

Presentation of Engie Chair



About Me

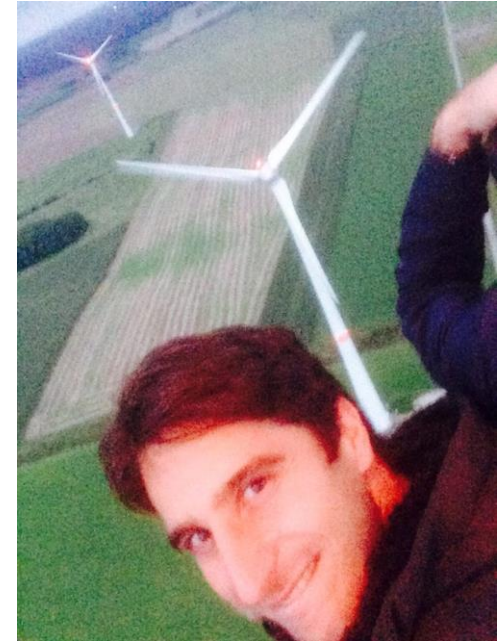
Assistant Professor, Engie Chair
Center for Operations Research and Econometrics
Université catholique de Louvain

**M.Sc. (2007) and Ph.D. (2011) in Industrial
Engineering and Operations Research (2011)**

University of California at Berkeley, USA

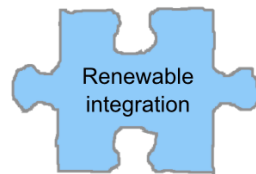
**B.Sc. in Electrical and Computer Engineering
(2006)**

National Technical University of Athens, Greece



Solving the Sustainability Puzzle

Engie Chair research **problems** and **methodology**



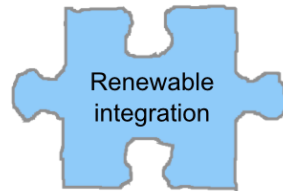
Solving the Sustainability Puzzle

Engie Chair research **problems** and **methodology**

Researcher in electricity
production

Energy
markets

Value of flexibility markets
time domain



Global energy markets and electricity
production and consumption based on
weather and climate data scenarios

