and to 53.66 €/MWh for the 10 years after that<sup>17</sup>.

In **Germany**, since the Renewable Energy Sources Act (EEG) of 2012, hydroelectricity producers have the choice to receive support through a feed-in-tariff or a sliding premium (based on the same support rates augmented by an additional premium, called "management premium", to cover direct marketing costs). With the EEG 2014, direct marketing has become mandatory for producers with installed capacity higher than 500 kW (since the 1st August 2014). This obligation is extended to installed capacities higher than 100 kW from January 2016. Lower capacities will retain the possibility to be supported through feed-in-tariff.

**Table 5.** Guaranteed Prices for Hydroelectricity in Germany in 2012 - 2014

Installed Capacity (IC)	Support Level (€/MWh) for 20 years		
	2012	2013	2014
IC<500kW	127.0	125.7	125.2
IC<2MW	83.0	82.2	82.5
IC<5MW	63.0	62.4	63.1
IC<10MW	55.0	54.5	55.4
IC<20MW	53.0	52.5	53.4
IC<50MW	42.0	41.6	42.8
IC>50MW	34.0	33.7	35.0
Market Premium	12.0	6.5	4.0

In **Estonia**, producers of electricity from hydroelectric power plants receive a premium of 53.7 €/MWh on top of the market price of electricity. This amount does not depend on the technology used to produce the electricity.

In **Ireland**, electricity generation using hydroelectric power plants is supported through different feed-in-tariff schemes (see Section 5.2.7). The admissions to the schemes are valid only for applications before December 2015. The following table displays the average support level granted to small hydroelectric power plants with installed capacity lower than 5 MW.

**Table 6.** Average Level of Support Granted to Hydroelectric Power Plant in Ireland, 2010-2014

	Average Level of Support (€/MWh)				
	2010 REFIT 1	2011 REFIT 1	2012 REFIT 1&2	2013 REFIT 1&2	2014 REFIT 1&2
Hydro Power Plant of up to 5MW	83.814	83.814	85.993	87.455	87.892

In **Greece**, hydroelectricity generation is supported by a feed-in tariff. The following table sums up the overall support granted to electricity generated by hydroelectric power plants.

**Table 7.** Overall Support Received by hydropower plants in Greece (M€), 2012-2014

Small Hydroelectric Plants (IC<15MW)	2012	2013	2014
Interconnected system	59.5	69.4	61.8
Non-interconnected islands	0.1	0.05	-

In **Spain**, up until 2012, new hydroelectric power plants with installed capacity of up to 10 MW had access to either a feed-in-tariff support or to a semi-fixed premium on top of the market price of electricity (there was not always a choice depending on the technology). New hydroelectric plants

(<sup>17</sup>) Using 1 € = 7.4548 DKK (2014)

with an installed capacity higher than 10 MW can only receive the feed-in premium. The feed-in-tariff consisted of two rates, one for the first 25 years and the other (lower) for the 25 next years. The premium is semi-fixed as it is defined by a fixed premium tariff with a floor and ceiling price. The sum of the market price and the premium must stay between these boundaries. If the market price is too low or too high then the premium is reduced accordingly. For hydroelectric power plants with an installed capacity of up to 10 MW, the feed-in tariff was equal to 82.519 €/MWh for the first 25 years and to 74.268 €/MWh for the following 25 years. If they chose the feed-in premium, the rate was 26.459 €/MWh for 25 years and then 14.223 €/MWh for another 25 years. For hydroelectric power plants with an installed capacity higher than 10 MW, the premium was 22.263 €/MWh for 25 years and then 14.223 €/MWh for another 25 years. In 2011, 77.96 M€ are granted to hydroelectric power plants through feed-in tariffs and 126.46 M€ through feed-in premiums.

In 2012, a decree froze all support for new installations. Another decree from July 2013 updated the support scheme replacing the previous premium tariff by a plant-specific premium set to cover investments costs which could not be recovered through electricity sale and also to cover the discrepancy between operating costs and market costs.

**France** supports hydroelectricity production through a feed-in tariff system complemented with some premiums based on efficiency and a capacity market scheme. The feed-in tariffs are granted for 20 years. Between June 2001 and March 2007, the support was equal to 54.9 €/MWh to 61.0 €/MWh according to the power rating with an additional bonus between 0 and 15.2 €/MWh in winter according to production regularity. With the Order of the 1<sup>st</sup> of March 2007, the support was equal to 60.7 €/MWh, plus a bonus for small facilities between 5.0 and 25.0 €/MWh, and an additional bonus between 0 and 16.8 €/MWh in winter according to production regularity.

**Table 8.** Feed-in tariff support for hydropower plants in France

	<b>FIT</b>
<b><i>Installation with drop height &gt;30 m</i></b>	
<i>plants located in a non-interconnected area</i>	120
<i>plants located in interconnected areas and Corsica</i>	88-166
<b><i>Installation with a drop height ≤ 30 m</i></b>	
<i>plants located in a non-interconnected area</i>	132
<i>plants located in interconnected areas and Corsica</i>	96-182
<b><i>Installation for the turbinning of the minimum flows</i></b>	
<i>plants located in a non-interconnected area</i>	80
<i>plants located in interconnected areas and Corsica</i>	58-110

In 2014, the estimated cost of the support granted to hydroelectric installations was equal to 186.1 M€ (132.8 M€ in 2013, 65 M€ in 2011, 80 M€ in 2010 and 117.7 M€ in 2009) for an average support level of 71.8 €/MWh in 2014 (16 €/MWh in 2011 and 20 €/MWh in 2009).

Until 2013, **Italy** supported all renewable electricity production technologies other than PV, by the means of a green certificate scheme. In this scheme, hydroelectricity's banding factor was equal to one. It means that for each MWh of electricity generated by a hydroelectric power plant included in the system, one certificate was delivered. The following table displays the renewable electricity quotas and the average certificate prices from 2010 to 2014.

**Table 9.** Annual Quotas and Average Prices of Certificates for Electricity from Renewable Sources in Italy, 2010-2014

<b>Green Certificates System</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<i>Quotas</i>	6.05 %	6.80 %	7.55 %	5.03 %	2.52 %
<i>Average Price</i>	87.5 €	81.4 €	80.6 €	89.3 €	97.5 €

From 2010 to 2014, a number of certificates equivalent to 8.115 million of MWh was exchanged for an annual indicative cost of 790.6 M€ for hydroelectricity.

Hydroelectric power plants with an installed capacity lower than 1 MW could also opt for a feed-in tariff scheme (all-inclusive tariffs) as an alternative to the green certificate system. The tariff was equal to 220 €/MWh and was guaranteed for 15 years. The following table describes the support granted through this all-inclusive tariff for hydroelectric power plant.

**Table 10.** Hydroelectric Power Off-Taken and Incentive Cost of the All-Inclusive Tariff in Italy for 2012, 2013 and 2014

	<b>2012</b>		<b>2013</b>		<b>2014</b>	
	Power Off Taken (GWh)	Incentive Cost (M€) <sup>18</sup>	Power Off Taken (GWh)	Incentive Cost (M€) <sup>111</sup>	Power Off Taken (GWh)	Incentive Cost (M€) <sup>111</sup>
<i>Pumped Storage</i>	1	0	6	1	7	1
<i>Conventional Hydro</i>	9	1	16	3	19	3
<i>Run-of-the-river Hydro</i>	868	124	1 473	227	1 808	298
<i>Conduit Hydro</i>	33	5	46	7	54	9

From 2013 onwards, new incentives replaced this combination. They apply now to newly built, entirely rebuilt, reactivated, upgraded or renovated, commissioned from January 1st of 2013. A ceiling of 5 800 M€ has been set for the annual cumulative cost of incentives. Thus, annual supported quotas are distributed according to type of source and plant by the mean of auctions. Self-consumed energy is not included in this scheme.

**Table 11.** Annual supported power and incentive cost for hydroelectricity in Italy for 2013 and 2014

	<b>2013</b>		<b>2014</b>	
	Annual Supported Power (GWh)	Incentive Cost (M€)	Annual Supported Power (GWh)	Incentive Cost (M€)
<i>Conventional Hydro</i>	0.1	-	4.0	-
<i>Run-of-the-river Hydro</i>	32.1	3.2	169.7	21.2
<i>Conduit Hydro</i>	1.8	0.1	7.6	1.1

Plants with a capacity of up to 1 MW can choose between a feed-in tariff and a feed-in premium. Plants with a capacity higher than 1 MW only have access to the feed-in premium. The premium is equal to the all-inclusive tariff minus the hour zone electricity price.

**Table 12.** Premium tariff for hydropower in Italy

	<b>Capacity(kW)</b>	<b>Incentive(MWh)</b>
<i>Run-of-the-river Hydro</i>	1-250	210
<i>Run-of-the-river Hydro</i>	250-500	195
<i>Run-of-the-river Hydro</i>	500-1000	150
<i>Run-of-the-river Hydro</i>	1000-5000	125
<i>Conventional Hydro</i>		101

It also has to be noted that the authority compensates for the work on the national transmission grid and insure return on the investment for developing and operating the system to promote the off-taking of renewable energy technologies.

In **Cyprus**, investment by natural persons, legal entities and public sector agencies engaged in an economic activity in small hydroelectric plants in rivers or streams and small hydro projects in existing hydraulic networks is supported through subsidies. Concerning the regional support, the subsidy is 15 %, 25 % or 35 % of the eligible budget, according to the type of undertaking. The maximum subsidy is 50 000 €. The *de minimis* support grants a subsidy equivalent to 35 % of the eligible budget with restrictions on maximum eligible expenditure. The maximum subsidy is also 50 000 €.

Since 2007 in **Latvia**, hydroelectricity generation in power plants with an installed capacity lower than 5 MW is supported by the mean of a feed-in-tariff along with a mandatory procurement (compulsory purchase of electricity generated from renewable sources of energy). For hydropower plants, the formula for computing the purchase price (in LVL/MWh) was the following:

$$C = 188 \times e \times k \times 0.8, \text{ for the first 10 years after commissioning, and then,}$$

$$C = 159 \times e \times k, \text{ for the next 10 years after commissioning}$$

In these formulas we find  $e$ , the exchange rate of Lats (LVL) specified by the Bank of Latvia against the single currency of the EU on the day when the invoice for electricity was issued,  $k$ , the price differentiation coefficient of the power plant. The average price of electricity under this mandatory procurement applied to hydroelectric power plants was 180.69 €/MWh in 2013 and 180.15 €/MWh

(<sup>18</sup>) These values are obtained by deducting from the off-take cost of the supported power the revenue from the sale of the same power on the market.



in 2014 (the average per unit support above the market price was equal to 13.29 €/MWh in 2011 and 13.42 €/MWh in 2012<sup>19</sup>). Since July 2014 and until January 2020, no new renewable electricity producer can enter the support scheme. It should also be mentioned that in Latvia, electricity produced from renewable energy sources is exempted from the electricity tax.

Since 2002, **Lithuania** supports hydroelectricity generation by the means of a guaranteed purchase tariff (feed-in tariff). Since 2012, this support is distributed following quotas and through auctions for installations with an installed capacity higher than 10 kW. The national regulator set a maximum allowance and the successful bidder is the one who indicate the lowest fixed rate given the largest installed capacity of the group of power installations is not higher than 40 % of the maximum allowance of capacity for this region. The auction quota for hydropower is 14 MW over the whole territory of the Republic of Lithuania. The following table presents the guaranteed purchase prices from 2010 to 2014 for hydroelectricity (from 2012 onwards, prices for installed capacities higher than 10kW are maximum tariffs).

**Table 13.** Support level for hydroelectricity generation in Lithuania, 2010-2014 (€/MWh)

Installed capacity	2010	2011	2012	2013		2014
				Q1	Q2	
<i>IC&lt;10kW</i>					78.0	78.0
<i>IC&lt;30kW</i>			81.1	81.0		
<i>IC&lt;350kW</i>			78.2			
<i>IC&lt;1MW</i>	75.3	75.3	78.2	78.0	70.0	70.0
<i>IC&gt;1MW</i>			63.7	64.0	64.0	64.0

In **Luxembourg**, hydroelectricity generation is supported through a deed-in tariff scheme. The following table displays the support level granted to hydroelectric power plants up to 6 MW according to their installed capacity from 2010 to 2014. The tariffs are guaranteed for 15 years.

**Table 14** Level of Support for Hydroelectricity in Luxembourg, 2010-2014

Installed capacity	2010	2011	2012	2013	2014
<i>IC&lt;300kW</i>					180.0
<i>IC&lt;1MW</i>	104.48	104.21	103.95	103.69	150.0
<i>IC&lt;6MW</i>	84.58	84.36	84.15	83.94	125.0

**Croatia** supports hydroelectricity generation by the means of a feed-in tariff. This support applies to plants with an installed capacity of up to 5 000 MW. The following table displays the support level granted as well as the overall support granted for 2014.

**Table 15** Support Granted to Hydroelectricity Generation in Croatia in 2014

Installed Capacity (IC)	Support Level (€/MWh)	Overall Support (M€)
<i>IC &lt; 300 kW</i>	140.2	0.1571
<i>300 &lt; IC &lt; 2000 kW</i>	121.9	0.9966
<i>2 &lt; IC &lt; 5 MW</i>	115.3	-
<i>5 MW &lt; IC</i>	69.5	-

The following table displays the support granted in the previous years (2011, 2012 and 2013).

**Table 16** Support Granted to Hydroelectricity Generation in Croatia in 2011, 2012 and 2013

Installed Capacity (IC)	Annual Production (AP)	Support Level (€/MWh)			Overall Support (M€)		
		2011	2012	2013	2011	2012	2013
<i>IC &lt; 1 MW</i>	AP < 500 MWh	92.8	159.6	158.4	0.0116	0.0124	0.0502
	AP < 1000 MWh		106.4	105.6		-	-
	AP > 1000 MWh		79.8	79.2		-	-
<i>IC &lt; 10 MW</i>	AP < 5000 MWh	92.8	133.0	132.0	-	0.2732	1.0104
	AP < 15000 MWh	74.0	93.1	92.4	-	-	-
	AP > 15000 MWh	56.5	75.8	75.3	-	-	0-

(<sup>19</sup>) Using 1 € = 0.702804 LVL and the value of the support above the market price for hydropower plants.

Support was also granted to hydroelectricity generation installation through the Environmental Protection and Energy Efficiency Fund. Indeed, in 2012, 377.97 M€ were granted for investments in hydroelectric power plants. It corresponded to a unit support of approximately 382 905 €<sup>20</sup>.

In **Hungary**, hydroelectricity generation is supported by the means of a feed-in tariff scheme. The following table presents the average level of support granted under this scheme for hydroelectric plants.

**Table 17** Average level of support for Hydropower Plants in Hungary (€/MWh), 2009-2014

	2009	2010	2011	2012	2013	2014
<i>Installed Capacity Up to 5 MW</i>	96.89	102.12	105.95	203.93	97.73	103.12
<i>Installed Capacity Higher Than 5 MW</i>	56.05	58.34	60.52	38.75	54.32	57.51

The following table displays the overall support granted to hydroelectric power plants.

**Table 18** Overall support for Hydropower Plants in Hungary (M€), 2009-2014

	2009	2010	2011	2012	2013	2014
<i>Installed Capacity Up to 5 MW</i>	2.55	2.91	2.37	2.43	3.66	4.95
<i>Installed Capacity Higher Than 5 MW</i>	0.00	0.00	0.72	0.88	2.56	4.13

In **Malta**, there is no particular support scheme for hydroelectricity generation.

The support for hydro energy in the **Netherlands** is relatively low, in comparison with other renewable energy sources (see also section 3.2.19). From 2003 to 2006, in the Netherlands new producers of hydroelectricity accessed a fixed feed-in premium (granted for ten years), through the Environmental Quality of Electricity Production (MEP). This scheme was closed for new entries in 2006 and its payments should run out up to 2020. For hydroelectric power plants, the support level was equal to 97.0 €/MWh. The overall support for hydropower under the MEP was equal to 6 M€ in 2011, 7.2 M€ in 2012 and 7.5 M€ in 2013 and 2014.

Under the SDE (National Incentive Scheme for Sustainable Energy Production) the average support per unit was equal in 2010 to 123 €/MWh for hydropower plants with height of drop up to 5 meters and to 72.0 €/MWh for hydropower plants with a height of drop higher than 5 meters. In 2011, it was equal to 81 €/MWh, in 2013 to 73.0 €/MWh and to 81 €/MWh in 2014.

The support is drastically reduced to almost zero by 2016; the support per unit is relatively stable with around 100€ per MWh. (table 17).

**Table 19.** Support provided in Netherlands for hydro energy, 2011-2016<sup>21</sup> (RVO, 2017b; CBS, 2014)

	<b>Programmes MEP,SDE &amp; SDE+</b>	<b>Per unit support (€/MWh)</b>	<b>Total support (million €)</b>
2011	aggregated	95	4.0
2012	aggregated	96	7.2
2013	aggregated	96	7.5
2014	aggregated	98	7.5
2015	aggregated	101	4.8
2016	aggregated	97	0.4

In **Austria**, the generation of electricity using small and medium hydroelectric plants (<10MW) was moved from a feed-in tariff support scheme to investment grants under the Green Electricity Act.

For 2009 to 2014, 75 M€ were available for small hydroelectric plants and 50 M€ for medium hydroelectric plants. The scheme was reformed in 2011-2012. The annual support available then for new contracting installations was 50 M€ for 2012 (across all technologies). 1.5 M€ could be

<sup>(20)</sup> Using 1 € = 7.5217 HRK

<sup>(21)</sup> Source: (i) RVO, 2017b. Results renewable energy 2016 per 1st of March 2017 (IN Dutch: Resultaten hernieuwbare energieproductie 2016) <https://www.rvo.nl/subsidies-regelingen/stimulering-duurzame-energieproductie/feiten-en-cijfers/resultaten-2016> ; (ii) CBS, 2014. Renewable energy in the Netherlands 2013 (in Dutch: hernieuwbare energie in Nederland 2013; tabel 2.8.1 MEP en SDE(+) subsidie).

awarded to small-scale hydroelectric plants (under 10 MW). The following table display this investment support according to installed capacity in 2010.

**Table 20.** Investments Support Granted to Hydroelectric Installations in Austria

	Installed Capacity	Maximum Grant Level	Max. Investment Value Subsidized
<i>Small Hydro Plant</i>	IC < 500 kW	1 500 €/kW	30 %
	500 kW < IC < 2 MW	1 500 €/kW	20 %
	2 MW < IC < 10 MW	400 €/kW	10 %
<i>Medium HP</i>	10 MW < IC < 20 MW	400 €/kW	6 M€

Like for the other renewable sources of energy in **Poland**, hydropower use for electricity generation is supported by the means of renewable electricity quotas combined with a tradable green certificates system. This scheme is technology-neutral, that is to say the banding factor is the same for all technologies. The following table displays the evolution of the average price of green certificates in Poland and of the compulsory quota.

**Table 21** Annual Renewable Electricity Quotas and Average Certificate Prices in Poland, 2010-2014

	2010	2011	2012	2013	2014
<i>Average Certificate Price (€/MWh)</i>	47.13 <sup>22</sup>	65.70 <sup>22</sup>	60.53 <sup>22</sup>	49.74	47.20
<i>RE Quota (%)</i>	10.4 %	10.4 %	10.4 %	10.9 %	11.4 %

Also, from 2007 to 2013 under 16 EU funded Regional Operational Programs, funds were granted to projects in the 42<sup>th</sup> category: "Renewable energy: hydroelectricity, geothermal and other". The total sum reached 64.53 M€<sup>22</sup>, the overall funding 42.65 M€<sup>22</sup> and the EU funding 31.05 M€<sup>22</sup>.

In **Portugal** hydroelectricity is supported through a feed-in tariff scheme. For hydropower plants with an installed capacity of up to 10 MW the tariff is equal to 95.0 €/MWh and for plants with an installed capacity between 10 and 20 MW, the tariff is between 91 and 94 €/MWh. The following table display the overall level of support and average level of support (additional production incentive above the market prices) for hydropower plants.

**Table 22** Level of support above market prices for hydropower in Portugal, 2010-2014

	2010	2011	2012	2013	2014
<i>Average (€/MWh)</i>	50.0	39.6	49.8	47.21	49.96
<i>Overall (M€)</i>	68.1	40.2	22.9	50.9	56.4

As for the other renewable sources of energy, **Romania** supports hydroelectricity generation by the means of its green certificate scheme (for hydropower plants of an installed capacity of up to 10 MW). The following table displays the evolution of the average prices of certificates and the renewable electricity quotas. The penalty for missing certificate is equal to 110 € per certificate.

**Table 23** Annual Quotas and Average Certificate Prices in Romania, 2010-2014

	2010	2011	2012	2013	2014
<i>Average Certificate Price (€/MWh)</i>	55 €	56.16 €	57.39 €	42.66 €	36.07 €
<i>RE Quota (%)</i>	8.3 %	10 %	12 %	14 %	15 %

The system is not technology-neutral. Technologies have different banding factor, that is to say that the number of certificates granted per MWh generated is different across technologies. The following table displays the evolution of the banding factors applied in 2010, 2011, 2012, 2013 and 2014 and give the contract's length for different types of hydropower plants.

**Table 24** Banding factors applied to hydropower in Romania, 2010-2014

	Contract length	2010 - 2014
<i>Hydro – New Plant</i>	15 years	3
<i>Hydro – Retrofitted Plant ≤10 MW</i>	10 years	2
<i>Hydro non updated ≤ 10 MW</i>	3 years	0.5

(<sup>22</sup>) Using 1 € = 4.1843 PLN (2014)

The number of producers qualified to produce hydroelectricity under this scheme was equal to 32 in 2011, 47 in 2012, 77 in 2013 and 81 in 2014. In 2014, the amount of State aid from the sale of green certificates for hydroelectricity producers reached 187.2 M€.

Under the Sectoral Operational Programme "Increase of Economic Competitiveness" and under the Major Intervention Area 4.2 "Making use of renewable energy sources for the production of green energy", 4 projects were under implementation in 2013, representing a value of 35.25 M€ and an installed power of 21.8 MW. The same year 2 micro-hydroelectricity projects were completed, for a value of 4.78 M€ and an installed power of 3.5 M€. In 2014, 3 projects were completed in the hydroelectricity sector, for a value of 14.59 M€ and an installed power of 14.48 MW.

In 2010, within the program on the production of energy from renewable source (wind power, geothermal, solar, biomass and hydro) subsidies were granted up to 50 % of the total eligible value of the project for the entire Romanian territory and 40 % for the region of Bucharest-Ilfov region. Overall support reached 46.87 M€ for hydroelectric plants.

Since 2009 producers of hydroelectricity in **Slovenia** are supported through either a feed-in tariff or a feed-in premium. Renewable electricity producers with capacity of up to 5 MW (1 MW for CHP plants) can choose between the two schemes (in the case of the premium scheme they have to market their electricity themselves). In 2014, in order to limit the cost of the scheme a reform of the system lowered capacity threshold from 125 MW to 10 MW for RES generating plants except for wind-powered plants for which the threshold remained at 50 MW, and from 200 MW to 20 MW for CHP generating plants. Since 2014, support quotas are distributed through auctions.

The following table displays the level of support for hydroelectric power plants according to their installed capacity.

**Table 25** Feed-in Tariff and Premium Levels for Hydroelectricity Generation in Slovenia, 2010-2014

Capacity (IC)	Support Level (€/MWh)									
	2010		2011		2012		2013		2014	
	FIT	FIP	FIT	FIP	FIT	FIP	FIT	FIP	FIT	FIP
IC<50kW	105.47	49.57	105.47	59.78	105.47	57.49			105.47	71.37
IC<1MW	92.61	36.71	92.61	46.92	92.61	44.63			92.61	58.51
IC<5MW	82.35		82.34		82.34				82.34	
IC<10MW		23.84								
IC<125MW		18.07								
IC>1MW				34.52		32.13				46.66

In **Slovakia**, a feed-in tariff grant is available for hydroelectricity producers. The scheme is guaranteed for 15 years for new producers. Eligible facilities have an installed capacity of less than 125 MW (200 MW for CHP plants). The following table displays the support granted in 2011, 2012, 2013 and 2014 to hydroelectric power plants.

**Table 26** Average Level of Support Granted to Hydroelectricity Generation in Slovakia, 2010-2014

Support Level (in €/MWh)	2011	2012	2013	2014
Hydro	61.7-109.1	61.7-109.8	61.7-109.8	97.98-111.27

In **Finland**, hydroelectricity generation is not included in the feed-in premium scheme that supports electricity generation from renewable sources of energy. Hydroelectric power plants receive no particular support in Finland.

Renewable electricity generation in **Sweden** is supported through a technology-neutral green certificate scheme. The average price of the certificate was equal<sup>23</sup> to 29.77 €/MWh in 2010, 20.08 €/MWh in 2012, 20.49 €/MWh in 2013 and 19.78 €/MWh in 2014. In case of non-fulfilment of the obligation, the charge is equal to 150 % of the volume weighted average of the certificate price during a period from 1 April of the calculation year to 31 March of the following year inclusive. The average penalty was equal to 42.39 €/MWh in 2010, 30.08 €/MWh in 2012, 30.38 €/MWh in 2013 and 27.75 €/MWh in 2014.

As for the other renewable energy sources in the **United Kingdom**, hydroelectricity is supported through three support scheme. The first is the Renewables Obligation, a green certificate scheme

<sup>(23)</sup> Using 1 SEK = 0.100927116 €

launched in 2002, which supports all renewable sources of energy. This scheme is expected to be completely closed to new applications in 2017. In 2014, it was supporting a total installed capacity of 24.6 GW. This scheme is not technology-neutral. The banding factor for hydroelectricity is equal to one. It means that for each MWh of hydroelectricity generated, one certificate is awarded to the producer.

**Table 27** Annual Quotas and Average Certificate Prices in 2010 & 2011 in the United Kingdom

	England, Wales & Scotland	Northern Ireland
<i>Quota in 2010</i>	9.70 %	3.50 %
<i>Quota in 2011</i>	12.40 %	5.50 %
<i>Average Certificate Price in 2010</i>	59.46 €/MWh <sup>24</sup>	
<i>Average Certificate Price in 2011</i>	50.28 €/MWh <sup>171</sup>	

Then, since 2010, a feed-in tariff scheme supports electricity generation by plants using hydroelectricity, among other renewable sources of energy, with an installed capacity of up to 5 MW. The following table displays the guaranteed purchase prices for plants installed between October and December 2014<sup>25</sup>.

**Table 28** Level of Support for Hydroelectricity Generation under the FIT Scheme in the United Kingdom, 2010-2014

Installed capacity	Support Level (€/MWh <sup>26</sup> )									
	April 2010	April 2011	March 2012	April 2012	Dec. 2012	March 2013	April 2013	Jan. 2014	April 2014	Oct. 2014
<i>IC&lt;15kW</i>	284.90	281.61	301.40	301.40	288.95	275.89	275.89	290.65	276.14	248.47
<i>IC&lt;100kW</i>	254.94	251.99	269.71	269.71	269.71	257.52	257.52	271.30	257.90	232.10
<i>IC&lt;500kW</i>				166.73	166.73	203.59	203.59	214.48	203.82	183.35
<i>IC&lt;2MW</i>	157.61	155.78	166.73	166.73	166.73	159.20	159.20	167.72	159.16	143.28
<i>IC&lt;5MW</i>	63.65	62.91	67.34	67.34	61.66	58.87	41.21	43.42	43.42	39.20

Finally, a feed-in premium scheme called Contracts for Difference was launched in 2014. This scheme is designed as a sliding feed-in premium scheme. A contract is signed between the renewable electricity producer and the Low Carbon Contracts Company (a government-owned company) for a "strike price", for 15-years. The State compensates the producer for the difference between the strike price and the actual market price. Only producers with an installed capacity higher than 5 MW are eligible for this scheme. Its first allocation round was completed in March 2015 by the means of a competitive auction for 25 contracts representing approximately 341 M€ per year.

<sup>(24)</sup> Using 1 £ = 1.13565181 €

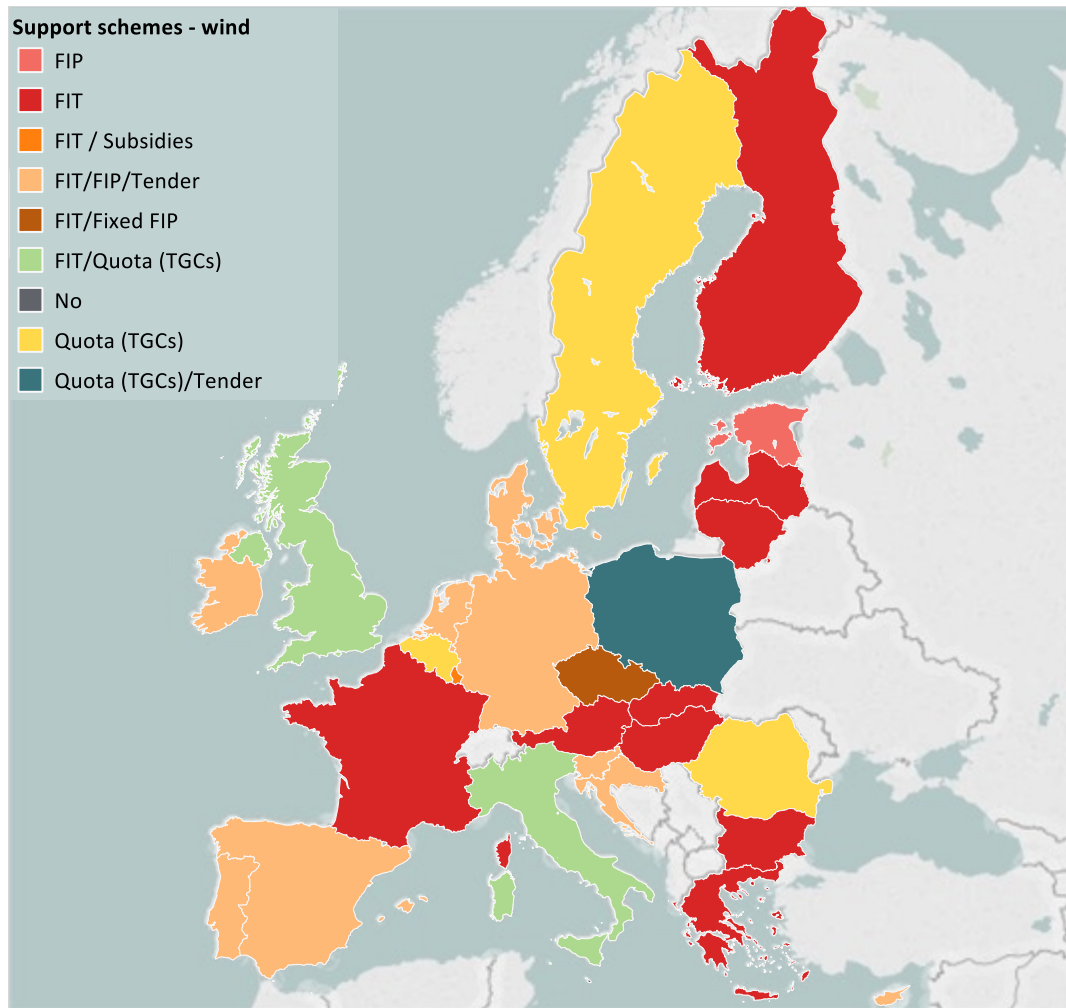
<sup>(25)</sup> Following the indications in the PRs, tariffs were extracted from <https://www.ofgem.gov.uk/environmental-programmes/fit/fit-tariff-rates> on the 20th of November 2017

<sup>(26)</sup> Using 1 € = 0.80612 GBP for 2014, € = 0.849261 GBP for 2013, 1 € = 0.81087 GBP for 2012, 1 € = 0.86788 GBP for 2011 and 1 € = 0.85784 GBP for 2010.

### 6.1.2 Wind

Figure 13 illustrates the support schemes applied in the EU countries for wind power technology<sup>27</sup>. The main support schemes for this technology are feed-in-tariffs and feed-in-premiums: applied in 24 EU countries. 3 countries (Belgium, Romania and Sweden) apply quotas (tradable green certificates) to support wind power plants. Italy together with the feed-in-tariff applies also the quota. Tender together with sliding feed-in-premium are applied in some EU countries (Denmark, Germany, Ireland, Spain, Croatia, Netherlands, Poland, Portugal, Slovenia). In the UK the support is given through feed-in-tariff (Renewables Obligation) and quota system. 5 EU countries (Czech Republic, Denmark, Estonia, Netherlands and Slovenia) applies fixed feed-in-premium scheme.

**Figure 13.** Support schemes in EU countries – wind power technology



In **Belgium** the support scheme in electricity sector are valid for onshore wind power but not for offshore installations. It is the transmission system operator Elia<sup>28</sup> who has the obligation to buy the certificates at a minimum price set by federal legislation (107 € for installations with capacity up to 216 MW and at 90 € for installations with capacity higher than 216 MW). Then the operator has a second obligation to sell these certificates on the regional markets. The transmission operator is also required to finance one third of the cost of the underwater cable installed to connect the plant to the network (up to a maximum amount of 25 M€ for a 216 MW or larger project, this amount is reduced proportionally when the project is less than 216 MW). This system has been slightly amended in 2014 with the introduction of a new formula to compute the minimum price of purchase (the aim is to take network imbalances into account).

<sup>(27)</sup> The schematic presentation of the support schemes for wind technology includes the type of support schemes applied to the ongoing wind projects and to the new applications.

<sup>(28)</sup> Belgium's electricity transmission system operator

In the Royal Decree of 4 April 2014, the support scheme for offshore wind power was amended from a fixed price to a variable price scheme. This new support scheme applies to all domain concessions (administrative agreements on exclusive temporary occupation of public domain sites) for which the financial close takes place after 1 May 2014. The price of green certificates will be determined by a factor estimating the economic cost of offshore wind power, the Levelised Cost of Energy (LCOE), and will be evaluated regularly to take account of changes in production costs and electricity prices. The new minimum price applicable under this new support scheme is calculated using a levelized cost of electricity (LCOE)<sup>29</sup> multiplied by a correction factor equal to 10% of the electricity price. For installations with a domain concession granted after 1 July 2007 for which the financial close takes place after 1 May 2014 and which have been authorised to connect directly to the onshore electricity transmission network, the minimum price is increased by €12/MWh.

In **Bulgaria** electricity production from wind is supported through a feed-in-tariff. For wind energy, in 2011 and 2012 the support level was dependent on the number of full-load hours of the installation. The tariff differed for installations with less or more than 2 500 full-load hours per year. Since 2013, the support depends on the installed capacity. Tariffs are set on the following scale: 30, 200 and 1 000 kW of installed capacity. Since 2011, tariffs are also specific for installations with asynchronous cage rotor generator.

**Table 29.** Feed-in-tariff level in Bulgaria for electricity from wind power plants in 2014

	Capacity	Tariff (€/MWh) <sup>30</sup>
<i>Installed capacity</i>	< 30 kW	70.63
	> 30 kW and < 200 kW	65.78
	> 200 kW and < 1 000 kW	59.88
	> 1 000 kW	48.91
<i>Installations with an asynchronous cage rotor generator</i>		42.77

In **Czech Republic**, electricity producers running a wind power plant can choose between a feed-in-tariff and a green bonus (premium tariff received additionally to the market purchase price). The two schemes cannot be combined so the producer has to choose between the two systems. Since 2012, only producers with installed capacity under 100 kW can choose the purchase price option (10 MW for installations using hydroelectricity). For wind power, the level of support is related with the time the plant was commissioned. Table 30 illustrates the levels of support applied for this technology until 2014<sup>31</sup>.

**Table 30.** Purchase price and Green Bonuses for wind power plants commissioned in Czech Republic

Wind power plants commissioned	Purchase Price €/MWh	Green Bonuses €/MWh
<i>before 2004</i>	139.76	122.00
<i>in 2004</i>	126.30	108.53
<i>in 2005</i>	120.15	102.39
<i>in 2006</i>	109.72	91.96
<i>in 2007</i>	107.79	90.03
<i>in 2008</i>	105.13	87.37
<i>in 2009</i>	95.88	78.12
<i>in 2010</i>	89.74	71.97
<i>in 2011</i>	87.81	70.05
<i>in 2012</i>	85.89	68.12
<i>in 2013</i>	80.00	62.24
<i>in 2014</i>	74.53	56.76

In **Denmark** electricity production using wind power is supported through a feed-in-premium and auctions (offshore wind parks). Until the end of 2013 this premium was fixed, i.e. independent of the market price for electricity. After 1<sup>st</sup> of January 2014 for wind turbines connected to the grid the premium tariff is set only to complement the revenues from direct marketing up to a predefined level. Such system is called a "sliding premium". Domestic wind turbines connected to

<sup>(29)</sup> LCOE equals EUR 138/MWh

<sup>(30)</sup> Conversion rate 1 € = 1,9535 BGN (2016)

<sup>(31)</sup> Conversion rate 1 € = 27.0240 CZK (2016)

its own consumer installation and with installed capacity up to 25 kW have access to a special sliding premium tariff. Since the end of November 2012, distinct premium are set for installed capacity up to 10 kW and between 10 and 25 kW.

Support for offshore wind farms is distributed through auctions. The objective is to establish 1350 MW of offshore wind capacity. A total of 12 million DKK is to be allocated from 2012 to 2015 to support the tenders. A 50 MW pool is also planned for pilot projects using turbines helping to reduce the cost of offshore electricity production. These projects should receive a higher level of support set so that summed with the market price it would reach 700 DKK/MWh (94.1 €/MWh<sup>32</sup>).

**Table 31.** Support for electricity from onshore wind in Denmark<sup>33</sup>

		Unit support
<i>From 21 February 2008 to 31 December 2013</i>		33.6 €/MWh <sup>A</sup>
<i>After 1 January 2014</i>	Max. Premium	33.6 €/MWh <sup>A</sup>
	Max. Revenue	78.0 €/MWh <sup>B</sup>
<i>Domestic wind turbines (&lt; 25 kW) connected to the grid</i>		
<i>No later than 19 November 2012</i>		80.7 €/MWh <sup>B</sup>
<i>Between 20 November 2012 and 31 December 2015<sup>34</sup></i>	< 10 kW	336.2 €/MWh <sup>B</sup>
	> 10 kW	201.7 €/MWh <sup>B</sup>

5 rounds of tender procedures for offshore wind took place between 2004 and 2014 (auctions for sliding FIP for 12 to 15 years). The results of these tenders are presented at the following table:

**Table 32.** Tenders results for offshore wind in Denmark, 2004 -2014

Name	Period	Capacity	Supplied Generation	Unit support
<i>Horns Rev 2</i>	Feb. 2005	200 MW	10 TWh	69 €/MWh
<i>Rødsand 2, 1<sup>st</sup> try</i>	May 2006	200 MW	10 TWh	67 €/MWh
<i>Rødsand 2, 2<sup>nd</sup> try</i>	Apr. 2008	200 MW	10 TWh	85 €/MWh
<i>Anholt</i>	Apr. 2010	390-400 MW	20 TWh	141 €/MWh

In **Germany**, according to Renewable Energy Sources Act (EEG), renewable electricity producers had the choice to receive support through a feed-in-tariff or a sliding premium (based on the same support rates augmented by an additional premium, called "management premium", to cover direct marketing costs<sup>35</sup>). Since 2014 direct marketing has become mandatory for producers with installed capacity higher than 500 kW. Lower capacities will retain the possibility to be supported through feed-in-tariff. These payments are guaranteed for 20 years.

**Table 33.** Onshore wind power plants Feed-in tariff<sup>36</sup>

	EEG 2014	EEG 2017
<i>Basic payment</i>	49.5 €/MWh	46.6 €/MWh
<i>Increased initial payment <sup>A</sup></i>	89.0 €/MWh	83.8 €/MWh
<i>Degression rate</i>	0.4 % per quarter	

For onshore wind power plants up 100 kW the support system is based on a feed-in tariff, which the grid operator pays to the plant operators. For onshore installations between 100 kW and 750 kW not eligible for the tenders and the fixed feed-in tariff the market premium mechanism applies. The premium is calculated as the difference between a fixed feed-in and the monthly market value of the electricity sold. Under the EEG 2017 the capacity of onshore wind of 2800 MW in 2017, 2018 and 2019 and from 2020, 2900MW (gross) will be auctioned each year. For onshore wind installations above 750 kW the market premium is determined in the auctioning process. Price cap of 70.0 €/MWh is applied for 2017.

<sup>(32)</sup> Conversion rate 1 € = 7,43690 DKK (2016)

<sup>(33)</sup> Wind turbines connected to the grid with the exception of offshore turbines put out to tender and domestic turbines  
A: value of the premium; B: overall value with premium on top of market price.

<sup>(34)</sup> At the moment of the redaction of the 3<sup>rd</sup> Progress Report, a draft law amending the support for domestic wind turbines as of 21 October 2015 had been proposed. The support was to be reduced gradually between 2016 and 2020, and an annual funding pool with expansion limits was to be set up.

<sup>(35)</sup> Such as: (i) costs of admission to the exchange; (ii) forecasting costs and (iii) forecasting errors, etc.

<sup>(36)</sup> A: granted for five years.



Up to 2030, offshore wind farms will be installed with a total capacity of 15000 MW; the "central 'Danish' target model" will be introduced (the Government examines in advance the sites to be auctioned for wind farms to ensure optimal dovetailing with the grid connections and avoid a stock of grid connections having to be built and resulting in significant extra costs). For offshore installations above 750 kW the market premium will be determined in the auctioning process. Price cap of 120 €/MWh is applied for 2017.

**Table 34.** Offshore wind power plants – payments and degressions rates<sup>37</sup>

<i>Basic payment</i>	39.0 €/MWh
<i>Increased initial payment <sup>A</sup></i>	154.0 <sup>B</sup> – 194.0 <sup>C</sup> €/MWh
<b>Degression rate</b>	
<i>01.01.2018</i>	5 €/MWh
<i>01.01.2020</i>	10 €/MWh
<i>From 2021</i>	5 €/MWh on 1 Jan. of each year

According to the German 2<sup>nd</sup> and 3<sup>rd</sup> Progress Reports, a large majority of producers of electricity from wind energy had already chosen the direct marketing option (80 % of onshore capacity and 100 % of offshore capacity in June 2013). Following the implementation of mandatory direct marketing, the management premium is taken into account in funding rates. EEG 2014 has set these marketing costs at 4 €/MWh for wind power plants and photovoltaic installations and at 2 €/MWh for the other technologies. For small installations choosing feed-in-tariff support, founding rates are reduced by these amounts.

The reform also plan that in case of negative electricity prices on the exchange market for more than six consecutive hours, the market premium will be reduced to zero. Only wind power plants up to 3 MW and other renewable plants up to 500 kW are exempted from this.

"Expansion corridors" have also been defined. It means that if the installed capacity becomes higher than the value of the corridor, funding rates for further plants fall. These corridors are defined in terms of annual growth except for offshore wind: (i) 2.5 GW per year for onshore wind (net); (ii) 6.5 GW installed in 2020 and 15 GW in 2030 for offshore wind. For the other sources, no corridors have been defined as these technologies have not been very dynamic in the past.

In **Estonia** producers of electricity from renewable sources of energy receive a premium of 53 €/kWh on top of the market price of electricity. This amount does not depend on the technology used to produce the electricity. According to the Electricity Market Act, wind power is supported up until the annual amount of 600 GWh is reached. However this limit was not reached in the period from 2010 to 2014. Moreover, through the Environmental Investment Centre, support for investment is available for installations using wind power (up to 19.85 M€ in 2011). In 2014, overall support for energy generation using wind power reached 26.3 M€. Electricity generated by a wind power plant is not eligible if the plant operator has received other investment subsidies from the state for the same plant

**Ireland** supports electricity from renewable sources through different feed-in-tariff schemes. REFIT 1 was open from 2007 to 2009 and encompass 1 379 MW of installed capacity. Its support will end in 2027. REFIT 2 opened in 2012 for onshore wind power installations, small hydroelectricity plants and landfill gas electricity plants. Its support cannot exceed 15 years and it will not extend beyond 2032. In 2014, under REFIT 2, the feed-in-tariff paid by the network operator to electricity producers using wind power was 72.023 €/MWh for small installations (< 5 MW) and 69.581 €/MWh for large installations (> 5 MW). A tax relief system, the Accelerated Capital Allowances, applied among others to wind turbines over 5 kW of installed capacity, was also launched in 2009 to promote investment in energy savings and renewables sources of energy by companies. It is a tax incentive tax incentive allowing firms to write off from their yearly profit the total investment value.

**Greece** uses a feed-in-tariff, a sliding feed-in-premium, net metering, investment aid and tax relief schemes to support electricity produced from wind technology. Under the FIT scheme all tariffs are adjusted each year, indexed on 25 % of an annual consumer index. In 2014, the whole amount granted through this scheme reached 266.7 M€ for installations part of the interconnected system and 68.8 M€ for turbines installed in non-interconnected islands. Given the gross electricity generation of 4152.4 GWh for wind power in 2014, the feed-in-tariff should have had granted an

(<sup>37</sup>) A: granted for 12 months, plus 0.5 months for every full nautical mile over 12 nautical miles and by 1.7 months for every full metre by which the depth of water exceeds 20 metres; B: basic model; C: compression model.

average support of approximately 80.8 €/MWh. Since 2010, investment in small wind turbines for small residential installations can also be eligible to some tax relief. This relief consist of a 10 % income tax reduction (of investment costs) up to a maximum subsidy of 6000 €. Under the sliding fee-in-premium the tariff per MWh is 98 €. The scheme is valid from 2016 and the maximum duration is 20 years. Net-metering is applied since 2006 to the capacities ≤5 MW. Under the Investment Aid the minimum investment amount in order to be eligible is: (i) Large enterprises: €500,000; (ii) Medium enterprises: €250,000; (iii) Small enterprises: €150,000; (iv) Very small enterprises: €100,000; (v) Social cooperatives: €50,000 and (vi) 25% of the budget is own participation. Leasing subsidy cannot exceed 7 years.

In **Spain**, up until 2012, new plants generating electricity using renewables sources of energy had access to either a feed-in-tariff support or to a semi-fixed premium on top of the market price of electricity. In 2010, feed-in-tariffs for onshore wind installations was 77.5 €/MWh during the first 25 years and then 64.7 €/MWh. The semi-fixed premium was 30.9 €/MWh and could vary so that added to the market price, the overall unit revenue of the producer would stay between 75.4 and 89.9 €/MWh. Offshore wind could only be supported through the semi-fixed premium scheme. In 2010, it was 89.2 €/MWh with a maximum overall unit revenue for the producer equal to 173.5 €/MWh. In 2012, a decree has frozen all support for new installations. Another decree from July 2013 updated the support scheme replacing the previous premium tariff by a plant-specific premium set to cover investments costs non which could not be recovered through electricity sale and also to cover the discrepancy between operating costs and market costs.

**France** has introduced a feed-in-tariff guaranteed for 15 years for wind power plants (onshore and offshore). The level of support is common for an initial period (5 or 10 years) and then is comprised between two values, depending on the project's location. However, the level of the tariffs also depends on the date of commissioning of the plant (Table 4). The support was given to installations using mechanical wind energy located in areas particularly exposed to cyclonic risk and having a device for forecasting and smoothing production. Turbines in cyclonic region: 23 €/kWh for 10 years and then between 5 and 23 €/kWh for next 5 years depending on operation hours per year

**Table 35.** Support scheme for wind power plans in France<sup>38</sup>

Period of commissioning		Length	Support (€/MWh)
<i>Between June 2001 and July 2006</i>		5 <sup>A</sup>	83.9
		10 <sup>B</sup>	30.5 - 83.9
<i>Between July 2006 and the 16<sup>th</sup> November 2008</i>	Onshore	10 <sup>A</sup>	82.0
		5 <sup>B</sup>	18.0 - 82.0
	Offshore	10 <sup>A</sup>	130.0
		10 <sup>B</sup>	30.0 - 130.0
<i>After November 2008</i>	Onshore	10 <sup>A</sup>	82.0
		5 <sup>B</sup>	18.0 - 82.0
	Offshore	10 <sup>A</sup>	130.0
		10 <sup>B</sup>	30.0 - 130.0
<i>After March 2013, for plants equipped with production smoothing and forecasting systems located in areas at risk of cyclones.</i>		10 <sup>A</sup>	230
		5 <sup>B</sup>	50 - 230

Individuals have also access to some tax relief on their investment in renewables energy, through the Sustainable Development Tax Credit. Some wind turbines may be included in the list of eligible technology. The measure enable tax payer to get a tax credit equivalent to their investment costs (minus the other local investment aid). The maximum eligible costs are equal to 8 000 € for a single person and 16 000 € for a couple subject to joint taxation (plus 400 € per dependant).

A capacity market scheme is applied to both onshore and offshore wind installations. For the year 2017, the market reference price is 9999.8 €/MW.

Offshore wind farms are also promoted through calls for tender. The first call, launched in 2011 ended in 2012 with the selection of candidates accounting for almost 2 000 MW split in four slots. Another call was launched in 2013, with an objective of 1 000 MW of installed capacity. Candidates were selected in 2014. Starting from 2017 a feed-in-premium scheme based on demand or public tenders is applied to onshore wind installations. Capacity limits on demand scheme are ≤ 6 turbines or 1 turbine with capacity ≤ than 3MW. In public tenders the capacity limit is ≥ 6 turbines or 1 turbine with capacity ≥ than 3MW.

(<sup>38</sup>) A: initial period; B: final period

In **Italy** Green Certificates (1MWh each, valid 3 years) replaced in 2013 the new incentive scheme introduced by the Ministerial Decree of 6 July 2012. The operating plants under the GC scheme changed already in 2016. An all-inclusive tariff incentive scheme was open to wind power plants with installed capacity of less than 200 kW and commissioned between 2008 and 2012. It consisted of a 300 €/MWh for wind power systems fixed feed-in tariff for electricity supplied to the grid, paid for 15 years. This measure introduced 2 types of subsidized tariffs for an incentive period of 20 to 30 year according to source and capacity (variable premium tariffs for plants with power output > 1MW and new all-inclusive tariffs for plants with power output ≤ 1MW) and established annual quotas of eligible installed capacity and new incentive application procedures through the entry in registers and descending-price auctions on the value of the incentive. Direct access still possible for very small plants within the maximum incentive limit set out. A cap has been set on the cumulative cost of this scheme: it cannot exceed 5.8 bn€ per year. Since 2016 the tendering system is applied for offshore installation less than 5 MW applying a cap of 165 €/MWh with an eligibility period of 25 years. For onshore installations feed-in tariff, market premium, tender for feed-in premium and net metering schemes are in place.

**Table 36.** Support level for wind power technology in Italy

	Capacity	Support (€/MWh)
<i>Feed-in-tariff</i> <sup>39</sup>	1 kW – 0.5 MW	140 - 250
<i>Market premium</i> <sup>27</sup>	1 kW – 5 MW	135 - 291 <sup>40</sup>
<i>Tender for FIP</i>	>5 MW	110
<i>Net metering</i> <sup>41</sup>	<500 kW & < 200 kW (operation before 2014)	Plant operators receive as much energy for free as they feed-in to the grid. If more is fed-in than consumed they receive a defined economic compensation
<i>Net metering</i>	<20 kW (operation before 2017)	

In **Cyprus** the Feed-in-tariff for electricity generation from large-scale wind farms in 2013 was 0.14€/kWh. The subsidy to the small-scale independent wind farms generating electricity with a capacity of up to 30 kW is defined based on the type of activity:

- For a person or entity non engaged in an economy activity the subsidy is equivalent to 55% of the eligible budget with restrictions on maximum eligible expenditure (max subsidy 50 000€);
- For a person or entity engaged in economy activity the subsidy is equivalent to 15%, 25% or 35% of the eligible budget (max 15 000€). The minimum support is equivalent to 35% of the eligible budget with restrictions on max eligible expenditure (max 15 000€)

In **Latvia** the Electricity Tax Law provides tax exemptions for electricity supplied to end-users produced from renewables. Mandatory procurement of electricity since 2007 is in the Feed-in-tariffs form at 106.90€/MWh in 2013 and 107.29€/MWh in 2014. Granting to new producers suspended until 1 January 2020. Reduced tax rate for renewable technologies plants under the Subsidised Electricity Tax Law (from 2014) is 10% for renewables plants against 15% for fossil energy sources.

In **Lithuania** the maximum rate of the fixed buying-in tariffs of electricity bought by Transmission System Operator depends on the installed capacity: for wind power 10kW<30kW <350kW between 0.064 and 0.107 €/kWh in 2013 and 0.96 €/kWh in 2014. Promotion quotas (distributed by means of auction amongst producers conforming to the established differentiation in terms of technical capacity and type of power plant). The auction region for promotion quotas for WP plants is the whole of the Republic of Lithuania. The promotion quota for the auction region is 260MW (including 210MW for power plants to be connected to the transmission system and 50MW for power plants to be connected to the distribution system), excluding small power plants with the installed capacity of 30 kW or less. Lithuanian Rural Development Programme for 2007-2013 provides support up to 65% of project costs. The construction of small-capacity (up to 250kW) wind plants are eligible.

In **Luxembourg** the feed-in-tariff after new regulation adoption applied from January 2014 onward are calculated based on the following formula:

$$92 \cdot (1 - (n - 2014) \cdot 0.25 / 100) \text{ €/MWh}^{42}$$

<sup>(39)</sup> Producers are free to choose between FIT and FIP

<sup>(40)</sup> minus the zonal hourly price

<sup>(41)</sup> This option can be taken instead of selling the electricity on the the free market or one of the othe support schemes. Starting in 2015 a fee is charged for the use of the net-metering service by the GSE

<sup>(42)</sup> 'n' is the official year of first feed-in-tariff.

Under the Climate Pact municipalities that are taking part in it are able to receive financial support from 2013 to 2020. These municipalities have to implement the international quality management and certification system European Energy Award. Municipalities can do that by i.e. increasing RES share in the electricity consumed by municipal buildings and facilities (from wind for instance). The revision in 2014 of assistance levels for municipalities in the framework of the Environmental Protection Funds provides support for feasibility studies for wind power plants: 50% of costs can be covered in this respect, up to a maximum of 25 000€ per study.

**Table 37.** The amount of tariff for wind power plants

Year of commissioning of the plant	2014	2015	2016	2017	2018
Tariff	92	91.8	91.5	91.3	91.1

In **Croatia** since 2016 the renewable energy is promoted through a premium tariff. Producers can receive a premium on top of the price of the electricity, which they have sold on the market pursuant to the Electricity Market Act.

In **Hungary** the mandatory off-take scheme is of utmost importance in the field of electricity generated from renewable energy sources and renewable-based combined heat energy production. The electricity from renewable energy sources is supported by a feed-in-tariff for installations with a capacity of 50 kW-500 kW. For installations with a capacity of 0.5-1 MW, the market 'green premium' applies. Plants with a capacity >1 MW and wind power plants are obliged to participate in a tendering procedure in order to receive the green premium.

The support system for electricity from renewable sources has been modified since 2013. The new Renewable Energy Support Scheme (METÁR) concept was sent to the EC under a pre-notification procedure on 18 July 2013. The new scheme came into force 1 January 2017. The system comprises three sub-systems for support determined by the plant's capacity, namely a feed-in tariff (which remains unchanged), a 'green premium' without tendering and a 'green premium' granted through tendering procedures.

**Table 38.** Support provided in Hungary for wind power technology, 2010-2014

	Av. Feed-in-tariff (€/MWh)	Per unit support (€/MWh)	Total support (M€)
2010	106.3	49.1	24.73
2011	109.98	54.46	32.73
2012	110.26	59.23	43.98
2013	106.5	67.41	46.3
2014	108.39	70.73	44.1

**Malta's** current wind energy capacity and generation is limited to a few micro-wind turbines. During 2007-2013 project calls from Planning and Priorities Coordination Division for financing of projects on energy related sectors including RES & EE were made. Set up support scheme depending on findings of study referred to in wind potential is planned for period 2015-2020.

In **Netherlands** almost half of 2014 cash expenditure under MEP<sup>43</sup>, SDE<sup>44</sup> and SDE+ (601 M€) went to the support of wind power, mainly onshore wind. The main support for wind technology comes from the MEP scheme. Under the SDE+ (Incentive Scheme for Sustainable Energy Production) more than 10 M€ were spent in 2014 to support the deployment of onshore wind.

The division of subsidies over onshore and offshore wind used to be 80% onshore and 20% offshore wind energy in the period 2011-2014, but has drastically changed in 2016. In 2016, offshore wind energy subsidies have overtaken those of onshore wind energy energies. Whereas the onshore wind options have stabilized across the Netherlands (above 200 M€ per annum), the offshore wind just has 'set sail' with support above 300 M€ per annum (table 39). New procedures have adapted the Structural Concept and allow the offshore wind turbine sites to be located in pre-designated areas between the 10 and 12-mile zones. The Concept is now implemented and further developed, like large electricity cables put on the bottom of the sea for electricity transport to the land.

<sup>(43)</sup> Environmental Quality of Electricity Production

<sup>(44)</sup> Stimulation of Energy Production Scheme

**Table 39.** Support provided in Netherlands for wind power, 2011-2016<sup>45</sup>

	Programme <sup>46</sup>	Per unit support (€/MWh)		Total support (M€)	
		Onshore wind	Offshore wind	Onshore wind	Offshore wind <sup>47</sup>
2011	Aggregated	77	50	255	71
2012	Aggregated	73	99	271	79
2013	Aggregated	68	99	264	77
2014	aggregated	76	94	284	70
2015	aggregated	51	96	224	108
2016	aggregated	58	139	208	306

Remarkably the average subsidies for onshore wind energy, on the one hand, have slightly decreased from 77 € per MWh in 2011 to 58 € per MWh in 2016. Those for offshore wind energy, on the other hand, seem to have stabilised just lower than 100€ per MWh since 2012. Nevertheless there was a strong increase in 2016 to 139 € per MWh (RVO, 2017b). This increase is due to the build-up of large new off-shore windmill facilities and logistics. By means of the National Energy Agreement, the Dutch government wants to achieve a substantial increase in the share of wind energy in the Netherlands' energy mix. To increase offshore wind energy capacity, the government has designated three zones in the North Sea for the development of new wind farms. With a standardised offshore grid concept, TenneT will bring the offshore wind energy onshore, to a high voltage sub-station. From there, the national 380 kV high-voltage grid will distribute the wind energy to households across the country. Resuming, the relative large initial unit support shall be compensated by larger power production in a later stage when the logistics are completed, leading to lower costs per unit.

The latest subsidy program (SDE+ 2017) includes the following three categories for wind energy:

- Onshore wind;
- Wind on primary flood defences;
- Wind on lake.

Offshore wind energy projects were used within the MEP program in the past. They are not eligible for the SDE programs, but instead separate tender procedures are applied to offshore projects via the Energy Agreement 2013 (RVO, 2017a). For more information about the Dutch subsidy programs, see section 3.2.19.

In **Austria** the support for wind technology is provided under the current law (ÖSG 2012)<sup>48</sup>. Feed-in tariffs in accordance with the Green Electricity Feed-in Tariff Regulation 2012 (ÖSET 2012)<sup>49</sup> for wind power ranged from 97 €/MWh in 2010 to 93.6 €/MWh in 2014. The ÖSG 2012 Act amended in 2017 set a tariff of 82 €/MWh for 2018 and 81.2 €/MWh in 2019. The Annual wind FIT cap has a minimum of 11.5 M€. Additionally, 30 M€ were available in 2017 and 15 M€ are available in 2018 to reduce subsidy waiting list. Wind projects also eligible for the common renewable subsidy that is 14 M€ in 2017, 12 M€ in 2018 and will then decline 1 M€ annually until 2022.

In **Poland** the support to wind power is provided through a green certificate scheme. According to the recent Act on renewables (starting from July 2016) the promotion of new renewable energy sources will include a scheme with a fixed feed-in tariff valid for 15 years and established by means of an auction mechanism. Support for RES electricity generators in RES installations will have the form of a premium compensating for the difference between the cost of generation of electricity and the market price for electricity on the competitive market (the feed-in-premium). The auctions are subdivided for units with capacity up to 1 MW and above 1 MW. For onshore wind micro-installations with installed capacities of up to 3 kW the feed-in-tariff is set at PLN 0.75 per kWh. For onshore wind installation with capacities between 3 kW and 10 kW the feed-in-tariff is PLN 0.65 per kWh. Higher installed capacities (10 kW – 40kW) are covered by the mandatory purchase of excess electricity by the 'obligated supplier', which purchases the excess electricity at a price equal to 100 % of the average selling price for electricity on the competitive market in the previous quarter.

<sup>(45)</sup> (RVO, 2017b), (CBS, 2014)

<sup>(46)</sup> Including Kaderwet EZ onshore and Energy Agreement offshore

<sup>(47)</sup> First MEP, later replaced by Energy Agreement (2013)

<sup>(48)</sup> Green Electricity Act

<sup>(49)</sup> Source: BGBl. II No 307/2012, as amended by BGBl. II No 503/2014; the 1% reductions provided for in law is taken into consideration.

**Table 40.** Support provided for wind power in Poland, 2010-2014

	2010	2011	2012	2013	2014
<i>Average Certificate Price (€/MWh)</i> <sup>50</sup>	46.68	65.07	59.95	49.74	47.20
<i>Tax exemption/refund (€)</i>	15.4	14.9	21.77	28.75	36.14

In **Portugal** the Decree-Law No 35/2013 of 23 February 2013 introduces a mechanism that provides for the possibility of granting an additional period of application for the guaranteed tariff regime for wind power plants, in situations where the holders propose a reduced rate, which may be supplemented or replaced by the payment of compensation. Tenders for wind power evolve during 2 phases: during phase 'A' discounts applied to the 5% tariff: during phase 'B' discounts applied to the 5% tariff during initial phase and 9% after renegotiation of the contract; during phase C discounts applied to the tariff between 5.15 and 23.15 %. The FIT ranges from 74 to 75 €/MWh.

**Table 41.** FIT for wind power (additional costs above market price) in Portugal, 2009-2014

	2009	2010	2011	2012	2013	2014
<i>Feed-in-tariff (€/MWh)</i>	49.1	53	41.7	52.5	47.29	47.56
<i>Total (M€)</i>	366	479	380.3	525.4	520.8	513.8

In **Romania** mandatory quotas combined with green certificates trading scheme are applied for this technology. The support is given for a period of 15 year (7 years if also wind power production is used in other states). Wind plants accredited before 31 December 2013 have received 2 GCs until 2017 2 certificates. From 2018 the number of GC is 1 per MWh of electricity generated. Wind energy plants accredited after 1<sup>st</sup> of January 2014 have received 1.5 GCs until 2017. From 2018 the number of certificates is 0.75 per MWh of electricity generated.

**Table 42.** Quotas of renewable electricity for the period 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<i>Quota (%)</i>	8.3	10	12	14	15	16	17	18	19	19.5	20

Suppliers and producers must purchase a number of GC equivalent with the product between the value of the annual mandatory quota for the year in question and the quantity of elec. provided. Market for GC has a minimum trading value 27€/GC and a maximum trading value 55€/GC. Suppliers/producers failing to meet annual target must pay the equivalent value of GC not purchased to Environment Fund Administration for a value of 110€/GC. The investment support is given through Sectoral Operational Program – assistance 70% for small/micro firms, 60% for medium-sized, 50% for large project and 98% for non-income generating projects (max 30M RON per project).

In **Slovenia** the energy producer from wind technology may receive: (i) Guaranteed purchase of electricity (up to 500 kW eligible): 95.38€/MWh for wind generators (2014); (ii) Feed-in premium for wind generators at the level 63.66€/MWh (2014) and (iii) Financial aid for current operations. The Cohesion Fund for 2014-2020 gives support for construction of new smaller facilities generating electricity from renewables (small hydro-electric power plants, wind power, solar energy, etc.). After September 2014 wind power plants with a capacity not exceeding 50 MW could take part in an open tender procedure in the first round of the selection.

In **Slovakia** a feed-it tariff scheme is in place to support this technology. The feed-in tariff consists of two parts: the price of electricity for losses (market price) and a surcharge. For wind plants with a capacity larger than 15 MW the surcharge is paid only for the proportionate amount of electricity produced annually. The support is guarantee for 15 years. Plants with an installed capacity less than 125MW received a FIT of 79.29€/MWh in 2013 and 70.30€/MWh in 2014. The Operational Program Environmental Quality provides 115 M€ national pilot project installation of small wind plants (wind turbines of less than 10 kW). The wind plants profit also from the exemption from excise tax. The amount of tax is calculated on the basis of the amount of electricity in MWh and the corresponding tax tariff. Since 1 January 2010, the tax on electricity has been 1.32 €/MWh. From 1 January 2017 the FIT for wind plants is 44.18 €/MWh.

In **Finland** the support to wind power has been given through a feed-in tariff scheme. Since 2011 the target price of 83.5€/MWh (for a reached capacity of 2500 MVA) was paid for wind power plants. Until 31.12.2015 (for three years at maximum), there was an "early bird rate", i.e. an

(<sup>50</sup>) Using 1 € = 4.2249 PLN

increased target price of € 105.3 per MWh. New government elected in 2015 decided to end the feed-in tariff scheme. No further applications were accepted once the wind power capacity of 2500 MVA has been reached on the basis of approval and quota decisions. The wind energy producers received a variable premium tariff on top of the wholesale electricity price for a period of 12 years. The generators get a fixed target price for their electricity. Wind energy plants are eligible for an increased target price until the end of 2015. There are several limits for receiving support under the premium tariff scheme as of 1 March 2016: (i) When the combined capacity of the generators exceeds 2500 MVA; (ii) When production exceeds the amount confirmed in the acceptance decision; (iii) When the price of electricity is below 30 €/MWh, the subsidy to be paid amounts to the target price less 30 €/MWh; (iv) Subsidy is not paid per hour when the price of electricity is negative. Under Decree No. 145/2016, the investment aid is granted against a fixed assets investment with eligible costs exceeding € 5,000,000. Investment aid can be up to 40 % of the project's costs.

In **Sweden** the support to wind technology is given through a (i) quota system and (ii) tax regulation mechanism. For the electricity certificate scheme the liability/quota was 13.5 % in 2013 and 14.2% in 2014 of quota-bound electricity consumption. Penalty was 301 SEK/certificate in 2013 and 275 in 2014. The quota is calculated by multiplying the number of megawatt hours of electricity sold or used during the calculation year with the quota obligation for the calculation year. The quotas for the period from 2016 to 2025 have been set as follows:

**Table 43.** Quota obligation per MWh of electricity sold or consumed in Sweden, 2016-2025

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<i>Quota</i>	0.231	0.247	0.270	0.291	0.288	0.272	0.257	0.244	0.227	0.206

Aid was also granted for wind power pilot projects in order to reduce the costs of establishing new wind power plants and to increase knowledge of the effects of establishment in certain environments. For the period from 2008 to 2012, 35.32 M€ were allocated. All the funds have now been allocated.

In the **United Kingdom** the support for wind power technology is given through:

(i) Renewables Obligation (RO) since 2002. RO will close for all new capacity in 2017 (for onshore wind generating stations from April 2016 with grace periods);

(ii) Contracts for Difference (CfDs) is in place for (i) contract between low carbon electricity generator and the Low Carbon Contracts Company (LCCC) (Government-owned company); (ii) payment of diff between 'strike price' (reflecting cost of investing in a particular low carbon tech.) and 'reference price' (average elec. market price). First CfD auction in 2015 (£300M/yr) delivered savings of around 20% against the administrative price for offshore wind;

(iii) Feed-in tariff scheme. In order to be accredited, installations of less than 50 kW shall take part in the Microgeneration Certification Scheme (MCS), an independent scheme that certifies microgeneration products of less than 50 kW and installers in accordance with consistent standards. For wind installations with a declared net capacity (DNC) of more than 50 kW preliminary accreditation is available.

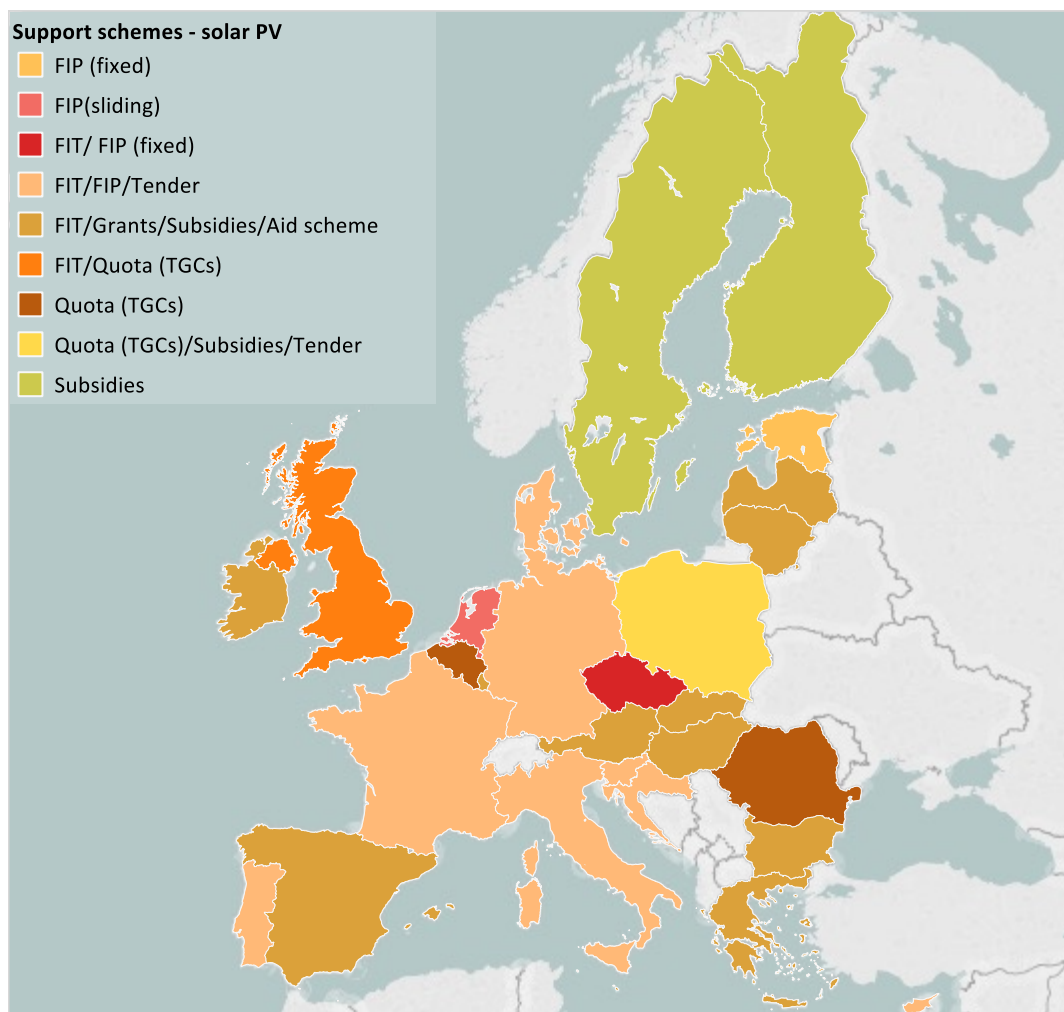
**Table 44.** Payment rates for wind power plants in UK, 01.01.2017 – 31.03.2017

Capacity	GBP/kWh
≤ 50 kW	0.0826 (approx. 0.0925 €/kWh)
50 kW - 100 kW	0.0488 (approx. 0.0546 €/kWh)
100kW - 1.5 MW	0.0258 (approx. 0.0288 €/kWh)
> 1.5MW	0.008 (approx. 0.0091 €/kWh)

### 6.1.3 Solar photovoltaic

Figure 14 illustrates the support schemes applied in the EU countries for solar photovoltaic technology. Feed-in-tariffs and feed-in-premiums are the main support schemes for this technology applied in 16 EU countries. Investments, quota and tariff subsidies are applied in 4 EU countries (Austria, Poland, Finland and Sweden). Green certificates are applied in Romania. An aid scheme combined with feed-in tariff and feed-in premium is applied in Luxembourg. Cyprus applies financial incentives to support the deployment of this technology.

**Figure 14.** Support schemes in EU countries – solar photovoltaic technology



In **Belgium** the support to solar photovoltaic is assured only through regional quota system. Guaranteed minimum price at regional and federal levels per generation source is valid for photovoltaic facilities commissioned before 1 August 2012; support mechanism repealed for photovoltaic facilities commissioned after 1 August 2012 with retroactive effect following the adoption of the Royal Decree of 21 December 2012 on Mechanisms Promoting Renewable Electricity Generation<sup>51</sup>. This minimum price is €150 at Federal level and €65 at regional level (Wallonia and Brussels Capital). Green certificates are revised for solar PV with a payback time 7 year in maximum. The solar PV systems of 10 kWp or less are part of a simplified support mechanism based on the differences between energy withdrawn and injected. There is no incorporation tariff for small-scale solar PV facilities of less than 10 kVA that use the network. Households, very small enterprises, self-employed workers and private entities are all eligible to receive grants based on 20% of the investment with a limit of EUR 3500. In 2011 the green quotas for 2013-2025 are set in Belgium. In the reform of the support mechanisms in 2012 the minimum green electricity price for all technologies was equal to EUR 93/certificate. In Brussels Capital Region, a grant of €9357 is offered in 2013 for the solar PV with an average unit aid of €1040. In

<sup>(51)</sup> Belgian Official Gazette of 16 January 2013.



2014 the grant was €6589 with an average unit aid of €1098. Green Certificates (GECs) granted for photovoltaic panels reached 108717 in 2013 and 170011 in 2014. Since March 2015, a mechanism called Quali watt is used to support residential PV systems up to 10 kW in Wallonia. For the first 5 years after installation, a fixed sum for the first 3 kW is paid.

**Table 45.** The amount of electricity to be produced from 1GSC for installations after 01.01.2017, Flemish region

Capacity	Banding factor	kWh/GSC
≤ 10 kW	-	-
> 10 and ≤ 250 kW	0.430	2,618 kWh
> 250 and ≤ 750 kW	0.438	2,604 kWh

In **Bulgaria** a preferential price is applied under feed-in tariff scheme. This price is applied to (i) Roof PV modules from 30 kWp up to 200 kWp (2011); (ii) PV modules from 200 kWp up to 1 000 kWp (2011); (iii) PV modules up to 30 kWp (2012) and Roof PV from 200 kWp to 1000 kWp on industrial buildings or warehouses in urban areas where they are already connected to transmission or distribution grids (2012). The feed-in tariff per unit applied for the electricity originated by solar photovoltaic was 50 BGN/MWh in 2014 corresponding to a total of 32 M€. 6.32 % of total amount of electricity sold in 2014 by the public supplier NEK EAD to CEZ Electro Bulgaria AD was originated from photovoltaic power plants.

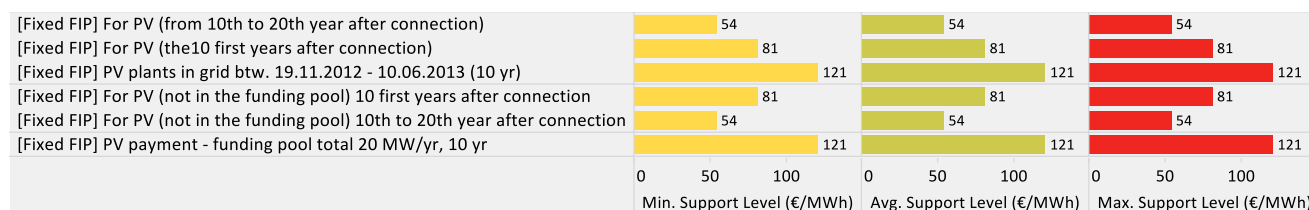
**Table 46.** Support level for solar photovoltaic in Bulgaria, 2014

	BGN/MWh
A total installed capacity of 5 kW or less, mounted on roofs or facades of urban buildings or adjacent properties that are connected to the distribution grid	211.81
A total installed capacity of 30 kW or less, mounted on roofs or facades of urban buildings or adjacent properties that are connected to the distribution grid	203.97
A total installed capacity over 30 kW and up to 200 kW mounted on roofs or facades of urban buildings or adjacent properties that are connected to the distribution grid	169.12
A total installed capacity over 200 kW and up to 1000 kW mounted on roofs or facades of urban buildings or adjacent properties that are connected to the distribution grid	144.68
An installed capacity of 30 kW and less	152.19

In **Czech Republic** feed-in tariffs and green bonuses are applied for this technology. Values are defined by Energy Regulatory Office which issues the pricing decisions laying down support for electricity generation from renewable energy sources, combined heat and power and secondary energy sources. Feed-in tariffs and green bonuses differ from what type of RES the electricity is produced.

In **Denmark** a premium is paid for electricity generated from plants that exclusively use solar power. The premium is set such that it and the market price together amount to DKK 0.60 per kWh for a period of 10 years following grid connection and DKK 0.40 per kWh for the subsequent 10 years. For electricity generated by plants using the above-mentioned renewable energy sources in combination with other energy sources, there is a premium of DKK 0.26 per kWh for 10 years and DKK 0.06 per kWh for the subsequent 10 years. Provisions have been adopted concerning increased premiums for solar photovoltaic plants for a certain period of time (transitional schemes) within an annual funding pool of 20 MW in the period 2013-2017.

**Figure 15.** Support level for solar PV installations under fixed FIP scheme, Denmark



For electricity generated by certain solar photovoltaic plants that are connected to the grid in the period from 19 November 2012 to 10 June 2013 inclusive, an increased premium was paid in accordance with the transitional schemes of between DKK 0.90 and DKK 1.45 per kWh for 10 years

from the connection date. The same applies to electricity generated by certain plants which are connected to the grid after 10 June 2013 where the owner has entered into a binding and unconditional agreement concerning the purchase of the solar photovoltaic plant within certain specified dates and otherwise fulfils certain specified conditions. The premium was reduced if the plant was connected to the grid after 2013.

From 2013 to 2017 inclusive, an increased premium of between DKK 0.90 and DKK 1.45 per kWh (2013 rates) is payable in relation to a funding pool totalling 20 MW annually. The pool concerns plants that are connected to domestic households. All increased premiums (DKK 0.90-1.45 per kWh) are paid for a period of 10 years from the connection date. The increased premiums are reduced each year during which the pool is distributed, so that the premium gradually approaches the settlement price of DKK 0.60 per kWh. In the case of solar photovoltaic plants that are not covered by the funding pool, the premium is set such that it and the market price together amount to DKK 0.60 per kWh for 10 years after the connection date and DKK 0.40 per kWh for the subsequent 10 years.

In **Germany** there are significant changes in photovoltaic power support. The capping of the increase in photovoltaic capacity that is subsidised in the EEG scheme at 52 GW installed capacity is retained but not applied in the auctioning process. Following the high installation figures achieved in recent years, the target corridor for the new photovoltaic capacity installed each year is reduced from 2400 MW to 2600 MW (from 2500 MW to 3500 MW). Compliance with this expansion corridor is indirectly controlled through the adjustment of the monthly degression of the payment rates. If the expansion corridor is adhered to, these are reduced by 0.5 % each month. If the target corridor is exceeded the monthly degression rises to up to 2.8 %, and if the target range is not reached, the monthly degression can be reduced to as low as zero. If the target corridor is missed by a significant margin, provision is made for a one-off increase in the funding rates of 1.5 %. The funding rates and their monthly degression for the next quarter are calculated and published by the Federal Network Agency on a quarterly basis.

**Table 47.** Degression rates for PV capacity calculated from the expansion volume pursuant to Section 31 EEG

under			target corridor	up to					
1000	1500	2400		2600	3500	4500	5500	6500	7500
-1.5%	0.0%	0.3%	0.5%	1.0%	1.4%	1.8%	2.2%	2.5%	2.8%

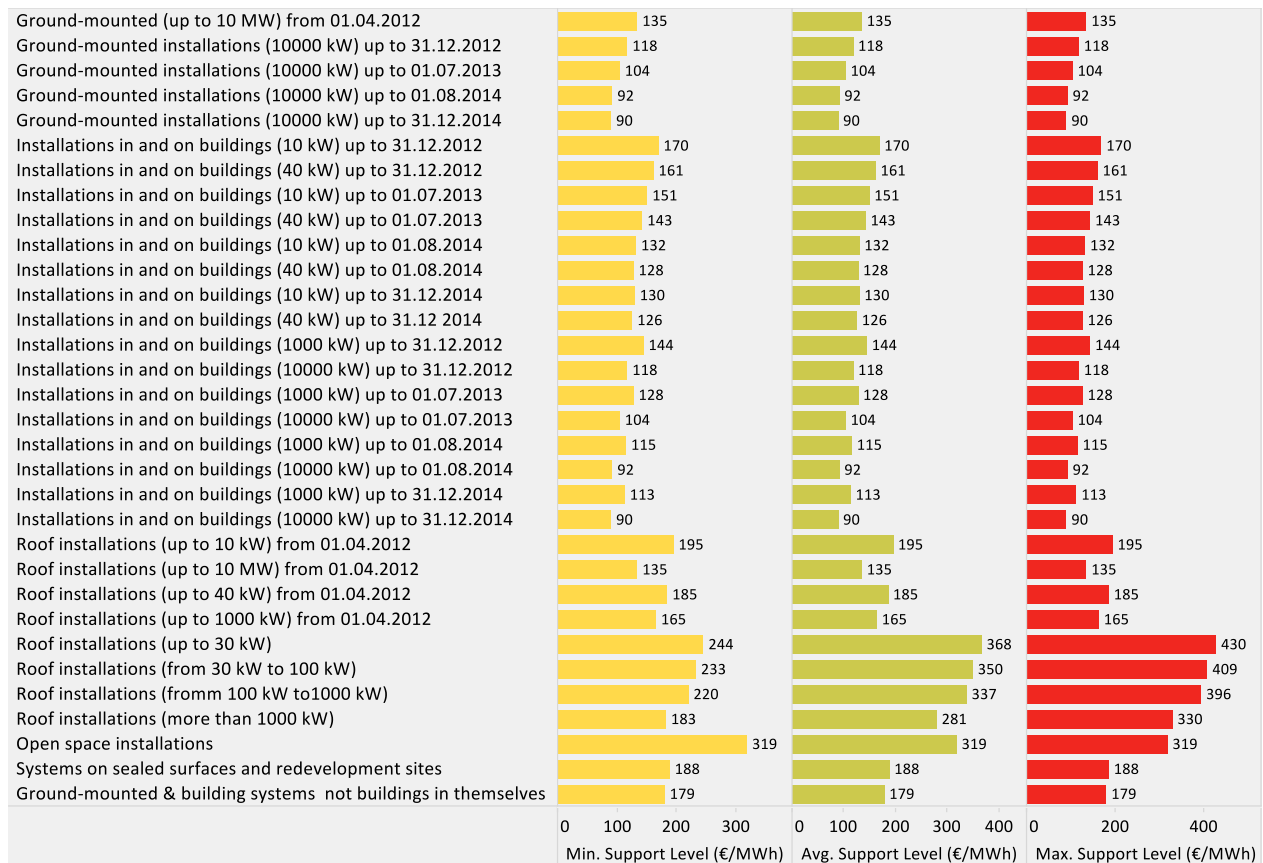
The payment classes defined in the EEG 2014 remain, but the subsidy system is changed from the fixed feed-in tariff and voluntary direct marketing to mandatory direct marketing in accordance with the market premium model. Small and medium-sized photovoltaic plants with a capacity of no more than 500 kW are exempted from the direct marketing obligation for the time being and can continue to receive fixed feed-in tariffs. From 2016, the ceiling for the fixed feed-in tariff is reduced to 100 kW. At the same time, the market integration model established in the EEG 2012, under which roof-top installations with an output of between 10 kW and 1 MW receive a normal feed-in payment for a maximum of 90 % of the electricity produced, is withdrawn for new installations under the EEG 2014.

**Table 48.** Payment for electricity generation from PV installations as 1 August 2014 and 31 October 2016, (€/MWh)

Photovoltaic installations	Capacity	Payment (1.08.2014)	Payment (1.1.2015)	Payment (30.09.2016)
<i>Installations in and on buildings</i>	10 kW	131.5	129.5	123.1
<i>Installations in and on buildings</i>	40 kW	128	126.1	119.7
<i>Installations in and on buildings</i>	1000 kW	114.9	113.2	107.1
<i>Installations in and on buildings</i>	10000 kW	92.3	90.2	85.3
<i>Ground-mounted installations</i>	10000 kW	92.3	90.2	

Under EEG 2017 the already existing auction scheme for ground mounted PV solar systems is extended to also cover rooftop plants and installations on other structures. The permitted areas for PV solar installations will now also include commercial and industrial property, areas with a plan approval decision or projects which are, subject to further requirements, located in "disadvantaged areas.

**Figure 16.** The support level for solar PV installations in Germany 2010-2014 (min, average and max)



In **Estonia** the Electricity Market Act in place guarantees a 12 year support through a feed-in-tariff obligatory scheme. Current premium level is 0.0537/kWh and does not differ for the individual technologies.

In **Ireland** the relief for investment in solar technology was introduced in 1999 and extended in 2012 until 31 December 2014 (Section 486B, Tax Consolidation Act (TCA), 1997). The relief applies to corporate equity investments in solar technology generation projects. The relief was given in the form of a deduction from a company's profits for its direct investment in new ordinary shares in a qualifying renewable energy company. Accelerated Capital Allowances (ACA) for Energy Efficient Equipment (SI 393 of 2009) existing since 2009 and extended until end of 2017 specifies certain technical standards to be met by renewable energy products to be eligible for the ACA tax relief. Solar PV was one of the technologies covered from this scheme.

