

# Open Access and Open Data in practice

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*(with ackn. to all funding sources, data providers, collaborators and students, for material and ideas)*

- **Two anecdotes**
- **When I have to explain what we do...**
- **Open research motivating feedback** (RESGen and the P2P market App)
- **Open research based on “events”**
- **Pushing data and benchmark case studies in the open**

... an introduction to our group and the way we work on [YouTube](#)

## Ownership of our research works



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### Consensus-based Approach to Peer-to-Peer Electricity Markets with Product Differentiation

**3 Author(s)** [Etienne Sorin](#) ; [Lucien Bobo](#) ; [Pierre Pinson](#) [View All Authors](#)



**Abstract**

**Abstract:** With the sustained deployment of distributed generation capacities and the more proactive role of consumers, power systems and their operation are drifting away from a conventional top-down hierarchical structure. Electricity market structures, however, have not yet embraced that evolution. Respecting the high-dimensional, distributed and dynamic nature of modern power systems would translate to designing peer-to-peer markets, or at least to using such a structure in the background for a bottom-up approach to future electricity markets. A peer-to-peer market structure based on a Multi-Bilateral Economic Dispatch (MBED) formulation is introduced, allowing for multi-bilateral trading with product differentiation, for instance based on consumer preferences. Consequently a Relaxed Consensus+Innovation (RCI) approach is proposed to solve the MBED in fully decentralized manner. A set of realistic case study analyses shows that such peer-to-peer market structures can effectively reduce externalities on power systems with a limited cost increase compared to centralized market approaches. Additionally, the RCI solving approach allows for a fully decentralized market clearing which converges with a negligible optimality gap, with a limited amount of information being shared.

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**Page(s):** 1 - 1 **DOI:** [10.1109/TPWRS.2018.2872880](#)

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## Unsuspected impact with open initiatives



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### Energy Analytics and Markets


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#### Organisation profile

Design of electricity markets and socio-economic optimization methods for market analysis and design, including power-system planning and operation analysis considering market aspects. Modeling and simulation of markets are central parts of the area, with emphasis on the stochastic and dynamic features of renewable energy generation and new patterns in electricity consumption at various temporal and spatial scales.

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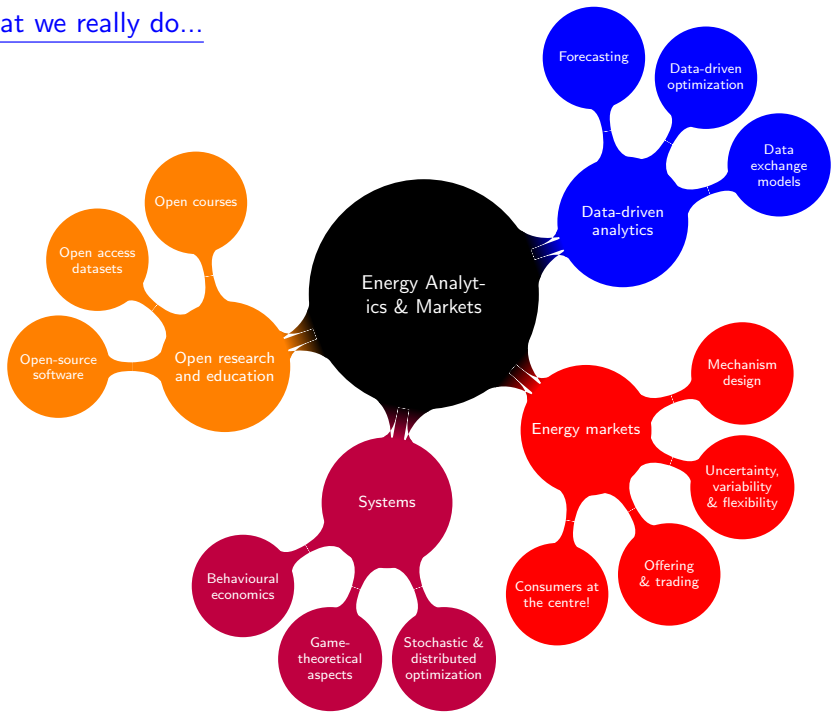
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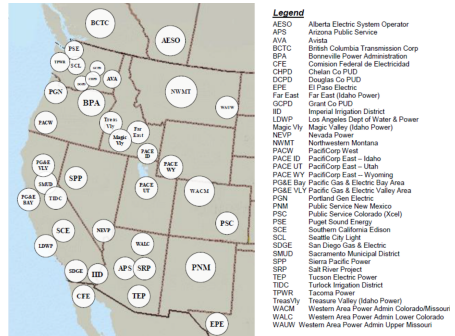
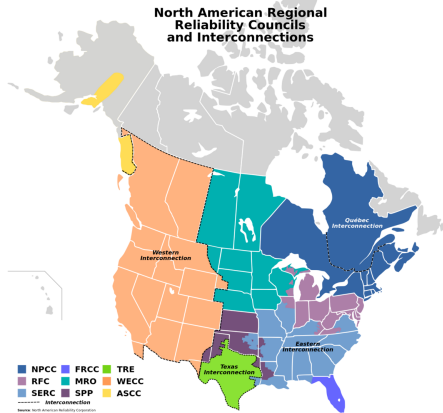
- 1 When I have to explain what we do...

