

# **Spatial features, energy semantics and data issues**

Piergiorgio Ciprano





# Table of Content

- Standards for interoperability
  - CityGML Energy ADE
  - ... with focus on ‘Occupancy’
- 3+1 projects and data issues
  - GeoSmartCity (CIP)
  - SUNSHINE (CIP)
  - ACCENT (Climate-KIC)
  - + CitiEnGov (Interreg)

20 practical questions

... from people “eating” the results



Result

- 5 conclusions

... in this case: **Municipal** civil servants



# The focus is threefold

- How geo-ICT **standards** like INSPIRE ones and CityGML ADE Energy can facilitate the semantic and technical **interoperability** between different platforms and tools
- **Data** (spatial, energy) availability and accessibility, sources heterogeneity, privacy issues
- **Replicability** (and 'marketability') of solutions in different cities and countries





# Development of the CityGML ADE Energy



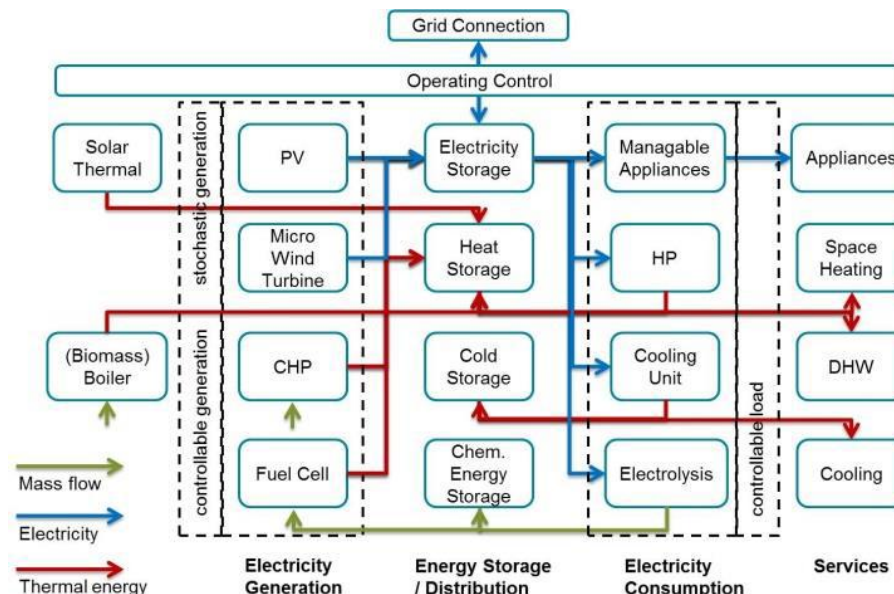
INSPIRE GWF 2015  
*Lisbon*  
25.05.2015

**Jean-Marie Bahu – EIFER**  
**Romain Nouvel – HFT Stuttgart**



# Urban energy modelling concept

- Urban energy simulation consists in **multi-dimensions**:
  - Multiple energy carriers and end-uses
  - Local and central energy transformation, storage and distribution
  - Multiple system dimensions: spatial and temporal
  - Multiple interactions (building, microclimate, etc.)
- ➔ **Specific requirements** (building, infrastructure, etc.)



*Reference: BAHU et al., 2013*



# Starting point

- No widely applicable open model standard exists until now for Urban Energy Modelling (like IFC or gbXML for buildings)
- CityGML, open standard for exchanging 3D urban data, it doesn't contain any **energy-related objects or attributes**.
- CityGML is **extensible** through **ADEs**.
- Urban energy tool developers (CitySim, UMI) have developed their **own tailor-made urban information model**





# Our Objectives

- Store relevant energy-related data in a common open city data model
- ...to offer **data exchange** and **interoperability** possibilities between urban energy stakeholders and tools
- ...as well as with other expert fields (acoustics, statics).  
Combine data collection effort!

➤ **Energy ADE for CityGML**



- **Flexibility:** Following the philosophy of CityGML and its Levels of Detail (LoDs)
- **Compatibility:** Allowing to be used in different urban energy platforms for different analysis methods, using data from different data specification standards
- **Modularity:** connection with other CityGML ADEs, use and extension of ADE Energy in other fields



# A participative development process

- Participative development in an international expert group from 12 organisations *(update: 19, at June 2016)*

## The Energy ADE Development Group [\[edit\]](#)

We are an international consortium of urban energy modellers and users from research centers and private companies, created in May 2014 and since constantly growing:

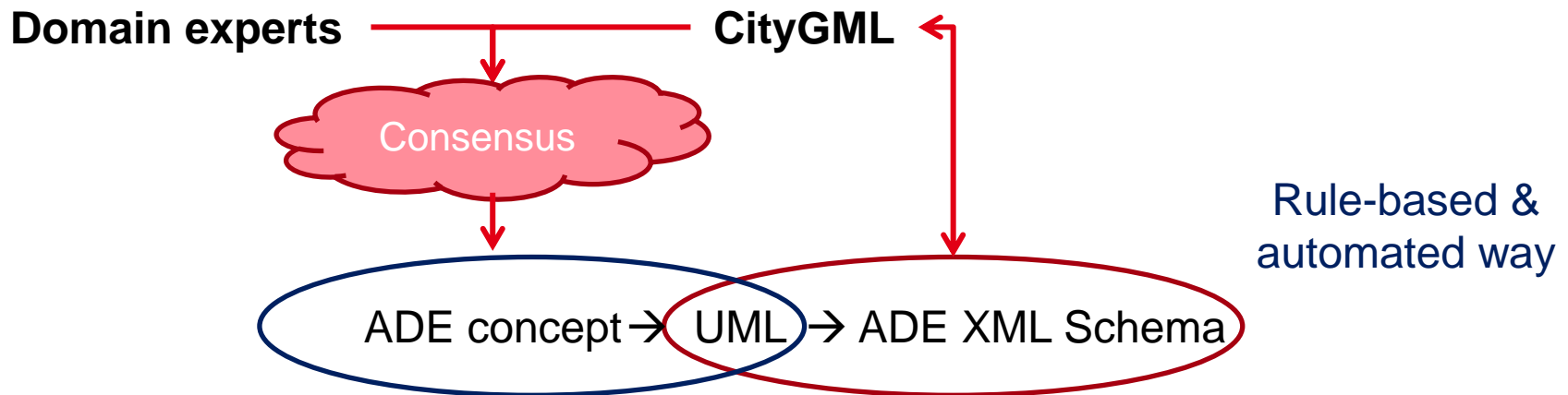
- in Germany: the Special Interest Group 3D (SIG3D), University of Applied Sciences Stuttgart, Technische Universität Munich, Karlsruhe Institute of Technology, European Institute for Energy Research, RWTH Aachen University / E.ON Energy Research Center, HafenCityUniversität Hamburg, M.O.S.S Computer Grafik Systeme
- in France: Centre Scientifique et Technique du Batiment, Electricité de France
- in Italy: Sinergis and Fondazione Graphitech
- in Austria: Austrian Institute of Technology
- in Switzerland: Ecole Polytechnique Fédérale de Lausanne, ETH Zürich, kaemco
- in Luxemburg: Luxembourg Institute of Science and Technology
- in Netherland: TU Delft
- in USA: Laurence Berkeley Laboratory

**Every new organisation willing to participate actively to this Energy ADE development is very welcome. For this purpose, please contact [SIG3D](#).**



# CityGML ADE concept

- What is an **ADE**?
  - Extension of the CityGML model for **specific application domains**
  - Formal specification in separate XML schemas referencing the CityGML schemas
- 2 types of ADEs:
  - Extension of existing CityGML feature types
  - Definition of new feature types



- Reference document: *Modeling an application domain extension of CityGML in UML*  
- OGC Best Practice, 2014



You may download the complete presentation at:

[http://en.wiki.energy.sig3d.org/images/upload/Presentation\\_WorldGeoForum\\_ADE-Energy\\_20152505.pdf](http://en.wiki.energy.sig3d.org/images/upload/Presentation_WorldGeoForum_ADE-Energy_20152505.pdf)



# CityGML Energy ADE 'wiki'



SIG3D Energy Working  
Group  
Events  
News  
Help

## Workshops

Workshop Ferrara  
2016  
Workshop Vienna  
2016  
Workshop Munich  
2015  
Workshop Sophia  
Antipolis 2015  
Workshop Karlsruhe  
2014  
Workshop Stuttgart  
2014

## Tools

What links here  
Related changes  
Upload file  
Special pages  
Printable version

Piergiorgio Cipriano [Talk](#) [Preferences](#) [Watchlist](#) [Contributions](#) [Log out](#)

Page [Discussion](#)

[Read](#)

[Edit](#)

[View history](#)



[More](#) ▾

## Main Page

**Welcome on the Energy ADE development Wiki, hosted by SIG3D**

Consult the [SIG3D web site](#) for further information about the SIG3D.

### Contents [\[hide\]](#)

- [1 News](#)
- [2 Short Description of the Energy ADE](#)
- [3 The Energy ADE Development Group](#)
- [4 Dissemination Activities](#)
  - [4.1 Presentations and publications](#)
  - [4.2 Next participations/contributions to conferences and events](#)
  - [4.3 Related Information and links](#)
- [5 Community Portal](#)

## News [\[edit\]](#)

[Latest News](#)

## Short Description of the Energy ADE [\[edit\]](#)

No widely applicable open model standard exists, until now for Urban Energy Modelling

[http://en.wiki.energy.sig3d.org/index.php/Main\\_Page](http://en.wiki.energy.sig3d.org/index.php/Main_Page)



# CityGML Energy ADE 'github'

The screenshot shows the GitHub repository page for 'cstb / citygml-energy'. The repository has 21 pulls, 11 stars, and 2 forks. The 'Code' tab is selected, showing the repository name 'CityGML Energy ADE'. Below this, statistics show 266 commits, 5 branches, 5 releases, and 12 contributors. A 'Branch: master' dropdown and a 'New pull request' button are visible. A 'Clone or download' button is also present. The commit history table shows the following entries:

Commit	Description	Time
pgcipriano	Updated BuildingUnit definition	a month ago
fme	Update simplified diagrams versions	a year ago
samples	Version with EnergyConversionSystems (Boiler, HeatPump, PV)	5 months ago
xsd	Update XSD schema	8 months ago
.gitignore	update guidelines, add Guidelines_EnergyADE.pdf	7 months ago
Changelog.txt	issue #7	2 years ago
Energy-ADE.xml	Update Enterprise Architect XMI exports	8 months ago
Energy-ADE_applicationSchema.xml	Update Enterprise Architect XMI exports	8 months ago

<https://github.com/cstb/citygml-energy/>



# CityGML Energy ADE ‘guidelines’

## 🔗 General structure overview

---

Its structure is conceived to be modular, so as to be potentially used and extended also for other applications (e.g. module Occupancy for socio-economics, module Construction and Materials for acoustics or statics, etc). It consists of 5 modules:

- Building Physics module,
- Occupancy module,
- Construction and Material module,
- Energy Use and System module,
- Timeseries and Schedules module.

The Building Physics module is the core of the Energy ADE. It extends the existing CityGML objects (Abstract Building, BoundarySurface and Opening) and relate them to new thermal entities (ThermalZone, ThermalBoundary, resp. ThermalComponent). Its central object is the ThermalZone, which is the volume unit for heat/cool energy demand calculation.

The Occupancy module is related to the CityGML model (AbstractBuilding) and Building Physics Module (ThermalZone) through its central object : UsageZone. The latter is the spatial unit for user-depending energy use study (e.g. domestic hot water, electrical appliances) and can provide usage boundary conditions for the heat/cool energy demand calculations.

The Construction and Material, Energy Use and System, and Timeseries and Schedules modules are independant « floating modules » which may be connected to different CityGML and Energy ADE CityObjects.

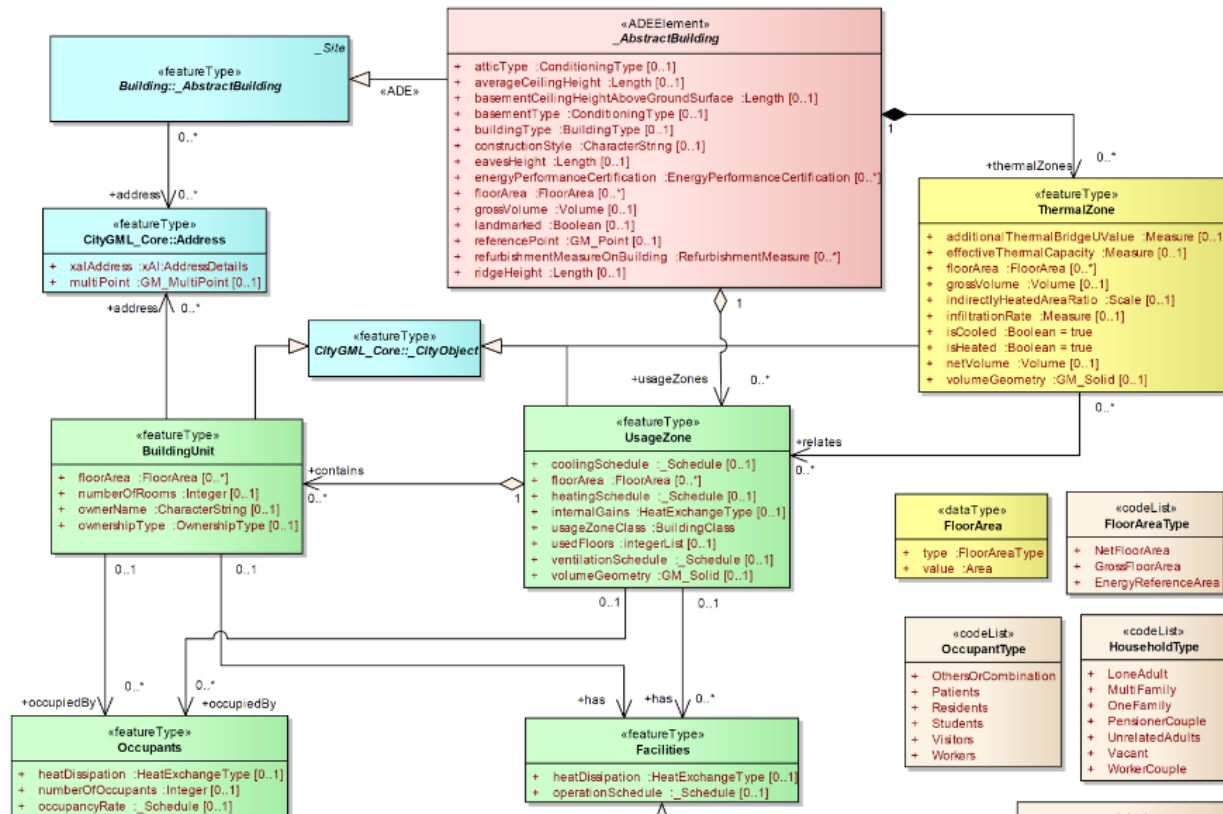
This document is intended to explain the characteristics and purposes of each module, their entities and attributes. It provides also a number of XML examples, illustrating how and where the Energy ADE entities and attributes may be embedded into CityGML.

[https://github.com/cstb/citygml-energy/blob/master/doc/guidelines/Guidelines\\_EnergyADE.md](https://github.com/cstb/citygml-energy/blob/master/doc/guidelines/Guidelines_EnergyADE.md)



# CityGML Energy ADE 'guidelines'

## Occupancy Module



[https://github.com/cstb/citygml-energy/blob/master/doc/guidelines/Guidelines\\_EnergyADE.md](https://github.com/cstb/citygml-energy/blob/master/doc/guidelines/Guidelines_EnergyADE.md)



# Energy ADE Occupancy Module

EC JRC Workshop “Methodologies for energy  
performance assessment based on location data”

Ispra (IT)

2016-09-12





# Working Group “Occupancy”

---

- As the occupant behaviour is a **key issue** for building and systems energy consumption, the aim of this WG is to investigate **questions related to occupancy, ownership or system scheduling**.
- As other WGs, the ADE module related to Occupancy present **many dependencies** and need common modelling decisions (e.g. with the Core or Energy systems WG).



# Working Group “Occupancy”

---

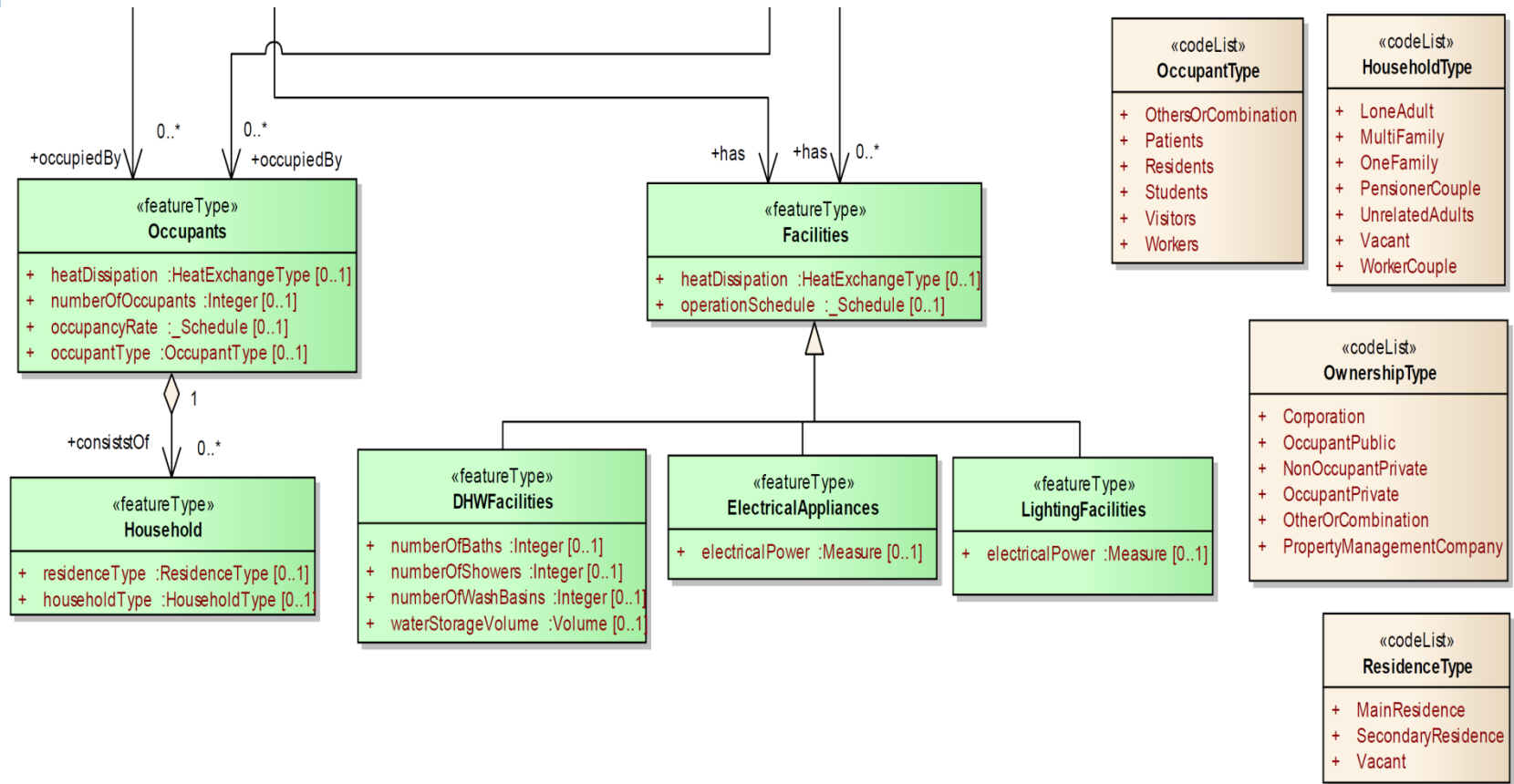
- From the guidelines:
  - The Occupancy Module contains the detailed characterization of the building usage, it means the **people** and the **facilities**.
  - It is related to the rest of the ADE Energy and CityGML model through the class **UsageZone**.
  - One building may have **several UsageZone** objects
  - Due to the type of information it allows to store, the Occupancy Module may be used also for **multi-field analysis** (socio-economics, demographics etc.).