In **Greece** the support for solar photovoltaic is assured through a (i) feed-in-tariff; (ii) sliding feed-in-premium; (iii) net metering; (iv) investment aid and (v) tax relief. The FIT scheme is applied for solar PV installations  $\leq 5$  MW. Tariff amount is calculated as  $1.2 \times \text{MASPv}$  where  $\text{MASPv-1}$  = Marginal average system price of the previous year. The scheme started from 2016 and the support will be guaranteed for a period of 20 years. Under the sliding feed-in-premium scheme the tariff will be decided through tendering system. The size of plants should be  $\geq 5$  MW with an upper limit at 10 MW. Maximum bidding price is set at 94 €/MWh for photovoltaic installations that are obliged to having a production license and at 104 €/MWh for those exempted. The lowest bid is accepted in the auction. The scheme is valid for 20 years starting from 2016. Net metering scheme is in place since 2006. The subsidy under the Investment Aid scheme cannot be applied for period longer than 7 years.

In **France** according to Art.1, of the Decree of 28 May 2016 only plants installed on buildings whose installed capacity does not exceed 100 kW are eligible to apply within the feed-in-tariff scheme. The tariffs depend on the type and the total capacity of the installation, without distinction of the use of the building. Art. 14 of the Decree of 9 May 2017 sets the conditions to benefit from the purchase obligation for photovoltaic installations  $\leq 100$  kWp installed on a building whose complete connection request was filed as of May 11, 2017. Purchase rates are self-adjusting each quarter based on connection requests filed in previous quarters to reflect technological progress.

Rates decrease by 5% per year if the number of connection requests is in line with the target path. The annual target trajectory is 350 MW/year, in line with the multiannual energy program

To be eligible for a purchase price and a possible premium, it is necessary to take into account: (i) the power of the installation P and the power Q of the other installations, with four thresholds: 3, 9, 36 and 100 kWp; (ii) installation on the building: built into the frame, parallel to the roof plan or flat roof, specific functions; (iii) the method of remuneration of the electricity produced: sale of all or sale of the surplus (attention, self-consumption without injection or with injection of surplus for free is not eligible).

Every quarter, the degression coefficients  $S_n$  and  $V_n$  will be adjusted to the number of grid connection requests adopted in the previous quarter. The French regulatory authority will publish the new coefficients and the resulting changes in tariff levels online approximately 3 weeks after the end of each quarter. The table below shows the tariffs for solar PV in France according to the decree of 9<sup>th</sup> of May 2017<sup>52</sup>.

**Table 49.** Purchase prices with building integration premium (c€/kWh) in France - Sale in full<sup>31</sup>

Type of tariff	Type of installation	Total power (P+Q)	11.05-30.06.17	01.07 to 30.09.17	01.10 to 31.12.17	01.01 to 31.03.18
Tariff Ta	Integration with buildings	≤3 kWc	23.2	22.4	21.48	20.47
		≤9 kWc	20.4	19.6	18.71	17.74
	On building and respecting the general criteria of implantation	≤3 kWc	18,7	18,65	18,48	18,22
		≤9 kWc	15,89	15,85	15,71	15,49
Tariff Tb	On building and respecting the general criteria of implantation	≤36 kWc	12,07	12,07	12,07	12,07
		≤100 kWc	11,5	11,46	11,36	11,12

In **Italy** until 2013, electricity generation using solar PV was supported by a premium tariff (PV feed-in-scheme)<sup>53</sup>. It stopped in June 2013 when the cumulative cost of the incentives reached the 6 700 M€ ceiling. New projects in the second half of 2013 have been mainly supported by net metering and/or via a tax deduction mechanism. In December 2014, a capacity of 17713 MW solar photovoltaic was covered by the scheme.

In **Cyprus** the support for renewable electricity generation from solar PV is given through a feed-in-premium, subsidy and a net metering scheme. Support Scheme for Electricity Generation from Renewables (SSRES) (Vulnerable groups) was in place in 2016. Under this scheme, grants are allocated to encourage the installation of photovoltaics maximum installed capacity 3kW to vulnerable consumers. The grant is allocated for EUR 900 for each kW with maximum grant EUR 2700 for each PV system. From 2016 the maximum installation capacity was increased to 5 kW, but the maximum grant is 2700 euros for each PV system. In 2017 the scheme that promotes renewable electricity production before the competitive electricity market is introduced (SSRES 2017). According to this scheme the basic price for August/ September 2017 was: LV: 69.74 €/MWh; MV (11KV): 68.29 €/MWh and HV (132/66 KV): 67.23 €/MWh.

**Table 50.** Level of support for solar PV in Cyprus, 2014

Technology/source	Type of installation/ Capacity	Level of support
Residential PV systems connected to the grid		350 €/MWh
Solar PV (small scale)	IC < 20 kW	310 -360 €/MWh
Solar PV (large scale)	20 < IC < 150 kW	138 - 340 €/MWh
Commercial solar PV	up to 150 kW	138 €/MWh

In **Latvia** in 2009 the Ministry of the Economy granted rights to sell electricity under the mandatory procurement procedure to two economic operators having an aggregate installed capacity of solar photovoltaic of 0.91 MW. However, the rights granted were not exercised by the due date and the decisions were therefore annulled. Cabinet Regulation No. 262, 2010 (amended in 2011 and 2012) defines the right to sell generated electricity as the quantity of electricity to be mandatorily purchased. Since July 2014 and until January 2020 the feed-in tariff scheme is closed

<sup>(52)</sup> The tariffs are published at the following addresses: [www.cre.fr/operateurs/producteurs/obligations-d-achat](http://www.cre.fr/operateurs/producteurs/obligations-d-achat).

<sup>(53)</sup> Conto Energia

for new renewable electricity producer. Since 1 January 2014 net-metering of electricity produced and fed-in to the grid through a small-scale connection ( $\leq 3 \times 16A$ ) is introduced.

In **Lithuania** the support to solar photovoltaic is given through: (i) Sliding feed-in premium for a period of 10 years. From 1 July 2017 to 31 December 2017 the following tariffs are applied for the capacities up to 10 kW: (a) the tariff rate for building-integrated solar power installations with installed capacity of up to and including 10 kW is 0.169 €/kWh; (b) the tariff rate for solar power installations not integrated in buildings with the installed capacity of up to and including 10 kW is 0.136 €/kWh; (ii) Sliding feed-in premium by taking part in the tender: solar power plants exceeding 10 kW are eligible for tenders with a support guaranteed for 12 years; (iii) Net metering scheme: eligible are solar power installations operated by individuals ( $\leq 10$  kW) and legal persons ( $\leq 100$  kW); (iv) Loan and Subsidy (Climate Change Special Programme); (v) Subsidy (Lithuanian Environmental Investment Fund)

In **Luxembourg** the support is given through: (i) Feed-in tariff guaranteed for a period of 15 years: electricity from PV installations  $\leq 30$  kW fed into the grid during the year 2014 receive a tariff amounting to 240.2 €/MWh; (ii) Premium tariff: In 2017 the premium payed for plants with a nominal electric capacity of  $\leq 30$  kW was 169.4 €/MWh; for plants with a nominal electric capacity of  $> 30$  kW and  $\leq 100$  kW the premium was 150 €/MWh; per MWh for plants with a nominal electric capacity of  $> 100$  kW and  $\leq 200$  kW the premium was 144 €/MWh; (iii) Subsidy I: the subsidy for PV installations amounts to 20% of the eligible costs, subject to a maximum of €500 per kWp; (iv) Tax regulation mechanism: PV installations with a capacity from 1 to 4 kW are eligible. The amount of subsidy is equal to the amount of tax a person is exempt from.

In **Croatia** until end 2015 the support was provided in the form of a feed-in tariff. Since January 2016 renewable energy from PV in Croatia is promoted through an incentive in the form of a guaranteed purchase price after undergoing a tendering process.

**Table 51.** Feed-in tariff support for solar PV in Croatia, 2011-2014

	Installed capacity	Support (€/kWh)	Overall Support M€
2011	Up to 10 kW	0.4573	0.0316
	10<IC<30 kW	0.4035	0.0337
	30 kW<IC<1MW	0.2825	0.0002
2012	Up to 10 kW	0.3499	0.1699
	10<IC<30 kW	0.2966	0.4211
	30 kW<IC<1MW	0.2195	0.3511
2013	Up to 10 kW	0.3473	1.0341
	10<IC<30 kW	0.2944	1.5726
	30 kW<IC<1MW	0.2179	1.3411
2014	Up to 10 kW	0.2503	2.5510
	10<IC<30 kW	0.2228	3.8218
	30 <IC<300 kW	0.2018	4.2792
	30 kW<IC<1MW	0.0695	0.3434

In **Hungary** the support for solar photovoltaic is given through: (i) Feed-in tariff for plants with capacity between 50 kW and 0.5 MW or in case of a demonstration project. In 2017 for plants of up to 0.5 MW or less the tariff was HUF 31.77 per kWh (103.1 €/MWh). Within the Decree No. 389/2007 there are benchmark periods for solar PV plants with capacity less than 2 MW which can be shortened if other investment schemes are used for the individual project. For solar power there is only 1 tariff within the day. There is only a tariff differentiation between solar power and other technologies. The tariffs for RES-E plants for which an application was submitted after 31 December 2016, will annually increase or decrease by the consumer price index of the previous year minus 1%; (ii) Green premium tariff introduced in 2017 provides the same basic tariffs for all technologies: 31.77 HUF/kWh (103.1 €/MWh); (iii) Tender if the technical and efficiency requirements are met: the minimum efficiency factor is 15% (crystalline solar cells) and 7% (thin-film solar cells); (iv) Net metering: eligible with a maximum capacity of 50 kVA.

In **Malta** the support to solar PV is given through a (i) Feed-in tariff: the tariff is paid per kWh of electricity generated and exported to the grid by solar PV installations with a capacity up to 1 MW. Between 3 July and 29 December 2017, the following feed-in tariff is applicable: (a) 0.155 €/kWh of electricity generated and exported to the grid by a PV installation which did not benefit from any form of grant or subsidy and having an installed capacity > 1 kW but < 40 kW; (b) 0.145 €/kWh of electricity generated and exported to the grid by a PV installation which did not benefit from any form of grant or subsidy and having an installed capacity > 40 kW but < 1 MW; (ii) An investment grant scheme: the Malta Resource Authority allocates once-only grants on the purchase of solar PV installations in the domestic sector until 31 December 2018. Under the PV grant, 50% of the eligible PV installation's costs are subsidised with a maximum limit of € 2300 per installation and € 757 per kW minus eligible cost

In **Netherlands** the main support for solar photovoltaic technology is given under the SDE scheme, almost 43 M€ over period 2011-2014. The technology receives also support from the MEP and SDE+ schemes. The duration of project contracts changed from 10 to 15 years (see section 3.2.19). Whereas the total public support has increased from about 7 M€ in 2011 to less than 29 M€ in 2016, the average support has stepwise decreased in the same period from 239 € per MWh to less than 100€ per MWh (table 39). In comparison with electricity from solar PV, the heat production from solar thermic systems is negligible in the period 2011-2016 (RVO, 2017b). The current SDE+ program can in principal be applied to two categories of solar energy (RVO, 2017a)<sup>54</sup>:

- Renewable electricity - Subsidies are available for photovoltaic solar panels (Solar PV) with a capacity of ≥ 15 kWp and a large-scale energy connection to the grid.
- Renewable heat. You can apply for a subsidy for "Solar collectors with a total thermal capacity of ≥ 140 kW", as long as all the collectors used are covered with a translucent layer.

For smaller electricity producers (15 kWh), there are currently options for both organised groups and individual houses (RVO, 2017a). First, private cooperatives (with at least 50 members) could apply for a special arrangement in the SDE+ schema to have the energy tax returned for every kWh of electricity produced by the solar cells, when it is placed with special permission on large public or private buildings or in the field. When those private parties produce more kWh than the individual consumption figures, the tax return is not valid but only a lower kind of compensation. A same kind of arrangement is also applicable for individual private houses, having installed their own solar cells on the roof. Discussion is going on in 2018 whether this kind of arrangement (netting scheme or "salderingsregeling" in Dutch) should last until 2020 or longer, or perhaps another kind of arrangement for solar panel support. Smaller systems of renewable heat from solar cells (< 140 kW) are subject to the Sustainable Energy Investment Grant (ISDE) scheme. The ISDE can partially cover the purchase of solar boilers, heat pumps, biomass boilers and pellet stoves, both for households and companies (RVO, 2017a).

**Table 52.** Support provided in Netherlands for solar photovoltaic, 2011-2016 (RVO, 2017b),

	<b>Programmes MEP, SDE &amp; SDE+</b>	<b>Per unit support (€/MWh)</b>	<b>Total support (M€)</b>
2011	Aggregated	219	7.0
2012	Aggregated	239	12.0
2013	Aggregated	211	13.6
2014	aggregated	171	14.1
2015	Aggregated	135	17.2
2016	Aggregated	99	28.8

In **Austria** photovoltaic plants below 5 kW (275 €/kW) and free-standing photovoltaic systems and roof-mounted systems for municipalities, community-owned enterprises, public institutions, associations, and energy model regions (275 €/kW + 100 €/kW) receive investment subsidies through means of the Climate and Energy Fund<sup>55</sup> with a budget of 8.5 M€. The prerequisites are that a plant is new and used in private households. The subsidies in 2010 were €1300 per kW for detached plants and those attached to the roof, and € 1700 per kW for plants integrated into a building. The overall budget's ceiling was €35 in 2010.

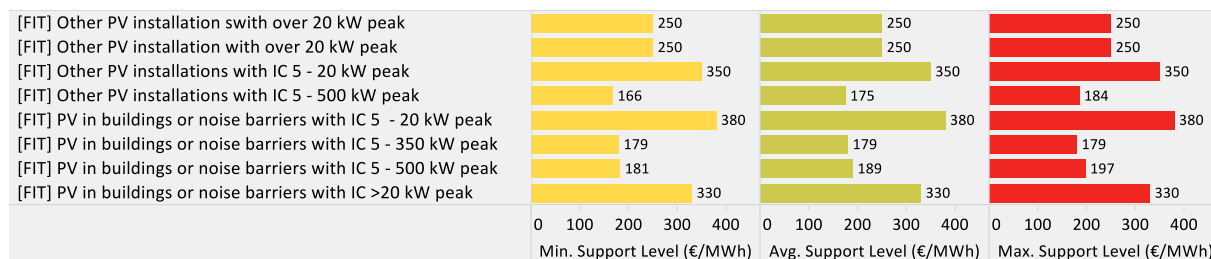
<sup>(54)</sup> RVO (Dutch Enterprise Agency), 2017a. Brochure SDE+ Autumn 2017. Retrieved at: <https://english.rvo.nl/subsidies-programmes/sde>

<sup>(55)</sup> Klima- und Energiefonds, KLI.EN



Figure 18 illustrates the support level for different types of solar PV installations in Austria during period 2010-2014.

**Figure 17.** Support level for solar PV in Austria under FIT scheme



Under the amendment of OSG in 2017 the tariff applied for solar PV installations will be 79.1 €/MWh in 2018 and €76.7/MWh in 2019. Annual solar FIT cap is set at 8 M€. Solar projects are also eligible for the common renewable subsidy pot that is 14 M€ in 2017, 12 M€ in 2018 and will then decline 1 M€ annually until 2022. For solar PV at buildings and storage the investment subsidy will reach 30% of investment cost (maximum) and €200-250/kW depending on capacity (maximum). 9-15 M€ subsidy are available annually in period 2018-2019. Under the UFG the subsidy for solar PV off-grid installations at a minimum of 10000 is assured. Investment subsidy for PV at agricultural and forestry businesses are given through Environmental Subsidy Directive of 2015. The amount of subsidy is 275-375 €/kW depending on installation type 5.95 M€ were available in 2017.

In **Poland** solar technology is eligible to apply within the (i) quota system receiving 1 GC for each MWh produced. The quota has been fixed until 2021. Until 2016 the quota system was the main support scheme for this technology. After 2016 the producers of energy from solar PV are eligible to participate in (ii) tendering system with a guaranteed feed-in tariff (pay as bid) for 15 years from the beginning of the energy production, no longer than until the end of 2035. (iii) Soft loans for period 2014 to 2020 are available for PV up to 75% of capital investments with a 2% interest rate, 15 year first payment 18 months after loan granting. Eligible are plants with capacity from 40 kW to 1 MW. Eligible are also large solar panels with a heat accumulator; (iv) An excise tax is levied on the sale of electricity from solar PV to end-users and their consumption.

In **Portugal** the support for solar photovoltaic is given through a feed-in tariff scheme. For existing photovoltaic installations the indicative average rate of the FIT is 257 €/MWh. For existing concentrated photovoltaics (CPV) with installations with a capacity ≤ 1 MW up to a limit of 5 MW of installed power on the national level the indicative average rate of the FIT is 380 €/MWh. For UPPs (see section 6.2.22), the FIT consists of 100% of the reference tariff. The reference tariff in 2017 is 95 €/MWh.

In **Romania** the quota system is applied to support this technology. A plant put into operation after 01.01.2004 is eligible for 15 years. PV-installations situated on land that on 31 December 2013 had the status of agricultural area are not eligible for the Green Certificate Scheme. The issuance of a share of the initial number of green certificates has been suspended for some technologies in the time from 1 July 2013 to 31 March 2017. The number of GCs awarded during this period for solar PV is 2 for each MWh electricity production. A subsidy on "Investments in physical assets" depends on the size of the project is also available. The maximum eligible sum for technologies is 2 M€.

In **Slovenia** the producers of electricity from solar photovoltaic technology connected to the grid after 22<sup>nd</sup> of September 2014 have the right to participate in a tendering system. The operators of renewable energy plants connected to the grid before 22<sup>nd</sup> September 2014 may sell their electricity to the Slovenian power market operator Borzen at a "uniform annual price", i.e. the feed-in tariff (alternatively, they can opt for a premium tariff). Solar PV plants with a capacity up to 10 MW can participate at the tender process. A subsidy scheme is also available to support this technology through state aid (regional aid, aid for small and medium enterprises) and "de minimis" aid. The low-interest loans can also be awarded to support solar PV technology.

In **Slovakia** solar photovoltaic is supported through: (i) Feed-in tariff scheme: only solar PV installations on rooftops or façades with an installed capacity of no more than 30 kW are eligible. From 1 January 2017 the tariff is 84.98 €/MWh. Solar PV plants with an installed capacity of 10 kW are eligible to receive a subsidy support. The amount of subsidy is determined for each individual call for application. The producers of electricity from solar PV are also eligible for exemption from excise tax. The amount of tax allowance is equal to the amount of tax entitled persons are exempt

from. The amount of tax is calculated on the basis of the amount of electricity in MWh and the corresponding tax tariff. Since 1 January 2010, the tax on electricity has been 1.32 €/MWh

In **Finland** the support to solar PV technology is provided through a subsidy system: (i) Energy Aid that is a state grant for investments in RES production facilities and research projects related to it. The amount of subsidy depends on the aim of the project in question. The support allocated to investments in renewable energy production facilities can make up to 30% of the project's overall cost, but can increase up to 40% in case the project involves the use of new technology. The support allocated to research can make up to 40% of the project's total cost. A company or entity receiving the subsidy has to finance at least 25% of the total project costs from non-state funding; (ii) Investment Aid for Renewable Energy and New Energy Technologies - the investment aid is granted against a fixed assets investment with eligible costs exceeding € 5,000,000. Investment aid can be up to 40 per cent of the project's costs.

In **Sweden** the main support for solar photovoltaic installation connected to either internal or external grid is given through an (i) Investment aid scheme (Ordinance (2009:689) on State aid for solar photovoltaic cells). The measure started in 2009 and will end in 2019. Approximately 8 000 applications were submitted to the County Administrative Boards as of December 2014, approximately 3 000 of which were granted aid. As of 1 January 2015, the aid level has been a maximum of 30 % for enterprises and 20 % for other stakeholders. The aid level is calculated on the basis of the eligible installation costs. The maximum aid possible for each solar photovoltaic cell system is SEK 1.2 million, and the eligible costs may amount to no more than SEK 37 000, excluding VAT, for each kilowatt of electrical peak power installed. The previous aid level of 35 % still applies to applications from stakeholders other than enterprises who submitted their applications prior to 1 January 2015. The aid covers the installation of all kinds of solar photovoltaic cell system and solar electricity/solar heating hybrid systems that are connected to the grid by 31 December 2016. For the 2009 to 2012 period 26.34 M€ were granted (19.48 M€ paid in 2012). As part of this scheme 7.37 M€ were paid in 2013 (on 12.62 M€ granted) and 6.76 M€ in 2014. The budget for the scheme for 2016 was 225 million SEK (26.3 M€) and 390 million SEK (41 M€) from 2017 to 2019 annually.

(ii) Solar PV technology is also eligible for tax reduction. Electricity produced from solar energy in electricity generators with a capacity lower than 255 kW is not taxable.

(ii) A tax reduction is provided for the excess electricity fed from micro-producers of electricity generated from renewable energy sources into the grid at the basis of the kWh of renewable electricity fed into the grid at the connection point during a calendar year. The tax reduction amounts to 60 öre (€ct. 6.3) per kWh of renewable electricity fed into the grid at the access point during the calendar year. However, the tax reduction may not exceed 30,000 kWh or the amount of electricity withdrawn from the electricity grid at the access point during the same year per natural person / legal entity or per connection point.

In the **United Kingdom** the contracts for differences for renewable electricity generators are designed to gradually replace Renewable Obligation (RO) system. The RO closed to large-scale solar PV on 1 April 2015. On 17 December 2015 the UK government announced the RO would close to solar PV, with a capacity at 5MW and below, from 1 April 2016.

CfD provide a premium payment for renewable electricity paid on top of the wholesale market price to reach the agreed payment level (strike price). If the market price is higher than the agreed "strike price", renewable generator must pay back the difference. CfD is accompanied by capacity auctions structure. Under feed-in-tariff scheme solar PV installations are eligible. In order to be accredited, installations of less than 50 kW shall take part in the Microgeneration Certification Scheme (MCS), an independent scheme that certifies microgeneration products of less than 50 kW and installers in accordance with consistent standards.

**Table 53.** CfD Strike Prices (GBP/MWh, 2012 prices)

	2014/15	2015/16	2016/17	2017/18	2018/19
(>5MW)	120	120	115	110	100

The feed-in-tariffs are applied for solar PV < 5 MW. Reduced tariffs for new 50kW to 5MW and all stand-alone PV installations are in place since 1 August 2011. Reduced solar PV tariffs for smaller scale installations were applied in 2012 with a cost control mechanism for all solar PV tariffs. Feed-in tariff rates for new installations are adjusted on a quarterly basis for solar PV. Solar PV installation with eligibility date on or after 1 April 2012 and with a total installed capacity up to and including 250 kW consisting of 25 or more PV installations receives a multi-installation tariff which equals the middle tariff rate (M) that applies to such an installation. The installed solar PV capacity



within FIT scheme reached almost 3.4 GW in 2015 (84% of the total installed capacity supported by FIT scheme).

**Table 54.** Solar PV installed capacity and number of PV installation in UK under Fit scheme, 2014-2015<sup>56</sup>

	<b>2014</b>	<b>2015</b>
<i>PV capacity (MW)</i>	2662	3374
<i>PV installations (thousand)</i>	599.4	755

The following table displays the guaranteed purchase prices for solar PV plants installed between October and December 2014.

**Table 55.** Feed-in tariffs for solar photovoltaic technology in UK, 01.10 – 31.12.2014

<b>Technology</b>	<b>Installed Capacity</b>	<b>Support Level<sup>57</sup> (€/MWh)</b>
<i>PV - Standard PV receiving the higher rate</i>	IC<4kW	172.16
	IC<10kW	156.04
	IC<50kW	145.14
	IC<150kW	123.90
	IC<250kW	118.33
<i>PV - Standard PV receiving the middle rate</i>	IC<4kW	154.90
	IC<10kW	140.37
	IC<50kW	130.60
	IC<150kW	111.41
	IC<250kW	106.52
<i>PV -Standard PV receiving the lower rate</i>	IC<4kW	76.32
	IC<10kW	76.32
	IC<50kW	76.32
	IC<150kW	76.32
	IC<250kW	76.32
<i>PV - Standard large PV</i>	0.25<IC<5MW	76.32
<i>PV - Stand-alone PV</i>	IC<5MW	76.32

In order to be eligible for the highest generation tariff rates solar PV installation(s) or its/their extension(s) with a total installed capacity up to and including 250 kW are required to demonstrate that the building to which the solar PV is attached or wired to supply electricity to has achieved an Energy Performance Certificate (EPC) rating of Level D or above. Installations which do not meet this requirement are eligible for a lower (L) tariff rate.

**Table 56.** Feed-in tariff payment for solar PV installations in UK, 01.10 - 31.12.2017

<b>Capacity</b>	<b>GBP per kWh</b>
<i>≤ 10kW (other than stand-alone)</i>	H: 0.04 (approx. 0.0447 €/kWh)
	M: 0.0360 (approx. 0.0403 €/kWh)
	L: 0.0038 (approx. 0.0042 €/kWh)
<i>10kW - 50kW (other than stand-alone)</i>	H: 0.0422 (approx. 0.0472€/kWh)
	M: 0.038 (approx. 0.0425 €/kWh)
	L: 0.0038 (approx. 0.0042 €/kWh)
<i>50kW - 250kW (other than stand-alone)</i>	H: 0.0189 (approx. 0.0211 €/kWh)
	M: 0.017 (approx. 0.019 €/kWh)
	L: 0.0038 (approx. 0.0042 €/kWh)
<i>250kW - 1MW (other than stand-alone)</i>	0.0154 (approx. 0.0172 €/kWh)
<i>&gt; 1MW (other than stand-alone)</i>	0.0038 (approx. 0.0042 €/kWh)
<i>Stand-alone (&gt;1MW)</i>	0.0023 (approx. 0.0025 €/kWh)

Payment rates from 1 October 2017 to 31 Dezember2017 with depending on efficiency parameters of as outlined in Annex 2 of Schedule A to Standard Condition 33, three rates ("higher" - H, "middle" - M and "lower" - L) for PV installations are provided for PV installations are provided are provided in Table 56.

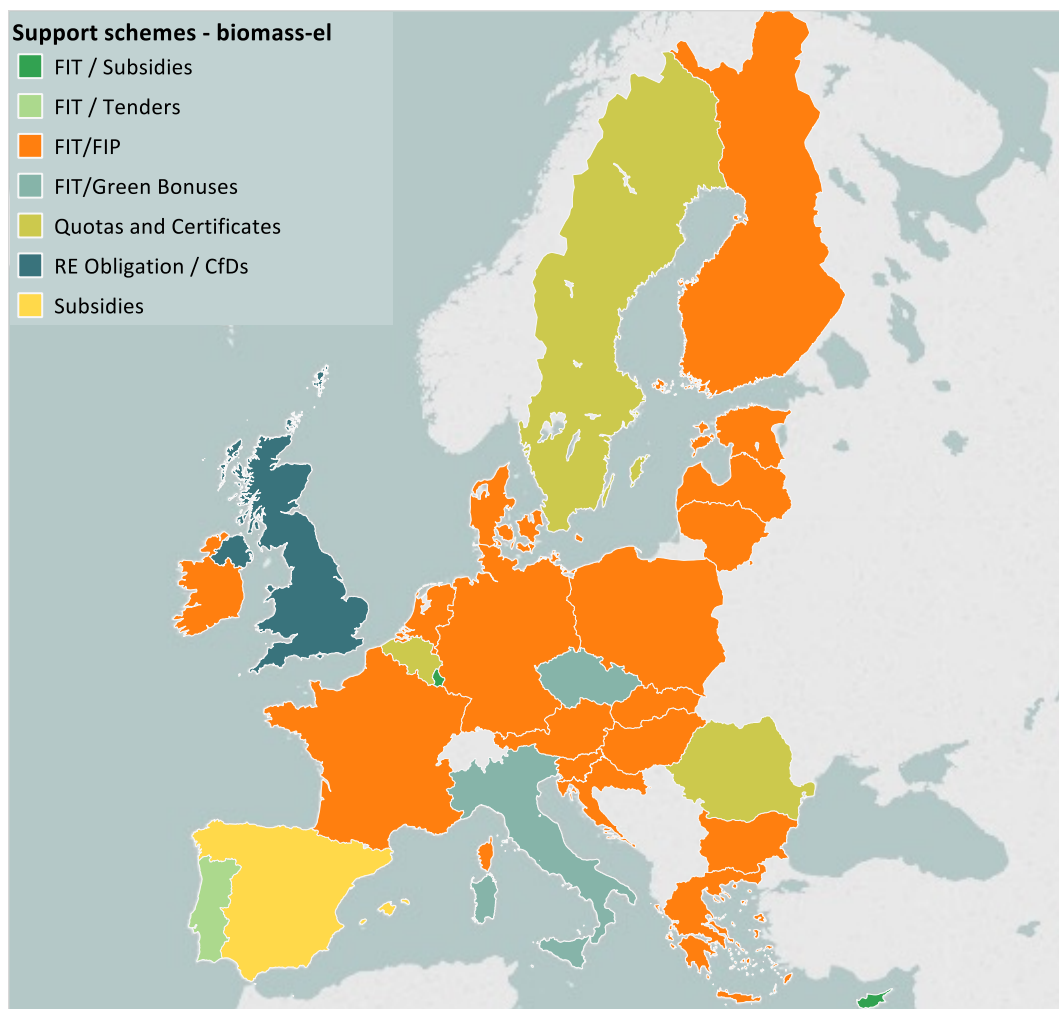
<sup>(56)</sup> Platts, Issue 713, 2015

<sup>(57)</sup> Using 1 £ = 1.13565181 €

### 6.1.4 Biomass

Figure 18 illustrates the support schemes applied in the EU countries for biomass source. Feed-in-tariffs and feed-in-premiums are the main support schemes for this technology applied in 23 EU countries. Quota and certificates are applied in 3 EU countries (Belgium, Romania and Sweden). Italy and Austria combines FIT with Green Bonuses. Ireland and the UK combines RE Obligation / CfDs with Subsidies.

**Figure 18.** Support schemes in EU countries – biomass



**Belgium** support schemes are based on an annually increased quota and negotiable green certificates to promote electricity generation from renewable sources, taking account of the powers assigned. The minimum green electricity price for all technologies is equal to EUR 93/certificate. The amount of support received by an installation from 1 January 2013 is now only dependent on the 'banding factor' applicable to the project category concerned. Subsidy is the support scheme in heating/cooling sector and depends by the size of the plant. For biogas and biomass CHP plant the subsidy amounts to 20 % of the installation costs with a cap up to € 15,000. In case the CHP installation is a central heating plant, the amount of the subsidy is increased by € 100 per meter of piping. This additional premium cannot exceed 50 % of the installation costs and is limited to € 100,000 per district heating. For biomass the subsidy ranges between € 1,750 for installations under 50 kW and € 10,700 for installations above 500 kW. Moreover, above 50 kW the subsidy is increased by € 8 to 35 per kW depending on the capacity of the installation. The amount of the subsidy for biomass heating plants cannot exceed 50 % of the total installation costs, with a maximum subsidy amount of € 15,000.

In **Bulgaria** the purchase of electricity under a feed-in tariff and long-term contracts is the most attractive support scheme while for promoting renewable heat the subsidy exemption from property tax for building owners is used. Depending on the type of fuel the FIT range: wood waste – about €ct 11.4–12.8 per kWh; agricultural waste – about €ct 9.1 per kWh; energy crops-about €ct 8.4 per kWh; biogas from plant and animal waste-about €ct 19.8–23.2 per kWh, biogas from household waste-about €ct 10.5–11.5 per kWh; biogas from household wastewater – about €ct

4.6–6.4 per kWh). The period of the obligation to purchase and dispatch electricity depends on the subsidy agreement between the plant operator and the grid operator. The term of such an agreement is 20 years for plants using biomass and 15 years for plants that are using biogas. In Bulgaria the scheme for promoting renewable heat is the subsidy exemption from property tax for building owners.

**Czech Republic's** feed-in tariffs support schemes go together with green bonuses. Values are defined by Energy Regulatory Office which issues the pricing decisions laying down support for electricity generation from renewable energy sources, combined heat and power and secondary energy sources. Feed-in tariffs and Green bonuses differ from what type of renewable energy sources the electricity is produced. From 1 January – 31 December 2014 for biomass used in electricity – about €ct 4.8-12.1) per kWh. In the year in which the plant was put into operation, the feed-in tariff shall not exceed 57pprox.. € 180 per MWh; with regard to biogas the tariff may not exceed 57pprox.. € 68) per MWh (§ 35 par. 3 Act No. 165/2012). Subsidy is also used as a support scheme for renewable energy in heating/cooling but a subsidy cohesion programme for 2014-2020 has not yet been adopted there.

In **Denmark** the support in the form of feed-in-premium is provided for electricity generation based on biomass and for the use of biogas for upgrading. Support for upgrading of biogas is laid down in the Natural Gas Supply Act. In addition, support schemes have been reported for the use of biogas for process purposes, transport purposes and other purposes not covered by the other support schemes. These support schemes have not entered into force because they are awaiting the EC's approval under the State aid rules.

For electricity generated by plants exclusively run on biogas and gasification gas produced using biomass a feed-in premium which when combined with the market price amounts to DKK 0.793/kWh is paid. For electricity generated using biogas, gasification gas produced using biomass and other fuels, a feed-in premium of DKK 0.431/kWh is paid for the part of the electricity that is generated using biogas and/or gasification gas. In both cases the sum of the premium and the market price is adjusted annually on the basis of 60 % of the net price index. For electricity generated from the burning of biomass, a premium of DKK 0.15 per kWh will be paid, irrespective of whether the electricity is generated by plants using biomass exclusively or by plants using biomass in combination with other fuels. For electricity produced using biogas, producers can choose between these options:

- Electricity generation by means of biogas and gasification gas produced using biomass - a feed-in premium which when combined with the market price amounts to DKK 0.793/kWh is paid. The sum of the premium and the market price is adjusted annually on the basis of 60 % of the net price index. If the price of natural gas falls below the base price, the support will be adjusted upwards correspondingly. In addition to the above-mentioned subsidies, premiums of DKK 0.26/kWh and DKK 0.10/kWh respectively will also be paid. The premium of DKK 0.10/kWh will be reduced in stages by DKK 0.02/kWh each year between 2016 and 2020, when it will be removed completely.
- Electricity generation using biogas and gasification gas produced using biomass and other fuels - a feed-in premium of DKK 0.431/kWh is paid for the part of the electricity that is generated using biogas and/or gasification gas. The premium is adjusted annually on the basis of 60 % of the net price index. The additional premiums are applied and adjusted as described above.
- Support for upgraded biogas supplied to the natural gas network and cleaned biogas supplied to the town gas network - A premium of DKK 79/GJ will be paid for upgraded biogas that is supplied to the natural gas network. The additional premiums (DKK 26/GJ and DKK 10/GJ) are applied and adjusted as described above.

The Danish Parliament has adopted three support schemes on biogas that have not yet entered into force:

- Support for biogas for transport - a basic subsidy of DKK 39/GJ of biogas sold for use in transport will be payable. In addition, two premiums, of DKK 26/GJ and DKK 10/GJ, respectively, will be payable. The two premiums will be adjusted as described above for upgraded biogas;
- Support for biogas for process purposes – the same scheme as above
- Support for biogas for other purposes - for other uses of biogas, two premiums, of DKK 26/GJ and DKK 10/GJ, respectively, will be payable. The two premiums will be adjusted as described above for upgraded biogas.

In **Germany** the Renewable Energies Heat Act, the Market Incentive Programme and low-interest loans support renewable heating/cooling and numerous support schemes are available for renewable heat at Land level: Bonus support – (i) Efficiency bonus: 0.5 times the basic support but only for Installations with a capacity between 5kW – 100kW using wood pellets plus 500 € grant if combined with solar; (ii) Innovation support – Installation or retrofitting for the purpose of emission reduction and efficiency for installations firing solid biomass with < 100 kW nominal heat output: € 750 and for newly erected installations € 850 (Guidelines for the support of RES-H Art. 12.2.3 a-b); (iii) Taking all options into account, the support that can be granted ranges for: Pellet boilers with water bag between € 1,400 – € 3,600; Pellet boiler between € 2,400 – € 3,600; Pellet boiler with new buffer storage (30 l / kW) between € 2,900 – € 3,600.

In electricity sector the tariff payment period is usually 20 years plus the year in which the system or plant was put into operation (§ 22 EEG 2014). The amount of tariff for a given plant is the tariff level as defined by law. It differs for every source of energy (§§ 40 – 51 EEG 2014). For some technologies there were several tariffs depending on the plant capacity, the plant location and the technology and raw materials used: (i) for biomass used in electricity the tariff was €ct 5.85 – 23.73 per kWh (according to plant size and fuel) minus €ct 0.2 per kWh (§ 37 par. 3 no. 1 EEG 2014); (ii) applicable to power plants put into operation after 01.01.2014: biogas from biomass tariff - €ct 5.85 – 27.73 per kWh (according to plant size and fuel) (§§ 44-46 EEG 2014) minus €ct 0.2 per kWh (§ 37 par. 3 no. 1 EEG 2014); landfill gas: €ct 5.83 – 8.42 per kWh (§ 41 EEG) minus €ct 0.2 per kWh (§ 37 par. 3 no. 1 EEG 2014); sewage gas: €ct 5.83 – 6.69 per kWh (§ 42 EEG) minus €ct 0.2 per kWh (§ 37 par. 3 no. 1 EEG 2014).

Under EEG 2017 the support given changed as following: (i) biomass used for electricity received a tariff of €ct 5.71 – 13.32 per kWh (according to plant size) (§§ 42 EEG 2017) minus €ct 0.2 per kWh (§ 53 no. 1 EEG 2017); (ii) biogas from bio-waste is €ct 13.05 – 14.88 per kWh (according to plant size) (§§ 436 EEG 2017) minus €ct 0.2 per kWh (§ 53 no. 1 EEG 2017); (iii) Biogas from manure: €ct 23.14 kWh minus €ct 0.2 per kWh (§ 53 no. 1 EEG 2017) for plants smaller than 75 kW (§ 44 EEG 2017); (iv) Landfill gas: €ct 5.66 – 8.17 per kWh (§ 41 par 1 EEG 2017) minus €ct 0.2 per kWh (§ 53 no. 1 EEG 2017); (v) Sewage gas: €ct 5.66 – 6.49 per kWh (§ 41 par 2 EEG 2017) minus €ct 0.2 per kWh (§ 53 no. 1 EEG 2017).

In **Estonia**, electricity from renewable sources is mainly promoted through a feed-in-premium tariff. In compliance with Section 59 of the Electricity Market Act support is granted for electricity that has been generated from renewable sources, from biomass in a cogeneration process, or in an efficient cogeneration process, and in accordance with the EU state aid rules. The bonus amounts to 5.37 €ct/kWh and does not differ for the individual technologies. In addition, investment subsidies are available for specific types of renewable energy production technologies. CHP plants with a production capacity below 10 MW using waste, peat or oil-shale retorting gas are eligible for an investment subsidy amounting to 3.2 €ct/kWh. For wood chips in boiler house the investment subsidy reach 37.1 €/MWh. Under the Environmental Program an investment subsidy of 75.8 €/MWh for wood chips in boiler house is applied. To encourage the use of renewable energy sources for heating, investment supports are made available for the construction of CHP plants with capacity less than 2 MW, for the reconstruction of boiler-houses with capacity less than 4 MW, for the reconstruction of the district heating network to improve energy efficiency (projects less than 50 M€).

In **Ireland** the main support for biomass is coming from REFIT3 scheme. The admission to the scheme is available only for the applications before December 2015.

**Table 57.** REFIT 3 Support levels for biomass electricity generation in Ireland, 2014<sup>58</sup>

Technology/Process		REFIT 3
<i>Biomass Combustion</i>		89.14 €/MWh
<i>Biomass Combustion – Energy Crops</i>		99.62 €/MWh
<i>Biomass CHP<sup>A</sup></i>	Capacity > 1500 kW	125.84 €/MWh
	Capacity < 1500 kW	146.81 €/MWh
<i>AD<sup>B</sup> Non-CHP<sup>A</sup></i>	Capacity > 500 kW	104.87 €/MWh
	Capacity < 500 kW	115.35 €/MWh
<i>AD<sup>B</sup> CHP<sup>A</sup></i>	Capacity > 500 kW	136.33 €/MWh
	Capacity < 500 kW	157.30 €/MWh

State aid for new generation reach 400 MW in REFIT1, 4000 MW in REFIT2 whereas REFIT3 covers 310 MW of certain biomass-related categories, divided as follows: 50 MW of anaerobic digestion

(<sup>58</sup>) A: combined heat and power; B: anaerobic digestion

(including AD CHP), 100 MW of biomass CHP, and 160 MW of biomass combustion (including biomass co-firing with peat).

In **Greece**, the main support schemes to promote the renewable energy from biomass are: (i) feed-in tariff, which differentiates the tariffs depending on the project size, having considered co-benefits and project development costs. It is readjusted annually, indexed at 25% of the annual consumer index. The total support in 2013 for biogas through this scheme reached 22.5 M€. The scheme is applied to capacities less than 1 MW and the support ranges 184-193 €/MWh; (ii) subsidy on investments through: income tax relief, subsidized expenditure and leasing subsidy. Biomass and biogas plants are eligible also to profit a tax incentive. A special fee for GHG reduction per end consumer category is also applied; (iii) net metering scheme; (iv) sliding feed-in-premium scheme limited for capacities valid since 2016 for a period of 20 years: (i) <1 MW (the premium ranges between 184-193 €/MWh minus SWP<sup>59</sup>); (ii) 1-5 MW (162 €/MWh minus SWP); (iii) 5-15 MW (140 €/MWh minus SWP). The tax exemption is granted for the installation of renewable boilers or the replacement of existing fossil heating boilers with renewable ones. Loan scheme is applied in heating sector to improve the energy performance of residential buildings. For CHP plants a sliding feed-in-premium is valid since 2016 for a period of 20 years: (i) capacity 1-5 MW (support range 80-84 €/MWh + NGPA<sup>60</sup> - SWP); (ii) 5-10 MW (support range 74-78 €/MWh + NGPA - SWP); (iii) 10-35 MW (support range 68-72 €/MWh + NGPA - SWP); (iv) >35 MW (support range 61-65 €/MWh + NGPA - SWP).

In **Spain**, the main support scheme based on a system of regulated premiums and tariffs operated until 2012. In 2012 Spain government temporarily stopped accepting applications for projects planned to start operation at the beginning of 2013. Law 15/2012 of 27 December 2012 on fiscal measures for energy sustainability is governing three new taxes, one of which is a tax on the electricity production value, applicable to renewable production as well. The new support scheme is composed by the (i) feed-in-tariff and (ii) reasonable compensation.

Under the new scheme, beneficiaries receive support through a premium on top of the market price of electricity, so that they have to respond to market signals. This premium is meant to help these facilities compensate for costs that cannot be recovered from selling electricity in the market, and obtain a reasonable return on investment. The scheme has been in place since 2014 and applies to new beneficiaries as well as to facilities that were benefitting from previous support. In total, the scheme has around 40,000 beneficiaries. In 2016, the annual payments under the scheme amounted to €6.4 billion. Since 2016, support to new facilities is granted through competitive auctions. Different technologies have competed with each other in the latest auctions of May 2017 and July 2017. In total, support for capacity of slightly more than 8 gigawatts was awarded, essentially to wind and solar panel plants. As a result of these auctions, beneficiaries will receive compensation only if, in the coming years, the market price drops to a level significantly below today's market prices. This protection against an unexpectedly sharp fall in market prices helps developers to secure project financing, and therefore complete the projects on time. This will help Spain achieve its 2020 environmental and climate change objectives.

**France** feed-in tariff support scheme guarantee minimum payments which may be increased by a premium. The tariff rate depends on the costs of investment and operation, which arise for the plant operators but are to be borne by the suppliers (EDF and private suppliers). In addition, plant operators may receive a premium, which depends on the amount of electricity exported: 43.4 €/MWh + premium of at least 77.1 €/MWh, depending on energy efficiency, the system capacity and the resources used. According to the orders on the feed-in tariffs for the single technologies, eligibility for the tariff is limited in time. The duration of payment varies according to the source of energy: biogas 15 years and biomass 20 years. Electricity production by cogeneration from biomass and from biogas is supported by purchase prices and calls for tender. In 2014 support costs for biomass reached 158 M€ whereas for biogas 107 M€. For biogas plants with a capacity ≤ 150 kW the support is 97.45 €/MWh; biogas plants with a capacity ≥ 2 MW - €ct 81.21 €/MWh. A bonus of 40 €/MWh can also be granted for biogas plants with an energetic performance of at least 70%. The support for renewable heat is done through Heat Fund scheme in which around €1.28 billion were allocated during period 2009-2014. The payment to be awarded is calculated in accordance with the successful tenderer's finance plan and with consideration of the relation between the amounts of support asked for and the amount of renewable heat produced. For non BCIAT wood (Biomass heat-Industry-Agriculture-Services) the scheme provided in 2014 a support of 667 €/toe; for BCIAT wood the support was 356 €/toe and for biogas 204 €/toe. For a biogas

<sup>(59)</sup> SMP(Special Market Price)=monthly average of the marginal average system price

<sup>(60)</sup> Natural Gas Price Adaptation (NGPA) = (Mean Monthly Natural Gas Price - 26) \* (1-(n-ne)/nhr)/ ne where ne = electr.l performance level of CHP, nth = thermal performance level of CHP, n= ne + nth

plant with a capacity  $\leq 80$  kW a tariff of 175 €/MWh and for capacity  $\geq 500$  kW a tariff of 150 €/MWh is paid. The tariff is paid for the treatment of livestock effluents, namely 50 €/Wh. As of January 1, 2018, the value of feed-in tariffs decreases by 0.5% at the end of each quarter

In **Italy** until 2016 the main national schemes promoting the use of renewable energy sources in electricity and heating/cooling sectors are the (i) Feed-in-tariff scheme for PV and CSP, (ii) Green Certificates, (iii) All-inclusive feed-in-tariffs, (iv) Ministerial Decision (MD) of 6 July 2012, (v) White Certificates, (vi) the Thermal Account and (vii) Tax Deductions. Green Certificates for non-PV renewable energy plants provide an incentive period of 15 years and it is applied through three types of prices: own consumption or free market; simplified purchase and sale arrangements; net metering. All-inclusive tariffs are open to installation less than 1 MW. This scheme provide a tariff of 280 €/MWh for biogas and biomass (excluding liquid biofuels, pure vegetable oils, ethyl alcohol of agricultural origin, butchery waste, by-products of agricultural, agro-foodstuffs and forestry activities) and 180 €/MWh for Landfill gas, residue gas from sewage treatment processes and liquid biofuels with the exception of pure vegetable oils. In heating/cooling biomass heating systems can benefit from a support scheme for energy saving in the building sector via tax deductions (at the rate of 55%), a voluntary mechanism. In 2015 the tax deduction also applies to the purchase and installation of winter heating systems using biomass-fuelled boilers (maximum deduction of 30000 € only for 2015). The Ministerial Decision of June 2016 defined the new tariffs and premiums as showed in Table 58.

**Table 58.** Support for biomass in Italy under the DM 26/06/2016

	Capacity	Support (€/MWh)
Feed-in-tariff <sup>61</sup>	1 kW – 0.5 MW	150 – 246
Market premium <sup>48</sup>	1 kW – 5 MW	115 – 246 <sup>62</sup>
Tender for FIP	>5 MW	119
Net metering <sup>63</sup>	<500 kW & < 200 kW (operation before 2014)	Plant operators receive as much energy for free as they feed-in to the grid. If more is fed-in than consumed they receive a defined economic compensation
Net metering	<20 kW (operation before 2017)	

In **Cyprus**, electricity from renewable sources is promoted through financial incentives combined with a net metering scheme. Biomass and biogas are eligible to net metering scheme since 2017. For industrial/commercial units and public administration buildings the autonomous biomass/biogas plants eligible to net metering have a capacity between 10 kW-10,000 kW (aggregate installed capacity 40 MW).

**Table 59.** Level of support for biomass in Cyprus, 2014

Technology/source	Type of installation/ Capacity	Level of support
Biomass	Exploitation of biomass	0.135 €/kWh
Biomass	Exploitation of biogas from sanitary landfills	0.114 €/kWh

**Latvia** applies some support schemes as: (i) tax exemption for electricity produces from RES (high efficiency cogeneration plants are included), which reach 1.01 € /MWh; (ii) mandatory procurement of electricity produced from RES within which the producers of electricity have the right to sell the electricity by applying the guaranteed feed-in-tariff. In 2014 the guaranteed feed-in-tariff for biomass plants was 168.54 € /MWh and for biogas plants 185.94 € /MWh. The granting within this scheme is suspended until 1<sup>st</sup> of January 2020 due to not compliance with the EU State Aid Regulatory framework for Environment and Energy; (iii) guaranteed payment for electrical capacity installed at a cogeneration plant using RES. Up to now only one operator has received this support (5.16 M€) for a biomass cogeneration plant of capacity 23 MW. The granting within this scheme is suspended until 1<sup>st</sup> of January 2020; (iv) tax exemption for subsidised electricity produced from RES (Subsidised Electricity Tax law, 1<sup>st</sup> of January 2014. See point (ii) for more). This scheme applied to the income under scheme (ii) and (iii) and implies a rate of 10% for plants using RES and 5% for high-efficiency cogeneration plants using wood biomass with capacity less than 4 MW, using at least 70% of heat generated in the cogeneration process.

<sup>(61)</sup> Producers are free to choose between FIT and FIP

<sup>(62)</sup> minus the zonal hourly price

<sup>(63)</sup> This option can be taken instead of selling the electricity on the the free market or one of the othe support schemes. Starting in 2015 a fee is charged for the use of the net-metering service by the GSE

In **Lithuania** the support scheme includes one or many incentive measures as fixed rate, buying-in prices, compensation of grid connection costs, promotion quotas, reservation of grid or system capacity etc. Fixed buying-in tariffs for new build power plants using biomass at the end of year 2014 were: for installed capacity of up to and including 10 kW – EUR 0.087 per kWh. For power plants using biomass: installed capacity exceeding 10 kW up to and including 5000 kW EUR – 0.075 per kWh; installed capacity exceeding 5000 kW: EUR 0.067 per kWh. For reconstructed power plants using biomass: installed capacity of up to and including 10 kW – EUR 0.072 per kWh. For reconstructed power plants using biomass: installed capacity exceeding 10 kW up to and including 5000 kW – EUR 0.064 per kWh; installed capacity exceeding 5000 kW – EUR 0.055 per kWh. For power plants using landfill gas: installed capacity of up to and including 10 kW – EUR 0.116 per kWh. For power plants using biogas derived from anaerobic digestion or other biodegradable organic waste or substrates: installed capacity of up to and including 10 kW- EUR 0.153 per kWh.

**Luxembourg** applies new feed-in-tariff scheme to support the renewables in electricity sector since 1<sup>st</sup> of January 2014 introducing some new elements as for e.g. a bonus for using liquid manure in biogas plants. According to this new support scheme the existing biogas plants under certain conditions can attract a residual feed-in tariff for 10 years of EUR 118 per MWh (nominal electrical output < 500 kW) or EUR 98 per MWh (500 kW < nominal electrical output < 2.5 MW). This additional bonus (+15 €/MWh or +30 €/MWh) can be available even in cases when commercialised heat was produced exclusively from sewage gas, solid biomass and old/scrap woods if certain conditions are fulfilled. The funding rate for power stations generating electricity and heat from biomass has been reduced from 33% to 30%. The funding rate for heating systems generating heat from biomass has been increased from 33% to 40% of investment costs. Wood gasification plans are no longer supported directly. The tariff is guaranteed for a period of 15 years, starting on the day of the first electricity export. Renewed or extended biogas stations are entitled to 20 years of feed-in tariff.

In **Croatia** the production of electricity from renewable energy sources is promoted through a combination of feed-in tariff and loans. The amount of feed-in tariff can depend on the generating capacity, the specific technology or the efficiency of the plant. The tariff of each individual plant is composed by the basic tariff multiplied by a coefficient (k), which varies according to the annual plant efficiency. Based on plant capacity and efficiency (<45% to >55%) the tariff varies from 16.9 €/kWh (<300 kW) to 15.6 €/kWh (> 2 MW), whereas for capacities larger than 5 MW the amount of the tariff depends on the "reference price". The contracts have duration of 14 years (Art. 18 § 1 Tariff system for RES-E). A support scheme for renewable heating from biomass is in progress.

In **Hungary** the new 2013 mandatory off-take scheme is of utmost importance for power and heat coming from renewables. This scheme introduces stricter sustainability criteria, especially for wood combustion. Mandatory off-take support is the difference between the mandatory FIT and the average price of the day-ahead market in the organized electricity market and the amount of electricity taken over, relating to a specific technology. The mandatory off-take scheme is composed by two components: (i) average FIT and (ii) per unit support. In 2014 for biomass and its sub-categories the "average FIT" ranges between 76.5 €/MWh (renewable part of waste) to 114.5 €/MWh (sewage treatment plant gas) whereas the "per unit support" ranges between 38.1 €/MWh (renewable part of waste) to 69.7 €/MWh (multi-firing with coal-biomass).

In **Malta** feed-in tariff is the main support scheme and is mainly aimed to solar photovoltaics. No specific schemes exist for power and heat biomass.

The electricity and heating/cooling sectors in the **Netherlands** are increasingly using agricultural biomass, woody biomass and renewable waste since 2003, when the MEP subsidy program (2003-2006) for renewable energy was settled. The scheme was in the form of fixed feed-in-premiums applied for a period of 10 years. It will run up to 2020 until that time will still be covered by general funds. The support for biomass (incl. waste and landfill gas; incl. transitional MEP) was 8.2 €/MWh in 2014 with a total support of 199.7 M€. The MEP was then continued via the SDE program (2008-2010). It will be valid up to 2030 inclusive. In 2014 the support for biomass renewable electricity (incl. sustainable energy from waste and landfill gas) was 7 €/MWh (total amount 42.7 M€) and for biomass renewable gas 3.2 €/MWh (total amount 9.2 M€). The successor of SDE program, called the SDE+, started to operate in 2011 (see section 3.2.19 for an overview). Producers receive now financial compensation for the renewable energy they generate during a subsidy period of maximum 12 years (except for the newest category of wood pellet boilers > 5 MWth with a maximum of 8 years). Production of renewable energy is not always profitable because the cost price of renewable energy is higher than the market price. The

difference in price is called the unprofitable component. SDE+ compensates producers for this unprofitable component for a fixed number of years, depending on the technology used. The SDE+ is made available for the production of renewable electricity; renewable heat or a combination of renewable heat and electricity (CHP); and renewable gas (see table 44 for the subsidy levels).

The Dutch subsidy for biomass for electricity, mostly co-firing of pellets in coal fired power plants, is traditionally the largest supported biomass category in the Netherlands, ranging from 250 M€ to 350 M€ per annum in the period 2011-2016 (table 60). The support for biomass for heating, including small scale CHP, is steadily growing up to a level of 27 M€ in 2016. The support for electricity is quite stable at around 70€ per MWh (equal to 20€ per PJ), whereas that for heating/cooling is slightly increasing up to 30 € per MWh in 2016 (equal to less than 8€ per PJ).

The SDE+ also granted support for installations using gas such as landfill gas or biogas from waste water treatment plants/sewage treatment plants biomass (various types of digester). One part of the gas is directly used for energy production. Another part is used to inject in a green gas hub, as a test to mix it together with Dutch natural gas resources. The subsidy for renewable gas has the same support level as heating & cooling, about 27 M€ in 2016 (RVO, 2017b). The support per unit is fluctuating, mostly in between 30€ and 40€ per MWh (equal with about 0.25€ and 0.35€ per m<sup>3</sup> of gas).

**Table 60.** Support provided for biomass in the Netherlands in 2011-2016<sup>64</sup>

	Programme	Per unit support (€/MWh)			Total support (M€)		
		Power production	Heating/cooling, including CHP	Renewable gas	Power production	Heating/cooling, including CHP	Renewable gas
2011	Aggregated	67	-	83	371	-	4
2012	Aggregated	68	3	32	344	0.4	6.5
2013	Aggregated	69	18	30	292	3.5	11.5
2014	Aggregated	65	21	23	256	16.5	12.0
2015	aggregated	64	24	36	264	23.2	23.9
2016	aggregated	71	29	37	288	27.2	27.4

Direct support to renewable energy is the dominant type of support in **Austria** in which tariff and subsidies are used to support the development of renewables. Feed-in-tariffs were applied for new green electricity installation in 15 year terms. During period 2010-2014 the tariffs applied to: (i) solid biomass ranged from 199 €/kWh (<500 kWh) to 109 €/kWh (> 10 MW); (ii) liquid biomass (supplement 2 €/kWh premium for production in efficient CHP); (iii) biogas from agricultural products – range from 196 €/kWh (< 250 kWh) to 13 €/kWh (> 750 kWh). Under the Environmental Assistance special investment incentives were in place for biomass heating plants. At the federal level, the support differs according to technology: usually, a flat rate of support is carefully calculated. Another option was a standard reimbursement rate amounting to 25 % of the environment-related investment costs possibly to be increased through awards to a maximum of 30 %. Support takes the form of investment subsidies capped at 30% (for undertakings) or 50% (for territorial units) of eligible costs. In 2018 the support for solid biomass applications will range from 101 €/kWh -217.8 €/kWh. In 2019 the range will be from 100 €/kWh to 215.6 €/kWh depending on capacity. Waste with high biogenic share 25-40% less will receive a support of 47 €/kWh in 2018 and 46.6 €/kWh in 2019. Depending on primary energy source, lower rates (82.2 €/kWh -180.9 €/kWh) will be applied if solid biomass capacity that has been awarded subsidies since 2009 reaches 100MW. The support for liquid biomass in 2018 will reach 54.5 €/kWh and in 2019 the support will be 54 €/kWh, with extra 20 €/kWh if efficient CHP. Investment subsidy for highly efficient new CHP and modernisation is applied for installations larger than 100 kW. The maximum of support ranges from 125 €/kWh to 250 kWh. Annually 12 M€ will be available until 2020.

In **Poland** the main support schemes for biomass in electricity sector are: (i) the average certificate price, (ii) tax exemption. The average value of certificates of origin in 2014 was determined on the basis of the Polish Power Exchange data. In Poland, all electricity produced from renewable sources is exempt from excise duty, which is PLN 20 per 1 MWh. For biomass and solid

<sup>64</sup>) Biomass for electricity, heating and renewable gas purposes. Source: (RVO, 2017b) (CBS, 2013-2017)



biomass in electricity the average certificate price in 2014 was 47.2 €/MWh and the tax exemption 4.73 €/MWh.

Support schemes establishing measures to promote the production and use of biomass in order to ensure the supply of plants dedicated to forest biomass, including the creation of an incentive for the construction and operation of plants mentioned and the long-term sustainability of securing its supply, continue to apply in Portugal. For existing plants using forest biomass the feed-in-tariff scheme provides a support of 119 €/MWh; for plants using animal biomass the rate ranges between 102-104 €/MWh. The amount of feed-in-tariff depends also by the type of the unit plan: for micro-production units, the reference tariff in 2014 was 218 €/MWh for the first period of eight years and € 115/MWh for the second period of seven years. For mini-production units, the reference tariff in 2014 is 159 €/MWh. For mini-production units, the FiT consists of 60% of the reference tariff. Additional costs (above the market rates) are also applied: for biomass 70.8 €/MWh and for biogas 67.9 €/MWh.

**Romania** applies the system of green certificates system (annual quotas) through long-term contracts (15 years). The support scheme implies the granting of a non-refundable financing from structural funds for the performance of investments. The benefits from this support scheme is expressed in a number of green certificates: 2 green certificates for each 1 MWh generated and delivered by the producers of electricity from biomass, bioliquids or biogas power; 1 green certificate for each 1 MWh generated and delivered by the producers of electricity from landfill gas and sewage treatment plant gas; for electricity generated in power plants/units that use biomass – energy crops, 1 green certificate shall be granted in addition for each 1 MWh generated and delivered; for electricity produced in cogeneration power plants/generation units that use biomass – biological residue, and which are classified by as being of high efficiency, 1 additional green certificate is granted for each 1 MWh generated and delivered. In the case of application of State aid rules, the producers of electricity from biomass, bioliquids and biogas benefit from the promotion scheme only if they have certificates of origin for the biomass used as fuel or raw material. For electricity produced from renewable sources in a cogeneration process, producers applying for a promotion scheme are required to choose between the support scheme for the promotion of high-efficiency cogeneration based on useful heat demand

**Slovenia** supports the renewable energy sources through two schemes: (i) guaranteed purchase of electricity only for plants with a power of up to 500 kW; (ii) financial aid for current operations. The duration of support shall be defined in the decision allocating support, and is 15 years for new RES generating plants and ten years for new CHP generating plants. Support in the form of guaranteed purchase shall be paid out for the net generated electricity for which the support centre receives guarantees of origin. Premiums shall be paid out for electricity that producers sell on the market themselves. The support for biomass used in heating and cooling is provided within different streams targeting specific subcategories: wood biomass boilers in households, wood biomass and geothermal district heating systems and wood biomass boiler equipment. The level of support for woody biomass (less than 1 MW and over 1 MW) that guarantee the purchase of electricity ranges between 189 €/MWh and 250.4 €/MWh whereas the feed-in –premium for the same categories between 152.7 €/MWh and 214.4 €/MWh. For biogas the range was from 61.7 €/MWh (biogas power plants using landfill gas over 1 MW) to 169.7 €/MWh (biogas power plants using agricultural biomass up to 50 kW). The feed-in premium for the same categories ranges between 25.2 €/MWh and 134.8 €/MWh.

In **Slovakia**, the aim of feed-in-tariff support scheme is to guarantee electricity producers the same purchase price for 15 years with no limit in the overall amount of electricity produced. The limit is installed capacity is up to 12.5 MW. In case of high-efficiency cogeneration plants which use RES more than 30% in their fuel mix the limit of capacity is 200 MW. The operational programs under the Structural Funds are the main financial support instrument in the field of energy. Preferences are given to the construction of plants using biomass by renovating and upgrading existing fossil-fuel energy installations with a maximum thermal input of 20 MW; construction of plants producing and using biogas, landfill gas and gas from sewage treatment plants. The feed-in-tariff support for biomass in 2014 varies between 92.1- 126.1 €/MWh and for biogas between 107.3- 125.3 €/MWh.

In **Finland** the main support schemes to promote renewable energy include: (i) Production incentives; (ii) Production aid for wind power, biogas electricity and small-scale CHP as a sliding premium feed-in tariff from wood. For wood chips, the premium feed-in tariff is applied according to the wood-paying capability, emissions allowances, peat price and taxes. Target price for biogas electricity is 50 €/MWh and for small-scale CHP 20 €/MWh; aid for electricity from wood chips from forestry is 13.1 €/MWh. In 2014 significant amounts of energy aid (investment aid for investments in renewable energy) were granted, particularly for biomass boilers that have replaced oil-fired

boilers. The amount of guarantee aid for energy wood has been EUR 7 per cubic metre throughout the country, and hectare-based management aid for young, growing forests, for example, has also been approximately EUR 4-7 per cubic metre.

**Sweden** support schemes for biomass includes: (i) a liability/quota system that in 2014 reached 14.2% of quota-bound electricity consumption; (ii) mean electricity certificate price; (iii) investment aid for biogas and other renewable gases; (iv) Investment aid for the production or processing of biogas under the Rural Development Programme; (v) tax exemptions that are the main incentives to support renewable heating. This scheme is applied for liquid biomass not used in transport sector; (vi) Energy and carbon dioxide taxes from which the renewable energy sources are exempt.

Since 2010, the Swedish Government has set aside resources each year to promote the launch to market of new technology and new solutions that improve the profitability of biogas and help to increase its production. In 2013 and 2014, some SEK 180 million was paid out as part of this aid. The projects that have already been decided before 2015 will continue even in 2015 and 2016, after which the aid will end.

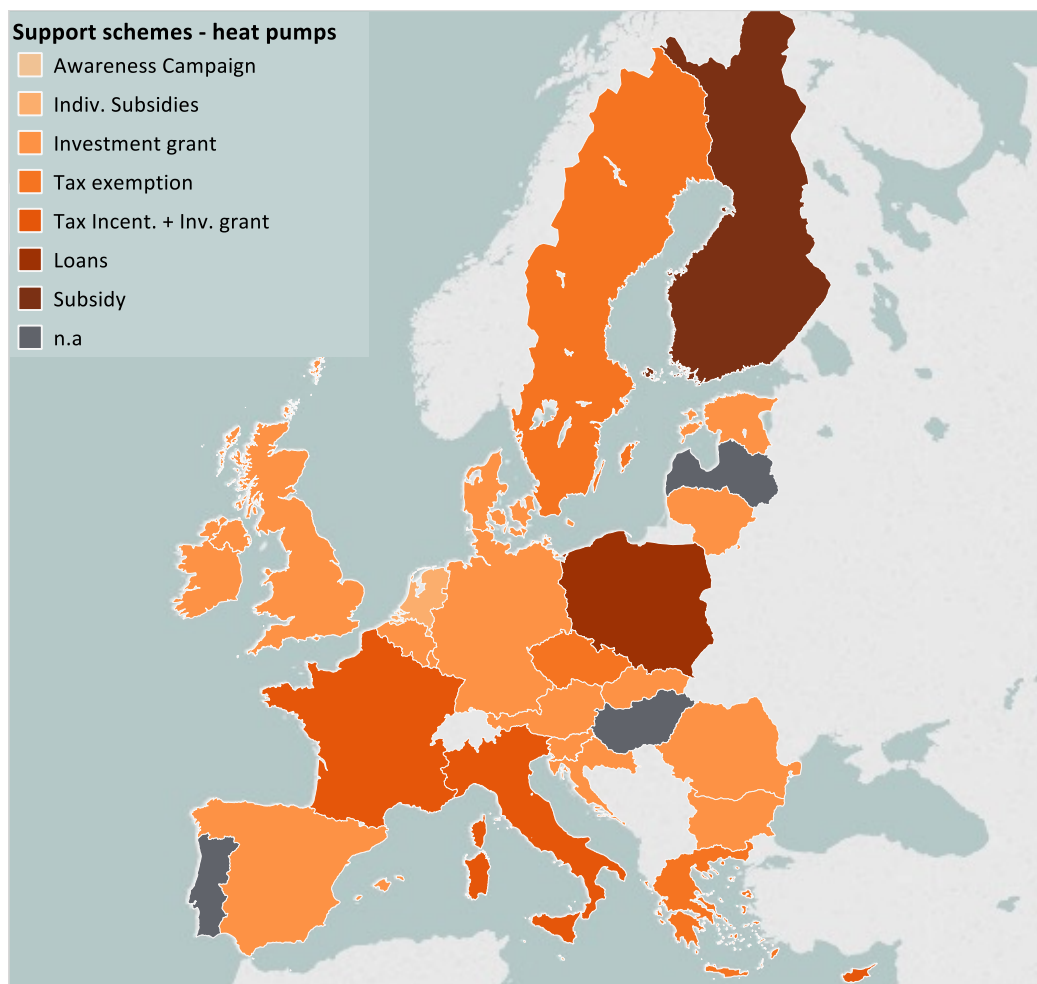
Aid for the production of biogas from manure has been available since 2014. The aid has been designed in the form of a project running from 2014 to 2023. The amount of aid is SEK 0.20 per kWh multiplied by production during the aid period. Over the ten-year period, there will be SEK 240 million available for distribution under this project. The aid to reduce methane gas has been increased by SEK 30 million per annum over the 2016-2019 period. The compensation rate for methane reductions will be increased from a maximum of SEK 0.20/kWh to a maximum of SEK 0.40/kWh on 1 January 2016. A total of SEK 72.83 million will be advertised for 2016, and SEK 79.83 million per annum over the 2017–2019 period for the Environmental Improvement Measures in Agriculture appropriation.

The support of renewables in electricity and heat sectors in **United Kingdom** is based on a number of support schemes as: (i) renewables obligation scheme (RO); (ii) contracts for difference (CfDs); (iii) feed-in-tariff and (iv) the renewable heat incentive (RHI). The RO scheme is going to be replaced by the CfDs so the support rate under the RO for new biomass conversion and co-firing projects will no longer be covered. The CfDs scheme is the key mechanism of the Electricity Market Reform in the UK through a private law contract between a low carbon electricity generator and the Low Carbon Contracts Company (LCCC), a Government-owned company. The RHI scheme, a first of its kind in the world, pays the subject that generates and uses renewable energy to heat buildings or inject bio-methane into the national gas grid. The non-domestic RHI has delivered support for over 5TWh of renewable heat generation and almost 13,000 accreditations since its launch in 2011 to October 2015. Domestic RHI has supported 43,000 accreditations since its launch in 2014 to October 2015. The scheme applies different banding factors

### 6.1.5 Heat pumps

Figure 19 illustrates the main schemes in place in the EU countries to support the deployment of heat pump technology. This technology is supported mainly through investments grants and tax exemption schemes.

**Figure 19.** Support schemes in EU countries – heat pumps



In **Belgium** the Federal Government provided a support by 750€/unit investment grant in period 2013 – 2014. Investments in heat pump technology are eligible for tax relief. The tax deduction amounted to 13.5% of the investment value for the fiscal year 2017. In the Flemish Region to promote green heat grants for solar boilers and heat pumps are increased for families and SMEs. In Walloon Region investment grant (and exemption from property tax) is available to individuals for the installation of heat pumps. In Brussels-Capital Region an energy grant of 189651 € was available for 44 cases in 2014. The installation of aerothermal heat pumps for the production of heat and/or sanitary hot water is eligible under several conditions.

In **Bulgaria** the support for this technology is given through "Green Industry Investments". There are 320 grant aid contracts since 2011 including HPs/chillers. Another way of support is through "Energy efficiency and green economy". The heat pumps eligible activities include purchase, supply, installation and putting into operation of systems for heating and AC for own needs.

In **Czech Republic** the provided support is through the exemption from real-estate tax for sources of geo-thermal energy, including heat pumps.

In **Denmark** the heat pump task force set a support of DKK 4.0 million/year for 2015-2017 to district heating plants and implementation of heat pumps solutions. The task force will advise the plants on the possibilities of establishing a large heat pump for district heating generation on the basis of locally available energy resources. However, the funds were rolled back in the 2016 Finance Act and the current status of the heat pump task force is that the opportunity to obtain advice will end on 31 December 2015. Energy Policy Agreement 2012: Funding pool for RE tech. in

district heating (geothermal energy and large HPs) - DKK 35 million for the period 2012-2015. To support the conversion from oil and natural gas-fired boilers in existing buildings to forms of heating based on RE, a funding pool totalling DKK 42 million will be allocated for the period 2012-2015 to promote initiatives for and the preparation of analyses of energy-efficient alternatives, including HPs, solar and solar thermal. Demonstration programme for large electric HPs for district heating generation (18 MW of thermal output expected to be installed) from 2015 to 2016.

Denmark is set to support 13 large heat pump projects with DKK23m (\$3.7m) in funding, the country's energy agency announced last week. The 13 projects will be installed at 11 combined heat and power (CHP)-based district heating plants across Denmark, which have a combined capacity of 29.7 MWe. Denmark's support for electric heat pumps is targeted at avoiding price rises for district heating customers when the country's current subsidy for natural gas-based CHP plants expires at the end of 2018 (EuroHeat&Power, 2018).

In **Germany** the main support for this technology is given through the Renewable Energies Heat Act. At least 15% of the requirement for heating and cooling energy in new and thoroughly renovated public buildings must now be covered by renewable energy. Market Incentive Programme (MAP) is a key instrument since 1994 to promote the use of renewable energy in the heating/cooling sector – in 2014, 209 M€ were spent on plants built under the MAP, triggering investments worth 1.07 bn€. KfW (funded by CO<sub>2</sub> Building Renovation Programme) is an essential element for energy saving in the building sector. It includes the upgrading of heating system and the construction of new energy efficient buildings. The support is given through low-interest loans, which can also be combined with repayment subsidy (up to 27.5% of the loan on the energy efficiency level). Private owners of single and two-family houses or owners of flats (owner-occupiers and landlords) can receive a one-off grant for up to 30% of the investment costs – in 2015, 2 bn€ were spent (1.7 for interest subsidies and 0.3 for grants). The basic support for electrical heat pumps (heat source: air) is 40 €/kW of nominal heat output up to at least 1500 € for performance-controlled installations and/or monovalent heat pumps and at least of 1300 € for all others installations. For the electrical heat pumps (heat source: geothermal energy, water), sorption and gas-motoric heat pumps the support reach 100 €/kW of nominal heat output up to at least 4500 € for the erection of electrical heat pumps based on geothermal energy, as long as an associated earth probe drilling is also being executed; at least 4500 € for each sorption and gas-motoric heat pump installation; at least 4000 € for all other electrical pumps with geothermal or water heat sources.

In **Estonia** support for modernising the heating systems of small building in residential sector is given. Financial instruments are created to help local authorities to prepare development plans for heating infrastructure (will raise administrative cap. of local authorities to undertake mutually beneficial cooperation with heating/cooling companies).

In **Ireland** the support for heat pumps is given through the application of tax exemption. The Taxes Consolidation Act 1997, which refers to the Accelerated Capital Allowance (ACA) scheme, allows companies to depreciate 100% of the purchase value of certain energy efficient equipment against their profit in the first year, instead of claiming for the standard capital allowance, which is generally given over an 8-year period and at an annual rate of 12.5% of the capital expenditure. There is a minimum expenditure to qualify for the ACA, which is € 1,000 for heating equipment.

In **Greece** the tax exemption is applied to support this technology. Law No. 2238/1994 provides for an income tax relief for natural and legal persons who have performed an energy upgrading of their building either at their own expense or through participation in national programmes. 10% of the project costs may be deducted from taxable income (up to a maximum of € 3,000).

In **Spain** funding of projects for heat production from RE through energy service companies (ESCOs) was launched in 2009.

In **France** fiscal measures are applied to increase the number and quality of energy performance works including heat pumps in 2 million dwellings by 2020: (i) Energy Transition Tax Credit (formerly the Sustainable Development Tax Credit); (ii) Lower VAT rate (works in housing over two years old) for renewable energy production equipment in the existing residential sector; (iii) Zero-rated eco-loan for works to improve the over-all energy performance of housing. Heat pumps systems are eligible for subsidy under the national programme to support households with low income in the thermal renovation of their buildings in order to decrease energy losses called "habiter mieux". The 2012 Thermal Regulation makes the use of renewable energy compulsory in individual homes through notably the production of domestic hot water using a thermodynamic water heater.

In **Italy** tax deduction for energy efficiency improvements for the achievement of targets of energy efficiency and thermal energy generation from renewables is applied. Through a voluntary mechanism (individuals or businesses may deduct respectively from their personal (IRPEF) or corporate (IRES) income tax a percentage of the expenditure incurred for certain types of energy upgrading works on existing buildings. The deduction is staggered over 10 years (up to 65% in 2015, 36% from 2016) – eligible: replacement of heating systems with high efficiency HPs and low-enthalpy geothermal systems (maximum deduction: 30 000€).

White Certificates (or Energy Efficiency Securities- EES) are tradable securities which certify energy savings in final energy uses. In 2014, 22 EES issued, with 8 toe of savings, from the installation of external air intake heat pumps in place of boilers in new or renovated residential buildings. Installer qualification schemes (Article 15 of Legislative Decree No 28/2011) - The professional qualification for the installation and extraordinary maintenance of heat pumps can be obtained by means of specific courses organised by the Regions. Thermal Account: a new incentive (in 2012 but fully operational in 2014) proportionate to the amount of thermal renewable energy production or energy saving achieved is applied for a period not exceeding ten years. The following actions are eligible for the scheme: (i) replacement of existing space heating systems with heating systems equipped with electric or gas heat pumps, also geothermal, (with rated thermal power output of up to 1 000 kWt)(type 2.A); (ii) replacement of electrical water heaters with HP water heaters (type 2.D). 181 projects implemented until 2014, with an average of 3682 €/project.

In **Cyprus** the support is given: (i) for natural persons and organisations not engaged in economic activity: in 2013 for HPs with a geo-thermal heat exchanger for heating/cooling in private residential units the subsidy is equivalent to 55% of the eligible budget with restrictions on maximum eligible expenditure. The maximum subsidy is 20 000€; (ii) for natural and legal persons, and public entities engaged in economic activity: in 2013 for HPs with geothermal heat exchangers for heating/cooling the subsidy is 15%, 25% or 35% of the eligible budget, according to the type of undertaking. The maximum subsidy is 100 000€.

In **Lithuania** the support is provided through loans under the "Climate Change Special Programme". Under the National Heating Sector Development Programme for 2015-2021 (there are plans to install new or upgrade existing heat generation facilities using renewable energy. Heat pumps technology is eligible to be supported through a price-based mechanism (priority purchase of heat produced from RES).

In **Luxembourg** the support is given through: (i) Subsidy I scheme (RGD 12.12.2012): for *aerothermal heat pumps*: The subsidy amounts to 25% of the eligible costs, subject to a maximum of €2,500 in a single-family passive house. The following expenses are eligible: the heat pump, additional needed devices, and installation costs. For *geothermal heat pumps*: The subsidy amounts to 50% of the eligible costs, subject to a maximum of €8,000 in a single-family house. For multi-family houses, the subsidy amounts to 50% of the eligible costs, subject to a maximum of €6,000 without exceeding a maximum support of €30,000 per house. The following expenses are eligible: the heat pump, additional needed devices, geothermal drilling and installation costs. (ii) Subsidy III scheme (Law 30.06.2004): Grants may cover up to 40% of the eligible investment costs. The grant may increase by 10 percentage points for small and medium-sized enterprises. Moreover, the grant may increase by 10 percentage points if the installed renewable energy plant allows the self-sufficient supply to a community of beneficiaries. (iii) Investment assistance for municipalities. The support funding 40% of investment costs for heat pumps has been introduced in 2014. (iv) Climate Pact introduced for municipalities (2013-2020) is giving support through funding for an energy advisor. Flat annual funding of 10k€ is available. Variable annual funding between 5 and 35€/inhabitant is applied.

In **Croatia** through the Environmental Protection and Energy Efficiency Fund investment subsidies (capital grants or loans) (€/unit) are provided for this technology: 60000.15 HRK/unit (total 7.87 M€) in 2012; 543627.80 HRK/unit (total 71.06M€) in 2014.

In **Hungary** the use of heat pumps continues not to be subject to a licence (neither a building nor energy licence is required), which largely facilitates the spreading of these devices.

In **Malta** ongoing awareness campaign are in place on the benefits of the use of heat pumps for space heating. Aerothermal heat pumps in private households are eligible for subsidy under Heat Pump Water Heater scheme. The amount of subsidy for aerothermal heat pumps is 40% of eligible costs and up to a maximum of € 400.

In **Netherlands** the Investeringssubsidie Duurzame Energie (ISDE) provides both private persons and small-scale business with a subsidy for the purchase of heat pumps. This technology (aerothermal and hydrothermal) can also benefit from tax regulation mechanism. Under this

mechanism the amount of tax credit may be up to 57.5% of the total investments made in renewable energy or energy-efficiency technologies within one year. The eligible technologies are published in the Energy List, which is updated on an annual basis. The maximum project costs per company are € 120 M€ per calendar year. Investments of less than € 450 are not eligible for the tax credit. The total sum of investments in eligible projects shall reach € 2300 within one year.

In **Austria** under the Climate and Energy Fund (UFI) the following support is provided. A maximum € 675 is paid per each ton of CO<sub>2</sub> reduced. Environment-related investment costs have a minimum of € 10000.

**Table 61.** Support for heat pump technology in Austria

Heat pump type	Capacity	Support
<i>Water/Water (until 2014)</i>	< 400 kWth	85 €/kWth up to 80 kW ; 45 €/kWth for each additional kW
<i>Water/Water (after 2014)</i>	< 400 kWth	€ 51 per kWth up to 80 kWth ; € 27 for each additional kWth
<i>Air/water (until 2014)</i>	< 400 kWth	70 €/kWth up to 80 kW; 35 €/kWth for each additional kW
<i>Air/water (after 2014)</i>	< 400 kWth	€ 42 per kWth up to 80 kWth) ; € 21 for each additional kWth
<i>Small heat pumps</i>	< 400 kWth	Max. 30% of investment
<i>Large heat pumps</i>	≥ 400 kWth	Max. 15% of investment

In **Poland** heat pumps technology is eligible for support under the National Fund for Environmental Protection and Water Management – Stork. Aerothermal installations are eligible for a capacity between 40 kWe and 3 MWe and for a maximum cost of the installation. The support for heat pump technology was 7 €/toe in 2013 and 13 €/toe in 2014. Poland has in place since in 2013 measures to facilitate the process of installation of heat pumps.

In **Romania** the Environment Fund 'Green House' Program ensures for any applicant natural person a financing of up to RON 8 000 for installing heat pumps. The subsidy can cover up to 90% of the projects' costs.

In **Slovenia** the Eco Fund provides subsidies to promote the use of renewables in households through the non-repayable financial incentives for investments in the use of renewables in single- and two-dwelling buildings since 2008. Heat pump technology is eligible also in tendering system. In period 2013-2014 four public tenders were published with incentives in the area of renewables use being allocated for the installation of a solar heating system, a combustion installation for central heating using wood biomass, and *heat pumps* for the preparation of domestic hot water and/or central heating, and for the connection of a building to district heating using renewables. The maximum support (per unit) for ground/water or water/water heat pumps for heating and the preparation of domestic hot water in households was 2500 € (in average 2420.56 €/pc). The total support ranged from 0.311 M€ in 2013 to 119 M€ in 2014.

In **Slovakia** the support is provided under the Operational Program Environmental Quality (2014-2020). The support is given for business use of renewables as the construction of plants using geothermal energy possibly in combination with a heat pump system or using aerothermal, hydrothermal or geothermal energy using heat pumps. The program give support for household use of renewables as heat plants (including heat pump) covering the energy needs of a family home or residential building.

In **Finland** the heat pumps are eligible under the "State grant for investment in RES" or the so-called "energy aid". The amount of subsidy depends on the aim of the project in question. The support allocated to investments in renewable energy production facilities can make up to 30% of the project's overall cost, but can increase up to 40% in case the project involves the use of new technology. The support allocated to research can make up to 40% of the project's total cost.

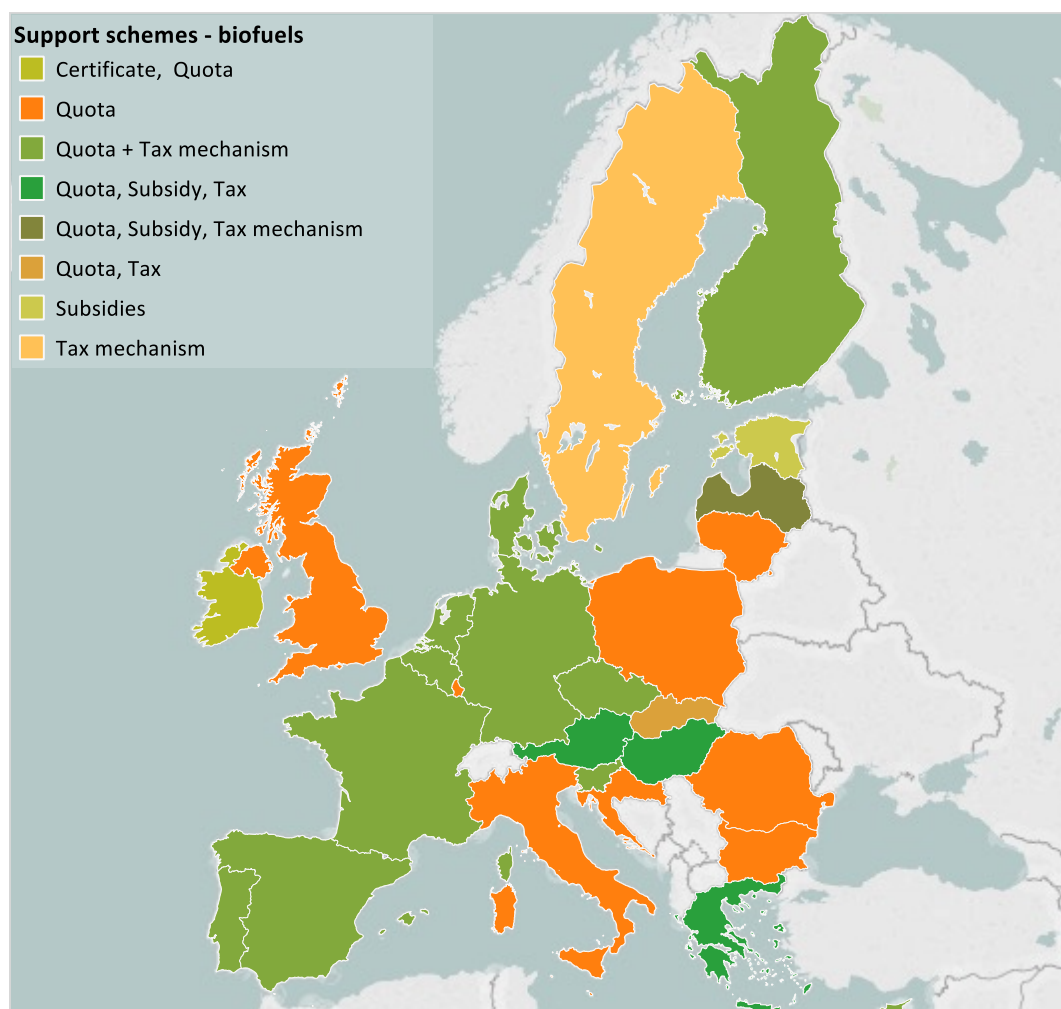
In **Sweden** the installation or replacement of a heat pump in both apartments and single-family houses is eligible for the tax allowance. The amount of the tax reduction can cover 30% of the labour costs but shall not exceed SEK 50 000 per year. This technology is also eligible for the exemption from energy, carbon dioxide nitrogen dioxide taxes.

In **United Kingdom** under the Renewable Heat Incentive Domestic the generation of renewable heat in households (payment for heat generated) is incentivised: Air source heat pumps: 113 €/MWth; Ground source heat pumps 220.5 €/MWth; Renewable Heat Incentive Non-Domestic is applied for non-domestic properties, industrial, commercial, public and district heating installers and manufacturers. £1.15billion by 2021 will be shared across domestic and non-domestic schemes. Green Deal incentive scheme for energy-efficiency improvements in buildings provides also loans for this technology.