Researcher in electricity
consumption

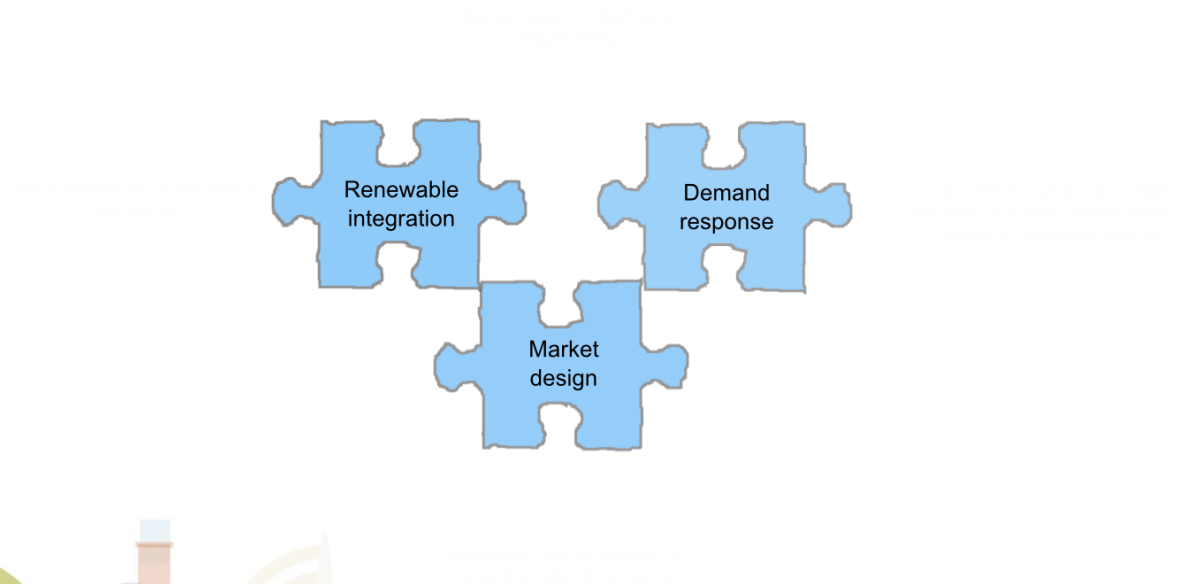


GDF SUEZ Chair

ENERGY ECONOMICS AND ENERGY RISK MANAGEMENT

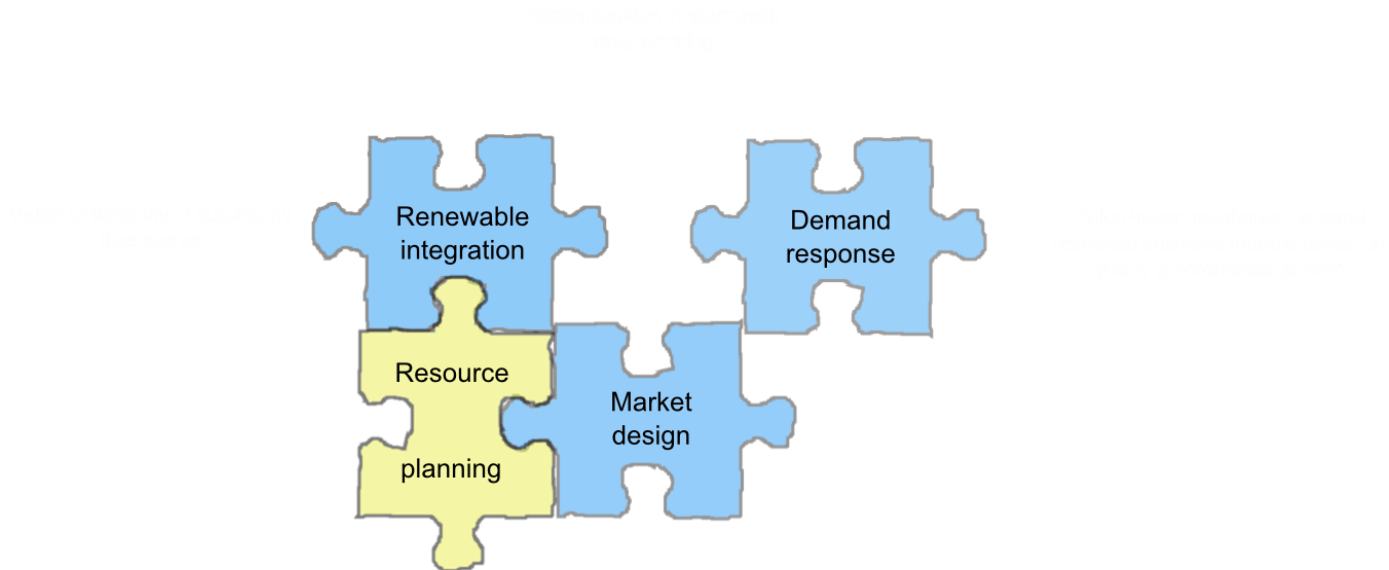
Solving the Sustainability Puzzle

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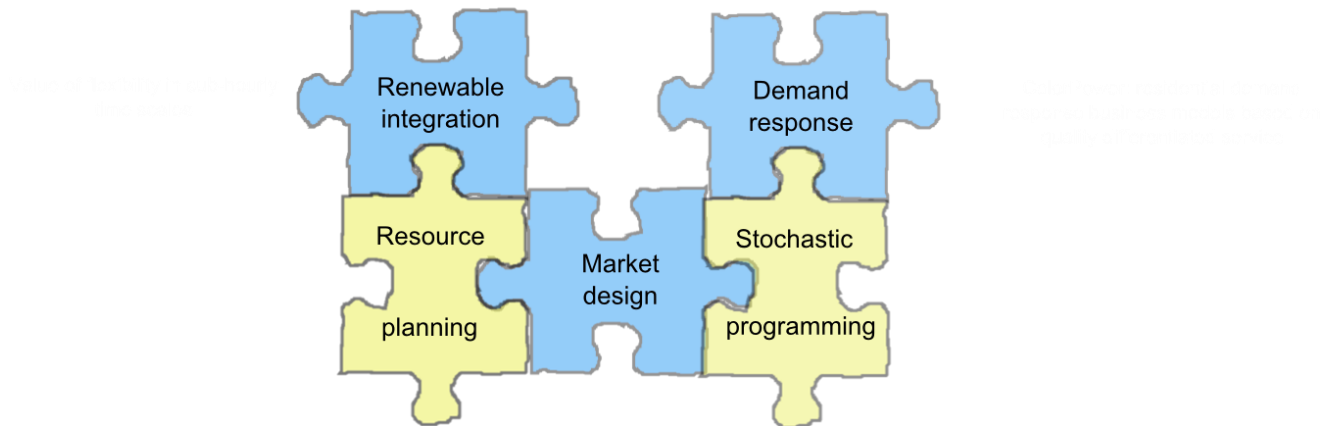
Solving the Sustainability Puzzle