# UML overview





# Occupancy example





# Occupancy example

---

- The previous picture shows a real mixed-use building, corresponding to a single **Building** entity in a CityGML model file (with several real addresses).
- It consists in 3 different **usageZone** objects:
  - post office covering the whole ground floor and the part of the first floor just above the main entrance ("Post")
  - private office on the first floor at the left of the main entrance
  - dwelling on the first floor in the opposite side of the building
- Both UsageZone of type **privateOffice** and **dwelling** have two BuildingUnit objects each, corresponding to different private offices ("O1" and "O2"), respectively different dwellings ("D1" and "D2").



# Occupancy example (data IT)

```
41      <bldg:boundedBy>
58      <bldg:boundedBy>
75      <bldg:boundedBy>
92      <bldg:boundedBy>
109     <bldg:boundedBy>
126     <bldg:boundedBy>
143     <bldg:address>
152     <energy:EnergyDemand>
153       <energy:endUse>ElectricalAppliances</energy:endUse>
154       <energy:energyAmount>
155         <energy:IrregularTimeSeries>
156           <energy:variableProperties>
157             <energy:TimeValuesProperties>
158               <energy:acquisitionMethod>Measured with digital meters</energy:acquisitionMethod>
159               <energy:interpolationType>AverageInSucceedingInterval</energy:interpolationType>
160             </energy:TimeValuesProperties>
161           </energy:variableProperties>
162           <energy:uom uom="kWh"/>
163           <energy:contains>
164             <energy:MeasurementPoint>
165               <energy:time>2010-12-31</energy:time>
166               <energy:value>18291.0</energy:value>
167             </energy:MeasurementPoint>
168           </energy:contains>
169         </energy:IrregularTimeSeries>
170       </energy:energyAmount>
171     </energy:EnergyDemand>
172     <energy:EnergyDemand>
```

EnergyAmount  
at **building** level with actual  
data from National tax agency  
(raw data are at user level)



# Occupancy example (data IT)

```
192 <energy:EnergyDemand>
212 <energy:EnergyDemand>
232 <energy:EnergyDemand>
252 <energy:EnergyDemand>
272 <energy:EnergyDemand>
273 <energy:endUse>SpaceHeating</energy:endUse>
274 <energy:energyAmount>
275 <energy:IrregularTimeSeries>
276 <energy:variableProperties>
277 <energy:TimeValuesProperties>
278 <energy:acquisitionMethod>Measured with analogic gas meters
279 <energy:interpolationType>AverageInSucceedingInterval</energy:interpolationType>
280 </energy:TimeValuesProperties>
281 </energy:variableProperties>
282 <energy:uom uom="m^3"/>
283 <energy:contains>
284 <energy:MeasurementPoint>
285 <energy:time>2012-12-31</energy:time>
286 <energy:value>691.0</energy:value>
287 </energy:MeasurementPoint>
288 </energy:contains>
289 </energy:IrregularTimeSeries>
290 </energy:energyAmount>
291 </energy:EnergyDemand>
292 <energy:EnergyDemand>
312 <energy:energyPerformanceCertification>
318 <energy:usageZone>
352 <energy:usageZone>
```

EnergyAmount  
at **building** level with actual  
data from National tax agency  
(raw data are at user level)



# Occupancy example (data IT)

```
415 <energy:averageInternalGains>
424 <energy:contains>
425   <energy:BuildingUnit gml:id="H223_123-456-88">
426     <energy:floorArea>
427       <energy:FloorArea>
428         <energy:type>NetFloorArea</energy:type>
429         <energy:value uom="m^2">120</energy:value>
430       </energy:FloorArea>
431     </energy:floorArea>
432     <energy:energyPerformanceCertification>
433       <energy:EnergyPerformanceCertification>
434         <energy:certificationRating>E</energy:certificationRating>
435         <energy:certificationName>Regional law 7/2014 (Regione Emilia-Romagna) implementing 2010/31/UE</energy:certificationName>
436         <energy:certificationId>00052-00013-2012</energy:certificationId>
437       </energy:EnergyPerformanceCertification>
438     </energy:energyPerformanceCertification>
439   </energy:BuildingUnit>
440 </energy:contains>
441 <energy:contains>
458 <energy:occupiedBy>
459 <!-- For residential the number of residents are sourced by the municipal regi...
included in this usage zone (residential) -->
460 <energy:Occupants>
461   <energy:numberOfOccupants>7</energy:numberOfOccupants>
462   <energy:occupantType codeSpace="http://hub.geosmartcity.eu/registry/codelist/OccupantTypeValue/Occupant...
energy:occupantType>
463 </energy:Occupants>
464 </energy:occupiedBy>
```

EnergyPerformanceCertification  
at **building unit** level with actual  
data from Regional register

numberOfOccupants at  
**building unit** level with actual  
data from Municipal register

its<



# Some questions

1. Where to find the necessary information to represent energy-related information at **building** or **building unit** levels?
2. How to **generate** datasets encoded as CityGML ADE Energy?
3. How to practically and efficiently **store** these data?
4. How to **practically use** these data?



# GeoSmartCity

*open geo-data for innovative services and user applications  
towards Smart Cities*

**CIP ICT-PSP Project n. 621150**

**Start date 01-03-2014, duration 36 months**

EC JRC Workshop “Methodologies for energy performance assessment  
based on location data”

Ispra (IT)

2016-09-12



GeoSmartCity implements a **platform to share and publish** geographical open data coming **from different sources**, such as Public Administrations, Multi-utilities, Companies and Crowd-sourcing.

[www.geosmartcity.eu](http://www.geosmartcity.eu)

The platform includes specialized web services to integrate public geographical data with other geo-referenced data (public or private) useful for the smart management of urban infrastructures and public services in the context of the **Smart City** initiative and the **Digital Agenda** for Europe.

## Partnership





# The importance of 'good metadata'

- The first data service we focused on is:
  - **metadata catalogue** (search, harvest, publish/transaction, ... of metadata), via APIs and OGC CSW standard
- All pilots provided INSPIRE-conformant metadata for data using:
  - Geonetwork
  - EUOSME (Inspire Metadata editor by JRC)\*
  - GeoSmartCity spreadsheet \*\*
  - QGIS with Qsphere plugin (v.2.14) \*\*\*

\* extended by eENVplus project with Thesaurus Framework

\*\* developed in GeoSmartCity with CSW-T functionality

\*\*\* extended and tested GeoSmartCity with CSW-T functionality



# The importance of 'good metadata'

 **GeoSmartCity**

[Datasets](#) [Organizations](#) [About](#)



[Home](#) / [Organizations](#) / [Comune di Reggio-Emilia](#) / **Energy certificates of ...**

**Energy certificates of buildings of Reggio Emilia territory**

Followers

0

[Follow](#)

**Organization**



**Comune di Reggio-Emilia**

The Municipality of Reggio Emilia, with a population of

[Dataset](#)

[Groups](#)

[Activity Stream](#)

[Related](#)

[Manage](#)

## Energy certificates of buildings of Reggio Emilia territory

Energy certificates of real estate in the town of Reggio Emilia issued by Emilia-Romagna Region (SACE). Fields provide information on the certificate and key data relating to energy certification (eg. energy class, EP, ...)

### Data and Resources



XLS

[Explore](#)



**PIAZZA DELLA VITTORIA N.5**

Energy performance certificate of municipal building located in PIAZZA DELLA...

[Explore](#)



**Sample data Energy Certificate**

OData endpoint <http://hub.geosmartcity.eu/catalog>

[Explore](#)



# The importance of 'good metadata'

located in... <a href="#">read more</a>	
<b>Social</b>	
Google+	
Twitter	
Facebook	
<b>Dataset extent</b>	
<div> <div>+</div> <div> <div>MapQuest + D</div> <div>As of July 11, 2016, direct has been discontinued.</div> <div>Please visit our blog post information: <a href="http://goo.gl/xBOxTt">http://goo.gl/xBOxTt</a></div> <div>Have questions? Contact us: <a href="mailto:developer-services@mapquest.com">developer-services@mapquest.com</a></div> <div>Visit us: <a href="http://developer.mapquest.com/">developer.mapquest.com/</a></div> </div> <div>-</div> </div>	
Map data © <a href="#">OpenStreetMap</a> contributors	
Tiles by <a href="#">MapQuest</a>	
<b>Field</b>	<b>Value</b>
State	active
Last Updated	June 7, 2016, 12:21
Created	June 7, 2016, 09:10
Resource type	
Resource identifier	Reggio:Energy-certificates-of-buildings-of-Reggio-Emilia-territory
Resource language	eng
Topic category	Planning, Cadastre
Keywords	Free <ul style="list-style-type: none"> <li>GeoSmartCity, Reggio, Energy certificates, background</li> </ul> GEMET - INSPIRE themes, version 1.0 <ul style="list-style-type: none"> <li><b>Buildings</b></li> </ul>
Geographic bounding box	10.49 44.62 10.77 44.78
Reference date	creation: 2015-09-30
Lineage	The data was provided periodically by Emilia-Romagna Region through extraction from SACE database and linked to topography and cadastre of the Municipality of Reggio Emilia
Spatial resolution	
Specification	Commission Regulation (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and



# The importance of 'well described' data

 GeoSmartCity

[Datasets](#) [Organizations](#) [About](#)

[Home](#) / [Organizations](#) / [Comune di Reggio-Emilia](#) / [Energy certificates of ...](#)

**Energy certificates of buildings of Reggio Emilia territory**

Followers

0

[Follow](#)

[Organization](#)



**Comune di Reggio-Emilia**

The Municipality of Reggio Emilia, with a population of

[Dataset](#)

[Groups](#)

[Activity Stream](#)

[Related](#)

[Manage](#)

## Energy certificates of buildings of Reggio Emilia territory

Energy certificates of real estate in the town of Reggio Emilia issued by Emilia-Romagna Region (SACE). Fields provide information on the certificate and key data relating to energy certification (eg. energy class, EP, ...)

### Data and Resources



XLS

[Explore](#)



**PIAZZA DELLA VITTORIA N.5**

Energy performance certificate of municipal building located in PIAZZA DELLA...

[Explore](#)



**Sample data Energy Certificate**

OData endpoint <http://hub.geosmartcity.eu/catalog>

[Explore](#)



# The importance of 'well described' data

## Sample data Energy Certificate

[Manage](#)
[Go to resource](#)
[Data API](#)

URL: <http://hub.geosmartcity.eu/catalog/dataset/80742f99-4b06-4861-bec4-32df6d7a49e1/resource/c93eb953-0651-4572-aba8-7820ccc...>

### From the dataset abstract

Energy certificates of real estate in the town of Reggio Emilia issued by Emilia-Romagna Region (SACE). Fields provide information on the certificate and key data relating to energy...

Source: [Energy certificates of buildings of Reggio Emilia territory](#)

[Data Explorer](#)
[Embed](#)

Add Filter

Grid Graph Map

42 records

« 1 – 42 »

Search data ...

Go »

Filters

_id	IDCertifi...	Regione	Provincia	Comune	Codice...	Indirizzo	DataRil...	Rilascia...	Unitalm...	ClasseE...
1	277	Emilia-R...	Reggio ...	REGGIO...	00052-0...	via reiter, a	2009-01...	Marco Al...	E1 - Abit...	G
2	590	Emilia-R...	Reggio ...	REGGIO...	00121-0...	Via Vladi...	2009-01...	linda iori	E1 - Abit...	G
3	966	Emilia-R...	Reggio ...	REGGIO...	00346-0...	VIA OSP...	2009-01...	LUCA CI...	E1 - Abit...	E
4	972	Emilia-R...	Reggio ...	REGGIO...	00346-0...	VIA OPE...	2009-01...	LUCA CI...	E1 - Abit...	E
5	1005	Emilia-R...	Reggio ...	REGGIO...	00346-0...	VIA OSP...	2009-01...	LUCA CI...	E1 - Abit...	E
6	1031	Emilia-R...	Reggio ...	REGGIO...	00346-0...	VIA OSP...	2009-01...	LUCA CI...	E1 - Abit...	E
7	1303	Emilia-R...	Reggio ...	REGGIO...	00052-0...	Via Triss...	2009-01...	Marco Al...	E1 - Abit...	D
8	1506	Emilia-R...	Reggio ...	REGGIO...	00145-0...	VIA SOC...	2009-01...	Gabriele...	E1 - Abit...	D
9	1687	Emilia-R...	Reggio ...	REGGIO...	00145-0...	VIA SOC...	2009-01...	Gabriele...	E1 - Abit...	D



# The importance of 'well described' data

admin 0

**GeoSmartCity**

Datasets Organizations About Search



Home / Organizations / Comune di Reggio-Emilia / Energy certificates of ...

**Energy certificates of buildings of Reggio Emilia territory**

Followers  
**0**

[Follow](#)

Organization

  **Reggio Emilia città delle persone**

**Comune di Reggio-Emilia**


The Municipality of Reggio Emilia, with a population of


Dataset Groups Activity Stream Related Manage

**Energy certificates of buildings of Reggio Emilia territory**


Energy certificates of real estate in the town of Reggio Emilia issued by Emilia-Romagna Region (SACE). Fields provide information on the certificate and key data relating to energy certification (eg. energy class, EP, ...)

**Data and Resources**

 **XLS** [Explore](#)

 **PIAZZA DELLA VITTORIA N.5** [Explore](#)

Energy performance certificate of municipal building located in PIAZZA DELLA...

 **Sample data Energy Certificate** [Explore](#)

OData endpoint `http://hub.geosmartcity.eu/catalog`



# The importance of 'well described' data

## PIAZZA DELLA VITTORIA N.5

URL: <http://hub.geosmartcity.eu/catalog/dataset/80742f99-4b06-4861-bec4-32df6d7a49e1/resource/84092127-2fac-4616-849e-74037a0...>

Energy performance certificate of municipal building located in PIAZZA DELLA VITTORIA N.5

PDF

Embed

Page: 1 of 3 Automatic Zoom



### Regione Emilia-Romagna

### SISTEMA DI CERTIFICAZIONE ENERGETICA

DATI DELL'IMMOBILE	DATI GENERALI
» <b>Comune:</b> H223 REGGIO NELL'EMILIA (RE)	» <b>Zona Climatica:</b> E
» <b>Indirizzo:</b> PIAZZA DELLA VITTORIA N.5	» <b>Gradi Giorno:</b> 2560,00
» <b>Piano-Interno:</b>	» <b>Volume lordo riscaldato:</b> 18303,50 m³
» <b>Foglio-Particella-Sub:</b> (133-124-2)	» <b>Superficie utile riscaldata:</b> 4101,74 m²
» <b>Proprietario:</b> -vedi foglio 3-	» <b>Superficie disperdente:</b> 6399,43 m²
» <b>Destinazione d'uso:</b> E4 - Edifici adibiti a mostre, musei e biblioteche, luoghi di culto e assimilabili	» <b>Rapporto S/V:</b> 0,35

**CLASSE ENERGETICA**

SCIATO IL 24/09/2015  
IDIO FINO AL 24/09/2025



# The importance of 'harmonized' data





# The importance of 'harmonized' data

Generic  
workflow to  
transform  
datasets  
according to  
selected  
target schema  
requirements

Import target/source schemas

Import data

Set mapping rules

Export transformed data

Validate transformed dataset



# The importance of 'harmonized' data

SHP, XLS, CSV,  
ORACLE, POSTGIS, ...



Type New Type	Documentation	Attribute Association role New attribute	Attribute / Association role Documentation	Values / Enumerations	Multipli city	Voidable / Non-Voidable
<b>Building</b> <small>Supertypes: Building, BuildingAbstract, BuildingInfo, BuildingAndBuildingUnitInfo</small>	<p>-- Name -- Building A</p> <p>Building is an enclosed &lt;b&gt;construction &lt;/b&gt;above and/or underground, used or intended for the shelter of humans, animals or things or for the production of economic goods. A building refers to any structure permanently constructed or erected on its site.</p>					
		<b>beginLifespanVersion</b>	-- Name -- Begin lifespan version -- Date and time at	DateTime	1	voidable
		<b>conditionOfConstruction</b>	-- Name -- Condition of construction -- Status of the	ConditionOfConstructionValue	1	voidable
		<b>dateOfConstruction</b>	-- Name -- Date of construction -- Date of	DateOfEvent	0..1	voidable
		<b>dateOfDemolition</b>	-- Name -- Date of demolition -- Date of demolition	DateOfEvent	0..1	voidable
		<b>dateOfRenovation</b>	-- Name -- Date of last major renovation -- Date of first	DateOfEvent	0..1	voidable
		<b>RefurbishmentClass</b>				
		<b>elevation</b>	-- Name -- Elevation -- Vertically constrained	Elevation	0..*	voidable
		<b>endLifespanVersion</b>	-- Name -- End lifespan version -- Date and time at	DateTime	0..1	voidable
		<b>externalReference</b>	-- Name -- External reference -- Reference to an external	ExternalReference	0..*	voidable
		<b>heightAboveGround</b>	-- Name -- Height above ground -- Height above	HeightAboveGround	0..*	voidable
		<b>inspireId</b>	-- Name -- inspire id -- External object identifier of the	Identifier	1	
		<b>name</b>	-- Name -- Name -- Name of the construction -- EXAMPLES:	GeographicalName	0..*	voidable
		<b>buildingNature</b>	-- Name -- Building nature -- Characteristic of the building that	BuildingNatureValue	0..*	voidable
		<b>currentUse</b>	-- Name -- Current use -- Activity hosted within the building	CurrentUse	0..*	voidable
		<b>numberOfDwellings</b>	-- Name -- Number of dwellings -- Number of	Integer	0..1	voidable
		<b>numberOfBuildingUnits</b>	-- Name -- Number of building units -- Number of building	Integer	0..1	voidable
		<b>numberOfFloorsAboveGr</b>	-- Name -- Number of floors above ground -- Number of	Integer	0..1	voidable
		<b>parts</b>	The building parts composing the	BuildingPart	0..*	voidable



# The importance of 'harmonized' data

- To facilitate pilots to harmonize their own data, a double-step approach has been proposed:
  - 1<sup>st</sup> transformation into an extended **pseudo-INSPIRE SQL database** ( for “Buildings” data theme), structured for creating target databases on pilots’ premises (Reggio Emilia, Oeiras, Marousi)
  - 2<sup>nd</sup> transformation from the pseudo-INSPIRE SQL db into GSC (INSPIRE extended) **GML compliant datasets**
- SQL structures are based on extended INSPIRE data model
- This approach also facilitates pilots to replicate the entire workflow in the future (beyond GeoSmartCity project)



```
CREATE TABLE conversion (
    classid varchar(70) NOT NULL,
    input varchar(80) NOT NULL,
    location varchar(80),
    output varchar(80) NOT NULL,
    value double precision NOT NULL,
    year date
);

--
-- CREATE TABLE: buildings
-- Rappresenta la classe: Buildings - BUILDINGS
--
```

42



# The importance of 'harmonized' data

[Home](#) / [Organizations](#) / [Comune di Reggio-Emilia](#) / [GeoSmartCity harmonized ...](#)

## GeoSmartCity harmonized dataset of buildings

Followers

1

[Unfollow](#)

### Organization



**Comune di Reggio-Emilia**

The Municipality of Reggio Emilia. with a population of

[Dataset](#)

[Groups](#)

[Activity Stream](#)

[Related](#)

[Manage](#)

## GeoSmartCity harmonized dataset of buildings

This dataset has been generated in the context of GeoSmartCity project by the Municipality of Reggio nell'Emilia, based on different background data sources already available in the Municipality itself or from other external authoritative sources. The full dataset contains information about buildings' characteristics (areas, volumes, uses, number of building units, ...) as well as aggregated data about energy performance derived from energy certificates, as well as annual energy consumption (gas, electricity and district heating).

### Data and Resources



**application/x-shapefile**

[Explore](#)



**Harmonized GML dataset**

GML dataset harmonized and compliant to INSPIRE-GSC "Buildings" Schemas...

[Explore](#)



**WMS service**

Web Map Service for viewing energy classification of buildings ...