### 6.1.6 Biofuels

Figure 20 illustrates the support schemes applied in the EU countries for biofuels. The main support schemes for biofuels are the certifications combined with mandatory blending: applied in 8 EU countries. Mandatory blending together with tax exemption is applied in 6 EU countries (Belgium, Germany, Denmark, Latvia, Lithuania and Portugal). 3 countries (Spain, France and Sweden) apply tax exemption to support biofuels. Subsidies are applied in Austria, Netherlands and Estonia. No specific support for biofuels is applied in Czech Republic and Hungary.

**Figure 20.** Support schemes in EU countries - biofuels



In **Belgium** between 2006 and 2013 petrol used in transport contained at least 7% (in volume) of bioethanol (pure or in the form of ETBE<sup>65</sup>). During the same period the share of FAME<sup>66</sup> in the diesel used in this sector was 5%. Since 2009 mandatory blending at rate 4% of sustainable biofuels is applied in transport sector. The rate is revised in 2013 requiring that all fuel must incorporate a minimum share of sustainable biofuels in fossil fuels, i.e. a nominal volume of 1% below the corresponding standard on an annual administrative basis, and a real volume of 2% below the corresponding standard on an annual basis. Tax exemptions for sustainable biofuels are applied together with mandatory blending for period 2006-2013.

In **Bulgaria** obligations for persons releasing petroleum-derived liquid fuels onto the market are introduced in order to continue the gradual increase of the bio-component percentage of the fuel: 8% from 2018 and 9% from 2019. Grant scheme for the production of fuels from biomass are given: SME are the beneficiaries under the scheme. A total of nine contracts are signed to a total value of 1.5 M€.

<sup>65</sup>) Ethyl tertiary butyl ether.

<sup>66</sup>) Fatty acid methyl ester, the principal molecule of biodiesel.

The Excise Duties and Customs Warehouses Act (promulgated: SG No 91, 15.11.2005; last amended: SG No 99, 16.12.2011) reduced the excise duties on motor fuels with a biofuel content of at least 4 % by volume. For unleaded petrol with the above bioethanol content, the rate was decreased from BGN 710 to BGN 688 per 1 000 litres. Accordingly, the rate of excise duty on diesel fuel with a biodiesel content of at least 4 % was decreased from BGN 630 to BGN 596 per 1 000 litres.

**Table 62.** Tax exemption level for petrol and diesel in Bulgaria (%)

Fuel	Tax exemption level (%)
<i>unleaded petrol with 4 % by volume of bioethanol content</i>	3.1
<i>diesel fuel with a biodiesel content of at least 4 %</i>	4.8

In **Denmark** biofuels are exempt from CO<sub>2</sub> tax. The use of fossil fuels for heating and cooling attracts a substantial energy tax. In addition, there are CO<sub>2</sub> taxes which are dependent on the carbon content of the individual fuel. The energy and CO<sub>2</sub> taxes on fossil fuels for space heating are around DKK 65 to 70 per GJ in 2015. The rates of energy tax are indexed to the net price index. At present there is no energy tax on renewable fuels. This means that in 2015 there is a tax advantage of around DKK 65 to 70 per GJ from using renewable fuels rather than fossil fuels. Biofuels based on waste, waste products, non-food cellulosic material and lignocellulosic material count double with respect to the Danish blending requirement. According to Act No, 468 of 12 June 2009 on sustainable biofuels and Executive Order, companies that sell fuels for land transport have an obligation to ensure that biofuels make up at least 5.75 % of the company's total annual sale. This target was phased in over a three year period: 0.75 % in 2010, 3.35 % in 2011 and 5.75 % in 2012. Biofuels must comply with the requirements on sustainability in the RE Act.

In **Germany** the intention is to focus on (i) biomass residues (manure & waste); (ii) withdrawal of all fuel-based 'special payments' and also for (iii) treatment of gases fed into the natural gas network. Biofuels Quota Act (amendment in 2014) requires that anyone who places biofuels into circulation in Germany had to ensure by the end of 2014 that he also marketed 6.25% relative to the energy content of biofuels.

**Table 63.** Biofuels Quota Levels in Germany from 2010 to 2014 (%)

	2010	2011	2012	2013	2014
<i>Overall Quota</i>	6.25	6.25	6.25	6.25	6.25
<i>Quota for Diesel</i>	4.4	4.4	4.4	4.4	4.4
<i>Quota for Petrol</i>	2.8	2.8	2.8	2.8	2.8

From 2015, this requirement has been changed aiming the reduction in greenhouse gases. A first draft on this matter has been published in October 2016 by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear. According to the draft, it is expected that both electricity and hydrogen will be prospectively eligible within the GHG reduction quota. Biofuels from waste, residues, cellulosic non-food material and lingo-cellulosic material count double in the blending obligation. Special biofuels (obtained from thermo-chemical conversion of biomass and alcohols produced by biotechnological processes to break down cellulose) are qualified for special funding: tax relief and counted in German biofuels quota. Until the end of 2015, there was also a possibility of tax relief on the bioethanol portion of fuels with bioethanol content of at least 70% by volume (e.g. E85).

Starting from 2015 the GHG emissions have to be reduced by 3.5%, from 2017 by 4% and beyond 2020 by 6%. Accordingly, the allowed share of greenhouse gases discharged from diesel and gasoline is being reduced in form of a quota, meaning that the usage of biofuel is only indirectly stimulated.

The penalty in the case of missing the fulfilment of the quota can vary between €19 and €43 per gigajoule. The missing amount is being charged with €0.47/kg of CO<sub>2</sub>-eq.

In **Estonia** at the end of 2015 two support schemes to promote use of bio-methane are applied: (i) support for bio-methane filling stations and (ii) support for regular public bus service. Nevertheless there wasn't until quite recently any generally applicable support scheme to promote the use of renewable energy sources in the transport sector. In December 2016 an amendment to the Liquid Fuel Act was proposed, which foresees the introduction of a blending mandate. According to the proposed amendments, the share of biocomponents in petrol and diesel fuel should have been at least 3.3% by May 2017 and gradually have risen to at least 10% by 2020. However, in March



2017 the Parliament decided to postpone the new regulation by one year. Thus, the blending mandate will come into effect in May 2018. The goal of 10% by 2020 will stay in place.

In **Ireland** the Energy (Biofuels Obligation and Miscellaneous Provisions) Act 2010 became law on 1 July 2010 and is designed to ensure that Ireland can achieve a target of 10% biofuels in the fuel mix by 2020. This provides market players with long-term certainty to develop economically viable scale into their projects going forward. It facilitates industry in developing appropriate financing, planting, refining, storage, distribution and supply chain logistics. Under the Biofuel Obligation provided for in the Act, road transport fuel suppliers must ensure that biofuels represent a certain percentage of the national annual fuel sales. The percentage will be increased periodically, taking account of the Fuel Quality Directive requirements and the future requirements in respect of ILUC. Biofuels Obligation Certificates are awarded for the supply of one litre of sustainable biofuel. To incentivise the use of biofuels from wastes and residues, two certificates are awarded for each litre placed on the market. For other types of sustainable biofuel, one certificate is awarded for each litre. At the end of each year, fuel suppliers must have a certain percentage of certificates in proportion to the amount of petroleum based fuel placed on the market. In 2011 and 2012, the obligation was for 4 certificates per 96 litres of petroleum based fuels (or notionally 4% by volume). From 1 January 2013, the obligation rate was increased to 6% (or 6 certificates per 94 litres of petroleum based fuels).

In **Greece** according to the provisions of L.3054/2002, as amended by L.3769/2009 biofuel quantities are allocated every year, after a relevant call for tenders and an evaluation and allocation procedure, to stakeholders, producers or importers, who are interested in participating in this quota system. Through the evaluation procedure which is based on specific criteria and a specified formula for quota allocation, raw materials like energy crops, agro-industrial by products (cottonseed) and wastes (animal fats and used vegetable oils) are approved for biofuel production. According to the relevant Joint Ministerial Decrees (JMD) of the Ministry of Finance, the Ministry of Environment, Energy and Climate Change and the Ministry of Rural Development and Food a specific quantity of pure biodiesel is allocated to beneficiaries in order to achieve the mandatory percentage of biodiesel blended in diesel of 4.5%, increased to 6.5% in January 2010. The JMDs also foresee the maximum premium to be offered by the beneficiaries, which is binding for the beneficiaries' firms' sales over the course and for the whole quantity of pure biodiesel for the 2011 allocation period.

In **Spain** the Royal Decree 1085/2015 of 4 December 2015 set a minimum obligatory annual overall goal for the sale or consumption of biofuels of 4.3 % for 2016 and targets of 5 %, 6 %, 7 % and 8.5 % for 2017, 2018, 2019 and 2020 respectively, all in terms of energy content. These targets represent a significant upward revision of the targets previously set out in Article 41 of Law 11/2013 of 26 July 2013, which set the targets as 4.1 % for diesel and overall and 3.9 % for petrol. The decree limits the contribution of first-generation biofuels. This means that the percentage of biofuels produced from cereals and other crops with a high content of starch, sugar or oilseed and other crops planted on farmland as main crops primarily for energy purposes may not exceed 7 %. Lastly, it orders that a subsidiary target was set for advanced biofuels by 6 April 2017. Currently, none of the support schemes are differentiated by type of fuel or technology within the framework of the binding agreement. Neither does it establish specific support for biofuels that meet the criteria laid down in Article 21(2) of the Directive 2009/28/EC or for the advanced biofuels referred to in the Directive following the amendment made through the publication of Directive (EU) No 2015/1513 of the European Parliament and of the Council of 9 September 2015 (this amendment repeals the aforementioned Article 21). Tax exemption is applied for biofuels pilot projects for the technological development of less polluting products. A maximum size is established for the purposes of accrediting the experimental nature of a project, i.e. that it is limited to demonstrating the technical or technological feasibility of the production or use thereof. This condition will be considered to have been met when the amount of biofuel produced does not exceed 5000 litres/year.

In **France** partial exemption from the domestic consumption tax (TIC) enables the reduction of additional costs of producing biofuels in comparison with fossil fuels. The Finance Law of 2005 instituted a taxation system for fuels aimed at promoting the incorporation of biofuel as stipulated by article L641-6 of the energy code. Its article 32 introduced a tax on pollution activities (TGAP) to the customs code (article 266-15) on the consumption of gasoline on the one hand and of diesel on the other, based on the sales price excluding VAT. The rate for this tax has grown each year, from 1.2 % in 2005 to 7 % in 2010 (compared to 6.25% in 2009); this rate has been maintained at 7% since 2010.

**Table 64.** Exemption from the domestic consumption tax in France 2010-2014 (€/hl)

Fuels	2010	2011	2012	2013	2014
<i>Biodiesel from synthesis, AOME, UOME and VOME</i>	11	8	8	8	4.5
<i>ETBE, Ethanol and VOEE</i>	18	14	14	14	8.25

In **Croatia** the promotion of biofuel production is implemented under the Biofuel Production Incentive Programme for the period from 2011 to 31 December 2014. The production of transport biofuels is encouraged by funding eligible producers in proportion to the amount of biofuel produced and placed on the Croatian market via the entities required to put biofuels on the market or end users, provided that the biofuel sale price, excluding taxes and mandatory charges, does not exceed the highest biofuel sale price and provided that the biofuels meet the sustainability requirement stipulated by the Transport Biofuels Act. The size of the share of revenue from excise tax set aside for the production of biofuels is specified by decision of the Government, according to the total planned expenditure of the biofuel production promotion system. The amount of the charges payable by distributors will be adjusted every year based on the amounts of biofuel needed, as well as biofuel prices on the international market, domestic costs of biofuel production and distributors' plans to market mineral fuels (in accordance with the prescribed methodology). The incentive for the production of biofuels (biodiesel) amounted to HRK 4.02 per litre in 2011, HRK 3.46 per litre in 2012, HRK 2.82 per litre in 2013 and HRK 1.70 per litre in 2014.

In **Italy** in period from 2012 to 2014 the minimum share of biofuels to be released for consumption, calculated on the basis of the calorific power of the fossil fuels released for consumption the previous year, amounts to 4.5%. The *Ministerial Decree of 10 October 2014* has established for the years after 2015 the minimum quantity of biofuels which must be released for consumption each year and its breakdown into different shares among the different types of biofuels. The Decree has also introduced the concept of 'advanced biofuels' amending also the legislation related to the 'Certificates of Release for Consumption' (CIC). Generally, a Certificate attests to the release of 10 Gigacalories (Gcal) of biofuel. However, for some types of biofuels the quantity to be released in order to obtain a certificate is lower. Specifically, for biofuels from waste, including landfill gas, or from by-products a certificate is granted every 5 Gcal released (double counting). Moreover, from 2013 to 31 March 2014 the obligated parties which released for consumption particular types of biofuels, known as 'premium' received a 'certificate of release for consumption' for every 8 Gcal. Non-compliance with the release for consumption obligation carries a fine from EUR 600 to EUR 900 for every missing CIC. Starting from the 2016 releases for consumption, new rules will apply, with a single fine of EUR 750 per missing Certificate. With respect to the quantity of sustainable biofuels released for consumption in 2013, in 2014 GSE issued to the obligated parties more than 1.5 million Certificates of Release for Consumption, broken down as follows: (i) 15.17% 'double counting' (1 CIC every 5 Gcal); (ii) 43.03% 'premium' (1 CIC every 8 Gcal); (iii) 41.80% 'single counting' (1 CIC every 10 Gcal). To estimate the value of the CIC, initially one may use the average trading value of the Certificates from the information collection campaign carried out among operators by GSE in 2015, of about EUR 295 per Certificate, which places the total value of the CIC issued in 2014 at just below 450 M€.

The biomethane produced by biogas plants already in operation as at 18 December 2013 and which after that date were entirely converted to the production of biomethane or used part of the gas or biogas produced in order to obtain biomethane, is eligible for:

- 70% of the incentive granted to an equivalent new plant in the case of use in transport, after injection into the natural gas network;
- 40% of the incentive granted to an equivalent new plant in the case of injection into the natural gas transport and distribution network or use in high-efficiency CHP plants.

The biomethane injected into the natural gas network and used in transport receives incentives through the issue of Certificates of release for consumption (CIC) for 20 years from the start of the plant's operation. Similarly to the other biofuels, issue of the CIC is conditional on the biomethane released for consumption in transport to fulfil sustainability requirements. Premiums are granted according to the organic matrix delivered to the biomethane production plant. This premium is only granted to 70% of biomethane production in the event of co-digestion of these matrices with other bio-origin products making up no more than 30% of the total by weight. An additional 50% of CIC is issued for 10 years if the biomethane is released for consumption in transport, without using the natural gas transport or distribution network through a new transport biomethane distribution plant created by the producer at his own expense and with first acceptance testing after 18 December 2013.

The incentive for biomethane injected into the natural gas transport and distribution network without a specific intended use is calculated on the basis of the quantity of biomethane injected into the grid, net of the energy consumption from biomethane production processes and from its compression for injection into the network. If the producer sells the gas directly on the market, the benefit is granted for 20 years from the start of the plant's operation and is equal in EUR/MWh, to the difference of double the annual average price of natural gas. The value of the incentive, so determined is then adjusted according to the plant's production capacity, specifically:

- it is increased by 10% for plants with production capacity of up to 500 standard m<sup>3</sup>/hour;
- it remains unchanged for plants with production capacity between 501 and 1 000 standard m<sup>3</sup>/hour;
- it is reduced by 10% for plants with production capacity above 1 000 standard m<sup>3</sup>/hour;

The Decree also grants a 50% increase to the resulting amount (incentive + adjustment) if the biomethane is obtained solely from by-products.

In **Cyprus** it is in place the obligation to replace conventional transport fuels with biofuels at a level of 2.4% per energy content of all transport fuels. Support schemes for natural and legal persons, and public entities engaged in economic activity are based on the utilisation of biomass for production of biofuels for transport and district heating and/or cooling applying a subsidy of 15%, 25% or 35% of budget (max 200 000€).

In **Latvia** given that the mandatory blending of biofuels in fossil fuels was introduced on 1 October 2009, the reduced taxation of low blends (5 %) became unreasonable, ceasing to be an effective stimulus to biofuel production and consumption. Considering that biofuel production costs and, accordingly, retail prices have exceeded those of fossil fuels so far, reduced rates of excise duty have been introduced for biofuels and biofuels blended with fossil fuels depending on biofuel content according to the Excise Duty Law. By 1 January 2011 the reduced rate of excise duty applies to the following types of fuels: (i) blend of unleaded petrol and ethanol with an ethanol content of 70 to 85 % by volume (inclusive) (E85); (ii) rapeseed oil that is sold or used as heating fuel or transport fuel and pure biodiesel from rapeseed oil (B100).

**Table 65.** Reduced rates of excise duty on biofuels in Latvia 2010 -2014

Fuel	%
<i>Biodiesel (B100) compared to Diesel</i>	1
<i>Diesel (bio at least 30%) (B30) compared to Diesel</i>	0.3
<i>Marked fuel (bio 5%) compared to Marked fuel</i>	0.63
<i>Unleaded petrol with bioethanol (bio 85%) (E85) compared to Unleaded petrol</i>	0.7

Only diesel with 4.5–5 % by volume biodiesel content of the total amount of the end-product and petrol with 4.5–5 % by volume bioethanol content of the total amount of petrol may be sold. Latvia has been allowed to apply differentiated tax to biofuels and high concentration biofuel blends (B100, E85, B30) by 31 December 2013.

**Table 66.** Rates of excise duty on fuels in Latvia, EUR/1000 litres

Fuel	2011	2011	2012	2013	2014
<i>Unleaded petrol</i>	368.5	395.9	395.9	411.21	411.21
<i>Unleaded petrol with ethanol (bio 5 %) (E5)</i>	368.5	395.9	395.9	411.21	411.21
<i>Unleaded petrol with ethanol (bio 85 %) (E85)</i>	110.6	118.8	118.8	123.36	123.36
<i>Leaded petrol</i>	300	320	320	320	320
<i>Diesel</i>	234	234	234	332.95	332.95
<i>Diesel (bio 5–30 %) (B5)</i>	234	234	234	332.95	332.95
<i>Diesel (bio at least 30 %) (B30)</i>	164	164	164	233.35	233.35
<i>Market fuel</i>	40	40	40	40	40
<i>Market fuel (bio 5%)</i>	15	15	15	15	15

In **Lithuania** promotion quotas distributed by means of auction amongst producers conforming to the established differentiation in terms of technical capacity and type of power plant are applied. Lithuanian Rural Development Programme for 2007-2013 (up to 65% of eligible project costs)

supports the production of biofuels: portion of the price of rapeseed oil and rapeseed and cereal grain purchased for the production of biofuels is offset from State budget funds currently 46.34€/t for rapeseed and 33.02€/t for cereal grain.). Law No VIII-1183 of the Republic of Lithuania on the pollution tax sets out that natural and legal persons polluting the environment from vehicles powered by biofuels meeting relevant standards are exempt from pollution tax provided that they produce. The pollution tax concessions are applied to relief of biofuels excise duty (for energy products that exceed the mandatory percentage of additives of biological origin). For energy products, in which the proportion of additives of biological origin is 30% or higher, the rate of excise duty is reduced in proportion to the percentage of additives of biological origin. Since 2010 manufactured only from biomaterials are exempt from excise duties.

The State Tax Inspectorate under the Ministry of Finance of the Republic of Lithuania has indicated that in accordance with Articles 40(4) and (5) of the Law on excise duties, relief was granted to bioenergy products as follows:

- the total in 2013 for biofuels: the relief of EUR 835 000;
- the total in 2014 for biofuels: the relief of EUR 1286 000.

In **Luxembourg** there are no plants for producing biofuels. All biofuels have to be imported. In addition, there are no mixing plants in Luxembourg which means that all biofuels are introduced as additives in blended products. The Act establishing excise duties and equivalent taxes on energy products, electricity, manufactured tobacco products, alcohol and alcoholic beverages of 17 December 2010 establishes an admixture requirement for all diesel and petrol fuels. Hence, in 2011, biofuels had to account for at least 2 % of all fuels, calculated by reference to the calorific value of the fuels. On 5 March 2011, a new grand-ducal regulation entered into force: The Grand-Ducal Regulation establishing sustainability criteria for biofuels and bioliquids. The mandatory blending percentages for all diesel and petrol fuels were increased to 3.75% in 2013 and 4.75% in 2014.

In **Netherlands** biofuel is supported by the obligation for fuel providers to respect an annual quota of 10% by 2020 (European renewable energy Directive 2009/28/EC). Since 2009 the Netherlands has regulations in place concerning the double-counting of biofuels from waste, residues, non-food cellulosic material and ligno-cellulose. The required share of bio-based content in transportation fuels (bioethanol; biodiesel) is 8.5% for 2018, and need to lift in two steps of 0.75% to 9.25% in 2019 and 10% in 2020. Via the latest DKTI Transport subsidy scheme<sup>67</sup>, Dutch enterprises, research centres, and non-governmental organisations can get subsidies for innovative transport solutions with low or now carbon emissions. The new scheme (launched in 2017) closely links to the Dutch Sustainable Fuel Vision<sup>68</sup> and focuses on the following categories:

- electric cars and electric ships
- efficient shipping
- hydrogen vehicles
- biobased fuels for aircrafts, shipping and heavy truck transport

In **Austria** the Biofuels Directive has been implemented into national law within the scope of the Fuel Order Amendment (BGBl. II No 417/2004). It specifies that from 1 October 2005 a 2.5 % share of biofuels or other renewable fuels (as measured by total energy content of the binding mineral oil tax introduced in federal territory on petrol and diesel fuels in the transport sector per year) must be introduced under the substitution obligation. This target value rose in October 2007 to 4.3 % and in October 2008 to 5.75 %. § 6a (4) of the Fuel Order provides that from 1 January 2009 the substitution target, depending on the energy content, amounts to 5.75 %, measured by the total fossil petrol or diesel introduced or used in the federal territory. To meet the overall target, depending on the energy content, at least a 3.4 % share of biofuels or other renewable fuel, measured by the total fossil petrol or diesel introduced or used in the federal territory per year, must be introduced or used under the substitution obligation. In addition, a 6.3 % share of biofuel or other renewable fuel, measured by the total fossil diesel introduced or used in the federal territory per year, must be introduced or used under the substitution obligation. A bonus and so a tax reduction is granted for the purchase of vehicles with low pollutant emissions (< 120 g/km CO<sub>2</sub> emission) and with environmentally-friendly power supply motors. Tax exemption ranging from 0.028 – 0.03 €/l is applied to diesel and petrol from a minimum content of 4.4 % of biogenic material.

<sup>(67)</sup> Demonstratieregeling KlimaatTechnologieën en -Innovaties in transport

<sup>(68)</sup> Duurzame Brandstofvisie

In **Poland** in period 2009-2010, around PLN 34.5 million was allocated from the State Budget to research and R&D projects in the field of biofuels. Since 2013 financial support schemes are provided in order to implement the measures related to the production of biofuels components, liquid biofuels or other renewable fuels and their use in transport. For products being a blend of petrol with bio-components, containing more than 2% of bio-components an excise duty rate for motor petrol is reduced by PLN 1.565 per 1 litre to not less than PLN 10.00/1000 l. In accordance with the Corporate Income Tax Act of 15 February 1992 (Journal of Laws No 54 item 654 as amended), producers of bio-components may deduct from their tax for the fiscal years 2007-2014 the amount equal to 19% of the surplus of costs of bio-component production by the cost of production of liquid fuels with the same calorific value (if such deduction cannot be made in a given fiscal year, non-deducted amount shall be deducted in subsequent fiscal years).

**Table 67.** Support for biofuels in transport sector in Poland (€/unit)

<b>Fuels</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<i>Bioethanol</i>	178.8	153.9	144.1	132.9
<i>Biodiesel</i>	535.6	635.6	603.4	573.5

In **Portugal** with the publication of Decree Law No. 49/2009, of 26 February, it became compulsory to incorporate biofuels into automotive diesel for a percentage, in volume, of 6% in 2009 and 7% in 2010, keeping in mind the maximum biodiesel content (FAME) permitted by the EN 590 for automotive diesel. In order to apply for support the biofuels the obligation quota is 5% energy content. Exemption from Portuguese ISP (tax on oil and energy products) to biofuels for consumption (only available to small specialist producers, in accordance with the Portuguese Code on Excise Duties) is applied. In the case of biofuels produced using residues, waste, non-food cellulosic material and lignocellulosic material, the application of double counting in Portugal when biofuels vouchers (BVs) are issued.

**Table 68.** Blending shares and tax exemptions applies in Portugal, 2010-2014

	<b>Blending share (%)</b>	<b>Tax exemption (€/1000 l)<sup>69</sup></b>
<i>2010</i>	7	364.4
<i>2011</i>	5	364.4
<i>2012</i>	5	366.7
<i>2013</i>	5	367.5
<i>2014</i>	5	369.4

Large biodiesel producers benefit from an ISP exemption of €280/1000 litres, as a result of a procedure for attributing such an exemption stipulated in Order No. 1391- A/2006, of 12 December, for the year 2007, and in Order No. 1554-A/2007, of 7 December, for the years 2008 to 2010. Small dedicated producers benefit from a total ISP exemption. In order for a producer to be recognised as a small dedicated producer and benefit from a total exemption from ISP, the producer must submit an application to the Directorate General for Energy and Geology, proving compliance with the criteria that have been established by prevailing legislation, namely: · They must have an installed capacity that is equal to or less than 3000 tonnes per year; · Their technology must be based on innovative solutions or at least 50% of the raw materials used must be derived from waste; They must deliver the entire production to dedicated clients identified by means of contracts.

In **Romania** difficulties persist with regard to developing the necessary infrastructure for a wide scale use of waste, and with regard to funding support schemes that facilitate the introduction of costly technologies, such as the biofuels laid down in Article 21(2). Pursuant to GD No 1121 of 18 December 2013, the biofuel share in petrol sold in Romania decreased from 5 to 4.5 % as from 1 January 2014. Concerning diesel oil, the biodiesel share remained 5 % and will be maintained as such until 1 January 2016, when it will increase to 6.5 %. The biodiesel share in diesel oil should have reached 6 % already at the beginning of 2013, but, in autumn 2012, the oil companies stated that they failed to prepare the infrastructure necessary for the transfer to the new recipes, and they also expressed their suspicions related to potential problems these recipes might cause on engines in older generation vehicles. Should the 6 % share have been exceeded, the oil companies had to enter on the market two types of petrol: one for more recent cars, which allow such a share of bio-components, and one for older cars. As from 1 January 2018, the mandatory share will be 8

<sup>(69)</sup> Tax exemption applied to small dedicated producers

% . Government Decision No 1121/2013 also stipulates that fuel suppliers have to reduce the level of greenhouse gas emissions by 31 December 2020 by 10 % as compared to 2010. As intermediary threshold, the emissions have to be reduced by 6 % by 31 December 2018.

In **Slovenia** there are no producers of biofuels from waste, residues, non-food cellulosic material or ligno-cellulosic material. Slovenia has no oil refineries. It imports all liquid fuels, for transport as well as for heating. The liquid fuels for transport which Slovenia imports frequently contain a small proportion of biofuels. The Decree on Promotion of the Use of biofuels and other renewable fuels for the Propulsion of Motor Vehicles<sup>70</sup> is in place. The tax exemption applied to the pure biofuels is set at 1%. Biofuels mixed with fossil fuels or more if it is standardised fuel containing biofuel profit by a tax exemption of 0.05%.

In **Slovakia** a requirement has been established in law for producers and sellers of motor fuels to place on the market fuels with a biofuel content corresponding to a reference value calculated from the energy content of the total amount of fuels placed on the market: 4.5% of biofuels energy content in motor fuels (penalty of 2€/L) in 2014. In 2013 the biofuels energy content in motor fuels was 4.0%.

In **Finland** an obligation/quota in transport is applied. The energy content of biofuels supplied to market as a proportion of the total energy from petrol, diesel and BFs supplied is 6% aiming to reach 20% in 2020.

In 2010, an energy tax reform was prepared, which entered into force at the beginning of 2011. The most important element of the reform is that the taxation of all fuels, including transport fuels, is now based on their energy content and carbon dioxide emissions. Compared with the earlier scheme, where the tax per litre for biofuels was the same as for fossil fuels, the position of biofuels is improved in the new tax structure, as it takes into account the lower energy content of biofuels, particularly ethanol. The tax was increased for the first time at the start of 2012 and for the second time at the start of 2014. In comparison with the former system, where biofuels were subject to the same tax per litre as fossil fuels, the situation for biofuels improved under the new tax structure, since it takes account of the lower energy content of biofuels, and particularly of ethanol. The consideration of CO<sub>2</sub> emissions also provides a benefit for biofuels. The basis for CO<sub>2</sub> tax on biofuels is the carbon-dioxide emissions during their lifetime in comparison with their fossil equivalents. Unsustainable biofuels are subject to the same CO<sub>2</sub> tax as fossil fuels, sustainable biofuels are subject to 50 % of the CO<sub>2</sub> tax on the equivalent fossil fuel, and double-counted fuels under the RES Directive are not subject to any carbon-dioxide tax. The basis for calculating CO<sub>2</sub> tax has been EUR 58/tCO<sub>2</sub> since 2014. Above all, the new tax structure endeavours to guide the use of biofuels towards second-generation alternatives. Bioliquids are subject to a similar tax structure, but both energy-content tax and carbon-dioxide tax on heating fuels are clearly lower than for transport fuels.

In **Sweden** as a result of overcompensation, energy tax was imposed on biofuels for the first time in 2013. When the new provisions in the Energy Tax Act came into force on 1 February 2013, the reduction in energy tax for biofuel became dependent on the type of fuel. From 1 February 2013 the tax exemption level of ethanol in petrol and biodiesel in diesel at a maximum of 5 % by volume on average is applied. All ethanol and biodiesel in low biofuel blends over and above these levels are taxed as petrol and diesel respectively. These restrictions were abolished by the Autumn Amendment Budget for 2015 (but the Fuel Act<sup>33</sup> limits the degree of blending to 10 % of ethanol and 7 % of FAME). New provisions concerning a reduced tax exemption for renewable fuels entered into force on 1 January 2015.

**Table 69.** Tax exemptions for biofuels in Sweden, 2009-2014, (M€)

	Biofuels for transport	Biofuels not for transport
2009	206	17
2010	235	17
2011	218	506
2012	223	634
2013	284	614
2014	241	588

The energy tax exemption was reduced for fatty acid methyl esters (FAME) sold or consumed as motor fuel. For FAME in low diesel blends, the tax exemption was reduced from 84 % to 8 % of the

(<sup>70</sup>) UL RS, No 103/57

energy tax. The tax exemption for high blends or pure FAME was reduced from 100 % to 44 % of the energy tax. On the other hand, the tax exemption for CO<sub>2</sub> tax was not amended but will remain at 100 %. The abolished restriction on tax exemption for HVO (hydro-treated vegetable and animal oils and fats) was implemented on 1 January 2015, but applied from 1 May 2014 onwards. The tax exemption applies to all HVO contained in the diesel fuel and which was produced from biomass. The tax exemption for HVO was previously up to 15 % HVO by volume of the diesel fuel declared for tax purposes during a given accounting period.

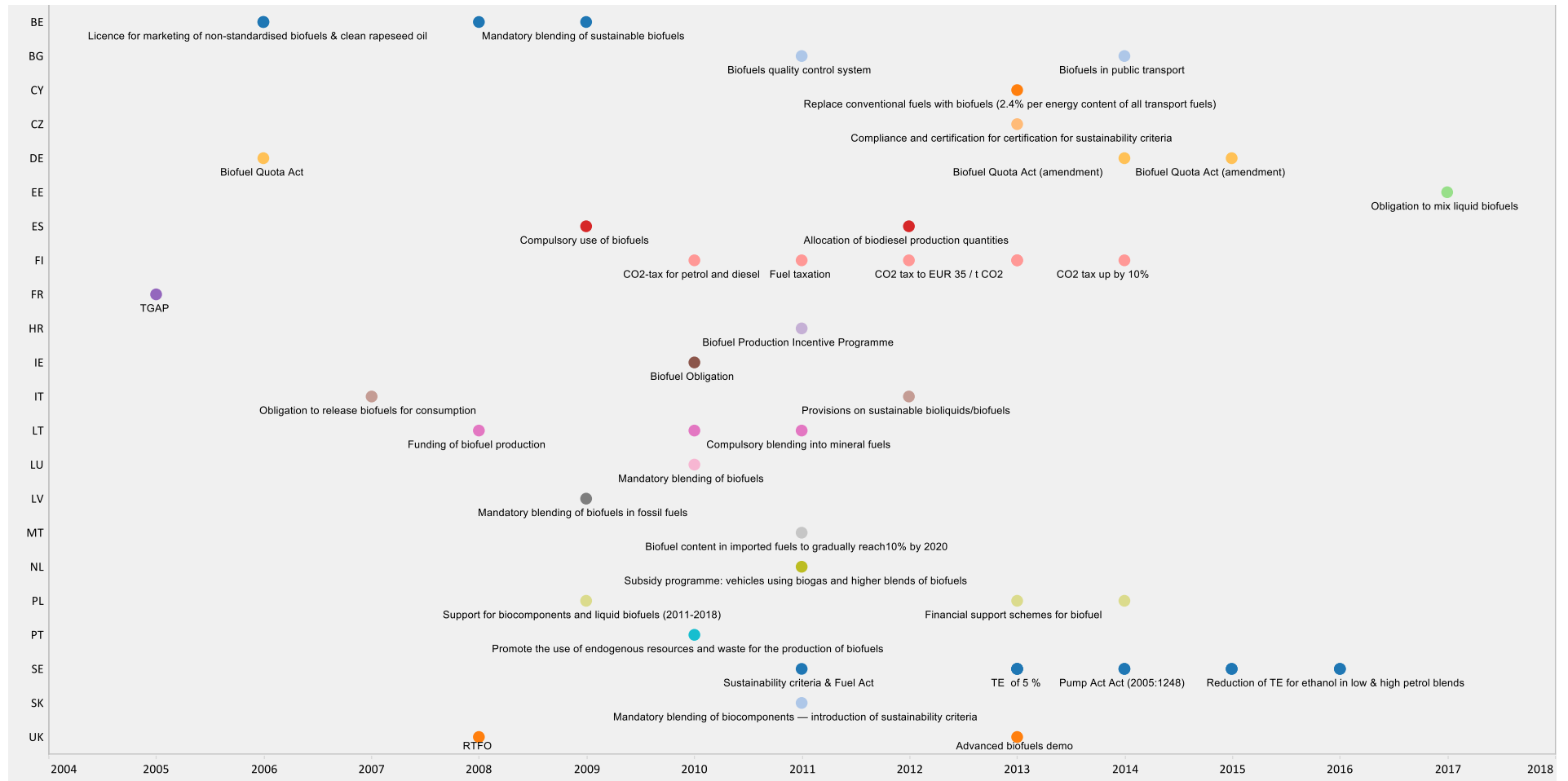
According to the Autumn Amendment Budget entered in force in 2015 the exemption from energy tax is reduced for ethanol in low petrol blends, from 89 % to 79 %, and for ethanol in high blends from 100 % to 78 % of the energy tax payable on petrol. Low biofuel blends other than ethanol, and FAME, are granted full exemption from energy tax.

The *Budget for 2016* decides the exemption from energy tax are reduced further, to 74 % for ethanol in low petrol blends and for ethanol in high blends to 73 % of the energy tax payable on petrol. The exemption from energy tax for high FAME blends is being increased from 44 % to 50 % of the energy tax payable on diesel fuel. Sweden has State aid approval for the current tax relief on liquid biofuels up until the end of 2018, and for biogas used as fuel up until the end of 2020.

Green cars tax exemption reached 14.13 M€ in 2010, 20.19 M€ in 2011, 28.26 M€, 40.27 M€ in 2013 and 40.07 M€ in 2014. Meanwhile the taxes on benefits from the use of green cars were also reduced. This tax relief reached 45.42 M€ in 2010, 42.39 M€ in 2011, 15.14 M€ in 2012, 19.18 M€ in 2013 and 26.24 M€ in 2014.

In **United Kingdom** under the Energy Act 2004, the Renewable Transport Fuel Obligations Order 2007 introduced a scheme in April 2008 to increase the percentage of renewable fuel used in road transport in the UK. The order obligates refiners, importers and any others who supply fossil based road transport fuels at the point at which Her Majesty's Revenue & Customs (HMRC) excise duties become payable, to produce evidence that a specified percentage of their fuels for road transport in the UK comes from renewable sources. Suppliers of biofuel will earn certificates to be used as evidence of meeting the obligation. Suppliers of less than 450,000 litres of fossil fuel for road transport use per year are currently excluded as are all suppliers of fuel for non-road transport purposes. The UK government has provided M£25 of funding for biofuels in December 2014 for three years up to 2018. Double counting for biofuels made from wastes, residues, non-food cellulosic material, and lignocellulosic material is applied.

**Figure 21. Main measures on biofuels in EU countries (2005-2017)<sup>71</sup>**



<sup>(71)</sup> TGAP - Tax on Polluting Activities; RTFO - Renewable Transport Fuel Obligation



## 6.2 Overview by EU country

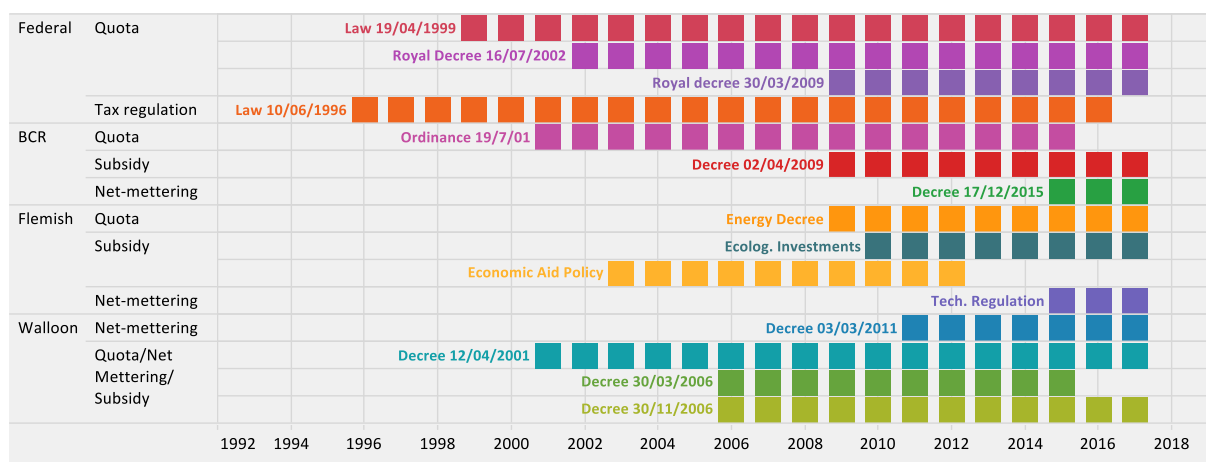
### 6.2.1 Belgium

The overall renewable energy contribution in gross final energy consumption in Belgium reached 7.9% in 2015 and 8.7% in 2016. The 2020 target that Belgium has to reach for the overall RES share is 13%. Overall renewable energy share in Belgium remained above the NREAP and indicative trajectories throughout 2010-2016. Belgium may need to make additional efforts to stay on course for the 2020 target set in its NREAP.

In Belgium the Law of 19 April 1999 on "Functioning of electricity market" establishes a general framework for the organisation of the electricity market. The Royal Decree of 16 July 2002 was related to the establishment of mechanisms aiming to promote electricity produced from sustainable energy sources. Royal Decree of 30 March 2009 concerned the production differences relating to facilities producing energy from wind in maritime transport space. The Law of 10 July 1996 was related to biofuels. It regulates the tax exemption of biofuels and introduces a reduced rate of excise duty for petrol containing a certain amount of biofuels.

In *Brussels-Capital region* the Order of 19 July 2001 was relating to the organisation of the electricity market. Decree of 29 March 2007 sets the green certificate quotas for 2008 and following. The Law of 22 July 2009 set the mandatory to blend 4% biofuels in fossil road fuel used on the Belgian market. Royal Decree of 30 March 2009 was on production variations on installations for electricity generation from wind in offshore areas. In *Flemish region* Decree of 8 May 2009 laid down general provisions on energy policy (Energy Law). In *Walloon region* Decree of 12 April 2001 set the basis for the organisation of the regional electricity market. Walloon Government Order of 30 November 2006 was related to the promotion of electricity produced from renewable energy sources or cogeneration. Walloon Government Order of 30 March 2006 was related to the public service obligations in the electricity market.

**Figure 22.** Support framework for renewables in Belgium, 1995-2017<sup>72</sup>



The support scheme for **electricity production** from all types of renewables takes the form of annually-increasing quotas combined with a system of tradable certificates. Producers receive those green certificates and then sell them on a national market. Financial support for the production of electricity from renewable sources consists in the revenues from the sale of green certificates. Producers using non-renewable sources have to fill their certificate deficit in order to reach the yearly quota.

The price of the certificates is comprised between a minimum price set by the authority and the value of the fine that energy suppliers have to pay for each certificate missing. This fine has been set at 100 € in the BCR and in Wallonia and at 125 € in Flemish (decreased to 100 € in 2015). The same pattern appears for the minimum price which is lower in the BCR and Wallonia, at 65 €, and higher in Flemish, at 90 €. The relative support granted between production technologies is defined with the "banding factor" which determines the number of certificates that the producer will receive

<sup>(72)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

for each MWh of green electricity produced. This factor depends on several characteristics including production costs and carbon emissions savings.

**Table 70.** Annual Quotas for Electricity from Renewable Sources in Belgium, 2010-2014

Region	2010	2011	2012	2013	2014	2015	2016	2017
<i>Brussels-Capital (BCR)</i>	2.75%	3.00%	3.25%	3.50%	3.80%	4.5%	8.2%	7.8%
<i>Flemish</i>	5.25%	6.00%	7.00%	14.00%	15.50%	16.8%	18%	23%
<i>Wallonia</i>	11.25%	13.5%	15.75%	19.40%	23.10%	27.7%	32.4%	34.03%

The cost of the tradable certificate scheme was estimated at €14.49 million for 2013 and €19.14 million for 2014 in the BCR. In Flemish this cost was estimated to be €866.2 million in 2013 and €921.6 million in 2014. In Wallonia it reached €606.88 million in 2013 and €599 million in 2013.

The transmission operator is also required to finance one third of the cost of the underwater cable installed to connect the plant to the network (up to a maximum amount of €25 million for a 216 MW or larger project, this amount is reduced proportionally when the project is less than 216 MW).

Individuals and companies can also access to investment support in each of the Belgian regions. In Wallonia, companies can receive a premium for investments in the production of energy from renewable energy sources (supporting electricity production as well as heating and cooling installations). This subsidy is equal to 50 % of eligible costs for small and medium firms and between 20 and 30 % for large firms. Eligible costs are defined according to the technology used. Companies in Flemish also have access for this type of subsidy. Small and medium Flemish firms get 40 % of eligible costs against at most 20 % for large firms. Again, admissible additional costs vary according to technology. In particular, those costs amount to 10 % for wind energy (more than 1.5 MW), to 50 % for biomass, biogas and CHP generation plants and to 10 % for photovoltaic solar panels.

Companies can benefit from a premium for investments in the production of energy from renewable energy sources. For small and medium-sized enterprises, the subsidy is at most 40% of the admissible additional costs, and at most 20% for large enterprises.

For offshore wind power installations, it is the transmission system operator (Elia) who has the obligation to buy the certificates at a minimum price set by federal legislation (107 € for installations with capacity up to 216 MW and at 90 € for installations with capacity higher than 216 MW). Then the operator has a second obligation to sell these certificates on the regional markets.

On December 2016 the EC authorises Belgian support for electricity generation from offshore renewable energy (EC, State aid Belgian support for offshore wind - Press release, 2016). Under the scheme, operators will receive certificates for offshore energy produced from renewable energy sources from the federal energy regulatory (CREG). The operators can then sell these certificates to the transmission system operator Elia at a premium on top of the price they receive for electricity sold on the market. Belgium will also support the construction of a 296 MW wind farm (the Rentel project) and a 350 MW wind farm (the Norther project). Both projects are located in the Belgian part of the North Sea. They also receive certificates for energy produced, which they can sell to Elia at a premium on top of the price they receive for electricity sold on the market. Based on the information provided by Belgium, the support level is in line with the Guidelines and does not result in overcompensation. The two projects are partly financed by the European Investment Bank under the European Fund for Strategic Investments (EFSI). The support scheme is financed by a surcharge that is finally paid by electricity consumers. In order to avoid any discrimination against foreign renewable energy producers resulting from the financing mechanism, Belgium has committed to partially opening up the scheme, as from 1 January 2017, to foreign producers of electricity from renewable resources.

In Flemish' **heating/cooling sector**, the certificate scheme is adapted to CHP heat production. Producers receive one certificate for each MWh of heat produced and are able to sell it to electricity producers who need to fulfil their obligations regarding the renewable electricity quotas. In the two other regions, the certificate scheme also allows support for CHP installations. In Wallonia the recovery of useful heat is used to compute the rate for the granting of green certificates and in Brussels-Capital Region for 217 kg of avoided CO<sub>2</sub><sup>73</sup> (compared to the reference installations), one certificate is issued. All three regions have also implemented a system of energy premium designed to support investment in installations producing energy from renewable sources. Part of this

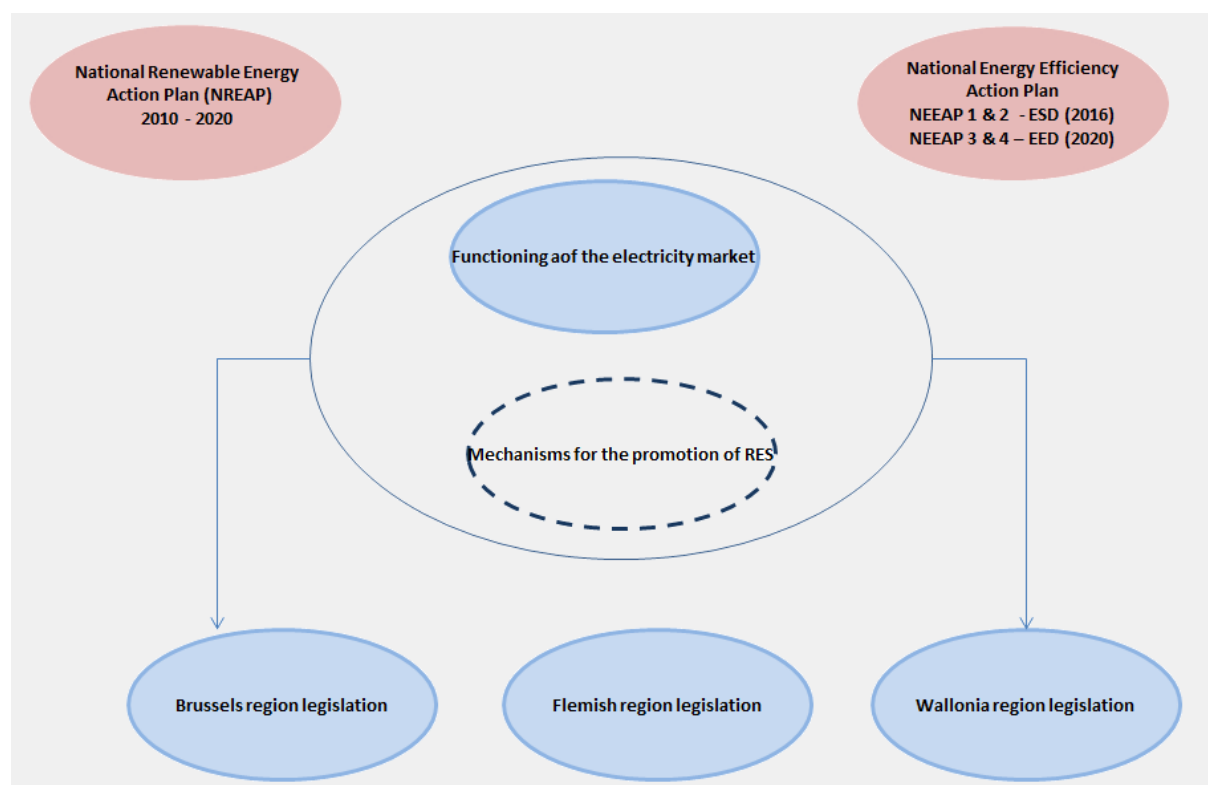
<sup>(73)</sup> As of 2010

system is described in the previous section on electricity production. Regarding heating and cooling activities, these schemes also support small-scale installations using biomass boilers, heat pumps and solar thermal boilers. For biomass boilers and in existing residence, individuals can get a premium up to 50 % of the investment for a maximum subsidy of 15 000 €. In Brussels-Capital Region, the premium can reach 30 % of the investment cost. The Flemish government grants a 210 € per kVA of compressor capacity premium for heat pumps installed in existing buildings, up to a maximum subsidy of 1 680€. In Wallonia and Brussels-Capital Region, individuals can get a lump-sum subsidy between 750 and 2 250 € depending on the type of pump and system installed. For solar water heating systems, the Flemish grants a 75 € per m<sup>2</sup> premium up to a 1 500 € subsidy and Walloon and BCR governments grant respectively lump-sum premiums equal to 1 500 and 3 000 €.

Individual who invest in biomass boilers, heat pumps and solar thermal panels are eligible for a subsidized interest rate of 1.5 % along with a tax reduction of 40 % on the residual interest on loans taken out for the investments.

The federal government has set a blending obligation for biofuels use in **transport sector** with a quota equal to 4 %. It means that over a year, registered oil companies have to offer a quantity of 4 % of biofuels relative to their whole fuel offer. The government has set a penalty of 900 € per 1000 l missing. A reduced rate of excise duty for fuels containing over a certain amount of biofuels has also been implemented. This reduced rate consists of two tax-exempt quotas, one for petrol containing over 7 % of bioethanol and one for diesel over 5 % of FAME<sup>74</sup>.

**Figure 23.** Energy legislative landscape in Belgium<sup>75</sup>



<sup>(74)</sup> Fatty acid methyl ester, the principal molecule of biodiesel

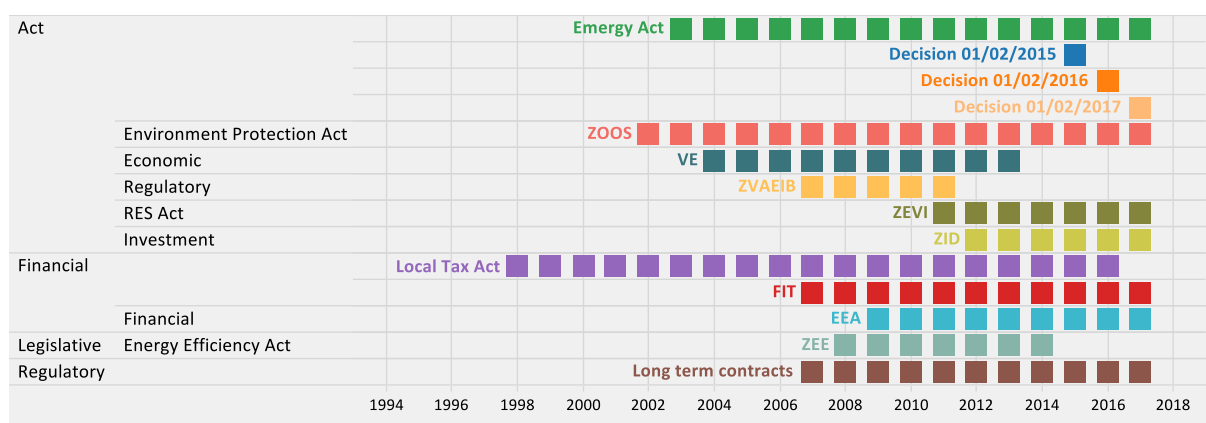
<sup>(75)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.2 Bulgaria

The overall renewable energy contribution in gross final energy consumption in Bulgaria reached 18.2% in 2015 and 18.8% in 2016. Overall renewable energy share in Bulgaria remained well above the NREAP and indicative trajectories throughout 2010-2015. Bulgaria exceeded its overall renewable energy target for 2020 (16%) already in 2012.

The Energy Act in Bulgaria entered in force in 2003. The Act governs the electricity and fuels market and infrastructure. The Renewable Energy Act (ZEVI), which transposes the provisions of Directive 2009/28/EC on the promotion of the use of energy from renewable sources, entered into force on 3 May 2011. ZEVI is the main legislative document regulating public affairs relating to the production and use of renewable energy to achieve the national target for the share of renewable energy in the gross final consumption of Bulgaria. ZEVI followed ZWAEIB (Renewable and Alternative Energy Sources and Biofuels Act) which play its role in period 2007-2011. An Amending and Supplementing Act (ZID), adopted in April 2012, introduced amendments to the ZEVI that improved the investment conditions, taking into account the current status and development of the sector.

**Figure 24.** Support framework for renewables in Bulgaria, 1998 - 2017<sup>76</sup>



The renewable energy support mechanism of Bulgaria is approved by the EC as compatible with the internal market, in compliance with art. 107 (3) of the TFEU, the Environment - Environmental Aid Guidelines, 2008-2014 and the Environment and Energy - Guidelines on State aid for environmental protection and energy 2014-2020. The utilisation of the potential of energy from renewables is stimulated by a system of measures: administrative, financial, regulatory and informational. The support is also available through EU-financed operational programs:

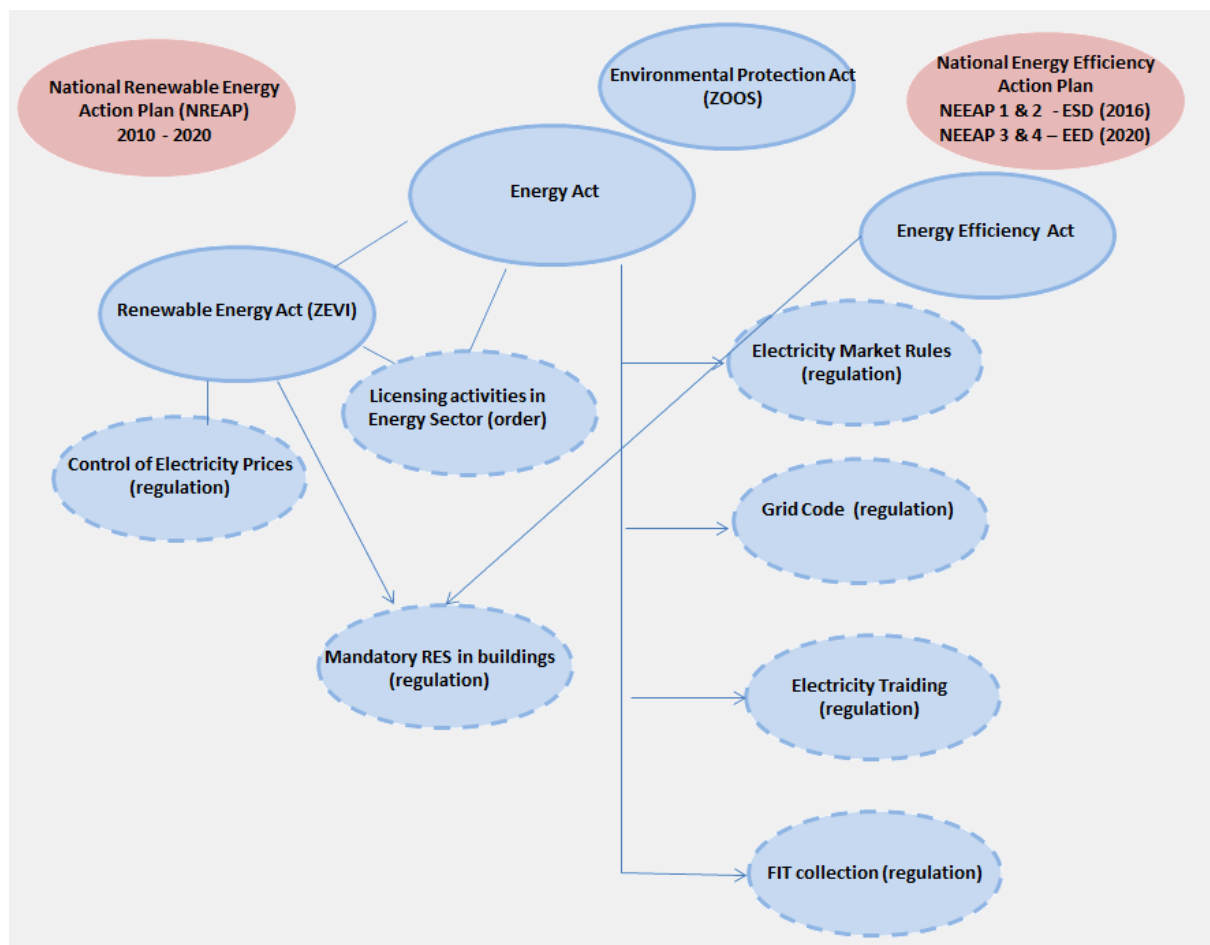
- Development of the Competitiveness of the Bulgarian Economy 2007-2013 for the promotion of energy efficiency and use of energy from renewable sources: support for renewable heating and cooling through two grant aid procedures, "Green industry investments" and "Energy efficiency and green economy", the former aiming at large undertakings and the latter at investments in micro, small and medium-sized enterprises. It focuses on solar plants for hot water, boilers operating on biomass, heat pumps and chillers and cogeneration facilities.
- Environment 2007-2013 which financed plants for the utilisation of gas emissions (methane) from household waste landfills to generate electricity. Three main projects were part of this scheme: the construction of an integrated system of facilities for the treatment of the household waste of the Sofia Municipality (149.39 M€<sup>77</sup>), the construction of a regional system for waste management in the Veliko Tarnovo Region (15.56 M€<sup>77</sup>) and in the Haskovo Region (13.80 M€<sup>77</sup>).
- Rural Development Programme, 2007-2013 aiming at developing production and use of energy from renewable sources for electricity or heat generation in farms and food processing undertakings, in the forestry sector and in rural regions and municipalities (in 2013 and 2014, 9.048 MW installed representing investment up to of 17.26 M€<sup>77</sup>).

<sup>(76)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

<sup>(77)</sup> Using 1 € = 1.9535 BGN (2016)

- Energy Efficiency and Renewable Sources Fund, launched in 2015, which is expected to bring about 100 493 MWh of electricity savings per year through loans reaching 23.84 M€.
- Energy Efficiency and Renewable Energy Credit Line, providing subsidies for the development of wind energy, small hydroelectric plants, biomass, geothermal energy, biogas and solar energy for heating. It financed grants to companies up to 24.4 M€ and loans up to 151.6 M€.
- The European Economic Area (EEA) Financial Mechanism 2009-2014 also provided some support through the programme "Energy Efficiency and Renewable Energy". The total budget of the program was 15.6 M€ distributed between support for energy efficiency and renewable use energy in municipal and public buildings and local heating systems (10.44 M€ until now) and the production of fuels from biomass (1.51 M€ until now) and training activities for strengthening the administrative capacity with respect to measures for energy efficiency and renewable energy (0.67 M€ until now).

**Figure 25.** Energy legislative landscape in Bulgaria<sup>78</sup>



In Bulgaria **electricity production** is supported through a feed-in tariff (FIT) available to certain categories of RES producers combined with a preferential price in long terms agreement. It is defined by the Bulgarian utility regulator based on the actual production costs and a defined rate of return of the investment, being 7% before taxation as of 2012. The FIT is applicable in respect of: small hydro power plants (below 10 MW installed capacity) and PV, wind, biomass, biogas and geothermal power plants. Following certain legislative changes these categories of beneficiaries were reduced and after 1 January 2016 these include only certain RES projects with total installed capacity of up to 30 kW inclusive.

In 2014 an 'average price' is used based on the amounts of electricity on the regulated and free markets. These amounts are determined by Decisions No Ts-12/30.06.2014 of the DKEVR and the electricity prices for the regulated and free markets. With a view to the considerable difference in the feed-in prices set by the KEVR, the following prices were used when calculating the total assistance for the different types of renewable technologies in 2014:

<sup>(78)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

- Hydropower plants: 189.00 BGN/MWh (369 €/MWh)
- Wind power plants: 117.00 BGN/MWh (228.6 €/MWh)
- Photovoltaic power plants: 145 BGN/MWh (283.3 €/MWh)
- Biomass power plants: 250 BGN/MWh (488.4 €/MWh)

The difference between the 'average price' and the price for the relevant type of plant is multiplied by the amount of electricity generated in 2014.

**Table 71.** Feed-in-tariffs for renewable technologies in Bulgaria's electricity sector, 2014

Type	Per unit support BGN/MWh (€/MWh)	Total amount (M€)
<i>HPPs with an installed capacity &lt; 10 MW</i>	94 (183.6)	64
<i>Wind power plants</i>	22 (43)	15
<i>Solar photovoltaic power plants</i>	50 (97.7)	32
<i>Power plants operating on biomass</i>	155 (302.8)	16

The support in **heating/cooling sector** is the subsidy exemption from property tax for building owners. Buildings that were operational before 2005 and have been granted a class A certificate under the Energy Efficiency Act are exempted from taxation for 7 years. This period can be increased to 10 years if some renewable energy measures have been implemented to meet the energy needs of the building. These periods are reduced to 3 and 5 years if the building has only been granted a class B certificate.

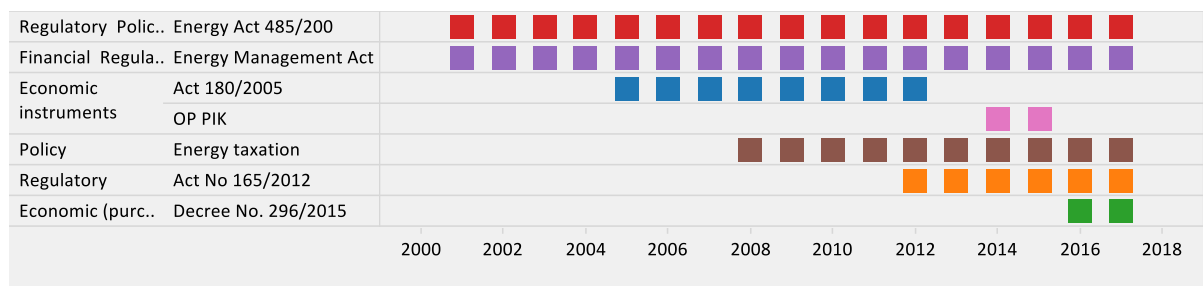
Bulgaria applies a mandatory blending obligation to promote biofuels use in **transport sector**. In 2014, the blending share was equal to 7 % for bioethanol in petrol and 6 % for biodiesel in diesel. Reduced excise duties on motor fuels with a biofuel content of at least 4 % by volume used to be applied but it was stopped in 2011. It was equivalent to a 3.10 % rate decrease for petrol and 7.79 % for biodiesel.

### 6.2.3 Czech Republic

The overall renewable energy share in Czech Republic reached 15.1% in 2015 and 14.9% in 2016. Czech Republic has exceeded the 2020 target of 14%. The deployment of renewable energy was faster in both the heating/cooling and electricity sectors exceeded in 2016 the planned renewable energy shares for the two sectors for 2020.

Legal regulation of support for the use of energy from renewable sources is based on Act No. 180/2005 Coll., on promotion of electricity generation from renewable energy sources. In 2013, a new Act No. 165/2012 Coll., on supported sources of energy, and on amending certain acts, was enacted, which repeals Act No. 180/2005 Coll. A part of the Act took effect in 2012. The objective of the new act was to regulate conditions for promoting renewable sources, such as to allow for more efficient fulfilment of the binding target for a share of energy from renewable sources in gross final energy consumption in the Czech Republic, and ensure an increase of the share of renewable sources in the consumption of primary energy sources, pursuant to Directive 2009/28/EC. In 2013, Act No. 310/2013 Coll., amending Act No. 165/2012 Coll., took effect, which, as of 1 January 2014, discontinued operational support for electricity generation from an electricity generation installation using all renewable sources, with the exception of small hydro power installations with a capacity of up to 10 MW, and projects under way for generation installations using biomass, wind, and geothermal energy, put into operation before 31 December 2015.

**Figure 26.** Support framework for renewables in Czech Republic, 2001-2017<sup>79</sup>



National programs provide support for projects in heating and cooling and electricity production: (i) National Programme for the Promotion of Energy-Saving Measures and the Use of Renewable Energy Sources; (ii) Green Savings Programme (Ministry of the Environment). The EU Structural Funds also provides support through several operational programs: (i) Operational Programmes in Business and Innovation (Ministry of Industry and Trade) and the Environment (Ministry of the Environment); (ii) Operational Programmes for the Environment; (iii) Rural Development Plan of the CR (Ministry of Agriculture)

**Table 72.** Support costs for renewable energy technologies/sources in Czech Republic, 2011-2014 (M€<sup>80</sup>)

	2011	2012	2013	2014
<i>Hydro (&lt;10 MW)</i>	53.73	53.58	66.72	68.86
<i>PV</i>	872.67	915.26	861.42	910.34
<i>Wind</i>	23.31	27.64	34.64	37.63
<i>Geothermal</i>	0.00	0.00	0.00	0.00
<i>Biogas</i>	92.73	149.24	237.31	279.42
<i>Biomass</i>	85.66	93.69	92.14	123.26

In Czech Republic, electricity producers can choose between a feed-in-tariff and a green bonus (premium tariff received additionally to the market purchase price). The two schemes cannot be combined so the producer has to choose between the two systems. During the five years following their entry into service, installations producing electricity from hydropower (up to 1 MW), wind power, heat pumps, solar installations, biogas, wood-gas, biomass and other biologically degradable substances are exempted from income tax. Renewable energy projects are also

<sup>(79)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

<sup>(80)</sup> Using 1 € = 27.0240 CZK (2016)



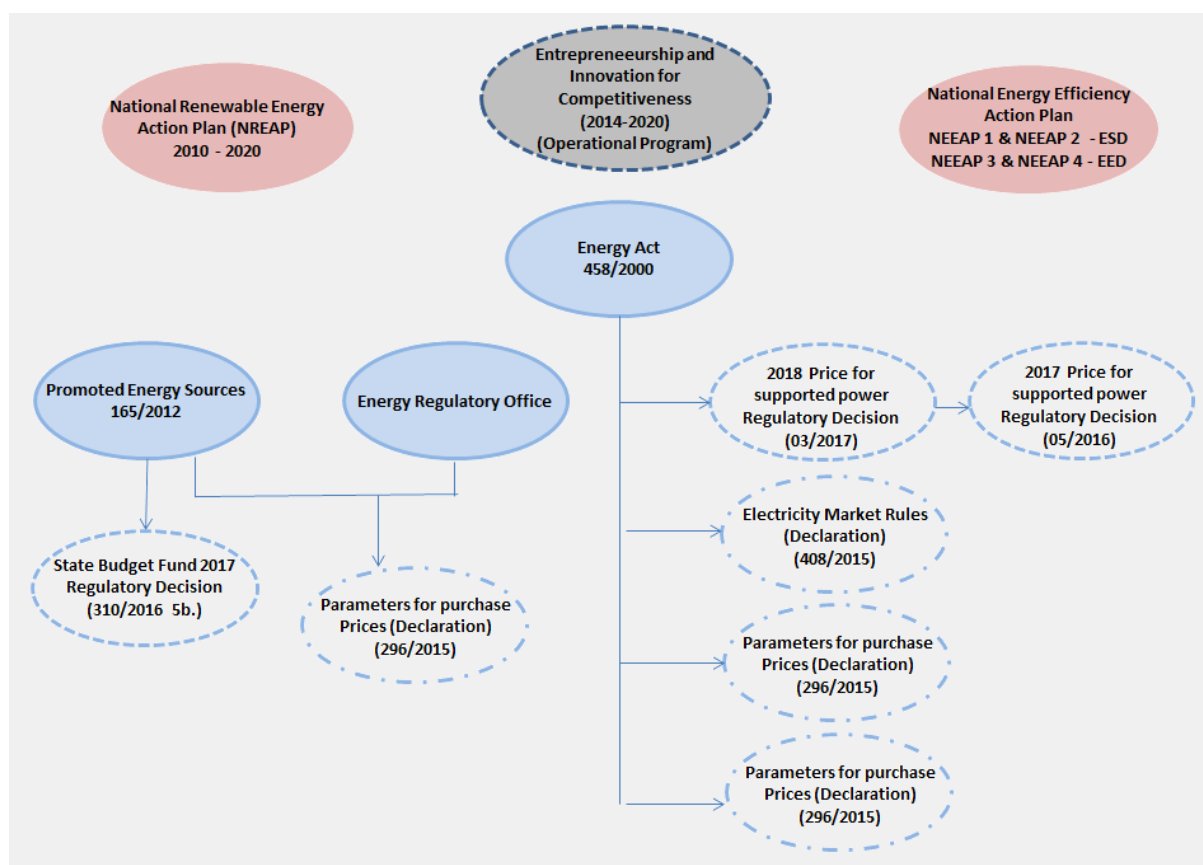
exempted from property tax. Since 2012, only producers with installed capacity under 100 kW could choose the purchase price option (10 MW for installations using hydroelectricity).

In 2014, the operational support for electricity produced using all renewable sources was stopped except for hydropower (under 10 MW), biomass, wind and geothermal energy put into operation before the 31<sup>th</sup> of December 2015. Photovoltaic and biogas installations are only supported if they have been put into operation before the 31<sup>th</sup> of December 2013.

In September 2015, the Czech Republic notified plans to provide support to operators of hydropower installations with a capacity of up to 10 MW. The total budget of the measure will be CZK 218 million (around €8 million). On August 2016 the EC has found this support electricity scheme in line with EU state aid rules. In line with the Guidelines, hydropower installations with a capacity above 0.5 MW will receive their support in the form of a market premium paid on top of the market price, while for those below this threshold a feed-in tariff is payable.

On March 2017 the EC has approved a Czech Republic support scheme for electricity generation from high-efficiency combined heat and power plants under EU state aid rules. The scheme supports electricity produced from high-efficiency combined heat and power plants commissioned from January 2016 until December 2020. The scheme has a total budget of €420 million, which is financed by a combination of a surcharge levied on electricity consumers and contributions from the Czech State budget. Under the scheme, operators of combined heat and power plants receive a fixed premium on top of the market price of electricity. The premium will be updated on annual basis in relation to the main cost components to ensure costs to the State are kept to a minimum. High-efficiency co-generation of electricity and heat helps to increase energy efficiency and reduce CO<sub>2</sub> emissions, and leads to higher levels of environmental protection (ECPressRelease, 2016).

**Figure 27.** Energy legislative landscape in Czech Republic<sup>81</sup>



**Heating/cooling** installations can receive an indirect operational support through the scheme supporting electricity production or the use of combined heat and electricity production. They also benefit for the tax exemptions mentioned above. Direct operational support in the form of a heat bonus is also available for heat production from biomass, bio-liquids and geothermal energy in installations with a rated thermal output of more than 200 kW.

<sup>(81)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)



In October 2015, the Czech Republic notified plans to provide support to biogas installations with a capacity of up to 0.5 MW. These installations will produce heat by burning biogas that is at least 70% derived from animal by-products, barnyard manure or biodegradable waste. The total budget for this measure will be CZK 522 million (around €19 million). All biogas installations will receive a fixed premium for the heat they produce. On August 2016 the EC has approved the Czech support scheme on heat production from biogas.

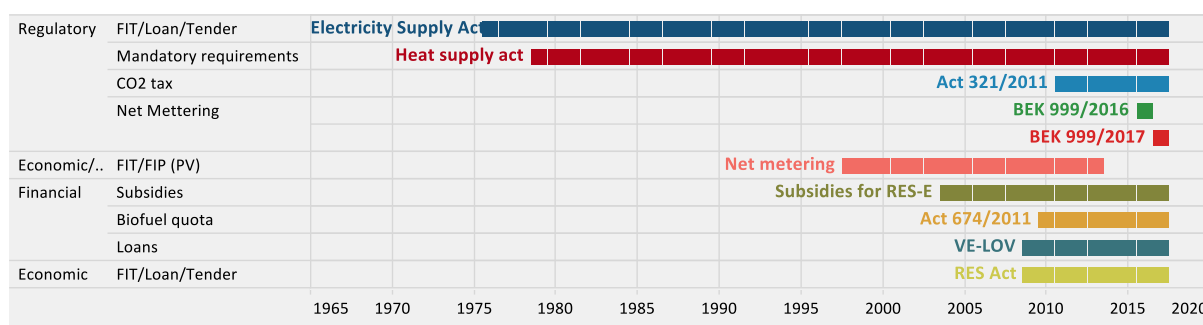
Suppliers of petrol or diesel in Czech Republic's **transport sector** have the obligation to ensure that their fuels include at least 6.0 % of bio-components for diesel and 4.1 % for petrol. Moreover, there is an excise tax reduction for high-percentage blends (E85, E95, SMN 30 and B100). On the contrary, motor fuels and diesel oil with low bio-content (E5, E10 and B7) are not tax-advantaged.

## 6.2.4 Denmark

Overall renewable energy share in Denmark reached 30.8% in 2015 and 32.2% in 2016 remaining above the NREAP and indicative trajectories. Denmark has exceeded since in 2015 its 2020 NREAP overall target of 30.4%. According to the Energy Policy Agreement of 2012 the Denmark has put the commitment to reach a share of 35% from renewable energy in 2020 and 50% of wind energy in Danish electricity consumption in 2020.

In Denmark the support for renewable energy sources is based on the Act for the Promotion of Renewable Energy (Act No. 1392 of 27 December 2008, with later amendments<sup>82</sup>). The purpose of this Act is to promote the production of energy through the use of renewable energy sources in accordance with climate, environment and macroeconomic considerations. The Consolidated Act No. 1115 of 08/11/2006 on Electricity Supply<sup>83</sup> stipulates binding guidelines for the promotion of electricity from renewable sources. The act has been amended in 2012 and 2017. Other support legislation is the Act on Energinet.dk (Consolidation Act No. 224 of 16 March 2009 with later amendments) as well as Executive Orders issued in pursuance of these. Denmark's Renewable Energy Action Plan was submitted to the Commission in June 2010. This action plan was most recently updated through the Energy Policy Agreement of 2012 (EnergyPolicyAgreement, 2012), which sets out specific energy policy initiatives up until 2020.

**Figure 28.** Support framework for renewables in Denmark, 1976-2017<sup>84</sup>



In Denmark the support is provided for electricity generation based on renewable energy and for the use of biogas for upgrading. Support for upgrading of biogas is laid down in the Natural Gas Supply Act, while the other support schemes are laid down in the Act on the promotion of renewable energy (the RES Act). The support is provided in the form of feed-in premiums with a special focus to wind power:

- Wind turbines (Sections 35a to 43 of the RES Act);
- Biogas, etc. (Sections 43a and 44 of the RES Act and Section 35c of the Natural Gas Supply Act);
- Biomass (Sections 45 and 46 of the RES Act);
- Other RE plants (Sections 47 and 48 of the RES Act).

Subsidies are paid to promote the spread of smaller capacity electricity generating plants comprising solar photovoltaic, wave power and biogas installations using technologies that are of significance for the future spread of electricity from renewable sources. Subsidies are dependent on the plant being connected to the grid.

The pool has been extended in connection with the Energy Policy Agreement of 2012 (cf. Annex 1, point 2.6). Subsidies amounting to DKK 25 million per year will be paid in the period 2008-2015. The pool is administered by Energinet.dk, which will invite applications once a year.

In Denmark **electricity** production from wind power is supported through a feed-in-premium and auctions (only for offshore wind). Depending on the technology used to produce the electricity, the premium can either be fixed or sliding.

- For wind turbines connected to the grid<sup>85</sup> after the 1st of January 2014, the premium tariff semi-sliding (i.e. the overall revenue cannot be higher than a predefined level).

<sup>(82)</sup> Consolidated RES Act No. 1288/2016

<sup>(83)</sup> Electricity Supply Act is in place since 1976

<sup>(84)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

- For offshore wind put out to tender the price is the critical award criterion. Settlements and subsidies are therefore not fixed until the tenders have been completed. Creating good competition for the open tenders ensures that the lowest possible support costs are achieved.
- For domestic wind turbines with a capacity of less than 25 kW, the support takes the form of a sliding premium. A draft law amending the support for domestic wind turbines as of 21 October 2015 has been proposed. According to the draft law, the support for domestic wind turbines will be reduced gradually between 2016 and 2020, and annual funding pools with expansion limits will be set up.
- Increased premium for offshore pilot projects concerns a 50 MW pool for pilot projects involving one or more offshore turbines which could help to reduce the cost of generating electricity from offshore wind turbines. These pilot projects can receive a higher feed-in premium which is set such that it and the market price together amount to DKK 0.70 per kWh. The calculation base is determined on the basis of the turbine's power rating and rotor area, such that for ordinary turbine types it more or less corresponds to 50 000 full-load hours of electricity generation.

For biomass, only the fixed premium is available. Photovoltaic not included in the funding pool, hydroelectricity and wave power receive support through a sliding premium. Electricity produced using all other renewable sources of energy can receive support through a fixed premium.

In the **heating/cooling sector** the Heat Supply Act (revised in 1990, 2000, 2005<sup>86</sup> and 2012<sup>87</sup>) regulates public supply installations in Denmark with heating output over 250 kW and CHP installation with heating output up to 25 MW. The Act regulates also the heating supply of large CHP plants.

The recent changes in the Danish Heat Supply Act were aiming the promotion of the conversion of central CHP plants to biomass CHP plants. The latest changes will give opportunity to the electricity and heating generators and heating customers to enter into voluntary agreements, according to which the tax benefits of switching from fossil fuels to biomass for heat generation may be split between the two parties. According to the Heat Supply Act the heat price paid by the consumer should cover all the necessary costs related to heat supply. For the heat purpose only

To assist the smaller and troubled open-field plants struggling with high heating prices, changes are made to the rules so that the 35 CHP plants with the highest heating prices in connection with the dispensation application may be given permission to install a maximum 1 MW biomass-powered boiler to be used solely for heat production. A fund for the promotion of renewable energy in district heating (geothermal, large heat pumps, etc.) amounting to a total of DKK 35 million was planned for period 2012-2015.

Through the tax applied on fossil fuels used for space heating as well as the CO<sub>2</sub> taxes (dependent on the carbon content of the individual fuel), renewable technologies in heating/cooling sector benefit from a tax advantage of approximately 70 DKK/GJ (9.4 €/GJ<sup>88</sup>).

For the period 2015 to 2017, 0.5 M€<sup>88</sup> is going to be allocated to a task force to develop district heating plants with a focus on the use of heat pump. Heat pumps for district heating will also be supported through a demonstration program (grants). Large expansion investment will be supported up to 25-40 % with a maximum of 0.2 M€<sup>88</sup> per MW installed. Overall in 2015 and 2016, 7.42 M€<sup>88</sup> should have been granted to heat pumps projects.

Suppliers of fuels in Denmark **transport sector** are also subject to a blending obligation. The mandatory share of biofuels to be mixed into conventional fuels passed from 0.75 % in 2010 to 5.75 %. Biofuels used in transport also benefit from the tax advantages presented in the heating and cooling section. Denmark also supports the use of biogas in transport. A premium of 5.24 €/GJ is to be paid for biogas sold for use in transport (plus two additional premium of 3.50 €/GJ and 1.34 €/GJ for upgraded biogas).

In 2009, 26.9 M€ were allocated to trial projects in the framework of an "Energy-efficient transport solutions" program. There is also a support scheme targeting electric and hydrogen-powered vehicles. Started in 2008, it was extended from 2010 to 2015. Green vehicles are also exempted from registration and green ownership tax until 2015. The tax advantage is also valid for biofuels used in the transport sector.

---

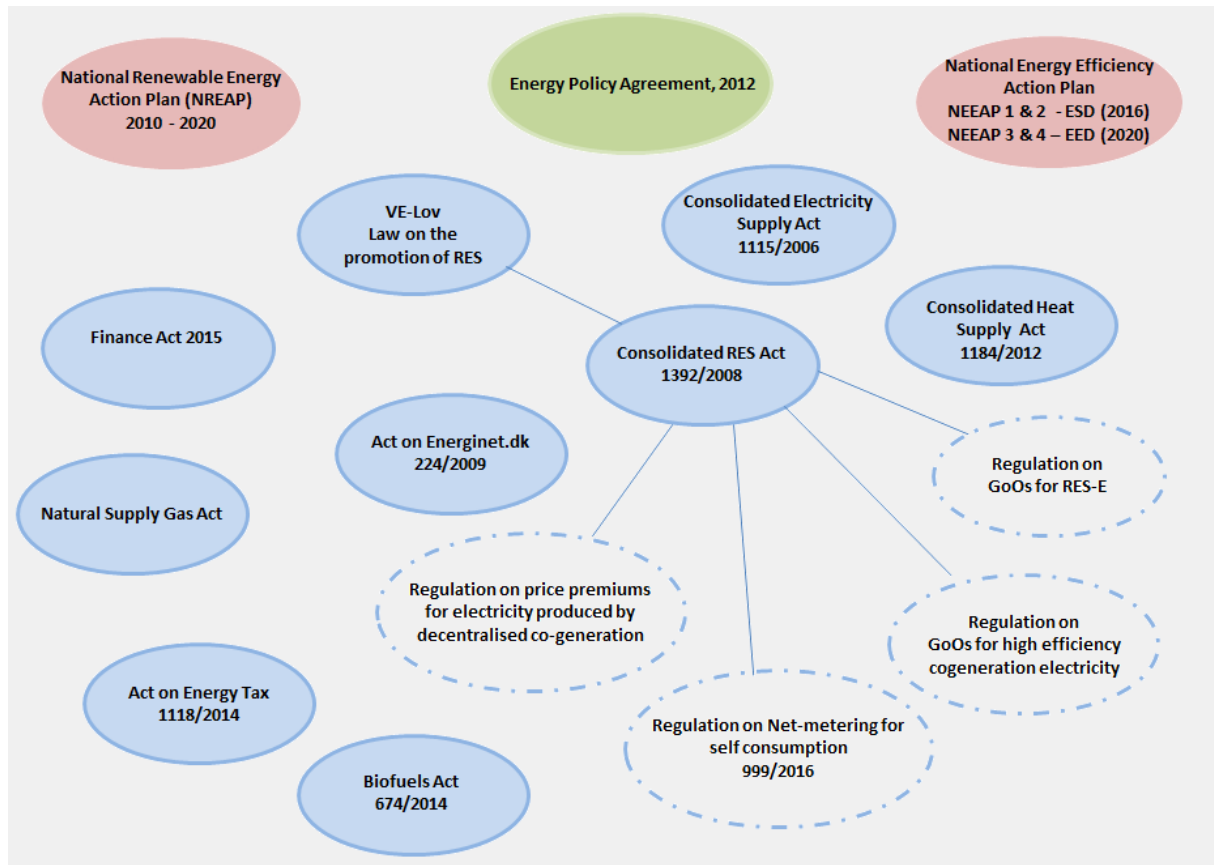
<sup>(85)</sup> With the exception of offshore turbines put out to tender and domestic turbines

<sup>(86)</sup> Consolidation Act No. 347 of 17/05/2005

<sup>(87)</sup> Consolidation Act No. 1184 of 14/12/2012

<sup>(88)</sup> Using 1 € = 7,43690 DKK (2016)

**Figure 29.** Energy legislative landscape in Denmark



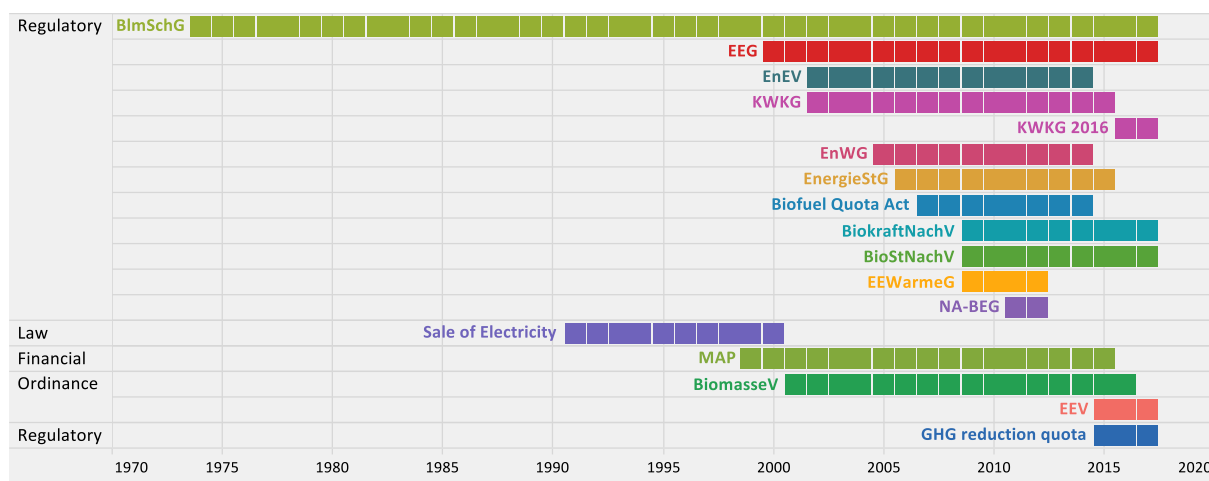
Source: Authors work (Banja M.)

## 6.2.5 Germany

Overall renewable energy share in Germany reached 14.6% in 2015 and 14.8% in 2016. The 2020 target that Germany has to reach for the overall renewable energy share is 19.6%. Germany needs to keep to its trajectory of the last 3 years to stay on track for its 2020 target since its planned trajectory for 2016-2020 is steeper.

The Renewable Energy Sources Act (EEG) in Germany follows up the law on the sale of electricity to the grid, in force since 1991. The EEG is the mayor instrument of the German energy transition and sets the basic principles that lead to the increasing share of renewables in the past years in Germany. The main amendments of EEG took place in 2004, 2009, 2011, 2012, 2014 and 2017. The amendments in 2014 brought a thoroughgoing reform of the Renewable Energies Act. Market Premium became the main support scheme for electricity from renewable energy sources. Although the German Government does not regard any of the provisions of the EEG as State aid, the reform already incorporates most of the provisions of the new environmental and energy aid guidelines published by the EC in April 2014, in the interests of legal certainty. The Energy Act (EnWG) is another important part of German legislation setting rules for the general structure of the energy market concerning market stability and security of supply.