Engie Chair research **problems** and **methodology**



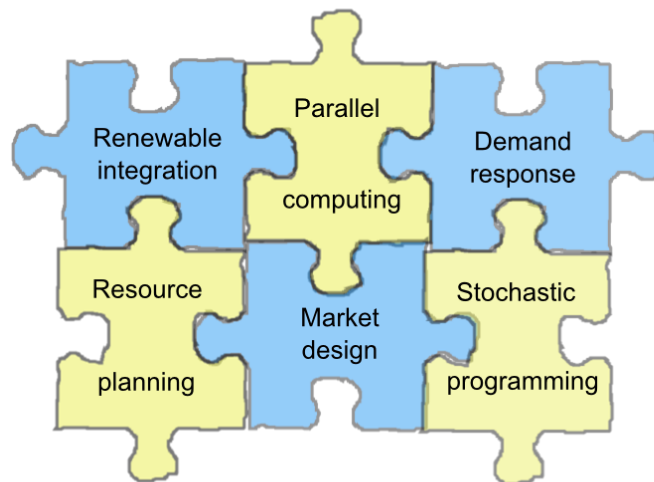
Solving the Sustainability Puzzle

Engie Chair research **problems** and **methodology**



Solving the Sustainability Puzzle

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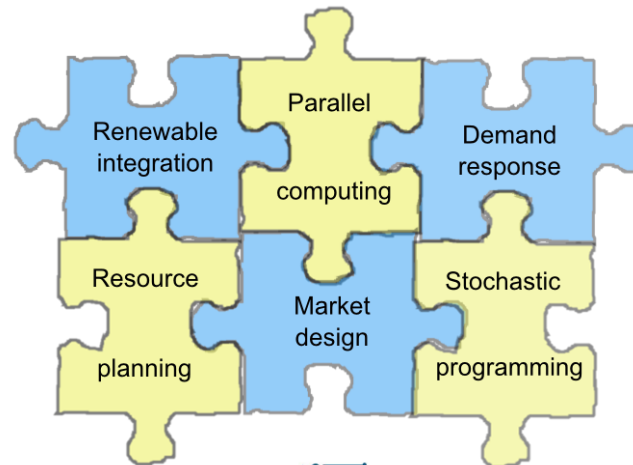


Solving the Sustainability Puzzle

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High-fidelity economic dispatch
and unit commitment



ColorPower: residential demand
response business models based on
quality differentiated service



Rewarding flexible capacity in
the Belgian electricity market



Chair Objective

Develop an internationally competitive research and education program in **computational** and **modeling** methods for the

- analysis of **restructuring** of energy markets
- analysis and management of **risks** affecting the energy sector