# What we really do...



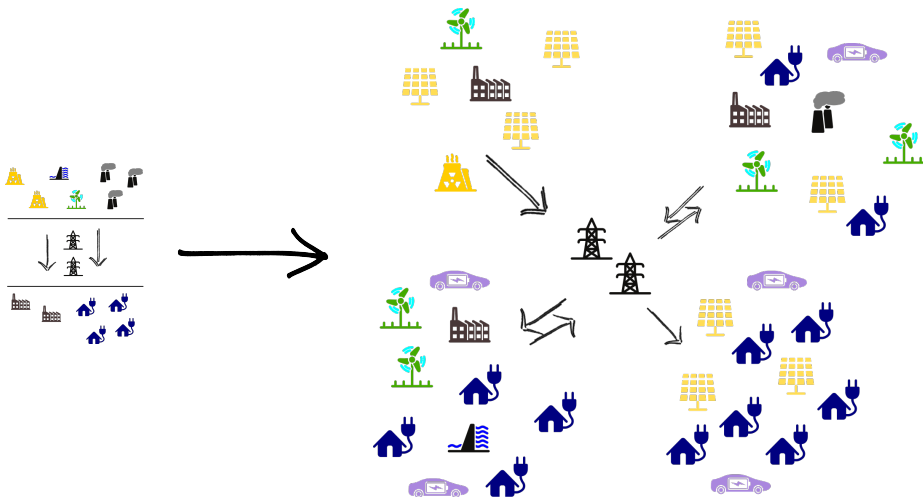
- ② **Open research motivating feedback**

- EPRI, US, sponsored us to produce open-source code to generate space-time scenarios (for wind and solar power):
  - the application area is the whole US Western Interconnection!
  - software used to feed system studies for the US energy system