**Figure 30.** Support framework for renewables in Germany, 1974 - 2017<sup>89</sup>



The expansion of renewable energy sources was set out in detail in the EEG (2014 & 2017). Their share should reach 18% in 2020, 40 % - 45 % by 2025, 55 % - 60 % by 2035 and 80% by 2050. In the EEG 2017 for the first time, specific volume targets for the annual increase in capacity are defined for several key renewable energy technologies. This is intended to make the expansion more consistent, and to bring greater predictability and reliability to the energy transformation for all the operators. In order to meet the expansion targets, new instruments to control the volumes are introduced. For example, the 'breathing cap' for photovoltaic plants will initially be transferred to other technologies. Germany has already applied the competitive technology-specific tendering procedures to determine the amount of financial support for renewable energy. With regard to regional cooperation, from 2017 the plan is to open up tenders for a share of at least 5 % of the annual increase in capacity for electricity from renewable energy from other EU countries.

In Germany, since the Renewable Energy Sources Act (EEG) of 2012, **renewables electricity** producers had the choice to receive support through a feed-in-tariff or a sliding premium (based on the same support rates augmented by an additional premium, called "management premium", to cover direct marketing costs). With the EEG 2014, direct marketing has become mandatory for producers with installed capacity higher than 500 kW (since the 1<sup>st</sup> August 2014). This obligation was extended to installed capacities higher than 100 kW from January 2016. Lower capacities retained the possibility to be supported through feed-in-tariff. According to the German 2<sup>nd</sup> and 3<sup>rd</sup> Progress Reports, a large majority of producers of electricity from wind energy had already elected the direct marketing option (80 % of onshore capacity and 100 % of offshore capacity in June 2013). Under the EEG 2017 the plants of a certain size need to take part in a competitive tender to

<sup>(89)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

determine the amount of the market premium. The fixed feed-in tariff and market premium, however, still apply to some technologies and plant sizes. Further mechanisms exist for conventional energy sources that have the purpose of securing security of supply and support efficient technologies.

The capping of the increase in photovoltaic capacity that was subsidised in the EEG 2012 scheme at 52 GW installed capacity will not apply to installations bidding in auctions. Following the high installation figures achieved in recent years, the target corridor for the new photovoltaic capacity installed each year is reduced to 2400 MW up to 2600 MW (from 2500 MW to 3500 MW). Compliance with this expansion corridor is indirectly controlled through the adjustment of the monthly degression of the payment rates. If the expansion corridor is adhered to, these are reduced by 0.5 % each month. If the target corridor is exceeded the monthly degression rises to up to 2.8 %, and if the target range is not reached, the monthly degression can be reduced to as low as zero. If the target corridor is missed by a significant margin, provision is made for a one-off increase in the funding rates of 1.5 %.

With the EEG 2017 auctions will be organised to select offshore and onshore wind installations above 750 kW, solar installations above 750 kW and biomass and biogas installations above 150 kW. Each auction is limited to a specific technology. Biomass and biogas will participate in the same tender including new and existing installations. As already provided in the EEG 2014 for pilot auctions, the auctions to be organised under the EEG 2017 will be opened for up to 5% of the auctioned capacity to installations located in Member States who have concluded a cooperation agreement with Germany. Germany organized the first cross-border tender with Denmark in November 2016. Other technologies supported under the EEG 2017 (hydropower, geothermal and installations using sewage gas) will continue to be eligible for *feed-in tariffs* (for installations up to 100 kW) and *market premiums* defined in the EEG 2017 in line with the Commission's 2014 Guidelines on state aid for environmental protection and energy. This is because there are not enough potential projects for those technologies to enable the organisation of competitive bidding processes. On December 2016 the EC approves auction scheme for electricity from renewable sources in Germany.

**Table 73.** Development of payments in Germany under the EEG (in M€)<sup>90</sup>

	2009	2010	2011	2012	2013	2014	2015	2016
<i>Hydropower</i>	382	421	231	347	420	401	407	467
<i>Landfill, sewage &amp; mine gas</i>	143	83	36	46	48	83	73	72
<i>Biomass</i> <sup>91</sup>	3700	4240	4476	5842	6162	6398	6754	6902
<i>Geothermal</i>	4	6	4	6	19	23	29	39
<i>Onshore wind</i>	3395	3342	4250	3625	3523	4,046	5,083	4,693
<i>Offshore wind</i>	-	-	-	95	123	213	1262	1948
<i>Solar</i>	3156	5090	7767	9156	9346	10230	10640	10226
<i>Total</i>	10780	13182	16764	19118	19641	21394	24248	24346

The principal instrument to support **heating/cooling sector** in Germany is the "Market Incentive Programme (MAP)". This scheme consists of investment subsidies that trigger loans to facilitate the investment in solar thermal installations, biomass boilers and heat pumps. In 2010, 2012 and 2014, 235 M€, 301 M€ and 209 M€ were granted. The investment support is divided into basic support, bonus support and innovation support. Installations need to supply heat or cold predominantly in Germany and have to be operating for at least 7 years.

The KfW Programme Renewable Energy 'Premium', a section of the MAP scheme, offers low-interest loans with repayment subsidies for renewable heat produced in large installations. Biomass installations working based on solid biomass are eligible only up to a capacity of 2 MW. The amount of support goes up to 100% of the investment costs eligible for financing (without VAT), however, not more than 50 M€ per project. It is a long-term and low-interest loan with a fixed interest period of 5 or 10 years including a repayment-free start-up period. A fixed interest period of up to 20

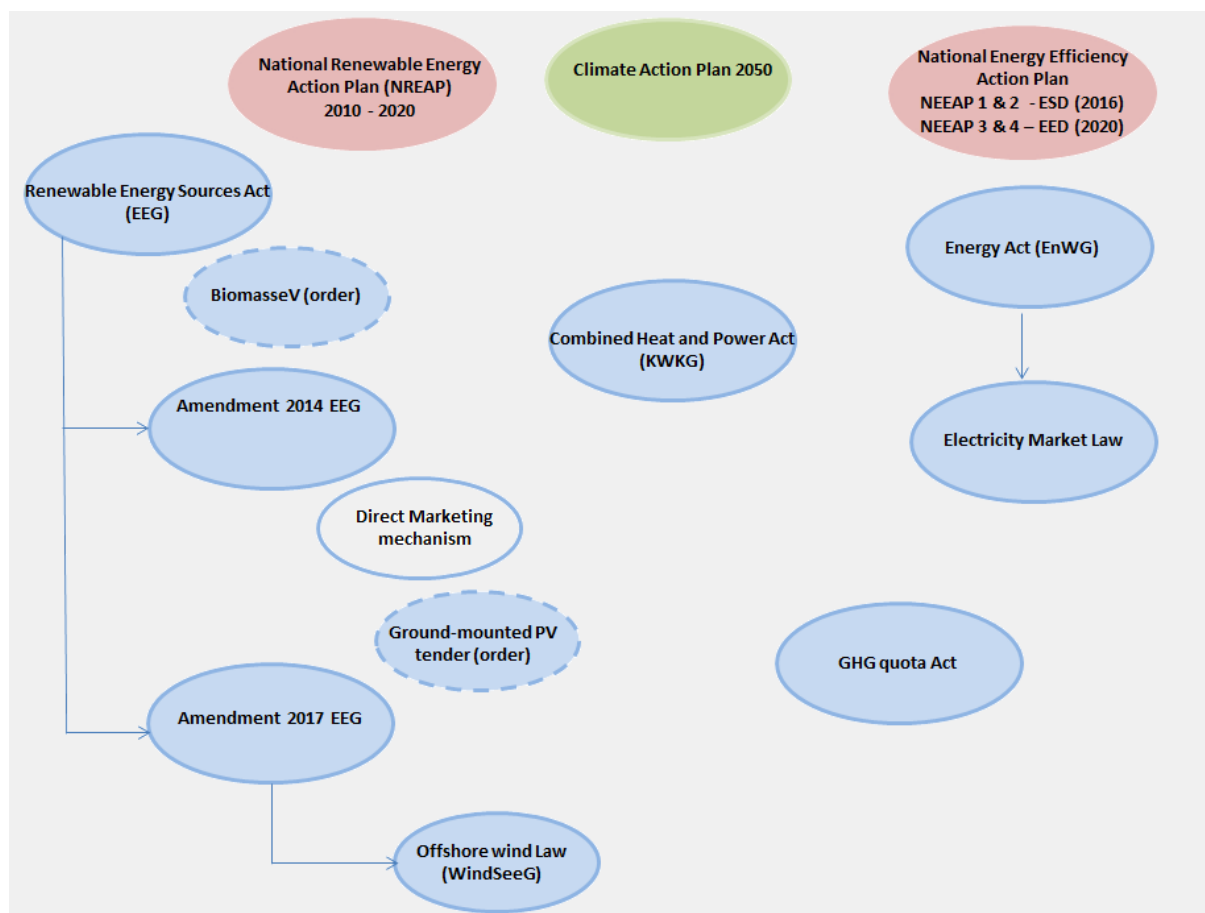
<sup>(90)</sup> [https://www.bundesnetzagentur.de/EN/Areas/Energy/Companies/RenewableEnergy/RenewableEnergy\\_node.html](https://www.bundesnetzagentur.de/EN/Areas/Energy/Companies/RenewableEnergy/RenewableEnergy_node.html)

<sup>(91)</sup> Including payments for flexibility in biomass plants

years is granted if technical and economic duration of co-financed investment is longer than 10 years. Moreover, a commitment fee of 0.25% per month is charged.

The new CHP Act (KWKG 2016) is in place since January 2016. The new act does not promote new plants that are fuelled by coal. The new CHP Act provides financial support to existing installations. For this reason, the maximum annual funding volume of €750 million (\$820 million) was increased to €1.5 billion.

**Figure 31.** Energy legislative landscape in Germany<sup>92</sup>



Until 2014, a quota system for biofuels was in place in Germany's **transport sector**. In 2014, all suppliers of fuels had to ensure that at least 6.25 % of the fuel marketed was biofuel (and at least 4.40 % of biodiesel in diesels and 2.80 % in petrol). Certain biofuels (synthetic hydrocarbons or synthetic hydrocarbon mixtures obtained from the thermo-chemical conversion of biomass and alcohols produced by biotechnological processes to break down cellulose) were also eligible for complete tax exemption until the end of 2015. The biofuel quota has been replaced as of January 2015 by a greenhouse gas reduction quota.

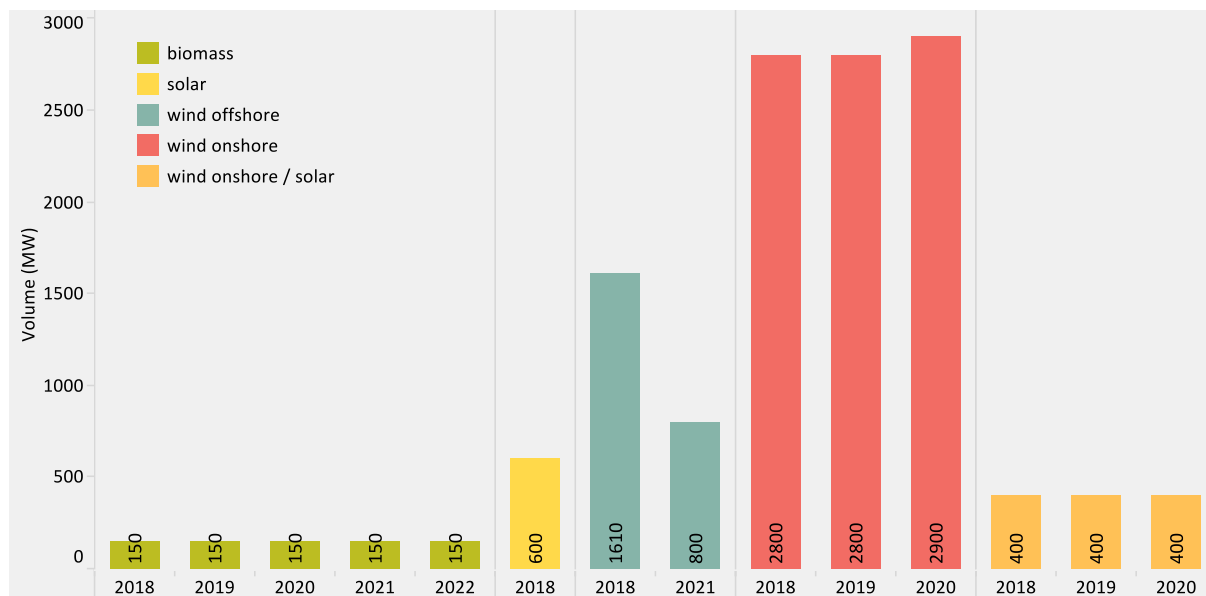
At the beginning of 2016 all tax reliefs for biofuels including biomethane have been terminated. However, the energy tax declaration for 2015 can be still filled out (form 1103) and handed in to the Main Customs Authority until the end of 2016. The biofuel quota has been replaced with a greenhouse gas reductions quota beginning of 01.01.2015. In 2016 an Environmental Bonus for the purchase of electric, plug-in and hydrogen passenger cars has been introduced.

In 2017, Germany introduced auctioning as a main principle of tendering future wind, solar and biomass capacities. The auctions are technology specific and allow exact steering of additional capacity coming online. The first auction results show a steady decline in renewable subsidy levels with some offshore wind projects being realised subsidy-free. The majority of awarded wind onshore projects belong to "citizen energy cooperation" that have laxer rules regarding permit

<sup>(92)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

requirements and more lenient timelines for implementation. Installations with a capacity below 750kW are exempted from the auctions and receive feed-in-tariffs. Bidders have to pay a technology-specific fixed fee and a variable security per bid kW preceding the auction result. The Bundesnetzagentur (BNetzA, Federal Network Agency) announces tender specifications 6-8 weeks prior to the respective auction (ICIS, 2018).

**Figure 32.** Volume of future auctions for solar PV, wind and biomass in Germany, 2018-2022



Source: ISIC power Perspective Tool, (ICIS, 2018)

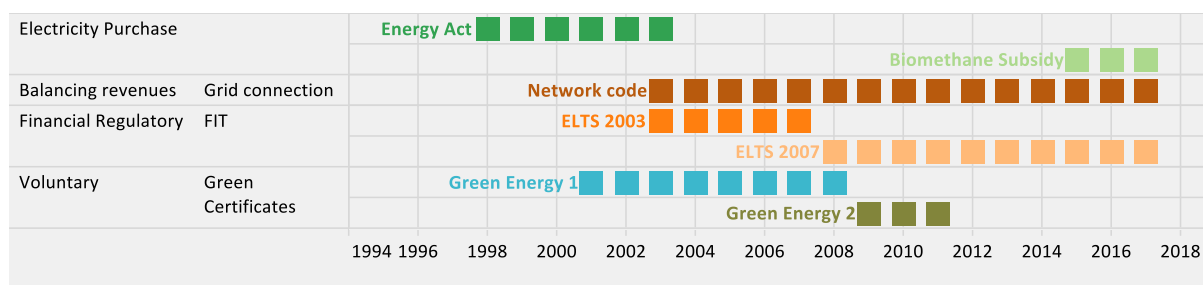


## 6.2.6 Estonia

Overall renewable energy share in Estonia reached 28.6% in 2015 and 28.8% in 2016. Estonia already exceeded the target of overall renewable energy share for 2020 (25%) in 2011. The Energy Strategy adopted in 2017 set a target of 50% for overall renewable energy share in 2030. Over period 2018-2020 Estonia will sell renewable energy statistics to Luxembourg for 10.5 M€.

The Energy Act of July 1998 preceded the Electricity Market Act of 2003 that sets the basic principles for Estonia's power market operation and the subsidy system for renewables and CHP. An amendment to the law that shifts the subsidy system from guaranteed payments to tenders is nearing adoption, after several years of unsuccessful attempts to agree on a new system and thereby reduce subsidy burden on consumer electricity bills. The amendment also lays ground for Estonia's plan to use cross-border renewable subsidy cooperation as a tool for its renewables expansion. Oil shale support measures are set by various acts. The Network Code is a key government act for ensuring grid stability and supply security.

**Figure 33.** Support framework for renewables in Estonia, 1998-2017<sup>93</sup>



In Estonia producers of **electricity** from renewable sources of energy receive a premium of 53 €/kWh on top of the market price of electricity. This amount does not depend on the technology used to produce the electricity. According to the Electricity Market Act, wind power is supported until the annual amount of 600 GWh is reached. Overall, 1.1 TWh of renewable energy were supported in 2014, reaching nearly 60 M€. Moreover, through the Environmental Investment Centre, support for investment is available for installations using wind power (up to 19.85 M€ in 2011). In 2014, overall support for energy generation using wind power reached 26.3 M€. In the same year 32.3 M€ in support was paid for electricity produced from biomass, biogas and waste, in comparison to 30.1 M€ in the previous year. The support for solar photovoltaic reached 28000 € in 2014. This amount nevertheless represents a marginal proportion of the total amount of support paid. As of the beginning of 2015, there were a total of 175 producers of electricity using solar panels (most of those being micro-producers).

Through the European Agricultural Fund for Rural Development and in the framework of the Rural Development Plan, Estonia provides support in the **heating/cooling sector** for investment to production of bioenergy from raw materials for forestry activities. The grant is comprised between 40 % and 60 %. A condition for it is that at least half of the produced energy is used in the producer's farm. In the same context, support is granted to farms and undertakings producing biogas. Support is paid up from 40 up to 60 % of the investment costs with a maximum of 299 745.6 € per application in the programming period. These schemes support bioenergy production with applications in electricity production sector, heating and cooling sector but also in the transport sector. It also has to be mentioned that heat production is also supported through the support of which cogeneration plants benefit.

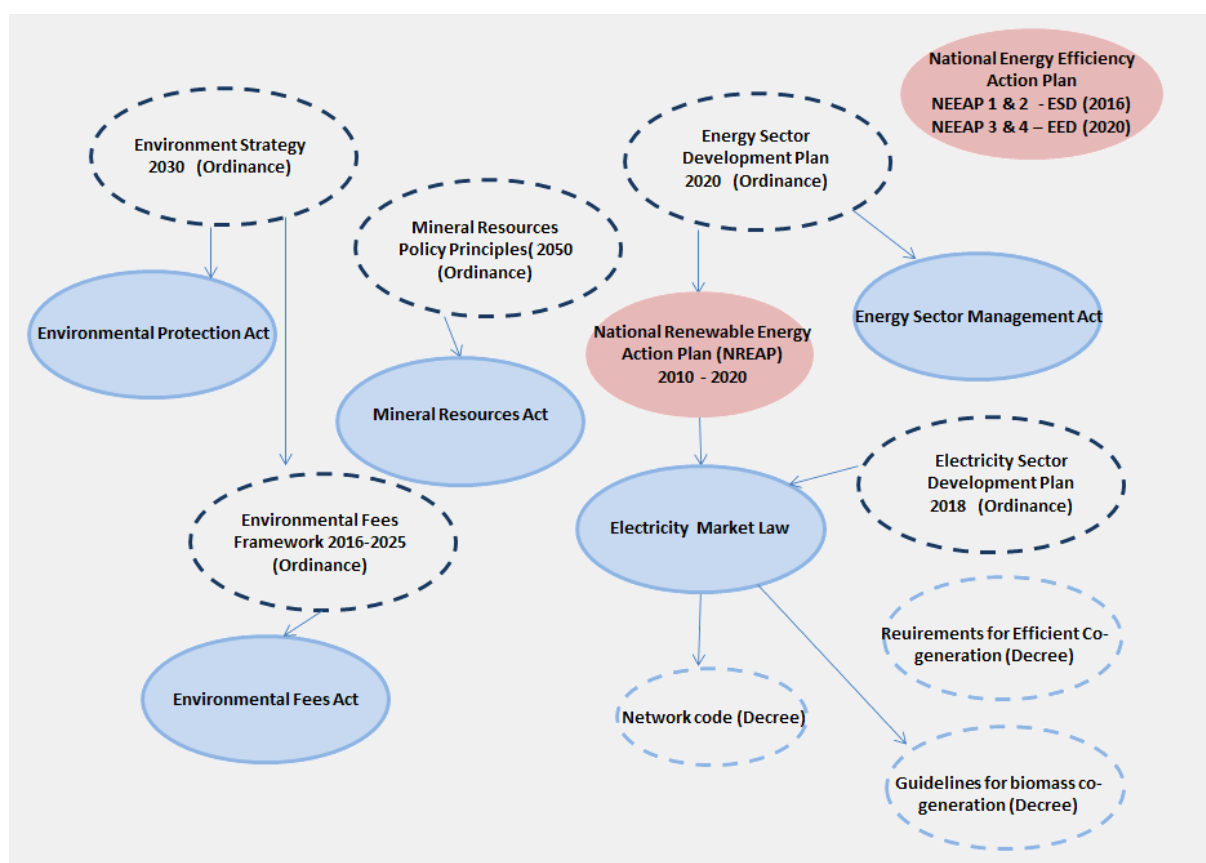
The European Commission approved on 10 October 2007 a major development programme in Estonia for the period 2007-2013, entitled "Development of Living Environment". It involves European Union support for Estonia within the framework of Convergence objective. The total budget of the programme was around EUR 1.9 billion and Community investment through the ERDF and CF amounts to EUR 1.6 billion (approximately 47.2 % of the total EU money invested in

<sup>(93)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

Estonia under Cohesion policy 2007-2013). The programme was focused on the establishment of combined heat and power plants (with the exception of plants outside of the Estonian islands with installed capacity higher than 2 MW, district heating boilers of installed capacity higher than 4 MW and investments higher than 3.2 M€<sup>94</sup>). The maximum level of this subsidy was 3.2 €<sup>94</sup> with a maximum rate of support equal to 50 %.

Regarding the support to the development of renewable energies in the **transport sector**, Estonia promotes the consumption of bio-methane. This support is achieved through two schemes: grants for filling station first and then measures targeting public buses. The possibility of introducing an obligation to mix liquid biofuels is currently under scrutiny (the NREAP mention a 5–7% blended fuel obligation). Until July 2011, biofuels were also exempted from excise duty. For blended fuels, the exemption only applied to the biofuel share. This measure wasn't renewed in the following years.

**Figure 34.** Energy legislative landscape in Estonia<sup>95</sup>



<sup>(94)</sup> Using 1 € = 15,6466 EEK (2016)

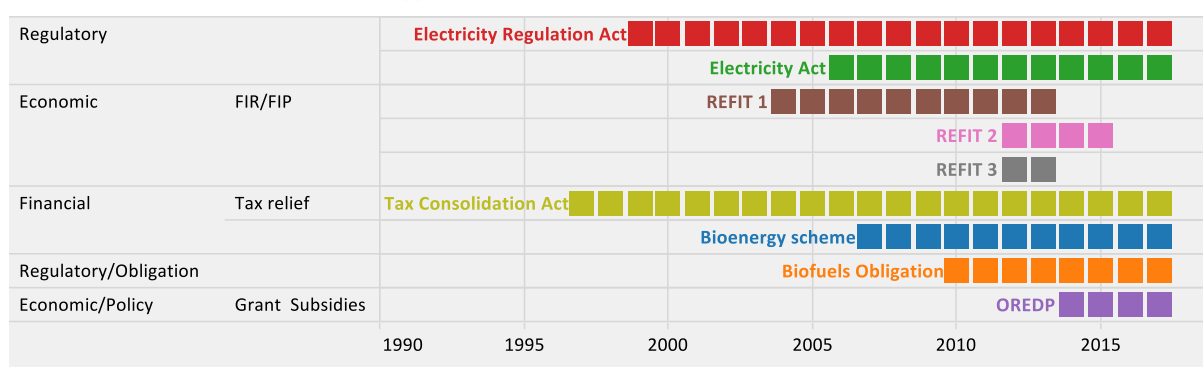
<sup>(95)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.7 Ireland

Overall renewable energy share in Ireland reached 9.2% in 2015 and 9.5% in 2016. The overall renewable energy current trend trajectory remained below the NREAP trajectory but above the indicative trajectory. However the growth is insufficient for the 2020 target to be met.

Ireland's key energy laws are the Electricity Regulation Act 1999 and the Electricity Act 2006, which organize the electricity market and build the legal foundation for RES support schemes. The regulations REFIT 2 and REFIT 3 support electricity generation from RES with a feed-in-tariff. However, this support expired for new applications in Dec 2015. A new system for the support of RES is under development at the moment. Currently, it is under public consultation (Jan 2018). Therefore, a new support scheme for Ireland can be expected in the short to mid-term. Furthermore, it's possible to request Guarantee of Origins for electricity generation from RES.

**Figure 35.** Support framework for renewables in Ireland, 1999-2017<sup>96</sup>



Ireland supports **electricity** from renewable sources through different feed-in-tariff scheme which operates as a floor price tariff mechanism. The first Renewable Energy Feed in Tariff (REFIT 1) was open from 2007 to 2009 and encompasses 1379 MW of installed capacity. Its support will end in 2027. REFIT 2 opened in 2012 for onshore wind power installations, small hydroelectricity plants and landfill gas electricity plants. Its support cannot exceed 15 years and it will not extend beyond 2032. The scheme is opened only for the applications before December 2015.

The estimated overall support for the electricity sector in Ireland was equal to 54.8 M€ (REFIT, AER, Tax Relief) in 2013. The support accounted for 60.1 M€ in 2014.

**Table 74.** REFIT 1 & 2 Support Level for Electricity Generation in Ireland

2014		REFIT 1 & REFIT 2
Wind Power	Capacity < 5 MW	72.02 €/MWh
	Capacity > 5 MW	69.58 €/MWh
Hydroelectricity	Capacity < 5 MW	87.89 €/MWh
Landfill gas		85.45 €/MWh
Biomass		87.89 €/MWh

In 2012, REFIT 3 was introduced as a support tariff for biomass technologies. It encompasses different technologies such as anaerobic digestion, biomass combustion and co-firing of biomass with peat. The total budget of the scheme depends largely on the electricity prices. On the basis of a market price for electricity of 70 €/MWh, the budget was estimated at €70 million to be paid per year, corresponding to a total budget of €1.05 billion.

A tax relief system, the Accelerated Capital Allowances, applied among others to wind turbines over 5 kW of installed capacity, solar PV and CHP with biomass boilers, was also launched in 2009 to promote investment in energy savings and renewables sources of energy by companies. It is a tax incentive tax incentive allowing firms to write off from their yearly profit the total investment value. As of 2013, marine energies (wave, tidal, offshore) became one of the axis of the National research Prioritisation process which funds agencies, academics, industry researchers in marine energies.

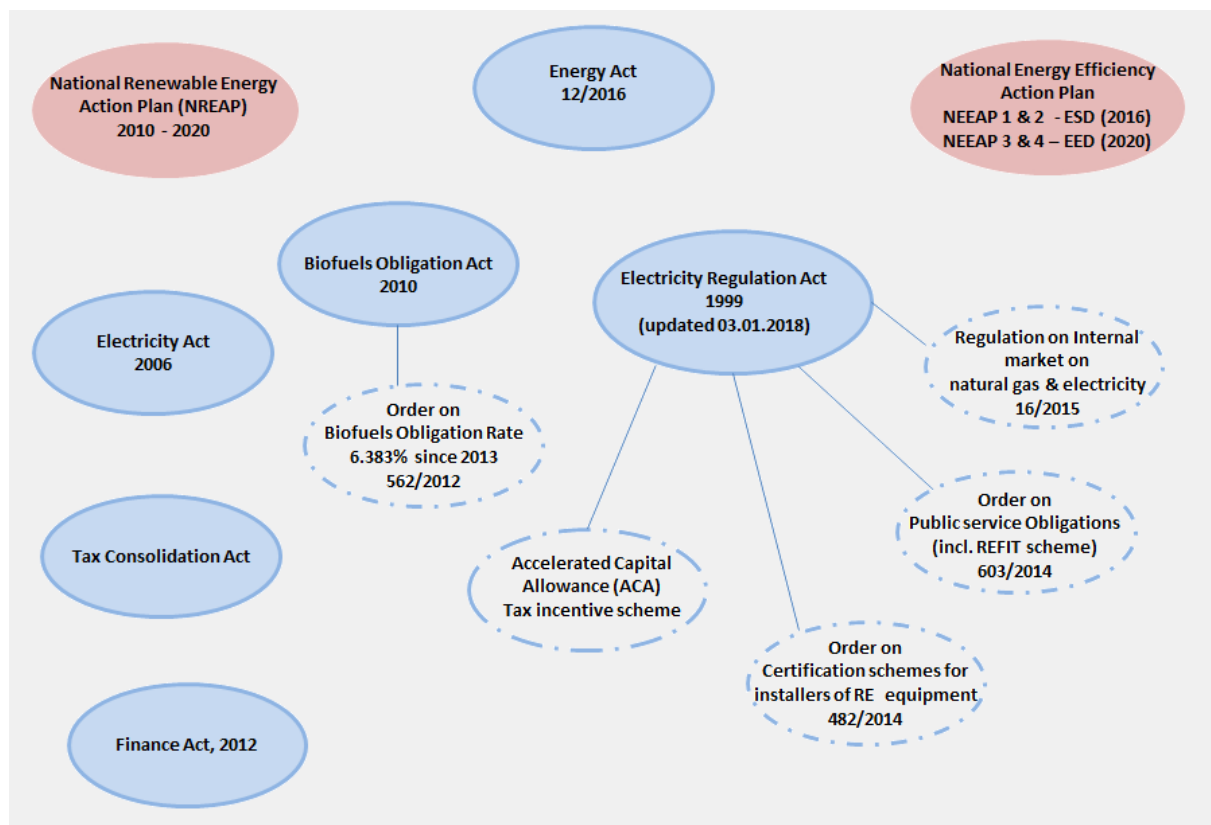
<sup>(96)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

Simultaneously, an Ocean Energy Prototype Development Fund has been implemented to provide grants for industry. The Offshore Renewable Energy Development Plan has been launched in 2014 to try to identify the economic opportunity for Ireland of realising its potential in offshore wind, tidal and wave energy resources before 2030.

The Renewable Energy RD&D program, which exists since 2002, tries to stimulate deployment of renewable energy technologies that are close to market, and on assessing the development of technologies that have prospects for the future and on overcoming barriers to renewable energy deployment and informing national and local policies. Another tax relief, introduced in 1997, the Employee Investment Incentive attributes relief from income tax for individuals for investment in renewable energy production. Another section of the Tax Consolidation Act grants tax relief to corporate equity investments.

In 2015 a consultation on proposed amendments to the REFIT 3 terms and conditions was launched. The consultation closed on July 2015. The REFIT 3 closed for applications on 31 December 2015. Following the public consultation on amendments to the REFIT 3 Terms and Conditions the REFIT Power Purchase Agreement (PPA) commenced on the basis of having the installed capacity operational by 30 September 2019. There is currently no support mechanism or feed-in-tariff scheme for micro generation.

**Figure 36.** Energy legislative landscape in Ireland



Source: Authors (Banja M.)

**Heat** produced in CHP plants using biomass is supported through the REFIT 3 scheme presented in the previous section. Since 2007, there is also a bioenergy scheme to promote the production of non-food crops (willow and miscanthus) with the purpose to produce energy.

The draft Bioenergy Plan, published in October 2014, identifies that an additional bioenergy-focussed measure in the heat sector represents the most cost effective means of meeting a number of different policy goals, including reducing the emerging gap to meeting 12% renewable energy in the heat sector and recommends, subject to further approvals, the introduction by 2016 of a Renewable Heat Incentive for larger heat users outside the EU ETS to change to heating solutions that produce heat from renewable sources.

The Electric Vehicle Grant Scheme was launched in 2011 to assist the purchase of electric cars in **transport sector**. In the framework of this scheme, the purchase of a full battery electric vehicle (BEV) or plug-in hybrid electric vehicles (PHEV) is aided up to 5 000 € (depending on the price of

the vehicle). Electric cars were also added to the Accelerated Capital Allowances in 2011 (see above).

Since 2010, road fuel suppliers have to make sure that biofuel reach a certain share of the national sales of fuels. To implement this obligation, a biofuel certificate scheme has been introduced. Biofuels producers get one certificate per litre produced (two for biofuels from wastes and residues, four different feedstocks and also for Palm Oil Mill Effluent and Spent Bleached Earth). Certificates are tradable and at the end of the year all suppliers must present the required number of certificates. From 2010 to 2012 the quotas was 4 % and since 2013 it is 6 %.

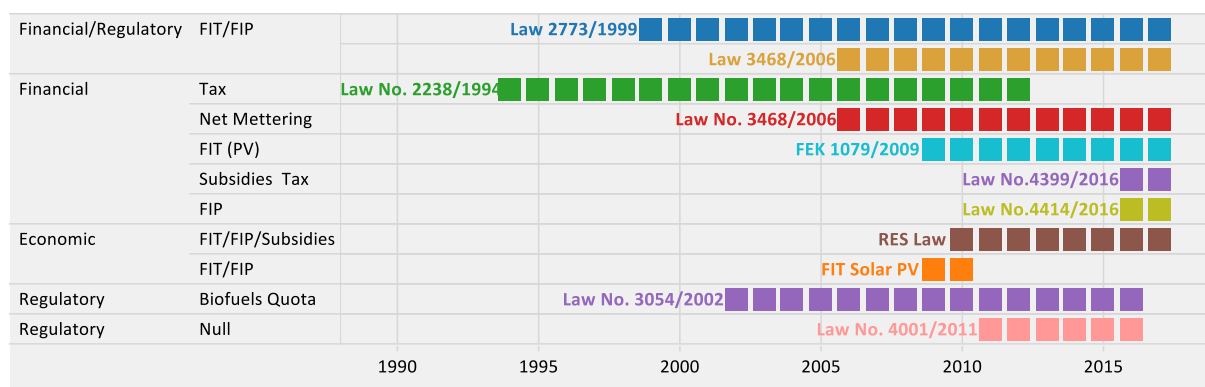
From 2005 to 2010, biofuels also benefited from a tax relief ("Biofuels Mineral Oil Tax Relief"). It concerned biofuel blends complying with EU standards, some bioethanol, pure plant oil produced from oilseed rape (used in modified diesel vehicle engines) and biofuels used in identified captive fleets where it can be shown that the engine warranties of the vehicles in question cover the use of the specified biofuels at the specified blend levels.

## 6.2.8 Greece

Overall renewable energy share in Greece reached 15.4% in 2015 and 15.2% in 2016. The 2020 target that Greece has to reach for the overall RES share is 18%. Overall renewable energy share in Greece remained well above the NREAP and indicative trajectories throughout 2010-2016.

Law No. 2773/1999 on Electricity Market Liberalisation paved the way towards the liberalisation of Greek Electricity Industry. The law which is still relevant today since it regulates a lot of issues related to energy policies. Law No 3468/2006 is another fundamental aspect of the Greek Energy Regulatory Scheme since it governs the conditions for setting up units producing electricity from Renewable Energy Sources (RES) and establishes the Guarantees of Origin. From 2017 onwards, electricity generation from RES and CHP plants is promoted through a Feed-in-Premium support mechanism specified in the New Support Scheme for RES and CHP (Law 4414/2016). Law 4414/2016 also foresees a shift towards a general RES tendering scheme from the 1<sup>st</sup> of January 2017, including a partial opening for RES projects from other European Economic Area (EEA) countries. The New Development Law (No. 4399/2016) aims at supporting specific RES projects for self-production in the form of subsidies. Moreover, certain decisions of the Regulatory Energy Authority and Ministerial Decrees amend to a greater or lesser extent the already existing Laws.

**Figure 37.** Support framework for renewables in Greece, 1994-2017<sup>97</sup>



Greece uses a feed-in-tariff scheme to support electricity produced from renewable sources of energy. The scheme grants different tariffs according to the technologies, the size of the project, its future profits and costs. All tariffs are adjusted each year, indexed on 25 % of an annual consumer index.

The main technology supported through this scheme is the photovoltaic generation of electricity. In 2014, 1 170.8 M€ were granted to PV installations of the interconnected system (and 92.3 M€ for the non-interconnected islands). The unit level of support was 115 €/MWh for small installations (capacity up to 100 kW) connected to the main system and 90 €/MWh for large installations (capacity higher than 100 kW) connected to the main system. The tariff was 95 €/MWh for installations on non-interconnected islands. Since 2014, there are some provisions supporting the installation of PV systems up to 10 kW on buildings and roofs, and up to 20 kW. Special support is also granted to PV installations of up to 100 kW owned by professional farmers.

Still in 2014, the whole amount granted through this scheme reached 266.7 M€ for wind power installations part of the interconnected system and 68.8 M€ for turbines installed in non-interconnected islands. Support has reached 61.8 M€ for small hydroelectric plants and 21.6 M€ for biogas and biomass installations in 2014. All RES technologies installed for electricity production of heating/cooling purposes are eligible for tax incentives (solar energy systems, heat pumps, biomass boilers but also decentralized power generation systems like PV and small wind turbines). This relief consist in an income tax reduction of 10 % of the costs of intervention. The relief is capped at 6 000 €.

In November 2016 the EC approves Greek support scheme for renewable electricity and cogeneration. The scheme includes state support either through a feed-in tariff or through a price premium in line with the Guidelines. Support with a feed-in tariff will be limited to small

<sup>(97)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

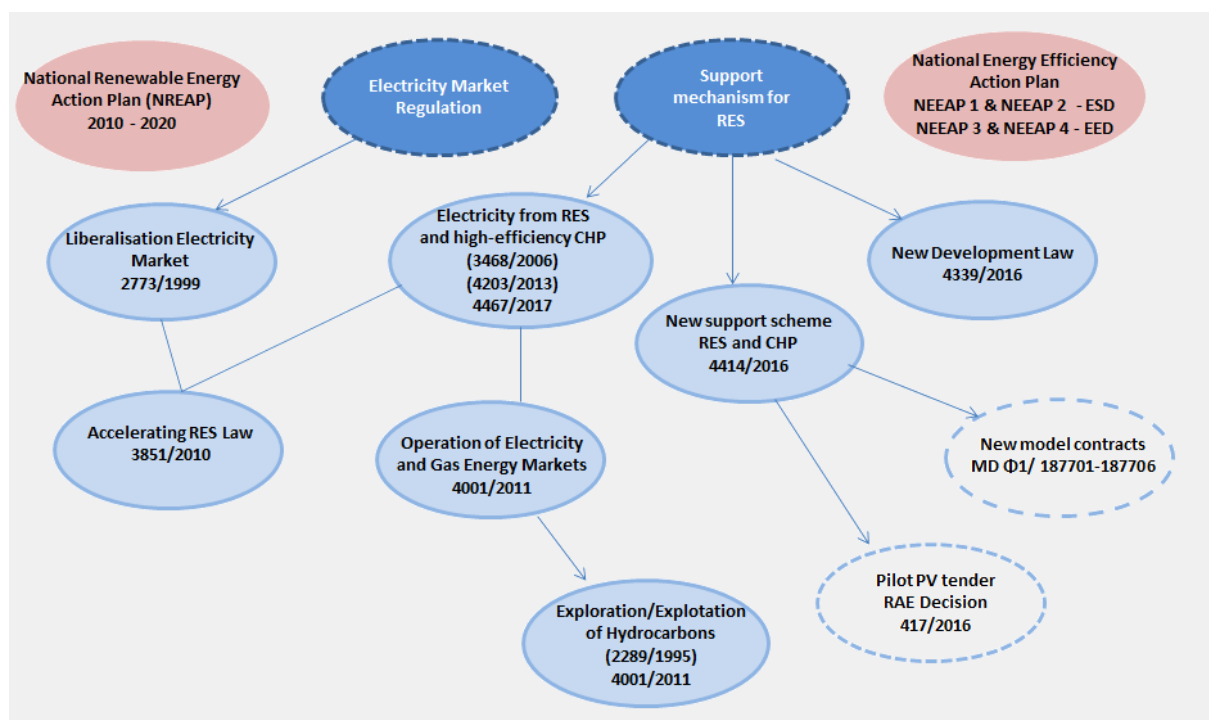
installations and installations on non-interconnected islands. Installations with a capacity above 500 kilowatt (KW) will, over a period of 20 to 25 years, receive a premium on top of the market price of electricity. Greece has demonstrated that the aid is limited in line with the Guidelines. This will minimise potential distortions of competition created by the public funding.

The approved scheme aids to larger installations (above 1 000 KW) for the year 2016. Under the Guidelines, as of 1 January 2017, aid to larger installations has to be granted through competitive tenders to ensure that energy is produced at minimal cost for taxpayers. Greece will organise a pilot tender for photovoltaic energy and has committed to use competitive bidding processes for all aid granted to large installations as of 2017. The Greek scheme will be financed through the renewables support levy currently in place in Greece. In order to avoid any discrimination against foreign renewable energy producers resulting from the financing mechanism, as of 2017 Greece will partially open up the renewables support scheme to foreign producers.

**Heating/cooling** installations are supported through tax relief and investment grants. The new Development Law that came into force in July 2016 foresees support for CHP plants and RES H&C plants (for self-consumption, but not only). The 2016 Development Law foresees support for CHP and RES H&C plants in a form of an income tax relief and a stabilization of income tax coefficient. They can be substituted with other support mechanisms, i.e. subsidies, under the Development Law. The 2016 Development Law foresees support for CHP and RES H&C plants in a form of subsidies, leasing subsidies, and subsidies for the creation of new jobs. They can be substituted with other support mechanisms under the Development Law, i.e. tax relief. Law No. 2238/1994 provides an income tax relief for natural and legal persons who have performed an energy upgrading of their building either at their own expense or through participation in national programmes (e.g. Exoikonomo).

Support for biofuels in **transport sector** is granted through annually allocated quotas (Law 3054/2002). Law No. 3054/2002 obliges producers and distributors of petrol and diesel to blend their fuels with a certain amount "quota" of biofuels. The mandatory quota is specified in the distribution scheme, which is reviewed every year (art. 15A par. 3 Law No. 3054/2002). These quotas are chosen by means of a call for tenders as well as an evaluation and allocation procedure. Beneficiaries have to achieve mandatory shares of blended biodiesel. This share is equal to 7.00 % since 2011 (it was equal to 6.50 % in 2010).

**Figure 38.** Energy legislative landscape in Greece<sup>98</sup>



<sup>(98)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

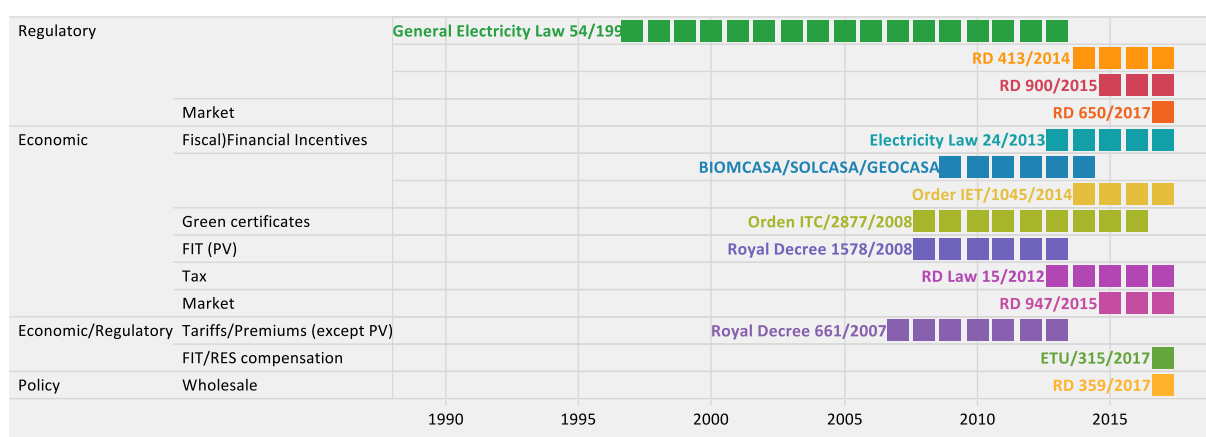


## 6.2.9 Spain

Overall renewable energy share in Spain reached 16.17% in 2015 and 17.26% in 2016. The 2020 target that Spain has to reach for the overall renewable energy share is 20.8%. Overall renewable energy share in Spain remained above the indicative trajectory throughout 2010-2016. However this development was slightly slower than the NREAP planned trajectory, meeting it only in 2014.

The framework for Spain's renewable sector, cogeneration and waste sectors is laid out in the Electric Sector Law<sup>99</sup> and Royal Decree 413/2014. The Royal Decree lays out access to a "reasonable rate of return" to plant operators through an auction system. In addition, guarantees of origin are provided on request by the regulator CNMC. The main support scheme was suspended at the beginning of 2012 accepting applications for projects beginning operation after January 2013. With the "Régimen Retributivo Específico", a new support scheme was established in June 2014. Three tenders took place. Spain has a capacity mechanism in place to ensure security of supply when RES sources are insufficient. Auctions of 8.5GW of renewable capacity have also been recently successfully acquired, with bidders competing to provide capacity at the lowest possible support from the state. Resolution of 10 April 2017 laid out the structure for 3GW of this capacity. Demand-side support is available through an interruptibility market system. Both the demand structure and capacity mechanism are being investigated by the EC. Further, guarantees of origin are provided on request by national regulator CNMC.

**Figure 39.** Support framework for renewables in Spain, 1997-2017<sup>100</sup>



Royal Decree 900/2015 regulates administrative, technical and economic modalities for electricity supply and generation with self-consumption. Royal Decree 650/2017 allocates the specific compensation regime to 3000 MW of new RES production plants. Order IET/1045/2014, approves the remuneration parameters for standard facilities, applicable to certain electricity production facilities based on renewable energy, cogeneration and waste. The Order ITC/2877/2008 regulates the management of the mechanism for the promotion of the use of biofuels and other renewable fuels for transport, defines and sets certain aspects related to the national system for checking biofuel's sustainability, and also states who has an obligation, and how this must be proved by means of biofuels certificates. Ministerial Order ETU/315/2017 approves procedural rules for participating in a second call for new facilities

In Spain, until 2012, new plants generating **electricity** using renewables sources of energy had access to either a feed-in-tariff support or to a semi-fixed premium on top of the market price of electricity (there was not always a choice depending on the technology). The feed-in-tariff consisted of two rates, one for the first 25 years and the other (lower) for the 25 next years. The premium is semi-fixed as it is defined by a fixed premium tariff with a floor and ceiling price. The sum of the market price and the premium must stay between these boundaries. If the market price was too low or too high then the premium was reduced accordingly.

<sup>(99)</sup> General Electricity Law No. 54/1997; Electricity Law 24/2013

<sup>(100)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

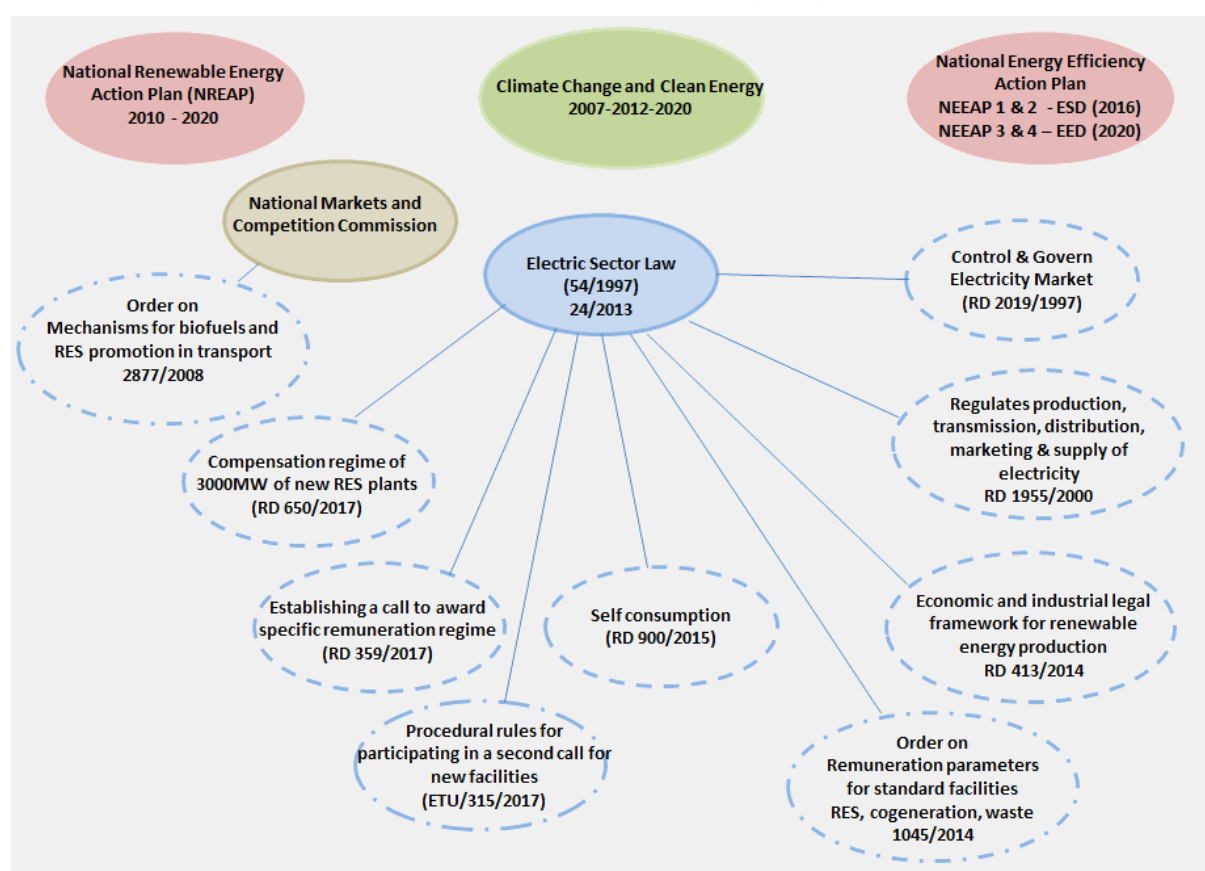


In 2012, a decree froze all support for new installations. Another decree from July 2013 updated the support scheme replacing the previous premium tariff by a plant-specific premium set to cover investments costs non which could not be recovered through electricity sale and also to cover the discrepancy between operating costs and market costs.

In November 2017 the EC approves Spanish support scheme for renewable electricity. The scheme has been in place since 2014 and applies to new beneficiaries as well as to facilities that were benefitting from previous support. In total, the scheme has around 40,000 beneficiaries. In 2016, the annual payments under the scheme amounted to €6.4 billion.

Since 2016, support to new facilities is granted through competitive auctions. Different technologies have competed with each other in the latest auctions of May 2017 and July 2017. In total, support for capacity of slightly more than 8 gigawatts was awarded, essentially to wind and solar panel plants. As a result of these auctions, beneficiaries will receive compensation only if, in the coming years, the market price drops to a level significantly below today's market prices. This protection against an unexpectedly sharp fall in market prices helps developers to secure project financing, and therefore complete the projects on time.

**Figure 40.** Energy legislative landscape in Spain



Source: Authors work (Banja M.)

In 2009, support programs were introduced in the **heating/cooling sector**. They aimed at promoting the development of biomass, geothermal and solar energy for the heating needs. Three programs for Major Thermal Installations (GIT) supplement the programs BOIMCASA, GEOCASA and SOLCASA<sup>101</sup> that have limitations with regard to the amount per project.

<sup>(101)</sup> Establish a system for financing projects submitted by ESCOs [1], which also promotes such projects. Promotes a quality product suitable for the needs of hot water and climate control system users in buildings, using solar thermal, geothermal or biomass energy.

**Table 75.** Support for technologies/sources in heating/cooling sector in Spain, 2014<sup>102</sup>

2014	Programme funding (Loan amount in €)	Aid per unit
<b>BIOMASS GIT</b>	2 827 935	0.129 €/kWh
<b>BIOMCASA II</b>	2 388 680	0.199 €/kWh
<b>SOLCASA</b>	329 088	0.621 €/kWh
<b>Total</b>	5 545 703	

In the **transport sector** since 1992, biofuel pilot projects, to produce automobile fuel, full-strength or mixed with conventional fuels, are exempted from taxes from special duty on hydrocarbons. The project will be deemed experimental if the amount of biofuel produced annually does not exceed 5 000 litres.

A new decree has recently set a minimum obligatory goal for the sale of biofuels. It amounts to 4.3 % in 2016<sup>103</sup>. Before this decree, there were overall compulsory objectives set at 5.83 %, 6.2 %, 6.5 % and 6.5 % for 2010, 2011, 2012 and 2013. In 2008, a system of certificates was installed to achieve per-product targets. In 2011, the target for biodiesel was 6 % then 7 % in 2012 and 2013 and for bio-petrol it was 3.90 % in 2011 and then 4.1 % in 2012 and 2013 with a penalty of 185 € per missing certificates in 2011. A decision of 2013 put the compensatory amount to be paid in the case of missing certificates at 763 € per certificate.

<sup>(102)</sup> No loans for SOLAR GIT, GEOTHERMAL GIT and GEOTCASA in 2014

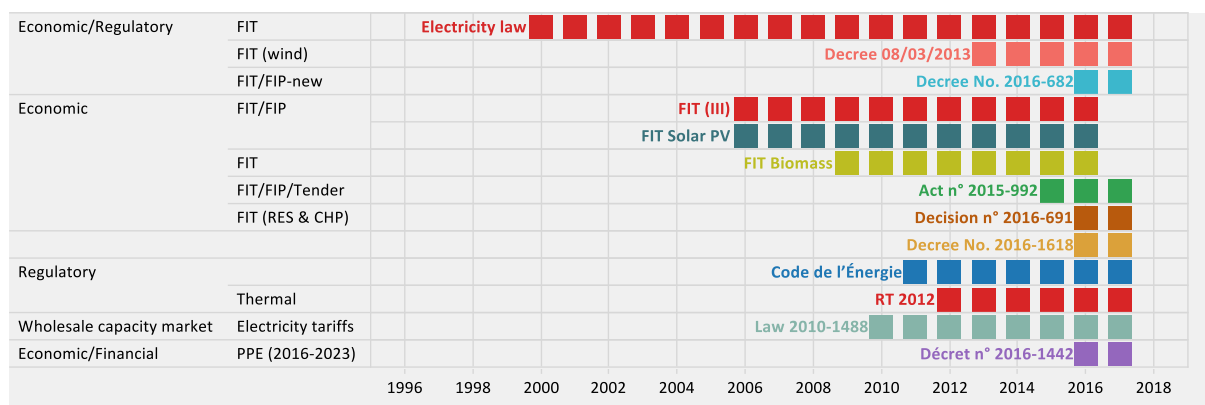
<sup>(103)</sup> 5 %, 6 %, 7 % and 8.5 % in 2017, 2018, 2019 and 2020 respectively.

## 6.2.10 France

Overall renewable energy share in France reached 15.14% in 2015 and 15.98% in 2016. The 2020 target that France has to reach for the overall RES share is 23%. Overall renewable energy share in France remained under the NREAP trajectory throughout 2010-2016, but was more or less in line with the indicative trajectory. This development means that France is not on course to reach the 2020 target on overall renewable energy share. The renewable energy share was deployed faster than planned only in the transport sector. The French Energy Transition Act of 2015 set goals to be reached in 2030: 32% of renewables energies in the end energy consumption; 40% of the electricity must be produced from renewable energy; 38% heat consumption must be produced from renewable energy and 15% of end fuel consumption must be produced from renewable sources.

Law No. 2000/108 of February 2000 on modernisation and development of electricity public addressed the obligatory purchase of electricity from renewable sources and cogeneration at fixed feed-in tariffs. The law regulated the free access of independent energy producers to the grid and lays the foundation for higher feed-in tariffs for electricity production from renewables and a new tender scheme for renewable energy production capacity. These tariffs have subsequently been updated in the upcoming years. Law No. 2010/1488 of December 2010 on the new organisation of the electricity market creates the Regulated Access to the Historical Nuclear Electricity (ARENH) which allowed alternative suppliers an access to nuclear electricity in order to sell it to end consumers and ended regulated tariffs for industrial consumers. The French Energy Code (Code de l'énergie) was edited in 2011 for the first time and consolidates laws and decrees relative to energy law. Several decrees and orders set the framework implementing the subsidy schemes supporting renewable energy and co-generation. Under Law No. 2015/992 of August 2015 (Energy Transition Act) on energy transition green growth feed-in tariffs contracts are exceptional, the main support mechanism is the feed-in premium. In October 2016 the first pluriannual energy programming (programmation pluriannuelle de l'énergie, PPE) for the period 2016-23 was adopted.

**Figure 41.** Support framework for renewables in France, 2000-2017<sup>104</sup>



France has introduced a feed-in-tariff guaranteed for 15 or 20 years for all renewable technologies. In some cases this tariff can be increased by an energy savings premium. Changes are currently being made to the support scheme for renewable electricity production in France taking effect from 201. A new support scheme, the 'additional payment' (FIP), is introduced, which will, in part, take the place of the purchase obligation. This additional payment consists of a bonus paid to a renewable electricity producer on top of the market price received for the sale of the electricity. This bonus should help ensure that producers benefit from an overall level of compensation that allows them to cover the cost of running their facility while guaranteeing a normal return on invested capital. It is also allocated in two ways: on request or by tender.

Producers can apply for a *feed-in tariff* contract, if they own: (i) Integrated solar plant: less or equal to 100kW; (ii) Some small plants using biogas made from non-dangerous waste or methanisation; (iii) Gas co-generation and heat plants less than 300kW; (iv) Plants using mine gas, in some conditions, less than 12MW; (v) Hydraulic plants: less than 500kW; (vi) Wind power

<sup>(104)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

plants located in cyclonic areas; (vii) Offshore floating wind-power and hydropower plants which won a French call "Investment of the Future" or a European call "New entrant reserve".

Producers can apply for a *feed-in premium* in open window if they own: (i) Hydraulic plants less than 1MW; (ii) Thermal treatment of domestic waste plants; (iii) Plants mainly using biogas made from waste of water treatment, between 500kW and 12MW; (iv) Plants using energy geothermal deposits; (v) Co-generation and heat plant using natural gas less than 1MW; (vi) Wind power plants with no aero-generator exceeding 3MW and under aero-generators.

For other types of plants, it will only be possible to apply for a feed-in premium contract through a competitive procedure. Fiscal advantages can be granted according to criteria such as the use of renewable energies. For instance, individuals undertaking restoration works in order to save energy can benefit from a tax credit.

Table 10 shows the overall and average unit support granted to the renewable technologies in the France **electricity sector** in 2014.

**Table 76.** Financial support to renewable technologies in France's electricity sector, 2014

<b>Technology</b>	<b>Total support (M€)</b>	<b>Average cost unit (€/MWh)</b>
<i>Photovoltaic</i>	2438.2	422.2
<i>Wind</i>	820.7	88.6
<i>Hydropower</i>	186.1	71.8
<i>Biomass</i>	158.1	133.3
<i>Biogas</i>	107.1	113.6
<i>Geothermal</i>	4.8	
<i>Waste (domestic)</i>	34	56.8
<i>All technologies</i>	3749.1	

On December 2016 the EC has approved four support measures for renewable electricity in France by granting a feed-in tariff or a top-up payment to the following installations:

- installations using energy extracted from geothermal deposits
- installations of less than 500 kW which use biogas produced by anaerobic digestion (i.e. gas produced from agricultural residues and organic waste)
- hydroelectric plants of less than 1 megawatt (MW)
- wind farms which submitted a complete aid application in 2016

The four schemes in question helped integrate renewable energy producers into the market in line with the aforementioned guidelines. Only small installations of less than 500 kW are eligible for feed-in tariffs. Installations of 500 kW or more will offer their electricity on the market and will receive support in the form of a premium on top of the market price (top-up payment), exposing them to market signals.

The measures also include monitoring arrangements to prevent the installations from receiving excessive compensation and to ensure that the aid granted is limited to the minimum necessary to achieve the objectives pursued. These aid schemes, with an estimated budget of EUR 7 681 million until 2042, will help France meet its objectives in terms of renewable energy by boosting renewable energy production capacity by some 2 148 MW. The four aid schemes are financed from the earmarked 'Energy Transition' account. This account was funded in 2016 by the domestic tax on final electricity consumption. From 1 January 2017, it will be financed by a share of the domestic tax on coal, brown coal and coke and a share of the proceeds of the domestic tax on the consumption of petroleum and similar products.

On September 2017 the EC has approved four schemes to support electricity production from onshore wind and solar on buildings and on the ground in France under EU state aid rules. The schemes will allow France to develop over 7 additional GW in renewable energy. The onshore wind scheme has a provisional budget of €188 million per year (or a total of €3.8 billion over 20 years) and the two solar schemes have a provisional budget of €232 million per year (or a total of €4.6 billion over 20 years). The last scheme will support both onshore wind and solar installations, with a provisional budget of €6 million per year (or a total of €124 million over 20 years). The beneficiaries of the aid will be selected through tenders to be organised between 2017 and 2020. The approved schemes consist of the following measures:

- An onshore wind support scheme which will grant support to 3 gigawatt of additional capacity over the next three years, taking the form of a premium on top of the market price (so-called "complément de rémunération") to operators of medium to large-scale onshore installations of more than 6 turbines, or with at least one turbine exceeding the limit of 3 megawatts.
- A solar support scheme for large-scale photovoltaic installations on buildings. Installations will receive a feed-in tariff (for installations between 100 and 500 kilowatts) or a feed-in premium (for installations comprised between 500 kilowatts and 8 megawatts) over twenty years.
- A solar support scheme for large-scale photovoltaic installations on the ground. The tender will grant support for up to 3 gigawatt of additional capacity, by means of a feed-in premium over twenty years.
- A support scheme for 200 megawatts of additional capacity, available to both onshore wind and solar installations not exceeding 18 megawatts.

Each scheme provides for a bonus to local projects or local participation in projects. The four schemes are accompanied by a detailed evaluation plan to assess their impact. The results of this evaluation will be submitted to the Commission in 2022, with an interim report to be submitted in 2018.

In France individuals have also access to some tax relief on their investment in renewables energy (for heating and cooling as well as electricity), through the Sustainable Development Tax Credit. In **heating/cooling sector** the measure enable tax payer to get a tax credit equivalent to their investment costs (minus the other local investment aid).

The maximum eligible costs are equal to 8 000 € for a single person and 16 000 € for a couple subject to joint taxation (plus 400 € per dependant). One of the objectives is to increase the performance and number of wood-fired heating (9 million dwellings), of heat pumps (2 million dwellings) and solar thermal equipment (4 million dwellings) by 2020. This objective is also supported by the availability of zero-rated eco-loan for works to improve the overall energy performance of housing.

Since 2009, investments in biomass boilers and heat pumps are also eligible for lower VAT rate for works in housing over two years old. Lower VAT rates are also available for district heating networks using over 50 % renewable or recovered energy.

The National Housing Agency supports thermal renovation in low/income households and a plan of renovation is also planned for social housing and public buildings until 2020. Launched in December 2008, the Heat Fund supports the development of the use of biomass (forestry, agriculture, production and thermal recovery of biogas, etc.), geothermal energy, heat pumps and solar thermal in the heating and cooling sector. The scheme aims at producing 5.5 Mtoe of heat between 2009 and 2020 and takes the form of a subsidy. Between 2009 and 2014, 1 280 M€ was allocated to the Fund.

To complete these schemes, an energy saving certificates system was launched in 2005, and revised in 2011. It obliged suppliers of electricity, gas, domestic fuel oil, LPG and heat or cold via networks to make energy savings. Then, they are awarded certificates that can be exchanged on a secondary market. At the end of a three-year period, the obliged parties have to present the right amount of certificates. In case of non-compliance, they face a 2 ct€ penalty per each kWh missing. The second period, which ran from January 2011 to December 2014, should make it possible to achieve energy savings of 460 TWh.

The Finance Act for 2005 introduced a fuel taxation system intended to promote the incorporation of biofuels used in **transport sector** to the level specified in Article L641-6 of the Energy Code. The French authorities Progress report on the promotion and use of energy from renewable sources Article 32 of the Act established a tax on the release for consumption of petrol, on the one hand, and diesel, on the other, based on the sale price excluding VAT.

In accordance with the annual targets set by France for the incorporation of biofuels, this General Tax on Polluting Activities (TGAP) is reduced in proportion to the volume of biofuels incorporated into fuels released for consumption.

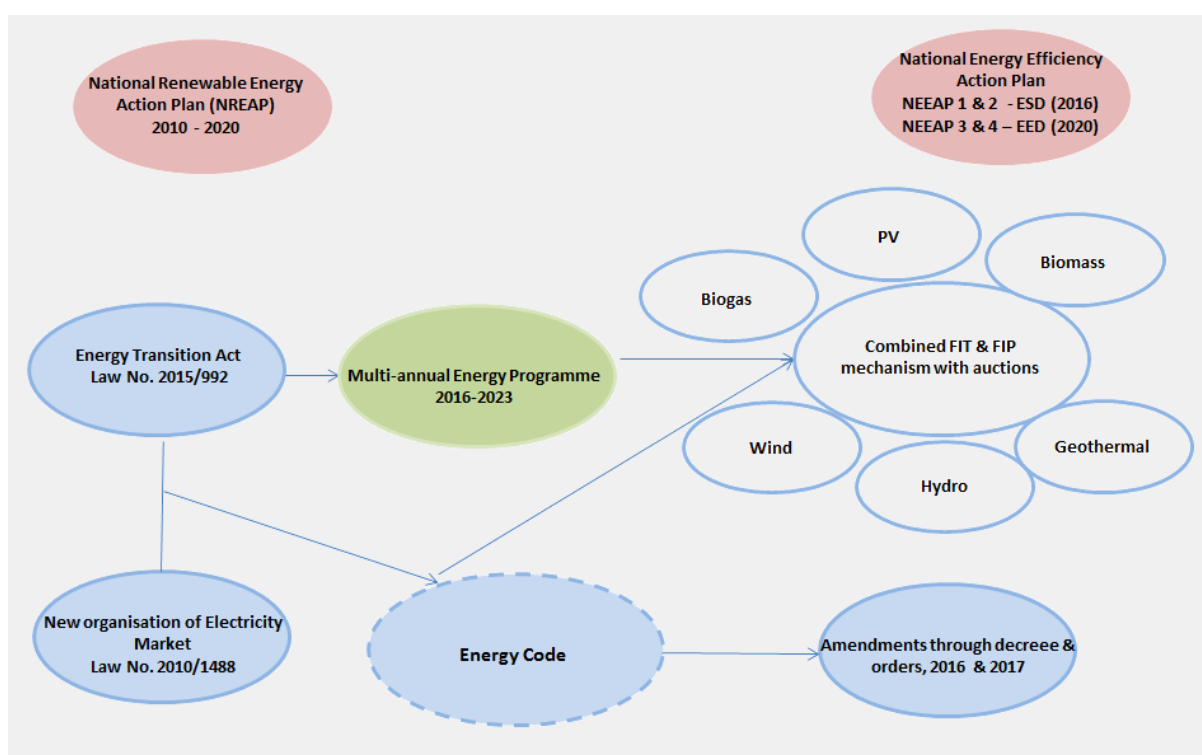
**Table 77.** Biofuels incorporation targets as percentage of energy, 2007-2014

	2007	2008	2009	2010	2011	2012	2013	2014
<i>Diesel</i>	3.5	5.75	6.25	7.0	7.0	7.0	7.0	7.7
<i>Petrol</i>	3.5	5.75	6.25	7.0	7.0	7.0	7.0	7.0

**Table 78.** Tax exemption rates for types of biofuels (€/hl), 2009-2015

	2009	2010	2011	2012	2013	2014	2015
ETBE <sup>105</sup>	21	18	14	14	14	8.25	7
Ethanol	21	18	14	18	18	8.25	7
VOME <sup>106</sup>	15	11	8	8	8	4.5	3
VOEE <sup>107</sup>	21	18	14	14	18	8.25	7
FAME & UCOME <sup>108</sup>	15	11	8	8	8	4.5	3
Synthesised biodiesel	15	11	8	8	8	4.5	3

Along with an obligation to sell at least 7 % and 7.7 % of biofuels in transport sector respectively with regard to the amount of petrol and diesel sold, biofuel consumption is also supported by several tax exemptions. For instance, the rate of the General Tax on Polluting Activities (TGAP) , tax applied to consumption of petrol and diesel, is reduced in proportion to the volume of biofuels incorporated into fuels released for consumption. Several biofuels are also partially exempted from the domestic consumption tax with exemptions between 3 and 7 €/hl in 2015.

**Figure 42.** Energy legislative landscape in France

Source: Authors work (Jégard M.)

<sup>(105)</sup> Ethyl tert-butyl ether (ETBE)

<sup>(106)</sup> Vegetable oil methyl ester (VOME)

<sup>(107)</sup> Vegetable oil ethyl esters (VOEE)

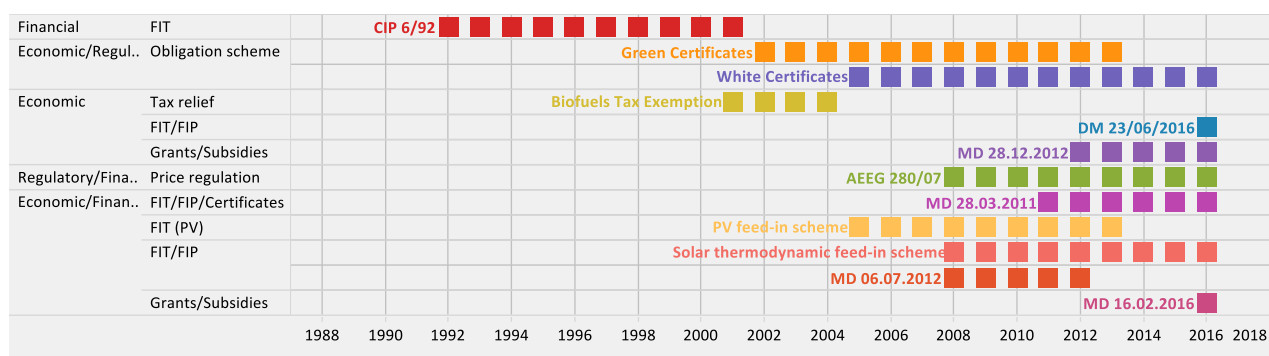
<sup>(108)</sup> Fatty acid methyl ester (FAME) and used cooking oil (UCOME)

### 6.2.11 Italy

Overall renewable energy share in Italy reached 17.53% in 2015 and 17.41% in 2016. Overall renewable energy share in Italy remained well above the NREAP and indicative trajectories throughout 2010-2016. In 2014 the achieved overall renewable energy share exceeded the 2020 target (17%) by 0.08 percentage points.

The Decree 6/1992, issued by the Inter-ministry Commission of Prices (CIP), establishes a feed-in tariff in Italy. The pre-determined price is updated yearly and is offered per every unit of electricity produced for a given period of time and introduced into the grid. The regulatory framework for energy in Italy is based on the Legislative Decree 79/99 that introduced the liberalisation of the electricity sector. From 2001 until 2013 Green Certificates scheme as well as an all-inclusive tariff (for installations with capacity up to 1 MW, 200 kW for wind turbines) was in place supporting renewable energy technologies (other than solar PV). From 2005 to 2013, there have been 5 different incentive programs in the solar PV Feed-in scheme (*Conto Energia*), each in overcoming, adjusting or redefining the previous one. The 5<sup>th</sup> energy bill ended on July 6, 2013 without the issuance of a new incentive plan for energy produced but replaced by tax breaks on plant cost. A premium tariff for 20 years was paid from the moment the plant becomes operational. Under Legislative Decree No 28/2011 plants (excluding solar) in operation since 2013 were supported by new incentives replacing the Green Certificates and the all-inclusive tariffs (in place from 2008 to 2012).

**Figure 43.** Main support framework for renewables in Italy, 1992-2016<sup>109</sup>



In 2012 entered in force a new law MD 6/07/2012 replacing existing support schemes for RES other than PV. This law kept feed in tariff and feed in premium mechanism, in addition introduced auction process and capacity quota to access the system. The Ministerial Decree of 6 July 2012 has established new types of incentives for electricity generation from renewable sources other than PV solar. The incentives under the Decree apply to installations that are: newly built, entirely rebuilt, reactivated, upgraded or renovated, commissioned from 1<sup>st</sup> January 2013. The Feed-in-tariff II scheme (Ritiro dedicato), in place since 2008 is the regulation for the sale of electricity in Italy rather than a "classical" feed-in tariff. The scheme supports RES except photovoltaics with a fixed feed-in tariff for plants with a capacity below 1 MW and a sliding feed-in premium for plants with a capacity above 1MW. DM 26/06/2016 is the scheme currently in place for RES non PV, it replaces the former scheme introducing simplifications for auction process and capacity quota access, includes new parameters for incentive calculations, especially for repowering-upgrade existing RES facilities.

The green certificate scheme as well as the all-inclusive tariff covered apart solar PV even other technologies (for installations with capacity up to 1 MW, 200 kW for wind turbines). The certificate scheme is completely ended in 2016 (it was closed to new applications in 2013). It was decided that plants which production was supported by the certificate scheme would be entitled to a support for the remaining period of entitlement. The incentive is computed as follow:  $I = K \cdot (180 - Re) \cdot 0.78$ , with K equal to the banding factors used previously and Re equal to the sales price in the previous year.

<sup>(109)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

**Table 79.** Banding Factors in the Italian Green Certificates System

Green Certificates System	Banding Factors <sup>110</sup>
<i>Wind</i>	1.0
<i>Offshore Wind</i>	1.5
<i>Geothermal</i>	0.9
<i>Wave and Tidal</i>	1.8
<i>Hydro</i>	1.0
<i>Biodegradable waste, biomass other than that included in the point below</i>	1.3
<i>Biomass and biogas produced by local agriculture or forestry</i>	1.8
<i>Landfill gas and residual gases from purification processes and biogas other than those included in the point above</i>	0.8

Over period 2010 – 2014 the following annual quotas and average prices of certificates for the electricity generated from renewable energy sources are applied (Table 81). The quotas saw the largest value in 2012 whereas the average price peaked in 2014.

**Table 80.** Annual Quotas and Average Prices of Certificates for Electricity from Renewable Sources in Italy, 2010-2014

Green Certificates System	2010	2011	2012	2013	2014
<i>Quotas (%)</i>	6.05	6.80	7.55	5.03	2.52
<i>Average Price (€)</i>	87.5	81.4	80.6	89.3	97.5

The following table gives the number of certificates exchanged (equivalent to the amount of generated electricity supported) and the indicative annual cost of the green certificates scheme (updated as of the 30th of September 2015).

**Table 81.** Number of Certificates Exchanged and Annual Cost of the Italian Green Certificates Scheme, 2010-2014

	No. GCs (1 000 MWh)	Indicative annual cost
<i>Hydropower</i>	8 115	790.6
<i>Wind Turbine</i>	14 121	1 375.7
<i>Wave and Tide</i>	0.013	0.0
<i>Geothermal</i>	1 243	121.1
<i>Biomass</i>	4 636	451.7
<i>Bio-liquids</i>	3 430	334.2
<i>Biogas</i>	855	83.4
<i>Overall Total</i>	<b>32 403</b>	<b>3 156.8</b>

The All-inclusive tariff (running in parallel of the certificate system) was open to plants with capacity of less than 1 MW (200 kW for wind power plants) between 2008 and 2012 (with an extension option for 2013 at lower tariff rates). The following tables present the overall support granted through this scheme from 2012 to 2014 and the tariffs applied in 2014.

**Table 82.** Power Off-Taken and Incentive Cost of the All-Inclusive Tariff in Italy for 2012, 2013 and 2014

	2012		2013		2014	
	Power Off Taken	Incentive Cost (M€) <sup>111</sup>	Power Off Taken	Incentive Cost	Power Off Taken	Incentive Cost (M€) <sup>111</sup>
<i>Pumped Storage</i>	1	0	6	1	7	1
<i>Conventional Hydro</i>	9	1	16	3	19	3
<i>Run-of-the-river</i>	868	124	1 473	227	1 808	298
<i>Conduit Hydro</i>	33	5	46	7	54	9
<i>Wind Turbines</i>	13	3	20	5	22	5
<i>Solid Biomass</i>	168	34	315	67	344	77
<i>Bio-liquids</i>	198	39	296	63	591	130
<i>Biogas</i>	2687	545	5 179	1 109	5 793	1 297
<i>Landfill Gas</i>	210	22	278	32	292	36
<i>Overall Total</i>	4 187	773	7629	1 514	8 921	1 858

<sup>(110)</sup> Number of certificates granted per MWh of renewable electricity produced.

<sup>(111)</sup> These values are obtained by deducting from the off-take cost of the supported power the revenue from the sale of the same power on the market.



**Table 83.** Support Level Granted by the All-Inclusive Tariff in Italy in 2014

<b>All-Inclusive FIT (IC<sup>112</sup> &lt; 1 MW)</b>	<b>Tariffs in 2014 (€/kWh)</b>
<i>Wind power for plants smaller than 200 kW</i>	0.30
<i>Geothermal</i>	0.20
<i>Wave and Tidal</i>	0.34
<i>Hydro</i>	0.22
<i>Biogas and biomass</i>	0.28
<i>Landfill gas and residual gases</i>	0.18

From 2013 onwards, new incentives replaced this combination. They apply now to newly built, entirely rebuilt, reactivated, upgraded or renovated, commissioned from January 1<sup>st</sup> of 2013. A ceiling of 5 800 M€ has been set for the annual cumulative cost of incentives. Thus, annual supported quotas are distributed according to type of source and plant by the mean of auctions. Self-consumed energy is not included in this scheme. The following table summarize the costs of this new incentive system introduced in 2013.

**Table 84.** Annual Supported Power and Incentive Cost in Italy for 2013 and 2014

	<b>2013</b>		<b>2014</b>	
	<b>Annual Supported Power (GWh)</b>	<b>Incentive Cost (M€)</b>	<b>Annual Supported Power (GWh)</b>	<b>Incentive Cost (M€)</b>
<i>Conventional Hydro</i>	0.1	0.0	4.0	-
<i>Run-of-the-river Hydro</i>	32.1	3.2	169.7	21.2
<i>Conduit Hydro</i>	1.8	0.1	7.6	1.1
<i>Onshore Wind Turbines</i>	7.4	0.6	371.4	28.5
<i>Geothermal</i>	-	-	153.3	1.8
<i>Biomass</i>	1.0	0.1	31.8	4.3
<i>Biogas</i>	5.4	0.3	98.3	14.6
<i>Landfill Gas</i>	-	-	1.1	0.0
<i>Overall Total</i>	47.8	4.4	837.2	71.6

Plants with a capacity of up to 1 MW can choose between a feed-in tariff and a feed-in premium. Plants with a capacity higher than 1 MW only have access to the feed-in premium. The premium is equal to the all-inclusive tariff minus the hour zone electricity price. It also has to be noted that the authority compensates for the work on the national transmission grid and insure return on the investment for developing and operating the system to promote the off-taking of renewable energy technologies.

Updated incentives under green certificate scheme, all-inclusive scheme, CIP 6, DM 6/7/2012 and DM 26/6/2016 are shown in table

**Table 85.** Incentives to support renewables in Italy – updated 31/12/2017

	<b>GCs ( M€)</b>	<b>All inclusive ( M€)</b>	<b>CIP 6</b>	<b>DM 6/7/2012</b>	<b>DM 26/6/2016</b>
<i>Hydropower</i>	625.4	261.3		101.7	21
<i>Wind</i>	1275.7	5.2	0.9	169.2	31.2
<i>Geothermal</i>	93.3			16.9	
<i>Biomass</i>	424.5	77.4	73,9	42.7	15.9
<i>Bioliquid</i>	404.5	158.6			0.3
<i>Biogas</i>	71.2	1367.1	0.7	68.8	13.1
<i>Overall Total</i>	2948.8	1869.6	75.4	399.3	81.5

The main national schemes promoting the use of renewable energy sources in **heating/cooling** sector are the White Certificates (or Energy Efficiency Securities), the Thermal Account (Conto Termico) and Tax Deductions. Introduced in 2004, the Energy Efficiency Securities program set national targets for energy reduction in heating/cooling. The Thermal Account<sup>113</sup> scheme helps the technological turnover within heating systems. This support scheme helps the replacement of existing outdated heating and cooling systems fed with biomass and heating oil with high performing renewable energy devices (both boilers and stoves). The Thermal Account scheme is

<sup>(112)</sup> Installed Capacity

<sup>(113)</sup> Thermal Account 1 (MD 28.12.2012) and Thermal Account 2 (MD 16.02.2016)

based on a supply-chain approach to guarantee efficiency and low emissions. These objectives are distributed among large electricity and natural gas distributors (those with more than 50 000 final customers). Then they can either choose to implement efficiency projects or buy energy efficiency credit TEE (Titolo Efficienza Energetica or white certificates) to other entities. The interventions eligible in this scheme can include the following technologies: solar collectors, aerothermal heat pumps, small CHP units, etc.

**Table 86.** Levels of Electricity and Gas Saved through the Energy Efficiency Securities Program, 2010-2014

Objectives	2010	2011	2012	2013	2014
<i>Electricity Saved</i>	2.4	3.1	3.5	3.03	3.71
<i>Gas Saved</i>	1.9	2.2	2.5	2.48	3.04

To make obliged entities able to regain the charges, it was decided to include a recovery component in electricity and gas tariffs. This contribution evolved as follow: 92.22 €/toe in 2010, 93.68 €/toe in 2011, 86.98 €/toe in 2012, 110.27 €/toe in 2013 and 105.83 €/toe in 2014. The following table displays the average prices (surveyed among bilateral exchange) and the annual support for the technologies included in the scheme.

**Table 87.** Certificates Prices and Support by Technologies from the Energy Efficiency Securities Program, 2010-2014

	2010	2011	2012	2013	2014
<i>Average price of the certificates (€)</i>	85.14	95.49	92.88	101.41	108.18
<i>Solar collectors (€)</i>	3 195 730	4 141 497	21 880 578	2 034 082	1 021 03
<i>Electrical heat pumps (€)</i>	4 421	25 687	37 988	1 521	2 380
<i>Small CHP for space H&amp;C (€)</i>	219 917	2 026 011	1 151 433	1 781 46	1 076 961
<i>District heating systems (€)</i>	1 705 184	20 252 570	5 649 519	19 894 005	10 832 141 €
<i>Centralised H&amp;C systems (€)</i>	596 831	1 023 366	2 903 893	7 166 340	9 433 985
<i>New installation of single-household heating equipment fuelled by woody biomass with power output of up to 35 thermal kW (€)</i>				161 242	391 839
<i>Installation of heating equipment fuelled by woody biomass in greenhouse agriculture (€)</i>				23 527	3 702 669

In the case of buildings renovation, taxpayers also benefit from tax relief up to 36 % of the costs they incurred before June 2012 (up to a maximum relief of 48 000 €) and 50 % of the costs incurred between June 2012 and December 2015 (up to 96 000 €). Different types of work are eligible for this relief, such as the installing of PV systems, containing noise pollution, achieving energy savings. Tax reductions are also available for energy efficiency improvements in buildings. Up to 65 % of expenditure incurred from June 2013 to December 2015 can be deducted for taxpayers owning a building (36 % thereafter). The improvements eligible are: the replacement of heating systems by efficient heat pumps of geothermal heaters (30 000 € maximum deduction), installation solar panel to produce industrial or domestic hot water (60 000 € maximum deduction), installation of vertical opaque structures, horizontal opaque structures or windows, including blinds or shutters (60 00 € maximum deduction) and projects decreasing annual primary energy demand for heating by at least 20 % (100 000 € maximum deduction). For the installation of solar panels for hot water production, 194.0 M€ were deducted in 2010, 115.6 M€ in 2011, 88.0 M€ in 2012 and 106.0 M€ in 2016. For the replacement of space heating systems, 91.7 M€ were deducted in 2010, 55.9 M€ in 2011, 62.7 M€ in 2012 and 92.8 M€ (these estimates are limited to the use of RES systems).

Since 2012, small-scale renewable thermal energy production and energy efficiency projects are granted an incentive proportionate to the amount of renewable thermal energy production or energy saving achieved (200 M€ planned for actions in public administrations and 700 M€ for private parties). This scheme is called the Thermal Account and in 2013-2014, 23.80 M€ were already granted through direct access (7 720 contracts). A National Energy Efficiency Fund, launched in 2014, also aims at achieving national efficiency targets by involving national and EU financial institutes. Among its various objectives are the development of district heating and district cooling networks, the improvement of energy efficiency in residential buildings, public services and infrastructure and in the industry and services sector.