[Explore](#)



# The importance of 'harmonized' data

🏠 / Organizations / Comune di Reggio-Emilia / GeoSmartCity harmonized ... / WMS service

## WMS service

🔧 Manage

🔗 Go to resource

URL: <http://labcatania.dedagroup.it/geoserver/MappaReggioEmilia/ows?service=wms&version=1.3.0&request=GetCapabilities>

Web Map Service for viewing energy classification of buildings ...

🗺 Map viewer

</> Embed





# The importance of 'harmonized' data

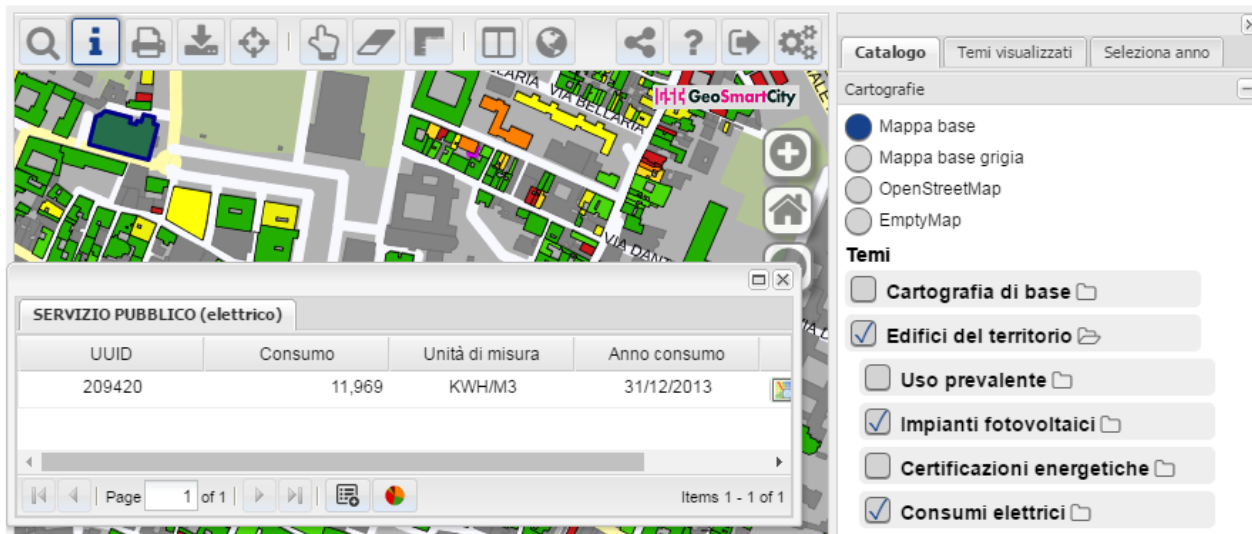
## Municipality of Reggio-Emilia - GeoSmartCity ...

URL: <http://labcatania.dedagroup.it/geosmartcity-ctw/login.html>

GeoSmartCity webGIS client of the Municipality of Reggio-Emilia, with layers grouped at "building stock" and "municipal energy unit" levels showing actual energy consumption data and energy certificates.

Website

Embed



The screenshot displays the GeoSmartCity webGIS interface. At the top, there is a toolbar with various icons for map navigation and data management. Below the toolbar is a map showing a residential area with buildings and streets. A data table is overlaid on the map, displaying information for the 'SERVIZIO PUBBLICO (elettrico)' layer. The table has columns for UUID, Consumo, Unità di misura, and Anno consumo. The data row shows a UUID of 209420, a consumption of 11,969 KWH/M3, and a consumption year of 31/12/2013. To the right of the map is a sidebar with a 'Catalogo' section containing a list of layers and themes. The 'Temi visualizzati' section shows a list of themes with checkboxes, including 'Edifici del territorio', 'Impianti fotovoltaici', 'Consumi elettrici', and 'Consumi elettrici'.

UUID	Consumo	Unità di misura	Anno consumo
209420	11,969	KWH/M3	31/12/2013



# The importance of 'harmonized' data

Home / Organizations / Comune di Reggio-Emilia / GeoSmartCity harmonized ...

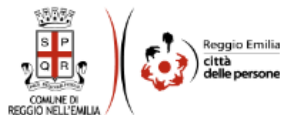
## GeoSmartCity harmonized dataset of buildings

Followers

1

Unfollow

### Organization



**Comune di Reggio-Emilia**

The Municipality of Reggio Emilia. with a population of

[Dataset](#) [Groups](#) [Activity Stream](#) [Related](#)

Manage

## GeoSmartCity harmonized dataset of buildings

This dataset has been generated in the context of GeoSmartCity project by the Municipality of Reggio nell'Emilia, based on different background data sources already available in the Municipality itself or from other external authoritative sources. The full dataset contains information about buildings' characteristics (areas, volumes, uses, number of building units, ...) as well as aggregated data about energy performance derived from energy certificates, as well as annual energy consumption (gas, electricity and district heating).

### Data and Resources



application/x-shapefile

Explore



**Harmonized GML dataset**

GML dataset harmonized and compliant to INSPIRE-GSC "Buildings" Schemas...

Explore



**WMS service**

Web Map Service for viewing energy classification of buildings ...

Explore



# The importance of 'harmonized' data

```
2391957.5672795265 4380727.127901457 2391955.270009875 4380737.147447805 2391957.515776212 4380738.899639699 2391958.5552152955 4380748.644212689 2391959.1182685
4380741.747281801 2391959.5282513057 4380740.810227597 2391961.8926024977 4380741.830739673 2391961.6155886576 4380742.488801749 2391964.4071002863
4380743.694828465 2391964.7966441354 4380742.797612881 2391971.4624258596 4380745.683653224 2391970.7651263387 4380747.308709066 2391979.3482526406
4380751.019485774 2391980.1889356934 4380749.075479373 2391983.3280967 4380750.436002399 2391987.513944158 4380740.505315433 2391982.864750689 4380738.495310412
2391982.4752066955 4380739.392525907 2391976.6239316734 4380736.8670149455 2391977.2493113033 4380735.421475205 2391967.7423371044 4380731.308766968
2391967.2911966327 4380732.355558973 2391961.9566881135 4380730.036681774 2391962.325700315 4380729.189325638 2391957.5672795265 4380727.127901457
```

```
</gml:posList>
</gml:LinearRing>
</gml:exterior>
</gml:Polygon>
</gml:surfaceMember>
</gml:MultiSurface>
</bu-base:geometry>
<bu-base:referenceGeometry/>
<bu-base:horizontalGeometryReference/>
<bu-base:horizontalGeometryEstimatedAccuracy xsi:nil="true"/>
</bu-base:BuildingGeometry2D>
</bu-core2d:geometry2D>
<gsc-bu2d-energy:buildingInfo>
  <gsc-bu2d-energy:BuildingInfo>
    <gsc-bu2d-energy:additionalInfo>
```

```
    <gsc-bu2d-energy:volume>
      <gsc-bu2d-energy:volumeType xlink:href="http://hub.geosmartcity.eu/registry/codelist/VolumeTypeValue/">
      <gsc-bu2d-energy:value uom="mc">5385.35</gsc-bu2d-energy:value>
      <gsc-bu2d-energy:source xlink:href="http://hub.geosmartcity.eu/registry/codelist/SourceValue/" xlink:title="From Italian Cadastre database"/>
    </gsc-bu2d-energy:volume>
    <gsc-bu2d-energy:presenceOfThermalPlants>false</gsc-bu2d-energy:presenceOfThermalPlants>
    <gsc-bu2d-energy:presenceOfSolarPanels>false</gsc-bu2d-energy:presenceOfSolarPanels>
    <gsc-bu2d-energy:presenceOfPhotovoltaicPanels>false</gsc-bu2d-energy:presenceOfPhotovoltaicPanels>
    <gsc-bu2d-energy:presenceOfElectricityMeter>true</gsc-bu2d-energy:presenceOfElectricityMeter>
```

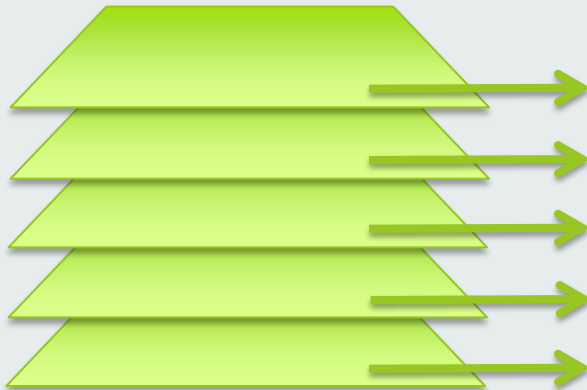
```
    <gsc-bu2d-energy:estimatedEnergyNeed uom="KWh">39218.0</gsc-bu2d-energy:estimatedEnergyNeed>
    <gsc-bu2d-energy:energyPerformanceValueSource/>
    <gsc-bu2d-energy:energyPerformanceValue xlink:href="http://hub.geosmartcity.eu/registry/codelist/EnergyPerformanceValue/6" xlink:title="G"/>
    <gsc-bu2d-energy:dateOfAssessment/>
    <gsc-bu2d-energy:assessmentMethod gml:id="EP_method_1">
      <base2:name>from SACE database</base2:name>
      <base2:date xsi:nil="true"/>
      <base2:link xsi:nil="true"/>
    </gsc-bu2d-energy:assessmentMethod>
```

```
    <gsc-bu2d-energy:energyAmount>
      <gsc-bu2d-energy:value uom="KWh">31651.0</gsc-bu2d-energy:value>
```



# The importance of 'harmonized' data

SHP, XLS, CSV,  
ORACLE, POSTGIS, ...



```
<bu-base:status xlink:href="http://inspire.ec.europa.eu/codelist/HeightStatusValue/estimated"/>
<bu-base:value uom="meter">8.0</bu-base:value>
</bu-base:HeightAboveGround>
</bu-base:heightAboveGround>
<bu-base:inspireId>
<base:Identifier>
<base:localId>6910</base:localId>
<base:namespace>http://www.municipio.re.it</base:namespace>
</base:Identifier>
</bu-base:inspireId>
<bu-base:currentUse>
<bu-base:CurrentUse>
<bu-base:currentUse xlink:href="http://inspire.ec.europa.eu/codelist/CurrentUseValue/individualResidence" in
<bu-base:percentage>100</bu-base:percentage>
</bu-base:CurrentUse>
</bu-base:currentUse>
<bu-base:numberOfDwellings>1</bu-base:numberOfDwellings>
<bu-base:numberOfFloorsAboveGround>2</bu-base:numberOfFloorsAboveGround>
<bu-core2d:geometry2D>
<bu-base:BuildingGeometry2D>
<bu-base:geometry>
<gml:Polygon gml:id="_2cb12b17-5bkd-7b57-720e-8fe04av0c931" srsName="EPSG:3044">
<gml:exterior>
<gml:LinearRing>
```



# The importance of 'registered' semantics

## Hub Support resources

### Validation Service



On-line validation of datasets harmonized according to the GeoSmartCity target data models.

[Validation Service](#)

### Geospatial Catalogue



A cataloging application for spatially referenced resources. It provides metadata editing and search functions.

[Geospatial Catalogue](#)

### Codelists Manager



The JRC's **Re3gistry** is reused and extended in order to manage new codelists and codelist values.

[Codelists Manager](#)

### Specialised Services



Standardized and re-usable data processing services based on requirements coming from the **GeoSmartCity Pilots**.

[Specialised Services](#)

## User resources

[GeoSmartCity Repository](#)[Applications Showcase](#)[User Guides and Training](#)[Contact and Enquiries](#)



# The importance of 'registered' semantics

A proposito di questo sito

italiano (it)

```
<?xml version="1.0" encoding="UTF-8"?>
<RE_RegisterItem xmlns:gmd="http://www.isotc211.org/2005/gmd"
  xmlns:gco="http://www.isotc211.org/2005/gco"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.isotc211.org/2005/grg"
  xsi:schemaLocation="http://www.isotc211.org/2005/grg http://standards.iso.org/iso/19135/-2/register.xsd">
  <itemIdentifier gco:nilReason="inapplicable"/>
  <name>
    <gco:CharacterString>publicServices</gco:CharacterString>
  </name>
  <status>
    <RE_ItemStatus>valid</RE_ItemStatus>
  </status>
  <definition>
    <gco:CharacterString>The building (or building component) hosts public services. Public services are tertiary services provided for the benefit of the citizens.</gco:CharacterString>
  </definition>
  <description>
    <gco:CharacterString>Public services are often ruled by public governments or on behalf of them. EXAMPLES: Schools, hospitals, governmental buildings, prisons, rescue stations, transport station.NOTE: in case of a building being both office and public service (e.g. a city hall), the building should be classified preferably as public service.</gco:CharacterString>
  </description>
  <additionInformation xlink:href="http://hub.geosmartcity.eu/registry/codelist/CurrentUseValue/publicServices"/>
  <itemClass>
    <RE_ItemClass>
      <name>
        <gco:CharacterString>CodeListValue</gco:CharacterString>
      </name>
      <technicalStandard gco:nilReason="inapplicable"/>
      <alternativeNames gco:nilReason="inapplicable"/>
      <describedItem gco:nilReason="inapplicable"/>
    </RE_ItemClass>
  </itemClass>
</RE_RegisterItem>
```

<http://hub.geosmartcity.eu/registry/codelist/CurrentUseValue/publicServices/>



# The importance of 'interoperable' services

## Hub Support resources

### Validation Service



On-line validation of datasets harmonized according to the GeoSmartCity target data models.

[Validation Service](#)

### Geospatial Catalogue



A cataloging application for spatially referenced resources. It provides metadata editing and search functions.

[Geospatial Catalogue](#)

### Codelists Manager



The JRC's **Re3gistry** is reused and extended in order to manage new codelists and codelist values.

[Codelists Manager](#)

### Specialised Services



Standardized and re-usable data processing services based on requirements coming from the **GeoSmartCity Pilots**.

[Specialised Services](#)

## User resources

[GeoSmartCity Repository](#)[Applications Showcase](#)[User Guides and Training](#)[Contact and Enquiries](#)

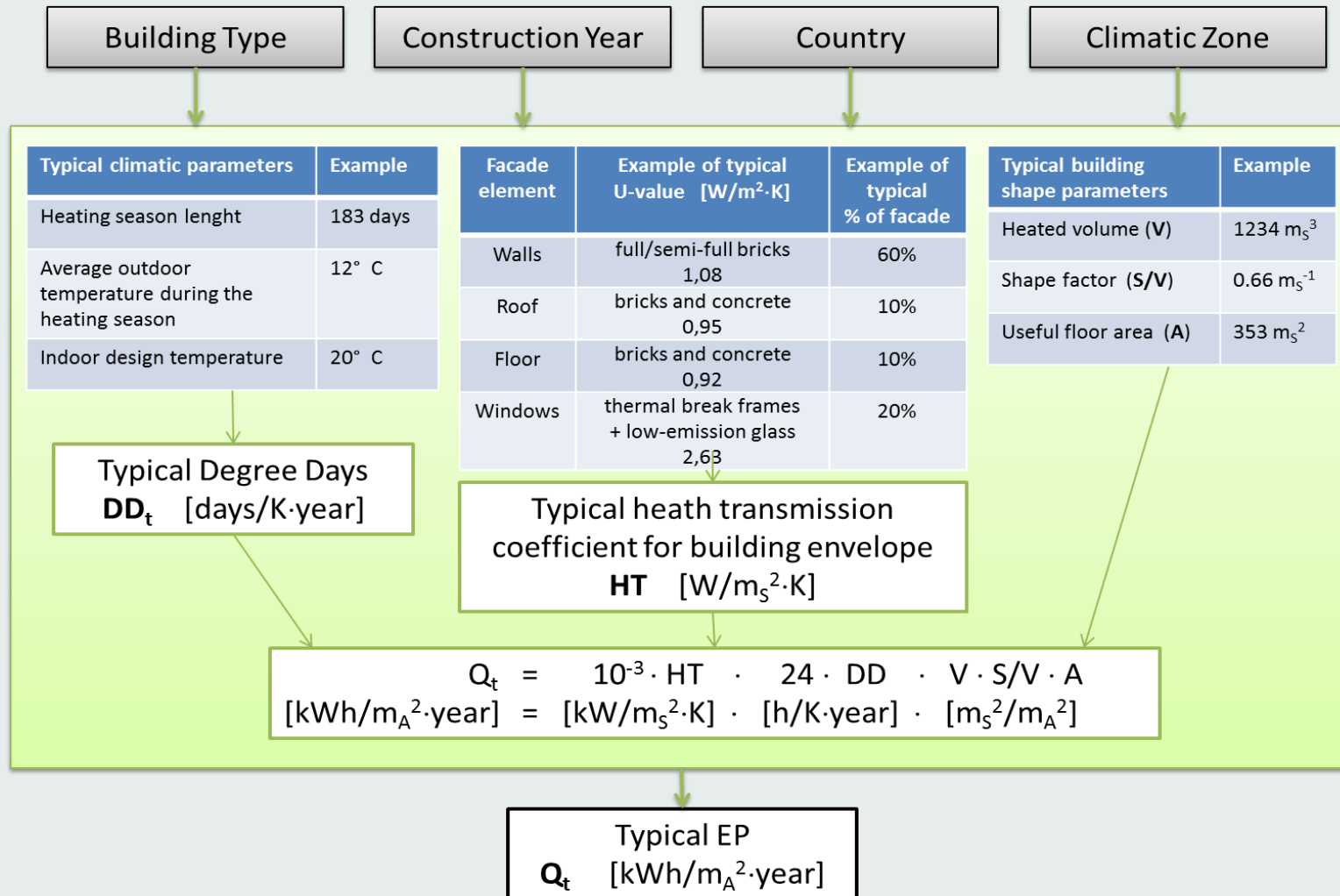


## A WPS “specialized” service in brief

- For the households “**Estimation of Energy Performance**” a standard Web Processing Service (OGC WPS) has been implemented that:
  - Considers the **characteristics of buildings** (e.g. age of construction, size, usage, ...) and data about climatic zones and calculates vertical surfaces (envelope)
  - Apply **TABULA** typologies for households (U-values for roof, floor, envelope, ... degree-days of the location, ...) to existing buildings
  - Generates the typical **EP value** in annual kWh/m<sup>2</sup> (or other units of measures according to legislation)



# A WPS “specialized” service in brief





# A WPS “specialized” service in brief

## refurbishment - String

name of the attribute that contains the information about the refurbishment level. The values on the layer can be: 0 -> no refurbishment 1 -> standard 2 -> advance If this field is not edited all buildings use the standard refurbishment.

## residential - String

name of the attribute that indicates whether the building is residential. If this field is not edited all building is considered as residential

## id - String

field that indicate a key to add at the layer that will be generate.

## layer\* - SimpleFeatureCollection

the building layer

## Process outputs

### result\* - SimpleFeatureCollection

mappa di energy performance

☒ Generate 

## Authentication

☐ Authenticate (will run the request as anonymous otherwise)

Execute process

Generate XML from process inputs/outputs



## A WFS-T “specialized” service in brief

- In order to calculate the energy performance we need data with **good level of accuracy and detail**.
- If not yet available in existing datasets, or if the quality has to be validated, we need to consider the possibility to involve local communities to **collect or correct data “on site”**.