Evolution of Optimization Technology

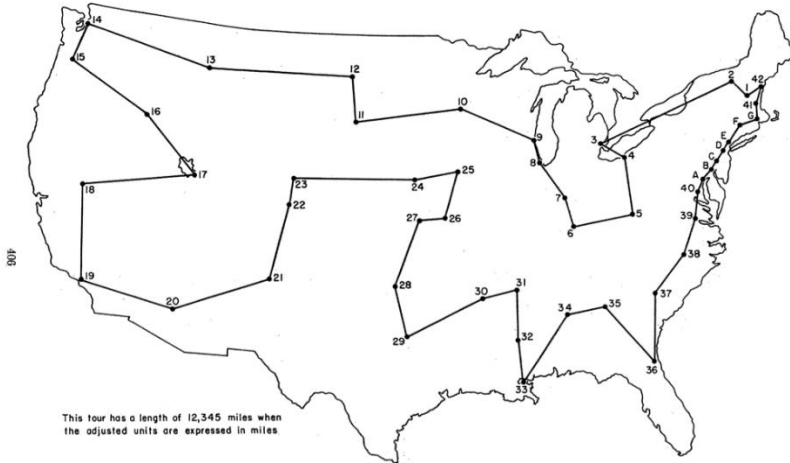
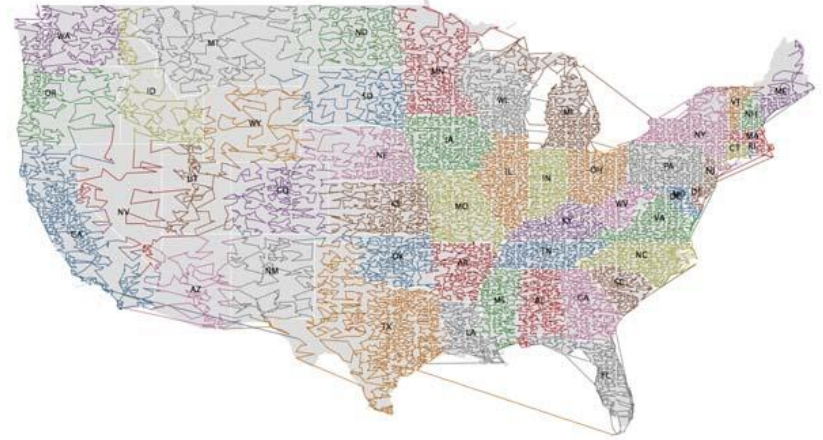


FIG. 16. The optimal tour of 49 cities.



In 1952, Dantzig et al. solve an instance of the Traveling Salesman Problem with 49 cities **by hand**

In 2006 Cook et al. solve a problem with 85,900 'cities' (the one above has 37,000 cities)

It took	It takes
> 4 months (early 90's)	1 second (2007)
> 7 years (early 90's)	1 second (now)

Evolution of Computing



X1,000,000

X40

Intel Pentium II (1997-1999)

233-450 MHz

1 core

Intel Core i7 975 (2014)

3.33 GHz

4 cores

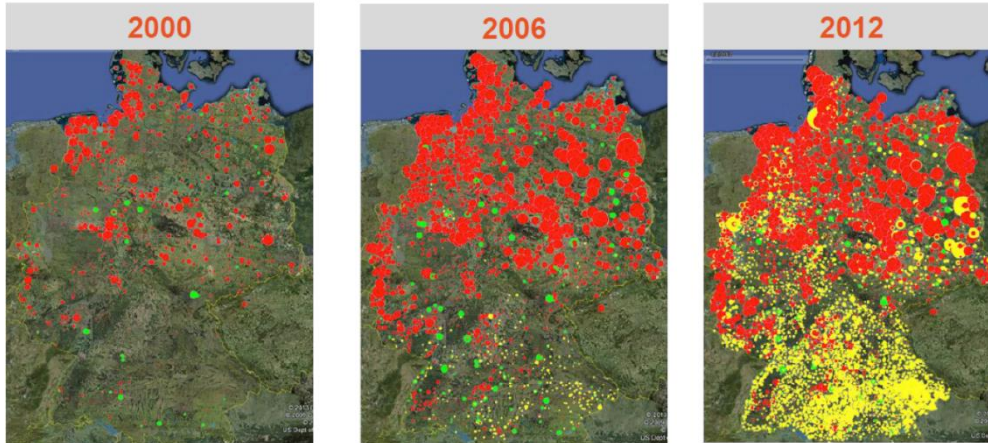
Sequoia Cluster (2012)

PowerPC A2 2.3 GHz

1.6 million cores

Evolution of Energy Policy

Evolution of renewable integration in Germany



- Wind
- Photovoltaic
- Biomass

Source: 50Hertz,
TenneT, Amprion,
TransnetBW

August 2013:

- Number of units: ~ 1,3 Mio.
- Power > 72 GW
- Energy (2012) ~ 135 TWh



Germany: Nuclear power plants to close by 2022

COMMENTS (542)