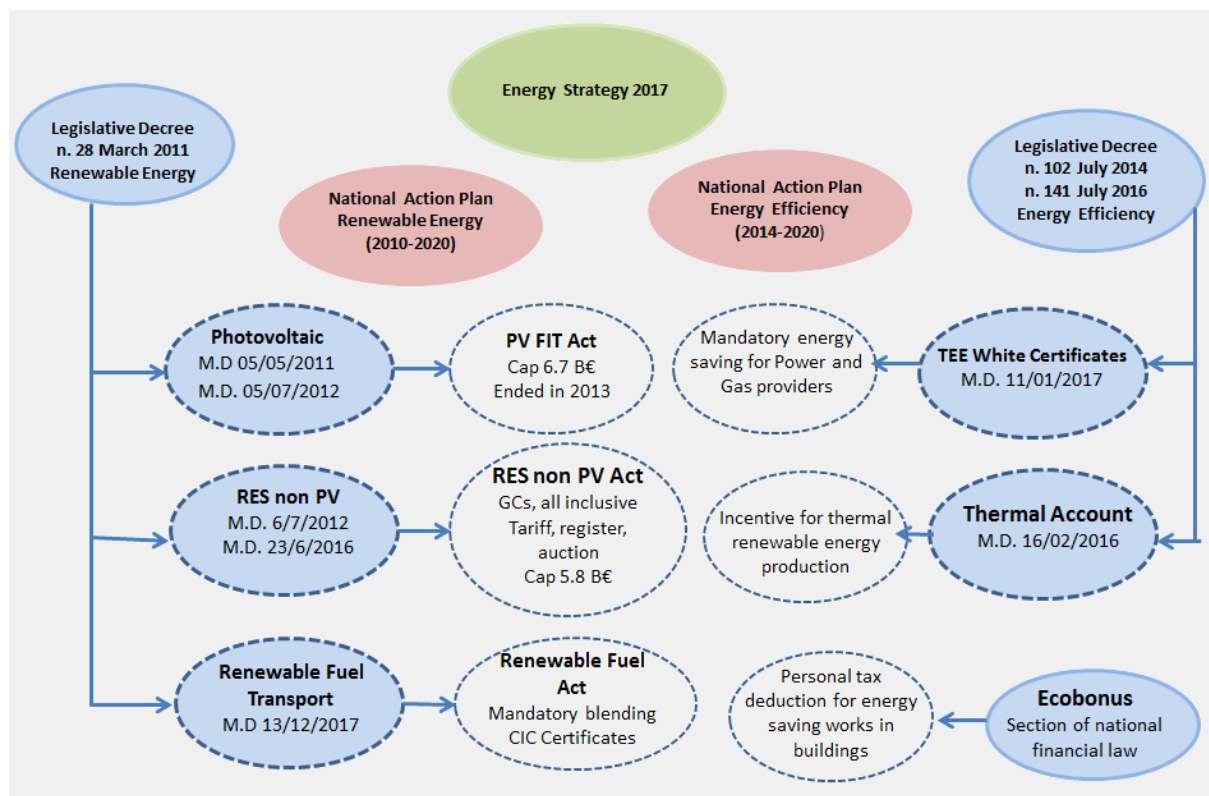
Suppliers of petrol and diesel from fossil sources used in the **transport** sector are subjects to a compulsory minimum share of biofuel released. A system has been put in place that allows parties to fulfil this obligation by purchasing part of the required biofuel share to other fuel suppliers. The obligatory share was 3.5 % in 2010, 4.0 % in 2011 and 4.5 % in 2012, 2013 and 2014.

In April 2016 the EC assessed and authorised the support scheme for renewable energy in Italy. The scheme authorised lasted until the end of 2016. All renewable energy technologies benefited from the scheme, except solar power. According to Italy, solar power is already competitive on the Italian market without the need for direct support to the electricity produced, as confirmed by the significant generation capacity deployed in recent years without such support. The type of support renewable energy projects can receive under the scheme depends on their size:

- large projects > 5 MW of installed power competed in tenders specific for each technology;
- medium size projects 0.5 MW - 5 MW entered a list specific for each technology, and were a prioritised subject to set criteria in order to receive support;
- projects < 0.5 MW had direct access to aid upon request.

Only small installations benefited from feed-in tariffs, whilst larger installations received support through a premium, i.e. a top-up on the market price, which exposes these renewable energy sources to market signals. The scheme supported also the refurbishing of existing generators of any size, for example to increase their efficiency or extend their operational lifetime. On 1<sup>st</sup> of March 2018 European Commission approves €4.7 billion public support scheme for advanced biomethane and biofuels in Italy (ECPressRelease, 2018)

**Figure 44.** Energy legislative landscape in Italy



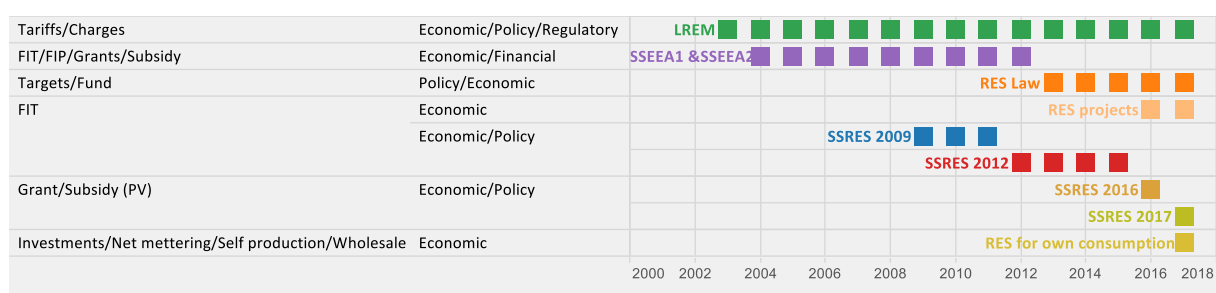
Source: Authors work (Motola V.)

## 6.2.12 Cyprus

Overall renewable energy share in Cyprus reached 9.38% in 2015 and 9.35% in 2016. The 2020 target that Cyprus has to reach for the overall RES share is 13%. Overall renewable energy share in Cyprus was above both the NREAP and indicative trajectories from 2013 to 2015 only. It missed the plan in 2016. Renewable energy share in the electricity is currently growing faster than planned, but heating/cooling and transport sectors lag behind the plans.

In Cyprus the Law Regulating the Electricity Market (LREM) came into force in 2003. The purpose of this law was to implement European Union Directives 96/92/EC and 2003/54/EC. From 2004 to 2012 the schemes (SSEEA1 and SSEEA2) supported projects and investments to increase energy efficiency and the use of renewable energy. SSEEA1 applied to natural persons and public entities whereas SSEEA2 covered legal persons and commercial public entities. In 2009 the Support Scheme for Electricity Generation from Renewables (SSRES) entered into force. The support was dedicated to bioenergy, solar and wind. The scheme aimed to incentivise renewable electricity generation through a premium tariff. The Cypriot power company (EAC) purchases every kWh of generated electricity from the plant operators at the market price. The Special Fund for RES and Energy Efficiency pays a bonus on top of the market price. Installations of on-grid PV (up to 150 kW) under this programme were capped at 25.45 MW and for wind power at 10 MW. Applications to benefit from the programme closed on 31 October 2012. In addition SSRES 2012 also encouraged renewable electricity generation through tenders. The call for applications ended on 3 September 2012. In 2016 the Support Scheme for Electricity Generation from Renewables (SSRES) (Vulnerable groups) was in place.

**Figure 45.** Main support for renewables in Cyprus, 2003-2017<sup>114</sup>



From 2010 to 2014, support for the renewable **electricity** sector in Cyprus went through a system of subsidies and net metering system. During the period 2013-2014 the following were implemented for the first time:

- The net metering system under the operating framework of the scheme 'Solar Energy for All', also designed to support dispersed power generation. This scheme also benefits vulnerable electricity consumers who receive a subsidy for part of the costs (about 50%).
- Support for installation of photovoltaic systems for the purposes of self-production/consumption for enterprises under the 'Solar Energy for All' scheme.
- Tenders for the installation of photovoltaic systems with total capacity of 50MW (31 January 2013).
- Provision of urban planning incentive grants for installation of RES systems in different types of development.
- Completion of the process of installing charging stations for electric vehicles by the DSO.

Given developments due to the economic recession, the restructuring of the energy sector in the Republic of Cyprus as a result of the discovery of indigenous hydrocarbon resources, as well as the framing of EC joint strategy for Energy and Climate Change, it became clear in 2015 that it was necessary to update that part of the NAP concerned with electricity generation in order to ensure that national objectives are achieved in the most economical manner. The update of the National Action Plan (NAP) section pertaining to electricity generation was approved by the Council of Ministers on 16 February 2016 under Decision No 80.240. The report took into account the results of several recent studies, as well as current policy and strategic factors including:

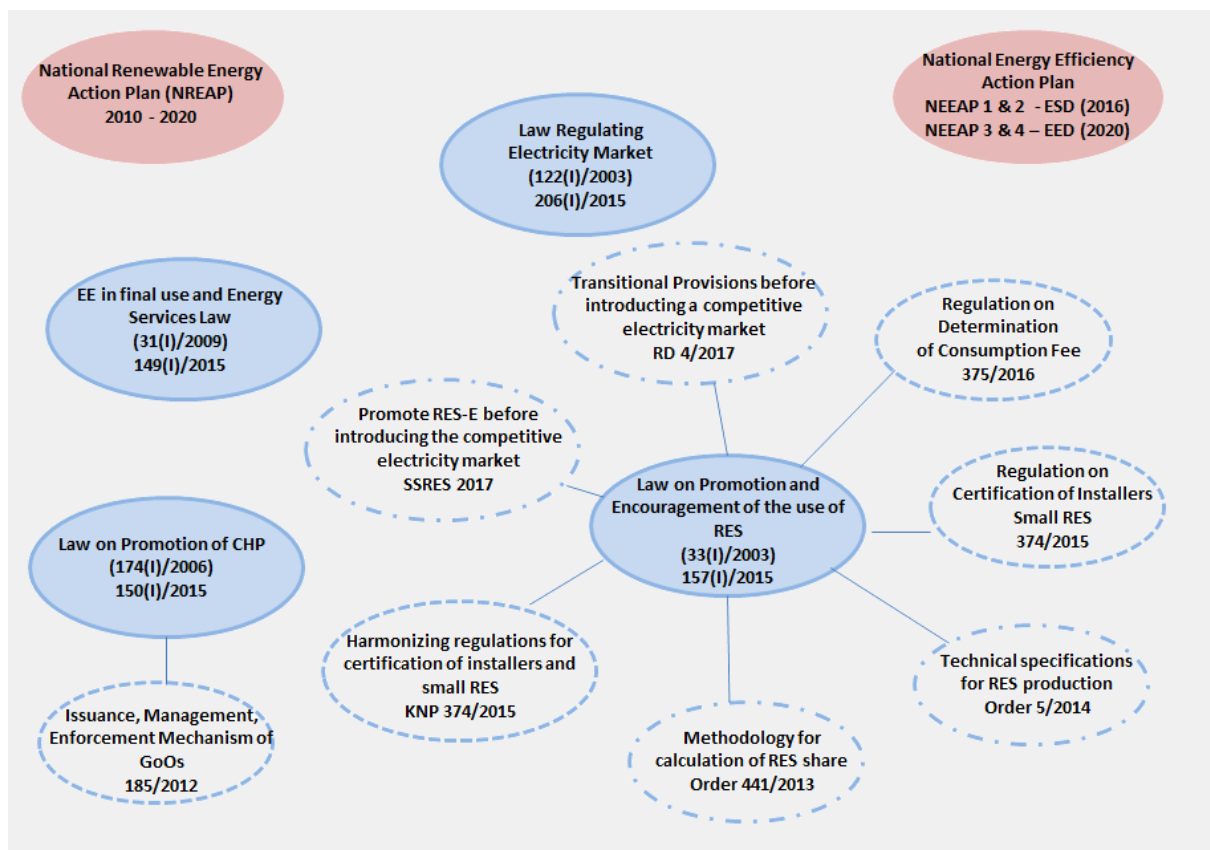
<sup>(114)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

- EU guidelines on state subsidies in the fields of environment and energy for the years 2014-2020, on the basis of which Council of Ministers Decision No 78.656 of 15 April 2015 was made, whereby support schemes providing guaranteed long-term subsidy prices were abolished.
- The significant reduction in electricity consumption in recent years due to the economic recession, which largely overturned the official forecasts that were used in preparation of the existing NAP for the period up to 2020,
- The proposed amendment to the electricity market rules which will permit the participation of RES in the competitive market for electricity from 2018-2019 onwards, and
- The potential introduction of natural gas, primarily as fuel for electricity generation.
- The new strategic plan for the use of renewable and alternative fuels in transport, which is based on three basic elements: (i) integrated use of electric vehicles in transport; (ii) the use of natural gas and (iii) the use of biofuels.

The following 5 support schemes were implemented in the period 2013-2014:

- Support schemes for financial incentives in the form of government grants and/or subsidies in the sector to encourage the use of renewable energy sources and energy saving. The scheme ended on 31 December 2013.
- Charges for ancillary services, network use and other services imposed by the network for the wider application of the net metering system for electricity generated by photovoltaic systems installed in residences (CERA Decision 909/2013).
- Charges for ancillary services, network use and other services imposed by the network for the wider application of the direct self-consumption system generated with use of photovoltaic systems in industrial and commercial facilities (CERA Decision 919/2013).
- Provision of support for investments to improve competitiveness and management of waste in farms.
- The 'Solar Energy for All' scheme.

**Figure 46.** Energy legislative landscape in Cyprus



Source: Authors work (Banja M.)

Under the feed-in tariff scheme the applications will be accepted from 16 October 2017 until 16 April 2018 or until the capacity defined for each renewable technology is reached.

The following table shows the level of investments for electricity generation for investors engaged and not engaged in an economic activity in 2014.

**Table 88.** Level of investment support in electricity generation for investors not & engaged in an economic activity

		% of eligible budget	Max subsidy/project
	<i>Support for natural persons and organisations not engaged in an economic activity</i>		
Wind	Small-scale wind farms (IC < 30 kW)	55 %	50 000 €
PV	Small-scale PV systems (IC < 20 kW), connected to the grid	18.3 c€/kWh	
PV	Small domestic PV (IC<3 kW) on houses roofs of vulnerable groups of domestic consumers and with "net-metering" method	900 € per unit	
PV	Stand-alone PV (IC<7 kW).	55 %	20 000 €
	<i>Support scheme for natural persons and organisations engaged in an economic activity</i>		
Wind	Small-scale wind farms (IC < 30 kW)	15-35 %	15 000 €
Wind	Wind turbines pumping water (IC < 30 kW)	15-35 %	15 000 €
PV	Stand-alone PV (IC<20 kW).	35-40 %	15 000 €
PV	Stand-alone PV systems to pump water (IC < 20 kW)	35-40 %	15 000 €
Hydro	Small hydro projects in rivers, waterways in general and plumbing networks		

In the **heating and cooling sector**, several types of installations can benefit from investment grants. Solar installations are eligible to a 45 % subsidy (up to 20 000 €) for new installation or replacement of central active domestic hot water systems and a 55 % subsidy for investments in heating and cooling systems (max. 15 000 €).

**Table 89.** Level of Investment Support in Heating Generation for Investors Not Engaged in an Economic Activity

			% of eligible	Max
Support scheme for natural persons, legal entities and public sector agencies <u>not engaged in an economic activity</u>				
Solar	Central active domestic hot water	IC<2 560 W	45 %	20 000 €
	Heating systems		55 %	15 000 €
	Heating and cooling systems		55 %	50 000 €
	For the replacement of residential solar systems: 175 to 345 € per unit			
Biomass	Central heating/cooling systems		55%	19 000 €
Heat pump with geothermal heat exchanger	For private residential heating/cooling		55 %	20 000 €
	For non-profit organisations, municipalities, communities, churches, monasteries, associations and		40 %	50 000 €
CHP	Cogeneration of electricity – heating/cooling		30 %	160 000 €
	Support scheme for natural persons, legal entities and public sector agencies <u>engaged in an economic activity</u>			
Solar	Central active domestic hot water system		IC>2 560 W	15 %
Solar heating and cooling systems			15-30 %	75 000 €
Heat pump with geothermal heat exchanger for heating/cooling			15-35 %	100 000 €
Biomass	District heating and or cooling		15-35 %	200 000 €
	Heating and cooling			
Cogeneration of electricity and heating and cooling				
Production of biofuels for transport/district heating and/or cooling			15-35 %	200 000 €
CHP	Cogeneration of electricity – heating/cooling		15-30 %	100 000 €

Natural and legal persons can access grants for the production of biofuels for **transport** or district **heating and cooling**. This grant is equal to 15 %, 25 % of 35 % of the eligible expenses with a maximum subsidy equal to 200 000 €.

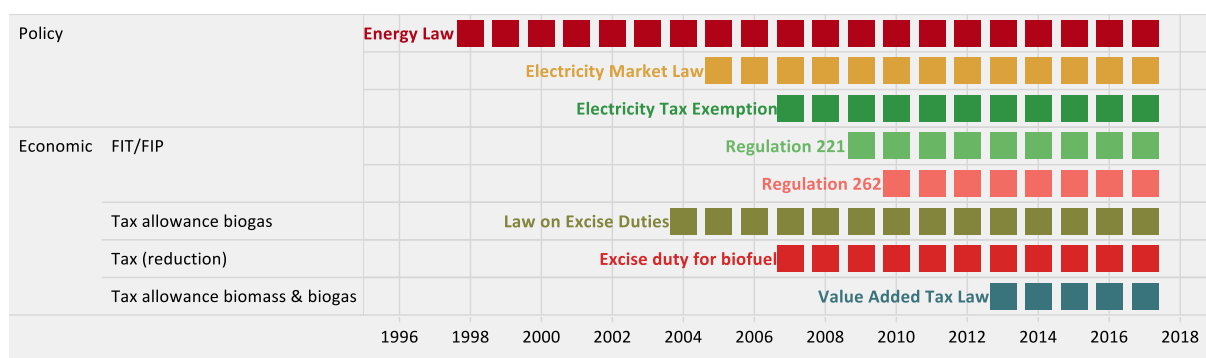
Since 2013, the purchase of a hybrid/fuel flexible car or an electric car is eligible to a subsidy of up to 1 200 € and 700 €. The production of biogas for transport is also supported by a subsidy between 15 and 35 % of the eligible budget up to a maximum of 300 000 €.

### 6.2.13 Latvia

Overall renewable energy share in Latvia reached 37.56% in 2016 and 37.16% in 2016. The 2020 NREAP target that Latvia has to reach for the overall renewable energy share is 40%. Overall renewable energy share in Latvia remained above both the flattened NREAP and indicative trajectories between 2012 and 2016 and the country is on track for the 2020 target. However, the slight slowdown in renewable energy deployment in 2014 and 2016 might mean that Latvia will need to make more efforts to stay on course for the 2020 target.

The Latvian state regulates the electricity sector via two general laws, the Energy Law (1998) and the Electricity Market Law (2005). The latter law sets up the support systems for electricity production in cogeneration, from RES and by prosumers in a general manner, and the support is detailed in government regulations. The feed-in tariff system to support electricity production from RES and cogeneration is implemented via two regulations – one on electricity generation and price setting for electricity from cogeneration (No. 221), which was valid since 18 March 2009, and another on electricity generation from RES and price setting (No. 262), which came into force on 1 April 2010. The currently applicable versions of Cabinet Regulations No 221 and 262 stipulate that until 1 January 2020, no new producers can qualify for the aid (to obtain the right to sell electricity under the mandatory procurement and to obtain the right to receive the guaranteed payment for the installed electrical capacity at a power plant). The support mechanism implemented in the form of mandatory electricity procurement or guaranteed payment for the installed capacity has been suspended. At the same time, the moratorium which will be applicable until 2020 does not affect the economic operators already operating within the support mechanism.

**Figure 47.** Main support for renewables in Latvia, 1998-2017<sup>115</sup>



In Latvia, **electricity** generation from renewable energy sources is supported since 2007 by the mean of a feed-in-tariff along with a mandatory procurement (compulsory purchase of electricity generated from renewable sources of energy). In total for 2011 and 2012 the support for the mandatory procurement for electricity from RES reached 58.33 M€. The support above the market price for hydropower technology reached 13.198 M€, for wind power 6.853 M€, for biomass 6.402 M€ and for biogas 31.876 M€. The Latvian government, however, put the support system on hold by amending the above mentioned regulations, for RES in mid-2011, and for cogeneration in the second part of 2012. Since July 2014 and until January 2020, no new renewable electricity producer can enter the support scheme. It should also be mentioned that in Latvia, electricity produced from renewable energy sources is exempted from the electricity tax.

**Table 90.** Average price of electricity from RES under the mandatory procurement procedure<sup>116</sup>

Technology	2011 (LVL/MWh)	2012 (LVL/MWh)	2013 (€/MWh)	2014 (€/MWh)
Hydropower	9.34	9.43	180.69	180.15
Wind power	3.71	4.21	106.90	107.29
Biomass	8.29	9.76	175.14	168.54
Biogas	9.49	10.40	189.28	185.94
Average	7.75	8.76	169.98	170.34

<sup>(115)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

<sup>(116)</sup> For years 2011 & 2012 the average support per unit above the market price is reported



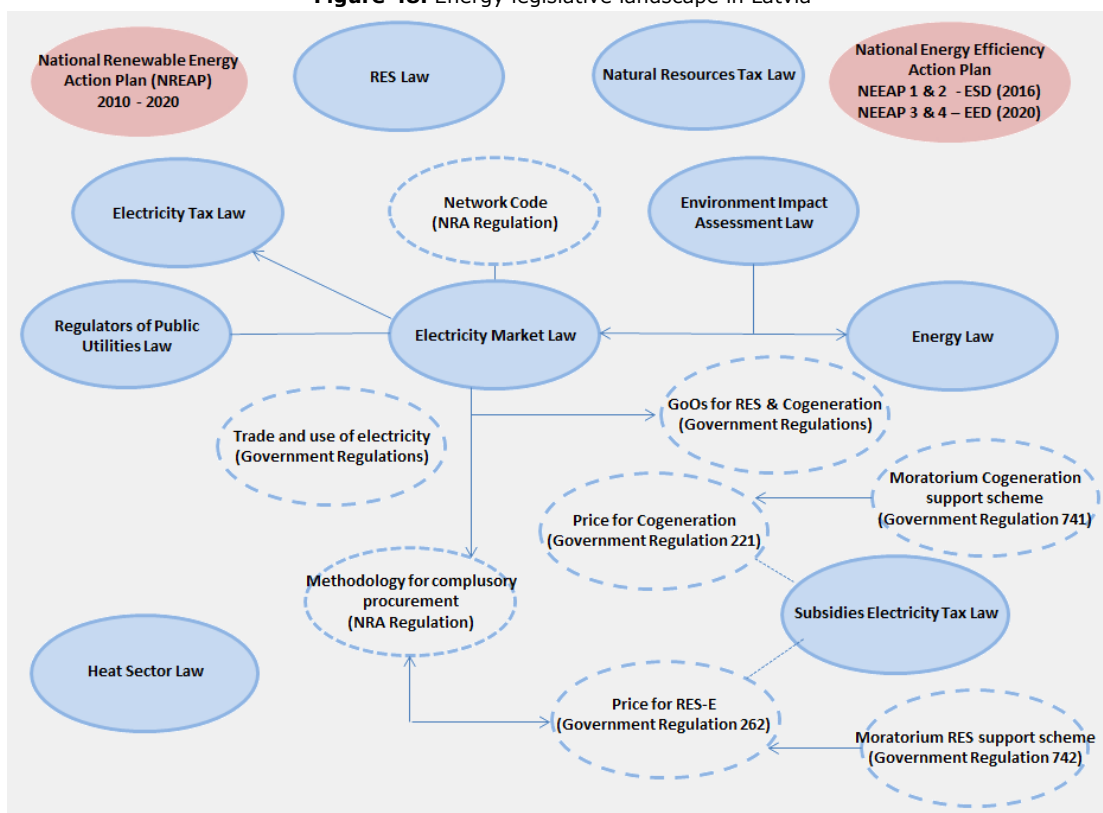
Since 1 January 2014 net-metering of electricity produced and fed-in to the grid through a small-scale connection ( $\leq 3 \times 16A$ ) is introduced. There is no direct financial compensation for the injected electricity, but the financial equivalent of the injected kW is deducted from the overall electricity bill. If an installation feeds more electricity into the grid than it has taken from the grid during a billing period, this amount will be transferred to the next billing period.

In the electricity sector support was granted through the Latvian Rural Development Programme for the period from 2007 to 2013 with the measure "Energy generation from biomass of agricultural and forestry origin". It encompassed an installed capacity of approximately 40 MW and supported operators generating energy from biomass of agricultural and forestry origin and expecting to sell the electricity produced in the form of biogas cogeneration. Latvia also benefited from the Norwegian Financial Mechanism for the period from 2009 to 2014 with the programme "Green Industry Innovation". The total funding of this program was 12 586 667 €. The Norwegian Financial Mechanism financed 11 328 000 € and the Latvian State 1 258 667 €. The program "National Climate Policy" of the European Economic Area (EEA) Financial Mechanism, which ran from 2009 to 2014, reached a total funding of 11 205 406 €. The EEA Financial Mechanism co-financed 10 365 000 € and the Latvian State 840 406 €.

Investments in **heating and cooling** have been supported through the EU Structural Funds 2007-2013. Its budget was 24.4 M€ and projects were funded to at least 25 % of all eligible expenditure, for an amount of support comprised between 140 657 € and 5.6 M€. Support could be received for the installation of new CHP stations and for the conversion of existing boilers into CHP installations. Measures were also launched to enhance the efficiency of district heating systems (through the Operational Programme "Infrastructure and Services" of the Cohesion Fund).

With regard to the **transport** sector, suppliers of road fuels are subjects to a blending obligation. This obligation exists since 2009 and is equal to 4.5 % to 5 % depending on the class of the fuel. Biofuels of different types can also benefit from tax exemption. With regard to the excise tax on fuels, unleaded petrol with a bioethanol component (bio-component of 85%, i.e. E85) receive a lower rate resulting in a 70.00 % fiscal advantage compared to basic unleaded petrol. Biodiesel with a 30 % share of bio-component (B30) benefits from a 29.91 % fiscal advantage. For diesel only made of bio-diesel the fiscal advantage is equal to 100 %.

**Figure 48.** Energy legislative landscape in Latvia<sup>117</sup>



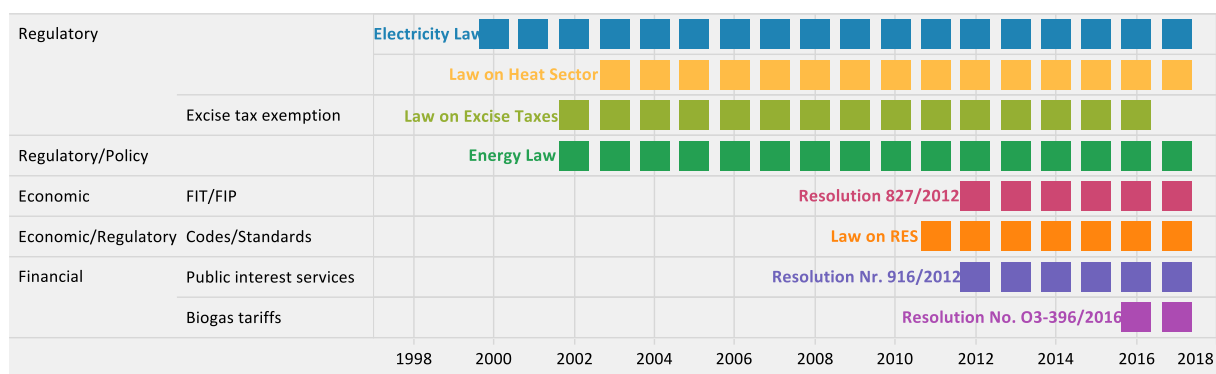
<sup>(117)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.14 Lithuania

Overall renewable energy share in Lithuania reached 25.75% in 2015 and 25.58% in 2016. Overall renewable energy share in Lithuania remained well above the NREAP and indicative trajectories throughout 2010-2016. In 2015 it exceeded the 2020 planned overall renewable energy share of 24%. Growth was faster only in the heating/cooling sector (+16.5 percentage points above 2016 plan), whereas the other two sectors experienced slower than planned deployment of renewable energy.

In Lithuania renewable energy is supported mainly by the Law on Electricity<sup>118</sup> of 2000 (regulates generation, transmission, distribution and supply of electricity in the state), the Law on Energy of 2002 (that regulates general energy activities by establishing the role of the energy regulator, government and related ministries), the Law on Energy from Renewable Sources<sup>119</sup> of 2011 (that outlines how Lithuania will meet its binding renewable energy targets for 2020, establishing the legal and administrative framework for renewable support), the Law on Heat Sector<sup>120</sup> of 2003 (that promotes cogeneration of heat and electricity and generation of heat from various renewable energy sources).

**Figure 49.** Main support for renewables in Lithuania, 2000-2017<sup>121</sup>



According to the Article 3(2) of the Law on Energy from Renewable Sources incentive measures include the following: (i) fixed rate; (ii) buying-in of energy from renewable energy sources; (iii) compensation of grid connection costs for facilities using renewable energy resources; (iv) reservation of grid or system capacity and throughput or other relevant technical parameters for connecting facilities using renewable energy resources; (v) priority transport of energy generated from renewable energy sources; (vi) exemption of electricity producers from the responsibility to balance electricity produced and/or to reserve power plant capacity during the promotional period.

The Law on Energy from Renewable Sources introduced a cap on feed-in premium payments for each eligible technology. This means that until 2020 only a limited amount of electricity produced with a particular technology will be supported through the feed-in premium scheme: for wind power plants 500 MW; for solar photovoltaic 10 MW (excluding plants of up to 30kW authorised to expand electricity generation capacity according to the applications submitted on 31<sup>st</sup> of December 2012 at the latest); for hydropower 128 MW; for biogas and biomass 105 MW.

Between 2010 and 2014, **electricity** generation from renewable sources of energy was supported by the mean of a guaranteed purchase tariff in Lithuania (tendering system). Since 2012, this support is distributed following quotas and through auctions for installations with an installed capacity higher than 10 kW. The national regulator set a maximum allowance and the successful bidder is the one who indicate the lowest fixed rate given the largest installed capacity of the group of power installations is not higher than 40 % of the maximum allowance of capacity for this

<sup>(118)</sup> Amendments: 20 December 2000; 26 June 2001; 1 July 2004; 19 March 2009; 15 July 2009; 22 December 2009; 17 January 2012; 21 June 2012; 17 January 2013

<sup>(119)</sup> Amendments: 22 May 2012; 21 June 2012; 17 January 2013; 30 May 2013; 2 July 2013

<sup>(120)</sup> Amendments: 20 November 2007; 12 January 2009; 12 May 2009; 21 December 2009; 1 June 2010; 29 September 2011; 11 October 2011; 28 June 2012; 6 November 2012; 17 January 2013; 14 March 2013; 2 July 2013

<sup>(121)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

region. A sliding feed-in premium is applied for installed capacities less than 10 kW with an eligibility period of 10 years.

Investment in renewable electricity generation is also granted through subsidies. For instance new producers were granted reductions of cost for the connection to an electricity distribution network. Levels of reduction depend on the installed capacity of the plant. If the capacity of the power plant being connected is less than 30 kW, a 100 % reduction of connection costs is granted. If the capacity is comprised between 30 and 350 kW, the producer will only pay 20 % of the connection costs and if the capacity is higher than 350 kW, the producer will pay 40 % of the connection costs.

**Table 91.** Auction quotas for the support of renewable energy production in Lithuania

	<b>Auction Quota</b>
<i>Wind Power Plants</i>	260 MW
<i>PV</i>	10 MW
<i>Hydro</i>	14 MW
<i>Liquid and Solid Biofuels</i>	230 MW
<i>Biogas</i>	75 MW

Also the Lithuanian Environmental Investment Fund (LAAIF) grants support to installation when the installed capacity of the power plant is up to 250 kW. In 2010, it granted support to six wind power plant up to a supported capacity of 1 500 MW. This support amounted to 759 738 €. In 2011, it also supported the installation of a PV power plant (with a capacity of 0.015 MW) up to an amount of 31 227 €.

Law on Heat Sector (2015, Nr. 19370) sets out rules for state control over the **heating/cooling** sector, activities of heat plant operators, their relations with heat consumers, and their responsibilities. The financial support in this sector is also given from the LAAIF fund. From 2007 to 2013, the LAAIF fund financed the installation of biofuel boilers in public and residential buildings (2 biofuel-burning boiler-houses for a total installed capacity of 0.16 MW and a support of 20 935 € in 2011 and three in 2012 for a total capacity of 23.75 MW and a support of 449 125 €). In 2013 support was granted for the installation of biofuel boilers of the capacity of up to 10 MW for district heating.

Since 2007, the EU structural assistance also supported the use of renewable energies in the heating and cooling sector. In 2013 and 2014, 18 127 147.90 € were granted for the measure "Use of renewable energy sources in energy production" (projects selected through competitive bidding) and 1 882 530.13 € for the measure "Use of renewable energy sources for energy production" (projects selected through state planning). The projects supported were mainly the installation of systems using biomass.

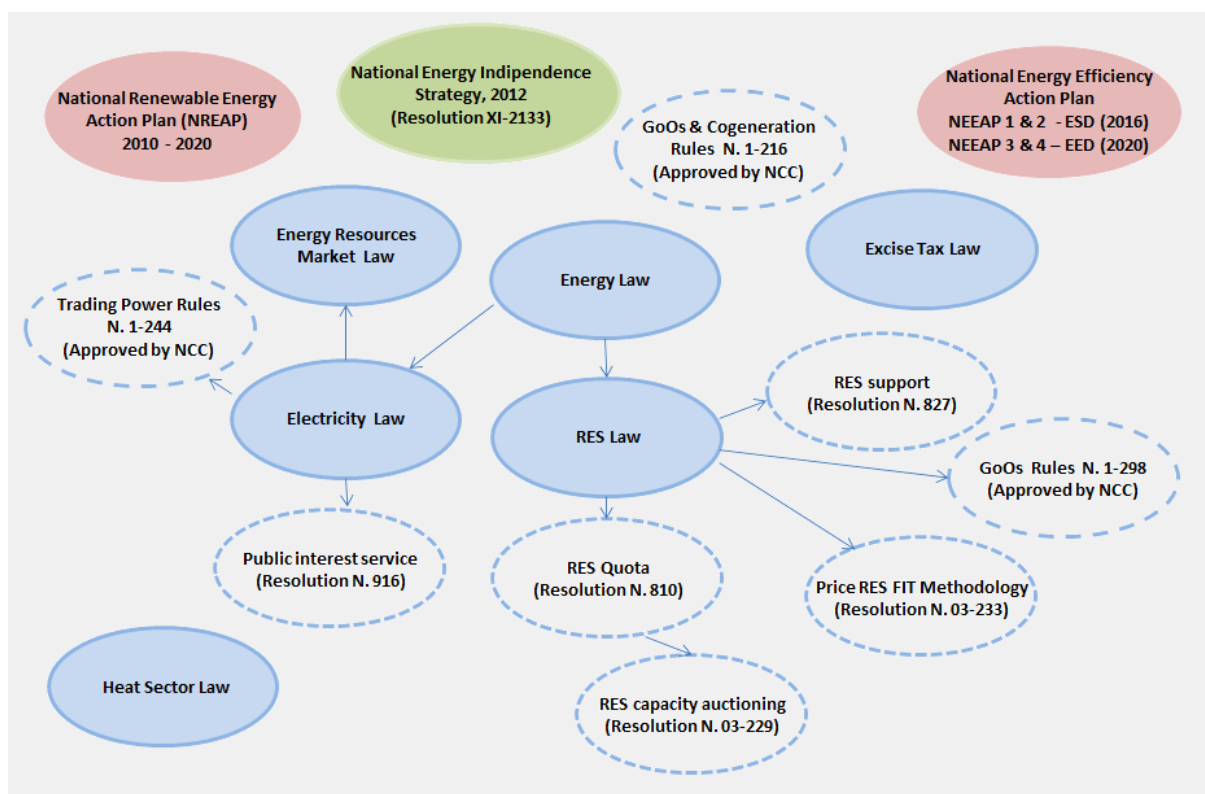
In the **transport** sector the use of biofuels is supported through a pollution tax concession. Natural and legal people using vehicles powered by biofuels (meeting relevant standard) are exempted from pollution tax. It is also the case for natural and legal persons using biofuel in stationary sources of pollution for the pollutant emissions generated from the use of biofuels. Fuel suppliers are also subjects to a blending obligation.

The compulsory rate of blending is 2 % for petrol fuels and 5.75 % for diesels. Biofuels also benefit from reduced excise rates. Indeed, for eligible fuels in which the share of additives of biological origin is 30 % or higher, the rate of excise duty set in the Law on excise duties is reduced in proportion to the share of additives of biological origin in the product. Since 2008, a share of the price of rapeseed oil intended for the production of rapeseed methyl(ethyl)ester (RME) and of rapeseed and cereal grain ('raw material') purchased for the production of dehydrated ethanol is compensated by the State. Beneficiaries receive compensation for the raw material acquisition between January and November of the current year to the amount of 46.34 €/t for rapeseed and 33.02 €/t for cereal.

The Lithuanian Rural Development Programme from 2007 to 2013 also supported numerous project using renewable sources of energy in diverse sectors. In 2011 and 2012, 120 projects received around 27.22 M€ in support under the measures "Modernisation of agricultural holdings", "Transition to non-agricultural activities" and "Support to business start-up and development" (the support in 2009 and 2010 reached 12.88 M€). Supported projects exploited a broad range of

technologies (such as gas turbines, biodiesel plants, biogas, biofuels and biomass boilers, wind power plants, hydropower plants, solar battery and collector systems, geothermal installations and other installations using renewable energy sources, etc.).

**Figure 50.** Energy legislative landscape in Lithuania<sup>122</sup>



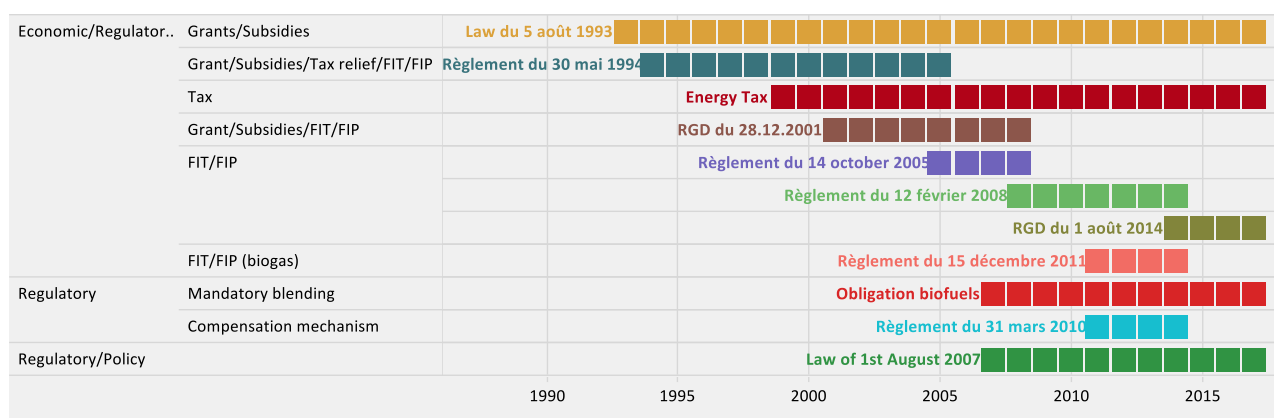
(<sup>122</sup>) Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.15 Luxembourg

Overall renewable energy share in Luxembourg reached 5% in 2015 and 5.4% in 2016. Only in 2012 and 2014 the overall renewable energy share in Luxembourg was above the NREAP and indicative trajectory. In 2016 this share met the plan. This development means that Luxembourg is not on track to achieve its 2020 target, particularly as the trajectory will become steeper in the upcoming years.

In Luxembourg, the Law of 5 August 1993 provides the legal basis for deployment and renewable energy usage in Luxembourg. The Law sets out energy savings and renewable energy objectives and measures. The feed-in tariffs for electricity produced by renewables are implemented by the Grand Ducal regulation of 30 May 1994. Law of 1<sup>st</sup> August 2007 on electricity market organization establishes, amongst other things, a framework for the system of certification guarantying electricity origin and the grid connection for renewable electricity. A revised regulation was for feed-in tariffs for electricity published in August 2014<sup>123</sup>. The revision was based extensively on the development trajectories pursued in the NREAP for the relevant renewable energy sources. Support for biogas production and supply into the gas network. The RGD on production of electricity based on renewable energy sources establishes system of certificates guaranteeing renewable origin of the electricity produced. Certificates are necessary for the administration purposes and dealings between plant's owner and network operator and other administrative purposes. Furthermore the RGD modifies the Regulation of 31 March 2010 concerning the compensation mechanism for renewable electricity and the Regulation of 15 December 2011 concerning the remuneration and commercialization of biogas injected into the natural gas grid.

**Figure 51.** Main support for renewables in Luxembourg, 1993-2017<sup>124</sup>



Renewable **electricity** generation is supported mainly with a feed-in tariff scheme. The RGD of August 2014 outlines method of calculating feed-in tariff (FIT) levels for renewable energy electricity. FIT levels vary depending on the renewable energy source and generation capacity of the plant. FITs are being guaranteed for a period of 15 years for all types of renewable plants (except geothermal installations) counting from the year when the plant was connected to the national grid. Biogas plants are eligible for the tariff provided that they were commissioned on or after 1<sup>st</sup> of January 2007 and that they were renewed or extended from then in order to increase their capacity. An additional bonus of 20 €/MWh is granted for liquid manure produced by biogas plants using at least 70% liquid manure. It applies to existing gas plants that attract a feed-in tariff or a residual feed-in tariff.

Feed-in tariffs for new biogas plants in 2014 were €80/MWh. The legislative procedure for amending the regulation has been underway since November 2014, for the increase feed-in tariffs for existing plants. Technical and financial analysis in this regard was completed in July 2014.

Table 90 display the support level for various technologies in 2014. The Luxembourg scheme introduces premium payments to support operators of wind, solar, biogas, hydropower and

<sup>(123)</sup> Règlement grand-ducal du 1er août 2014 relatif à la production d'électricité basée sur les sources d'énergie renouvelables. This regulation is amendet by the Règlement grand-ducal du 23 juillet 2016.

<sup>(124)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

biomass installations. The total budget of the measure will be approximately €150 million, allocated between 2016 and 2020.

**Table 92.** Feed-in tariffs for renewable electricity generation in 2014 in Luxembourg

	<b>Capacity</b>	<b>Feed-in tariff</b>
<i>PV</i>	IC<30kW	240 €/MWh
	30<IC<1000kW	303 €/MWh
<i>Biogas</i>	IC<150kW	192 €/MWh
	150<IC<300kW	181 €/MWh
	300<IC<500kW	171 €/MWh
	500<IC<2500kW	153 €/MWh
<i>Sewage Gas</i>	'Publicly' operated plant	65 €/MWh
	All existing plant	120 €/MWh
<i>Biomass</i>	IC<1MW	163 €/MWh
	IC>1MW	143 €/MWh
<i>Biomass – Old and Scrap Wood</i>	IC<1MW	138 €/MWh
	1<IC<10MW	118 €/MWh
<i>Wind</i>		92 €/MWh
<i>Hydro</i>	IC<300kW	180 €/MWh
	300<IC<1000kW	150 €/MWh
	1<IC<6MW	125 €/MWh

Investment assistance is also granted for the installation of PV panels on roofs, facades or integrated in building shells. It amounts to 20 % of investment costs for private individuals with a maximum subsidy of 500 €/kW. For communities it amounts to 15 % of investment costs with a maximum subsidy of 350 €/kW. Funding was also introduced for feasibility studies on wind park installations. Costs can be compensated up to 50 % with a maximum of 25 000 € per study. For wind power, funding was introduced for feasibility studies on wind park installations. 50% of costs can be covered in this respect, up to a maximum of EUR 25 000 per study.

Under the RGD of 23.07.2016 in case of the direct sale of electricity produced from renewable energy sources, plant operators receive a variable bonus on top of the market price. The amount of market premium (PM) results from the sum of the direct sales premium (PVD) and the difference between a technology-specific reference remuneration (PRR) and the monthly market price (PMM):  

$$PM = PRR - PMM + PVD.$$

**Table 93.** Premium tariffs for renewable electricity generation in 2017 in Luxembourg

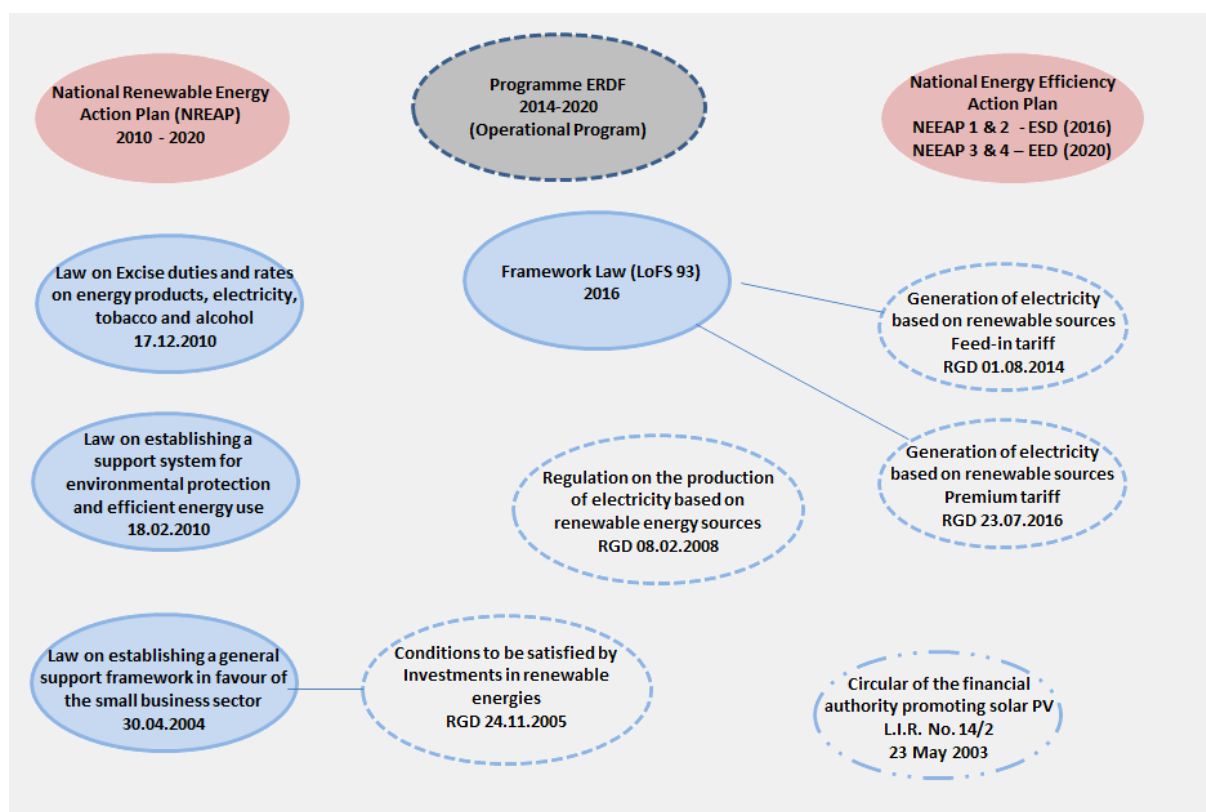
	<b>Capacity</b>	<b>Feed-in tariff</b>
<i>PV</i>	IC<30kW	169.4 €/MWh
	30<IC<100kW	150 €/MWh
<i>Biogas</i>	100<IC<200kW	144 €/MWh
	IC<150kW	190.08 €/MWh
	150<IC<300kW	179.19 €/MWh
	300<IC<500kW	169.29 €/MWh
	500<IC<2500kW	151.47 €/MWh
<i>Biomass</i>	IC<1MW	161.37 €/MWh
	1<IC<10MW	141.57 €/MWh
<i>Biomass – Old and Scrap Wood</i>	IC<1MW	136.62 €/MWh
	1<IC<10MW	116.82 €/MWh
<i>Wind</i>		91.3 €/MWh
<i>Hydro</i>	IC<300kW	178.2 €/MWh
	300<IC<1000kW	148.5 €/MWh
	1<IC<6MW	123.75 €/MWh

Production of **heat** is also supported by the means of a heat bonus. The RGD of August 2014 introduces additional bonus for commercialised heat generated by combined heat and power based on biomass, biogas and wood waste. Bonus is paid on top of the feed-in tariff. In order to benefit from the additional premium certain conditions must be met. This bonus applies to existing biogas, sewage gas or biomass (all and from old and scrap wood) plants that attract a feed-in tariff or a residual feed-in tariff. For each of those technologies the bonus is comprised between 15 and 30 €/MWh depending on a number of conditions. The basic condition is that the commercialised heat must account to at least 35 % of the entire heat produced over the first three years of operation of the plant (25 % for biogas). Then if, from the fourth year of operation, the commercialised heat accounts for at least 75 % of the entire heat produced (50 % for biogas), the bonus is 30 €/MWh and if it is between 65 and 75 % (40 and 50 % for biogas) the bonus is 15 €/MWh.

Connection to local heating grid was also subsidized in 2010, for existing and new single-unit house (20 €/kW up to 20 and 15 kW) and flat in existing and new residential building (15 €/kW up to 12 and 8 kW), up to between 120 and 1000 €. Assistance also applies to communities and community syndicates, up to one third of investment costs.

Biofuels receive support in the **transport** sector, with a quota system for fuel suppliers. Mandatory blending of the company's total annual sale of fuel (petrol and diesel), which was supplemented by the sustainability criteria laid down in Directive 2009/28/EC, was increased to 3.75% in 2013 and 4.75% in 2014. In the case where a fuel suppliers would fail to fulfil his obligation, there is a penalty of 1 200 € per 1 000 litres missing.

**Figure 52.** Energy legislative landscape in Luxembourg



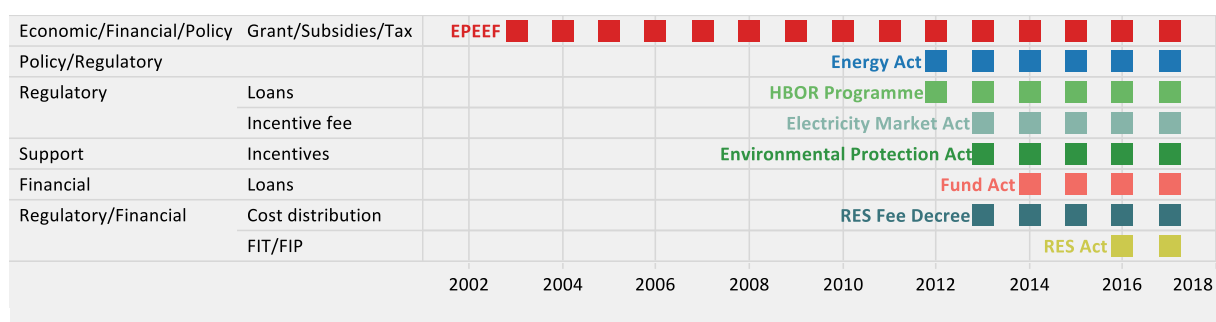
Source: Authors work (Banja M.)

## 6.2.16 Croatia

Overall renewable energy share in Croatia reached 28.98% in 2015 and 28.28% in 2016. Croatia's achievements in terms of overall renewable energy share have been faster than planned. The 2020 target for overall renewable energy share is 20%.

The main law that determine Croatia's electricity market is the "Energy development strategy" (2012). The law sets up Croatia's targets and expected energy developments by 2020. Energy Efficiency Act regulates the adoption of local, regional and national plans to improve energy efficiency. The support mechanisms for renewable energy are regulated via the "Law on Renewable Energy Sources and Highly-Efficient Cogeneration". Tariff system for electricity transmission, without the amounts of tariff values set the methodology for calculating transmission tariffs. The Electricity Market Act regulates the rules and measures for safe and reliable generation, transmission, distribution and supply of electricity and for electricity trading. The Energy act lays out the general rules and set up of the energy sector, without touching upon specific technologies, which are regulated in specialised laws. The RES Fee Decree lays down the method of use, amount, calculation, collection, distribution and payment of the incentive (feed-in tariff) for the promotion of electricity generation from renewable energy and cogeneration plants

**Figure 53.** Main support for renewables in Luxembourg, 1993-2017<sup>125</sup>



In Croatia, renewable **electricity** generation since end 2015 was mainly supported by the mean of a feed-in tariff. This scheme support electricity generation from PV plants, hydroelectric plants, wind farms, geothermal energy, liquid biofuel, solid biomass excluding biodegradable industrial and district waste, biogas using agricultural crops and organic residue, plant and animal origin waste, biodegradable waste, landfill gas and gas from waste water treatment plants.

Support was also granted to electricity generation installation through the Environmental Protection and Energy Efficiency Fund. The following table sum up this support granted in 2011, 2012, 2013 and 2014. The total annual estimated support in the electricity sector granted by the EPEEF is 204.54 M€ in 2011, 1 518.38 M€ in 2012, 225.82 M€ in 2013 and 320.62 M€ in 2014.

**Table 94.** Investment subsidies & overall support through the EPEFF for electricity from RES in Croatia

	Project	Estimated Unit Support <sup>126</sup>	Overall Support M€
2011	Photovoltaic systems	205 864.07 €	204.54
2012	Hydro-electric power plant	380 421.45 €	377.97
	Photovoltaic systems	297 690.80 €	295.77
	Wind farm	449 093.58 €	446.19
2013	Photovoltaic systems	157 488.00 €	155.86
2014	Cogeneration plant	166 428.80 €	164.71
	Photovoltaic systems	305 68.29 €	30.25
	Biomass production	391 19.82 €	38.71

Since January 2016 renewable energy in Croatia is promoted through an incentive in the form of a guaranteed purchase price after undergoing a tendering process. The classification of power plants by technology, source of energy and capacity, for which public tenders will be carried out, shall be

<sup>(125)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.



governed by a special Rulebook on RES (the Rulebook is not yet adopted). However Croatia doesn't have any subsidies in place for new renewable plants at the moment. For feed-in premium the subsidy is given for 12 years through the following procedure:

(i) The market operator (ie HROTE) should schedule a tender every year by 1 April, with the call for tender published between 2-4 months before the auction; (ii) Establish the quota of capacity to be subsidised in MW; (iii) Definition of a maximum premium price with a regular yearly review; (iv) Definition of the method of selection of the winning bid.

Payment of the subsidy is on a monthly basis using exchange prices as a reference price (exact formula can be found under art. 65 of the rulebook)

For feed-in tariff the annual auction will be organised by 1 April. The auction will establish a maximum FIT price, a quota in MW and the maximum capacity per project. Construction times for winning projects: 1 year for <10kV; 3 years for 10-20kV; 4 years for >30kV

In the **heating/cooling** sector the Environmental Protection and Energy Efficiency Fund granted investment subsidies for the installation of heat pumps, biomass boilers and solar thermal collectors. Indeed, the Fund finance investments, regardless of the type of technology, at a percentage rate, usually between 40% and 80% of eligible investment costs, depending on the type of beneficiary. The following table sum up the overall support granted in 2011, 2012, 2013 and 2014 through this fund. The total annual estimated support in the heating sector granted by the EPEEF is 712.10 M€ in 2011, 1 494.58 M€ in 2012, 610.49 M€ in 2013 and 923.44 M€ in 2014.

**Table 95.** Support Level and Overall Support through the EPEEF for Heating and Cooling using RES in Croatia

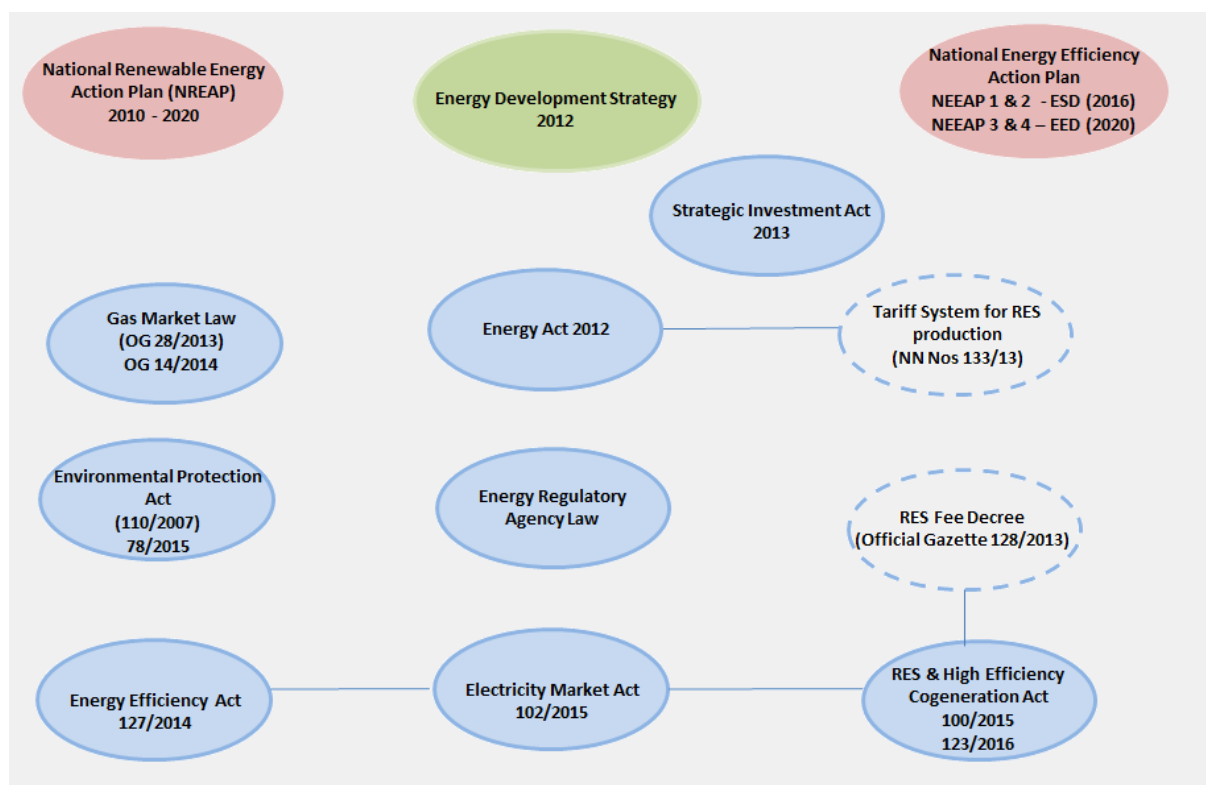
	Project	Estimated Unit Support <sup>126</sup>	Overall Support
2011	Heat pump	68 674.08 €	68.23 M€
	Biomass boilers	176 426.45 €	175.29 M€
	Pellet production	9 796.78 €	140.97 M€
	Solar thermal collectors	325 494.72 €	323.39 M€
	Research related to the use of geothermal energy	4 252.96 €	4.23 M€
2012	Biomass boilers	825 662.25 €	820.33 M€
	Heat pumps	7 925.20 €	7.87 M€
	Pellet production	449 093.58 €	446.19 M€
	Solar thermal collectors	388 041.73 €	385.54 M€
	Preparation of project documentation	234 616.50 €	233.10 M€
2013	Biomass boilers	17 536.48 €	17.35 M€
	Pellet production	175 147.51 €	173.33 M€
	Biogas plant	706 92.36 €	69.96 M€
	Solar thermal collectors	384 516.16 €	380.54 M€
	Preparation of project documentation	39 679.17 €	39.27 M€
2014	Biogas plant	5 480.43 €	5.42 M€
	Heat pumps	71 805.81 €	71.06 M€
	Biomass boilers	409 820.85 €	408.08 M€
	Solar thermal collectors	412 348.87 €	408.08 M€
	Preparation of project documentation	121 493.27 €	120.24 M€

The use of biofuels in **transports** is promoted through an obligation for distributors of gasoline and diesel fuel in Croatia to place a certain share of biofuel on the market. These compulsory shares follow the national objectives. In the 2013 National Action Plan for Renewable Energy Sources, the objective for the integration of biofuels were 0.13 %, 0.89 %, 1.69 %, 2.44 % and 3.18 % in 2010, 2011, 2012, 2013 and 2014. Biofuel production is also promoted under the Biofuel Production Incentive Programme for the period from 2011 to 31 December 2014. Biofuel producers received 531 €<sup>126</sup>, 457 €<sup>126</sup>, 372 €<sup>126</sup> and 225 €<sup>126</sup> per 1 000 litres of biofuel produced in 2011, 2012, 2013 and 2014. Also, no excise duty is levied on biofuels and on the biofuel component of blended fuels. Funding for projects in the field of environmental protection is also available through

(<sup>126</sup>) Using 1 HRK = 0.132086346 €

the Croatian Bank for Reconstruction and Development (CBRD) (Loan Programme for environmental projects, energy efficiency and RES). Borrowers can be local and regional self-government units (municipalities, towns and cities, counties and the City of Zagreb), provided that they meet all legal criteria, utility companies, other companies, craftsmen and other legal persons or commercial banks which have a cooperation agreement with the CBRD on implementation of the programme.

**Figure 54.** Energy legislative landscape in Croatia<sup>127</sup>



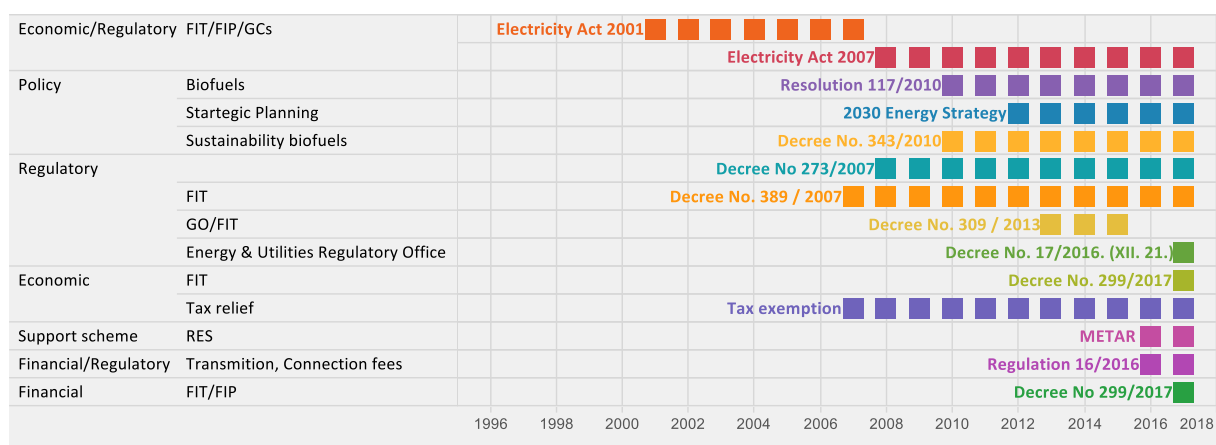
<sup>(127)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.17 Hungary

Overall renewable energy share in Hungary reached 14.4% in 2015 and 14.2% in 2016. The 2020 target that Hungary has set for the overall renewable energy share is 14.7%. In 2012 and 2013 Hungary exceeded the 2020 target for overall renewable energy share due to the fast deployment of renewables in the heating/cooling sector. Nevertheless a decrease took place in the following 3 years, bringing the overall renewable energy share below the 2020 target. Hungary's 2030 Energy Strategy indicates an indicative target of 20% by 2030.

The main piece of legislation that forms the framework of Hungarian energy law is the 2007 Act on Electricity, covering the power system and setting up a system to support renewable energy sources. Electricity Act 2007 created legal basis for creation of feed-in tariff for renewable electricity. Section 3(45b) of the Act transposes the concept of the support scheme laid down in Directive 2009/28/EC. Furthermore, Act of 2007 lays down that support under the renewable energy support scheme may only be granted for the establishment and operation of those pieces of equipment utilising renewable energy sources that comply with the technical requirements specified in a separate decree. Article 13 of the Act of 2007 regulates the allocation of electricity taken off under mandatory off-take. Decree No. 389/2007 on the obligatory dispatch and purchase of electricity generated from waste or from renewable energy sources introduced feed-in tariff in Hungary. Support for renewable sources was further defined by the Government ordinance 309/2013 on certificates of origin for electricity from renewable energy sources and high efficiency cogeneration, from 2013. The 2013 Law for the Hungarian Energy and Utilities Regulatory Office outlined the responsibilities of the national regulatory authority. On the regulator side, there is one important regulator for energy markets: Hungarian Energy and Public Utility Regulatory Authority (MEHK).

**Figure 55.** Main support for renewables in Hungary, 2001-2017<sup>128</sup>



In Hungary, renewable **electricity** generation have been supported by a feed-in tariff scheme. Table 93 displays the average support level (quotient of the total amount paid under the mandatory dispatch scheme and the quantity of electricity dispatched for the given technology) and the overall support through this scheme for the year 2014.

A full revision of the scheme began in 2013 and the regulatory concept of a new mandatory off-take scheme for heat and electricity generated from renewable energy sources was created, introducing stricter sustainability criteria (especially for wood combustion) on the one hand, and more reliable regulatory conditions for consumer on the other hand. Installations with a capacity above 500 kW will receive a premium on top of the market price of electricity, exposing them to market signals. For installations with a capacity above 1 MW and wind installations the premium will be determined and beneficiaries selected in a competitive bidding process.

<sup>(128)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

**Table 96.** Level of support and overall support for electricity generation from RES in Hungary, 2014

Technology		Average Support Level	Overall Support
Hydroelectricity	IC<5MW	57.51 €/MWh	4.13 M€
	IC>5MW	103.12 €/MWh	4.95 M€
Biomass (firing only)		107.89 €/MWh	49.94 M€
Mixed coal and Biomass		109.34 €/MWh	39.15 M€
Landfill Gas		99.24 €/MWh	3.31 M€
Sewage Gas		114.51 €/MWh	0.00 M€
Biogas		106.15 €/MWh	8.45 M€
Wind Power		108.39 €/MWh	44.10 M€
PV		102.49 €/MWh	0.41 M€
Renewable Part of Communal Waste		76.53 €/MWh	0.25 M€

The support system for electricity from renewable sources has been modified in mid-2016 and has been partially replaced by the new Renewable Energy Support Scheme (METÁR) which came into force 1 January 2017. Decree 389/2007 was replaced by the Decree 299/2017 that sets the amount of the feed-in tariff as well as the premium tariff ("green premium") for plants not subject to obligatory tendering procedures (between 50 kW and 1 MW, except for wind power plants). Operations with a capacity of 0.5-1 MW are obliged to apply for a premium tariff, installations with 50 kW-0.5 MW can indicate whether they choose the feed-in or the market premium tariff. The base prices for the feed-in tariff and the market premium are identical. In general, the tariffs are not technology-specific, except for solar power. On 20 October 2017, the successive tariff for biogas and biomass plants ("brown premium") was introduced in the framework of this Decree.

In July 2017 the EC approves Hungarian support scheme for renewable electricity. The scheme, with a yearly budget of up to HUF 45 billion (approximately €146 million), foresees state support either through a feed-in tariff or through a price premium, in line with the Guidelines. Support with a feed-in tariff will be limited to small installations (below 500 kilowatt) and demonstration projects. The Hungarian scheme will be financed through the renewables support levy currently in place in Hungary. In order to avoid any discrimination against foreign renewable energy producers resulting from the financing mechanism, as of 2017 Hungary will partially open up the renewables support scheme to foreign producers.

The support for the use of renewable energy sources in **heating/cooling** is currently provided by subsidy programmes under the Environmental and Energy Efficiency Operative Programme (EEEOP)<sup>129</sup> and other operative programmes financed through European Union funds in conjunction with funds provided by the Hungarian government. Furthermore, favourable loans are granted within the Economic Development Innovation Operative Programme (EDIOP)<sup>130</sup>. Following the Decision 1084/2016, invitations for tenders are supposed to be initiated between 2015 and 2017. Further, the decree determines the direction of financing and the amount of funding for each of the directions, HUF 325.96 billion (approx. € 1.05 billion) are/will be allocated to the "enhancement of energy efficiency and the application of renewable energy sources" in late 2015 and 2016/2017.

In the **transport** sector, biofuel is supported by the annual quotas set by the government. Indeed fuel suppliers have to respect compulsory shares of pure biofuels and biofuels added to conventional fuels in the total quantity of petrol placed in the market. Until 2014 it was obligatory to mix in 4.8 % v/v biofuel in both petrol and diesel or to sell a volume of biofuel corresponding to 4.8% v/v of the fuels sold to be used in transport. In the case where a supplier would not fulfil its obligation the fine is equal to 111.41 €/kJ<sup>131</sup> on the energy content of the unsold volume. Moreover, the Hungarian standards allow the distribution of E85 fuel, the bioethanol component of which is exempt from excise tax.

Only certified biofuels satisfying specific sustainability criteria can be accounted into fulfilling the prescribed quota. For plants put into operation before on or before 5 October 2015, the use of biofuels has to result in 35% (until 2018: 50%) lower greenhouse gas (GHG) emission levels than if conventional fuels were used. For plants put into operation after the 5 October 2015, the use of

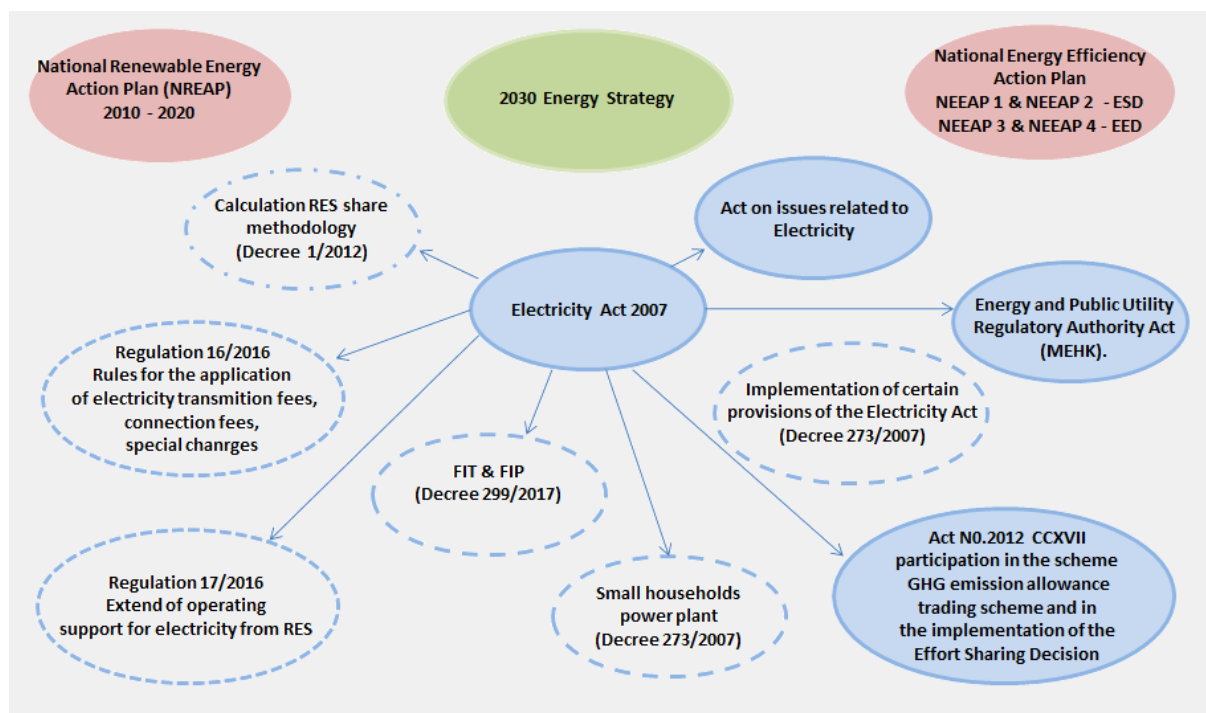
<sup>(129)</sup> Környezet és Energiahatékonysági Operatív Program' – KEHOP

<sup>(130)</sup> Gazdaságfejlesztési és Innovációs Operatív Program' – GINOP

<sup>(131)</sup> Using 1 HUF = 0,0031831995 €

biofuels has to result in 60% lower greenhouse gas (GHG) emission levels than if conventional fuels were used. There is a reimbursement of excise duty in place for E85, bioethanol and biodiesel in case of engine development projects and vehicles used in the mining industry and water management

**Figure 56.** Energy legislative landscape in Hungary<sup>132</sup>



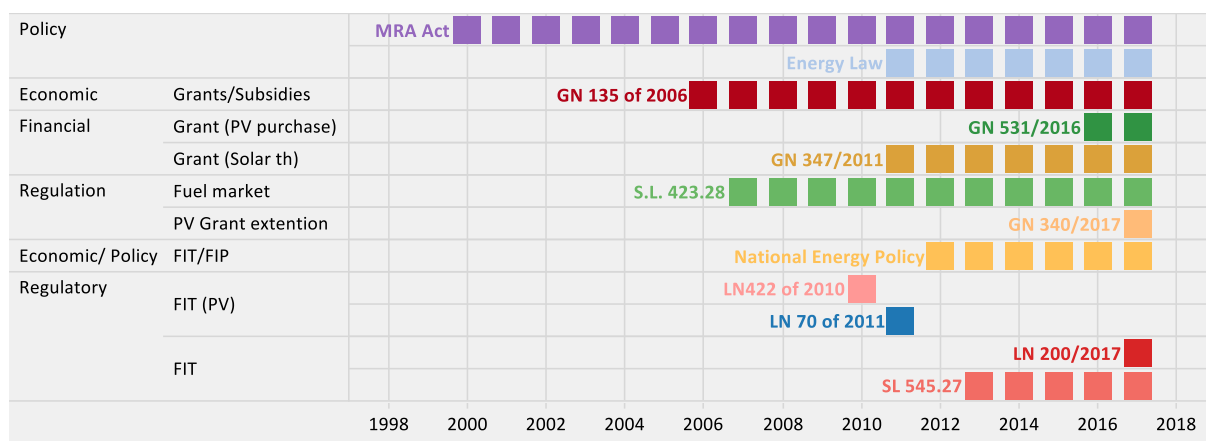
(<sup>132</sup>) Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.18 Malta

Overall renewable energy share in Malta reached 5% in 2015 and 6.05% in 2016. The 2020 target that Malta has to reach for the overall renewable energy share is 10.2%. Throughout 2010-2016 overall renewable energy share in Malta remained broadly in line with the NREAP trajectory but was above the indicative trajectory. This development might put Malta's achievement of the 2020 target for overall renewable energy share at risk.

The Malta Resources Authority Act (2000) established the responsibilities of the Authority (MRA) to regulate water, energy and mineral resources, to promote energy efficiency and renewables. The Regulator for Energy and Water Services Act, 2015, changed the MRA's responsibilities mainly to registration and metering of boreholes, mineral resource regulation and climate change reporting and operation of the emission trading scheme. The National Energy Policy for Malta was launched in December 2012. It lists decisions and actions that have already been implemented as well as measures aimed at ensuring the sustainability of Malta's energy sector. The biofuels substitution regulation came into force in 2011 (LN 68 of 2011) through an amendment to Legal Notice 278 of 2007 to promote the use of biofuels. Feed-in tariffs scheme (electricity generated from solar photovoltaic installations) regulations was in place in 2013 through Subsidiary Legislation 545.27. The regulations aim to establish a feed-in tariff scheme and are applied only to renewable energy.

**Figure 57. Main support for renewables in Malta, 2000-2017<sup>133</sup>**



In the **electricity** sector, support schemes focus on electricity generation using photovoltaic (PV) technology. In 2005, a grant scheme for the purchase of small photovoltaic (PV) systems for domestic residences was introduced. Eligible applicants could apply for a once-only grant of 20% on the purchase price of a photovoltaic system with a minimum installed size of one kilowatt peak, and subject to a maximum grant of €1165. Applicants were also eligible to an additional grant of €582 for every additional installed kilowatt peak, subject to a total maximum input power of 3.7 kilowatt peak (3.7kWp). Fractions of a kilowatt peak installed additionally above the minimum of one kilowatt peak (1kWp) were treated pro rata. The systems purchased under these schemes had to be installed in a domestic residence and had to be connected to the national grid. This scheme was not very successful and was terminated and substituted with a revised scheme aimed at increasing uptake.

The scheme launched in 2009 increased the grant for PV systems to 50% of eligible costs up to a maximum of €3,000 and the sum allocated was of €500,000. The scheme was so popular all the grants were exhausted on the first day the scheme opened. A similar scheme was launched in 2010 which drew a further 2086 applications (MRA, pers. comm., 1st March 2010).

Between 2013 and 2014 solar PV technology was promoted by the means of a feed-in tariff reaching 50 €/MWh in average for grid-connected photovoltaic systems (for systems installed and connected in 2013 and 2014). Capital grants were also available. RES schemes in the domestic sector (MRA) granted up to 5.2 M€ to PV projects in 2011, 38.9 M€ in 2013 and 9.89 M€ in 2014. Schemes in the agricultural sector (PA) granted 0.95 M€ to PV in 2011 and schemes for local councils (OPM) around 0.12 M€ in 2011 and 0.2 M€.

<sup>(133)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

Concerning the grant schemes for PV installation in the domestic sector (co-financed through EU funding), an installed capacity of over 22 MWp of PV was installed throughout 2013 and 2014. The whole committed budget for planned measures amounts to 42.7 M€ (based on a co-financing rate of 80% of European funds and 20% of Maltese funds).

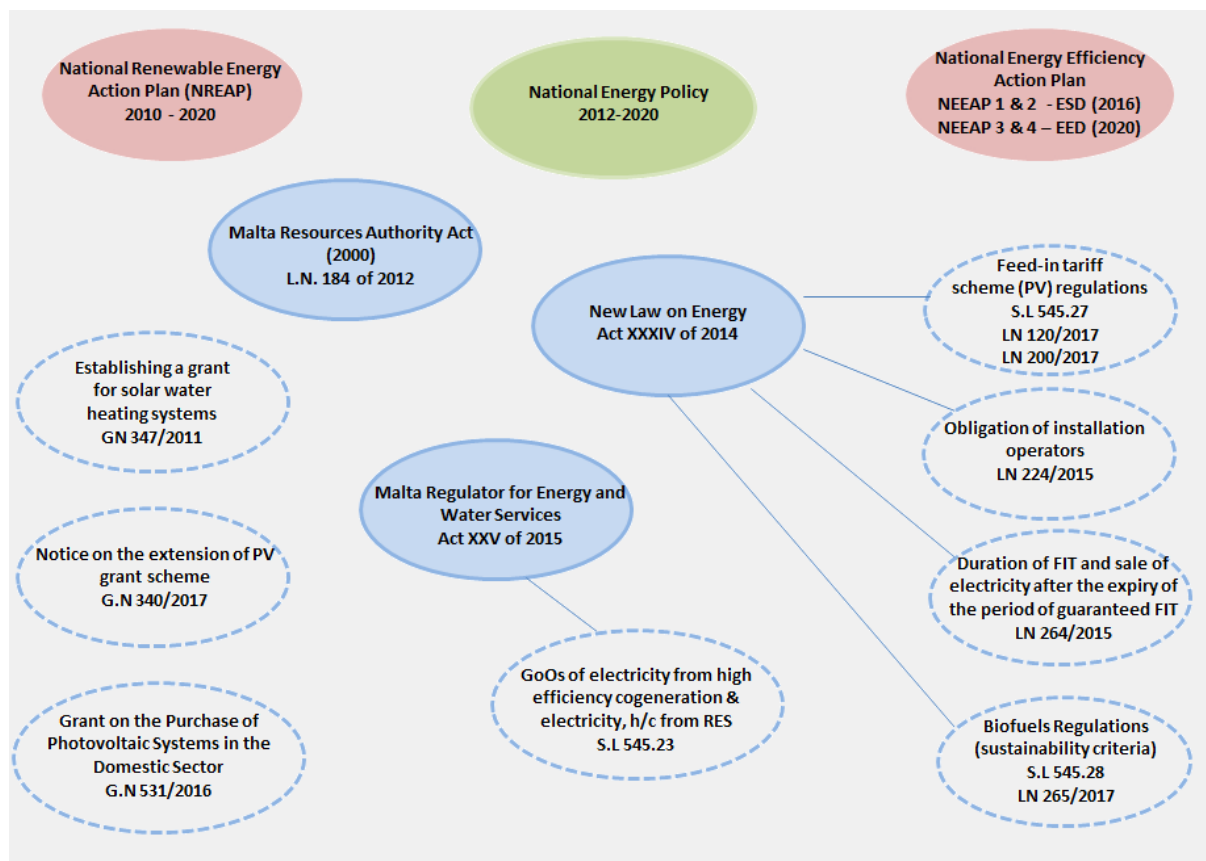
A plan for investments by public entities in PV systems on government buildings and development of PPP models with constituted bodies to develop solar PV farms. In 2013 and 2014, it led, in the public sector, to a total installed capacity of 0.7 MWp. According to the third Progress Report, support in the electricity sector reached, in 2014, 12.58 M€.

In December 2015, Malta notified plans to support operators of solar photovoltaic and onshore wind installations. In August 2016 the EC approves this support scheme for renewable energy in Malta. Aid would be granted in the form of a premium payment on top of the market price. According to the plans, onshore wind developers can also tender for support if an eligible site receives development consent during the lifetime of the scheme. The total budget of the measure will be approximately €140 million, allocated between 2016 and 2020.

Concerning the **heating and cooling** sector, different schemes co-existed. First RES schemes in the domestic sector (MRA) granted up to 2.34 M€ to solar water heaters in 2011, 2.9 M€ in 2013 and 0.2 M€ in 2014. Schemes in the agricultural sector (PA) granted 0.17 M€ to solar water heaters in 2011 and schemes for local councils (OPM) around 0.0046 M€ in 2013. Schemes in industrial and commercial sector (ME) granted around 13.67 M€ for PV installations and solar water heaters in 2011 and 9.29 M€ in 2013.

In the **transport** sector, the State promotes the use of biofuel through the introduction of annual quotas for its use. Fuel suppliers have the obligation to place on the market a minimum share of biofuel of the total content of petrol and diesel that they sell on the market over the year. Over the years the quotas were equal to 1.50 %, 2.50 %, 3.50 % and 4.50 % in 2011, 2012, 2013 and 2014. Moreover the biomass component of mixed fuels and pure biofuels is exempt from excise duty. In 2014, a capital grant also financed investment in electric vehicles up to 0.05 M€ (160 new vehicles were registered under this scheme by end 2014). According to the last Maltese Progress Report, the overall support for the transport sector was on average for 2013 and 2014 equal to 0.05 M€.

**Figure 58.** Energy legislative landscape, Malta



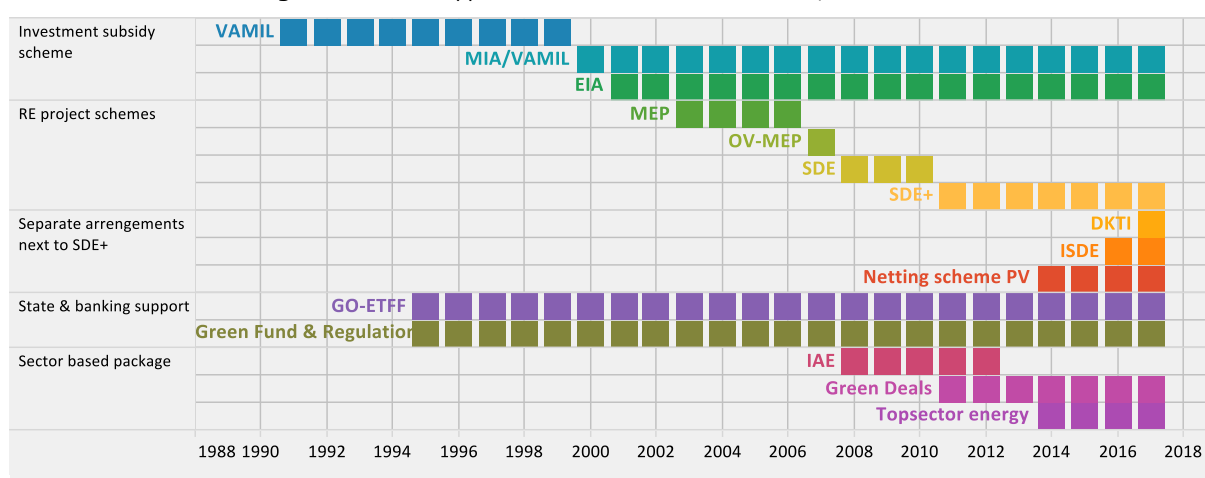
Source: Authors work (Banja M.)

## 6.2.19 Netherlands

Overall, the Netherlands received 5.8% in 2015 and 6% in 2016 of its energy from renewable energy sources. The 2020 target of the overall renewable energy share is 14.5%. Overall renewable energy share in the Netherlands remained under the NREAP and indicative trajectories throughout 2010-2016. This development has put at risk the achievement of the 2020 target, making additional measures necessary. Moreover, the planned overall renewable energy share trajectory becomes steeper in the upcoming years.

Over the years, renewable energy has been supported by different schemes in the Netherlands. Since 2003 three basic support schemes are consecutively introduced to promote the use of renewable energy in electricity, heating/cooling and transport sectors: (i) Environmental Quality of Electricity Production (MEP); (ii) National Incentive Scheme for Sustainable Energy Production (SDE); (iii) Promotion of Sustainable Energy Production Scheme Plus (SDE+).

**Figure 59. Main support for renewables in Netherlands, 1991-2017<sup>134</sup>**



- From 2003 to 2006 new renewable electricity producers could access a fixed feed-in premium (granted for ten years), through the Environmental Quality of Electricity Production (MEP). It is in the form of fixed feed-in-premiums applied for a period of 10 years. It has been closed by 2016. The support for biomass does include waste and landfill gas and was one year extended by a transitional MEP programme (OV-MEP) in 2007. This program was covered by the income of the Dutch government from the natural gas resources in the North of the Netherlands. Overall this transitional scheme granted 326 M€ for an average level of support of 97 €/MWh.
- In 2008, a new feed-in premium scheme was introduced, the SDE (National Incentive Scheme for Sustainable Energy Production). It had an annual budget ceiling established for each technology. Its support encompassed renewable electricity but also green gas. It will be valid up to 2025 inclusive, based on a maximum contribution of 15 years to granted projects. The support was applicable for biomass renewable electricity, including sustainable energy from renewable waste and landfill gas, and for biomass renewable gas. Similar to the MEP program, the SDE expenses are covered by Dutch natural gas resources.
- The successor of the SDE, called the SDE+, for Promotion of Sustainable Energy Production Scheme Plus, was opened in 2011. The SDE+ is an operating (feed-in-tariff) subsidy. Producers receive a guarantee payment (subsidy) for the energy they generate from renewable sources. The production of renewable energy is not always profitable, as the cost of the production is higher than fossil energy. SDE+, designed as a sliding feed-in-premium scheme, compensates for the difference between the cost price of renewable energy and the market value of the energy supplied: the non-profitable portion. Subsidies are allocated for periods of 8, 12 or 15 years (RVO, Brochure SDE+ Autumn 2017. Retrieved at: <https://english.rvo.nl/subsidies-programmes/sde>, 2017a). An upper limit was set for the subsidy: it couldn't be higher than the difference between the guaranteed price and the basic energy price (2/3 of the average energy price expected over the long term). This program is

<sup>(134)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed. Source: RVO.



covered by a dedicated consumer tariffs on their gas and electricity bills ("opslag energie rekening"). Note that for energy produced by using woody and agricultural biomass, there is a system of controls in place to ensure that the used biomass meets criteria for sustainability (see section 2.3).