# A WFS-T “specialized” service in brief

Buildings “on-site” data quality check



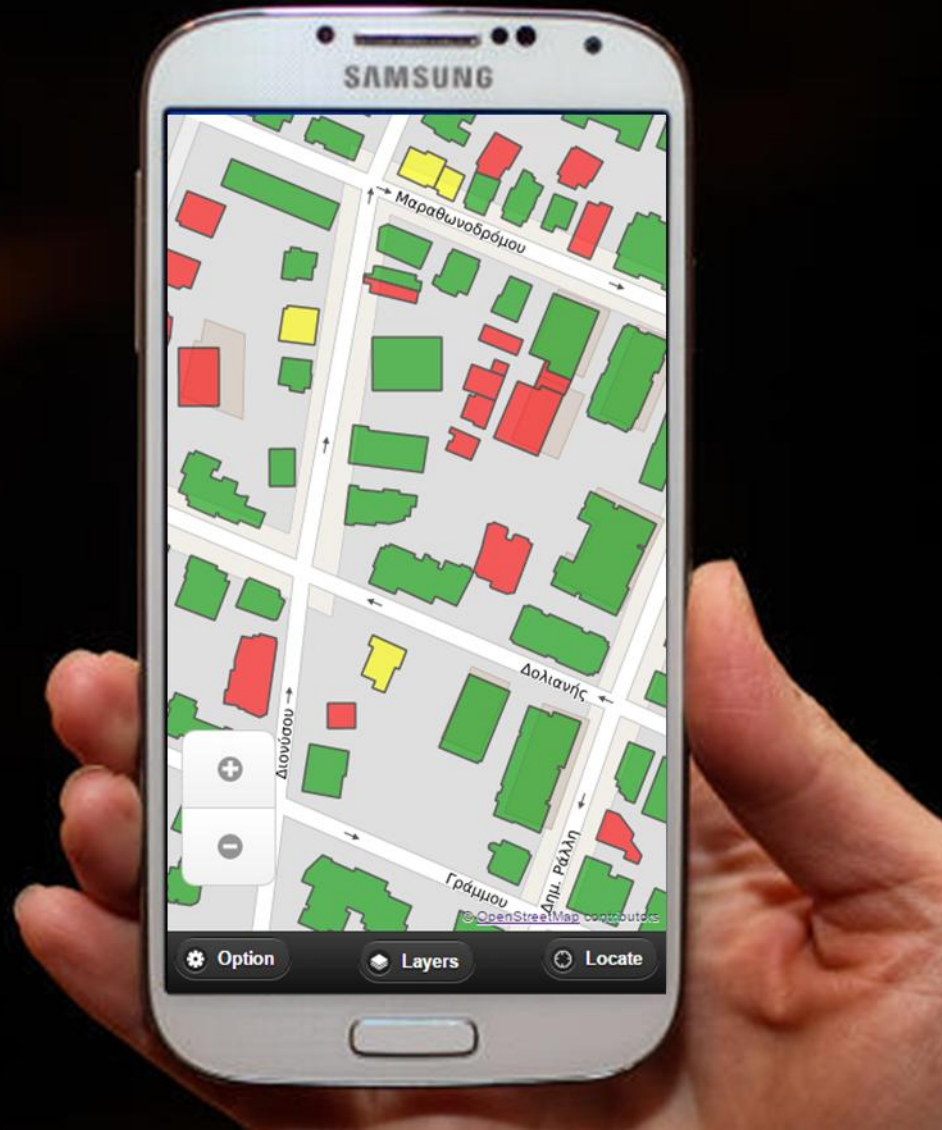
<https://play.google.com/store/apps/details?id=it.sinergis.geosmartcity.map4data>



In **Marousi(GR)** buildings' data have been collected, but some **attributes are still missing** or need to be checked (e.g. "age of construction, age of renovation, uses, ...").

An **on-site campaign** has been organized by the **EPSILON International**, involving the local School of Architecture.

People involved used smartphones and tablets to edit attributes via **WFS-T** service, and updates data on PostGIS database.







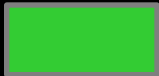
Buildings properties missing, on-site to be performed



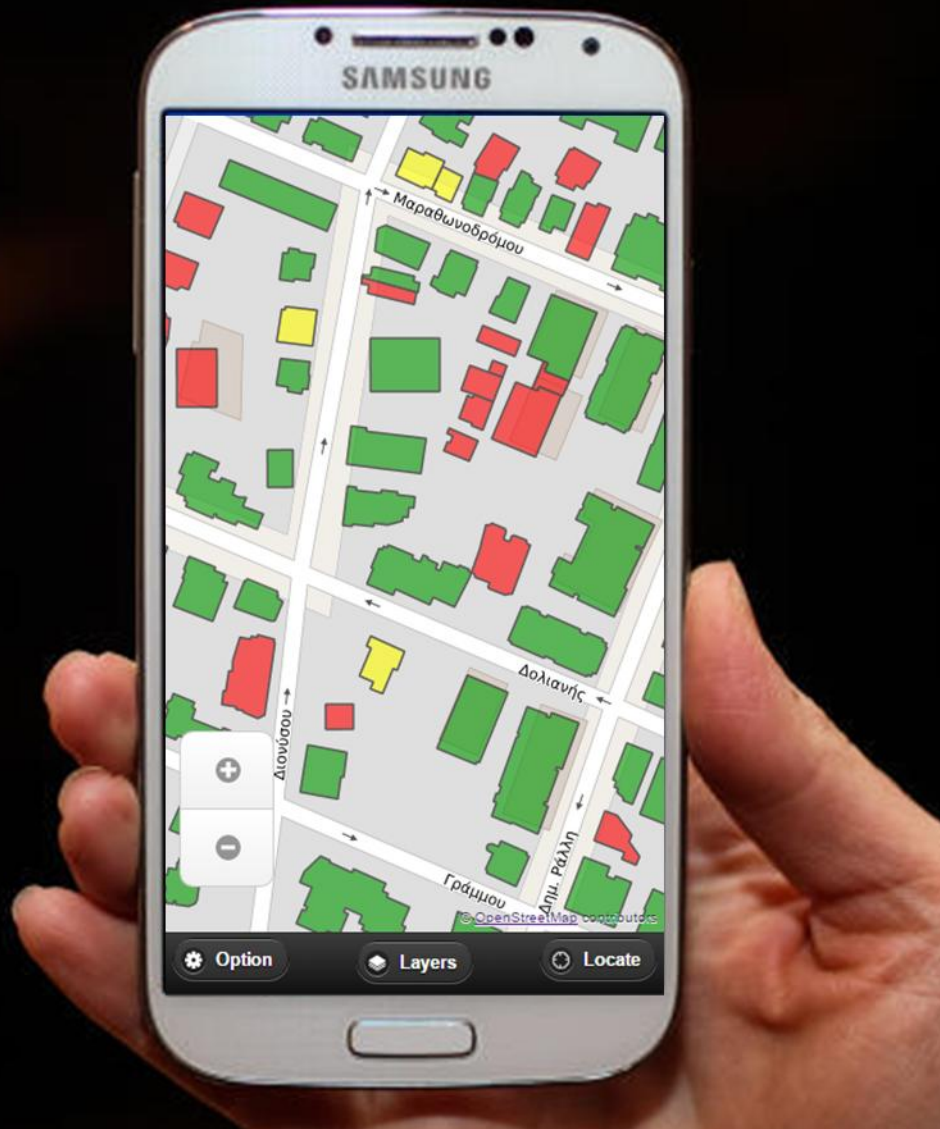
Some buildings properties still missing, on-site already done



Buildings properties available, on-site check suggested

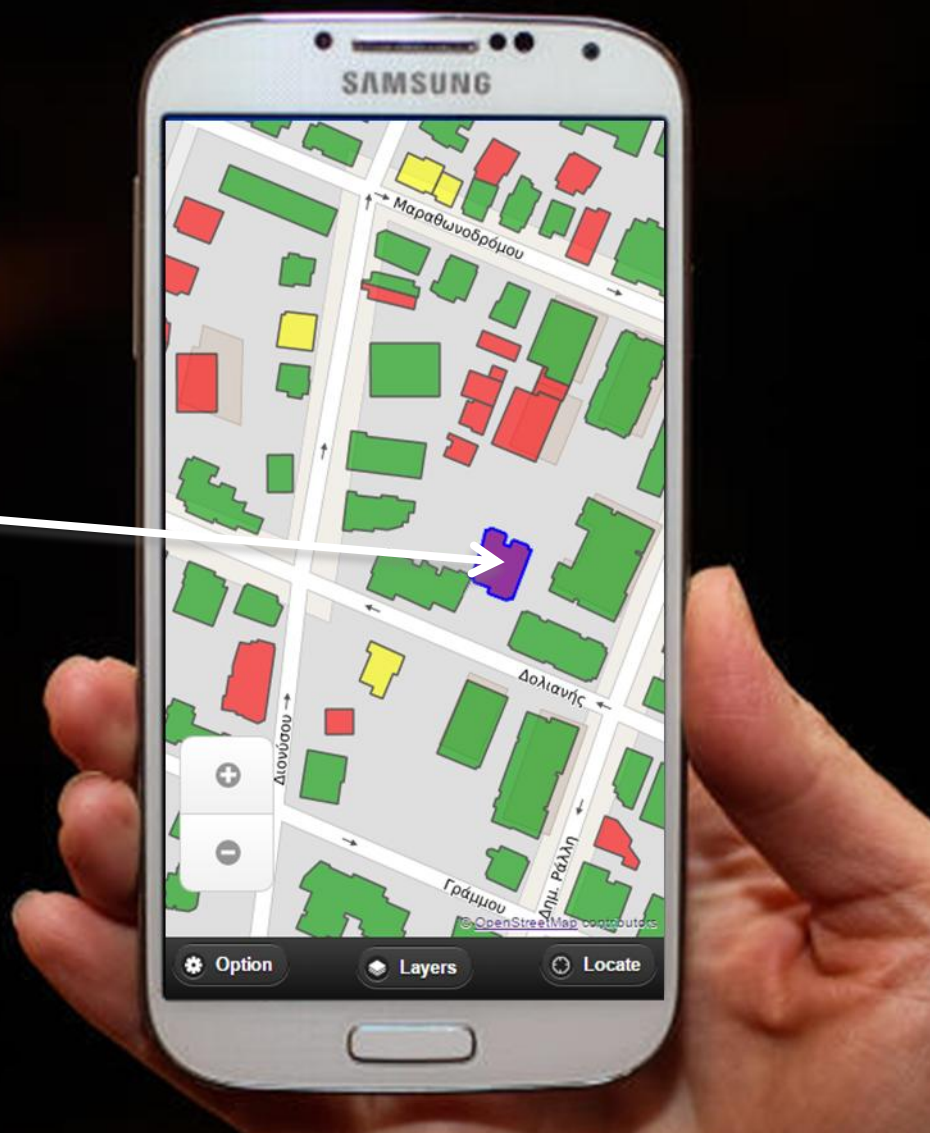


Buildings properties available and on-site check performed





Building selection  
(1<sup>st</sup> click)





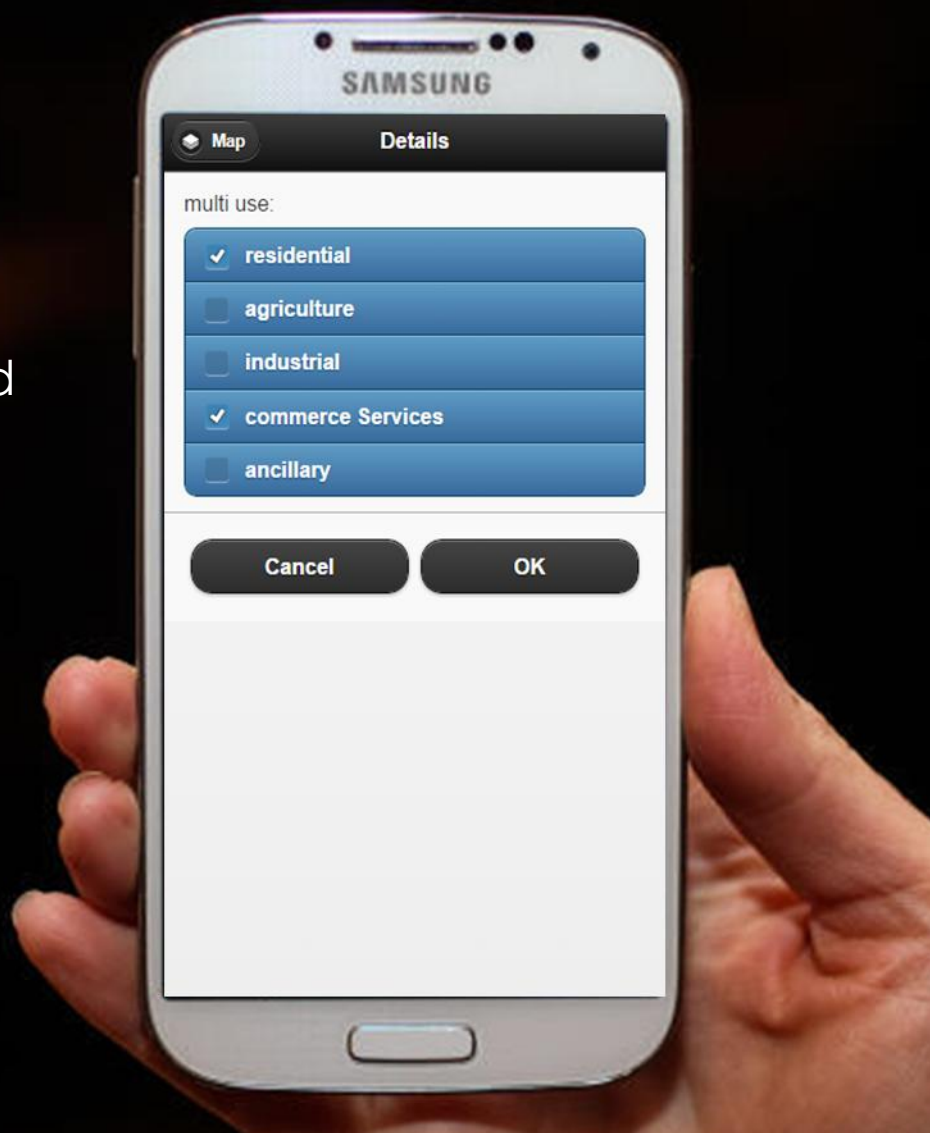
Building properties  
(2<sup>nd</sup> click)

Editing of multi-value  
attribute



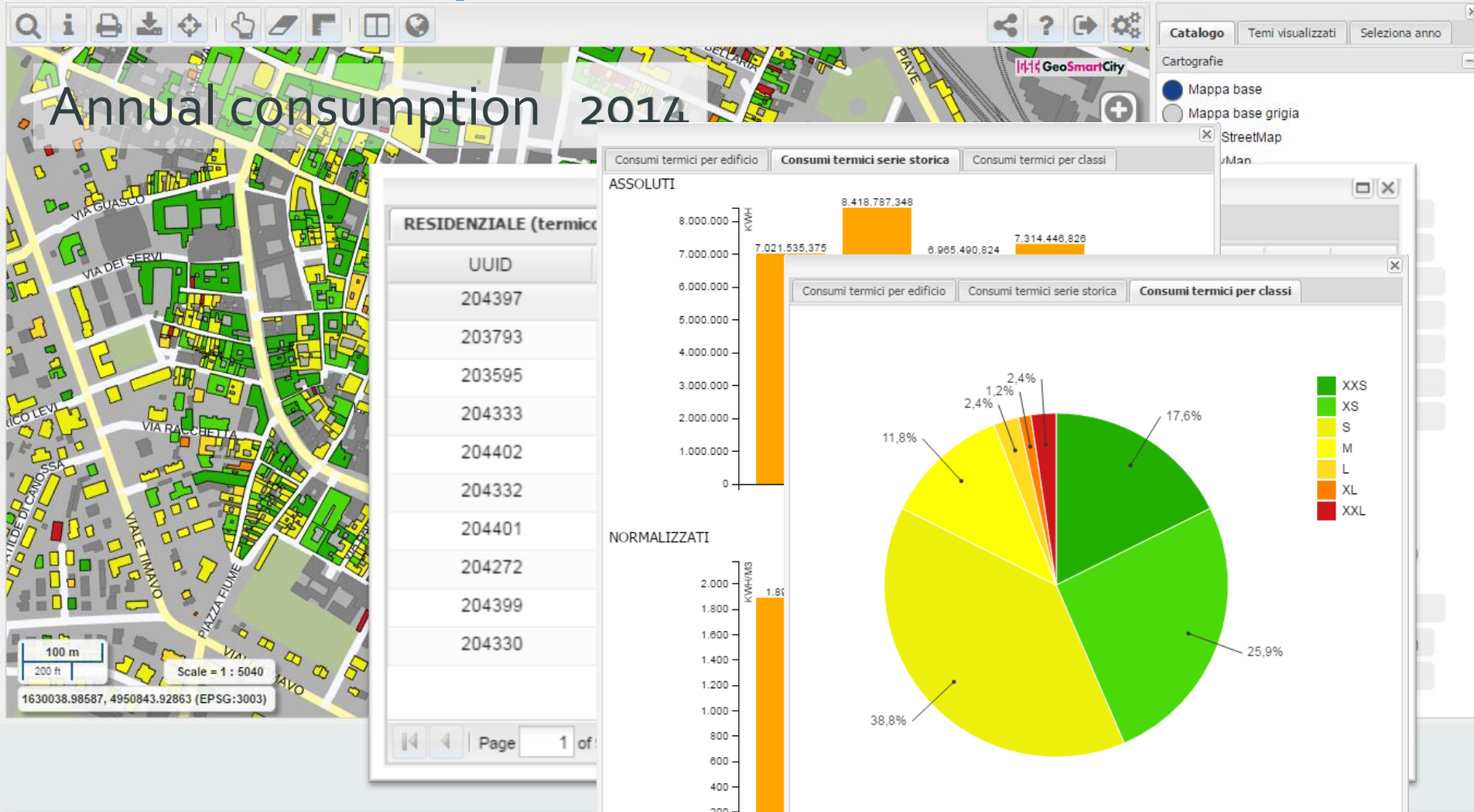


To facilitate the user, only general values are presented, based on the codelist provided by INSPIRE and extended by GeoSmartCity





# A RESTful “specialized” service in brief






# RDF Linked Open Data from WFS

Followers  
**1**

**Unfollow**

**Organization**



**Comune di Reggio Emilia**

The Municipality of Reggio Emilia, with a population of more than 170,000 inhabitants, is situated in the Emilia Romagna region, in the North-Centre of Italy. It is located in... [read more](#)

**Social**

Google+

Twitter

**Geo**

This dat  
nell'Emil  
other ex  
(areas,  
perform  
district h

**Data a**

WFS

GML

WMS

HTML

**RDF**

Reggio

Build

**Additi**

Field

## RDF dataset Reggio

**Manage** **Go to resource**

URL: <http://hub.geosmartcity.eu/catalog/dataset/e55e27a7-6604-4aee-971c-5157db510aa0/resource/5037eefd-f3df-404b-b8a1-646d23b...>

This is a sample dataset (30 buildings) has been automatically produced by an ad hoc REST-full service implemented in GeoSmartCity project. The service connects to the WFS providing spatial GML features and generates the RDF dataset. Existing ontologies were extended like the one implemented in SEMANCO project (<http://www.semanco-project.eu/ontology.htm>) by adding new concepts like the gsc:hasEnergyAmount.