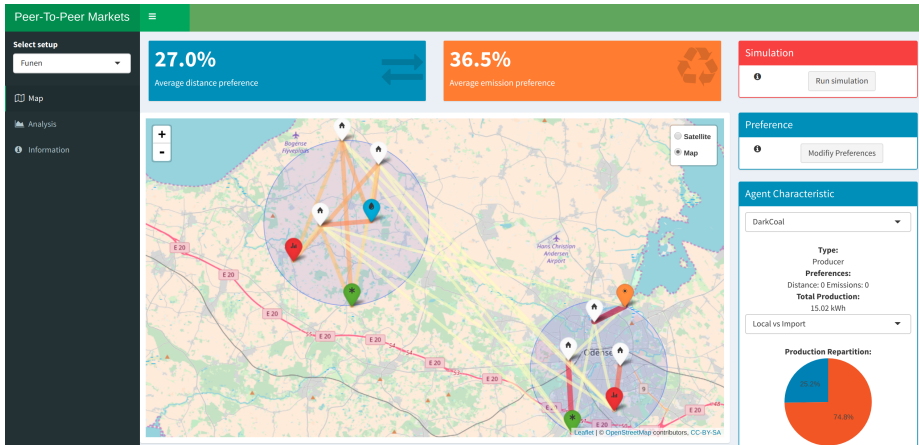
- RESGen is **open-source**: anyone can use it for operational/planning studies, for any test case of interest, or further develop it...

# Towards decentralized electric energy systems



Eventually, let's exchange electric energy in a peer-to-peer framework, which may have substantial benefits

# The peer-to-peer electricity market app



[https://p2psystems.shinyapps.io/ShinyApp\\_Project/](https://p2psystems.shinyapps.io/ShinyApp_Project/)

- 8 **Open research based on events**

# Organizing open energy forecasting competitions



## GEFCom2012 Wind Forecasting

Completed • \$7,500  
Global Energy Forecasting Competition 2012 - Wind Forecasting

Thu 6 Sep 2012 - Wed 31 Oct 2012 (3 years ago)

### Dashboard

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- Forum
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- Private

### Leaderboard

- LucaGaggs
- Duck7ka
- Giuseppe Tassinari jr
- Stefan Heß
- MC
- luchon
- Lionterpeka
- W. Li
- Woshua
- gongqianli

### Forum (31 topics)

#### getting the data?

use of data  
Methods used and  
software used

## A wind power forecasting problem: predicting hourly power generation up to 48 hours ahead at 7 wind farms

This is the Wind Forecasting track of Global Energy Forecasting Competition 2012 (GEFCom2012). This competition will bring together state-of-the-art techniques for energy forecasting, serve as the bridge to connect academic research and industry practice, promote analytics in power engineering education, and prepare the industry to overcome forecasting challenges in the smart grid world.

The total prize pool for the wind forecasting track is \$7,500. GEFCom is not a paper contest. Instead, this is a competition that requires participants to develop models and submit forecasts based on a given data set. Accuracy of the forecasts will be one of the evaluation criteria. In addition to accuracy, the participants are also required to submit a report describing the methodology, findings and models. Selected entries will be invited to IEEE PES General Meeting 2013 in Vancouver, Canada to present their methodologies and results. The team that finishes at the top of the leaderboard will win a cash prize. However overall winners of the competition will be determined by the GEFCom Award Committee after the presentations based on forecasting accuracy, clarity of documentation, rigors of the approach, interpretability of the models and practicality to the industry. A few winning entries will be invited to submit the report in scientific paper format to prestigious scholarly journals, such as International Journal of Forecasting and IEEE Transactions on Smart Grid.

The topic for the wind forecasting track is focused on mimicking the operation 48-hour ahead prediction of hourly power generation at 7 wind farms, based on historical measurements and additional wind forecast information (48-hour ahead predictions of wind speed and direction at the sites). The data is available for period ranging from the 1st hour of 2009/7/1 to the 12th hour of 2012/6/28.