Note that there some more options for promoting renewable energy occur in the Netherlands, like:

- The Green Investments scheme launched in 1995. It enables consumers to purchase green securities or share in a green investment fund with tax benefits for the return on these investments. In 2010, 34 M€ were dedicated to this scheme, 133 M€ in 2011, 95 M€ in 2012, 88 M€ in 2013 and 87 M€ in 2014.
- Energy investment allowance (EIA) launched in 2001. Companies can use the Energy Investment Allowance (EIA) to invest in energy-efficient technology and durable energy under favourable fiscal conditions. As a result, you pay less income tax or company tax. The Netherlands Enterprise Agency or RVO (on behalf of the Ministry of Economic Affairs) is offering a deduction of the investment cost from the tax profit: it is a fluctuating benefit, from 41.5% over de profits in 2014 and 2015, to 58% in 2016 and back to 54.5% in 2017 (Belastingdienst, 2018);
- Launched in 2000 the Environmental Investment Relief scheme (additional facility for a taxable profits deduction, over and above the other tax deduction options such as write-off) and the Unspecified Depreciation of Environmental Investments scheme (writing off of an investment at any given time) grant tax reliefs (MIA/VAMIL). In 2010, the MIA granted 113 M€ and the VAMIL 55 M€. In 2011, the MIA granted 101 M€ and the VAMIL 24 M€. The MIA offers an additional facility for a taxable profits deduction, over and above the other tax deduction options such as write-off.
- Since 2009, geothermal energy use is supported by the Geothermal Guarantee Scheme (*Garantieregeling geothermie*). The scheme covers the risk of miss/drilling. In 2010, its budget was equal to 35.7 M€.
- Green Projects Regulation. Since 1<sup>st</sup> of April 2016, the former Green Project scheme is switched to a Green Projects Regulation. It enables green savers and investors to purchase green securities or shares in a green investment fund (or direct investments) with tax benefits for the return on these investments. Next to the tax investment benefits for the green savers & investors, the green project benefit from attractive loans (around 0.75% lower than regular loans) with a term up to 10 years. Via this Regulation, shareholders, banks and project owners are required to cooperate together in new projects (RVO, 2018).

In the short term the participating organisations in the Dutch Energy Agreement 2015 have committed themselves to realise 14.5% renewable energy in 2020 and 16% in 2023 (based on the gross final energy consumption). Amongst others, the key goals are set for offshore wind (4500 MW of which 1400 MW via two separate tenders), onshore wind (6000 MW) and co-firing and combustion of biomass (25 PJ).

The following table shows the level of total SDE+ commitments for all options together since 2011. The commitments fluctuate in between 45€ and 93€ per MWh, excluding some off shore wind energy tenders.

**Table 97.** Support level within SDE+ programs in the Netherlands in 2011-2016.<sup>135</sup>

	2011	2012	2013	2014	2015	2016 spring	2016 autumn	2017 spring	2017 autumn
<i>M€</i>	1500	1700	3000	3500	3500	4000	5000	6000	6000
<i>All RE €/MWh</i>	77	45	70	94	75	80	93	-	-

Since the start of SDE+, obligations amounting to more than € 6 billion have been committed. The SDE+ also granted support for installations using gas such as landfill gas or biogas from waste water treatment plants/sewage treatment plants (including as part of a green gas hub), biomass (various types of digesters, including as part of a green gas hub) up to 1.04 €/Nm<sup>3</sup>. In 2015 the SDE+ budget reached €3.5bn increasing further to €9bn in 2016 and €12bn in 2017. For 2018 the SDE+ budget will remain almost the same as the previous year at €12.8bn<sup>136</sup>.

The available funds have increased from €1.5bn in 2011 to €12bn in 2017. To give an impression of the large interest in SDE+: about 4673 project proposals with a value of €7.1bn were received in

<sup>(135)</sup> Support level (based on the total commitments per annum), via the basic obligations in SDE+ programs in the Netherlands in 2011-2016. Excluding separate off shore wind tenders, (MEC, 2016), (MEC, 2017a,b)

<sup>(136)</sup> ICIS, "European Daily Electricity Market", 06.12.2017, [www.icis.com/energy](http://www.icis.com/energy)

spring 2017, and evaluated for their technical and economic feasibility. At least 77% of the projects are related to solar PV, as shown in a global overview to the Dutch parliament (MEC, 2016).

The indicated commitments (table 83) will be spread out (cash flows) over the consecutive years of project support: maximum 12 years for the biomass options, and maximum 15 years for all other renewable energy options (RVO, 2017a). The cash flows can be further divided into the different renewable energy options. Table 81 displays the granted subsidies for MEP, SDE, SDE+ and some other programs in the period 2011-2016. In 2016, offshore wind, biomass for electricity production and onshore wind are by far the largest categories in the Netherlands. Hydro energy is relatively small, and closes the row with less than 1 M€ support in 2016.

Over the years, **renewable electricity** production has been supported by MEP, SDE and SDE+ in the Netherlands. Next to those three basic schemes, some other, but dedicated support schemes have been applied, like the Kaderwet EZ for the promotion of wind mills nearshore (in the IJsselmeer), and dedicated SDE+ tender procedures for off shore windmills in designated areas in the North Sea.

Current support for the renewable energy in the **heating and cooling** sector can mostly be granted within the SDE+ scope. However, some technologies may have separate arrangements. For example, small scale solar thermal installations (< 140 kW) are subject to the sustainable energy investment grand (*ISDE*). Also, a separate tender is applicable for small-scale mono-fermentation of manure (in Dutch tender mono vergisting) (RVO, 2017a)

**Table 98.** Support level granted in the heating/cooling and power production in Netherlands, 2011-2016<sup>137, 138</sup>

Support Level in M€	2011	2012	2013	2014	2015	2016
<i>Offshore Wind</i>	71	79	77	70	108	306
<i>Biomass and renewable waste for electricity</i>	371	344	292	256	264	288
<i>Onshore Wind</i>	255	271	264	284	224	208
<i>Solar PV (including thermal)</i>	7	12	14	14	17	29
<i>Biogas</i>	4	6.5	12	12	24	27
<i>Biomass and renewable waste for heating &amp; cooling (incl. CHP)</i>	-	0.4	4	17	23	27
<i>Geothermal energy</i>	-	0.1	6	7	10	17
<i>Hydro</i>	4	7	8	8	5	0.4

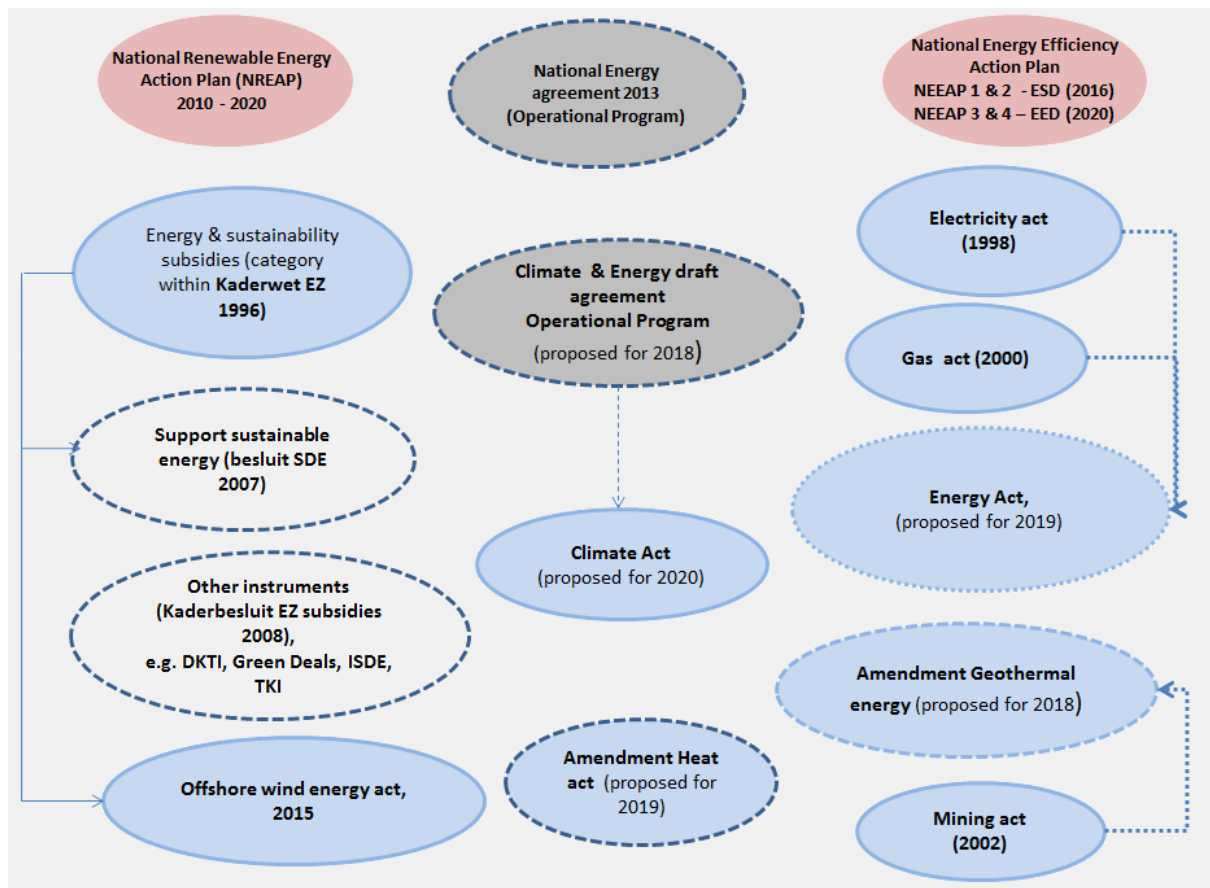
In the **transport** sector, biofuel is supported by the obligation for fuel providers to respect an annual quota. That is to say they have to market a minimum share of biofuel over the whole quantity of fuel marketed during the year. This quota was equal to 4 % in 2010, 4.25 % in 2011, 4.5 % in 2012, 5.0 % in 2013 and 5.5 % in 2014. Then, since 2010, a corrected excise rate is applied to E85. This correction takes account of the lower energy content of ethanol compared with lead-free petrol and lead to a compensation of excise duty equal to 27 % of the excise duty tariff for petrol. It also has to be noted that the tax on motor vehicles and motorcycles is differentiated based on CO2 emissions since 2011. It gives a comparative advantage to carbon/efficient vehicles.

Dutch Companies that deliver fuel to filling stations mix small amounts of biofuel through their petrol or diesel. Bioethanol (E85), for instance, is a blend of up to 85% ethanol and at least 15% petrol. This blend can be used in specially adapted cars. Several car manufacturers sell cars in the Netherlands that can run on E85. Some airlines are already flying on biokerosene, which is derived from plant material and animal fats. Some fuel suppliers market less biofuel than they should. They can still meet the norm by buying other companies' surplus in the form of biotickets.

<sup>(137)</sup> Support level granted (based on annual cash flows) in the heating/cooling and power production<sup>137</sup> sectors via aggregated MEP, SDE, SDE+ and other programs in 2011-2016 in the Netherlands, 2013-2017) Options are ranked from largest to lowest subsidy range in 2016.

<sup>(138)</sup> (i) RVO, 2017b. Results renewable energy 2016 per 1st of March 2017 (IN Dutch: Resultaten hernieuwbare energieproductie 2016) <https://www.rvo.nl/subsidies-regelingen/stimulering-duurzame-energieproductie/feiten-en-cijfers/resultaten-2016>; (ii) CBS, 2013-2017. Renewable energy in the Netherlands 2013, 2014, 2015, 2016 (in Dutch: Hernieuwbare energie in Nederland 2013, 2014, 2015, 2016; tabel 2.8.2 MEP en SDE(+) subsidie).

**Figure 60. .** Energy legislative landscape in Netherlands



Source: Authors work (Sikkema R.)

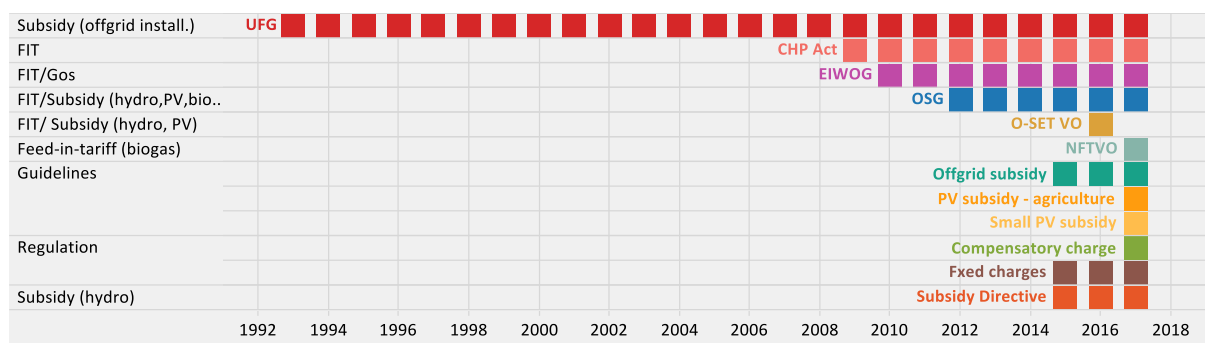
## 6.2.20 Austria

Overall renewable energy share in Austria reached 32.8% in 2015 and 33.5% in 2016. In 2020 the overall renewable energy share target for Austria is 34.2%. Overall renewable energy share in Austria followed more or less the NREAP trajectory during 2010-2016. It remained above the indicative trajectory, putting Austria on track to meet the 2020 target.

Energy policy in Austria is made at three levels: (i) the federal government, (ii) the provincial or Länder governments and of (iii) local government.

Since the electricity market was liberalised in 2001, the Austrian energy sector has changed and market economy structures have been implemented. Austria bases the support for renewables mainly on the Federal Electricity Management and Organisation Act (EIWOG) of 2010 and Green Electricity Act (ÖSG) of 2012. The energy projects are carried out every year in Austria and are publicly financed. In 2014, the public authorities provided some EUR 143 million for energy research in Austria, 23% of which (EUR 32.4 million) was used in the area of renewable energy sources. Solar technologies were the main renewable energy source taking this support, accounting for almost 60% of spending (EUR 20.2 million) (primarily photovoltaic systems and solar thermal). Other areas which received funding include bioenergy (EUR 9.4 million), hydropower, wind energy and geothermal energy.

Figure 61. Main support for renewables in Austria, 1993-2017<sup>139</sup>



In 2014 spending on solar technologies increased by 10% compared to 2013. Bioenergy also recorded an increase in 2014 compared to the previous year and includes the production of liquid and solid biofuels, the production of biogases (around 34%), conversion into heat and electricity (around 25%) and other bioenergy fields.

Renewable energy in **electricity sector** is supported under the Green Electricity Act (*Ökostromgesetz*)<sup>140</sup>. This act implements the development targets and correlating instruments for renewable energies. A feed-in tariff scheme with purchase prices granted for 13 to 15 years depending on the technologies is in place and ends after the 20<sup>th</sup> year of operation. The scheme is based on the date of application. The scheme was reformed in 2011-2012. The last amendment of the act took place in 2017. The scheme is technology-specific. The costs of this support mechanism are covered by a levy onto the grid charges.

Target groups of the support for electricity sector are legal entities and private individuals. Small hydroelectric plants up to 10 MW, combined heat and power plants and medium-sized hydroelectric power plants (10 MW to 20 MW) are supported under Sections 24, 25, 26 and 27 of the Green Electricity Act via investment subsidies. For private individuals, undertakings and territorial units the renewable energy systems are supported in accordance with the Green Electricity Act. They must be recognised as green electricity systems in a notice issued by the local governor. Support is provided via fixed acceptance tariffs for the green electricity generated.

Under ÖSG 2012 Act amendment a one-off sum of EUR 80 million for wind power systems and a sum of EUR 28 million for photovoltaic systems was provided. Wind power systems which, according to the waiting list, would have obtained a contract in 2012 or 2013, have obtained a

<sup>(139)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

UFG: Environmental Aid Act; EIWOG: Electricity Act; ÖSG: Green Electricity Act

<sup>(140)</sup> ÖSG, articles 18-20

contract immediately at a tariff of 97 €/MWh cents/kWh and a tariff of 94 €/MWh is provided for contracts that would otherwise be executed in 2014 or later. A similar rule was applied to photovoltaic systems, with discounts (depending on date of contract and tariff applied for) of between 2.5% and 22.5%.

In the ÖSG 2012 there was a special reduction in feed-in tariffs only for photovoltaic systems. Tariffs were set in annual regulations and may be set for several years. In this case, the tariffs valid for the previous year were applied, reduced by 10% for photovoltaic systems and 1% for all other types of green power systems, until new regulations are issued.

For the electricity fed into the grid, the producer has received a predetermined tariff (according to the time of application) from OeMAG<sup>141</sup> for a guaranteed period of time, with annual adjustments of tariffs for new plants. If all permit requirements are met and a valid contract between the plant operator and the OeMAG exists with reservation to the annual subsidy contingents, a duty lies with OeMAG to compensate the feed-in amounts of electricity within the legally guaranteed duration. With the amendment of 2017 of the ÖSG the wind onshore applications will receive a tariff of 82 €/MWh in 2018 which will reach 81.2 €/MWh in 2019.

Several schemes grant support for investment in the **heating/cooling** sector. First through the Environmental Support in Austria (UFI) program, grant are distributed for projects in: recovery of industrial or commercial waste heat and feeding into local and district heating networks, wood-fired heating for undertakings for own supply, district heating supply based on renewable energy sources (network, replacement, CHP, geothermal), district heating for undertakings, heat pumps, solar thermal systems, power generation in island position based on renewable energy sources, production systems for biodiesel, bioethanol, vegetable oils, biogas, energy recovery from bio-raw materials and bio-waste and natural gas combined heat and power for undertakings.

Within the framework of the Climate and Energy Fund, support is granted for investment in solar heating systems (40 % of investment costs with subsidized capacity between 100 and 2 000 m<sup>2</sup>) and pellet- and wood chip-fired central heating (between 500 and 1 400 € per unit).

Funding is available for municipalities, community-owned enterprises, public institutions, associations, and energy model regions that are planning to implement a project on/in public buildings/property. This scheme encompass investment in wood heating systems (support between 60 and 120 €/kW) and thermal solar system between (100 and 150 €/m<sup>2</sup>).

The CHP Act fosters the creation or renewal of high efficient cogeneration plants. Investment grants depend on the size of the facility. It is necessary to have at least a production capacity of 100 kW.

Since 2009, biofuel use in the **transport** sector is supported through an annual compulsory quota applied to fuel suppliers. These suppliers have to market at least 5.75 % of biofuel over their whole annual sale of fuel (with a sub-quota of 3.4 % for petrol and 6.3 % for diesel).

Pure biogenic materials fuels benefit from a mineral oil tax exemption (are included: bioethanol (from biomass and/or biodegradable parts of waste from produced undenatured ethanol), fatty acid methyl ester (FAME, biodiesel), biogas, bio-methanol, bio-dimethylether, bio-ETBE (ethyl tertiary butyl ether), bio-MTBE (methyl tertiary butylether) 8, synthetic biofuel (synthetic hydrocarbons yielded from biomass or synthetic hydrocarbon mix), bio substances and pure vegetable oil). Diesel and petrol with a minimum content of 4.4 % of biogenic materials benefit from a tax reduction equal to 28 to 33 € per 1000 litres.

A tax reduction is granted for the purchase of vehicles with low pollutant emissions (< 120 g/km CO<sub>2</sub> emission) and with environmentally-friendly power supply motors (it includes the use of E 85 fuel, methane in the form of natural/biogas, liquid gas or hydrogen).

Investments done for the construction or the conversion of fuel tank installations for alternative fuels (plant oil, gas or E85) for vehicles benefit from a subsidy of 30 % of investment costs up to 4 000 € per petrol pump or tank equipment (10 000 € for gas). Under the Klima:aktiv mobil Support Program, 30 % of investment costs are granted for undertaking for investment in vehicles with alternative engines and 50 % for territorial units.

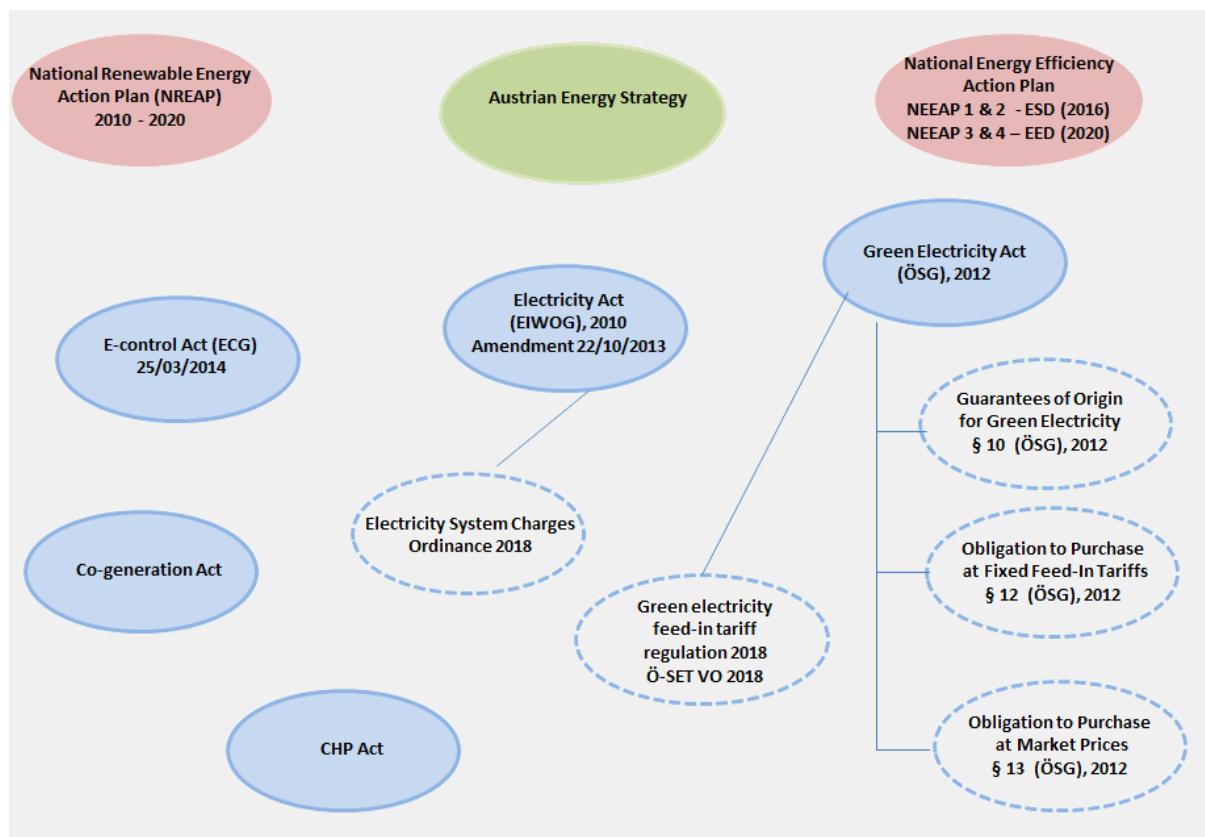
Under the Climate and Energy Fund, support was granted in seven model regions in 2014 for a total of 18.7 M€ to cover investments for electric vehicles, charging infrastructures and for

---

<sup>(141)</sup> Green Energy Handling Authority (Abwicklungsstelle für Ökostrom). ÖSG, article 37: OeMAG's responsibilities comprise the compensation for green power, calculation of green power (quota to be attributed to the respective electricity trader), daily allocation of green power to the traders/producers based on the quota, management of the newly created subsidy contingents, and the handling of applications for subsidies.

renewable energy supplies. Support is set at 30 % for undertakings and at 50 % for territorial units (% of eligible costs).

**Figure 62.** Energy legislative landscape in Austria



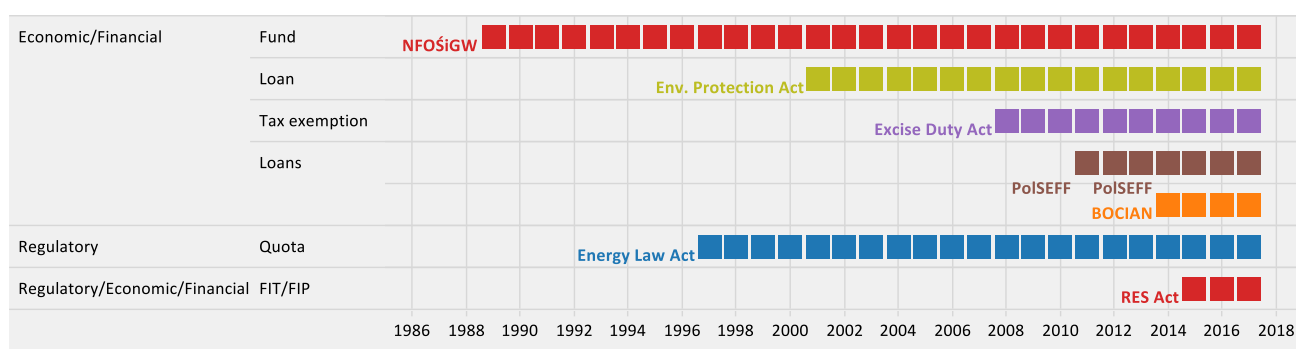
Source: Authors work (Banja M.)

## 6.2.21 Poland

Overall renewable energy in Poland reached 11.8% in 2015 and 11.3% in 2016. The 2020 target that Poland has to reach for the overall renewable energy share is 15.85%. Overall renewable energy share in Poland remained more or less in line with the NREAP trajectory until 2014, but above the indicative trajectory throughout 2010-2016. Due to the downward trend in 2015-2016 further efforts might be needed to keep Poland on track towards the achievement of the 2020 target.

In 1997 the Energy Law came into force (last amended in 2016) under which the support for renewables is in the form of quotas (TGOs). The Renewable Energy Law came in force in 20 February 2015. The law transposes the EU Renewable Energy Directive (2009/28/EC) into national law. Furthermore, and in addition to the former certificates of origin (CoO) system, it introduces an auctioning of RES system with a view to replace the CoO system in the future. The law replaces the previous system of "green certificates" with auctioning and allows a dual system to co-exist. Existing renewable installations in July 2016 were offered a choice of remaining under the current support system of "green certificates" or participating in auctions, where generators bid to produce power for the lowest price. Renewable capacities that came online in Poland or significantly upgraded installations after July 2016 can only take part in auctions. In each auction, there is a price cap introduced for all the bidders, which is defined in separate reports published by the Energy Ministry before each auction. The auction system is based on the share of RES installations in one of the specific "technology baskets".

**Figure 63.** Main support for renewables in Poland, 1989-2017<sup>142</sup>



In Poland the measures aimed at promoting the development of renewable energy are firstly implemented in the framework of the activities of the National Fund for Environmental Protection and Water Management (NFOŚiGW) since 1989. Under this programme in combination with Green Investment Scheme (GIS) for projects in the field of renewables and high-efficiency cogeneration units Part 1, 10.24 M€ were granted in 2011, 22.74 in 2012 and 4.36 in 2013. Under the second part of this program, 2.60 M€ were granted in 2011, 1.22 M€ in 2012 and 8.64 M€ in 2014. Under the third part of the program, 18.83 M€ were granted in 2011, 33.51 in 2012 and 33.22 in 2013.

Sustainable Energy Financing Facility (PoISEFF) is a 200 M€ credit line to help small and medium sized businesses in Poland investing in new, sustainable energy technologies. PoISEFF credit lines up to 1 M€ are available through partner banks and leasing companies. It is provided by the European Bank for Reconstruction and Development (EBRD).

Support of distributed RES (BOCIAN) is a programme aiming to reduce or to avoid CO<sub>2</sub> emissions by increasing energy production from renewable energy sources. The programme provides a support in a form of soft loans. The budget of 420 mln PLN is allocated for years 2014-2020.

**Renewable electricity** generation in Poland is supported mainly through a tender system for the definition of the support level of a feed-in tariff or premium. The Polish RES support scheme is a market-based mechanism that is conducive to optimal development and competition.

The installations launched before 1 July 2016 are allowed to choose between the tenders and a quota system. The quota system functions by the means of a green certificates scheme. This scheme is technology-neutral with the same banding factor for all technologies. The following table

<sup>(142)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.



displays the evolution of the average price of green certificates in Poland and of the compulsory quota.

**Table 99** Average certificate price and renewable electricity quotas in Poland, 2010-2014

	2010	2011	2012	2013	2014
<i>Average Certificate Price (€/MWh)</i>	46.68 <sup>143</sup>	65.07 <sup>143</sup>	59.95 <sup>143</sup>	49.74	47.20
<i>RE Quota (%)</i>	10.4 %	10.4 %	10.4 %	10.9 %	11.4 %

In December 2017 the EC approved under EU State aid rules a Polish renewable energy scheme and a reduced levy to finance the scheme for energy-intensive users. The scheme, with a total budget of PLN 40 billion (around €9.4 billion) will grant State support to producers of electricity from renewable sources. Beneficiaries will be selected by means of competitive auctions. The first two rounds took place in December 2016 and June 2017 and additional auctions will be organised until 30 June 2021. Under the scheme:

- Small installations with a capacity of up to 500kW can benefit from a feed-in tariff.
- Installations with a capacity of more than 500kW will receive a premium on top of the market price of electricity, so that they have to respond to market signals. Beneficiaries will only receive the premium if, in the coming years, the market price of electricity is below the bidding price submitted in the auction. This premium is meant to help these facilities to compensate for costs that cannot be recovered from selling electricity in the market, and so obtain a reasonable return on investment.

This requires competitive auctions for renewables support to ensure that the use of public funds is limited and there is no overcompensation. The EC found that the Polish scheme will encourage the development of different renewable technologies, in line with the requirements of the Guidelines, and will help Poland achieve its 2020 environmental and climate change objectives. The measure will boost the share of renewable electricity produced in Poland, while any distortion of competition caused by the State support is minimised.

This renewable support scheme is financed by a surcharge levied on electricity consumers. Poland has also notified to the EC plans to lower the financial burden on undertakings in certain energy-intensive sectors, which will benefit from a reduced surcharge. The Commission has found that these reductions are in line with the Guidelines, which allow Member States to provide reductions to undertakings in certain sectors that are particularly energy-intensive and exposed to international competition, in order to ensure their global competitiveness. The scheme is accompanied by an evaluation plan to assess its impact. The results of this evaluation will be submitted to the Commission by December 2020.

Investments in **heating/cooling** renewable technologies are support under the Green Investment Scheme (financed by the NFOŚiGW). It includes agricultural biogas plants (2.23 M€ as subsidies and 3.79 M€ as loans in 2012, and as subsidies 5.93 M€ in 2013 and 4.97 M€ in 2014) and CHP plants and biomass CHP (1.12 M€ as subsidies and 2.33 M€ as loans in 2012, and as subsidies 4.85 M€ in 2013 and 0.31 M€ in 2014).

Under this same scheme, 34.82 M€ were also requested in a 2012 call and evaluation of proposals for the construction, expansion and reconstruction of electricity grids to ensure the connection of wind power generators. 4.45 M€ were granted under this Green Investment Scheme in 2014 for development of electric grid for wind farms.

In the **transport sector**, biofuel use is supported by a compulsory quota of marketed biofuels for fuel suppliers. The compulsory share of biofuel marketed over the year was equal to 5.75 % in 2010, 6.20 % in 2011, 6.65 % in 2012 and 7.10 % in 2013 and 2014.

In 2010, selected research projects in the field of renewable energy funded by the Ministry of Science and Higher Education were granted 1.14 M€. In 2010 also, 7.29 M€ were granted in the field of renewable energy within the framework of Priority Axes I and II of the Operational Programme "Innovative Economy". The same year research tasks implemented under the strategic research and development programme "Integrated System for Reducing Energy Consumption in the Maintenance of Buildings" were granted 1.40 M€. Still in R&D funding, under the Technology Initiative II, research in biomass and biogas received 2.99 M€. Under the ERA-NET BIOENERGY program, 0.29 M€ were allocated to research on biomass and under ERA-NET MATERIA, 0.25 M€ were allocated to research in geothermal energy.

<sup>(143)</sup> Using 1 € = 4.2249 PLN

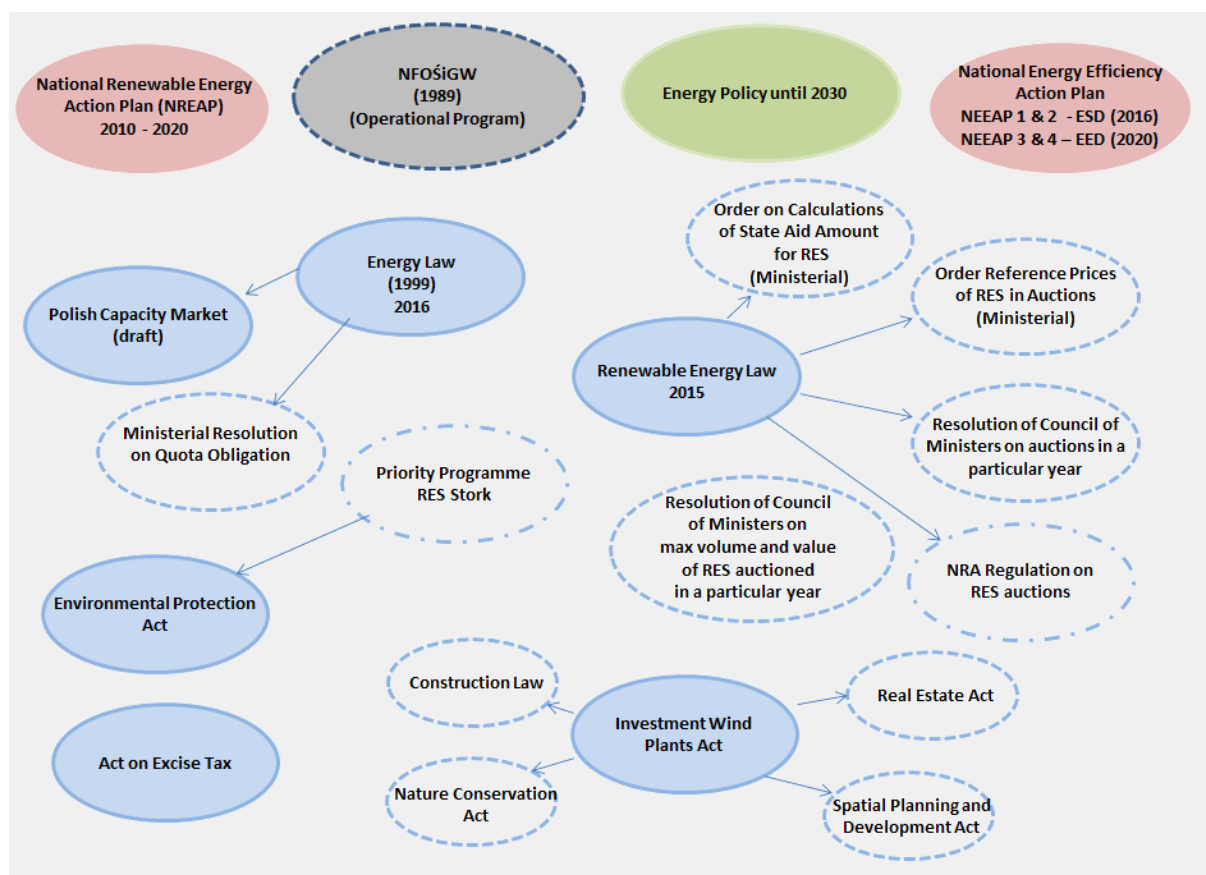


Until the end of February of 2011, blends of petrol or diesel with bio-components (or pure biofuels), containing more than 2 % of bio-components, benefit from a total exemption of excise duty on their bio-component volume. Also, biofuel producers can deduct from their taxes for the period from 2007 to 2014 an amount equal to 19% of the surplus of costs of bio-component production compared the cost of production of liquid fuels with the same calorific value (if such deduction cannot be made in a given fiscal year, non-deducted amount can be deducted in the following fiscal years).

Funding was also distributed for R&D expenses for projects related to biofuels. 8.17 M€ were allocated in the State Budget for the period 2009-2010. In 2010, the National Centre for Research and Development (NCBiR) launched 4 research projects within the framework of the strategic programme "Advanced Technologies for Energy Generation", including one concerning biofuels (Developing integrated technologies of fuel and energy production from biomass, agricultural wastes and other resources). These projects will run until 2013 and received a 16.57 M€ funding. The NCBiR received also 6.51 M€ in 2011, 8.44 M€ in 2012 and 5.28 M€ in 2013 for development and research work related to bio-components and liquid biofuels.

As of December 2014, the Operational Programme Infrastructure and Environment (OP IE) 2007-2013 had been granted 317.40 M€ in European funds under Measure 9.4 OP IE "Generation of energy from renewable sources" for the investments in the construction of RES electricity or heat generation. As of December 2014, under the Regional Operational Programmes for 2007-2013, wind power had been granted 351.90 M€, PV 205.85 M€, biomass 115.86 M€ and geothermal energy 32.17 M€. As of December 2014, under the Rural Development Programmes for 2007-2013, biomass had been granted 1.13 €M€ for the diversification of non-agricultural activities and 1.11 ~M€ for the creation and development of micro-enterprises. In the same time, solar lighting systems and photovoltaic systems had been granted 2.92 M€ in 2013 and 1.36 M€ in 2014 for basic services for the economy and rural population.

**Figure 64.** Energy legislative landscape in Poland<sup>144</sup>



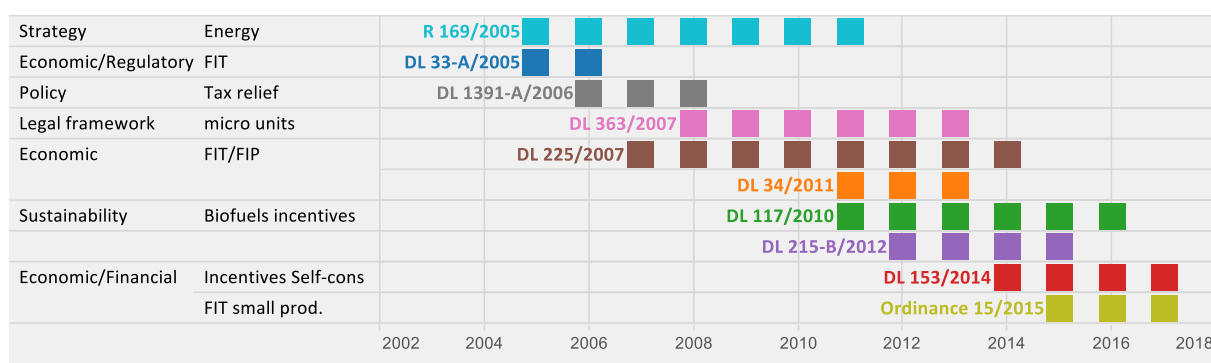
<sup>(144)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.22 Portugal

Overall renewable energy share in Portugal reached 27.98% in 2015 and 28.5% in 2016. The 2020 target that Portugal has to reach for the overall renewable energy share is 31%. Overall renewable energy share in Portugal remained slightly below the NREAP trajectory but above the indicative trajectory throughout 2010-2016. Additional efforts might be required to maintain the trend achieved in 2014-2016 to stay on course for the 2020 target. Under Green Growth Commitment 2030 Portugal aims to reach a renewable energy share at 40% in 2030.

In Portugal the National Strategy for the Energy Sector<sup>145</sup> was approved by Resolution no. 169/2005 determining the main policy guidelines and most relevant measures for energy sector. The 2005 strategy was superseded by the National Energy Strategy 2020 (2010). Decree-Law no. 29/2006 settled out the basic principles of the organisation and operation of the National Electricity System<sup>146</sup>. Decree-Law No. 225/2007 in place until 2014 sets measures related with renewable energies as provided in the National Energy Strategy (2005). The Decree-Law No. 363/2007 establishes the legal framework for electricity generated by 'microproduction units'. Decree-law 117/2010 defines the sustainability criteria for biofuels and sets mandatory blending targets for biofuels in the transport sector. Decree DL 35/2013 provides the changes of feed-in tariffs for electricity produced from wind plants. Ordinance 119/2013 regulates the consequences of breach of the obligation to pay the annual compensation provided for in the decree DL 35/2013. Ordinance 14/2015 established procedures that provide access to the support scheme for small power production units. The self-consumption DL 153/2014 establishes the legal regimes applicable to the production of electricity for self-consumption from Renewable sources. Ordinance 15/2015 set the reference tariff for small production units.

**Figure 65.** Main support for renewables in Portugal, 2005-2017<sup>147</sup>



In Portugal, **electricity** generation from renewable sources is supported through a feed-in tariff scheme. The following table display the average level of support and overall level of support according to technologies for the year 2014. The total support for feed-in tariffs (additional cost over market rates) in electricity sector reached 921.3 M€ in 2013 and 972.5 M€ in 2014.

**Table 100** Average and Overall Level of Support for Renewable Electricity Generation in 2014 in Portugal

	Average Level of Support	Overall Support
<i>Wind</i>	47.56 €/MWh	513.8 M€
<i>Hydro</i>	49.96 €/MWh	56.4 M€
<i>Micro-generation</i>	285.56 €/MWh	73.1 M€
<i>PV</i>	266.06 €/MWh	125.8 M€
<i>Biomass</i>	70.76 €/MWh	56.7 M€
<i>Biogas</i>	67.86 €/MWh	23.0 M€
<i>Renewable co-generation</i>	54.16 €/MWh	99.1 M€
<i>Solid Urban Waste (burning)</i>	45.26 €/MWh	24.6 M€

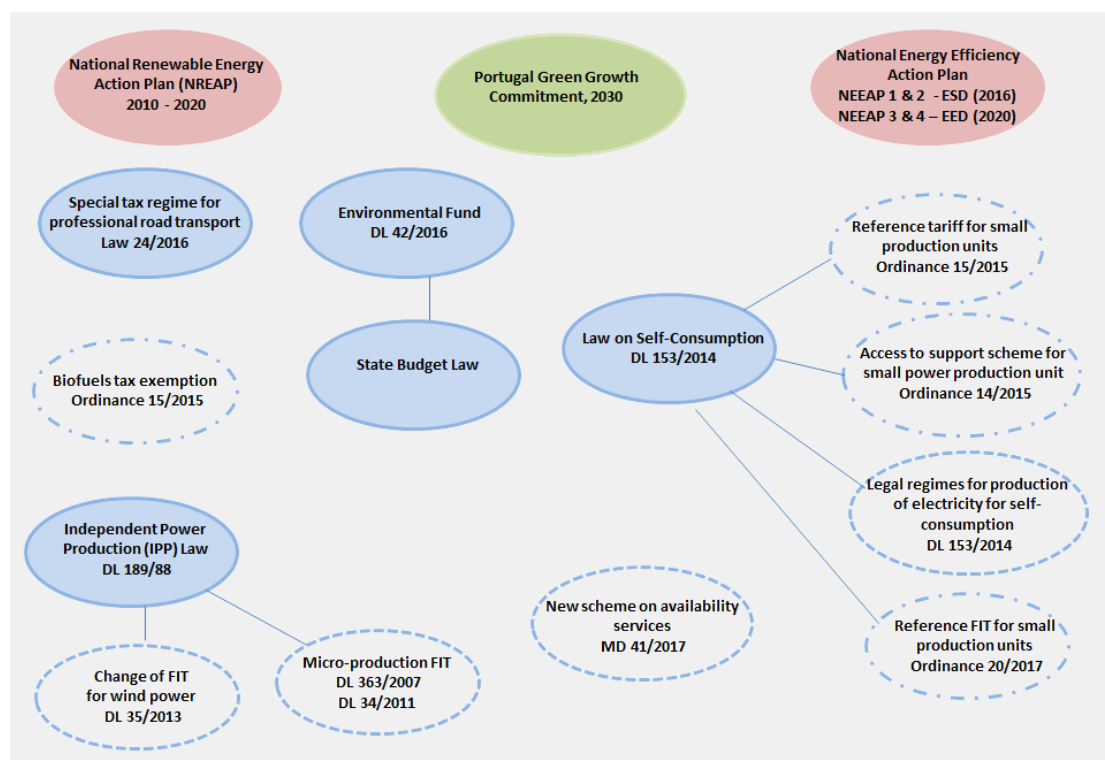
<sup>(145)</sup> Estratégia Nacional para o Setor Energético

<sup>(146)</sup> Sistema Eléctrico Nacional (SEN)

<sup>(147)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

For new small production installations, a remuneration regime came into force in 2015. This remuneration regime is based on a bidding model in which producers offer discounts to a reference tariff. In 2015 a unique regime for Small Production (UPP) and Self-consumption Units (UPAC) came into force. UPPs can have an installed capacity of up to 250 kW, whereas UPACs can have an installed capacity between 200 W and more than 1 MW.

**Figure 66.** Energy legislative landscape in Portugal



Source: Authors work (Banja M)

In the **heating and cooling sector**, under the Regional Operating Program of the Energy, funding for solar systems for heating domestic hot water (and other renewable systems) is available for municipalities, associations of municipalities and metropolitan areas, public municipal and inter-municipal companies and municipalized services, direct or indirect bodies of the central public administration, regional, inter-municipal and municipal agencies for the energy and environmental sectors, private non-profit companies regulated by private law, including private social solidarity institutions or equivalent entities and public sports associations. It takes the form of a subsidy equal to 70 % of eligible investment expenditures. Portugal promotes the installation of thermal solar systems in the residential sector and in swimming pools and sports areas, and the renewal of thermal solar systems at the end of their useful life through Financial FEE Notices 1 and 3. The support is provided for period 2003-2020 for: Residential at amount of 76200 tep in 2020 and Services at amount of 31776 tep in 2020.

In Portugal, the use of biofuels in the **transport** sector is supported through the implementation of a quota system. The compulsory share of biofuels to be marketed over the year by fuel providers was equal to 5.5 % of annual quantity of fuel marketed in 2014. A 2 000€ penalty was applied per each toe of biofuel missing. The tax exemption on oil and energy products (ISP<sup>148</sup>) for small dedicated biodiesel producers reached 1.6 M€ in 2010 and also in 2011, 1.8 M€ in 2012, 2.1 M€ in 2013 and 2.4 M€ in 2014. Individual investments for renewable energy sources equipment are eligible to a reduction of VAT rate. The applied VAT rate for such expenditures is equal to 13 %. Individuals have also access to a personal income tax allowance of 30 % of the value of the purchase of RES equipment with a ceiling of 803 €.

**Table 101.** Mandatory blending share of biofuels in Portugal

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Quota (%)	5.0	5.0	5.5	5.5	7.5	7.5	7.5	9.0	10.0	10.0

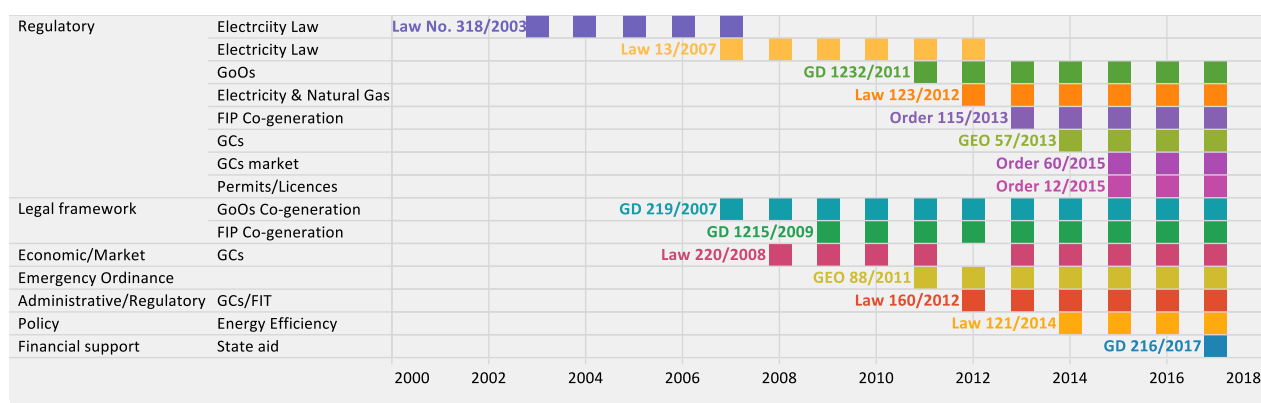
(<sup>148</sup>) Imposto sobre Produtos Petrolíferos e Energéticos

### 6.2.23 Romania

Overall renewable energy share in Romania reached 24.8% in 2015 and 25% in 2016. Overall renewable energy share in Romania remained above the NREAP and indicative trajectories throughout 2010-2016. In 2014 Romania exceeded the 2020 target for overall renewable energy share (24%).

The progressive shift from a regulated to a liberalised electricity market in Romania started officially in 2000 and was fully completed 1 July 2007, when all consumers became eligible to change electricity supplier. The Electricity Law (No. 318/2003) created the regulatory framework for the electricity sector of Romania. Law regulated activities and duties of Romanian Energy Regulatory Authority –ANRE, matter of licenses and concessions, electricity transmission and distribution. In 2007 Law was abrogated by the Electricity Law (No. 13/2007) which was further amended by Law on Electricity and Natural Gas (123/2012). Law No. 220/2008 complements this framework and obliges electricity suppliers and producers to present a certain number of green certificates on an annual basis. The scheme set in 2008 was amended and supplemented in 2013 by the Government Emergency Order (GEO) 57/2013 regarding Tax Code that was approved in 2014<sup>149</sup>. The order 60/2015 approves the Regulation for the green certificates market in Romania. The order 12/2015 approves the Regulation for the issuance of licences and permits in the electricity sector.

**Figure 67.** Main support for renewables in Romania, 2003-2017<sup>150</sup>



Romania introduced a support scheme for the first time in 2004, which was substantially amended in 2008, with full applicability starting July 2011 (after approval from the EU). The Romanian support system for renewable energy is based on green certificates that are granted by the State, free of charge, to **renewable electricity** producers and on an obligation imposed on electricity suppliers to acquire a certain amount of green certificates. The number of GCs is calculated by multiplying the mandatory quota of GC for that year (GC/MWh) with the total electricity supplied to final consumers. The beneficiaries are producers of electricity from the following renewable energy sources: hydropower <10 MW, wind, solar, biomass, landfill gas and sewage treatment plants. The scheme was open to new beneficiaries until 31 December 2016. Once a beneficiary was accepted into the scheme, it received a certain number of green certificates (depending on technology<sup>1</sup>) for each MWh of electricity produced from renewable energy sources, during 15 years.

As of 1<sup>st</sup> of January 2014 the plants owned by renewable electricity producers accredited by ANRE<sup>151</sup> has received:

- 0.7 GC for each MWh produced and supplied, where hydropower plants are new, with installed power of maximum 10MW;
- 0.5 GC until 2017 and 0.25 green certificate from 2018 for each MWh produced and supplied by producers of electricity from wind power;
- 3 GC for each MWh produced and supplied by the producers of electricity from solar power.

<sup>(149)</sup> Law 23/2014

<sup>(150)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

<sup>(151)</sup> National Energy Regulatory Authority

The following table displays the evolution of the average prices of certificates and the renewable electricity quotas over period 2010-2014. The penalty for missing certificate was equal to 110 € per certificate.

**Table 102.** Average and Overall Level of Support for Renewable Electricity Generation in Romania, 2010-2014

	2010	2011	2012	2013	2014
<i>Average Certificate Price (€/MWh)</i>	55	56.16	57.39	42.66	36.07
<i>RE Quota (%)</i>	8.3	10	12	14	15

This scheme was not technology-neutral. Technologies had different banding factor, that is to say that the number of certificates granted per MWh generated is different across technologies. The following table displays the evolution of the banding factors applied in 2010, 2011, 2012, 2013 and 2014 and the given contract length.

**Table 103.** Banding Factors for Technologies within the Green Certificate Scheme in Romania, 2010-2014

	NB. Years	2010	2011	2012	2013	2014
<i>Hydro – New Plant</i>	15		3			2.3
<i>Hydro – Retrofitted Plant</i>	10			2		
<i>Hydro - Other</i>	3		0.5			
<i>Wind</i>	15		2			1.5
<i>Geothermal</i>	15	3		2		
<i>Biomass</i>	15	3		2		
<i>Biogas</i>	15	3		2		
<i>Bioliquids</i>	15	3		2		
<i>Landfill Gas and Sewage treatment plant gas</i>	15	3		1		
<i>Solar</i>	15		6			3

In 2010, within the program on the production of energy from renewable source (wind power, geothermal, solar, biomass and hydro) subsidies were granted up to 50 % of the total eligible value of the project for the entire Romanian territory and 40 % for the region of Bucharest-Ilfov region. Overall support reached 6.02 M€<sup>152</sup> for biomass plants, 126.81 M€<sup>152</sup> for wind power plants and 46.87 M€<sup>152</sup> for hydroelectric plants.

Under the Sectoral Operational Programme "Increase of Economic Competitiveness" and under the Major Intervention Area 4.2 "Making use of renewable energy sources for the production of green energy", funding is available for wind power, geothermal, solar, biomass and micro/hydro plants. It reached 32.68 M€ in 2011, 12.88 M€ in 2012, 28.42 M€ in 2013 and 46.39 M€.

Wind power, solar systems, biomass plants, hydroelectric plants and geothermal installations, in electricity generation, received funding from the Environment Fund. Its budget reached 21.90 M€<sup>152</sup> in 2010, 24.10 M€<sup>152</sup> in 2011, 12.32 M€<sup>152</sup> in 2012, 7.33 M€<sup>152</sup> in 2013 and 10.99 M€<sup>152</sup> in 2014. In 2010, a program aiming at stimulation regional development by investing in agricultural and forestry product processing in order to obtain non-agricultural products budgeted 99 M€ for projects in biofuels production, biomass use, etc.

On November 2016 Romania notified several amendments to the green certificates support scheme for promoting electricity from renewable energy sources. On December 2016 Romania agreed with the EC State Aid SA.46894 (2016/N)<sup>153</sup> on the amendments to the green certificates support system for promoting electricity from renewable sources:

- The granting of a certain number of GC was temporarily postponed during the period 1 July 2013 - 31 March 2017, depending on technology, as follows: (i) 1 GC for new hydropower plants with installed power of maximum 10 MW; (ii) 1 GC for wind power plants; (iii) 2 GC for solar power plants. The GC postponed will be recovered as from 1 April 2017 for new hydropower plants and for solar power plants, and as from 1 January 2018 for wind power plants, in instalments until 31 December 2020. The calculation of the green certificate acquisition quota is modified: from 2017 onwards, the quota shall be based on the "fixed"

<sup>(152)</sup> Using 1 € = 4,5661 RON

<sup>(153)</sup> C(2016) 8865 final

annual quantity of green certificates, meaning the total quantity of green certificates estimated to be issued during 2017-2031 (including the green certificates postponed to trading during 2013-2024), divided to the number of years remaining from the support period. Increase of the validity of the certificates: The validity of certificates will be from the moment they are issued until 31 December 2031 (as compared to a 12-month-validity currently). The green certificates issued as of 1 January 2017 and the certificates postponed to trading as of 1 July 2013 are valid until the end of reference year 2031 and they may be traded until 31 March 2032. Amendments to the minimum and maximum price for the green certificates: For the period 1 January 2017 to 31 December 2031, the green certificates price can be between a minimum of 29.4 €/GC (compared to the previous 27 €/GC) and a maximum of 35 €/GC (compared to the previous 55 €/GC). In addition, as from 2017 the value of green certificates is no longer indexed.

- The penalty for non-fulfilment of the annual mandatory acquisition quota remains the double of the maximum price of the green certificates, but is reduced from €110 to €70 for each non-purchased green certificate (to reflect the new maximum price for green certificates).

In 2017 Romania adopted the Government Emergency Ordinance 24/2017 (Ordinance), which amended some of the main regulations in the renewable energy sector. An important development expected to be implemented by the end of 2017 is related to the opening of GCs support scheme to imports of RES-E coming from other EU countries. The main changes of this ordinance are:

- The validity period for GCs issued after 1 April 2017 and those suspended from trading from 1 July 2013, have been extended from 12 months to 15 years (until 31 March 2032);
- A new centralised and anonymous GCs market will be operational from September 2017. The new market will enable participants to remain anonymous, so transactions are expected to take place only based on objective and transparent criteria;
- A new centralised market for E-RES and green certificates will be operational from September 2017. On this new market, electricity produced from renewable energy sources will be traded together with the afferent amount of GCs in an anonymous, competitive, transparent, public, centralised and non-discriminatory way;
- A fixed annual number of GCs has been introduced. For 2017, this has been set at around 14.9 million GCs. From 2018, the Romanian Energy Regulatory Authority (ANRE) will set the fixed annual amount of GCs every two years, based on a methodology to be further published by ANRE. The fixed annual number of GCs, set by the ANRE, is to be approved by government resolution. The fixed annual number of GCs consists of the total number of GCs estimated to be issued until the expiry of the GCs support scheme and the GCs suspended from trading between 2013 and 2024 divided by the number of years remaining until the end of the GCs support scheme;
- Each year, in December, ANRE will set the annual mandatory quota for the acquisition of GCs estimated for the following year, taking into consideration the fixed amount of GCs and the electricity price for the end consumer, for the following year, which should not exceed an average impact of 11.1 €/MWh, reflected in the electricity invoice of the end consumer.

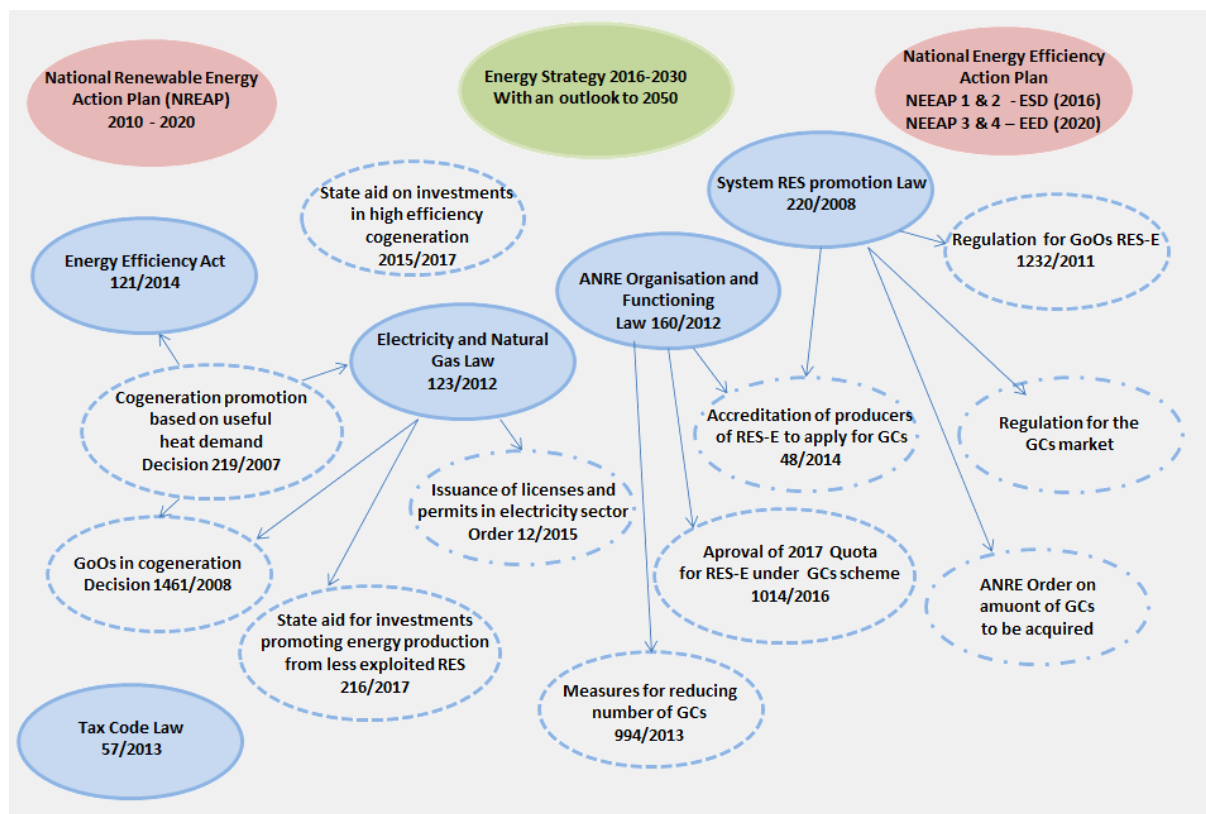
The Green House Program (funded by the Environment Fund), targeting natural and legal persons aimed at supporting installation or the replacement of **heating systems** that use renewable energy in private houses (apartment buildings excluded). It ensured a financing of 1 314 €<sup>152</sup> for installing solar panels (or for installations that generate thermal energy based on pellets, briquettes, sawdust, as well as any other plant, agricultural and forestry residues and waste) and 1 752 €<sup>152</sup> for installing heat pumps. In 2010, the allocated amount was 21.9 M€. In 2011, funding reached 13.15 M€. It reached 0.591 M€ in 2014. The Program regarding the installation or replacement of heating systems using RE for administrative units, public institutions and religious entities is also funded by the Environment Fund. It can provide subsidies for projects regarding the replacement or installations of systems using solar energy, geothermal energy, wind energy, hydro energy, biomass, landfill gas, sewage treatment plant gas and biogas or any other systems that lead to the improvement of air, water and soil quality. The amount allocated during the first call for proposal in 2010 and 2011 was 21.90 M€. In 2013, 11 projects whose value reached 2.28 M€ were completed.

In the **transport** sector, the production of biofuels is supported by a blending obligation for fuel producers. As of November 2011, biofuel producers have to put on the market diesel oil containing at least 5% volume biofuel and gas containing minimum 4% and maximum 5% volume of biofuel. As of January 2013, this obligation becomes 6% in volume of biofuel for gas and diesel oil. Under the Environment Fund, the Program for the renewal of the national vehicle fleet gives scrapping



bonuses for vehicles older than 10 years old. These bonuses can be used to buy electrical and hybrid cars. In 2011, 1.1 M€ was allocated to this program.

**Figure 68.** Energy legislative landscape in Romania<sup>154</sup>



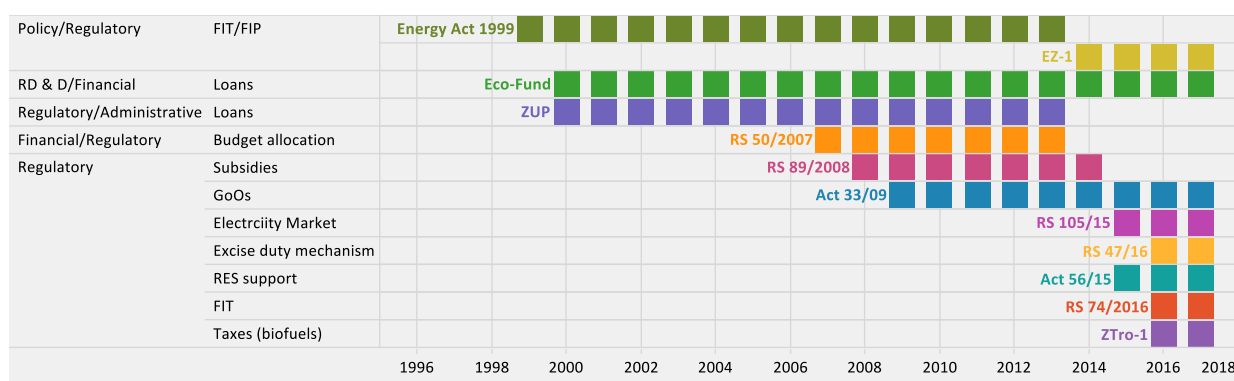
(<sup>154</sup>) Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.24 Slovenia

Overall renewable energy share in Slovenia reached 21.9% in 2015 and 21.3% in 2016. The 2020 target that Slovenia has to reach for the overall renewable energy share is 25.3%. Overall renewable energy share in Slovenia remained above the NREAP and indicative trajectories throughout 2010-2015, but missed the NREAP plan in 2016. The deployment of renewables was slower than planned in electricity sector (2015-2016) and transport sector (2014-2016). Further efforts might be needed to keep Slovenia on track to achieve the 2020 target.

Slovenia's main piece of legislation is the Energy Act (EZ-1) that was adopted in 2014. Its predecessor sets out the rules for the creation of the Energy Agency (63/04) which has the task of implementing the framework for renewable energy sources on the basis of Energy Act 1999. RS 50/2007 defines the rules on procedures for the implementation of the budget. Act on renewable energy support (56/15) determines the value of contributions to the provision of support for the production of electricity from renewable energy sources and high-efficiency cogeneration. It is paid by final customers for electricity and final customers of solid, liquid and gaseous fossil fuels and district heat. The Act on guarantees of origin (33/09) determines the rules for opening and closing accounts in the register of guarantees of origin (Pol register). The Regulation on renewable support (46/15) defines the method of calculating and accounting for contributions to provide support to the production of electricity in high-efficiency cogeneration and from renewable energy sources. The electricity market rules (105/15) define the operating principles of the Slovenian electricity markets.

**Figure 69.** Main support for renewables in Slovenia, 1999-2017<sup>155</sup>



In Slovenia renewable **electricity** generation is supported by the mean of a feed-in tariff and a premium system since 2009. Renewable electricity producers with capacity of up to 5 MW (1 MW for CHP plants) can choose between the two schemes (in the case of the premium scheme they have to market their electricity themselves). Qualified renewable producers can choose between a guaranteed feed-in tariff and a bonus on top of the free market price for electricity. Furthermore, public calls for subsidy applications are organised and loans are provided for renewable projects.

Since 2000, the Ecological Fund (Eco-Fund) has been supporting a variety of environmental investments in Slovenia. The Fund is a public financial institution providing soft loans for projects ranging from energy production, energy efficiency improvements, to renewable energy projects. Soft loans are provided to local authorities and other legal entities, up to 40% of eligible investment cost for large-scale companies and 50% of eligible investment cost for small and medium companies. The Administrative Procedures Act (ZUP) sets procedures (e.g. deadlines) within which the Environmental Fund or other administrative bodies shall decide on whether to grant loans to renewable energy projects.

The Eco Fund provides soft loans for projects ranging from energy production, energy efficiency improvements, to renewable energy projects. Soft loans are provided to local authorities and other legal entities, up to 40% of eligible investment cost for large-scale companies and 50% of eligible investment cost for small and medium companies. The Eco Fund has been financing investments in

<sup>(155)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.



the use of RES in buildings since 2008. In 2013, it disbursed 10.7 M€ for such investments in households (half of this sum going to the installation of wood biomass combustion installations) contributing to the production of 189.6 GWh of heat from RES per year. In 2014, it disbursed just over 5.9 M€ (44.6 % less than in 2013).

In 2013 the Eco Fund disbursed EUR 5.4 million for the installation of wood biomass combustion installations, and a mere EUR 2 million in 2014.

Through the Eco Fund tenders, support is granted since 2011 for the installation of solar panels (150 €/m<sup>2</sup>) and vacuum solar panels (200 €/m<sup>2</sup>) by households. For solar panels, 1.37 M€ were granted in 2011, 1.39 M€ in 2012, 0.87 M€ in 2013 and 0.39 M€ in 2014. For vacuum solar panels, 0.52 M€ were granted in 2011 and also in 2012, 0.31 M€ in 2013 and 0.12 M€ in 2014.

In 2014, in order to limit the cost of the scheme a reform of the system lowered capacity threshold from 125 MW to 10 MW for RES generating plants except for wind-powered plants for which the threshold remained at 50 MW, and from 200 MW to 20 MW for CHP generating plants. Since 2014, support quotas are distributed through auctions. The following table displays the level of support in 2014.

**Table 104.** Support Level Granted for Renewable Electricity Generation in 2014 in Slovenia

	<b>Capacity</b>	<b>FIT (€/MWh)</b>	<b>FIP (€/MWh)</b>
<i>Hydro</i>	IC<50kW	105.47	71.37
	IC<1MW	92.61	58.51
	IC>1MW	82.34	46.66
<i>Wind</i>		95.38	63.66
<i>PV on buildings</i>	IC<50kW	98.15	63.6
	IC<1MW	89.75	54.86
	IC>1MW	74.48	38.4
<i>PV Ground-level</i>	IC<50kW	92.22	57.33
	IC<1MW	84.95	50.06
	IC>1MW	68.48	32.4
<i>Geothermal</i>		152.47	115.99
<i>Biomass - Wood</i>	IC<1MW	250.44	214.36
	IC>1MW	189.15	152.67
<i>Biogas - Using agricultural biomass</i>	IC<50kW	169.71	134.82
	IC<1MW	166.28	130.2
	IC>1MW	153.06	116.58
<i>Biogas - Using biomass from waste</i>	IC<50kW	139.23	104.34
	IC<1MW	139.23	103.15
	IC>1MW	129.15	92.67
<i>Biogas - Using biomass from sewage sludge</i>	IC<50kW	85.84	49.36
	IC<1MW	74.42	37.94
	IC>1MW	66.09	29.61
<i>Biogas - Using biomass from landfill gas</i>	IC<50kW	99.33	62.85
	IC<1MW	67.47	30.99
	IC>1MW	61.67	25.19

In May 2015, Slovenia notified plans to amend their existing support scheme for renewable energy and high-efficiency cogeneration to make it more cost-effective and improve the integration of renewable electricity into the market. One of the most significant amendments to the scheme is the introduction of a tender process to select who will receive support under the scheme and determine the appropriate level of that support. In particular, Slovenia has introduced a two-round tender process designed to increase competition between potential beneficiaries and ensure support goes to the best value projects. This is in line with the Commission's Guidelines on state aid for environmental protection and energy 2014-2020, which require that from January 2017 such aid is granted on the basis of a clear, transparent, non-discriminatory competitive bidding process open to all producers of renewable electricity. Furthermore, the amended scheme introduces a market premium for operators above 500kW. In line with the Guidelines, operators of installations above this threshold will have to offer their electricity on the market and will receive their support in the

form of a premium paid on top of the market price. Operators below 500kW can continue to receive a feed-in tariff. This support scheme is financed by a surcharge levied on electricity consumers. Slovenia has also notified to the Commission plans to lower the financial burden on undertakings in certain energy-intensive sectors, which will benefit from a reduced levy. The Commission has found that these reductions are in line with the Guidelines, which allow Member States to provide reductions to undertakings in certain sectors that are particularly energy-intensive and exposed to international competition, in order to ensure their competitiveness.

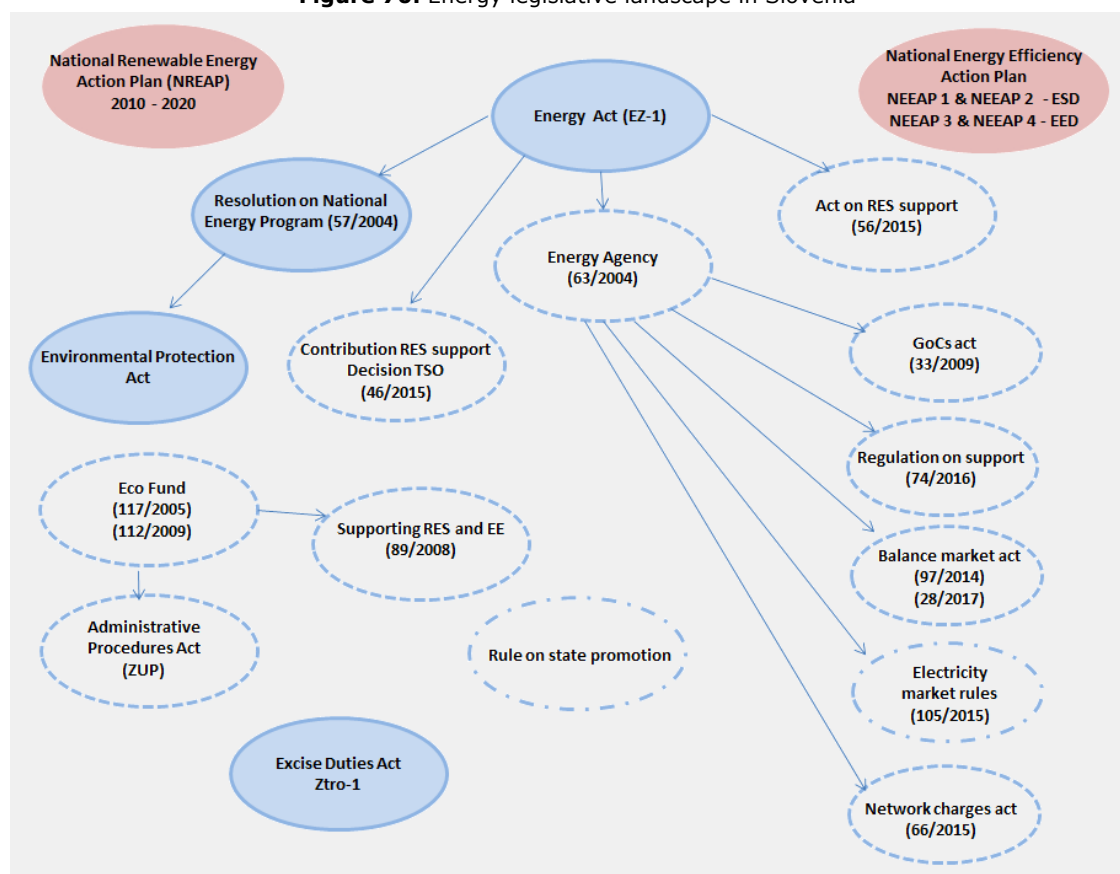
In the **heating and cooling** sector, subsidies were also granted from 2011 to 2014 for the installations of systems using wood, other biomass and heat pumps. The following table sums up the level of support granted as well as the overall support granted each year.

**Table 105.** Investment Support for Heating & Cooling Installations in Slovenia (M€) , 2011-2014

		Unit Support	2011	2012	2013	2014
<i>Heat Pumps</i>	ground/water or water/water	2500 €/pc	0.62	0.93	0.81	0.66
	air/water for heating	1500 €/pc	0.73	1.92	2.69	2.44
	air/water HP for the preparation of hot sanitary water	250 €/pc	0.48	0.76	0.68	0.33
<i>Biomass (woodchips, pellets, logs)</i>	Replacement of central heating boilers	30-50% % of investment costs	2.52	5.21	3.03	6.44
	boilers, micro district and district heating systems	2000 €/pc	3.20	3.20	5.36	2.01

The use of biofuels in the **transport** sector is supported by a quota system that obliged fuel suppliers to incorporate annually a certain share of biofuel in the whole fuel quantity marketed. In 2013 this share was 2.98 % and in 2014 it was 3.58 %. Biofuels used as motor fuels also benefit from an excise tax exemption. Pure biofuels are completely exempted and if they are blended with fossil fuels, an exemption may be granted up to 5 % (or more if it is standardised fuel containing biofuel).

**Figure 70.** Energy legislative landscape in Slovenia<sup>156</sup>



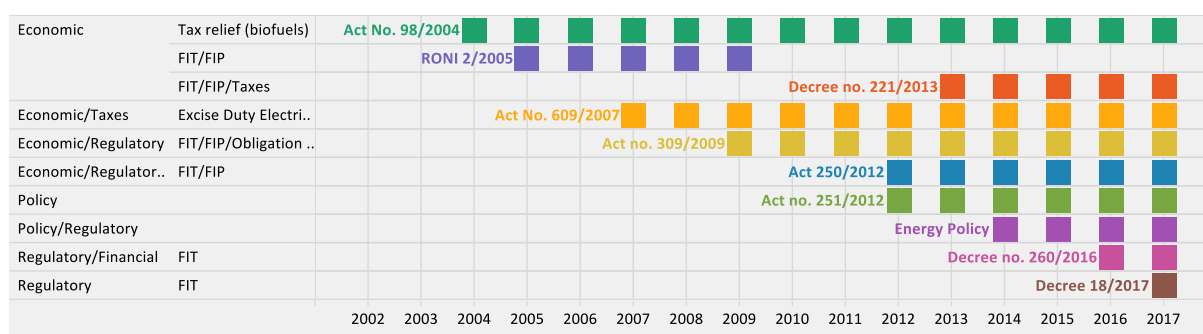
(<sup>156</sup>) Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.25 Slovakia

Overall renewable energy share in Slovakia reached 12.88% in 2015 and 11.99% in 2016. The 2020 target that Slovakia has to reach for the overall renewable energy share is 14%. Overall renewable energy share in Slovakia remained above the NREAP and indicative trajectories throughout 2010-2016. However, additional efforts might be needed since the development in heating/cooling remained below expectations in the last 4 years of the period 2010-2016 and renewable electricity missed the plans in both 2015 and 2016.

The Energy Policy (2014) of Slovakia is the strategic document defining the energy sector's primary objectives and priorities to 2035 with a view to 2050. The Energy Policy determines that a developing renewable energy source for heat, particularly through biomass and geothermal energy, is to be prioritised. Slovakia's key energy laws are the Energy Act (251/2012) and the Decree (656/2004) act amended in 2012 to implement the EU third energy package. Act No. 250/2012 governing the issue of regulation of network industries. The measures in the Act are mainly focused on promoting competition in the electricity and natural gas market. Act No. 309/2009 on Support of Renewable Energy Sources and High Efficiency CHP aims to increase the share of electricity generated by renewable energy sources (RES), as well as high-efficiency CHP plants. The Act is amended and supplemented in 2011<sup>157</sup> and in 2013<sup>158</sup>. Act No. 98/2004<sup>159</sup> establishes the framework to apply tax for electricity, coal and natural gas. Decree No. 221/2013<sup>160</sup> established a price regulation in electricity sector. Decree 260/2016 provides for price regulation in the electricity sector and some conditions for the implementation of regulated activities in the electricity sector. Decree 18/2017 regulation defines the feed-in tariff for electricity.

**Figure 71.** Main support for renewables in Slovakia, 2004-2017<sup>161</sup>



In Slovakia the Regulatory Office for Network Industries (RONI) is responsible for electricity and natural gas price regulation. A feed-in tariff is granted to renewable **electricity** producers for 15 years duration. Eligible facilities have an installed capacity of less than 125 MW (200 MW for CHP plants). The following table displays the support granted in 2011, 2012, 2013 and 2014. The overall support through this scheme reached 192 M€ in 2011, 270 M€ in 2012, 292 M€ in 2013 and 318 M€ in 2014.

**Table 106.** Support Level Granted for Renewable Electricity Generation in Slovakia, 2011-2014 (€/MWh)

	2011	2012	2013	2014
<i>Hydro</i>	61.7	61.7	61.7	97.98
<i>PV</i>	259.2	194.5	119.11	98.94
<i>Wind</i>	79.3	79.3	79.29	70.3
<i>Geothermal</i>	195.8	190.5	190.51	155.13
<i>Biomass</i>	112.2	112.2	112.24	92.09
<i>Biogas</i>	129.4	118.2	118.13	107.26

<sup>(157)</sup> Act No. 136 / 2011

<sup>(158)</sup> Act No. 30/2013

<sup>(159)</sup> Amended in 2007 and 2012

<sup>(160)</sup> Amended and supplemented by Decree No. 189/2014

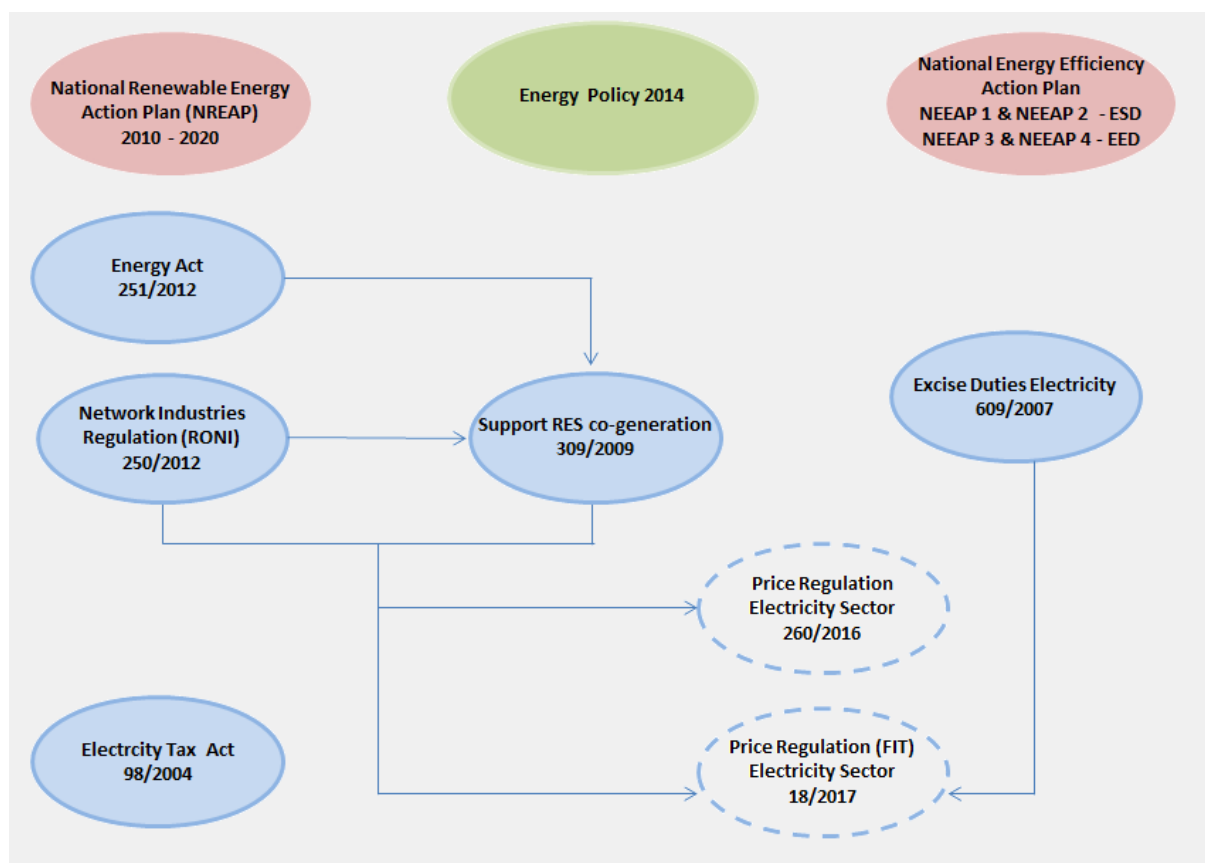
<sup>(161)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

In the **electricity** and **heating/cooling** sector, support is granted through the Operational Programme for Environmental Quality for the support use of RES & in the construction sector. A national project, funded by this program and targeting households, disposed of 45 M€ for its first phase which will end in 2018. The total amount of support for the installation of small renewable plants remained at its original level, 115 M€. It covered the installation of PV and wind power plants with an output of 10 kW or less, heat plants using solar panels, biomass boilers and heat pumps covering the energy needs of a family home or residential building.

A program was to be launched in 2014 to support the renovation of heat distribution pipes, to support the use of RES in businesses and to support renewable heating and cooling public buildings.

In the **transport** sector, biofuels benefit from a quotas system. Fuel suppliers have the obligation to market a certain share of biofuel per year over the whole quantity of fossil fuel sold over the year. The biofuel share to be sold was equal to 3.80 % in 2011, 3.90 % in 2012, 4.00 % in 2013 and 4.50 % in 2014. The penalty in case of non-fulfilment of this obligation is equal to 2 € per litre of biofuel missing.

**Figure 72.** Energy legislative landscape in Slovakia<sup>162</sup>



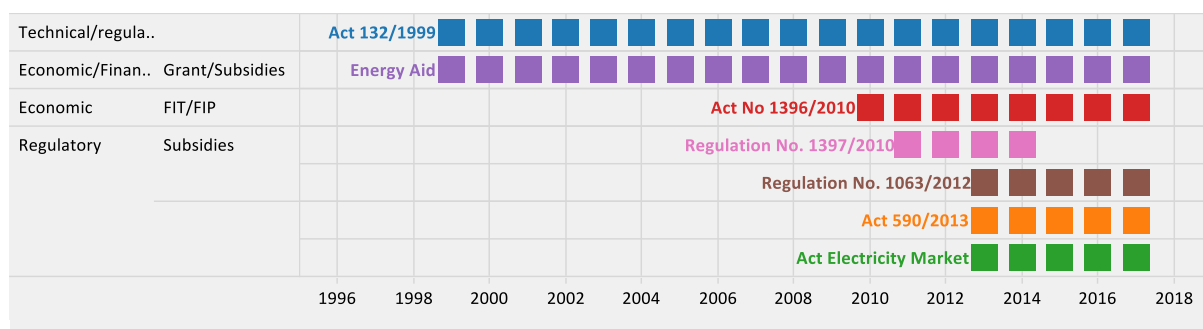
<sup>(162)</sup> Adopted from ICIS Power Perspective (ICIS, 2018)

## 6.2.26 Finland

Overall renewable energy share in Finland reached 39.2% in 2015 and 38.7% in 2016. Overall renewable energy share in Finland remained above the NREAP and indicative trajectories throughout 2010-2016. Finland exceeded its overall renewable energy target for 2020 already in 2014. However the use of biofuels in transport sector in 2016 was almost 3 times lower than in 2015 bringing the share of renewables in this sector from 22% in 2015 to 8.4% in 2016.