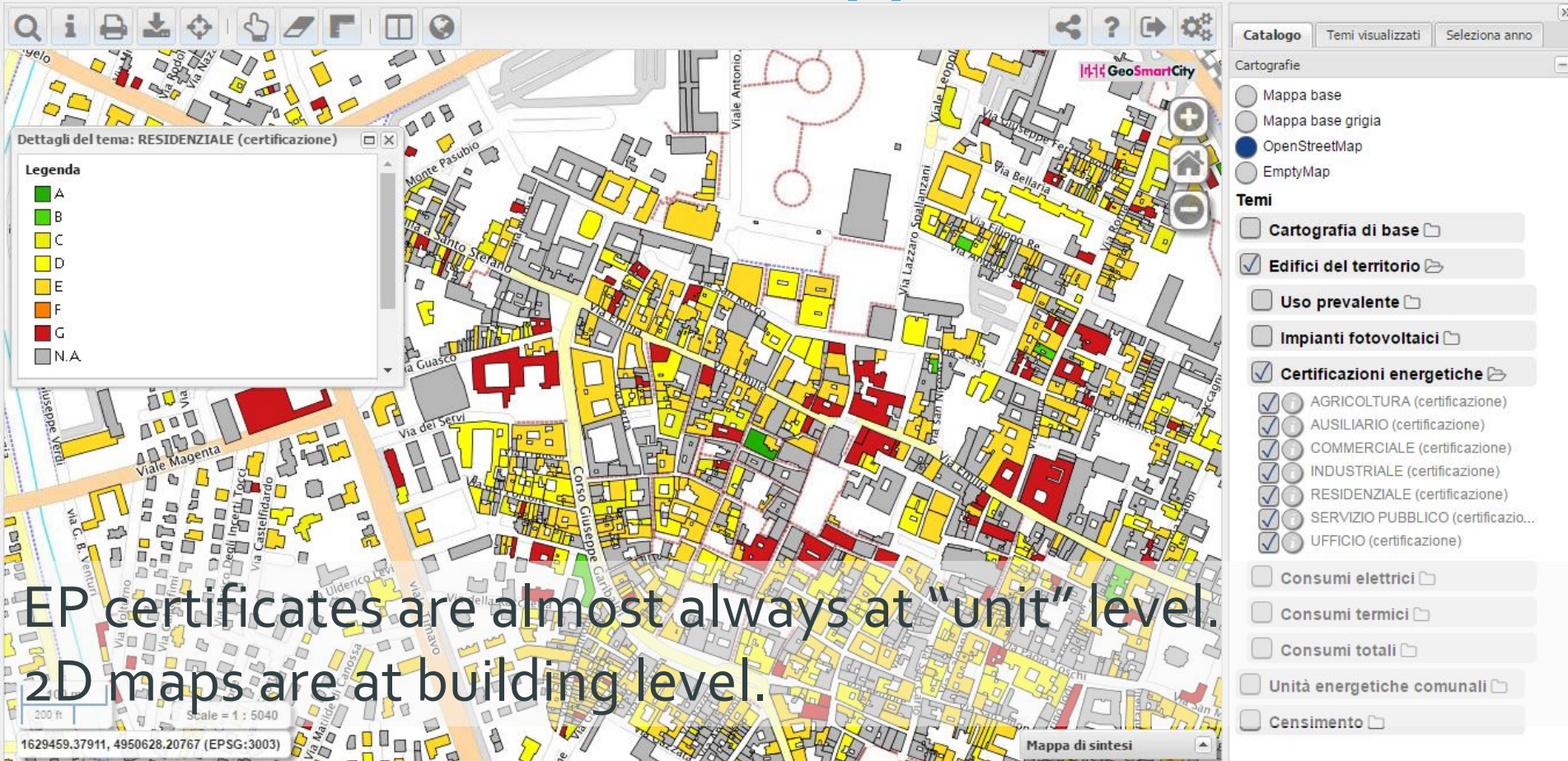
**Text**

**Embed**

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xmlns:
<rdf:Description rdf:about="http://hub.geosmartcity.eu/semantic/resource/A">
<rdf:type rdf:resource="http://hub.geosmartcity.eu/semantic/ontologies/EnergyCertificates/1.0/EnergyCertificates.owl#Asse
<rdfs:label xml:lang="it">A</rdfs:label>
</rdf:Description>
<rdf:Description rdf:about="http://hub.geosmartcity.eu/semantic/resource/B">
<rdf:type rdf:resource="http://hub.geosmartcity.eu/semantic/ontologies/EnergyCertificates/1.0/EnergyCertificates.owl#Asse
<rdfs:label xml:lang="it">B</rdfs:label>
</rdf:Description>
<rdf:Description rdf:about="http://hub.geosmartcity.eu/semantic/resource/C">
<rdf:type rdf:resource="http://hub.geosmartcity.eu/semantic/ontologies/EnergyCertificates/1.0/EnergyCertificates.owl#Asse
<rdfs:label xml:lang="it">C</rdfs:label>
</rdf:Description>
<rdf:Description rdf:about="http://hub.geosmartcity.eu/semantic/resource/D">
<rdf:type rdf:resource="http://hub.geosmartcity.eu/semantic/ontologies/EnergyCertificates/1.0/EnergyCertificates.owl#Asse
<rdfs:label xml:lang="it">D</rdfs:label>
</rdf:Description>
<rdf:Description rdf:about="http://hub.geosmartcity.eu/semantic/resource/E">
<rdf:type rdf:resource="http://hub.geosmartcity.eu/semantic/ontologies/EnergyCertificates/1.0/EnergyCertificates.owl#Asse
<rdfs:label xml:lang="it">E</rdfs:label>
</rdf:Description>
```



# EP Certificates data mapped





# Some questions

5. Do we need **transformation tools** from/to CityGML Energy ADE and INSPIRE?
6. How to represent EP of **buildings** on a 2D map using data at **building unit** level?
7. How to 1) **integrate** data and 2) **generate** INSPIRE (extended) GML compliant datasets?
8. Where to efficiently store them? Do we need an **extended pseudo-INSPIRE SQL database**?
9. How to **re-use and integrate** existing web services or platforms already implemented?



The background image on the left side of the slide shows a close-up of a yellow, spiral-shaped compact fluorescent light bulb (CFL) next to a bunch of green grass. The light bulb is on the left, and the grass is on the right. The background is a light blue gradient.

# SUNSHINE

“Smart Urban Services for  
Higher eNergy Efficiency”



[www.sunshineproject.eu](http://www.sunshineproject.eu)

EC JRC Workshop “Methodologies for energy  
performance assessment based on location data”

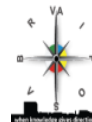
Ispra (IT)

2016-09-12



# Smart Urban Services for Higher eEnergy Efficiency"

- EU Project founded under the CIP/PSP 2007-2013 programme
- Duration 36 months (closed on January 2016)
- 14 Partners (8 EU MS)
- 8 Pilots
- 3 Application Scenarios





# Scenario 1

Wide-scale assessment of heating energy needs  
for of residential buildings

Example from: **Municipality of Ferrara**

# Scenario 2

Building energy awareness tools to support  
efficient management of heating/cooling systems

Example from: **Olicar SpA**



*Scenario 1:*

# ENERGY MAPS (MUNICIPALITY OF FERRARA)

## Requirements

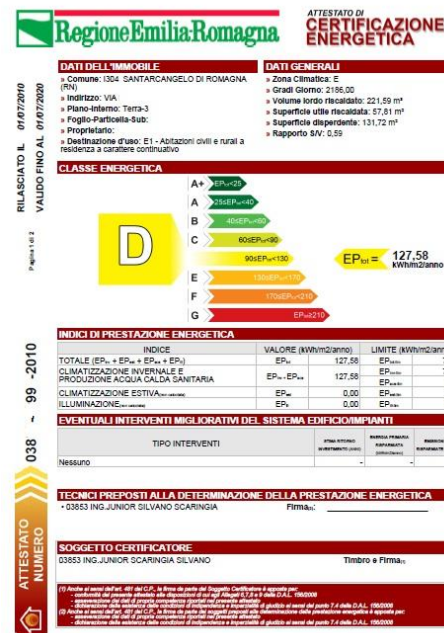
Tools to support building energy monitoring, energy need estimation and energy planning for the residential buildings at city scale.





# The initial conditions...

- Detailed building energy need estimations are available from Energy Performance Certificates, but only for a limited subset of the buildings stock:
- 595,389** energy certificates (84% residential) in Emilia-Romagna region up to 2014
- 15 mlns** building units (Cadastral database)

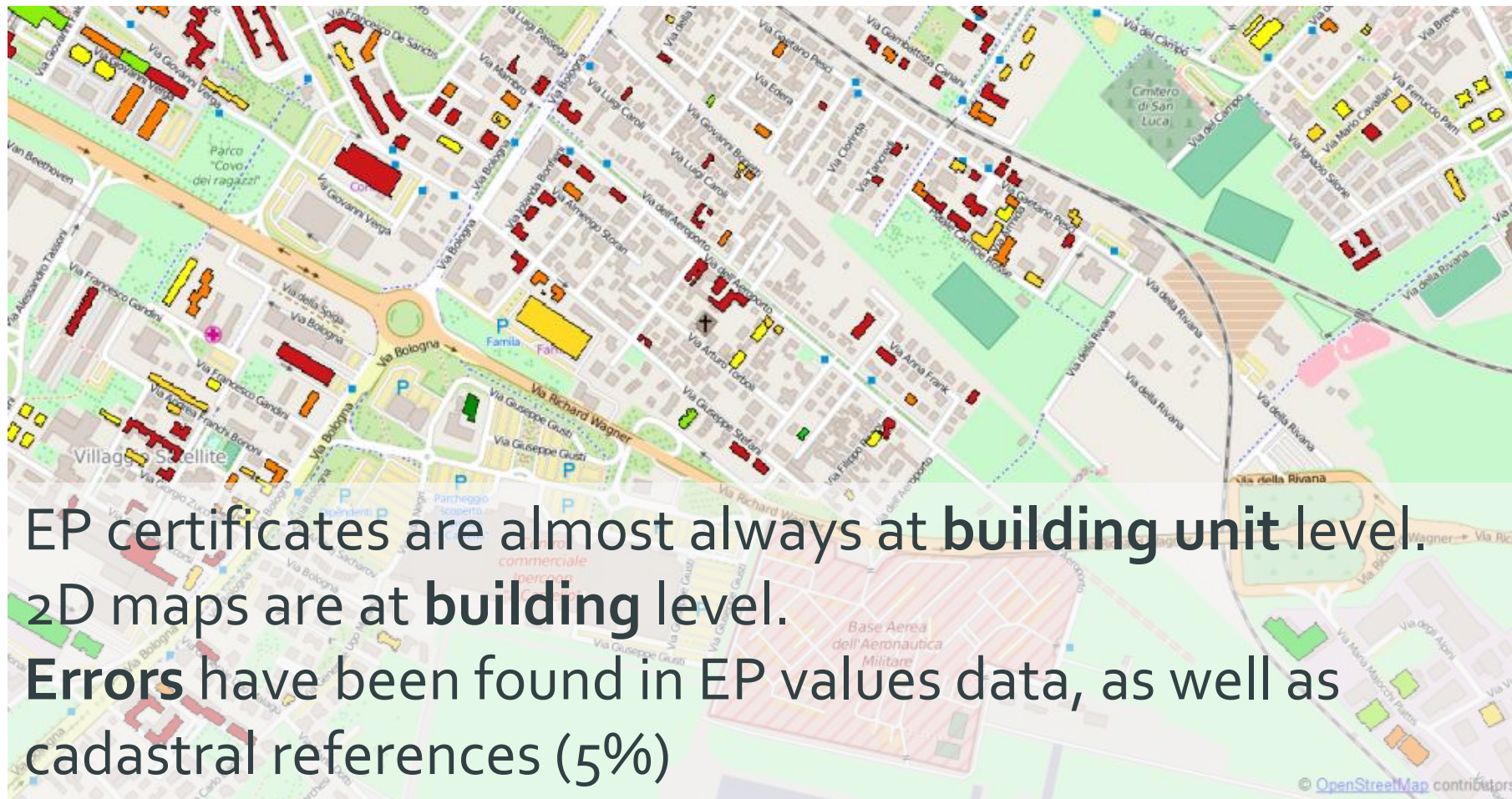


Comitato Termotecnico Italiano, Rapporto 2014 - Attuazione della certificazione energetica degli edifici in Italia

<http://www.cti2000.eu/rapporto-ce-2014/>



# The initial conditions...



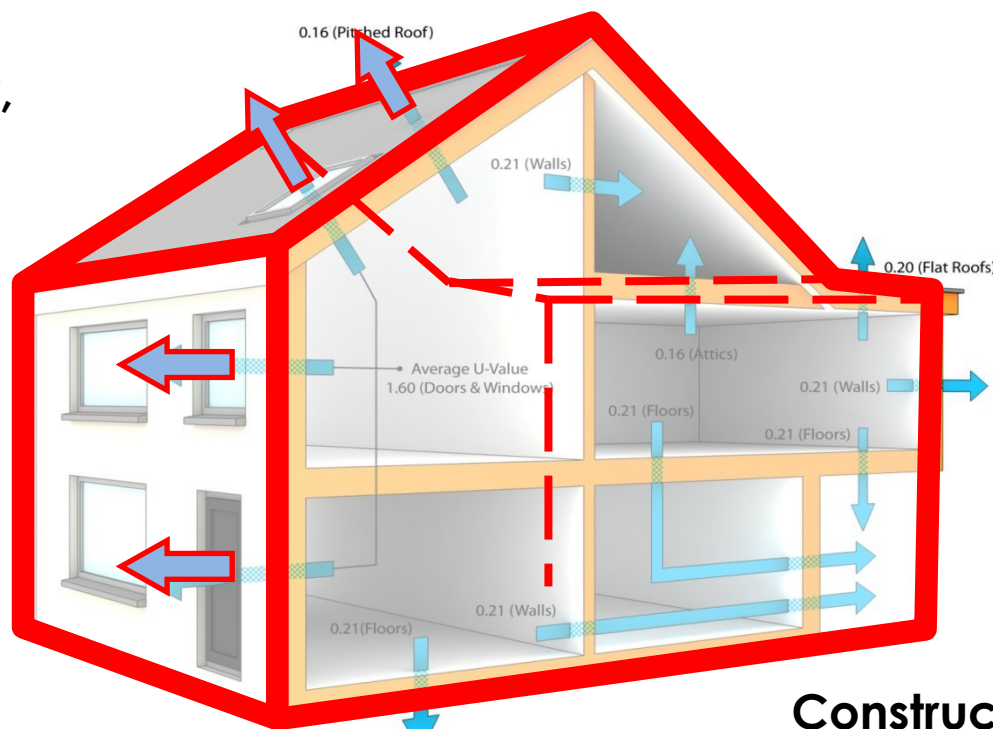


# Approach

The solution is to provide an automatic estimation

- capable of being computed at wide scale
- that just needs basic buildings' data as input

**EP, heat transfer, other properties**  
derivation from  
typological  
databases  
(TABULA)

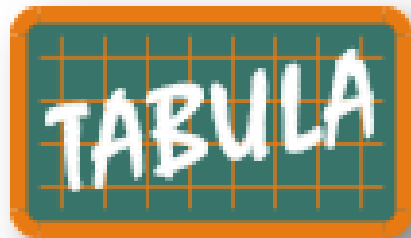


**Footprint, areas, volumes, uses, num.building units,**  
Municipal register  
of buildings,  
Cadastre

































**Construction period, height**  
ISTAT census, Regional topographic database,  
onsite observation and measurements



# Typological Databases



Residential  
buildings

	Region	Construction Year Class	Additional Classification	SFH Single-Family House	TH Terraced House	MFH Multi-Family House	AB Apartment Block
1	Middle Climatic Zone (Zona climatica media - ZONA E)	... 1900	generic	 IT_MidClim_SFH.01.Gen	 IT_MidClim_TH.01.Gen	 IT_MidClim_MFH.01.Gen	 IT_MidClim_AB.01.Gen
2	Middle Climatic Zone (Zona climatica media - ZONA E)	1901 ... 1920	generic	 IT_MidClim_SFH.02.Gen	 IT_MidClim_TH.02.Gen	 IT_MidClim_MFH.02.Gen	 IT_MidClim_AB.02.Gen
3	Middle Climatic Zone (Zona climatica media - ZONA E)	1921 ... 1945	generic	 IT_MidClim_SFH.03.Gen	 IT_MidClim_TH.03.Gen	 IT_MidClim_MFH.03.Gen	 IT_MidClim_AB.03.Gen
4	Middle Climatic Zone (Zona climatica media - ZONA E)	1946 ... 1960	generic	 IT_MidClim_SFH.04.Gen	 IT_MidClim_TH.04.Gen	 IT_MidClim_MFH.04.Gen	 IT_MidClim_AB.04.Gen
5	Middle Climatic Zone (Zona climatica media - ZONA E)	1961 ... 1975	generic	 IT_MidClim_SFH.05.Gen	 IT_MidClim_TH.05.Gen	 IT_MidClim_MFH.05.Gen	 IT_MidClim_AB.05.Gen
6	Middle Climatic Zone (Zona climatica media - ZONA E)	1976 ... 1990	generic	 IT_MidClim_SFH.06.Gen	 IT_MidClim_TH.06.Gen	 IT_MidClim_MFH.06.Gen	 IT_MidClim_AB.06.Gen
7	Middle Climatic Zone (Zona climatica media - ZONA E)	1991 ... 2005	generic	 IT_MidClim_SFH.07.Gen	 IT_MidClim_TH.07.Gen	 IT_MidClim_MFH.07.Gen	 IT_MidClim_AB.07.Gen
8	Middle Climatic Zone (Zona climatica media - ZONA E)	2006 ...	generic	 IT_MidClim_SFH.08.Gen	 IT_MidClim_TH.08.Gen	 IT_MidClim_MFH.08.Gen	 IT_MidClim_AB.08.Gen



# On-site data quality check



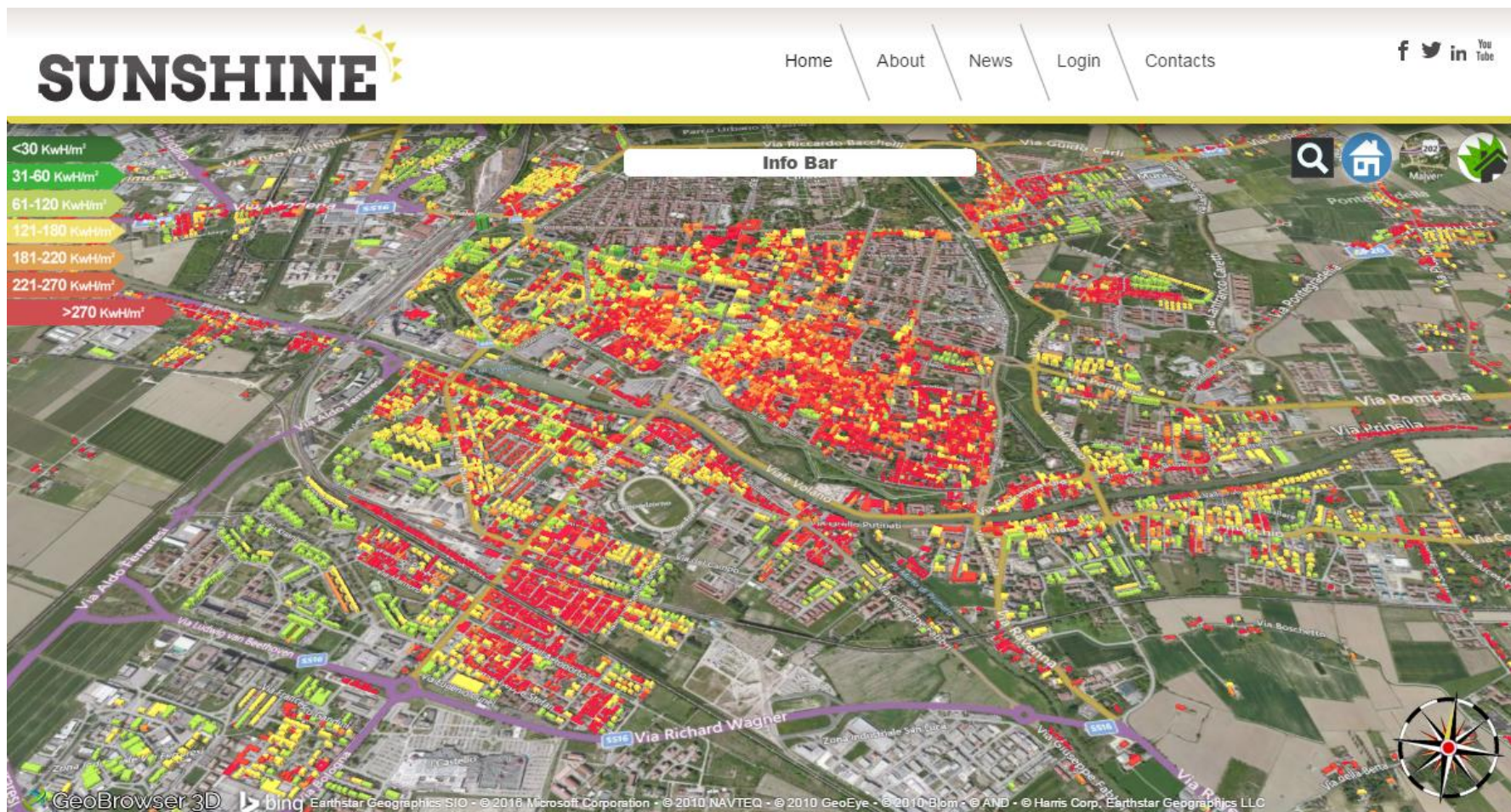


# From the initial conditions...





# Ferrara Energy Map



<http://sunshine.graphitech-projects.com>

<https://www.youtube.com/user/SunshineProjectEu/videos>

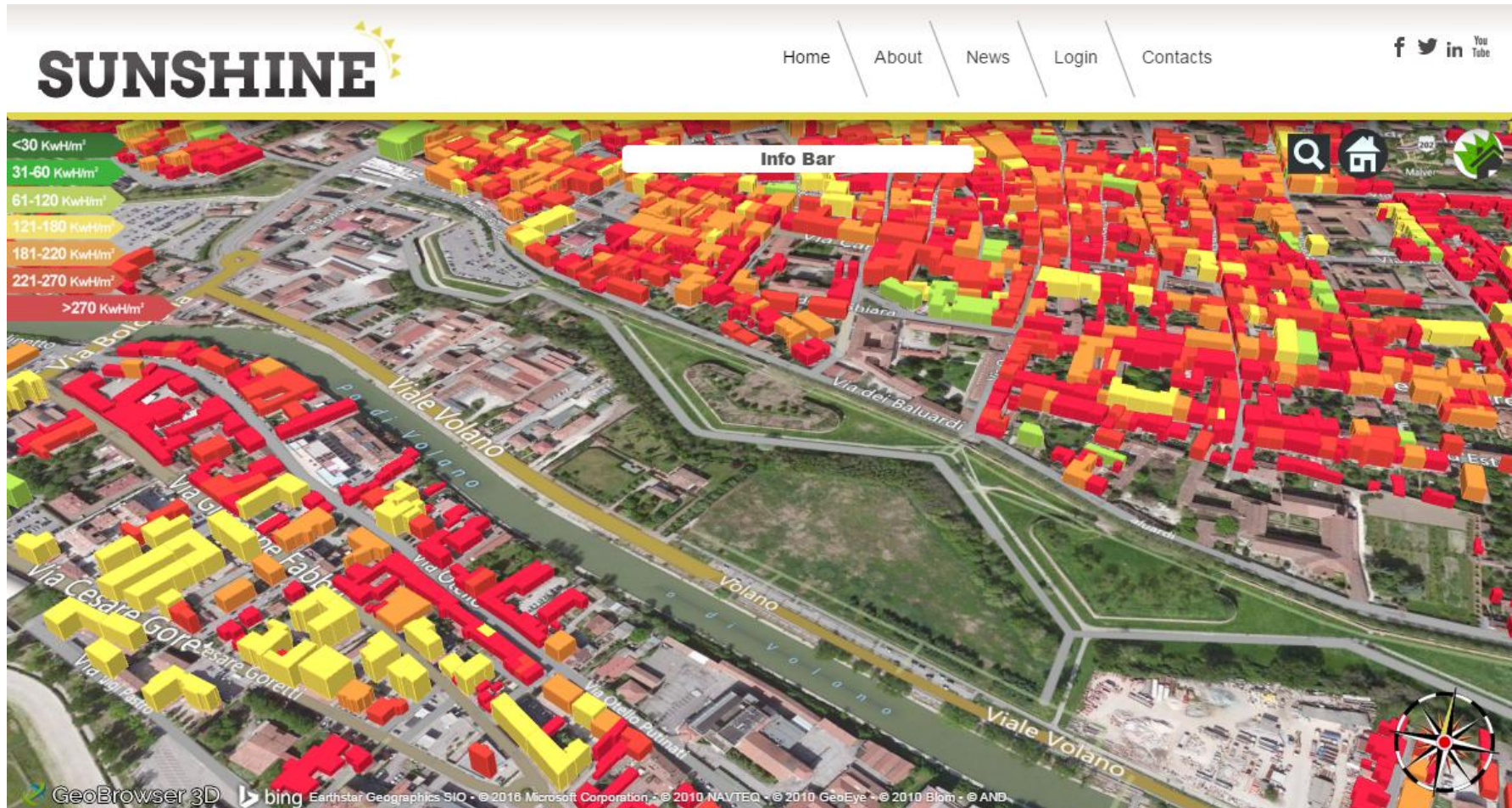
SUNSHINE - Smart Urban Services for Higher eNergy Efficiency (GA no: 325161)

"This project is partially funded under the ICT Policy Support Programme (ICT PSP) as part of the Competitiveness and Innovation Framework Programme by the European Community" ([http://ec.europa.eu/ict\\_psp](http://ec.europa.eu/ict_psp)).





# Ferrara Energy Map



<http://sunshine.graphitech-projects.com>

<https://www.youtube.com/user/SunshineProjectEu/videos>

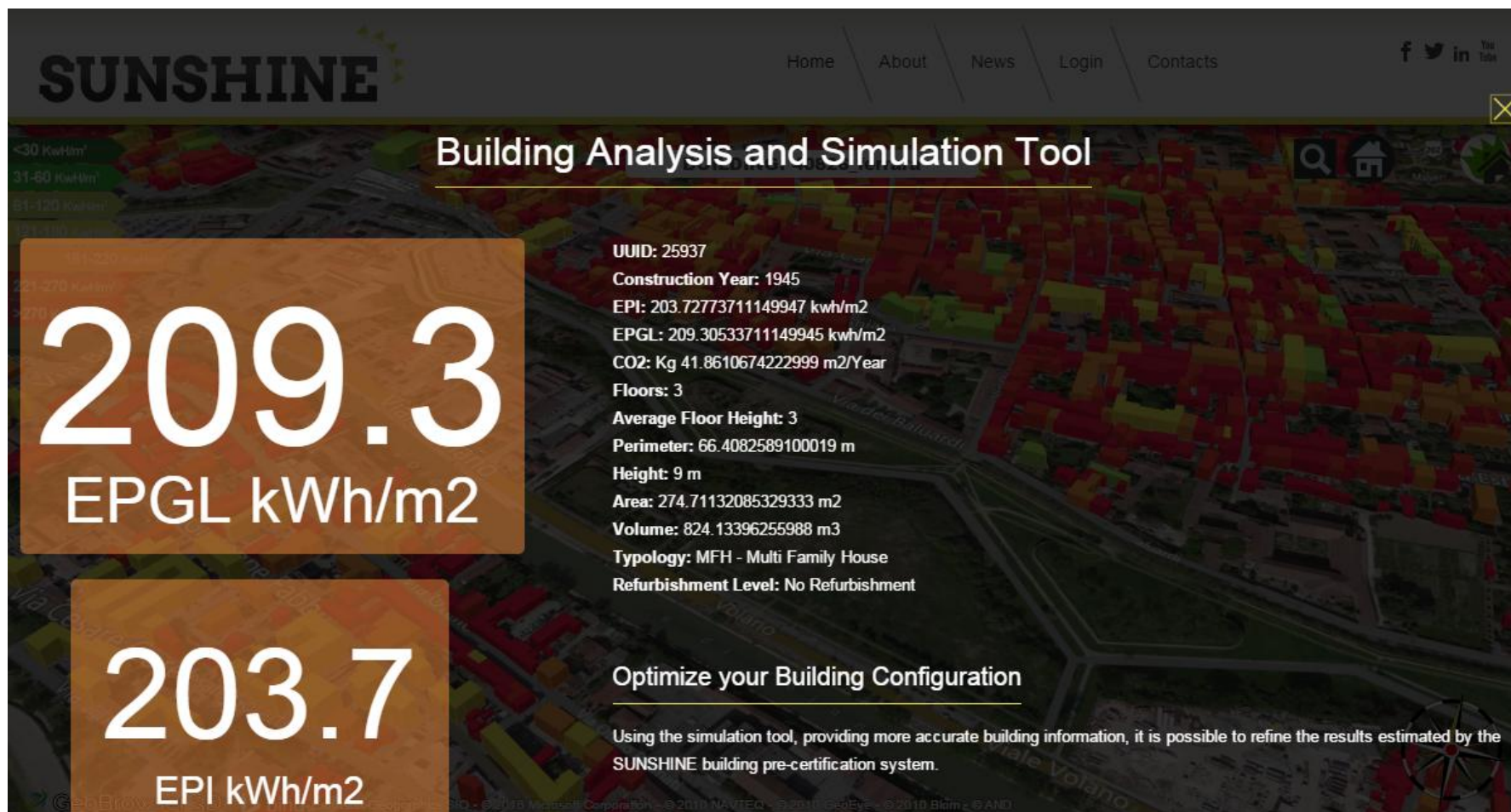
SUNSHINE - Smart Urban Services for Higher eNergy Efficiency (GA no: 325161)

"This project is partially funded under the ICT Policy Support Programme (ICT PSP) as part of the Competitiveness and Innovation Framework Programme by the European Community" ([http://ec.europa.eu/ict\\_psp](http://ec.europa.eu/ict_psp)).





# Ferrara Energy Map



<http://sunshine.graphitech-projects.com>

<https://www.youtube.com/user/SunshineProjectEu/videos>

SUNSHINE - Smart Urban Services for Higher eNergy Efficiency (GA no: 325161)

"This project is partially funded under the ICT Policy Support Programme (ICT PSP) as part of the Competitiveness and Innovation Framework Programme by the European Community" ([http://ec.europa.eu/ict\\_psp](http://ec.europa.eu/ict_psp)).