The period between 2009/7/1 and 2010/12/31 is a model identification and training period, while the remainder of the dataset, that is, from 2011/1/1 to 2012/6/28, is there for the evaluation. The training period is there to be used for designing and estimating

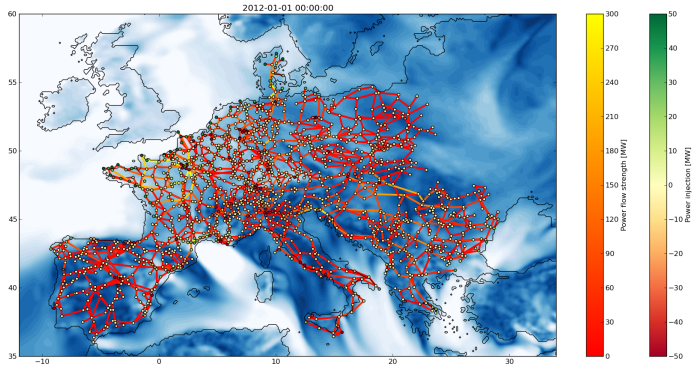
Another approach to benchmarking and sensing the state of the art... eventually to be brought in the classroom(!)



- Let's be frank: **it is \*A LOT\* of work!** But now:
  - Accepted benchmark cases are out there, with data freely available and well documented (reproducibility, benchmarking, etc.)
  - Methods and approaches employed by top-ranked teams were documented, presented at conferences and published
  - **There is a “before” and “after” GEFCom forecasting competitions**
- We eventually got **600 teams worldwide** to enter the GEFCom 2014 competition
- It allowed for unrivalled sensing of the state of the art in the field
- It led to very strong insights on novel approaches to invest in
- It debunked some myths, e.g., about who would win such competition
- Such initiatives may evolve in very interesting ways...

- ④ **Pushing data and benchmark case-studies in the open**

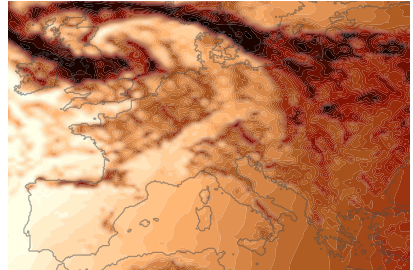
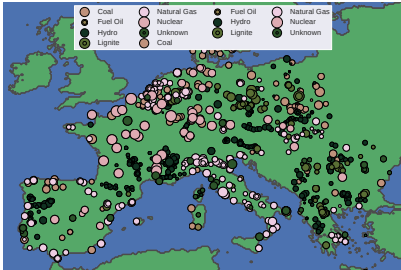
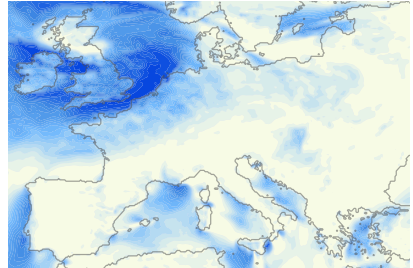
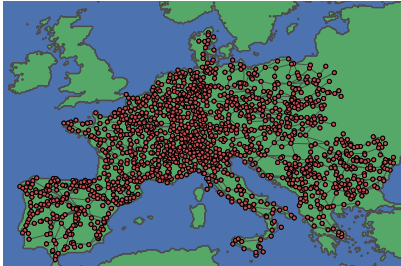
- The “**grand forecasting challenge**”: predict *renewable power generation, elastic loads and flexibilities* at once for the whole Europe...!



- Innovate for a **highly-renewable and market-based European energy system**, e.g.,
  - Collaborative approach to analytics (distributed learning, data markets, etc.)
  - Accommodating all data streams, heterogenous information in operation and decision processes

## How to get there?

Let us build a (very) large-scale dataset for the whole European system



Available CC-BY! (on zenodo.org) with companion paper in *Nature Scientific Data*

- Research (and education) is about a **collaborative common** e.g. knowledge, which justifies an **open approach**
- The right environment is there - think of Github/Zenodo, Arxiv, licences, etc.
- The first step(s) may be seen as difficult (requirements from grant givers, licencing, new ways to collaborate, etc.)... but after that **it feels so natural**
- **Be creative**
- The potential **benefits are substantial**, in terms of
  - impact and its strength
  - speed of diffusion of ideas
  - network development
  - possibility to bring research knowledge and material into education
  - etc.