In Finland the electricity market is regulated by the Electricity Market Act and Government Decrees based on the Electricity Market Act. The Energy Authority monitors compliance with the electricity market legislation and promotes the operation of the competitive electricity and natural gas markets. Act on Production Subsidy for Electricity Produced from Renewable Energy Sources, No. 1396/2010 was issued in 30<sup>th</sup> December 2010. The act opened the FIT scheme for wind, biogas, timber chip and wood-fuelled power plants. The regulatory framework for the electricity sector is mainly included in the Electricity Market Act and related decrees. The Electricity Market Act entered into force on 1 September 2013<sup>163</sup> and implemented EU's third Energy Package, including (Directive(2009/72/EC)). Additionally, the electricity sector is regulated by the: (i) Electricity and Natural Gas Market Supervision Act (590/2013, as amended); (ii) Land Use and Building Act (132/1999, as amended); (iii) Competition Act (948/2011, as amended).

**Figure 73.** Main support for renewables in Finland, 1999-2017<sup>164</sup>



The Regulation on the Promotion of Electricity from Renewable Sources (1397/2010) entered into force on 1 January 2011. It prescribed the approval of power plants for the feed-in tariff scheme regarding state subsidy criteria, the division of the calendar year into tariff periods, the calculation criteria for mean market prices of electricity and emission allowances, equipment responsible for power plant's own consumption of electrical power, the monitoring obligation and the monitoring system, determining a fuel and its energy content, total system efficiency of power plants, and verifier's fields of competency.

The production of electricity through the use of renewable energy (including wind power, wood fuel and biomass) in Finland is promoted through the feed-in tariff scheme, which is set out in the Act on Production Subsidy for Electricity Produced from Renewable Energy Sources. The feed-in tariff scheme is administered by the Energy Authority. In addition, the Finnish tax legislation provides for certain tax incentives for using renewable energy sources (for example, simplified excise taxation and possibility to apply for a tax refund).

The Ministry of Employment and the Economy can also grant energy subsidies on a case-by-case basis (for example, under the Government Decree on General Requirements for Granting Energy Subsidies (1063/2012)) to companies, municipalities or organisations for: (i) Climate and environmental-related investments; (ii) Surveys promoting the production or use of renewable energy.

Since 2013, under the Act on Wind-Power Compensation Regions (490/2013), construction of wind farms has been made possible in regions where it had previously been limited because of its

<sup>(163)</sup> Amending Electricity Market Act 1995

<sup>(164)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

interference with military radar activity. A fee is now collected from the wind power firms for each turbine installed in those areas.

The amount of the feed-in tariff is linked to the electricity market price and/or the price of emission rights. This subsidy can only be granted for a maximum period of 12 years. Under the feed-in tariff scheme, the relevant electricity producers are offered a guaranteed price of 83.5 €/MWh. If the previous three-month average market electricity price falls below the guaranteed price, the difference is paid as a premium feed-in tariff. However, if the market price falls below 30 €/MWh, this amount will constitute the minimum level for calculation of the difference between the market price and the guaranteed price.

For wind power plant a target price of 105.3 €/MWh is set until the end of 2015. The principle of a target price is that the electricity producer has the responsibility of marketing its own electricity but the State compensates him ex post for the difference between the guaranteed target price and the actual sale price. The overall production incentives reached 33.2 M€ in 2012, 56.9 M€ in 2013 and 79.6 M€ in 2014.

For wind power, no more than 2500 MVA may be approved for support under this scheme. For 2015, it was decided that no further applications will be accepted once the wind-power capacity is reached. However, to increase the experience in offshore wind turbines construction, the Finnish Ministry of Employment and the Economy decided in November 2014 to grant 20 M€ to a trial project (a wind-power farm planned by Suomen Hyötytuuli Oy at Tahkoluoto in Pori). This project may also be granted the production support (premium) for 12 years.

In late 2015, certain amendments entered into force in relation to the feed-in tariff scheme for wind power plants. The aim of the amendments is a controlled close-down of the feed-in tariff scheme for wind power plants.

To benefit from the feed-in tariff scheme, wind power plants now require a valid tariff quota decision. This type of decision was valid until 1 November 2017. Therefore, an application for acceptance into the feed-in tariff scheme would have been made before 1<sup>st</sup> of November 2017 (and before the relevant wind power plant is taken into commercial use), otherwise the granted tariff quota decision expires and no more capacity would have been released from the total quota of 2500 MVA (subject to certain exceptions regarding the offshore wind power demonstration plant of Tahkoluoto in Pori). Under the amendments, tariff quota decision applications will no longer be approved once the maximum capacity limit of 2500 MVA is exceeded.

A working group established by the Finnish Ministry of Employment and the Economy has published a report regarding the evaluation of potential new subsidy scheme alternatives for renewable energy sources. The working group submitted the report to the Finnish Minister of Economic Affairs, Mr Olli Rehn, on 13 May 2016. According to the report, the working group considers that a technology-neutral production subsidy scheme based on a tender process would be a cost-efficient way of ensuring the increase of production capacity for electricity through the use of renewable energy in Finland. According to the Ministry of Employment and the Economy, the preparation of a draft Government Bill regarding the implementation of the relevant new subsidy scheme has not yet begun.

The National Energy and Climate Strategy of Finland for 2030 was approved by the Finnish Government in 2016<sup>165</sup>. According to the strategy the current feed-in tariff system of wind power will be discontinued. The goal is for projects to be implemented on market terms in the future. For the transition period and to maintain Finnish project expertise, the implementation of technology-neutral competitive tendering is seen as necessary, which means that the electricity production subsidy will only be paid for the most cost-effective and competitive production investments of renewable electricity. In 2018–2020, a total of two terawatt hours (TWh) will be subject to an open tendering process.

In the **heating and cooling** sector, heat production from cogeneration plants using biogas and wood biomass is supported in the form of a heat premium. This premium is equal to 50 €/MWh for cogeneration plants using biogas and 20 €/MWh for cogeneration plants using wood biomass.

---

<sup>(165)</sup> In Finland Long Term National Energy and Climate Strategy entered into force in 2008. The strategy is superseded as it is replaced by 2012 Energy and Climate Strategy.

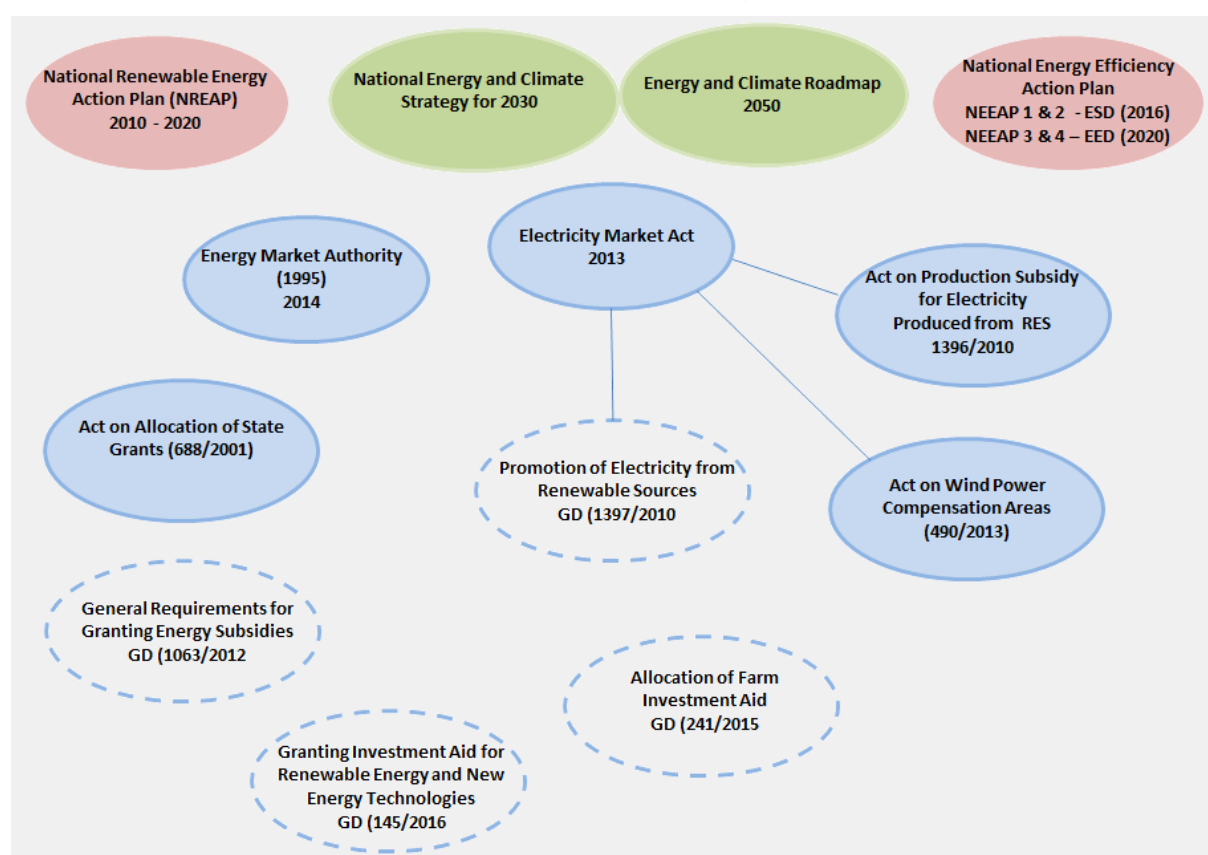
Aid has also been granted in 2013 and 2014 for the replacement of oil-fired boilers by biomass boilers. Also, the amount of guarantee aid for energy wood has been approximately 4 to 7 €/m<sup>3</sup> throughout the country.

The Rural Development Programme for mainland Finland for 2014–2020 is the continuation of the program running under the same name from 2007 to 2013, target rural micro-enterprises. Among other objectives, it promotes the production and distribution of biogas, the use of solid biomass fuels such as pellets and biochar and the chipping and drying of wood chips, and firewood. The Farm Energy Program, running from 2009 to 2016, promotes the development of renewable energies and energy efficiency in farms by the means of energy-efficiency agreements and energy plans. From 2015 onward it was included in the Rural Development Program.

Biofuel use in the **transport** sector is supported by a quota system. Fuel suppliers have the obligation to market a certain share of biofuel per year over the whole quantity of fossil fuel sold over the year. The biofuel share to be sold was equal to 6.00 % in 2011, 2012, 2013 and 2014.

Biofuels also benefit from a lower carbon dioxide rate. Indeed, since 2011, taxation of all fuels, including transport fuels, is based on their energy content and carbon dioxide emissions. Before this reform, the tax per litre levied on biofuels was the same as the one levied on fossil fuels. Now it takes into account the lower energy content of biofuels, particularly ethanol. In the end, the same carbon tax applies to unsustainable biofuels as on fossil fuels and only 50 % is applied to sustainable biofuels (no tax at all applies to double counted biofuels as requested in the RES Directive).

**Figure 74.** Energy legislative landscape in Finland



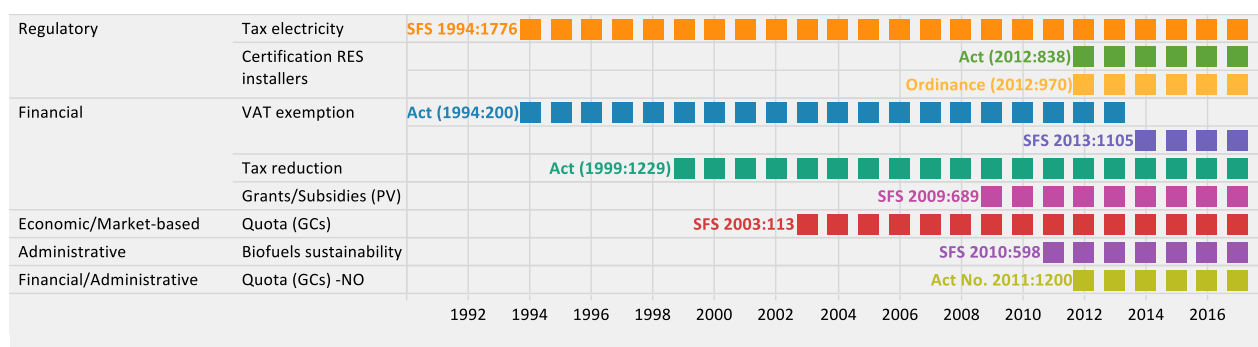
Source: Authors work (Banja M.)

## 6.2.27 Sweden

Overall renewable energy share in Sweden remained at 53.8% in 2015 and in 2016. Overall renewable energy share in Sweden remained above the NREAP and indicative trajectories throughout 2010-2016. Sweden already exceeded the planned 2020 target of 50.2 % in 2012, when it achieved 51.1%. Sweden also exceeded the 2020 plans on overall renewable energy share in all sectors. In 2016 an agreement on energy and climate policy was reached aiming a 100% share of renewables in electricity sector in 2040.

In Sweden, the Electricity Certificates Act (SFS 2003:113) is a market-based support system for renewable electricity production. The system is intended to increase the production of renewable electricity and to make the production more cost-efficient. The renewable energy sources include wind, solar, wave, geothermal certain hydro, certain biofuels, and peat in CHP plants. The initial objective of the electricity certificate system was to increase the production of electricity from renewable energy sources by 10 TWh by 2010, relative to the corresponding production in 2002. The system is extended until 2030. Regulation 2009:689 give the producer the possibility to apply for investment support for solar PV cells connected to the grid. Energy tax is an overall concept for excise duties on fuels and electricity, and is regulated by Act (1994:1776) on Energy Tax.

**Figure 75.** Main support for renewables in Sweden, 1994-2017<sup>166</sup>



A joint electricity certificate system with Norway is in place since 2012 under SFS 2011:1200. Producers of electricity whose electricity production meets the requirements in the Electricity Certificates Act receive one electricity certificate for each megawatt hour (MWh) of electricity that they produce. Each country has to provide half of the financing, but it is up to the market to determine where and when new production will take place. The common electricity certificate market is the first example in the EU of a common support scheme as described in Article 11 of the RED.

Since 2003 renewable **electricity** generation is supported in Sweden by the means of a green certificate system and a tax regulation mechanism. Green certificate scheme is technology-neutral (only electricity generation based on waste and on certain bio oils is not eligible). The average price of the certificate was equal to 29.77 €/MWh<sup>167</sup> in 2010, 20.08 €/MWh<sup>167</sup> in 2012, 20.49 €/MWh<sup>167</sup> in 2013 and 19.78 €/MWh<sup>167</sup> in 2014. Currently only about one eighth of all PV-generated electricity receives green electricity certificates, because only surplus exported electricity receives certificates.

In case of non-fulfilment of the obligation, the charge is equal to 150 % of the volume weighted average of the certificate price during a period from 1 April of the calculation year to 31 March of the following year inclusive. The average penalty was equal to 42.39 €/MWh<sup>167</sup> in 2010, 30.08 €/MWh<sup>167</sup> in 2012, 30.38 €/MWh<sup>167</sup> in 2013 and 27.75 €/MWh<sup>167</sup> in 2014.

The *investment aid for solar PV* is given for the installations that have commenced on 1<sup>st</sup> July 2009 or later and be completed by 31<sup>st</sup> December 2019. Installations generating both electricity and heat from solar energy (hybrid installations) are eligible only if the electricity generated amounts to

<sup>(166)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

<sup>(167)</sup> Using 1 SEK = 0.100927116 €



at least 20 % of an installation's total annual production. Under the investment aid for solar PV the total amount allocated was SEK 100 million in 2009, SEK 50 million in 2010, SEK 60 million for 2011 and 2012 respectively. The subsidy level has been changed as of 1 February 2013 covering a maximum of 35%<sup>168</sup> of the investment cost, compared to 45% in 2012. There has been a great interest in this aid, and approximately 8000 applications were submitted to the County Administrative Boards as of December 2014, approximately 3000 of which were granted aid. As of 1 January 2015, the aid level has been a maximum of 30 % for enterprises and 20 % for other stakeholders. The maximum aid possible for each solar photovoltaic cell system is SEK 1.2 million, and the eligible costs may amount to no more than SEK 37 000, excluding VAT, for each kilowatt of electrical peak power installed. For the period 2013-2016, the government allocated a total amount of SEK 210 million for this measure. For period 2016-2019 the allocated amount is SEK 1395 million.

The Wind Power Network in Sweden aims to promote the expansion of wind power through different support means. To some 15 projects were granted resources in 2013 and 25 in 2014. Some SEK 8.3 million was distributed in 2013, and in 2014 the total sum contributed was SEK 18 million. The Network has funding up to and including 2019. Some SEK 10 million per annum over the 2016–2019 period will be advertised for extended aid intended for the introduction of wind power to the market, and SEK 15 million per annum over the 2016–2019 period will be advertised for extended planning aid intended for wind power.

Under the *Income Tax Act (1999:1229)* the producer receive a tax reduction for the micro-scale production of renewable electricity. The right to a tax reduction is granted in respect of the kilowatt hours of renewable electricity that have been fed in at the connection point over the course of the calendar year, but amounting to no more than the number of kilowatt hours of electricity taken from that connection point during the year. The tax reduction is 0.60 SEK/kWh, and it may be up to 30 000 kWh per annum.

In the **heating and cooling** sector, aid was also granted for investment in the conversion of heating in dwelling houses (72.87 M€ between 2006 and 2011) and solar heating using solar thermal collectors for the production of hot water (16.15 M€ between 2006 and 2011).

For their use in electricity or heating and cooling sectors (not transport), certain heating fuels (vegetable oils and fats, etc., and biogas) can benefit from additional exemptions from energy and carbon dioxide taxes. These exemptions reached 557.83 M€ for 2011 and 2012, 525.83 M€ for 2013 and 512.71 M€ for 2014.

Heat production at combined heat and power (CHP) plants covered by the European Union emissions trading scheme (EU ETS) has been completely exempt from CO<sub>2</sub> tax since 1 January 2013, after having previously been subject to CO<sub>2</sub> tax at 7 %. Furthermore, energy tax on heat production was 30 % of the general energy tax rate. On 1 January 2014, CO<sub>2</sub> tax on district-heating plants exclusively producing heat under EU ETS was lowered from 94 % to 80 % of the general tax rate.

On the other hand, the tax allowance for the manufacturing industry outside the EU emissions trading scheme, and for agriculture, forestry and aquaculture, was reduced on 1 January 2015. They now pay CO<sub>2</sub> tax at 70 %, compared to 30 % previously.

In the **transport** sector, biofuels benefit from energy and carbon tax exemptions. In 2012, amendments were introduced into the Energy Tax Act (1994:1776), which set the tax exemption level of ethanol in petrol and biodiesel in diesel at a maximum of 5 % by volume on average from 1 February 2013. These restrictions were abolished by the Autumn Amendment Budget for 2015 (but the Fuel Act<sup>33</sup> limits the degree of blending to 10 % of ethanol and 7 % of FAME). When the new provisions in the Energy Tax Act came into force on 1 February 2013, the reduction in energy tax for biofuel became dependent on the type of fuel. New provisions concerning a reduced tax exemption for renewable fuels entered into force on 1 January 2015. The energy tax exemption was reduced for fatty acid methyl esters (FAME) sold or consumed as motor fuel. For FAME in low diesel blends, the tax exemption was reduced from 84 % to 8 % of the energy tax. The tax exemption for high blends or pure FAME was reduced from 100 % to 44 % of the energy tax. On the other hand, the tax exemption for CO<sub>2</sub> tax was not amended but will remain at 100 %. The

---

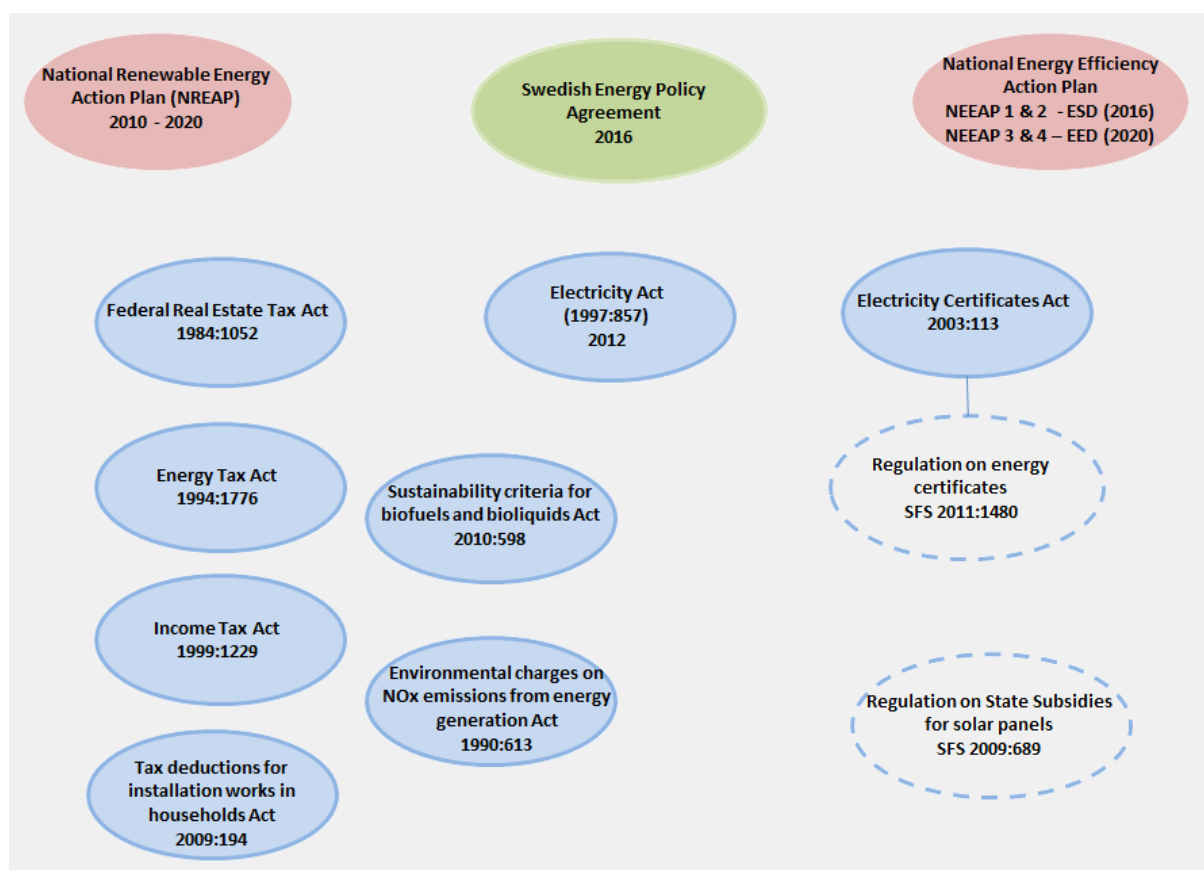
<sup>(168)</sup> The aid level of 35 % still applies to applications from stakeholders other than enterprises who submitted their applications prior to 1<sup>st</sup> of January 2015.

abolished restriction on tax exemption for HVO (hydro-treated vegetable and animal oils and fats) was implemented on 1 January 2015, but applied from 1 May 2014 onwards. The tax exemption applies to all HVO contained in the diesel fuel and which was produced from biomass. The tax exemption for HVO was previously up to 15 % HVO by volume of the diesel fuel declared for tax purposes during a given accounting period. Sweden has State aid approval for the current tax relief on liquid biofuels up until the end of 2018, and for biogas used as fuel up until the end of 2020.

The energy tax on fossil-based petrol and fossil-based diesel fuel from 2016 is SEK 0.48 per litre for petrol and SEK 0.53 per litre for diesel fuel, in addition to the annual conversion in relation to trends in the consumer price index. For petrol and diesel fuel, the tax rates are also converted to account for trends in gross domestic product. This is done using a template addition of two percentage points to the consumer price index (CPI) conversion. This additional conversion is done on both energy tax and CO<sub>2</sub> tax, but it is expressed as an increase in energy tax alone. The exemption from CO<sub>2</sub> tax for diesel fuel in work machinery used in agriculture, forestry and aquaculture activities will be enhanced. CO<sub>2</sub>-differentiated road tax was introduced in Sweden in 2006. As of 2015, this tax consists of a basic amount of SEK 360 per annum. The amount of CO<sub>2</sub> is SEK 22/gram of CO<sub>2</sub> emissions in excess of 111 grams/kilometre for combined-cycle use. For vehicles equipped with the technology to run on a fuel mixture consisting predominantly of alcohol, or consisting in whole or in part of a gas other than auto gas, the amount of CO<sub>2</sub> is SEK 11/gram of CO<sub>2</sub> that the vehicle emits per kilometre during combined-cycle use in excess of 111 grams (e.g. ethanol or methane gas).

Green cars are also eligible for tax reductions and tax exemptions. As of 1 January 2013, cars, light vans and light buses that fulfil the new definition of green vehicles and which are taken into use for the first time in Sweden are exempt from road tax for five years from the date on which the vehicle in question is taken into use. As from January 2017 the Swedish Parliament has decided that the temporary reduction in the taxable benefit value for certain environmentally-adapted vehicles is to be extended by three years, but that the maximum reduction is to be limited to SEK 10 000 per annum. In 2016 some SEK 50 million is being set aside for the electric bus premium, and SEK 100 million per annum is being set aside for the 2017–2019 period.

**Figure 76.** Energy legislative landscape in Sweden



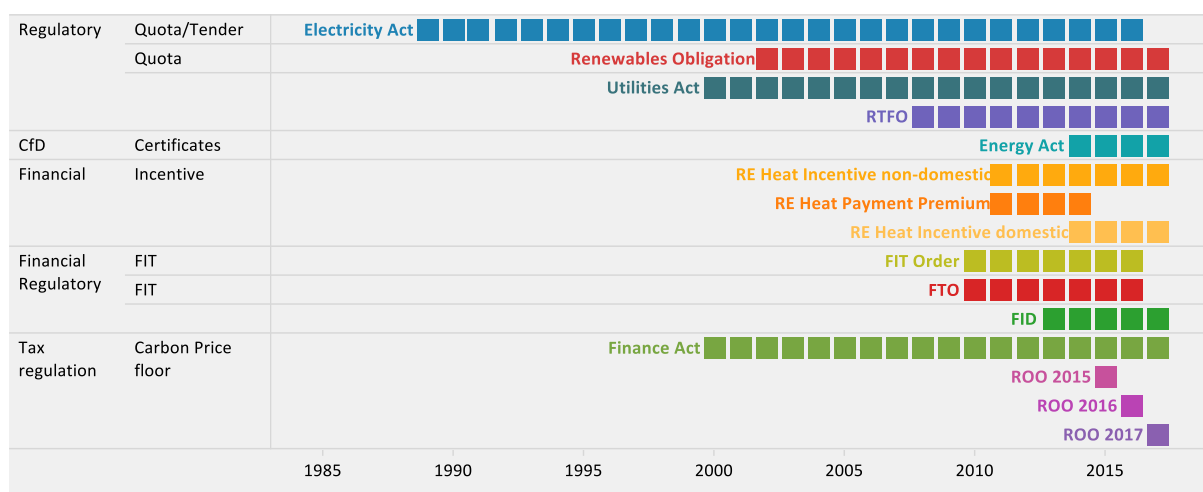
Source: Authors work (Banja M)

## 6.2.28 United Kingdom

Overall renewable energy share in the United Kingdom reached 8.5% in 2015 and 9.3% in 2016. Overall renewable energy share in the United Kingdom remained broadly in line with the NREAP and indicative trajectories throughout 2010-2016. The 2020 target that United Kingdom has to reach for the overall RES share is 15%. Even though renewable electricity deployment has progressed fast and renewable heating/cooling remained above the planned trend, the UK might fall behind expectations when it comes to meeting its 2020 target.

In the United Kingdom, the Electricity Act of 1989<sup>169</sup> allowed electricity companies, who meet certain criteria, to be exempt from having an electricity generation, transmission, distribution or supply licence. The Act provides a legal framework for the Electricity Market Reform (EMR). Renewables Obligation that entered into force in 2002 aimed the increase generation of renewable electricity from a range of technologies by setting obligations on electricity generators to ensure they generate electricity from renewable sources. Support is provided for up to 20 years from the time of accreditation. Scheme closed to all new generating capacity on 31 March 2017 with different closure dates for different technologies. To continue to support low-carbon electricity generation, the Contracts for Difference (CfD) scheme is introduced. The scheme was launched in October 2014 and the first CfD allocation round was successfully completed in March 2015. CfD contracts have a lifetime of 15 years from the point of contract award. The Feed-in-tariff in the UK is introduced on 1 April 2010. New entrants were eligible for 10-25 years, dependent upon the technology and time of application. Review of scheme, through a public consultation was completed in November 2015. The Financial Investment decision (FID) enabling for renewables process was launched in March 2013. The CfD programme has replaced the Renewable Obligation for subsidising new large-scale projects whereas the feed-in tariff remains the principal route to market for small-scale renewables.

**Figure 77.** Main support for renewables in United Kingdom, 1989-2017<sup>170</sup>



The Rural Community Energy Fund provided grants and loans from 2013 to 2017 to finance the costs of feasibility studies for local renewable energy projects and the costs associated with application to planning permission. The government allocated a budget of 17.03 M€<sup>174</sup> to this fund (which will run until funds are completely allocated). In 2011 the Anaerobic Digestion Loan Fund, the Anaerobic Digestion Strategy and Action Plan were launched. It consisted in an 11.36 M€ loan fund to help the development of anaerobic digestion by providing asset backed loans for plant, machinery and/or groundworks (minimum investment size of 56 782.59 € and maximum of 1.14 M€). In October 2013 the scope of this fund was extended to include an additional 3.41 M€ for farm based anaerobic digestion projects. Since 2012, the Green Investment Bank helps to mobilise investments from the private sector into green infrastructure. The aim is to decrease the risks of new green infrastructure projects in order to be able to raise more funds. Between 2012 and 2015, the government has made around 3.4 €bn available. These funds have supported almost 60 green projects in the UK. Between 2009 and 2016, the Community and Renewable Energy Scheme

<sup>(169)</sup> Last amendment in 2016

<sup>(170)</sup> The amendments dates of the support schemes/regulation/decisions/laws are not presented in details here but are taken into account when a period of a certain scheme is shown unless the name of the scheme has changed.

helped to deliver 500 MW (in 2020) of renewable energy in Scotland for local and community ownership. The program provided loans, advice and assistance to negotiate community benefits in commercial schemes. In 2016 over 150 projects have been funded and the average community payment reached 5 110 €/MW per year. *In 2012*, the Scottish Government launched the Renewable Energy Investment Fund to support community groups in connection with the Community Energy Scheme described above. It focuses on marine energy and district heating. This scheme had a budget of 117 M€. *In 2012* also was launched the Northern Ireland Biomass Processing Fund to support the installation of biomass fuelled energy technologies. Projects financed by the "Tranche Two" of the scheme are to be implemented by 2017. This Tranche provided funds up to 1.14 M€ supporting a total investment reaching 5.68 M€. *Since 2007*, the Low Carbon Research Institute, in Wales, works on turning the latest researches in low carbon energy into practical energy outcomes, as for instance improving the efficiency of solar panels, exploiting wave and tidal power, etc. The Institute was set up with a 5.8 M€4 budget granted by the Welsh government. An additional 17 M€ was granted in 2009 by the Welsh European Funding Office. *The Ynni'r Fro Program* is a Welsh program running from 2000 to 2015 providing advice, grants, capital support for community groups who want to launch their own social enterprise to produce energy. The financial part of this scheme consists of small grants up to 40.7 k€4 from local authorities and advice on making use of the different support schemes.

In the United Kingdom, renewable **electricity** generation is supported by three different schemes: (i) *Renewables Obligation (RO)* – The scheme is already closed for large-scale PV installations (< 5 MW) since 31<sup>st</sup> March 2015 and for other PV installations under 5 MW since April 2016. In 2014, it was supporting a total installed capacity of renewables equal to 24.6 GW. At the end of 2015 the total capacity reached 25.6 GW.

**Table 107** Average Certificate Price and Renewable Electricity Quota in the United Kingdom in 2010 and 2011

	England, Wales & Scotland	Northern Ireland
<i>Quota in 2010</i>	9.70 %	3.50 %
<i>Quota in 2011</i>	12.40 %	5.50 %
<i>Average Certificate Price in 2010</i>	59.46 €/MWh <sup>171</sup>	
<i>Average Certificate Price in 2011</i>	50.28 €/MWh <sup>171</sup>	

This scheme was not technology-neutral applying banding factors for each MWh of renewable electricity produced from the technology supported. The higher this factor is the higher is the support received by the technology.

**Table 108** Banding Factor by technology in the Green Certificate Scheme in the United Kingdom

Technologies	Banding Factor (Certificate/MWh)
<i>Hydro</i>	1
<i>Onshore Wind</i>	1
<i>Offshore Wind</i>	1.5
<i>Wave and Tidal (barrage &amp; lagoon)</i>	2
<i>PV</i>	2
<i>Geothermal</i>	2
<i>Geo-pressure</i>	1
<i>Landfill Gas</i>	0.25
<i>Sewage Gas</i>	0.5
<i>Waste with CHP</i>	1
<i>Pre-banded gasification &amp; pyrolysis</i>	1
<i>Standard gasification &amp; pyrolysis</i>	1
<i>Advanced gasification &amp; pyrolysis</i>	2
<i>Anaerobic Digestion</i>	2
<i>Co-firing of Biomass</i>	0.5
<i>Co-firing of Energy Crops &amp; biomass with CHP</i>	1
<i>Co-firing of Energy Crop with CHP &amp; dedicated biomass</i>	1.5
<i>Dedicated Energy Crops/ biomass &amp; energy crops with CHP</i>	2

(<sup>171</sup>) Using 1 £ = 1.13565181 €

(ii) *Feed-in-tariff* scheme that supports electricity generation by plants using PV, anaerobic digestion, combined heat and power, hydroelectricity and wind power with an installed capacity of up to 5 MW. The following table displays the guaranteed purchase prices for plants installed between October and December 2014<sup>172</sup>.

**Table 109** Support Level through the Feed-in Tariff scheme in the UK in 2014

Technology	Installed Capacity	Support Level <sup>173</sup> (€/MWh)
<i>PV - Stand-alone PV</i>	IC<5MW	76.32
<i>Anaerobic digestion</i>	IC<250kW	134.23
	IC<500kW	124.24
	IC<5MW	107.89
<i>Combined Heat and Power</i>	IC<2kW	158.42
<i>Hydro</i>	IC<15kW	227.47
	IC<100kW	212.48
	IC<500kW	167.85
	IC<2MW	131.17
	IC<5MW	35.89
<i>Wind</i>	IC<100kW	191.58
	IC<500kW	159.56
	IC<1.5MW	86.76
	IC<5MW	36.80

(iii) *Feed-in premium* scheme (CfD) that is designed as a sliding feed-in premium scheme. A contract is signed between the renewable electricity producer and the Low Carbon Contracts Company (a government-owned company) for a "strike price", for 15-years. The State compensates the producer for the difference between the strike price and the actual market price. Only producers with an installed capacity higher than 5 MW are eligible for this scheme. Its first allocation round was completed in March 2015 by the means of a competitive auction for 25 contracts representing approximately 341 M€ per year<sup>174</sup>. The Final Investment Decision enabling for renewables process was launched in 2013. In this framework, the government gave his approval for the five offshore wind projects in July 2014 and for biomass conversion project in December 2015.

In the **heating and cooling** sector, renewable heat generation is supported through 2 production aid schemes: *Domestic Renewable Heat Incentive* incentivises the generation of renewable heat in households. It replaced in 2014 the Renewable Heat Payment Premium that was opened in 2011. The following table displays the level of support granted as of July 2014. Additional funding is expected to reach a budget level of £1.15billion by 2021 shared across domestic and non-domestic schemes. Domestic RHI has supported 43000 accreditations since its launch in 2014 to October 2015. For the domestic scheme, heat is calculated as an estimate of deemed heat.

**Table 110** Level of Support Granted as of July 2014 through the Domestic Renewable Heat Incentive

Technology		Support Level <sup>174</sup>
<i>Heat pumps</i>	Air source	82.90 €/MWh
<i>Biomass</i>	Biomass-only boilers; and biomass pellet stoves with back boilers	138.55 €/MWh
<i>Geothermal</i>	Ground source heat pumps; and water source heat pumps	213.50 €/MWh
<i>Solar Thermal</i>	Evacuated tube solar thermal panels; and flat plate solar thermal panels	218.05 €/MWh

The support is also granted for *non-domestic heat installations*. This scheme was opened in 2011. The following table displays the support level granted as of December 2013. The non-domestic RHI has delivered support for over 5TWh of renewable heat generation and almost 13,000 accreditations since its launch in 2011 to October 2015.

<sup>(172)</sup> Following the indications in the PRs, tariffs were extracted from <https://www.ofgem.gov.uk/environmental-programmes/fit/fit-tariff-rates> on the 20<sup>th</sup> of November 2017

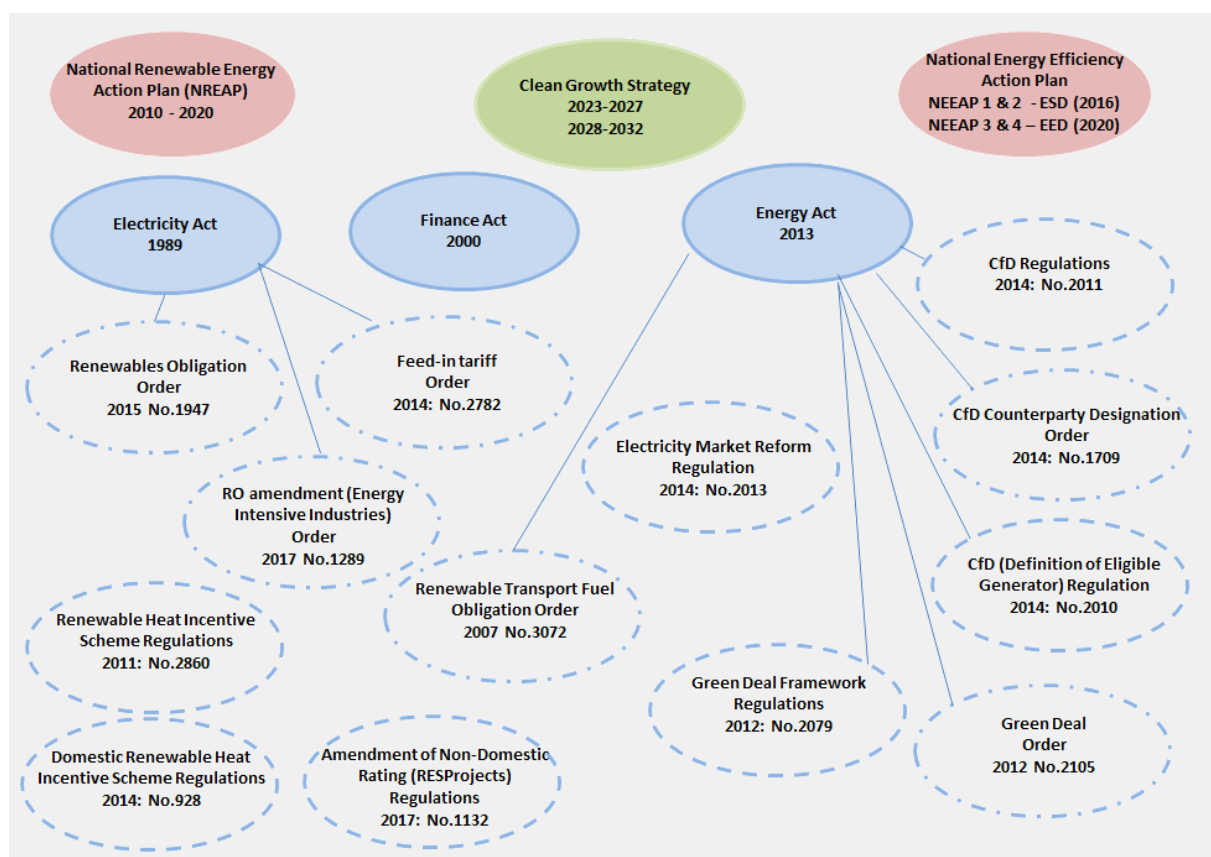
<sup>(173)</sup> Using 1 £ = 1.13565181 €

<sup>(174)</sup> Using 1 £ = 1.13565181 €

**Table 111** Level of Support Granted as of December 2013 through the Non-Domestic Renewable Heat Incentive

Technology		Capacity	Support Level <sup>174</sup>
Biomass	Solid biomass, municipal solid waste (inc. CHP)	IC<200kWth	99.94 €/MWh
		IC<1MWth	57.92 €/MWh
		IC>1MWth	22.71 €/MWh
Geothermal	Ground source heat pumps; water source heat pumps; deep geothermal		98.80 €/MWh
Solar Thermal		IC<200kWth	113.57 €/MWh
Bio-methane	Bio-methane injection and biogas combustion (except landfill gas)	IC<200kWth	85.17 €/MWh
Biogas	Small	IC<200kWth	85.17 €/MWh
	Medium	IC<600kWth	67.00 €/MWh
	Large	IC>600kWth	24.98 €/MWh
CHP			46.56 €/MWh
Deep Geothermal			56.78 €/MWh
Air-to-Water Heat Pumps			28.39 €/MWh

**Figure 78.** Energy legislative landscape in the United Kingdom



Source: Authors work (Banja M.)

In the **transport** sector, the use of biofuels is supported through a quota system. To comply with this scheme, fuel suppliers have to market a certain share of biofuels over the whole quantity of other fuels sold during a given year. This compulsory share was equal to 3.50 % in 2010, 4.00 % in 2011, 4.50 % in 2012, 4.75 % in 2013 and 5.00 % in 2014. A penalty of around 0.34 € per litre<sup>175</sup> (0.3 £) is applied for each missing litre. In 2009 a Green Bus Fund was launched to assist

(<sup>175</sup>) 0.3 £ using 1 £ = 1.13565181 €

bus operators and Local Authorities to buy around 350 new low carbon buses. The initial budget was around 34 M€. Biofuels also benefit from a 22.71 €<sup>176</sup> tax exemption per litre.

Biofuel development also benefited from the launch in 2013 of an advanced biofuels demo which objective was to bring together those in the R&D field (e.g. universities) with industry to share ideas and test fuels. The government granted a 28.39 M€ budget in December 2014, for three years until 2018.

A consultation was launched in 2017 on the proposed changes in the Renewable Transport Obligation scheme. These changes consist in:

- increasing the obligation level to 9.75% in 2020, rising to 12.4% in 2032;
- an additional target for development fuels at 0.1% in 2019, rising to 2.8% in 2032;
- a crop cap at 4% in 2018, reducing in equal increments annually from 2021 to reach 3% in 2026 and 2% in 2032;
- bringing renewable aviation fuels and renewable fuels of non-biological origin into the scheme

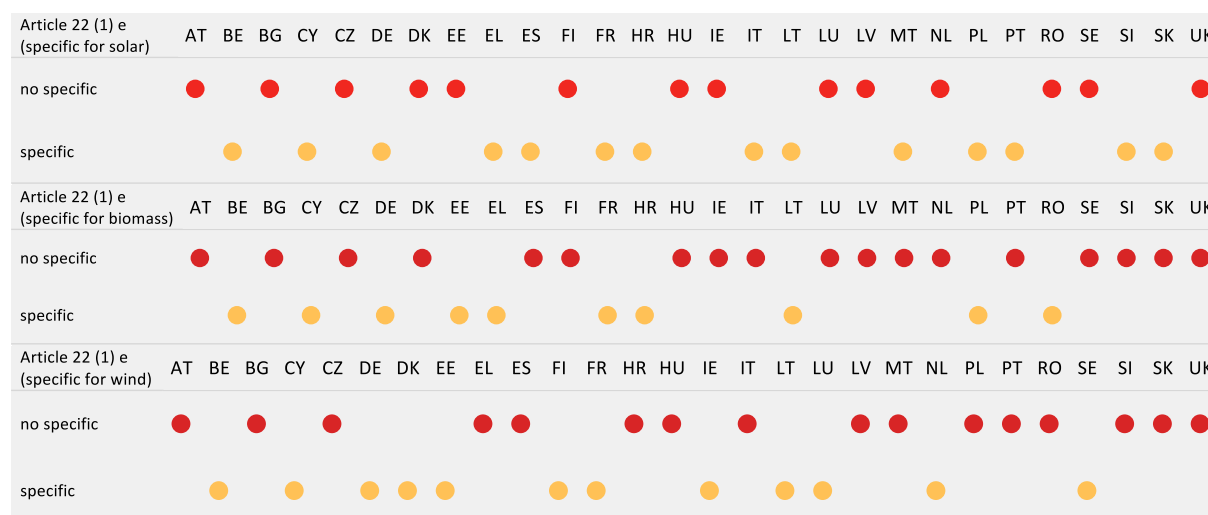
---

<sup>(176)</sup> 20 £/litre using 1 £ = 1.13565181 €

## 7 Administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy – reporting under Article 22(1) e

According to the Article 13 of the Directive 2009/28/EC "Member States shall ensure that any national rules concerning the authorisation, certification and licensing procedures that are applied to plants and associated transmission and distribution network infrastructures for the production of electricity, heating or cooling from renewable energy sources, and to the process of transformation of biomass into biofuels or other energy products, are proportionate and necessary".

**Figure 79.** Administrative procedures in EU countries, specific for solar PV, biomass, wind - end 2014



In **Belgium** the administrative procedures to remove the regulatory and non-regulatory barriers are in place since 2011. They are specific for solar photovoltaic, wind power, heat pumps, geothermal, biomass and biofuels. They applied to *PV facilities* under 10 kVA through: (i) the certification inspection visit: (ii) the meter readings for the award of green certificates which must be submitted annually. The lower the income's households the higher is the grant. The credits are given at higher price for installations  $\leq 5$  kW. The administrative procedures for *wind power* include (i) a system to streamline the necessary permits on the construction of offshore platform designed to optimise the connection of the North Sea wind farms to the onshore network. In Flemish Region: (i) accelerated process for permit applications of investment projects and wind turbines may be allowed in agricultural areas; (ii) new wind turbine circular (information and guidance on the location of wind turbines in Flemish for all officials involved in granting wind turbine licences). For *heat pumps* the improvement of administrative procedures consist in the establishment by the Flemish, Walloon and Brussels-Capital regions of a harmonised system for the education and certification of reliable and high-quality installers. For *biomass* the Walloon Region has in place a number of recommendations to develop wood energy. For *biofuels* a licence for marketing of non-standardised biofuels and clean rapeseed oil is in place since 2006.

In **Bulgaria** the administrative procedures for regulatory and non-regulatory barriers are defined in the Renewable Energy Act (ZEVI) since 2011. The amendments of ZEVI took place after 2013. In 2013 a regulation on the regulatory control of electricity prices came into effect amending the ZEVI: (i) obligation of development of a methodology to distribute costs across all end clients connected to the country's electricity system (in framework of feed-in prices for renewables); (ii) regulation of the obligation to pay charges for the generation of electricity from wind and solar energy; (iii) suppression of persons (building RES facility) register; (iv) incentives shall not apply to RES producers entered into service after the law (but for small sites  $< 30$  kW). Since 2014 an "one-stop-shop" for on-line submission, registration and handling of applications and information regarding generation of energy from renewables, guarantees of origin, transmission and distribution of electricity, production and use of biofuels.

The last amendment was done in 2015 providing that incentives for mandatory purchase of generated electricity at feed-in prices and under long-term contracts shall not apply to energy sites



producing electricity from renewables which were put into operation after the law entered into force. Exceptions are made for small sites with a total installed capacity 30 kW or less which are planned to be built on roofs and facades of manufacturing units and warehouses, connected to the electricity transmission and electricity distribution grids in urbanised territories and sites for co-generation and indirect use of biomass which are planned to be built in urbanised territories, farms or production zones and which have an installed power capacity of up to: (i) 1.5 MW and use biomass, of which the overall weight of manure is at least 60 % (sites under Article 24(3)(a) of the ZEVI); (ii) 500 kW and use biomass from plant waste from their own farming production (sites under Article 24(3)(b) of the ZEVI).

In **Czech Republic** the administrative procedures to remove the regulatory and non-regulatory barriers consist (i) on the improvement in acts for land-use planning and the building code and (ii) on removing or limiting ownership rights to land or a building. No specific administrative procedures are introduced for specific technologies.

In **Denmark** specific administrative procedures are introduced for *wind power*: (i) one-stop shop for offshore wind turbines (all the main licences for preliminary surveys, establishment and power production are issued by the Danish Energy Agency; (ii) intensive dialogue conducted during put to tender and license for preliminary surveys and establishment prepared in advance. Specific administrative procedures are applied for *heating buildings*: to all new buildings (except those built in areas designated for supply by district heating or which were designated for natural gas supply) the building heating must be based on renewables such as wind power, solar energy, heat pumps, biomass, landfill gas, gas from wastewater treatment plants, biogas and bio-oil.

In **Germany** no legal or other barriers exist to the expansion of renewables. The procedures are defined in the Renewable Energies European Law Adaptation Act (EAG EE). Nevertheless, facilities to exploit *wind power* with a total height of more than 50 metres are subject to approval according to Annex 1 No 1.6 of the 4<sup>th</sup> Federal Emission Control Regulation. A "one-stop-shop" for the procedures under the Grid Expansion Acceleration Act (NABEG) is in place.

In **Estonia** specific administrative procedures to remove barriers are applied to *wind power*: (i) focus on wind-based micro-generation (simplified condition to the Grid Code to connect micro-plants); (ii) more transparency on investment conditions; (iii) acceleration of project development. In the *heating/cooling sector* proposals are developed in cooperation with district heating agencies and other related organisations for the amendments to the District Heating Act to help enhance sustainability of district heating areas. For *biofuels* amendments to the Liquid Fuel Act on the obligation for fuel suppliers to supply biofuel corresponding to the biomass sustainability criteria are in place.

In **Ireland** facilitation of the needs of *windfarms* developers are implemented: (i) facilitation of transmission and distribution contestability; (ii) implementation of Least Cost Chargeable/ Least Cost Technically Acceptable charging; (iii) reduction of 8% in connection application fees in 2010 and developers of the less onerous bonding requirements. These administrative procedures are based on the Single Electricity Market Committee Decisions approved during period 2013-2014 in order to achieve greater level of clarity (objective is 75% instantaneous wind penetration). According to the Strategic Environmental Assessment 4 500MW of offshore wind can be developed. There are also in place proposition of Market Support Tariff for *marine technology*. For almost all technologies in 2010 was in place the Planning & Development (Amendment) Act according to which the renewables project developers have a security of 10 year extension of their planning permission grants. Draft Bioenergy Plan (2014) recommends introduction in 2016 of a Renewable Heat Incentive for larger *heat users*.

In **Greece** the legislative amendments address mainly the Special Account of Article 143, L.4001/2011 for the compensation of RES projects. For *solar photovoltaic* Law 4254/2014 abolished the suspension of the licensing procedure for new PV plants applications imposed in 2012. Moreover, new boundaries for the period 2014-2020 were introduced concerning (i) capability of PV installing capacity for the period of 200MW per year and (ii) an additional one-off 300MW capacity for fast track PV projects; (iii) one year after granted an annual fee is offered. A net metering scheme for small solar PV is guaranteed by Law 4203/2013.

The Law provided also boundaries after 01.01.2014 for installed capacity of *solar thermal*: 100MW for interconnected, 10% of system installed capacity for non-interconnected islands. For *geothermal* (i) creation of boundaries after 2014 for installed capacities of low-temperature geothermal (50MW); (ii) 5-year of lease contracts for exploration rights and management of high-temperature geothermal fields. For *biomass*: (i) creation of boundaries after 2014 for installed capacities of biomass (40MW) and biogas power units (50MW); (ii) priority to licensing of power generation projects related to biomass, biogas or biofuel of solid waste management bodies.

Installations that exceed the aforementioned boundaries should be compensated not by the FIT scheme price scale but according to the Power Exchange Code Manual of Art.120, L.4001/2011.

Regarding *biofuels and bioliquids*, law 4062/2012 fully transposed Directive 2009/28/EC into the Greek legislative framework, setting the regulatory grounds for statistical transfers, joint projects, joint support schemes, sustainability criteria for biofuels and bioliquids and verification of compliance, calculation of the biofuels and bioliquids impact on GHG emissions. More than half of the producers/traders of biofuels have been certified by a voluntary scheme.

In **Spain** 2011 saw the publication of Royal Decree 1699/2011 of 18 November, regulating the grid connection of low-power electricity production facilities. This standard establishes basic, simplified administrative and technical conditions for connection to the low and high voltage grid (up to 36 kV) of renewable energy and low-power cogeneration facilities in order to reduce the proceedings required to develop these facilities.

The Regulation on Heating Systems in Buildings (RITE) underwent several revisions in order to update it and an energy efficiency certification procedure was developed, culminating in the publication, in April 2013, of Royal Decree 238/2013 and Royal Decree 235/2013, respectively. Spanish Building technical Code (Order FOM/1635/2013) simplified the existing regulation and extended its application to all renewable technologies.

State Secretariat for Energy Decision of 18 December 2015 established criteria for participating in system adjustment services and approving certain operating and testing procedures for adaptation to Royal Decree 413/2014 of 6 June 2014 regulating the activity of electricity production from renewable energy sources, combined power and heat generation and waste.

In **France** since January 2012, facilities using renewable energy that have an installed electrical capacity of less than 12 MW have benefited from simplified operating authorisation procedures. The ceiling has been increased to 30 MW for wind farms.

From 2014 and on single authorisation for the onshore wind and biogas sectors (installations classified for environmental protection purposes) and for offshore renewable energy and hydropower (installations, structures, works and activities) is applied.

Under the Energy Transition Law (i) a single authorisation is issued for *onshore wind* farms subject to authorisation under the procedure for installations classified for environmental protection purposes (along with speeded up application procedure). Authorisations for *onshore and offshore wind* farms is set to be extended for up to 10 years (when no substantial change in the circumstances under which the authorisation was first granted), in particular so as to take account of connection times; (ii) revision of Town Planning Code to permit *wind farms* in coastal municipalities is in place; (iii) simplified operating authorisation procedures for wind farms of less than 30MW are applied; (iv) suppression for onshore wind farms of capacity thresholds for the eligibility to benefit from the electricity purchase obligation and (v) suppression of location and number of tower requirements for onshore wind power are set.

Plan to support *methanization* (2013) are based on the rise of threshold of the authorisation scheme for biogas plants subject to the Classified Installations for Environmental Protection (ICPE) regulations: 50 to 60 tonnes of inputs a day. Law on energy transition for green growth (2015): extension of single licence for the methanization setting limits for the use of food crops in biogas to steer the development of the methanation sector towards the treatment and utilisation of waste, in particular agricultural waste. Simplified operating authorisation for renewable facilities with installed capacity <12MW (from 2016 majority will be exempt) are applied.

In *transport sector* the introduction of fuel taxation system intended to promote the incorporation of biofuels (in accordance with the annual targets set by France for the incorporation of BFs, this General Tax on Polluting Activities (TGAP) is reduced in proportion to the volume of BFs incorporated into fuels released for consumption.) In 2015 extension of the incorporation target to 50% of non-road diesel by volume

For *heat pumps* the Energy Transition Law prioritises energy-plus buildings (BEPOS) and environmental performance by taking into consideration greenhouse gas emissions.

In **Italy** the National Energy Strategy (2013) included several policy measures for energy planning which further upgrade the governance system, to improve and simplify national-level horizontal coordination. Accordingly, Article 24 of Decree-Law No 90 of 24 June 2014, converted by Law No 114 of 11 August 2014, guaranteed the use, across the national territory of standardised and simplified forms for submitting to municipalities' communications and applications for building works covered by that procedure under national and regional legislation. Specifically for *solar PV*

technology, the Decree of the Ministry of Economic Development of 19 May 2015, published in the Official Gazette of 27 May 2015 approved the single form for installing, connecting and operating small PV plants on the roofs of buildings with output of less than 20 kW. The first part of the form is for data to be supplied before commencing the work, while the second part is for data to be provided at the end of the work. Similar simplification measures are set to be adopted for other renewable plants for which communication is required. The same Decree Law No 91/2014 introduced into Legislative Decree No 28/2011 a further Article (8-bis) governs the authorisation systems for the production of *biomethane*. Under this Article, biomethane production plants are authorised with the simplified authorisation procedure if their production capacity does not exceed 500 standard m<sup>3</sup>/hour or with the single authorisation if their production capacity is above that threshold.

The current national framework sets out three types of authorisation procedures for installations using renewable energy sources: (i) *Single Authorisation (AU)*: the AU is required for installations exceeding specific power thresholds, and is issued at the end of a single procedure. This authorisation enables construction and operation of the power plant, where necessary also derogating from the applicable zoning rules. Legislative Decree No 28/2011 reduced the maximum duration of the procedure from 180 to 90 days, plus the time allotted to the Environmental Impact Assessment (EIA), where required; (ii) *Simplified Authorisation Procedure (PAS)*: introduced by Legislative Decree No 28/2011 this simplified procedure can be used for the construction of renewable energy installations below certain installed capacity thresholds (above which the AU applies) and for certain types of thermal energy plants. The PAS must be submitted to the Municipality at least 30 days before commencement of works, together with a detailed report signed by a certified engineer and with project drawings and documents. Under the PAS system, the application is authorised via tacit acceptance: 30 days after its submission, if no replies or notices have been issued by the Municipality, works can commence; (iii) *Notification to the Municipality of minor works not requiring a building licence* (Edilizia Libera - CAEL): is the simplest authorisation procedure, applicable to certain small RES thermal or electricity plant projects, which are considered to be minor works and as such are exempted from building permits. The works commencement notification must be sent to the Municipality together with a detailed report signed by a certified engineer. There is no requirement to wait 30 days before starting works.

In **Cyprus** the progress is made through the following measures aimed at improving administrative procedures and removing barriers to the promotion of RES energy: (i) continued exemption of *wind* farm power stations up to 30kW, as well as *solar photovoltaic* and *biomass* systems up to 20 kW, from the obligation to obtain building and operating licences from the Cyprus Regulatory Authority; (ii) continued exemption of *solar photovoltaic* systems up to 20 kW from the obligation to obtain a town planning permit, on the understanding that said systems are installed in a specific manner, and exemption of photovoltaic systems up to 20 MW from the obligation to obtain building permits. Environmental impact assessments are not required in the following cases: (i) *wind* turbines with capacity up to 30 kW (a preliminary environmental impact assessment is required for wind turbines with capacity of over 30 kW); (ii) *solar photovoltaic* installations with a capacity of up to 100 kW; (iii) electricity generation plants using *biomass* with installed generating capacities of up to 20 kW; (iv) *wave energy* power plants. Cyprus Transmission System Operator no more request town planning permits /any other permits in addition to the building permit at the stage where connection applications are submitted

In **Latvia** necessity to improve the administrative procedures laid down in Cabinet Regulation No 221 and Regulation No 262. In 2013 the amendments in these 2 regulations introduced an additional mechanism for the verification of the operation of the power plants which had received aid, i.e. a control group. Together with the amendments these Regulations were supplemented by a legal provision which obliges the economic operators to submit a copy of a construction permit to the Ministry of the Economy and to submit a statement issued by a credit institution on granting a loan or a statement issued by a credit institution certifying that the economic operator has access to the funds necessary for the implementation of the project.

The *electricity price* of the mandatory procurement is based on a price formula, and one of its elements is a link to the Regulator's approved final trading tariff of natural gas (excluding value added tax), which varies on monthly basis and depends on the level of the trading price of natural gas. In 2014 further amendments are made to the 2 amendments envisaged a limit on the components included in the formulae of the mandatory procurement price, i.e. natural gas price variability, by setting the maximum limit value of this component at the level of natural gas trading tariff of March 2014 (€277.46/thousand n.m<sup>3</sup>).

The currently applicable versions of 2 Regulations stipulate that until 1 January 2020, no new producers can qualify for the aid (to obtain the right to sell electricity under the mandatory

procurement and to obtain the right to receive the guaranteed payment for the installed electrical capacity at a power plant). In 2014 the electricity net payment system for households generating electricity from RES for own consumption, such as using solar panels or wind generators was introduced. The system prescribes the settlement procedure for electricity consumed and the procedure according to which the distribution system operator offsets the electricity consumed by the user-household and produced by the user-household and transferred to the distribution system operator's grid.

In **Lithuania** amendments relating to the simplification of administrative procedures with a view to promoting the development of renewable energy are regulated by Law No XI-1375 of 2011 on energy from renewable sources: (i) for individual wind power plants and/or solar power plants installed in rural areas (capacity <350kW) no requirement to change the purpose of use of the land is applied; (ii) no construction permit, eligibility requirements, environmental and public health impact assessment procedure for low-capacity wind power plants (up to 30kW) is needed; (iii) simplified procedure for permits to expand electricity production capacity from renewables not of more than 10kW (not exceeding the allowable installed capacity existing at the closest connection point of distribution networks) except for hydro-plants of capacity<350kW and biogas power plants built at animal husbandry and poultry enterprises, landfills and waste water treatment plants of capacity<1.2MW. Article 16(4) of the Law sets out that within *30 calendar days* of receipt of the required documents the Ministry of Energy of the Republic of Lithuania must issue a permit to the producer to expand electricity production capacity from renewable energy resources or to provide a reasoned refusal to issue the permit.

In **Luxembourg** the Grand Duchy Regulation of 10<sup>th</sup> May 2012 makes provision for various simplifications to the Luxembourg Incommodo-Commodo procedure (approval procedure), which also applies to energy from renewable sources (e.g. geothermal boreholes). The Electricity Market Act (Amended Law of 1 August 2007 on the Organisation of the Electricity Market) contains the following provisions in its most recent amendment (2012) in connection with progress in evaluating and improving administrative procedures: (i) grid operators are required to send energy producers using renewable sources detailed information on grid connection costs and connection schedules; (ii) the source of renewable energies (and thus the 20 % target for renewable energies in 2020) is used as a criterion for approval of energy production plants. Some barriers which had blocked the potential for wind energy in the north of the country have been eliminated. Because wind power would only be possible to a limited degree in the vicinity of the planned radar, the planned construction of the radar acted as a barrier to the development of wind power. For aviation safety purposes, construction is not permitted within six kilometres of radar and projects within a radius of 16 kilometres require special studies. The new government (from 2013) has put greater focus on finding new solutions to ensure aviation safety on the one hand and to encourage the development of wind energy in Luxembourg on the other. A decision was made not to build the radar and to guarantee aviation safety by other means. The development of wind power can therefore be pursued more intensively.

In **Croatia** the Electricity Market Act was amended in 2012. The amendments aimed to simplify the procedures to obtain an energy permit: (i) simplification of procedures for the construction of solar power plants (authorizing construction & permits); (ii) Incentive purchase prices; as the initial costs of technological equipment for certain technologies have been reduced, levels of tariff items for new plants have been adjusted accordingly; (iii) improved quality of technology allocation; for some technologies, allocation has been improved, with incentive purchase prices according to installed plant power; (iv) increase in solar power plant quota between 1 MW and 15 MW (10 MW for integrated solar power plants and 5 MW for non-integrated solar power plants); (v) the use of renewables for generating heat energy has been enabled by providing additional bonuses to promote the use of solar and geothermal energy to generate thermal energy; (vi) an energy efficiency requirement has been introduced, requiring biomass and biogas plants to achieve a high level of efficiency, entailing an obligation to make use of the hot water too.

In November of 2013 the new Rules on the acquisition of eligible electricity producer status were adopted (NN No 132/13, 81/14, 93/14); they simplify further and shorten the procedure for gaining eligible producer status, for the purposes of production of electricity using simple buildings as defined in the spatial development and construction regulations, i.e. integrated solar electricity power plants (solar power generators installed on building surfaces. The new Tariff System for Production of Electricity from Renewable Sources of Energy and Cogeneration (NN No 133/13, 151/13, 20/14 and 107/14) was adopted in 2013. For integrated solar power plants (solar panels attached to buildings) the eligibility requirement is determined based on consumption at the place of generation only. The new tariff system also increased the quota for incentivising the construction of solar power plants of installed capacity up to and including 300 kW to the overall installed power

of 7 MW and for non-integrated solar panels to a total of 5MW overall installed power. The tariff system sets additional requirements for planned installations and projects for which purchase agreements at incentivised prices are being signed.

In **Hungary** gradually simplifying the authorisation rules are currently in effect. No special licence for the establishment of power plants below a nominal capacity of 0.5MW. In the case of power plants with a nominal capacity between 0.5MW and 50MW the regulatory authority issues a combined licence for small power plants under a simplified authorisation procedure (2007). The administration time of authorisation procedures concerning the construction of electrical installations was reduced significantly with the amendment of Act LIII of 2006, which entered into force on 1 May 2012, further simplifying the rules of procedure for priority cases. The competent authority must render a decision on issues within the scope of Act LIII of 2006 and classified as issues within the scope of that Act *within 30 days*, instead of the previous two months. Simplified electronic application management process is applied in the Environment and Energy Operational Programme and the Green Investment Scheme. From 2008, Act LXXXVI of 2007 on electricity and its implementing decree, Government Decree No 273/2007 of 19 October 2007, introduced the concept of small household power plant. The turnover of electricity is measured by a special electronic meter with phased measurement, showing the amount of electricity taken and fed into the network for each direction. Accordingly, electricity generation and own consumption operates on the basis of balance settlement.

In **Malta** the improvement of administrative procedures to remove regulatory and non-regulatory barriers is applied mainly to solar photovoltaic. In November 2015 new set of guidelines to further support the uptake of solar technologies within the curtilage of buildings was issued. These new guidelines encourage the introduction of solar PV and solar water heating systems (SWHs) at ground level within backyards, within the building fabric, and in surface car parks and other open spaces. The requirement to set back PV and SWH units from the front and back edge of rooftops has been removed. Solar applications that fall outside the scope of these guidelines may require a planning permit from the local planning authority. The application is endorsed, or otherwise, by the Authority *within 30 days*. As from 2015 the distinction between ground-mounted and roof-mounted tariffs was removed. Payments for electricity generated by PV installations with a capacity larger than 100kWp and exported to the grid are settled by the Development Notification Order (DSO) in intervals of a minimum of two months. Separate metering of multiple solar PV installations as well as co-generation units at the same premises has been also made possible. As from this year, structure-integrated PV systems are also eligible for support. For other technologies exemption for generators with installed capacity <16Amps per phase from requirement to obtain authorisation and license is applied.

In **Netherlands** the administrative procedure for renewable energy projects has been made more efficient over the past few years. Furthermore the administrative procedures have been simplified by means of digital 'one-stop-shop' service. The entry into force of the Crisis and Recovery Act also introduced coordination regulations for provinces and municipalities, and administrative law procedures have been streamlined in addition to this. For example, the deadlines for the courts have been shortened and decentralised authorities may no longer appeal against decisions of central government. This has cut the time required for spatial incorporation and the granting of permits including legal proceedings from what has often been 10 years to around 2 years. The Structural Concept concerning offshore wind was published in February 2013, followed by the Structural Concept concerning onshore wind in March 2014. At present, the procedures are underway to adapt the Structural Concept concerning offshore wind for the wind turbine sites located between the 10 and 12-mile zones. The system that was developed with the sector for the roll-out of offshore wind is being implemented and developed. A Core Team has been developed specifically with regard to onshore wind to work jointly on achieving the agreed targets: 6 000 MW of onshore wind by 2020. Ministry of Infrastructure and Environment is working on bottlenecks relating to noise, location-related risks, pipelines, and disruption of military radar caused by wind turbines to create greater scope for market parties to construct wind turbines.

In **Austria** approval of generation systems is based on statutory specifications which ensure that renewable energy-based systems are not disadvantaged. Support for a green electricity system can be divided into three stages: (i) approval under electricity law: various approvals may need to be submitted in individual cases (approval under electricity law, operational plant permission, planning permission, permission under water law, permission under forestry law, permission under waste law, environmental impact study/notice); (ii) recognition as a green electricity system in accordance with Section 7 of the Green Electricity Act 2012; (iii) application for support filed with the OeMAG (Green Electricity Clearing Agency): support for green electricity systems can be claimed both for raw material-dependent and raw material-independent technologies from the

OeMAG, money permitting, via feed-in tariffs. This does not apply to photovoltaic systems under 5 kWp or to small and medium hydroelectric plants. Support can only be provided for energy delivered to the public network under a network access contract with the local network operator. The OeMAG is only obliged to grant the application if the total electricity delivered to the public network from a green electricity system will be delivered to the Green Electricity Clearing Agency over a period of at *least 12 calendar months* and the system operator belongs to the Eco-balance Group. Own consumption must be deducted.

In **Poland** administrative procedures relating to the use of energy from renewables are proportionate and sufficient in view of the development of the large-scale (industrial) energy sector, as evidenced by new installed capacities. The Act on renewables was adopted on 20 February 2015, being the first piece of legislation in the form of an act of Parliament dedicated exclusively to renewables. The mechanism of certificates of origin was modified in such a manner that the cost of support for existing electricity generators would be reduced without affecting the rights vested in them. For existing renewables installations, the optimisation exercise involves restricting aid to multi-fuel firing units and large-scale hydropower (with installed capacity above 5 MW), freezing the substitution fee and limiting the period of support (to 15 years). The act was amended in 2016 with which the promotion of building of new renewable energy sources included a scheme with a fixed feed-in tariff valid for 15 years and established by means of an auction mechanism. A further amendment took place in 2017 aiming of less bureaucracy to pre-qualify New Installations - i.e. for formal evaluation of projects seeking a certificate of admission to an auction. Investors will have to submit only: the interconnection conditions or interconnection agreement to the grid, a valid building permit, the schedule of works and expenditures for RES installations.

In **Portugal** the legal systems for micro and mini-production have been reviewed, with a view to integrating those well, implementing and developing the solutions in line with common rules for the internal market in electricity. The legal regime for the production of electricity has been consolidated in a special set of rules specifically relating to the production of electricity by means of renewable energy sources, previously spread out across different pieces of legislation. Decree Law 363/2007 simplified the procedures for licensing for: (i) micro generation 3.6 KW or 11.4 KW (for blocks)– up to 120 days; (i) mini generation up to 250 kW – 190 days (LV) up to 250 days (MV).

2014 saw the publication of Decree-Law No 153/2014 of 20 October 2014, which sought to provide new solutions for producing decentralised energy and technological innovation, making provision for low-voltage electricity producer-consumers (or own-consumption producers) within the context of the Independent Electrical System. This Decree-Law amended the Decree-Law 363/2007 establishing the legal framework applicable to the production of electricity sold in its entirety to the public-service electricity grid (RESP) by means of small production units (UPPs) using renewable resources. The Law defines the systems for electricity production through micro-production and mini-production units, respectively. The system of UPPs retains the general characteristics established in previous legislation, although replaced by a single legal framework. Production is based around a single technology, where mains power is equal to or less than 250 kW, and allows the producer to sell all of the electricity produced to the RESP, on the basis of a supply model involving discounts from the reference rate. The procedures for accessing and carrying out the activity are completed via an electronic platform, called SERUP (Electronic System for Registering UPAC and UPPs)<sup>177</sup>.

In **Romania** the system of mandatory quotas of electricity from renewable energy sources is improved combined with the trading of Green Certificates (GC). In 2013 a monitoring of ex ante level of quotas took place. The granting of a number of GC temporary was postponed from July 2013 to March 2017 depending on technologies (1 GC for WP plants recovered from January 2017). As of 1 January 2014 a number of 0.5 GC/MWh until 2017 and 0.25 from 2018 are applied for wind power. The production of electricity from plants with an installed capacity <1MW (installed capacity <2MW for biomass-based high-efficiency cogeneration) may conclude bilateral contracts for energy and directly negotiated GC only with suppliers to end consumers, as an exception from GC centralised trading. Funds for RES projects are not linked to legal status of investor anymore.

In **Slovenia** the Article 379 of the Energy Act (EZ-1) sets out the exceptions applying to natural persons that produce electricity in generating plants with a power of up to 50 kW. Simplified procedures are applied to the installation of electricity generators with a power of up to 50 kW that use renewable energy sources and are mounted on or in buildings (they do not require a construction permit). The EZ-1 from 2014 abolished the obligation to obtain an energy permit for all energy facilities (including wood biomass boilers and RES district heating systems), with the

---

<sup>(177)</sup> <http://www.dgeg.pt>

exception of electricity generators with a power exceeding 1 MW. The obligation to obtain a licence to perform an energy-related activity was also removed. A decree is being compiled that will regulate the self-supply of electricity and form the basis for introducing a 'net-metering' method of billing electricity for electricity customers installing an RES generating plant for the purposes of self-supply.

In 2013 and 2014 the administrative procedures in **Slovakia** were simplified for plants with an output of 10 kW or less. Prior to this period the focus was on improving administrative procedures for plants with a capacity of 1 MW or less. An example of the reduction in the administrative burden for such plants is the fact that they can now be built without a certificate issued by the Slovak Ministry of the Economy. The amendment to the legislation since the beginning of 2014 has made it much easier for *households* to connect small sources of 10 kW or less, which cover a large part of their energy consumption. For small producers, a simple notification procedure has been introduced, which consists of a one-off information obligation without further reporting obligations for the producer. Such a producer is entitled to free connection to the distribution system at a point where there is an existing take-off point, free installation of a meter calculating power produced and supplied between phases in real time and free installation of a cut-off device that mechanically separates the connection contacts in the event of a loss of voltage loss in the distribution system, where it is possible for the small source to operate during an outage of the electricity distribution system.

In **Finland** the application of procedures relating to wind-power construction became clearer in 2012 and 2013 when the working group on promoting wind power that was appointed by the Ministry of Employment and the Economy finished its work. Barriers and restrictions were removed from various administrative areas. Various administrative areas subsequently made their activities more efficient with regard to the processing of wind power cases, the main outcomes have been achieved, and there has been closer dialogue and collaboration between authorities.

The Land Use and Building Act was amended in 2014 so that *wind power* construction in an area designated as an industrial or port area is not regarded as having a significant impact in terms of town planning, and so that a derogation from the town-planning regulations may be granted for wind-power construction if other conditions are fulfilled.

The measures with the most significant impact have been carried out in area covered by the Ministry of Transport and Communication. The controlled airspace was amended and the protective distances from roads were reduced in order to improve the conditions for wind power construction. The procedures for investing in *wind power* have become clearer in relation to transport, and restrictions have been eased considerably. The guideline distance of wind power from national roads is 300 m instead of the former 500 m, and generally 0.5–1.5 km from sea lanes. Other improvements include: (i) Noise - State Decree on Guideline Values for External Noise Levels at Wind-Power Plants was in place in 2015; (ii) Environmental impact assessments - guide for wind-power builders and land-use agreement with landowners (vicinity five times the rotor diameter); (iii) Act on Wind-Power Compensation Areas in 2013 (Bothnian Bay) - construction possible without assessment by Finnish Defence Forces.

For the *small-scale electricity* production simplification of connection and of the planning-permission process between municipalities, discussion around tax treatment of small-scale producers, solution of legal and optimisation problems associated with the net-billing procedure are in place.

Fuel taxation in Finland now takes account of the lower energy content of *biofuels*, and particularly of ethanol: Unsustainable BFs are subject to the same carbon-dioxide tax as fossil fuels, sustainable biofuels are subject to 50% of the carbon-dioxide tax on the equivalent fossil fuel, and double-counted fuels under the Renewable Energy Directive are not subject to any carbon-dioxide tax.

In **Sweden** licensing processes have been followed up in various ways with the aim of making the licensing processes for renewable electricity production more efficient. The final report, the County Administrative Board (March 2015) states that there is great variation in processing times for different cases, which primarily relate to the type of case involved. According to Swedish Environmental Code the local authority within the jurisdiction of which a wind-power facility is to be built must approve of such establishment in order for the licence to be granted avoiding the double assessment. How the provisions should be applied are included in the guidelines developed by Swedish Energy Agency in February 2015. The web-based 'Vindbrukskollen' mapping service concerning establishment of wind power plants was launched in August 2012. It may be used as an aid for project design and for preparing and submitting applications to the correct authority (may become a mandatory part of the licensing process).

Marine Planning Ordinance are adopted in 2015 stating that production of draft marine plans will ensure that marine resources are used sustainably and that industry can be developed whilst at the same time achieving a good marine environment. The Swedish Energy Agency is working in collaboration with the Swedish Environmental Protection Agency to develop guidelines for the decommissioning of wind-power plants and site reclamation.

In the **United Kingdom** the most notable step to remove administrative regulatory and non-regulatory barriers have been facilitating the move from the *Renewables Obligation* (RO) to Contracts for Difference (CfD) and providing an alternative route to market for generators. *Power Purchase Agreements* (PPAs) and best practice guidelines for PPA providers were the first package helping to reduce administrative and financial barriers for independent renewable generators and mitigate any investment hiatus. This has been achieved through the creation of a framework and guidelines agreed by purchasers of power and sellers. *The Off taker of Last Resort* (OLR) scheme was also introduced to help generators holding CFDs by providing an alternative route to market for their electricity by facilitating a Backstop Power Purchase Agreement (BPPA) between the generator and a supplier via a competitive auction process. OLR is intended as a last resort to help generators who cannot get a power purchase agreement through the usual commercial routes, so the electricity generated under a BPPA is sold at a specified discount below the market reference price. The aim of this scheme is to ensure that new entrants to the energy market will always have a market for the electricity they produce. Even if the electricity is sold at below market value, lenders to new entrants can take this into account when considering returns on their investment. It is hoped that the market will continue to grow so the OLR market will be an actual "last resort".



## 8 Transmission and distribution of renewable electricity and rules for bearing and sharing costs to grid connection – reporting under Article 22(1) f

According to Article 16 (1) of the Directive 2009/28/EC "*Member States shall take the appropriate steps to develop transmission and distribution grid infrastructure, intelligent networks, storage facilities and the electricity system, in order to allow the secure operation of the electricity system as it accommodates the further development of electricity production from renewable energy sources, including interconnection between Member States and between Member States and third countries. Member States shall also take appropriate steps to accelerate authorisation procedures for grid infrastructure and to coordinate approval of grid infrastructure with administrative and planning procedures*".

In **Belgium** the connection to and reinforcement of the network is the responsibility of the network operator, who thus initially bears the associated costs. However the connection rates are charged these are published on the Electricity and Gas Regulation Board (Commission voor de Regulering van de Elektriciteit en het Gas - CREG) website and the network operator can recover the connection costs. The producer ultimately pays the connection costs through those charges, although for certain categories of customer there is a way of sharing costs. To comply with the network capacity restriction, all new projects will have to connect 'flexibly to the network (and disconnect in exceptional cases). In the Flemish Region the connection costs are limited. Thus the costs of connection to the network paid by the 'green' production are limited to the costs of virtual connection, i.e. the costs of the shortest distance between the installation and the network. In the Brussels-Capital Region there are no costs associated with the injection of electricity into the network, irrespective of the power of the decentralised generation unit. For the sharing of costs for modification of the network, the distribution network operator in the Brussels-Capital Region works on a regulated model. By definition, allowance is made in the prices for the costs to be passed on. The prices are established by a 'cost-reflexive' method, i.e. they must reflect actual costs. Walloon Region applies a general prioritization rule for connection of production plants using renewables and good cogeneration units.

In **Bulgaria** the Regulations for Management of the Grid, adopted in 2014, (SG No 6 of 21 January 2014) laid down the procedures for planning the development of the transmission grid, the technical requirements for connection to the transmission grid, the procedures for using the transmission grid, the procedures for planning the operation of the electricity system, the procedures for real-time management of the electricity system, the activities of the transmission grid operator and the users of the transmission grid with respect to quality control of the operation of the electricity system and its testing procedures. The Regulations stipulate that the plans for the development of the electricity system are elaborated every two years in accordance with the development of the electricity transmission and distribution grids.

In the **Czech Republic**, the largest investors and operators of transmission and distribution networks publishes on its website information on the financial costs invested in transmission and distribution networks and also publishes its future plans in this area. The Energy Regulatory Authority (hereinafter referred to as the "ERA") sets the prices for electricity transmission and distribution, as well as for other activities of the Transmission System Operator (TSO) and Distribution System Operators (DSO) to cover the costs reasonably incurred in ensuring reliable, safe and efficient performance of the licensed activity. The established regulatory framework in the Czech Republic fully supports investment in the networks. In accordance with the wording of Section 19a (1) of the Energy Act, the ERA proceeds in the regulation of prices in such manner that the prices set cover the costs reasonably incurred in ensuring a reliable, safe and efficient performance of the licensed activity, as well as depreciation and a reasonable profit for providing a return on the investment made in facilities serving the activity licensed.

In **Denmark** the responsibility for and distribution of costs in connection with grid connection and grid reinforcement/expansion is described in the Order No 1115 of 18 September 2015 on the connection of wind turbines to the grid and premiums for wind turbine-generated electricity, etc. Owners of wind turbines must pay connection costs through to a certain specified connection point. All costs for grid reinforcement/expansion are covered by the grid and transmission undertakings. Energinet.dk is responsible for operation of the contiguous electricity supply system and for maintaining a balance and supply reliability in the grid by making adjustments (upwards or downwards) to electricity generation at power stations that are connected to the grid. The implementation of the wholesale model in 2016 provided an opportunity for billing of actual hourly

consumption for both large and small customers. In August 2012, Energinet.dk purchased ten regional transmission grids and now owns the entire Danish power transmission grid. The takeover of these regional networks is anticipated to generate benefits in the form of lower operating costs amounting to DKK 200 million by 2020.

In **Germany** the revision of the Energy Management Act [EnWG] in 2011 introduced a national grid development plan for extra high-voltage lines for the first time. The amendment in 2012 mined that the sequence of grid connections to offshore wind power plants will from 2013 be laid down in an Offshore Network Development Plan (O-NEP). The expansion targets for offshore wind power were adjusted throughout the reform of the Renewable Energies Act. The new 2014 Act further advance the integration of renewable energy into the electricity market by making direct marketing compulsory for all new plants (introduction in two stages: from August 2014, compulsory direct marketing for plants from 500 kW upwards; from January 2016, from 100 kW upwards). The Gas Network Access Regulation (GasNZV) defines the shares of the connection into the network: (i) costs of network connection shared 25 % by the recipient, 75 % by the network operator; (ii) at least 96 % availability of the network connection to be guaranteed over time

In **Estonia**, producers of electricity from renewable energy sources are granted both priority and guaranteed access to the network. Under Section 108 of the Electricity Market Act, a producer who uses renewable energy for generating electricity is granted a 12-year support period, which represents a market advantage over other producers, and thus priority access to the network. The order in which generating installations transmit their production to the grid has not yet been laid down. In particular, there are no intra-system bottlenecks in the Estonian electricity market system, and all production sold on the free market is transmitted to the grid.

In **Ireland** the energy regulator's (CER) direction on first stage payments for grid connections (CER/11/083) treats all developers seeking a connection in a fair and equal manner regardless of size, scale or ownership structure. In terms of cost, CER has in the past few years introduced many connection policy decisions designed to facilitate the industry and meet the needs of windfarm developers. The CER's 2009 decision (CER/09/138) which implemented the current First Stage Payments Scheme significantly reduced the level of financial commitment required from renewable generators at offer acceptance.

In **Greece** Law 4152/2013 modified a number of provisions regarding the access to the grid for RES plants, setting specific deadlines both for the competent System/Network Operator and the RES producer and allowing for a common application for a Connection Offer of multiple RES producers. Recently enacted Law 4203/2013 provides for the possibility of exceeding by 20% the congestion limits of the grid in areas declared congested by RAE decision, allowing the System Operator to continue granting Binding Connection Offers to RES projects until this limit is reached. However, it also provides for those RES projects to be subject to energy curtailment, in case other RES plants are installed in the same area, which had been granted a Binding Connection Offer at an earlier stage. Moreover, RAE Decision 787/2013 describes the procedure that is to be followed to grant grid access to groups of small-scaled RES producers in case of locally insufficient medium- or low-voltage grid capacity. The specific Decision sets the procedure as well as the rules for costs sharing, competencies sharing, contract signing and any other related issue. At the end of 2014 Independent Power Transmission Operator (IPTO) and HEDNO proceeded to issuing of bidding connection offers for residual power capacity of 46.78 MW in the congested power grid of Peloponnesus (RAE 699/2012).

In **Spain** the Royal Decree 1699/2011 defines the regulations for the grid connection of low-power electricity production facilities. This standard establishes basic, simplified administrative and technical conditions for connection to the low and high voltage grid (up to 36 kV) of renewable energy and low-power cogeneration facilities in order to reduce the proceedings required to develop these facilities. For solar photovoltaic the installations for self-consumption should be registered if the owner wants to produce and consume its energy. A new regime to "the regulatory lifespan of the solar PV installations is applied.

In **France** all producers have a right of access to the grid that is guaranteed by law. If the grid manager refuses to grant access, the regulator may impose a penalty, unless the refusal is justified by objective, non-discriminatory and open criteria. Producers are entitled to obtain a technical and financial proposal (PTF) for their connection under the conditions laid down in the grid manager's technical reference documentation. According to Decree No 2014-760 of 2 July 2014, all RES facilities with an installed capacity of more than 100 kVA are to be connected according to the methods set out in the regional renewable energy grid connection plans (S3REnR). The S3REnRs specify how the costs of any electricity works are to be shared among producers: all renewable energy producers connected under an S3REnR must therefore pay the same share. Electricity

works requiring reinforcement are financed by grid managers. As in the ordinary connection scheme, 'own works', i.e. works from the production facility up to S3REnR works, are financed by producers. The French Code of Energy (2015) grants exclusive rights to operate the distribution system to three categories of distribution system operators (DSO): (i) Enedis, which operates 95% of the metropolitan grid; (ii) Local distribution companies, which are local public structures; (iii) EDF Système électrique insulaire, for overseas territories. The DSO holds a concession contract on a municipality's jurisdiction in exchange for a fee. The DSO maintains the network according to the specifications of the concession.