# Ferrara Energy Map

The screenshot displays the Ferrara Energy Map interface. On the left, a legend identifies building types by color: green for residential, yellow for commercial, and red for industrial. The main panel shows an aerial map of Ferrara with numerous colored markers. A search bar at the top right contains the text 'Search ferrara'. Below the map, a table lists building IDs from 3073965 to 3073995. The entry for ID 3073994 is highlighted with a red box. To the right of the table, the XML data for this building is displayed, showing details such as its construction type, floor area, and energy usage zones.

ID	XML Data
3073965	</energy:Construction>
3073966	</energy:construction>
3073967	<bldg:lod2MultiSurface>
3073968	<gml:MultiSurface>
3073969	<gml:surfaceMember>
3073970	<gml:Polygon gml:id="UUID_aa20fabd-8e5e-4643-a34e-0afa3c0d6eb2">
3073971	<gml:exterior>
3073972	<gml:LinearRing>
3073973	<gml:posList srsDimension="3">1699039.682 4968565.76914444 0.0 1699039.682 4968565.76914444 0.0 1699055.783 4968566.31514444 0.0 1699055.783 4968566.31514444 0.0 1699039.682 4968565.76914444 0.0</gml:posList>
3073974	</gml:LinearRing>
3073975	</gml:exterior>
3073976	</gml:Polygon>
3073977	</gml:surfaceMember>
3073978	</gml:MultiSurface>
3073979	</bldg:lod2MultiSurface>
3073980	</bldg:WallSurface>
3073981	</bldg:boundedBy>
3073982	<energy:usageZones>
3073983	<energy:UsageZone>
3073984	<energy:usageZoneClass>residential</energy:usageZoneClass>
3073985	<energy:floorArea>
3073986	<energy:FloorArea>
3073987	<energy:value uom="m2">159.62422199851187</energy:value>
3073988	</energy:FloorArea>
3073989	</energy:floorArea>
3073990	</energy:UsageZone>
3073991	</energy:usageZones>
3073992	</bldg:Building>
3073993	</core:cityObjectMember>
3073994	</core:CityModel>
3073995	

<http://sunshine.graphitech-projects.com>

<https://www.youtube.com/user/SunshineProjectEu/videos>

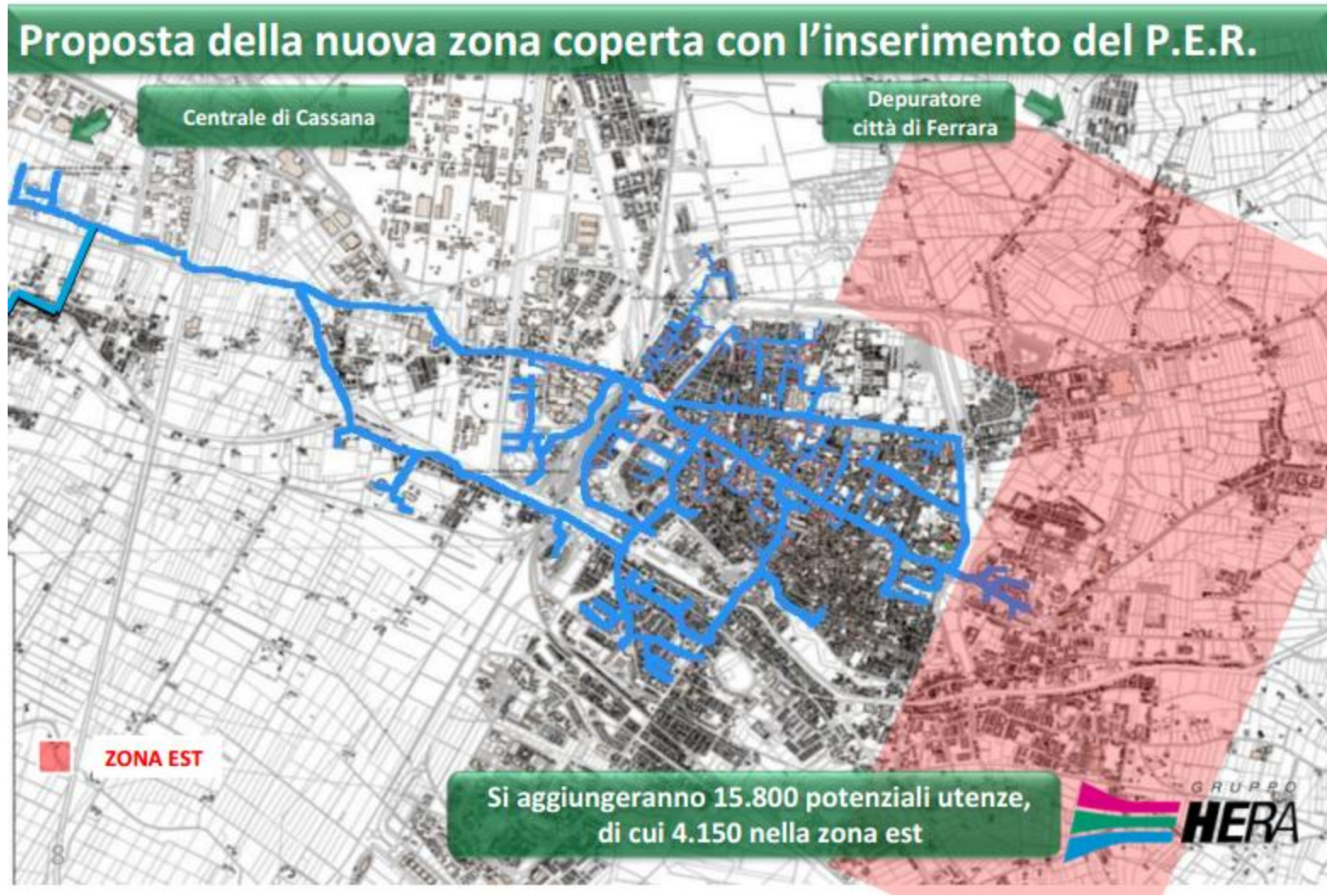
SUNSHINE - Smart Urban Services for Higher eEnergy Efficiency (GA no: 325161)

"This project is partially funded under the ICT Policy Support Programme (ICT PSP) as part of the Competitiveness and Innovation Framework Programme by the European Community" ([http://ec.europa.eu/ict\\_psp](http://ec.europa.eu/ict_psp)).





# Possible uses of Energy Map



[http://www.comune.fe.it/attach/superuser/docs/idea\\_progettuale\\_ing\\_ferraresi\\_hera.pdf](http://www.comune.fe.it/attach/superuser/docs/idea_progettuale_ing_ferraresi_hera.pdf)



# Possible uses of Energy Map





*Scenario 2:*

# **CONSUMPTION + WEATHER**

## **(OLICAR SPA)**

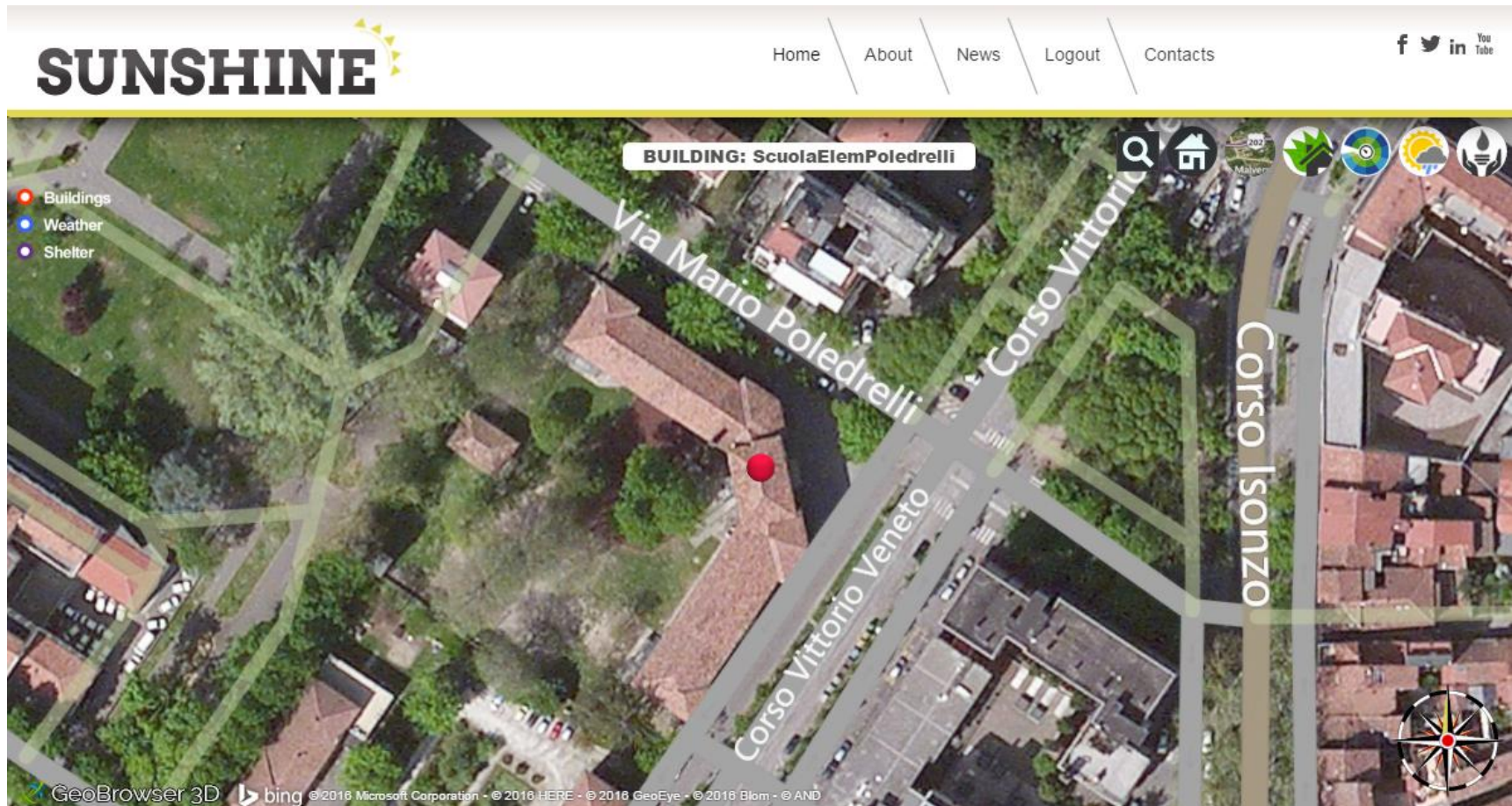
## Requirements

To increase knowledge about the energy behaviour of managed buildings and reduce unnecessary consumption while maintaining comfort.





# Hourly consumption



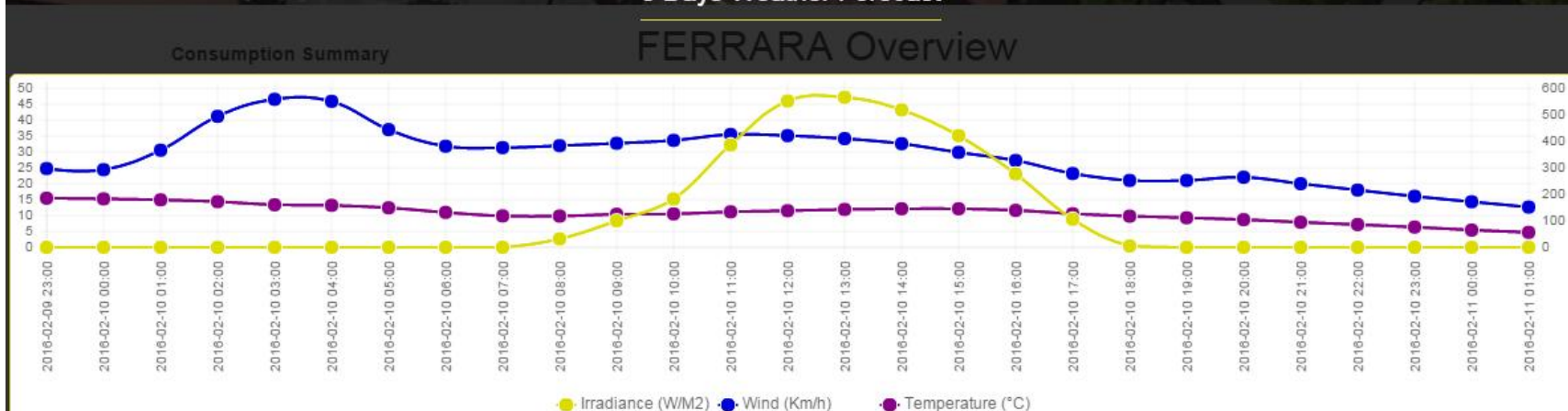
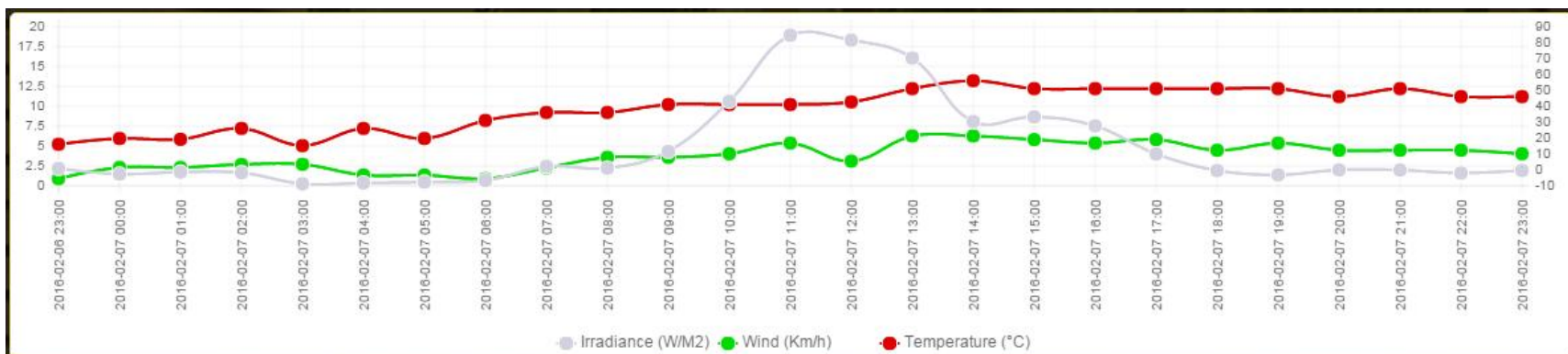


# Hourly consumption





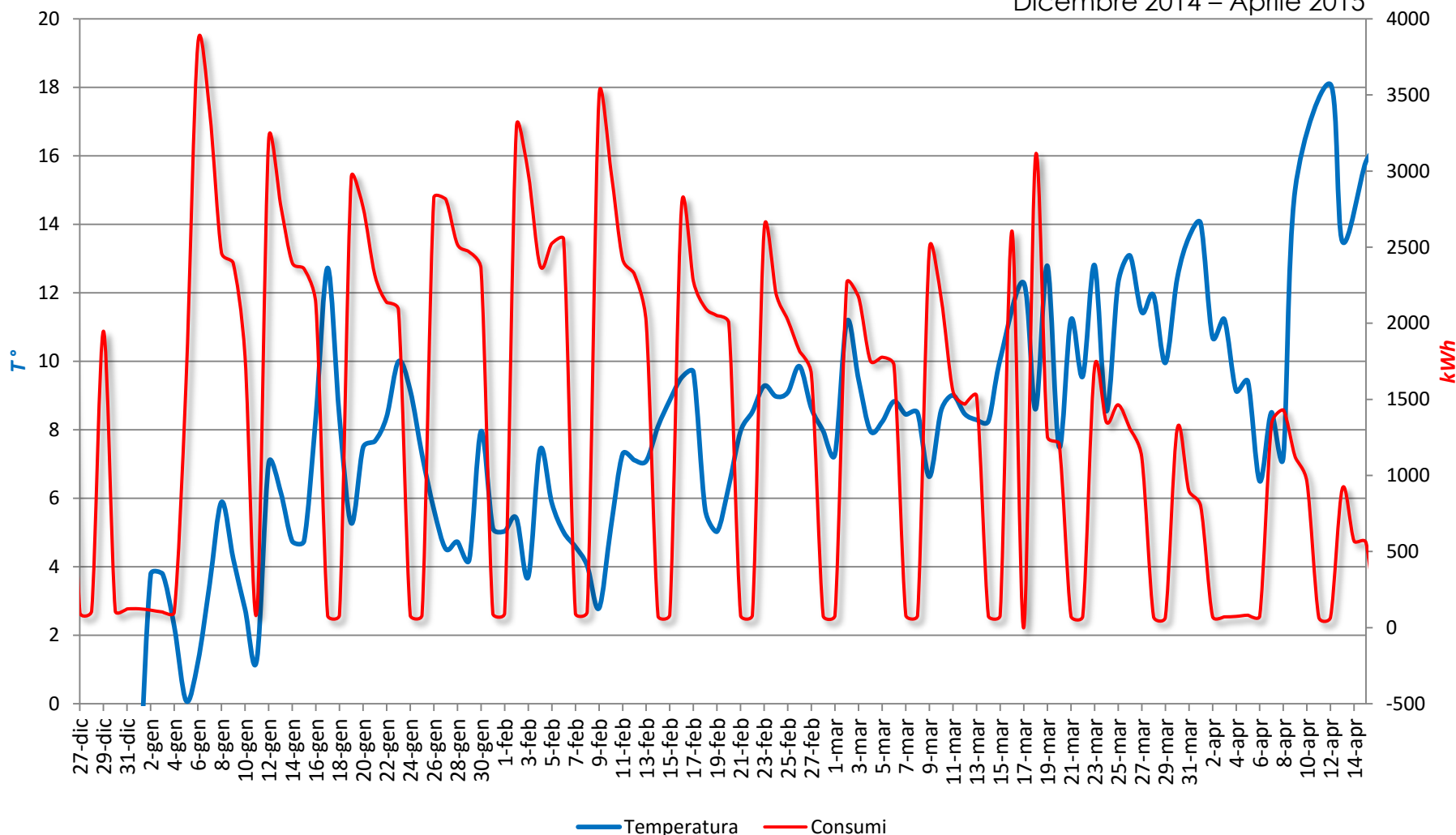
# Hourly weather forecast





# Primary school 'Poledrelli'

Dicembre 2014 – Aprile 2015





# Green Button

## What is Green Button?

Green Button is a secure way to get your energy usage information electronically.



### Learn

How the Green Button Initiative helps you!



### Use

Energy usage data for you!!



### Community

Getting involved in the [Green Button Alliance!](#)



### Build

The technology of Green Button



### Library

Videos, presentations, and documents

## Who's offering Green Button?

Today, more than 60 million households and businesses can use Green Button to access their own energy usage data from their electric utility, and a growing set of companies are offering products, services, and applications that use Green Button data.

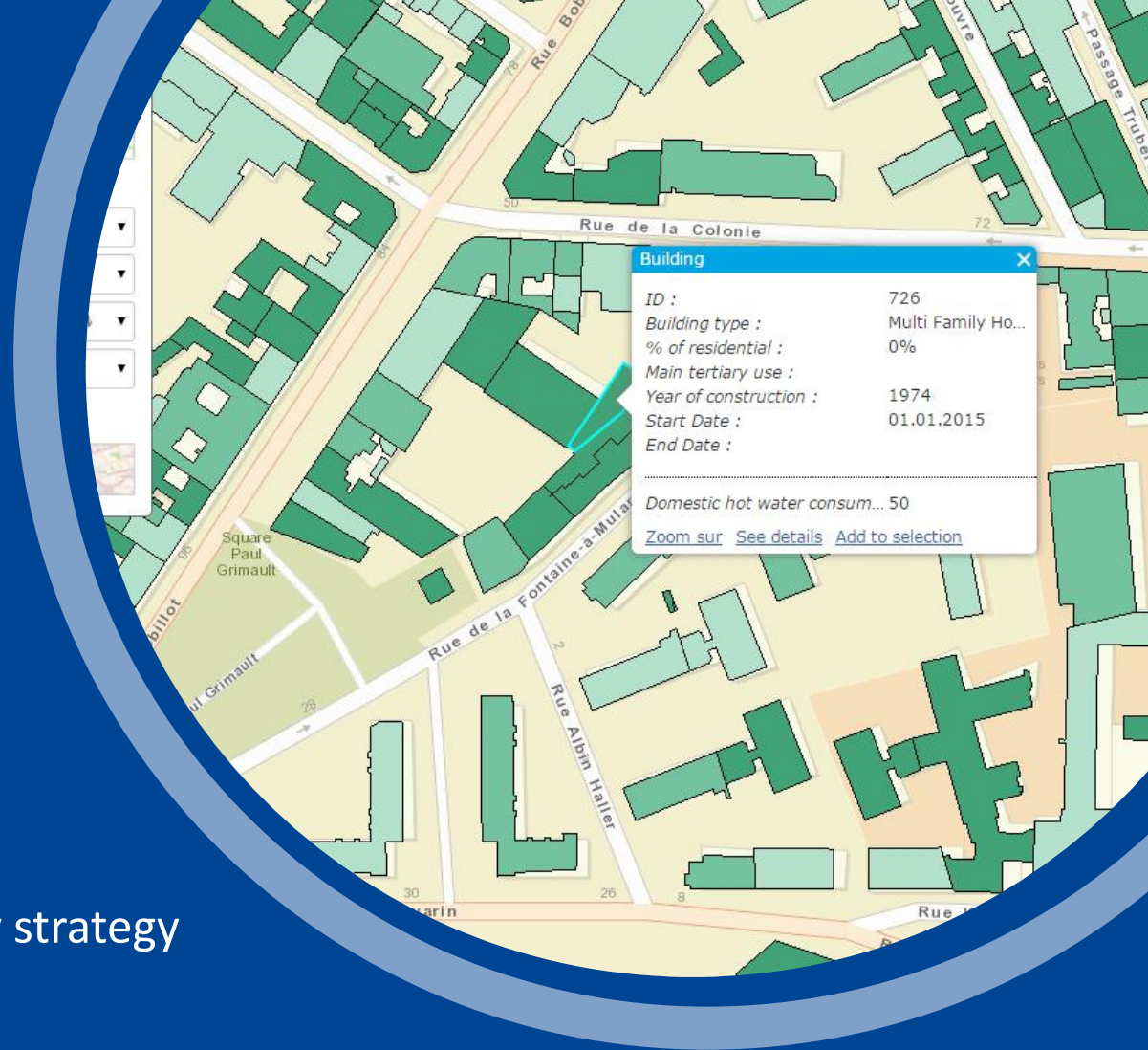
<http://www.greenbuttondata.org/>



# Some questions

10. How many **algorithms** to automatically calculate EP at building level do already exist in EU28?
11. Are they **open and publicly** available?
12. Are they based on geo-ICT **standard interfaces**?  
Or are they libraries that can be reused and “wrapped” by standard protocols?
13. Why **GreenButton** is not used in EU28 to get energy usage data in a **standardized** and transparent way between users (owners) and energy providers?





# ACCENT

Accompany cities in energy strategy

EC JRC Workshop “Methodologies for energy performance assessment based on location data”

Ispra (IT)

2016-09-12



Climate-KIC is supported by the  
EIT, a body of the European Union



# www.accentproject.com

**ACCENT**  
Smart City View

HOME

WHAT IS ACCENT

**THE PROJECT**

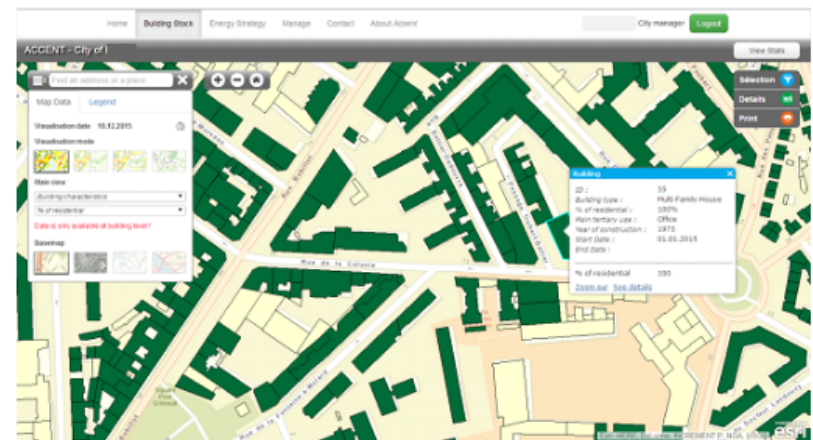
PILOT CITIES

NEWS AND EVENTS

LANG ▾

## The Project

Accompany cities in energy strategy (ACCENT) is an Innovation project developed within the [Climate KIC](#), Europe's largest public-private innovation partnership, working to address the challenge of climate change. ACCENT project started in 2014 with a proof of concept phase, intended to deepen the needs in key stakeholders with respect to energy planning. After having validated the feasibility and added value of its offer, ACCENT project have entered a demonstration phase in 2015. In order to support the energy transition of European cities, ACCENT will provide city stakeholders data and tools to map and diagnose existing energetic situation, and design energy strategies which maximize energy efficiency. ACCENT tool is being developed and tested in 4 pilot cities and will be available for every cities before the end of 2016.





# www.accentproject.com

**ACCENT**  
Smart City View

HOME

WHAT IS ACCENT

THE PROJECT

PILOT CITIES

NEWS AND EVENTS

LANG ▾



AJUNTAMENT  
DE VALÈNCIA



XXX  
aniversari  
1986-2016  
Instituto  
Valenciano de  
la Edificación



## What is ACCENT?

An innovative tool conceived to support urban energy planning for buildings, ACCENT provides maps and data to design actions reducing the carbon intensity of the city. Cities consume 78% of the world's energy and produce 60% of its emissions. As urban population is increasing worldwide, cities are crucial to emission reductions efforts. In Europe, buildings are responsible for more than 40% of the total energy consumption: the building sector can drive the energy transition we need.



www.accentproject.com



ACCENT

Smart City View

[HOME](#)

[WHAT IS ACCENT](#)

[THE PROJECT](#)

[PILOT CITIES](#)

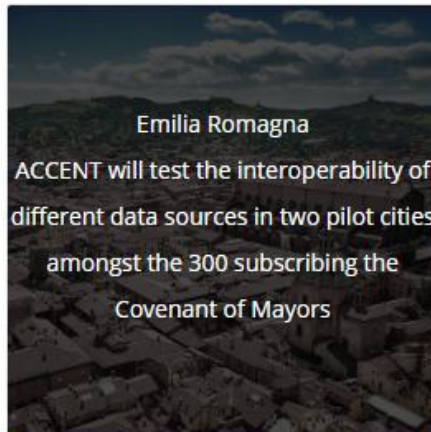
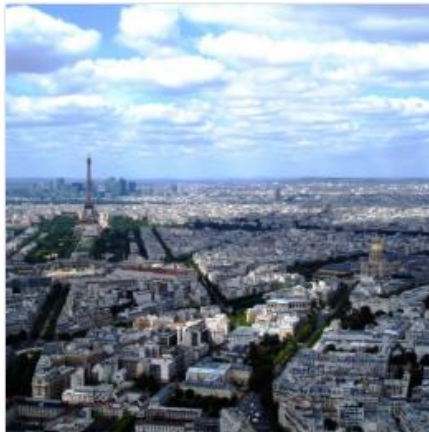
[NEWS AND EVENTS](#)

[LANG](#) 

## Pilot Cities

---

Each pilot city is a different challenge for the development of the ACCENT platform. Paris, Valencia, Reggio Emilia and Ferrara are cooperating with ACCENT partners to shape the platform functionalities and services according to their needs. Learn about the first cities where ACCENT is implemented in Europe.





## News and events



Apr, 8



### European Energy Efficiency Platform launched

*April 8, 2016 by spicone*

On April 5th, the European Joint Research Center presented the interactive and collaborative online European Energy Efficiency Platform. This beta platform is conceived to fill the gap opened by scattered data and fragmented knowledge resulting from a rapidly growing energy efficiency market. It is expected to be both a one-stop shop for information retrieval and [...]

[Read more](#)

Apr, 6



### Social housing: how to cover costs for refurbishment?

*April 6, 2016 by spicone*

The LEMON project (Less Energy More Opportunities) gives an innovative answer to this question by combining new types of financing and lease contracts targetting social housing. Lemon will test new types of EPC (Energy Performance Contract) and EPTA (Energy Performance Tenancy Agreement) contracts, to support the refurbishment of 622 social housing homes in Parma and Reggio Emilia, [...]

