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The Role of the Network in a Radical Transition to Renewables

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Exploratory Workshop on Energy Sustainability in the Current Transition to Renewables: Framings from Social Practices and Complex Systems Theories



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The Marchetti model 350

C. MARCHETTI



"The whole destiny of an energy source seems to be completely predetermined in the first childhood."

Fig. 6. Forecasting U.S. oil comsumption as a fraction of total energy consumption from 1930–1940 trends. \Box calculated values, \triangle statistical data. Other symbols and figures represent intermediate steps in the calculation, the graph having been drawn from my notebook.

Marchetti, C. 1977. Primary energy substitution models: On the interaction between energy and society. Technological Forecasting and Social Change 10: 345–356.



Predictions: optimism of math



Fig. 7(a). Historical evolution of the primary energy mix for the *world*. Wriggling lines are statistical data, smooth lines computed. Some values for the actual market fractions are given on the right side of the figure. The effect of introducing a new source of primary energy (1% in year 2000), solar, fusion or else, is indicated by the dashed lines. This effect appears minimal on conventional sources, and dramatic only on nuclear, but in the second half of the next century.

Marchetti, C. 1977. Primary energy substitution models: On the interaction between energy and society. Technological Forecasting and Social Change 10: 345–356.









Yet, we like quadratic laws

The Rise of Electric Cars

By 2022 electric vehicles will cost the same as their internalcombustion counterparts. That's the point of liftoff for sales.



Bloomberg 🕮

Sources: Data compiled by Bloomberg New Energy Finance, Marklines





What about hydrogen (2004-2010)?









"*...of living the present hostage of the future".* Mario Luzi, Ipazia

WHY AND HOW ARE WE SO OFTEN MISLEAD?



The two very common (complementary)mistakes

- The economic (social) paradigm: transition as a business model (technology penetration)
 - What about "energy imperatives"?
- 2. The physical paradigm: transition as an energy (source) process
 - What about "complexity"?



Jung vs Descartes

- > The Cartesian dichotomy: soul (form) and body (matter or energy)
- > The Jungian dichotomy: creatura (form) and pleroma (substance)
- > ""You must understand that while Pleroma is without thought or information, it still contains - *is the matrix* of – many other sorts of regularities. Inertia, cause and effect, *connection and disconnection*, and so on, these regularities are immanent in Pleroma". G.Bateson



First mistake: energy imperatives

6.1 Changes in Transportation

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Energy density comparison of several transportation fuels (indexed to gasoline = 1) energy content per unit weight



Fig. 6.1 Energy density comparisons (Source EIA 2013)



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Universal trend?

Entropy 2015, 17(12), 8007-8018; doi:10.3390/e17127857 *Energy Flows in Low-Entropy Complex Systems* Eric J. Chaisson





The conundrum of complexity

- > Is energy transition just about energy (pleroma)?
- > Oil is not *just about energy*
- Direct nexus: plastics, chemicals, pharmaceuticals, finance, transports (internal combustion), weapons (rockets).....
- > Indirect nexus: electricity (plastic), internet (transistors)...scale variance (big and micro) or phase separation
- > Interactions: creation of new spaces of interaction (networks)



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Complexity view

- > It is about the:
- > stratification and indentation cumulated to produce
- > new artefacts, new spaces of interactions and new connections
- > or to strengthen or eliminating existing ones,
- > in a process of creation, magnification and destruction.



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The "commodity bubble"





Financialization of the oil market







What means financialization?

- > On February 7 2018, at NYMEX (New York Mercantile Exchange), and at ICE (Intercontinental Chicago Exchange) were traded futures for 4.9 billion barrels of oil
- > 50 times the daily oil production in the world
- > 25% (option and futures) of total transactions at ICE and CME





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Synchronization 1





Synchronization 2





Explanation: pension funds





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Further explanation: Electronic platform trading

Between 2005-2008, implementation of the computer trading system at CME

Between 2012 and 2014, Automatic Trading accounted for 46% of total volumes of energy futures at CME (54% for crude oil

CME (54% for crude oil and between 38% and 79% for all other futures),





The "flat horizon-effect"



Riccardo Chiarucci, Maria I. Loffredo, Franco Ruzzenenti, Evidences for a structural change in the oil market before a financial crisis: The flat horizon effect, Research in International Business and Finance, Volume 42, 2017,





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Complexity leap (and destruction)







The role of networks

- > Globalization: trade, freights
- > Production network (value chain): futures
- Transport network: oil is the largest traded commodity (WTI vs Brent)
- Financialization: financial network (in and off shore)
- > Electronic trading: communication network (IT)
- > New social networks: "social machines" (humanmachines), new platforms ("symphony" by Reuters); new forms of insider trading (telegram); new "black pools".
- New interaction spaces: REUTERS (data, platforms, news)

COMPLEX NETWORKS

Network as a structure

Network as a paradigm



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Transition to renewable energy and the "energy imperatives"

- > What lesson?
- > Use networks as a *paradigm and a structure*.
- > Structure: the grid can make-up for the low energy intensity (and discontinuity), power reservoir
- > Paradigm: "smart-grids", use the actively the networks created by the agents of the grid



Questions, Benjamin Sovacool

> I agree networks can be important to promoting renewables but sometimes networks themselves can become **problems** –(solar panels, gas boilers) that they promote dogmatically and zealously to the exclusion of others, and sometimes to society. Can we better distinguish between useful or socially optimal networks, and those that serve other (incumbent) interests?





Untold, shadow goals the hegemonic discourse

- Financial (intangible assets):
- Redemption of national industry (electric cars can be craft-worked)
- Foster electricity demand (power glut due to renewable energy and recession)
- Political diversion (increasing difficulties in implementing standards and goals of air pollution and greenhouse gasses).
- > Business as usual: growth



At the end of Monday's trading, Tesla reached a market capitalization of \$48.7 billion compared with Ford's \$45.6 billion, according to Bloomberg. General Motors was at \$51.2 billion.



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Questions, Matt Watson

- > How does the drive towards greater energy density fuels and vectors relate to the development of dominating economic actors and interests in energy supply? In turn, what does a network approach offer for confronting the challenges presented by such actors and interests, for a transition towards lower density sources?
- >
- How does network theory contend with the challenges of entraining people to become energy producers and active energy market actors in the model of decentralisation you suggest?





The non-believers

Treasuries Held by Oil Exporters

Oil exporters with at least \$1 billion in U.S. Treasury securities, monthly data since 1974

Voices Financial markets are now betting against the future of the planet. This won't end well

There has been no fundamental readjustment of energy stock prices since the supposedly historic December 2015 United Nations Climate Change deal in Paris

Ben Chu Economics editor | @Benchu_ | Tuesday 28 February 2017 15:30 GMT | 💭







Source: U.S. Treasury Department

Bloomberg



Accelerating transition to RES?

- > Suppose we split inlet and outlet points in the grid: you can upload and down load energy when and wherever you want (almost)
- Suppose we provide access codes via IT and communication networks
- > Suppose we let agents (persons and firms) trade on the grid.
- > And the Utilities (public or private) act as a pivotal market-player: like central bank for bank system