In **Italy** regulation of imbalances has been introduced, and later updated from 2015. Now it is possible to opt for the application of imbalance prices without band, using the rules applying to non-authorised production units, thus avoiding part of the imbalance from being priced on the basis of average prices not differentiated by source. Specifically, 'bands' have been established to assign values to the energy subject to imbalance, which differ according to energy source: (i) the electricity subject to imbalance above the threshold is given a value in the same way as imbalances from production units not authorised to participate in the Dispatching Services Market; (ii) the imbalanced electricity below the band is priced at the hourly zone price plus a zonal balancing price based on the ratio of the residual share of the imbalance prices not yet allocated to non-renewable RES referred to each market zone to the sum of the imbalanced electricity within the same bands. From November 2015, for PV plants meeting certain characteristics (output of up to 20 kW) a simplified installation, connection and commercial operation procedure is in place.

In **Cyprus** according to the Law Regulating the Electricity Market According the renewable energy plant operators are contractually entitled against the grid operator to the priority connection of plants to the grid without discrimination. Plant operators are contractually entitled to priority access and transmission of electricity from renewable sources. After the conclusion of a connection agreement, a plant operator is contractually entitled against the grid operator to the expansion of the grid if the expansion is necessary to connect a plant to the grid.

In **Lithuania** transmission and distribution of electricity generated from renewable energy sources are regulated by Law No XI-1375 of the Republic of Lithuania on energy from renewable sources. A non-discriminatory rate of the full amount of RES electricity offered by a producer is applied. Where it is established that the power grid operator operated, maintained, managed and/or developed the power grid inappropriately (i.e. the power grid operator is at fault) and this calls for regulatory measures, the power grid operator shall cover the direct losses and lost income of the producers that were unable to produce and/or to supply electricity to the power networks as a result of such regulation. Connection of power plants to electricity grids is a public-interest service and the costs associated with connecting power plants to electricity grids are to be apportioned amongst the producer and the grid operator, having regard to grid ownership boundaries.

The new rule (in 2012) instructs **Luxembourg** regulatory authority was when preparing calculating methodologies for grid usage costs to encourage grid operators to take account of progress in energy from renewable sources during grid expansion. Grid operators were also instructed to take measures to minimise the shutdown risk of renewable production plants. If production of energy from renewable sources has to be withdrawn, the grid operator must notify the regulatory authorities and propose measures to prevent this from happening in future. Generally speaking, the regulatory authority is required to help ensure that the grid is designed to be able to integrate energy from renewable sources without additional problems and to eliminate barriers to the integration of energy from renewable sources.

In **Croatia** the following short and long-term measures were implemented to address the further transmission network development and the aspect of developing renewable energy sources: (i) amendments to existing legislation related to balancing mechanisms in the electricity system; (ii) mandatory provision of ancillary services and regulated reimbursement of costs ensured; (iii) generation plants in the system for incentivising electricity generation from renewable sources of energy and cogeneration have under the Act on renewable sources of energy and high-efficiency cogeneration ( NN No 100/15) acquired certain balancing mechanism related obligations (they are assigned to the so called green energy balance group while the Croatian Energy Market Operator (hereinafter HROTE) as the leader of the group is the undertaking responsible for planning and balancing); (iv) HOPS has introduced a mandatory requirement that all Croatian electricity system generators be equipped for operation in automated secondary P/f regulation. A distinction is drawn between producer connection to the low-voltage and medium-voltage grid which is a matter for HEP-ODS and connection to the high-voltage grid which falls within the competence of HOPS. Essentially, power generators are required to pay for the actual costs of connection to the power grid (so called 'deep connection charges'). Electricity producers (including those producing electricity from RES) do not pay a fee for use of the grid in respect of the energy they deliver to

the grid. The tariff items for the transmission and distribution of electricity are payable by end customers, i.e. a fee is payable for electricity supplied from the power grid.

In **Hungary** in operating networks and providing access to networks, network licensees have to prefer, under conditions specified by law, electricity generators using carbon-free technology and generating energy from renewable energy sources, waste and cogeneration. Transmission System Operator (TSO) may deny access to the transmission grid and to the distribution grid which affects the operation of the transmission grid in an objective and transparent way, without infringing the requirement of equal treatment, under conditions specified in separate legislation, and may curtail, reduce or suspend deliveries already contracted. The Operational Code of TSO defines: (i) content and formal requirements for the elaboration and amendment of the related guidelines, technical specifications and rules of procedures; (ii) the operational control of the electricity system, the rights and obligations of the transmission system operation licensee and the distribution network licensees (collectively: 'network licensees'), the generators and other entities connected to the system, as well as the structure and operation of the hierarchical management system; (iii) rules for the connection to the grid of the entities subject to the OC, commissioning, network use, operation and disconnection; (iv) the technical conditions for dispatching electricity generated from renewable energy and at power plants defined in separate legislation and the connection of such electricity generation equipment.

**Malta** has no transmission network (hence no TSO). It has a single Distribution System Operator (DSO). Smart meters are being installed for every electricity consumer in Malta. This project was started in 2009 and it was expected that the complete replacement of all 297,500 electricity meters (originally 245,000 but increased due to new consumers and PV systems) would be completed in three years. By mid-2015, around 274,500 electricity meters, equivalent to 92.3% of the total number of customer meters, were installed. Large industrial and commercial establishments are connected directly to the distribution substations, whilst the small to medium industrial and commercial entities and the domestic consumers are serviced through a low voltage network supplied from the distribution substations. The small size of the island and the high population density keeps network utilisation high and grid adaptation costs low. Development of networks for grid-connected RES plant is coordinated through established procedures. Large PV project proposals need to first obtain a planning permit and then evaluated by the DSO for grid stability. The DSO has established a maximum timeframe of 36 working days for the approval of a grid connection. Small domestic PV applications are not required to provide a grid stability evaluation and are handled directly by the regulator.

In **Netherlands** the Dutch Electricity Act 1998 (Article 23) requires grid operators to connect installations to the grid without discrimination. The connection must be completed within a reasonable period after installation and this period is limited to 18 weeks for (i) a connection of up to 10 MVA or (ii) a connection for a production installation for generating sustainable electricity or high-performance combined heat and power (CHP). Grid operators are also obliged to transport the produced electricity, unless grid capacity is not sufficient. If transport capacity appears to be insufficient, congestion management is used. Congestion has occurred relatively infrequently in the Netherlands and is limited to specific regions and specific time periods. The costs of congestion management are borne by all by means of transmission tariffs. Structural congestion is remedied by means of investing in additional grid capacity. Grid operators in the Netherlands are obliged by law to provide the necessary capacity (Article 16 of the Electricity Act). In addition, "measures with regard to sustainable electricity, energy-saving and demand regulation or decentralized energy production, as a result of which the need for replacement or expansion of production capacity can be met" (Article 16, paragraph one, sub-section c) should also be taken into consideration. The third Structural Concept concerning Electricity Supply (SEV III, 2009) provides capacity reservations for large-scale production and transmission of electricity in the Netherlands.

In **Austria** it is the network operator's responsibility to connect power generation systems to the network in accordance with EIWOG and the System Use Tariff Regulation (E-Control, SNE-R). The principle of non-discrimination in connection with electricity networks is fully provided for by law. No distinction is made between conventional systems and green electricity systems regarding costs related to grid connections and grid reinforcements. Grid feeders and grid customers must pay a network access fee, which must directly reflect the cost of providing the connection. Customers must also pay a grid supply fee. The grid supply fee payable by grid customers is an output-based grid user fee charged in order to offset indirect costs in the upstream grid. Thanks to these investments in the grid customers can use it at commensurately low prices.

In **Poland** in accordance with the provisions of the Energy Law Act amended by the revision of 20 February 2015 (Journal of Laws, items 478 and 2365), an energy company whose activity consists in the transmission or distribution of gaseous fuels or electricity is obliged to conclude a grid

connection agreement with entities requesting connection to the grid, on terms of equal treatment and giving priority to RES installations, if it is technically and economically feasible to supply energy or fuels and the applicant meets the requirements for being connected to the grid and taking supply. The aforesaid revision introduced further provisions into the agreement for the connection of a RES installation to the grid, setting out: (i) the time limit for feeding the electricity generated by that installation into the grid for the first time, which must not be longer than 48 months, and in the case of RES installations using offshore wind power to generate electricity: 72 months from the day of conclusion of that agreement; (ii) the failure to feed electricity generated by that installation into the grid for the first time within the time limit specified in the grid connection agreement forms the grounds for the termination of the grid connection agreement.

In **Portugal** the Regulation on commercial relations in the electricity sector was revised (Regulation No 561/2014) prompted mainly by the need to establish and clarify, at regulatory level, specific issues resulting from the publication of Decree-Law No 215-A/2012 and Decree-Law No 215-B/2012 particularly following the introduction of the role of market facilitator, the rules governing links between producers and networks, and the certification of the transmission system operator.

In **Romania** the access to the electricity grids of public interest is a mandatory service, under regulated conditions the transmission system operator (TSO), as well as the distribution operator (DO), have to meet. The stages and the procedures necessary for connecting the users to the transmission and distribution networks shall be established in the rules for the connection of users to public interest networks, approved by ANRE. Upon written request of a new or pre-existing grid user, the TSO, or the DO, as appropriate, is compelled to communicate in writing, within 30 days, the technical and economic conditions for the connection to the grid, and to cooperate with the applicant in order to choose the most advantageous connection solution.

In **Slovenia** measures to ensure the transmission and distribution of electricity produced from renewable energy sources and relating to the bearing and sharing of costs associated with grid connections and grid reinforcements are laid down in Articles 269–371 of the EZ-1. The electricity system operator may not refuse consent to the connection to the grid of an investor in an electricity generating plant using renewable energy sources or high-efficiency cogeneration if the sole reason for refusal is that the electricity system operator would incur disproportionately high costs from the connection. The costs of all analyses for the issuing of consent to connection to the grid shall be borne by the electricity system operator. The costs of implementing a connecting line from a generating plant to the electricity system operator's grid shall be borne by an investor in a plant generating electricity from renewable energy sources or through high-efficiency cogeneration. An investor in a plant generating electricity from renewable energy sources or through high-efficiency cogeneration shall not bear the costs of any upgrade of the existing transmission or distribution network required as a result of the connection of the generating plant.

In **Slovakia** priority for the transmission and distribution of electricity from RES is guaranteed by law. Similarly, the law guarantees the purchase of electricity from RES at a specified price for a period of 15 years from the commissioning of a plant. This guarantee applies to plants with an output of 125 MW or less (or 200 MW if certain conditions are met). The transmission system operator's existing powers ensure the operational safety of the transmission and distribution system. The sharing of costs related to connecting and extending the system is governed by an act issued by the independent regulator (the Office for the Regulation of Network Industries). The rules are non-discriminatory and transparent, and they are applied to every applicant in the same way. The rules also form part of the operating rules for the transmission system operator and distribution system operators.

In **Finland** the Electricity Market Act regulates the obligation for transmission and distribution network owners to develop the network. Finland applies a guaranteed network-access procedure. The same, equal rules apply to all electricity-production facilities connected to the grid. According to the Electricity Market Act, all parties that join the network must be treated equally. There are no primary connection rights or separately ensured connection capacity. The costs arising from development of the electricity grid are covered by transmission fees, and the costs arising from grid expansion and associated reinforcement are covered by connection fees. Distribution network owners collect a connection fee from parties that join their respective networks in accordance with the grounds for the connection fee (connection conditions) in force for their distribution area. When determining the amount of a connection fee for a power plant of no more than two megavolt amperes, the pricing is based on the direct costs of expanding the distribution network that are generated by construction of the connection in question. According to the Electricity Market Act, network reinforcement costs may not include any fee imposed for connection to the electricity grid in relation to electricity production of less than two megavolt amperes. The network owner may,

however, collect the network-protection costs arising from the connection as part of the connection fee.

In **Sweden**, the state-owned Svenska Kraftnät (the Swedish national grid) has the task of managing, operating and developing in a commercial way a cost-effective, reliable and environmentally-adapted power transmission system, allocating excess capacity, and otherwise running activities that are linked to the power transmission system. The Svenska Kraftnät guidance document has been produced for wind power, but is also relevant for the connection of other types of electricity production (including non-renewable). After having identified a need from wind power companies, to be able to reserve spare capacity in advance this option has been introduced. To facilitate the connection of new electricity production such as wind power to the backbone grid a certain amount of overbooking of capacity on radial lines and cross-border connections is permitted. With a rise in the connection of wind power, this should be an economically advantageous solution for the wind power company, since it results in an increased utilisation of the line before gain becomes necessary. However these measures cover all types of electricity production, not just from renewable sources.

In the **United Kingdom** renewable generators are subject to the same charging mechanisms as non-renewable generators by the transmission and distribution networks. UK has a self-dispatch regime. The TSO is therefore not in charge of dispatching generation installations.

The onshore transmission network in the UK (England, Scotland and Wales) is built and owned by three Transmission Owner companies. As regulated monopolies, these companies require approval from the independent regulator, Ofgem, to fund their activities, such as building new network and maintaining assets. This is primarily agreed through price controls where the network companies submit business plans to Ofgem for approval, presenting the outcomes they intend to deliver and the costs for doing so. The network is operated by one Transmission System Operator company. For the latest transmission price control that runs from 2013-2021 in United Kingdom, Ofgem has introduced a new price control framework, designed to help meet the investment and innovation challenge by introducing more emphasis on incentives to drive the innovation and investment needed to deliver a sustainable energy network that offers value for money to existing and future consumers. Ofgem agreed funding of up to £21.5bn in this price control period for the Transmission Owners to expand, replace and maintain the Great Britain transmission network. Work is underway on implementing the next electricity distribution price control period which will run from 2015 to 2023, and which will set out funding for the six Distribution Network Operators' (DNOs), who own the 14 regional distribution networks. For the transmission of generation from offshore sources (e.g. windfarms) to the onshore network, DECC and Ofgem have put in place a competitive regime in which licences to construct and/or operate transmission assets are granted by competitive tender to Offshore Transmission Owners (OFTOs) for a 20-year revenue stream. In England and Wales the government has introduced an *electronic application service* for processing applications under the Electricity Act 1989 for electric lines below the Planning Act threshold in order to help streamline the process. When connecting to a distribution network in UK, a connectee pays for any assets which they alone will use and a share of any reinforcement they have triggered. The remaining reinforcement costs are recovered from all other customers through distribution use of system charges. Should someone else connect to those assets within five years, the original connectee will receive a payment from the later connectee. In terms of the transmission network, connection charges relate to the costs of assets installed solely for, and only capable of use by, an individual generator. This is referred to as 'shallow connection cost charging'. Costs of reinforcement are borne by the Distribution Network Operators.

## 9 Support for solar photovoltaic and wind in EU countries

The deployment of modern renewable energy sources and technologies can only take off within the framework of supportive long-term government policies aimed at overcoming market and non-market barriers (Puig & Morgan, 2013).

The feed-in tariff support scheme in electricity sector is implemented in the majority of EU countries. However, the way how the feed-in tariff support scheme is implemented differs from one country to another. The deployment of renewables also differs from country to country reflecting the differences in local production potential and in policies to encourage them.

The implementation of policies and measures does not guarantee that renewables will actually be deployed on a large scale. Even where considerable potential exists, those policies may be unsuccessful if they fail to address adequately economic and other (non-market) barriers to the deployment of renewables (Puig & Morgan, 2013).

The success of renewables policies is generally measured in two ways: their impact on market growth (policy effectiveness) and their cost. Combining these 2 ways provides a measure of policy- or cost-efficiency. Assessing the effectiveness and efficiency of renewables policies in a regular manner is essential to enable policymakers to continuously improve the design of those policies and ensure that broad energy policy, environmental and socio-economic goals are being met at an acceptable cost. Quantitative indicators provide a means of evaluating these criteria in a systematic and reliable manner. In practice, policy effectiveness can be measured in several different ways. Possible parameters or indicators include consumption, production, installed production capacity, energy access (in the case of developing countries), employment and added value in manufacturing (direct and indirect). The appropriate parameter(s) will depend on the predefined objectives of the policy in question (Puig & Morgan, 2013)

In many countries, solar PV and onshore wind are within sight of full competitiveness and the investments can be justified based on market revenues alone without the need for additional subsidy. But cost reductions for wind and solar, on their own, are still not enough to deliver the rapid decarbonisation of the power sector. Policies do still matter – market design and structural changes to the power system will be essential to ensure adequate returns for investment and to integrate higher shares of variable wind and solar power (IEA, 2016).

Figure 80 illustrate the dispersion of minimum, average and maximum level of support provided in the EU countries for solar photovoltaic over period 2010-2014. The figure shows the large dispersion of support level for solar photovoltaic among EU countries. It can be seen that the levels of support (medians) for solar photovoltaic decreased over period 2010-2014. In countries as Czech Republic, France and Portugal the maximum level of support has slightly increased or remained almost unchanged.

**Figure 80.** Dispersion of FIT for solar photovoltaic (min, average, max) in EU countries (2010-2014)

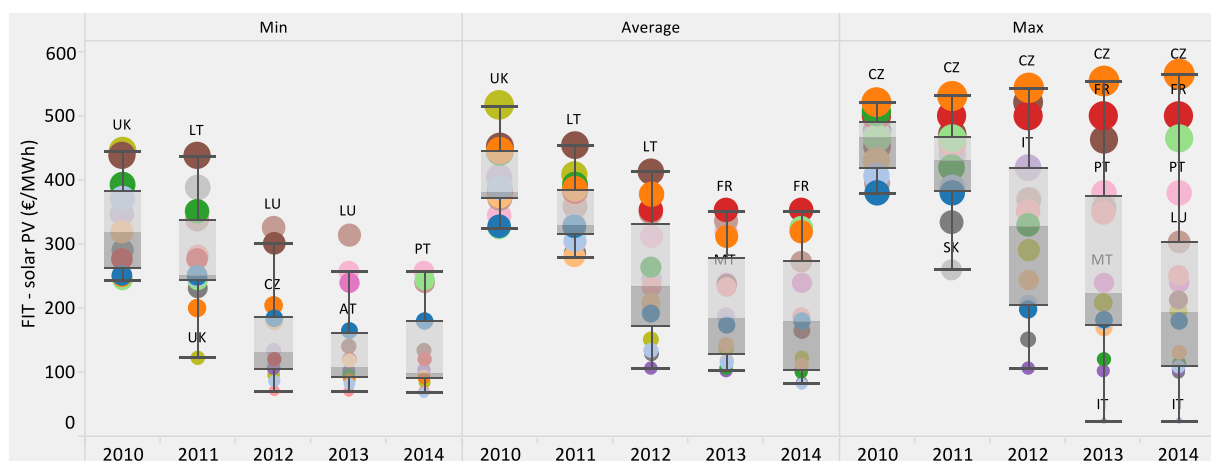
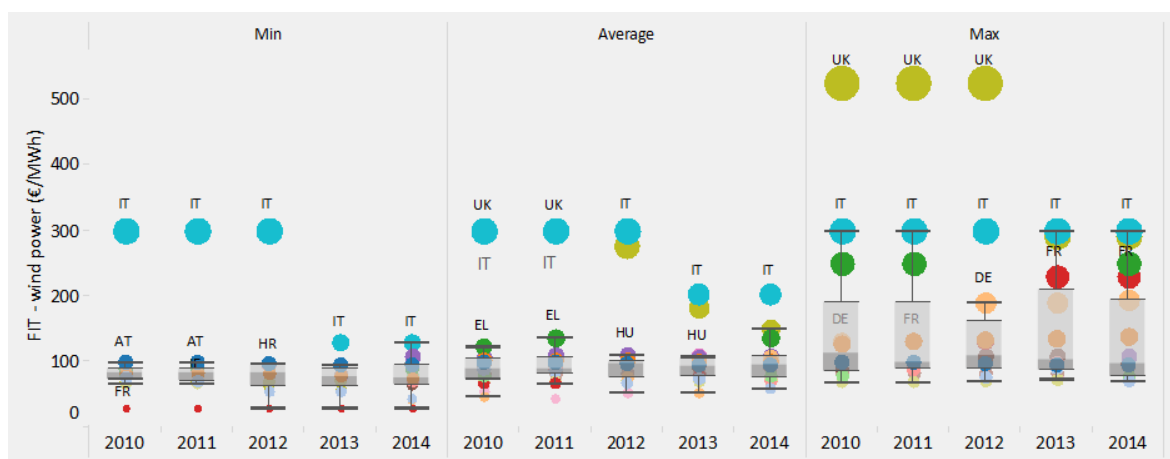


Figure 81 illustrate the dispersion of minimum, average and maximum level of support provided in the EU countries for wind power over period 2010-2014. The figure shows that for wind the differences between countries on the minimum, average and maximum levels of support are lower. The levels of support (medians) have remained almost unchanged during this period in the majority of EU countries. Countries as United Kingdom and Greece have had higher levels of support for this technology especially in maximum terms.

**Figure 81.** Dispersion of FIT for wind power (min, average, max) in EU countries (2010-2014)



Comparing figures 80 and 81 it can be seen that the levels of support for solar photovoltaic has been larger than the levels of support for wind power.

Figure 82 illustrates the support level (minimum, average and maximum) for solar photovoltaic under the feed-in tariff scheme in year 2014.

**Figure 82.** Feed-in tariffs for solar photovoltaic (min, average, max) in EU countries, 2014

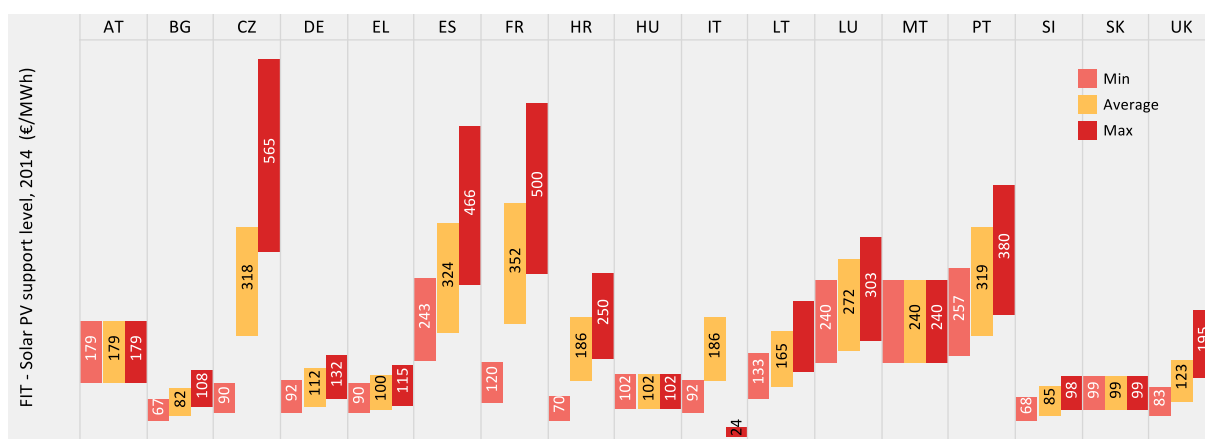


Figure 83 illustrates the support level (minimum, average and maximum) for wind power under the feed-in tariff scheme in year 2014.

**Figure 83.** Feed-in tariffs for wind power (min, average, max) in EU countries, 2014

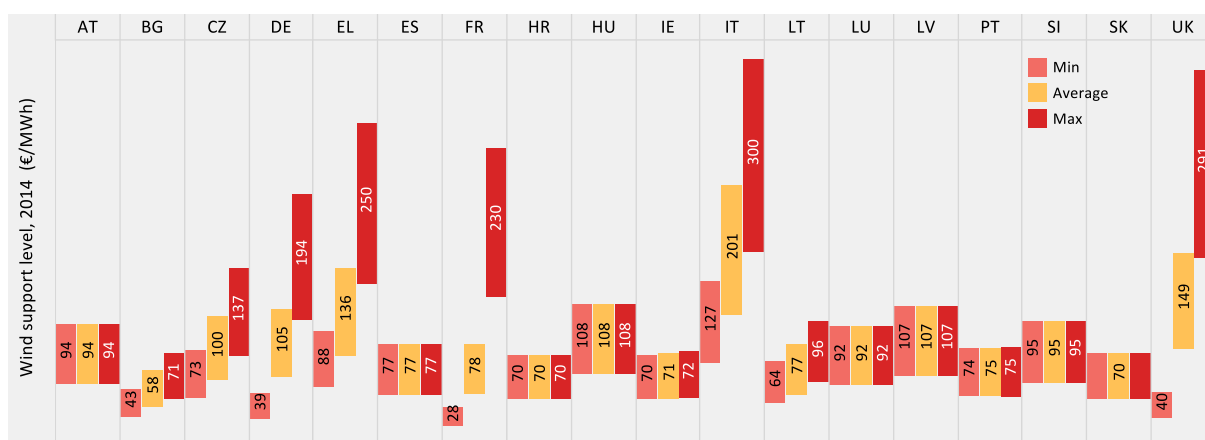


Figure 84 illustrates how the average level of support for solar photovoltaic technology under: (i) feed-in tariff; (ii) fixed feed-in premium; (iii) sliding feed-in premium and (iv) green certificates look like when compares with the wholesale baseload electricity price and levelized cost for solar



PV (EU average). As shown in the figure for all countries the incentive seems high enough to cover the cost of the electricity produced.

**Figure 84.** Support for solar PV (av.) vs wholesale baseload price of electricity & solar PV LCOE, 2014<sup>178</sup>

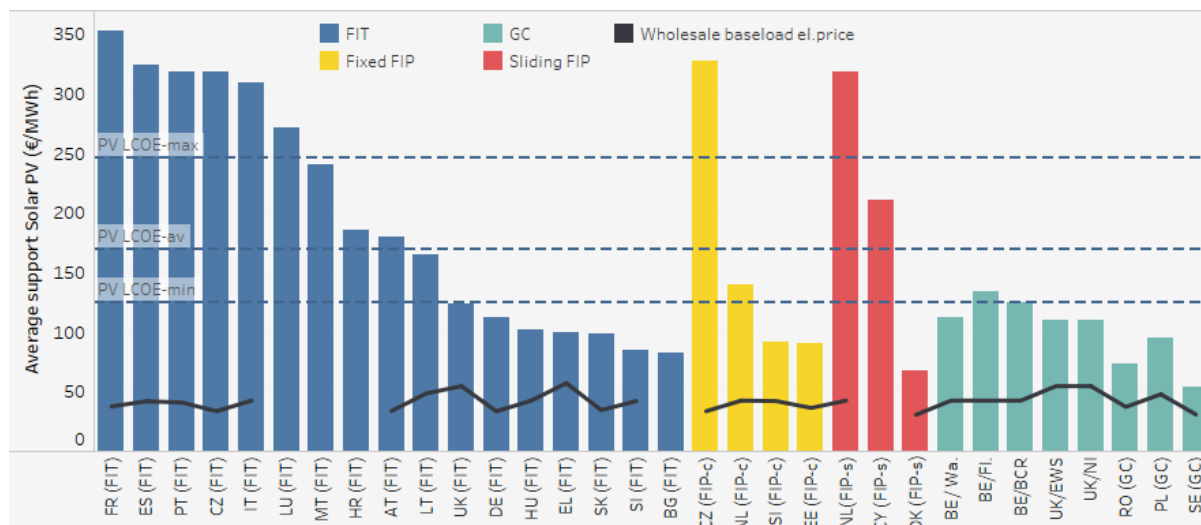
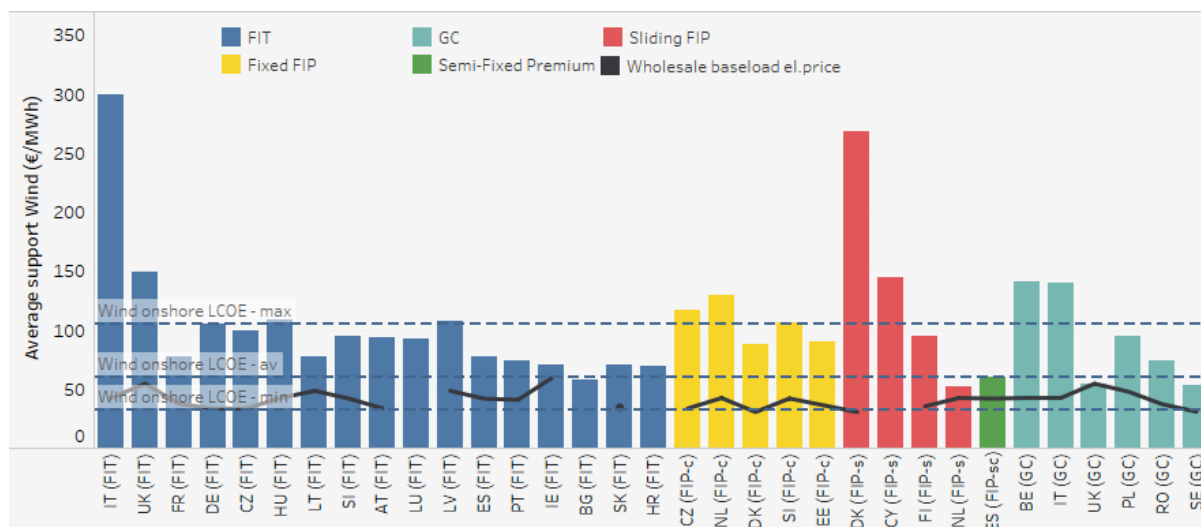


Figure 85 illustrates how the average level of support for wind power technology under: (i) feed-in tariff; (ii) fixed feed-in premium; (iii) sliding feed-in premium and (iv) green certificates look like when compares with the wholesale baseload electricity price and levelized cost for onshore wind (EU average). As shown in the figure for almost all countries the incentive seems high enough to cover the cost of the electricity produced.

**Figure 85.** Support for wind (av.) vs wholesale baseload price of electricity & onshore wind LCOE, 2014<sup>178</sup>



<sup>(178)</sup> FIT for feed-in tariff; FIP-c for feed-in premium constant; FIP-s for feed-in premium sliding; GC for green certificates

## 10 Policy Effectiveness Indicator

The Policy Effectiveness Indicator (PEI) is expressed as a percentage of the remaining production potential that can be realized by the end of the pre-defined medium-term period as measured at the start of that period.

$$\text{Eff.} = \frac{G_n - G_{n-1}}{G_{2020} - G_{n-1}}$$

$G_n$  – Electricity generation from technology "i" in year "n"

The advantage of PEI is that it takes into account the country-specific factors whereas the disadvantage is that it is difficult to identify additional mid-term potential. It is important to know that the PEI measures only the effectiveness of *overall renewables policy* in increasing the production or consumption of renewables. It *does not measure the impact of individual policies or measures, nor does* it provide any insights into why a particular national policy is effective or in effective relative to the potential or to performance in other sectors or countries (Puig & Morgan, 2013).

Other indicators can be used, the most obvious ones being the share of any target that is achieved and the annual rate of growth or the absolute rate of growth in production/use. These alternatives are easier to calculate as they make use of data that is generally available, but they suffer from important drawbacks: measuring effectiveness in terms of the degree to which a targeted level of deployment is achieved makes cross-country comparisons difficult as it does not take into account the ambitiousness of the target; this creates a bias in favour of less ambitious countries. The absolute increase in renewables production provides a measure of the policy effort to boost renewables, but clearly favours large countries, while the rate of growth favours countries starting from a low level of deployed renewables (Puig & Morgan, 2013)

The simplest indicators measure installed capacity or electricity output and growth rates thereof, either in absolute or percentage terms. These measures have the potential to provide a simple proxy for effectiveness, with minimal data requirements. Measuring energy output offers advantages over measuring capacity growth, since the latter cannot capture how productive renewable installations are – for example as a result of effective siting, maintenance and grid integration. However, the simple measures are subject to obvious limitations; they say nothing about progress relative to economic or technical potential, or relative to broader policy goals, or indeed to starting points or in terms of overall market share. They also lack predictive value, since they tell the analysts little about future prospects and cannot explain causation – they do not and cannot explain why a policy (or policy mix) has been effective (IRENA, 2014).

The EU countries are moving at different speeds in terms of deployment of solar photovoltaic and wind power. Most of them have seen a very fast deployment of solar photovoltaic compared with their plans and 2020 targets.

Figure 86 shows the comparison between the achieved in 2016 and 2020 plans in installed capacity of solar PV in each EU country. Most of the EU countries (IT, FR, UK, BE, NL, RO, AT, BG, SK, PT, SI) have already exceeded their plans for 2020. It should be emphasized that most of these countries have planned very low level of solar PV for 2020.

**Figure 86.** Solar PV installed capacity in EU countries in 2016 vs 2020 plans (MW)

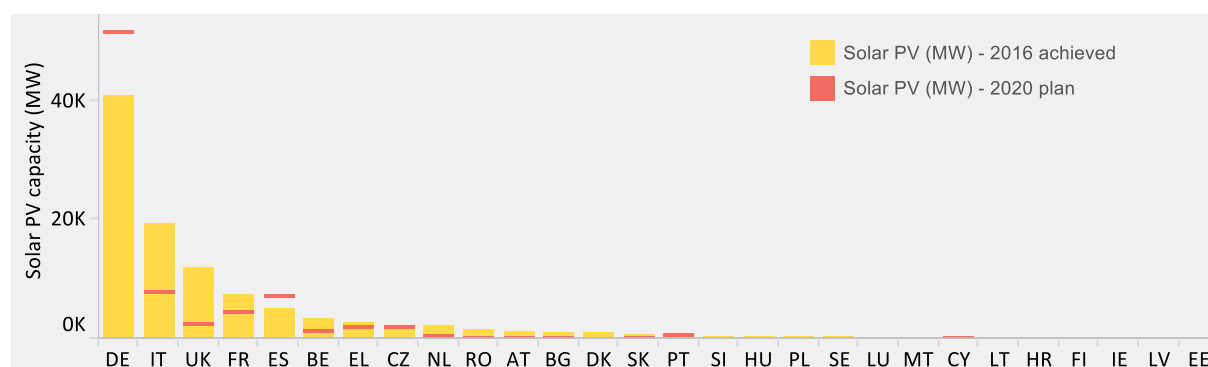
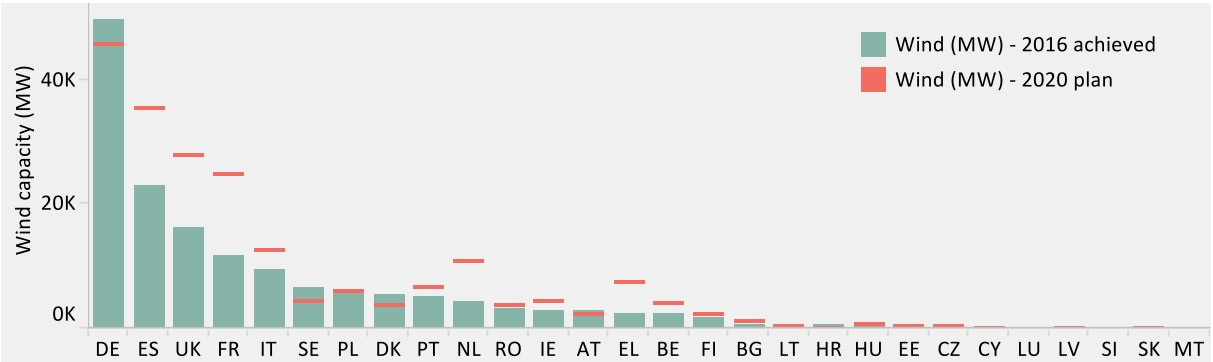


Figure 87 shows the comparison between the achieved in 2016 and 2020 plans in installed capacity of wind in each EU country. Countries as Germany, Sweden, Poland, Austria, Lithuania and Croatia have already met or exceeded their 2020 plans for the installed capacity of this technology.

**Figure 87.** Wind installed capacity in EU countries in 2016 vs 2020 plans (MW)



The policy effectiveness indicator is assessed for solar photovoltaic and wind power technologies covering period 2010-2014. The assessment is based on actual rates of deployment and the expected plans for 2020 as they are reported in the EU countries NREAPs.

Figure 88 illustrates the policy effectiveness indicator (cumulative %) for solar photovoltaic over period 2010-2014. As shown in the figure a clear pattern can be found in the relationship “support scheme – deployment” in the case of solar photovoltaic. The PEI is higher for applied support in the form of feed-in tariff combined with feed-in premium.

**Figure 88.** Policy Effectiveness Indicator for solar PV in EU countries, 2010-2014 (%) - cumulative

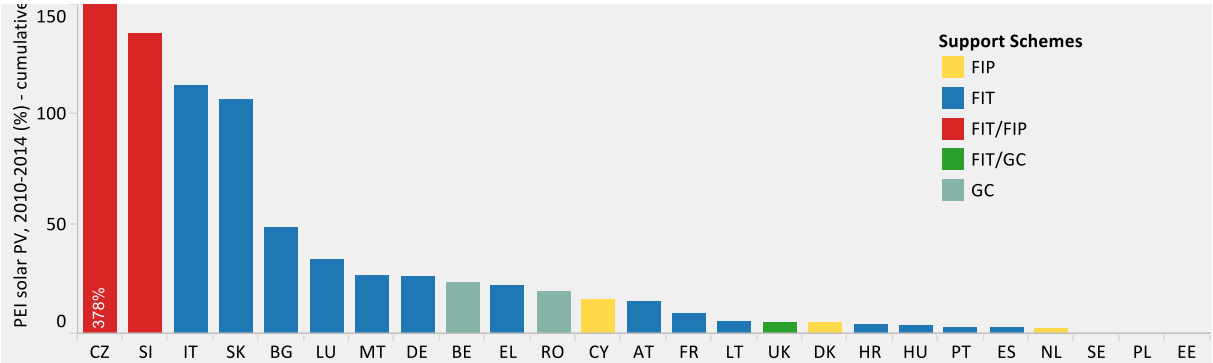
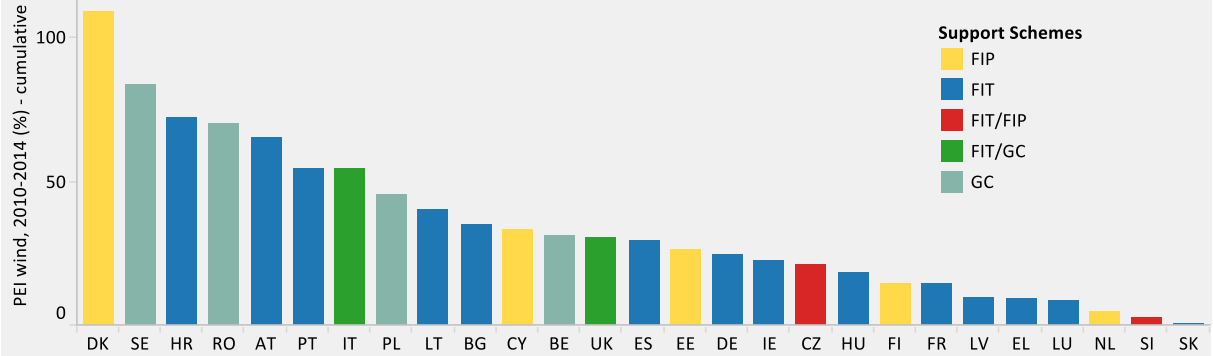


Figure 89 illustrates the policy effectiveness indicator (cumulative %) for wind power over period 2010-2014. As shown in the figure there is no clear pattern can be found in the relationship “support scheme – deployment” in the case of wind power. The application of feed-in premium to support wind power in Denmark has been successful. However, the application of the same type of support in Netherlands<sup>179</sup> has not seen a similar rate of deployment.

**Figure 89.** Policy Effectiveness Indicator for wind power in EU countries, 2010-2014 (%) - cumulative



<sup>(179)</sup> (In Netherlands the (pre-) investments are made in an early stage, while the related power producing capacity beyond 2020 is not yet accounted for).

## References

- AEBIOM. (2016). *European Bioenergy Outlook*, <http://www.aebiom.org/statistical-report-2016/>.
- Banja, M. and Jégard, M., *Renewable technologies in the EU electricity sector: trends and projections - Analysis in the framework of the EU 2030 climate and energy strategy*, EUR 28897 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-76903-0; doi:10.2760/733769, JRC109254. <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/renewable-technologies>.
- Banja, M., Monforti-Ferrario, F., & Bodis, K. (2015). Banja M., Monforti-Ferrario F., Bódis K.; *Renewable energy technologies/sources path within EU 2020 strategy*; EUR 27447 EN; doi: 10.2790/113648, <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/renewable-energy-technologies-sources-path-within-eu-2020-strategy>.
- Banja, M., Monforti-Ferrario, F., Bódis, K., Jäger-Waldau, A., Taylor, N., Dallemand, J.F., Scarlat, N., *Renewable energy in the European Union: Renewable energy in the EU further to Renewable Energy Directive reporting, Volume 3*, EUR 28512 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-70199-3, doi:10.2760/611663, JRC105731. <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/renewable-energy-deployment-european-union-renewable-energy-european-union-further-renewable>
- Banja M., Monforti-Ferrario F., Bódis K., Kona A., Jäger-Waldau A., Taylor N., Dallemand J.F., *Mitigating Climate Change: Renewables in the EU – Cutting greenhouse gas emissions through renewables - Volume 2*, EUR 28677 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-70479-6, doi:10.2760/6520, JRC106826 <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/mitigating-climate-change-renewables-eu-cutting-greenhou>.
- Banja, M., Monforti-Ferrario, F., Bodis, K., Motola, V., & Ossenbrink, H. (2015). *Renewable energy in European Union for climate change mitigation: Greenhouse gas emission savings due to renewable energy (2009-12)*, EUR 27253 EN, <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/renewable-energy-european-union-clim>.
- Banja, M., Monforti-Ferrario, F., Scarlat, N., Dallemand, J., Ossenbrink, H., & Motola, V. (2015). *Snapshot of renewable energy development in the EU-28 Volume 2*, EUR 27182 EN <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/snapshot-renewable-energy-development-eu-28-volume-2>.
- Banja, M., Scarlat, N., Monforti-Ferrario, F., & Dallemand, J. (2013). *Renewable Energy Progress in EU 27 (2005-2020)*, EUR 26481, <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/renewable-energy-progress-eu-27-2005-2020>.
- Belastingdienst. (2018). Energy investment allowance (EIA).
- Bergek, A., & Jacobsson, S. (2010). Are tradable green certificates a cost-efficient policy driving technical change or a rent-generating machine? Lessons from Sweden 2003–2008. *Energy Policy*, Volume 38, Issue 3, March 2010, Pages 1255-1271.
- Bürer, M. J., & Wüstenhagen, R. (2009). Which renewable energy policy is adventure capitalist's best friend? Empirical evidence from a survey of international cleantech investors. *Energy Policy*, Volume 37, Issue 12, December 2009, Pages 4997-5006.
- Butler, L., & Neuhoof, K. (2008). Comparison of feed-in tariff, quota and auction mechanisms to support wind power development. *Renewable Energy*, Volume 33, Issue 8, August 2008, Pages 1854-1867.
- CBS. (2013-2017). . Renewable energy in the Netherlands 2013, 2014, 2015, 2016 (in Dutch: Hernieuwbare energie in Nederland 2013, 2014, 2015, 2016; tabel 2.8.2 MEP en SDE(+) subsidie).

- CBS. (2014). *Renewable energy in the Netherlands 2013 (in Dutch: hernieuwbare energie in Nederland 2013; tabel 2.8.1 MEP en SDE(+) subsidie)*. CBS.
- CEER. (2016). *Key support elements of RES in Europe: moving towards market integration*. Council of European Regulators.
- CEER. (2017). *Status Review of Renewable Support Schemes in Europe*. Council of European Regulators.
- CERR. (2016). *Key support elements of RES in Europe: moving towards market integration*. Council of European Regulators.
- CERR. (2017). *Status Review of Renewable Support Schemes in Europe*. Council of European Regulators.
- COM(2010)84. (n.d.). *Report on progress in creating the internal gas and electricity market*.
- COM(2016)51. (2016). *An EU Strategy on Heating and Cooling*, [https://ec.europa.eu/energy/sites/ener/files/documents/1\\_EN\\_ACT\\_part1\\_v14.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v14.pdf).
- Cretu, G. (2016). *Progress in Promotion in Renewable Energy in the Energy Community, Cost-effective renewable energy in South East Europe, IRENA-Energy Community Joint Renewable Energy Workshop Vienna, 3-4 March 2016*.
- Del Río, P. (2017). Designing auctions for renewable electricity support. Best practices from around the world. *Energy for Sustainable Development, Volume 41, December 2017, Pages 1-13*.
- Del Río, P., & Dubscha, V. (2017). An economic analysis of the interactions between renewable support and other climate and energy policies. *Energy and Environment, Volume: 28 issue: 1-2, page(s): 11-33*.
- Del Río, P., & Linares, P. (2014). Back to the future? Rethinking auctions for renewable electricity support. *Renewable and Sustainable Energy Reviews, Volume 35, July 2014, Pages 42-56*.
- Del Río, P., & Mir-Artigues, P. (2014). Combinations of support instruments for renewable electricity in Europe: A review. *Renewable and Sustainable Energy Reviews, Volume 40, December 2014, Pages 287-295*.
- Directive. (2001/77/EC). *on the promotion of electricity produced from renewable energy sources in the internal electricity market*.
- Directive(2009/28/EC). (n.d.). *Directive 2009/28/EC "On the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC"*.
- Directive(2009/28/EC). (n.d.). *Directive 2009/28/EC "On the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC"*.
- Directive(2009/72/EC). (n.d.). *DIRECTIVE 2009/72/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC*.
- Dong, C. G. (2012). Feed-in tariff vs. renewable portfolio standard: An empirical test of their relative effectiveness in promoting wind capacity development. *Energy Policy, Volume 42, March 2012, Pages 476-485*.
- DutchGovernment. (2017). *Regulation conformity check solid biomass for energy purposes (Regeling conformiteitsbeoordeling vaste biomassa voor energietoepassingen; in Dutch). Staatscourant 70368: 1-18. The Hague, 21 December 2017*.
- EC. (1999). *Electricity from renewable energy sources and the internal electricity market*.

- EC. (2000). *Proposal for a Directive of the European Parliament and of the Council on the promotion of electricity from renewable energy sources in the internal electricity market*, COM (2000)/0279.
- EC. (2005). *The support of electricity from renewable energy sources. Communication from the Commission*, COM (2005) 627 final.
- EC. (2007). *Renewable Energy Roadmap, Renewable energies in the 21st century: Building a more sustainable future. Communication from the Commission to the Council and the European Parliament*, COM(2006) 848.
- EC. (2014). *2030 energy and climate package*, [https://ec.europa.eu/clima/policies/strategies/2030\\_en](https://ec.europa.eu/clima/policies/strategies/2030_en).
- EC. (2014). *Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01)*. European Commission.
- EC. (2016). *Clean Energy for All Europeans – unlocking Europe's growth potential* [http://europa.eu/rapid/press-release\\_IP-16-4009\\_en.htm](http://europa.eu/rapid/press-release_IP-16-4009_en.htm).
- EC. (2016). *Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources*.
- EC. (2016). *State aid Belgian support for offshore wind - Press release. State aid: Commission authorises Belgian support for electricity generation from offshore renewable energy*.
- EC-COM(2017)688. (n.d.). *Annex to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, Third Renewable Energy Progress Report*. European Commission.
- EC-Communication. (2010). *EC Communication "EUROPE 2020 - A strategy for smart, sustainable and inclusive growth"*, <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC2020&from=en>.
- EC-Communication. (2010a). *"Energy 2020 - A strategy for competitive, sustainable and secure energy"*, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0639:FIN:EN:PDF>.
- EC-Communication. (2014). *"A policy framework for climate and energy in the period from 2020 to 2030"*, <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN>.
- Ecofys. (2013). *Design features of support schemes for renewable electricity, 2013; A report compiled within the European project "Cooperation between EU MS under the Renewable Energy Directive and interaction with support schemes"*.
- ECPressRelease. (2016). *State aid: Commission clears Czech support scheme for renewable energy*, [http://europa.eu/rapid/press-release\\_IP-16-4083\\_en.htm?locale=en](http://europa.eu/rapid/press-release_IP-16-4083_en.htm?locale=en).
- ECPressRelease. (2018). *State aid: Commission approves €4.7 billion public support scheme for advanced biomethane and biofuels in Italy*, [http://europa.eu/rapid/press-release\\_IP-18-1441\\_en.htm](http://europa.eu/rapid/press-release_IP-18-1441_en.htm).
- EnergyPolicyAgreement. (2012). *Energy Policy Agreement Denmark, March 2012*, <https://stateofgreen.com/files/energyagreement>.
- Erbach, G. (2016). *Promotion of renewable energy sources in the EU: EU policies and Member States approaches*. (European Parliamentary Research Service).
- EU-Commission. (2008). *Annex to the impact assessment, Document accompanying the Package of the Implementation measures for the EU's objective on climate change and renewable energy from 2020. SEC (2008)85 Vol.II*.
- EU-Council. (2007). *Presidency Conclusion, 8/9 March 2007, 7224/07, Brussels*.

- EUParliament. (1997). *Resolution on the communication from the Commission on Energy for the Future: Renewable Sources of Energy - Green Paper for a Community Strategy* (COM(96)0576 - C4-0623/96).
- EU-Parliament. (2007). *Report on the roadmap for renewable energy in Europe, 2007/2090, Committee on Industry, Research and Energy, A6-0287/2007.*
- EuroHeat&Power. (2018). *Denmark funds heat pumps for district heating*, <https://www.euroheat.org/news/denmark-funds-heat-pumps-district-heating/>.
- EuropeanCouncil. (2015-2016). *Outcome of the Council Meeting 3429th Meeting, transport, Telecommunications and Energy, 26 November 2015 14632/15, Outcome of the Council Meeting, 3472nd Meeting, Transport, Telecommunications and Energy, 6 June 2016 9736/16.*
- EuropeanParliament. (2016). *European Parliament Resolution of 13 September 2016 on Towards a new Market Design (P8\_T A(2016) 0333).*
- Flinkman, M., Sikkema, R., Spelter, H., & Jonsson, R. (2018). *Exploring the drivers of demand for non-industrial wood pellets for heating. In: Baltic Forestry (under final review, not yet published).*
- García-Alvarez, M. T., Cabeza-García, L., & Soares, I. (2017). Analysis of the promotion of onshore wind energy in the EU: Feed-in tariff or renewable portfolio standard? *Renewable Energy, Volume 111, October 2017, Pages 256-264.*
- Gatzert, N., & Vogl, N. (2016). Evaluating investments in renewable energy under policy risks. *Energy Policy, Volume 95, August 2016, Pages 238-252.*
- GreenPaper. (1996). *Energy for the Future.*
- Hajos, A., Fulcher, P., Johnson, I., Strbac, G., & Pudjianto, D. (2015). *Supporting investments into renewable electricity in context of deep market integration of RES-e after 2020: Study on EU-, regional- and national-level options.* European Commission, Cambridge Economic Policy Associates.
- Hutington, S., Rodilla, P., Herrero, I., & Battle, C. (2017). Revisiting support policies for RES-E adulthood: Towards market compatible schemes. *Energy Policy, Volume 104, May 2017, Pages 474-483.*
- ICIS. (2018). *Power Perspective.*
- IEA. (2016). *World Energy Outlook*, <https://www.iea.org/newsroom/news/2016/november/world-energy-outlook-2016.html>
- IRENA. (2014). *Evaluating Renewable Energy Policy: A review of criteria and indicators for assessment*, [http://www.irena.org/documentdownloads/publications/evaluating\\_re\\_policy.pdf](http://www.irena.org/documentdownloads/publications/evaluating_re_policy.pdf).
- Jacobs, D. (2016). *Renewable Energy Policy Convergence in the EU.*
- Jenner, S., Groba, F., & Indvik, J. (2013). Assessing the strength and effectiveness of renewable electricity feed-in tariffs in European Union countries. *Energy Policy, Volume 52, January 2013, Pages 385-401*
- JRC. (2017). *Renewable energy in Europe for climate change mitigation. Database on NREAP's and progress reports. Available online at: https://e3p.jrc.ec.europa.eu/articles/renewable-energy-europe-climate-change-mitigation-0. Last accessed on: 26 February 2017.*
- LisbonTreaty. (2009). *Lisbon Treaty* [http://publications.europa.eu/resource/cellar/688a7a98-3110-4ffe-a6b3-8972d8445325.0007.01/DOC\\_19](http://publications.europa.eu/resource/cellar/688a7a98-3110-4ffe-a6b3-8972d8445325.0007.01/DOC_19).
- (Dutch) Ministry of Economic Affairs and Climate 2016. Incentives renewable energy production (In Dutch: Stimuleren duurzame energie productie). Letter to the Parliament (Tweede Kamer stuk 31 239). 6 July 2016.

- (Dutch) Ministry of Economic Affairs and Climate 2017ab. (a) *State of renewable energy production. Letter to the parliament 27 January 2017*; (b) *Second tender SDE+ 2017, Letter to the parliament 4 July 2017*.
- Meyer, N. I. (2003). European schemes for promoting renewables in liberalised markets. *Energy Policy, Volume 31, Issue 7, June 2003, Pages 665-676*.
- Nelson, D., O'Connell, B., De Lorenzo, L., & Huxham, M. (2016). *European Renewable Energy Policy and Investment*. Climate Policy Initiative.
- Nicolini, M., & Tavoni, M. (2016). Are renewable energy subsidies effective? *Renewable and Sustainable Energy Reviews, Volume 74, July 2017, Pages 412-423*.
- NREAPsTemplate. (2009). *Commission decision 2009/548/EC of 30 June 2009 establishing a template for national renewable energy action plans under the Directive 2009/28/EC*.
- NREL. (2010). *A Policymaker's Guide to Feed-in Tariff Policy Design, Technical Report NREL/TP-6A2-44849, July 2010, <https://www.nrel.gov/docs/fy10osti/44849.pdf>*.
- Oxera. (2014). "Almost a reform: the new German support scheme for renewable electricity", [https://www.oxera.com/Latest-Thinking/Agenda/2014/Almost-a-reform-the-new-German-support-scheme-for.aspx#\\_ftn8](https://www.oxera.com/Latest-Thinking/Agenda/2014/Almost-a-reform-the-new-German-support-scheme-for.aspx#_ftn8).
- Palmer, K., & Burtraw, D. (2005). Cost-effectiveness of renewable electricity policies. *Energy Economics, Volume 27, Issue 6, November 2005, Pages 873-894*
- PRsTemplate, *Template for Member State progress reports under Directive 2009/28/EC in their original language <https://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports>*.
- Puig, D., & Morgan, T. (2013). *Assessing the effectiveness of policies to support renewable energy. United Nations Environment Programme*.
- RVO. (2017a). Brochure SDE+ Autumn 2017. Retrieved at: <https://english.rvo.nl/subsidies-programmes/sde>.
- RVO. (2017b). Results renewable energy 2016 per 1st of March 2017 (IN Dutch: Resultaten hernieuwbare energieproductie 2016), <https://www.rvo.nl/subsidies-regelingen/stimuleren-duurzame-energieproductie/feiten-en-cijfers/resultaten-2016>.
- RVO. (2018). Regulation Green Projects (in Dutch: Regeling Groenprojecten); <https://www.rvo.nl/subsidies-regelingen/regeling-groenprojecten> .
- Sandén, B., & Azar, C. (2011). The elusive quest for technology-neutral policies. *Environmental Innovation and Societal Transitions, Volume 1, Issue 1, June 2011, Pages 135-139*.
- Scarlat, N., Banja, M., Dallemand, J., & Monforti-Ferrario, F. (2013). *Snapshots of renewable energy developments in the European Union. Status in 2010 and progress in comparison with National Renewable Energy Action Plans, <https://ec.europa.eu/jrc/en/publication/euro-scientific-and-technical-research-reports/snapshots-renewa>*.
- Schallenberg-Rodriguez, J., & Haas, R. (2012). Fixed feed-in tariff versus premium: A review of the current Spanish system. *Renewable and Sustainable Energy Reviews, Volume 16, Issue 1, January 2012, Pages 293-305*.
- SETIS. (Nov.2016, November). *Energy System Modelling*.
- Stockmayer, G., Finch, V., Komor, P., & Mignogna, R. (2012). Limiting the costs of renewable portfolio standards: A review and critique of current methods. *Energy Policy, Volume 42, March 2012, Pages 155-163*.
- SWD(2013)-439. (n.d.). *European Commission guidance for the design of renewables support schemes*.



- Toward a harmonization of national sustainability requirements and criteria for solid biomass. (n.d.). *Biofuels, Bioprod. Bioref.* (2017).
- WhitePaper. (1995). *An energy policy for the EU, COM\_1995\_0682\_FIN*.
- WhitePaper. (1998). *Harmonisation requirementsfor the internal electricity market*.
- Winkler, J., Gaio, A., Pfluger, B., & Ragwitz, M. (2016). Impact of renewables on electricity markets – Do support schemes matter? *Energy Policy, Volume 93, June 2016, Pages 157-167*.
- Winkler, J., Magosch, M., & Ragwitz, M. (2018). Effectiveness and efficiency of auctions for supporting renewable electricity – What can we learn from recent experiences? *Renewable Energy, Volume 119, April 2018, Pages 473-489*.

## List of figures

Figure 1. The EU policy framework for climate and energy 2020 & 2030 .....	8
Figure 2. Schematic illustration of "Clean Energy for all Europeans" package .....	9
Figure 3. Schematic illustration of main support schemes on promotion of renewables .....	11
Figure 4. The market premium model .....	12
Figure 5. Overall RES share progress (2010-2016) - comparison with NREAP & indicative trajectories .....	13
Figure 6. Overall renewable energy share in each EU country – comparison with NREAPs plan, 2016 .....	13
Figure 7. Breakdown of the EU gross final energy consumption in electricity, heating/cooling and transport, 2016 .....	14
Figure 8. Share of renewable in each EU country electricity sector – comparison with NREAPs, 2016 .....	14
Figure 9. Share of variable and all renewables in each EU country electricity sector, 2010 (left) & 2016 (right) .....	15
Figure 10. Share of renewable energy in EU country heating/cooling sector – comparison with NREAPs, 2016 .....	15
Figure 11. Share of renewable energy in each EU country transport sector – comparison with NREAPs, 2016 .....	16
Figure 12. Support schemes in EU countries – hydropower technology .....	26
Figure 13. Support schemes in EU countries – wind power technology .....	36
Figure 14. Support schemes in EU countries – solar photovoltaic technology .....	46
Figure 15. Support level for solar PV installations under fixed FIP scheme, Denmark .....	47
Figure 16. The support level for solar PV installations in Germany 2010-2014 (min, average and max) .....	49
Figure 17. Support level for solar PV in Austria under FIR scheme .....	53
Figure 18. Support schemes in EU countries – biomass .....	56
Figure 19. Support schemes in EU countries – heat pumps .....	65
Figure 20. Support schemes in EU countries - biofuels .....	69
Figure 21. Main measures on biofuels in EU countries (2005-2017) .....	78
Figure 22. Support framework for renewables in Belgium, 1995-2017 .....	79
Figure 23. Energy legislative landscape in Belgium .....	81
Figure 24. Support framework for renewables in Bulgaria, 1998 - 2017 .....	82
Figure 25. Energy legislative landscape in Bulgaria .....	83
Figure 26. Support framework for renewables in Czech Republic, 2001-2017 .....	85
Figure 27. Energy legislative landscape in Czech Republic .....	86
Figure 28. Support framework for renewables in Denmark, 1976-2017 .....	88
Figure 29. Energy legislative landscape in Denmark .....	90
Figure 30. Support framework for renewables in Germany, 1974 - 2017 .....	91
Figure 31. Energy legislative landscape in Germany .....	93
Figure 32. Volume of future auctions for solar PV, wind and biomass in Germany, 2018-2022 .....	94
Figure 33. Support framework for renewables in Estonia, 1998-2017 .....	95
Figure 34. Energy legislative landscape in Estonia .....	96
Figure 35. Support framework for renewables in Ireland, 1999-2017 .....	97
Figure 36. Energy legislative landscape in Ireland .....	98
Figure 37. Support framework for renewables in Greece, 1994-2017 .....	100
Figure 38. Energy legislative landscape in Greece .....	101
Figure 39. Support framework for renewables in Spain, 1997-2017 .....	102
Figure 40. Energy legislative landscape in Spain .....	103
Figure 41. Support framework for renewables in France, 2000-2017 .....	105
Figure 42. Energy legislative landscape in France .....	108
Figure 43. Main support framework for renewables in Italy, 1992-2016 .....	109
Figure 44. Energy legislative landscape in Italy .....	113
Figure 45. Main support for renewables in Cyprus, 2003-2017 .....	114
Figure 46. Energy legislative landscape in Cyprus .....	115
Figure 47. Main support for renewables in Latvia, 1998-2017 .....	118
Figure 48. Energy legislative landscape in Latvia .....	119
Figure 49. Main support for renewables in Lithuania, 2000-2017 .....	120
Figure 50. Energy legislative landscape in Lithuania .....	122
Figure 51. Main support for renewables in Luxembourg, 1993-2017 .....	123
Figure 52. Energy legislative landscape in Luxembourg .....	125
Figure 53. Main support for renewables in Luxembourg, 1993-2017 .....	126
Figure 54. Energy legislative landscape in Croatia .....	128
Figure 55. Main support for renewables in Hungary, 2001-2017 .....	129
Figure 56. Energy legislative landscape in Hungary .....	131
Figure 57. Main support for renewables in Malta, 2000-2017 .....	132
Figure 58. Energy legislative landscape, Malta .....	133
Figure 59. Main support for renewables in Netherlands, 1991-2017 .....	134
Figure 60. Energy legislative landscape in Netherlands .....	137
Figure 61. Main support for renewables in Austria, 1993-2017 .....	138
Figure 62. Energy legislative landscape in Austria .....	140
Figure 63. Main support for renewables in Poland, 1989-2017 .....	141
Figure 64. Energy legislative landscape in Poland .....	143
Figure 65. Main support for renewables in Portugal, 2005-2017 .....	144
Figure 66. Energy legislative landscape in Portugal .....	145
Figure 67. Main support for renewables in Romania, 2003-2017 .....	146
Figure 68. Energy legislative landscape in Romania .....	149

Figure 69. Main support for renewables in Slovenia, 1999-2017.....	150
Figure 70. Energy legislative landscape in Slovenia .....	152
Figure 71. Main support for renewables in Slovakia, 2004-2017.....	153
Figure 72. Energy legislative landscape in Slovakia .....	154
Figure 73. Main support for renewables in Finland, 1999-2017 .....	155
Figure 74. Energy legislative landscape in Finland.....	157
Figure 75. Main support for renewables in Sweden, 1994-2017 .....	158
Figure 76. Energy legislative landscape in Sweden .....	160
Figure 77. Main support for renewables in United Kingdom, 1989-2017 .....	161
Figure 78. Energy legislative landscape in the United Kingdom .....	164
Figure 79. Administrative procedures in EU countries, specific for solar PV, biomass, wind - end 2014 .....	166
Figure 80. Dispersion of FIT for solar photovoltaic (min, average, max) in EU countries (2010-2014).....	181
Figure 81. Dispersion of FIT for wind power (min, average, max) in EU countries (2010-2014) .....	182
Figure 82. Feed-in tariffs for solar photovoltaic (min, average, max) in EU countries, 2014 .....	182
Figure 83. Feed-in tariffs for wind power (min, average, max) in EU countries, 2014 .....	182
Figure 84. Support for solar PV (av.) vs wholesale baseload price of electricity & solar PV LCOE, 2014.....	183
Figure 85. Support for wind (av.) vs wholesale baseload price of electricity & onshore wind LCOE, 2014 <sup>177</sup> ...	183
Figure 86. Solar PV installed capacity in EU countries in 2016 vs 2020 plans (MW).....	184
Figure 87. Wind installed capacity in EU countries in 2016 vs 2020 plans (MW).....	185
Figure 88. Policy Effectiveness Indicator for solar PV in EU countries, 2010-2014 (%) - cumulative .....	185
Figure 89. Policy Effectiveness Indicator for wind power in EU countries, 2010-2014 (%) - cumulative.....	185

## List of tables

Table 1. Renewable energy support schemes in EU countries.....	22
Table 2. FIT Purchase Prices Granted to Hydroelectric Plants in Bulgaria as of July 2014 .....	27
Table 3. FIT Purchase Prices & Premiums Granted to Hydroelectric Plants in Czech Republic in 2014.....	27
Table 4. Actual Support Cost for Hydroelectricity Generation in Czech Republic, 2011-2014.....	28
Table 5. Guaranteed Prices for Hydroelectricity in Germany in 2012 - 2014 .....	28
Table 6. Average Level of Support Granted to Hydroelectric Power Plant in Ireland, 2010-2014.....	28
Table 7. Overall Support Received by hydropower plants in Greece (M€), 2012-2014.....	28
Table 8. Feed-in tariff support for hydropower plants in France.....	29
Table 9. Annual Quotas and Average Prices of Certificates for Electricity from Renewable Sources in Italy, 2010-2014 .....	29
Table 10. Hydroelectric Power Off-Taken and Incentive Cost of the All-Inclusive Tariff in Italy for 2012, 2013 and 2014 .....	30
Table 11. Annual supported power and incentive cost for hydroelectricity in Italy for 2013 and 2014 .....	30
Table 12. Premium tariff for hydropower in Italy.....	30
Table 13. Support level for hydroelectricity generation in Lithuania, 2010-2014 (€/MWh).....	31
Table 14 Level of Support for Hydroelectricity in Luxembourg, 2010-2014.....	31
Table 15 Support Granted to Hydroelectricity Generation in Croatia in 2014 .....	31
Table 16 Support Granted to Hydroelectricity Generation in Croatia in 2011, 2012 and 2013 .....	31
Table 17 Average level of support for Hydropower Plants in Hungary (€/MWh), 2009-2014 .....	32
Table 18 Overall support for Hydropower Plants in Hungary (M€), 2009-2014.....	32
Table 19. Support provided in Netherlands for hydro energy, 2011-2016 (RVO, 2017b; CBS, 2014) .....	32
Table 20. Investments Support Granted to Hydroelectric Installations in Austria .....	33
Table 21 Annual Renewable Electricity Quotas and Average Certificate Prices in Poland, 2010-2014.....	33
Table 22 Level of Support for Hydroelectricity in Portugal, 2010-2014 .....	33
Table 23 Annual Quotas and Average Certificate Prices in Romania, 2010-2014 .....	33
Table 24 Banding Factors Applied to Hydroelectricity in Romania, 2010-2014 .....	33
Table 25 Feed-in Tariff and Premium Levels for Hydroelectricity Generation in Slovenia, 2010-2014 .....	34
Table 26 Average Level of Support Granted to Hydroelectricity Generation in Slovakia, 2010-2014.....	34
Table 27 Annual Quotas and Average Certificate Prices in 2010 & 2011 in the United Kingdom .....	35
Table 28 Level of Support for Hydroelectricity Generation under the FIT Scheme in the United Kingdom, 2010-2014 .....	35
Table 29. Feed-in-tariff level in Bulgaria for electricity from wind power plants in 2014 .....	37
Table 30. Purchase price and Green Bonuses for wind power plants commissioned in Czech Republic.....	37
Table 31. Support for electricity from onshore wind in Denmark .....	38
Table 32. Tenders results for offshore wind in Denmark, 2004 -2014.....	38
Table 33. Onshore wind power plants Feed-in tariff.....	38
Table 34. Offshore wind power plants – payments and degressions rates .....	39
Table 35. Support scheme for wind power plans in France .....	40
Table 36. Support level for wind power technology in Italy.....	41
Table 37. The amount of tariff for wind power plants.....	42
Table 38. Support provided in Hungary for wind power technology, 2010-2014.....	42
Table 39. Support provided in Netherlands for wind power, 2011-2016.....	43
Table 40. Support provided for wind power in Poland, 2010-2014 .....	44
Table 41. Support provided for wind power in Portugal, 2009-2014 .....	44
Table 42. Quotas of renewable electricity for the period 2010-2020.....	44
Table 43. Quota obligation per MWh of electricity sold or consumed in Sweden, 2016-2025.....	45
Table 44. Payment rates for wind power plants in UK, 01.01.2017 – 31.03.2017.....	45
Table 45. The amount of electricity to be produced from 1GSC for installations after 01.01.2017, Flemish region .....	47
Table 46. Support level for solar photovoltaic in Bulgaria, 2014 .....	47
Table 47. Degression rates for PV capacity calculated from the expansion volume pursuant to Section 31 EEG 48	
Table 48. Payment for electricity generation from PV installations as 1 August 2014 and 31 October 2016, (€/MWh) .....	48
Table 49. Purchase prices with building integration premium (c€/kWh) in France - Sale in full <sup>31</sup> .....	50
Table 50. Level of support for solar PV in Cyprus, 2014 .....	50
Table 51. Feed-in tariff support for solar PV in Croatia, 2011-2014.....	51
Table 52. Support provided in Netherlands for solar photovoltaic, 2011-2016 (RVO, 2017b), .....	52
Table 53. CfD Strike Prices (GBP/MWh, 2012 prices) .....	54
Table 54. Solar PV installed capacity and number of PV installation in UK under Fit scheme, 2014-2015.....	55
Table 55. Feed-in tariffs for solar photovoltaic technology in UK, 01.10 – 31.12.2014.....	55
Table 56. Feed-in tariff payment for solar PV installations in UK, 01.10 - 31.12.2017.....	55
Table 57. REFIT 3 Support levels for biomass electricity generation in Ireland, 2014.....	58
Table 58. Support for biomass in Italy under the DM 26/06/2016 .....	60
Table 59. Level of support for biomass in Cyprus, 2014 .....	60
Table 60. Support provided for biomass in the Netherlands in 2011-2016 .....	62
Table 61. Support for heat pump technology in Austria.....	68
Table 62. Tax exemption level for petrol and diesel in Bulgaria (%).....	70
Table 63. Biofuels Quota Levels in Germany from 2010 to 2014 (%) .....	70
Table 64. Exemption from the domestic consumption tax in France 2010-2014 (€/hl).....	72

Table 65. Reduced rates of excise duty on biofuels in Latvia 2010 -2014.....	73
Table 66. Rates of excise duty on fuels in Latvia, EUR/1000 litres .....	73
Table 67. Support for biofuels in transport sector in Poland (€/unit) .....	75
Table 68. Blending shares and tax exemptions applies in Portugal, 2010-2014 .....	75
Table 69. Tax exemptions for biofuels in Sweden, 2009-2014, (M€) .....	76
Table 70. Annual Quotas for Electricity from Renewable Sources in Belgium, 2010-2014 .....	80
Table 71. Feed-in-tariffs for renewable technologies in Bulgaria's electricity sector, 2014 .....	84
Table 72. Support costs for renewable energy technologies/sources in Czech Republic, 2011-2014.....	85
Table 73. Development of payments in Germany under the EEG (in M€) .....	92
Table 74. REFIT 1 & 2 Support Level for Electricity Generation in Ireland .....	97
Table 75. Support for technologies/sources in heating/cooling sector in Spain, 2014 .....	104
Table 76. Financial support to renewable technologies in France's electricity sector, 2014 .....	106
Table 77. Biofuels incorporation targets as percentage of energy, 2007-2014 .....	107
Table 78. Tax exemption rates for types of biofuels (€/hl), 2009-2015 .....	108
Table 79. Banding Factors in the Italian Green Certificates System.....	110
Table 80. Annual Quotas and Average Prices of Certificates for Electricity from Renewable Sources in Italy, 2010-2014 .....	110
Table 81. Number of Certificates Exchanged and Annual Cost of the Italian Green Certificates Scheme, 2010-2014 .....	110
Table 82. Power Off-Taken and Incentive Cost of the All-Inclusive Tariff in Italy for 2012, 2013 and 2014....	110
Table 83. Support Level Granted by the All-Inclusive Tariff in Italy in 2014 .....	111
Table 84. Annual Supported Power and Incentive Cost in Italy for 2013 and 2014 .....	111
Table 85. Incentives to support renewables in Italy – updated 31/12/2017 .....	111
Table 86. Levels of Electricity and Gas Saved through the Energy Efficiency Securities Program, 2010-2014. 112	
Table 87. Certificates Prices and Support by Technologies from the Energy Efficiency Securities Program, 2010-2014 .....	112
Table 88. Level of investment support in electricity generation for investors not & engaged in an economic activity .....	116
Table 89. Level of Investment Support in Heating Generation for Investors Not Engaged in an Economic Activity .....	116
Table 90. Average price of electricity from RES under the mandatory procurement procedure (€/MWh) .....	118
Table 91. Auction quotas for the support of renewable energy production in Lithuania .....	121
Table 92. Feed-in tariffs for renewable electricity generation in 2014 in Luxembourg .....	124
Table 93. Premium tariffs for renewable electricity generation in 2017 in Luxembourg .....	124
Table 94. Investment subsidies & overall support through the EPEFF for electricity from RES in Croatia .....	126
Table 95. Support Level and Overall Support through the EPEFF for Heating and Cooling using RES in Croatia .....	127
Table 96. Level of support and overall support for electricity generation from RES in Hungary, 2014 .....	130
Table 97. Support level within SDE+ programs in the Netherlands in 2011-2016.....	135
Table 98. Support level granted in the heating/cooling and power production in Netherlands, 2011-2016, ....	136
Table 99 Average certificate price and renewable electricity quotas in Poland, 2010-2014 .....	142
Table 100 Average and Overall Level of Support for Renewable Electricity Generation in 2014 in Portugal ....	144
Table 101. Mandatory blending share of biofuels in Portugal.....	145
Table 102. Average and Overall Level of Support for Renewable Electricity Generation in Romania, 2010-2014 .....	147
Table 103. Banding Factors for Technologies within the Green Certificate Scheme in Romania, 2010-2014 ...	147
Table 104. Support Level Granted for Renewable Electricity Generation in 2014 in Slovenia.....	151
Table 105. Investment Support for Heating & Cooling Installations in Slovenia (M€) , 2011-2014.....	152
Table 106. Support Level Granted for Renewable Electricity Generation in Slovakia, 2011-2014 .....	153
Table 107 Average Certificate Price and Renewable Electricity Quota in the United Kingdom in 2010 and 2011 .....	162
Table 108 Banding Factor by technology in the Green Certificate Scheme in the United Kingdom .....	162
Table 109 Support Level through the Feed-in Tariff scheme in the UK in 2014 .....	163
Table 110 Level of Support Granted as of July 2014 through the Domestic Renewable Heat Incentive.....	163
Table 111 Level of Support Granted as of December 2013 through the Non-Domestic Renewable Heat Incentive .....	164

## Glossary

**Capital subsidy:** a subsidy that covers a share of the upfront capital cost of an asset (such as a solar water heater).

**Fiscal incentive:** an economic incentive that provides individuals, households or companies with a reduction in their contribution to the public treasury via income or other taxes, or with direct payments from the public treasury in the form of rebates or grants.

**Indirect strategies** include the institutional promotion of the deployment of RES plants, such as site planning and easy connection to the grid, and the operational conditions of feeding electricity into the system.

**Investment tax credit:** a taxation measure that allows investments in renewable energy to be fully or partially deducted from the tax obligations or income of a project developer, industry, building owner, etc.

**Loan** is a debt provided by an organization or individual to another entity at an interest rate, and evidenced by a promissory note which specifies, among other things, the principal amount of money borrowed, the interest rate the lender is charging, and date of repayment. A loan entails the reallocation of the subject asset(s) for a period of time, between the lender and the borrower.

**Mandate/obligation:** a measure that requires designated parties (consumers, suppliers, generators) to meet a minimum, and often gradually increasing, target for renewable energy, such as a percentage of total supply or a stated amount of capacity.

**Net metering:** a regulated arrangement in which utility customers who have installed their own generating systems pay only for the net electricity delivered from the utility (total consumption minus on-site self-generation).

**Production tax credit:** a taxation measure that provides the investor or owner of a qualifying property or facility with an annual tax credit based on the amount of renewable energy (electricity, heat or biofuel) generated by that facility.

**Policy effectiveness** means monitoring the efficiency and effectiveness of policies, rules or other methods in policy statements or plans (policy and plan monitoring).

**Policy effectiveness indicator** is expressed as a percentage of the remaining production potential that can be realized by the end of the pre-defined medium-term period as measured at the start of that period.

**Renewable energy certificate (REC):** a certificate awarded to certify the generation of one unit of renewable energy (typically 1 MWh of electricity, but also less commonly of heat).

**Renewable portfolio standard (RPS):** an obligation placed by a government on a utility company, group of companies or consumers to provide or use a predetermined minimum renewable share of installed capacity, or of electricity or heat generated or sold;" RPSs often include tradable certificates, and they are referred to as tradable green certificates (TGC systems).

**Subsidy** is a form of financial aid or support extended to an economic sector (or institution, business, or individual) generally with the aim of promoting economic and social policy.

**Tax exemption** is a monetary exemption which reduces taxable income. Tax exempt status can provide complete relief from taxes, reduced rates, or tax on only a portion of items.

**Tax relief** is any program or incentive that reduces the amount of tax owed by an individual or business entity.

**Tax credits** is a tax incentive which allows certain taxpayers to subtract the amount of the credit they have accrued from the total they owe the state. It may also be a credit granted in recognition of taxes already paid or a form of state support.

**White certificates** are documents certifying that a certain reduction of energy consumption has been attained. In most applications, the white certificates are tradable and combined with an obligation to achieve a certain target of energy savings.

## Appendix - Support schemes in the main non-EU European countries

In this section a short overview of the support schemes in non-EU European countries. The main data source of this analysis is the IEA/IRENA joint Policies and Measures Database, integrated with available national reports.

As a part of the European Economic Area (EEA), **Norway** has adopted the RED fixing an independent target of 67.5% as a share of gross final energy consumption being provided by renewables in 2020. Such a target is split into three sectorial targets set at 43% of heat consumption for heating and cooling, 10% in transport and 114% of electricity demand met by electricity generated from renewable energy sources.

According to the last Progress Report available (2013-2014), Norway reached in 2014 the share of 69.2% of GFEC provided by RES, with sectorial values of 32.5% in H&C, 109.6% in electricity and 4.8% in transport.

The main support tool has been re-launched on 1<sup>st</sup> January 2012 (after the re-designing of a first scheme dating back to 2003) and promotes new **power generation** from renewable energy sources. The scheme is based on the *certificate* concept: for each MWh produced from renewable resources, electricity producers have the opportunity to be granted an electricity certificate by the Government. The certificates can be sold on an open market to electricity consumers - mostly via electricity suppliers - who have to fulfil a quota obligation of certificated electricity. The quota is set in proportion to total electricity use. In the new design the certificate market is shared between Sweden and Norway and certificates may be traded between borders. The objective of the common certificates market is to increase the production of renewable electricity with 28.4 TWh by 2020. For consumers who fail to buy enough certificates, there is a financial penalty.

The state-run Enova Energy Fund promotes energy efficiency in **households**. The fund explicitly targets small heating plants and larger district heating plants. Enova also has a support programme directed towards industrial production of biogas.

Since 2015 the Enova fund also acts in supporting decarbonisation of the **transport** sector where also a number of tax exemptions support the use of renewable energy in the transport. Moreover, in 2013 and 2014 a binding national sales target applied in Norway requiring the total annual sales of biofuels to account for at least 3.5 % of overall fuel sales for road traffic purposes.

**Switzerland** has committed itself to reach a the share of renewable energy in energy consumption of 24% by 2020, starting from a 2007 figure of 16.2%. In energy consumption between 2010 and 2020 is planned to decrease by 5%, with a stabilisation thereafter. Measures consist in a mix of incentive measures, direct subsidies, and regulations and minimal standard.

Renewable **power generation** is mainly supported by a feed-in tariff, introduced 2009 by the federal government and renewing similar schemes dating back to 1991. The FITs target small hydropower (<10 MW), medium size PV (>10 kW), wind, geothermal and biomass including waste-to-energy. Tariff is applicable for 20 years (10 years for biomass infrastructure power plants), subject to a regular review. Starting from 2014, small photovoltaics plants are with investment aids.

In the **transport sector**, exemption from the mineral oil tax has been guaranteed to biofuels since 2008, provided they have a positive aggregate environmental impact and are produced under socially acceptable conditions. Moreover, a compensation obligation has been introduced in 2013: importers are obliged to compensate up to 10% of the fuel related carbon emissions by domestic projects, not necessarily in the same transportation sector.

A federal technology fund is also available to promote innovative technologies, including renewable energy and increase energy efficiency, providing loan guarantees for innovative companies.

In 2009 **Russian Federation** has established targets for the share of 4.5% of electricity generation from renewable energy sources in 2024, excluding large hydro over 25 MW. At the time the policy passed, less than 1% of total electricity generation came from renewable energy sources, excluding large hydro. This overall target has been translated in technological targets of 1.5 GW of solar PV and 0.9 GW of small hydro by 2020, and 3.5 GW of wind by 2024.

The main tool providing support to **renewable power** consists in an auction driven capacity remuneration system. Annually selected renewable power projects based on wind, solar PV and small hydropower technologies receive capacity payments for a period of 15 years for maintaining

readiness to generate electricity on demand. In the four rounds of auctions taking place from 2013 to 2016 a total capacity of 2.06 GW was awarded.

Several non-EU countries are Contracting Parties to the Energy Community Treaty (EnCT). Currently the Treaty includes the Western Balkan countries (Albania, Bosnia and Herzegovina, Kosovo, Former Republic of Macedonia, Montenegro and Serbia) as well as Moldova and Ukraine and, since 2017, Georgia. The Energy Community has adopted the relevant *Acquis Communautaire* in the energy field and has adopted in October 2012 the RED. The Contracting Parties have committed themselves to binding renewable energy targets by 2020 and to prepare NREAPs outlining the scenarios and policies they intend to pursue to meet these binding targets. Figure 37 shows RES targets for 2020 and 2009 status for the signatory countries.

A short summary of the main national policies and support schemes supporting RE deployment follows<sup>180</sup>.

**Albania** – In 2017 Albania has approved the Law on Promotion of the Use of Energy from Renewable Sources. For electricity, a support scheme based on contracts for difference has been introduced, which are equivalent to a sliding feed-in premium system: producers will sell the electricity in the market and receive the variable premium as the difference between the auction price and the electricity market price. The total support available will be determined on the basis of planned auctions that will involve producers offering more than 2 MW of installed capacity. Moreover, a Law on Energy Performance of Buildings is in force since November 2016, aiming at making newly built or renovated buildings nearly zero-energy buildings.

**Bosnia and Herzegovina** Support schemes are in place in both entities, but lack of power market is blocking costs transfer. Buildings sector also lacks of both RE and energy efficiency requirements. Both entities adopted secondary legislation defining the types, contents and quality of biofuels in motor vehicle fuels, introduced blending obligations, but no incentives have been put in place.

**Kosovo** - Support schemes exist for various renewable power technologies like small HPPs, wind, biomass and biogas, and, since 2014, also for solar PV. On the contrary substantive progress in heating and cooling from renewable sources is lacking with drafted legislation still pending adoption.

**Former Yugoslav Republic of Macedonia** Former Yugoslav Republic of Macedonia supports renewable power projects by means of feed-in tariffs for small hydro, wind, solar PV and power plants using biogas and biomass. Power purchase agreements are valid for 20 years for wind farms and small hydro, and 15 years for the other technologies and the country has started a transition towards a competitive procedure based on feed-in premium. Whilst secondary legislation on the use of renewable energy for heating and cooling in buildings is in place, proper implementation is still lacking. Nevertheless, several programmes have been launched in the last years, including on subsidising solar thermal collectors and pellet stoves. No progress on transport sector is reported.

**Moldova** - the 2016 Law on Promotion of Energy from Renewable Sources envisages the introduction of market-based support schemes. However, the new auction rules to grant support to renewable energy producers remain to be adopted, including rules for the competitive procedure to select the renewable energy producers. The same law requires including renewable energy technologies when planning, constructing and renovating buildings or industrial sites and introduces support measures. No progress in certification schemes for biofuels, although small quantities have been registered by the official statistics.

**Montenegro** - The Energy Law grants support for the use of renewable energy sources and high-efficiency cogeneration based on auctions, but secondary legislation is still missing. The support to renewable energy producers is based on a decree setting feed-in tariffs for renewable energy sources and high-efficiency cogeneration. Power purchase agreements (PPAs) on feed-in tariffs are signed between the market operator and the privileged producers for 12 years. For 2017, the incentive was set at a value of 0.058715 c€/kWh, representing a 27% increase compared with 2016.

**Serbia** - In accordance with the Energy Law, support schemes for various renewable energy technologies have been adopted, including a template for power purchase agreements between privileged renewable energy producers and the guaranteed supplier. Investment support for biomass heating power plants has recently been introduced while in the transport sector the sustainability criteria for biofuels have not been adopted so far.

---

<sup>(180)</sup> A detailed description of the current implementation progress of the Energy Community treaty is available on <https://www.energy-community.org/>



**Ukraine** - The promotion of renewable energy in Ukraine is in the form of feed-in tariffs based on "green coefficients" for various technologies. The basis for the feed-in tariffs is the Electricity Law of 2009, as amended for the last time in June 2015. It tasks the regulatory authority NEURC to approve a feed-in tariff for each generator of electricity from renewable energy sources per type of renewable energy source and per power plant until 1 January 2030. Nevertheless, the existing model is not compliant with the Guidelines on State Aid for Environmental Protection and Energy 2014 - 2020 that call for the introduction of market based support to renewable energy and market integration of energy from renewable sources and a mechanism based on a feed-in premium with the premium to be auctioned, has to be introduced. The Law on Energy Performance of Buildings was introduced in June 2017 and includes measures for the promotion of energy from renewable sources in the building sector.

## **GETTING IN TOUCH WITH THE EU**

### **In person**

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: <http://europea.eu/contact>

### **On the phone or by email**

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696, or
- by electronic mail via: <http://europa.eu/contact>

## **FINDING INFORMATION ABOUT THE EU**

### **Online**

Information about the European Union in all the official languages of the EU is available on the Europa website at: <http://europa.eu>

### **EU publications**

You can download or order free and priced EU publications from EU Bookshop at: <http://bookshop.europa.eu>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see <http://europa.eu/contact>).

## JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



**EU Science Hub**  
ec.europa.eu/jrc



@EU\_ScienceHub



EU Science Hub - Joint Research Centre



Joint Research Centre



EU Science Hub



Publications Office

doi:10.2760/521847

ISBN 978-92-79-79361-5