[Read more](#)



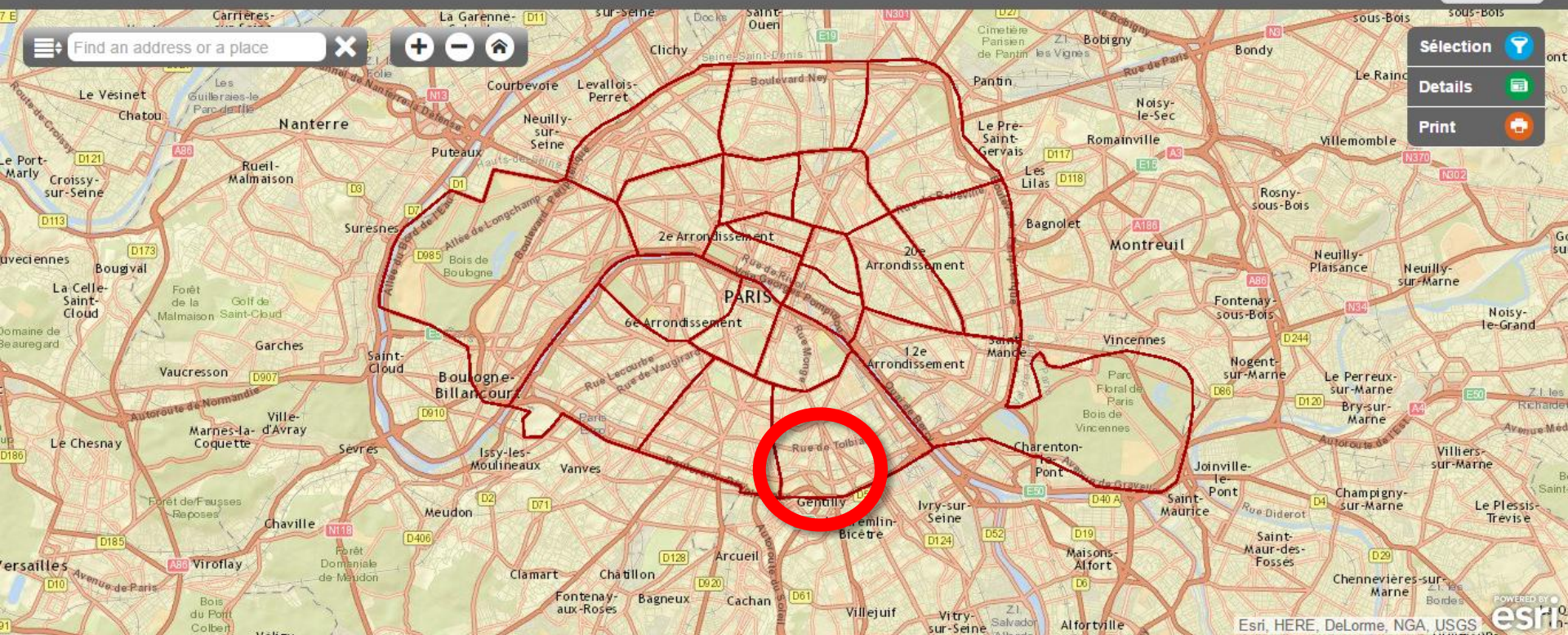
# Prototype (Paris)

[Home](#)[Building Stock](#)[Energy Strategy](#)[Contact](#)[About Accent](#)

Florent Krin, Advanced city user

[Logout](#)[View Stats](#)

ACCENT - City of Paris





# Prototype – physical properties

The screenshot displays the ACCENT - City of Paris web application. The top navigation bar includes links for Home, Building Stock, Energy Strategy, Contact, and About Accent. The user is logged in as Florent Krin, an Advanced city user, with a Logout button. The main header shows "ACCENT - City of Paris" and a "View Stats" button.

The interface features a map of Paris with a red outline around a specific building. A sidebar on the left contains a search bar, map controls, and a legend. The "Main view" section includes dropdown menus for "Energy and GHG ratios", "Cost", "Select indicator", and "Complete building". The "Basemap" section shows four different map styles.

The "Details" panel on the right provides information about the selected building. It includes tabs for "Characteristics" and "Energy info". The "Energy info" tab is active, showing the following data:

Envelope parts characteristics	
Resistance of structure (W/K/m²) for roof...	2
Resistance of insulation (W/K/m²) for r...	12.5
Refurbishment period for roof type en...	1975
Resistance of structure (W/K/m²) for w...	2
Resistance of insulation (W/K/m²) for ...	12.5
Refurbishment period for wall type en...	1975
Resistance of structure (W/K/m²) for co...	undefined
Resistance of insulation (W/K/m²) for c...	undefined
Refurbishment period for common wal...	1975
Resistance of structure (W/K/m²) for wi...	2
Resistance of insulation (W/K/m²) for ...	12.5
Refurbishment period for windows :	1975
Total energy transmittance for radiatio...	0.5



# Prototype – energy properties

The screenshot displays the ACCENT - City of Paris web application. The navigation bar at the top includes links for Home, Building Stock, Energy Strategy, Contact, and About Accent. The user is logged in as Florent Krin, an Advanced city user, with a Logout button. The main header shows 'ACCENT - City of Paris' and a 'View Stats' button.

The interface features a map of a city area with a search bar and a legend. The legend includes options for Map Data, Visualisation date (16.12.2015), Visualisation mode, Main view (Energy and GHG ratios, Cost, Select indicator, Complete building), and Basemap.

A 'Details' panel is open, showing energy properties for a selected building. The panel has tabs for Characteristics and Energy info. The Energy info tab is active, displaying a table of energy consumption and CO2 emissions.

Energy info	
Domestic hot water consumption ratio ...	35
Specific electricity consumption total (...)	13012700.0208
Specific electricity consumption ratio (...)	40
Total energy consumption total (kWh) :	57743856.3423
Total energy consumption ratio (kWh/...)	44.375
<b>CO2</b>	
Heating co2 emission (kgCo2) :	7644961.26222
Heating co2 emission ratio (kgCo2/m2) :	23.5
Cooling co2 emission (kgCo2) :	1333801.752132
Cooling co2 emission ratio (kgCo2/m2) :	4.1
Domestic hot water co2 emission (kg...	2927857.50468
Domestic hot water co2 emission ratio...	9
Specific electricity co2 emission (kgC...	2439881.2539
Specific electricity co2 emission ratio (...)	7.5
Total co2 emission (kgCo2) :	14346501.772932
Total co2 emission ratio (kgCo2/m2) :	11.025



# Prototype – indicators

The screenshot displays the ACCENT - City of Paris web application interface. The top navigation bar includes links for Home, Building Stock, Energy Strategy, Contact, and About Accent. The user is logged in as Florent Krin, an Advanced city user, with a Logout button. A View Stats button is also present.

The main interface shows a map of Paris with several overlapping panels for selecting indicators. The panels are organized into a grid, with each panel displaying a map view and a list of indicators. The indicators are categorized by Main view and Visualisation mode.

The first panel (leftmost) has a red box around the 'Heating Energy Need ratio (kWh/m2)' option. The other panels show various other indicators, including Energy and GHG ratios, Need, Consumption, CO2, Heating co2 emission, Cooling co2 emission, Domestic hot water co2, Specific electricity co2, Total co2 emission, Total energy consumption, Total primary energy, Heating primary energy, Cooling primary energy, Domestic hot water primary energy, Specific electricity primary energy, Total primary energy ratio, Heating cost, Heating cost ratio, Cooling cost, Cooling cost ratio, Domestic hot water cost, Domestic hot water cost ratio, Specific electricity cost, Specific electricity cost ratio, Total cost, and Total cost ratio.

The interface also includes a search bar for finding an address or a place, and a legend for the map data.



# Prototype – indicators

The screenshot displays the ACCENT - City of Paris web application. The top navigation bar includes links for Home, Building Stock, Energy Strategy, Contact, and About Accent. The user is logged in as Florent Krin, an Advanced city user, with a Logout button. A View Stats button is also present.

The main interface features a map of Paris with several overlays and controls:

- Search Bar:** "Find an address or a place" with a search icon and a close button.
- Map Data / Legend:** A panel on the left with a red border around the "Visualisation date" field, which is set to "16.12.2015". Below this, there are four small map thumbnails and a "Main view" dropdown menu. The "Main view" menu is open, showing options: "Energy and GHG ratios", "Need", "Heating Energy Need ratio (kWh/m2)", "Cooling Energy Need ratio (kWh/m2)", "Domestic hot water Need (kWh)", and "Domestic hot water Need ratio (kWh/m2)". The "Heating Energy Need ratio (kWh/m2)" option is selected.
- Map Data / Legend:** A panel on the right with a "Visualisation date" field set to "16.12.2015" and a "Visualisation mode" dropdown menu. The "Visualisation mode" menu is open, showing a calendar for December 2015. The date "16" is highlighted in blue. Below the calendar, there are three dropdown menus: "Main view" (set to "Energy and GHG ratios"), "Cost" (set to "Complete building"), and "Basemap" (set to "Complete building").
- Map Controls:** A "Sélection" button with a location pin icon, a "Details" button with a magnifying glass icon, and a "Print" button with a printer icon.
- Map:** A map of Paris showing streets and buildings. The map is centered on the area around Rue de Rungis and Rue de l'Intérieur.

The bottom of the page features the EIT Climate-KIC logo.



# Data sources (Italy)

with information available, sources and availability at building level

Dataset	Types of data	Responsible party / Owner	Access public	Access to PA
Municipal building registry	<ul style="list-style-type: none"><li>- 2D geometry + height</li><li>- Topology</li><li>- Administrative (address, use, house ID, ...)</li><li>- Buildings' permits</li></ul>	Municipalities		
Cadastre	<ul style="list-style-type: none"><li>- 2D geometry</li><li>- Topology</li><li>- Administrative (cadastral ID, use, ...)</li></ul>	National Tax Authority (Agenzia Entrate)		
Topographic Database	<ul style="list-style-type: none"><li>- 2D geometry + height</li><li>- Topology</li></ul>	Regional Authority (Regione Emilia-Romagna)		
Energy Bills	<ul style="list-style-type: none"><li>- Yearly consumption and bills for natural gas contracts</li><li>- Yearly consumption and bills for electrical energy contracts</li></ul>	Municipalities through National Tax Agency (Agenzia Entrate)		
HVAC Systems	<ul style="list-style-type: none"><li>- Type of energy systems for each building unit: efficiency, installation year, type of input energy, etc</li></ul>	Regional Authority (Regione Emilia-Romagna)		



# Data sources (Italy)

with information available, sources and availability at building level

Dataset	Types of data	Responsible party / Owner	Access public	Access to PA
Census of dwellings	<ul style="list-style-type: none"><li>- Age of construction</li><li>- HVAC system properties (only aggregated at Municipal level)</li></ul>	National Statistical Agency (ISTAT)		
Energy Performance Certificates	<ul style="list-style-type: none"><li>- Energy needs for heating and hot water,</li><li>- HVAC system properties</li><li>- Climatic properties</li><li>- Thermal properties of building envelope</li></ul>	Regional Authority (Regione Emilia-Romagna)		
Solar Panels	<ul style="list-style-type: none"><li>- Solar panels installations (location, power, type, etc)</li></ul>	National Authority (GSE)		
Fossil and Renewable Energy Sources	<ul style="list-style-type: none"><li>- Location and properties of energy plants: Fossil fuel, Biomass, Wind power, Hydroelectric, Geothermal, Photovoltaic.</li><li>- Power lines network</li><li>- Gas pipelines network</li><li>- Natural gas storing sites</li></ul>	Regional Environmental Agency (ARPA-ER)		



# Data model

## 1. Buildings Input data structure

### BUILDING

Invariant building reference data (shape and read only attributes).

In first version of Accent, it is considered that building shapes will not be modified after initial load.

Id\_district and id\_infra are calculated by spatial request during initial load in order not to have to perform this kind of requests on the fly through the web application.

Field	Type	Description	Sample
id_buil	Long integer	<b>Primary key</b> Auto increment by system	123
id_dist	Long integer	<b>Foreign key</b> to the district including the building	1
id_inf	Long integer	<b>Foreign key</b> to the infra including the building	10
shape	Shape	Building geometry	

### BUILDING\_DATA

Building data attributes for reference data

Field	Type	Description	Sample
id_buil_da	Long integer	<b>Primary key</b> Auto increment by system	456
id_buil	Long integer	<b>Foreign key</b> to the building Auto fill by system	123





# Replicability

Cost elements to be considered to replicate the ACCENT pilots



Data-related activity	new cities	
	estimated effort (person-days)	estimated cost
Agreement with Municipalities to authorize processing of municipal data by external actors		
Collect building and energy datasets		
Elaborate datasets and populate municipal energy database (see detail below)		
Verify correctness of municipal energy database		
Export data and convert to Accent format		
<b>TOTAL</b>		
DETAIL OF: Elaborate datasets and populate municipal energy database	new cities	
	estimated effort (person-days)	estimated cost
Geometry and topology		
Uses and volumes		
Energy (need, consumption, production)		
Detailed data for municipal buildings		
<b>TOTAL</b>		

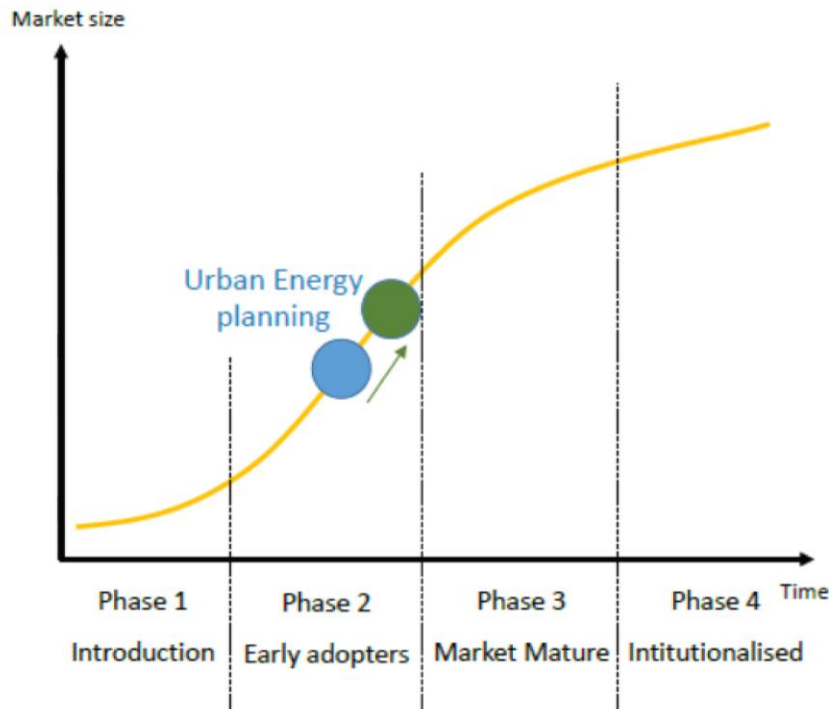


# 'Marketability'

Readiness of national markets in different Member States

UK

## Lifecycle of the sector



The update of the competitive analysis revealed that a **new type of actor** appeared in the UK: more and more **consulting companies** conduct energy planning studies for British cities.



# Some questions / 1

14. How much does it **cost** to collect, integrate, validate and harmonize energy-related data?
15. Do we have any idea of **sources** of detailed data available at building level in the EU28?
16. If then, how many **open and publicly available** datasets do exist?
17. How to really have **replicable** and **‘marketable’** approaches and tools?



# Some questions / 2

## 18. Do you know any of the following tools/projects?

- EnerTer (FR) - <http://www.energies-domain.com/EN/spip.php?article15>
- Crystal City (FR) - <https://www.artelys.com/en/applications/artelys-crystal-city>
- Nest (FR) - <http://www.nobatek-nest.com/>
- SimStadt (DE) - <http://www.simstadt.eu/de/index.html>
- URB Grade (ES) - <https://urb-grade.eu/>
- MEU (CH) - <http://meu.epfl.ch/>
- Glasgow Energy App (UK) - <https://www.glasgowenergyapp.org/>



# **CitiEnGov**

## **Project overview**

KICK OFF MEETING

Ferrara, 5th and 6th July 2016



**CitiEnGov**  
**Cities for a good energy governance**

Priority: 2. Cooperating on low-carbon strategies in CENTRAL EUROPE  
Priority specific objective: 2.2 To improve territorial based low-carbon energy planning strategies and policies supporting climate change mitigation

Start date: 01.06.2016

End date: 31.05.2019

Duration: 36 months

Lead partner: SIPRO Development Agency - Ferrara



# The project partnership

SIPRO Development Agency-Ferrara – LP (ITALY)

City of Bydgoszcz (POLAND)

Energy and Innovation Centre of Weiz Ltd. (AUSTRIA)

City of Split (CROATIA)

Municipality of Grodzisk (POLAND)

Goriska local energy agency, Nova Gorica (SLOVENIA)

Hajdu-Bihar County Government (HUNGARY)

Local Energy Agency of Gorenjska (SLOVENIA)

Sinergis srl (ITALY)

City of Ludwigsburg (GERMANY)

Several Associated partners for: SIPRO, Bydgoszcz, Weiz, Grodzisk, Golea, LEAG



## The project idea

- **Energy is an horizontal policy**, which involves all other ordinary policies, consequently it influences a complex socio-economic system.
- The role public authorities can play, especially cities, is to act as a “**facilitator**” of the energy transformation process, playing a crucial role in coordinating approaches to formulate and plan low-carbon energy strategies.
- This shall be achieved through the setting up of **municipal energy units** or the empowerment of those already established by cities, mainly providing them with tools and strategies but also appointing them an effective role within PA, representing an important change in relation to the current situation of most Central European regions.

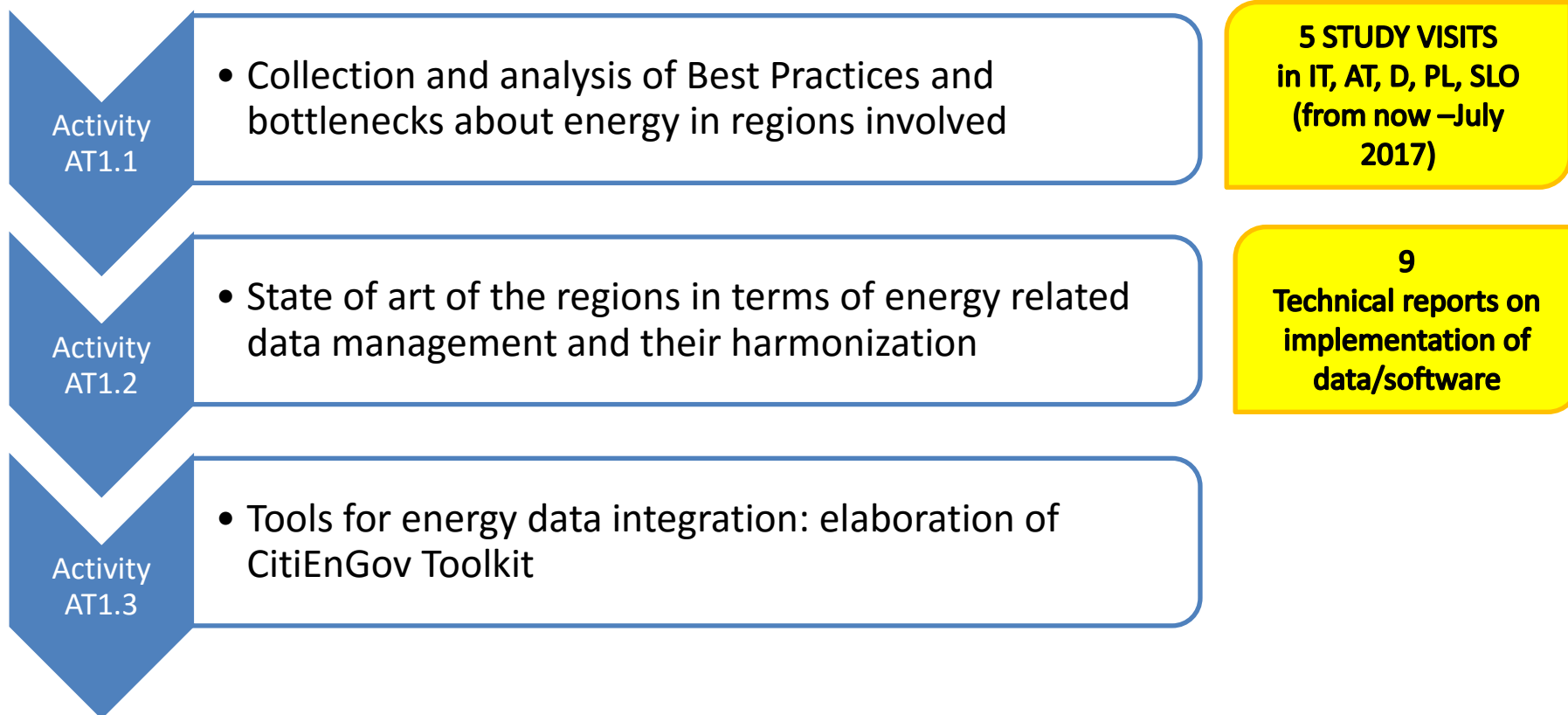


## **The project specific objectives**

- Developing and implementing integrated territorial plans to enhance the use of RES and improve energy performance
- Designing and testing already available approaches and tools to improve the energy management in Central Europe urban areas
- Enhancing the definition of low-carbon energy strategies and policies tailor made for the Central Europe urban areas.



## WP T1 – Role ascribed to energy issues ad harmonization of data





# Some (final) questions

19. How to have **municipal energy units** working with **harmonized** energy-related data, with details at building level?
20. How to effectively use building-detailed spatial data for **defining and monitoring** energy plans?



# Some conclusions / 1

- i. Data source **heterogeneity** is the main obstacle
- ii. Data availability, accessibility, level of details, licenses, semantics, ... varies from country to country (but also from city to city)
- iii. Data from EP Certificates, or energy consumption data can be easily geocoded (PoD > address > building) but often we need to **aggregate** and **anonymize** data



## Some conclusions / 2

- iv. CityGML Energy ADE and INSPIRE are two **target schemas** useful to integrate heterogeneous energy-related geodata
- v. Existing web services or platforms already implemented need to interoperate through **well-known geo-ICT standards** (e.g. OGC OWS)



# Thanks ... any (your) questions?