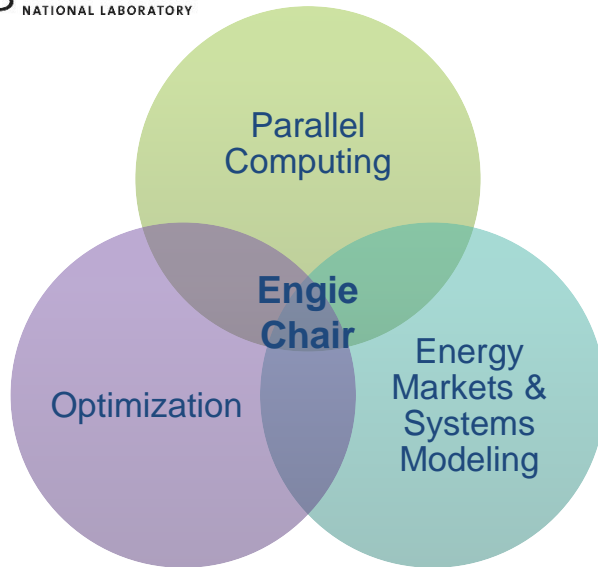
Germany saw mass anti-nuclear protests in the wake of the Fukushima disaster

Germany's coalition government has announced a reversal of policy that will see all the country's nuclear power plants phased out by 2022.

Related Stories

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ENERGY ECONOMICS AND ENERGY RISK MANAGEMENT

A New, Interdisciplinary Frontier



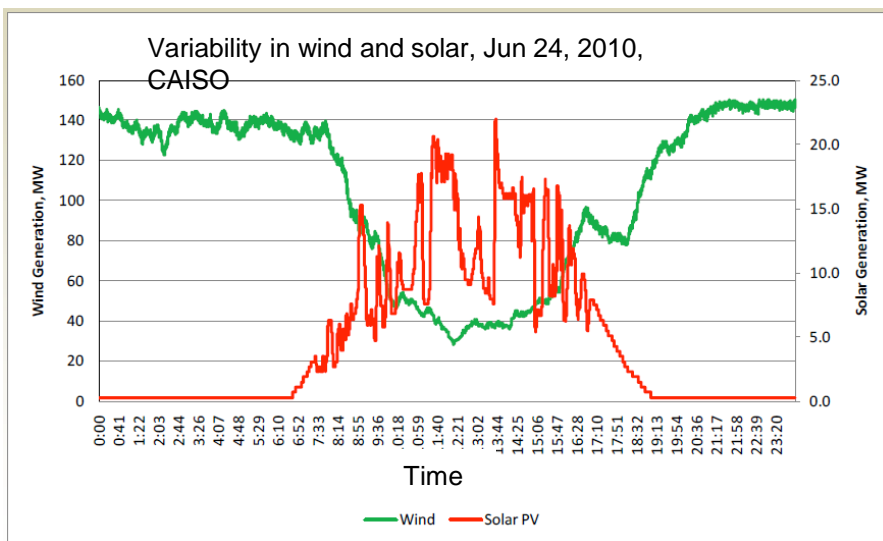
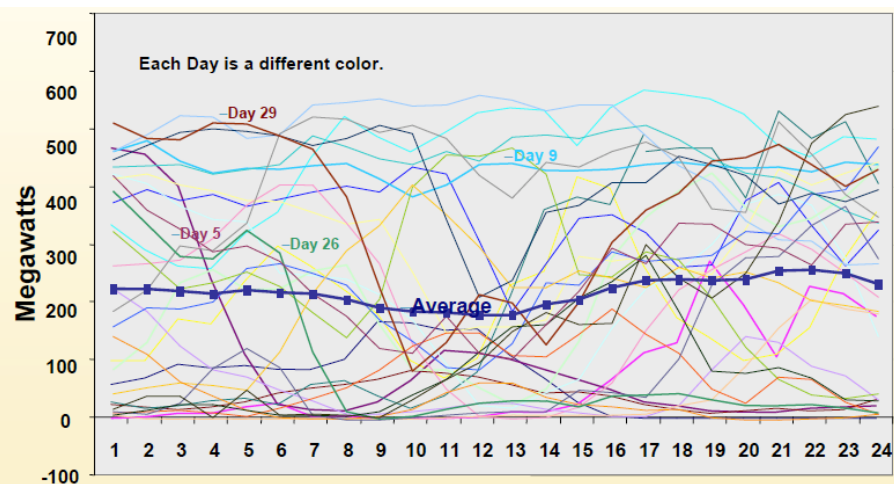
Opportunity: The Engie Chair links key players

- CORE houses towering experts in optimization, energy markets, economics, statistics
- LLNL provides access to unique supercomputing infrastructure
- UC Berkeley faculty has conducted pioneering work in electricity market deregulation and optimization



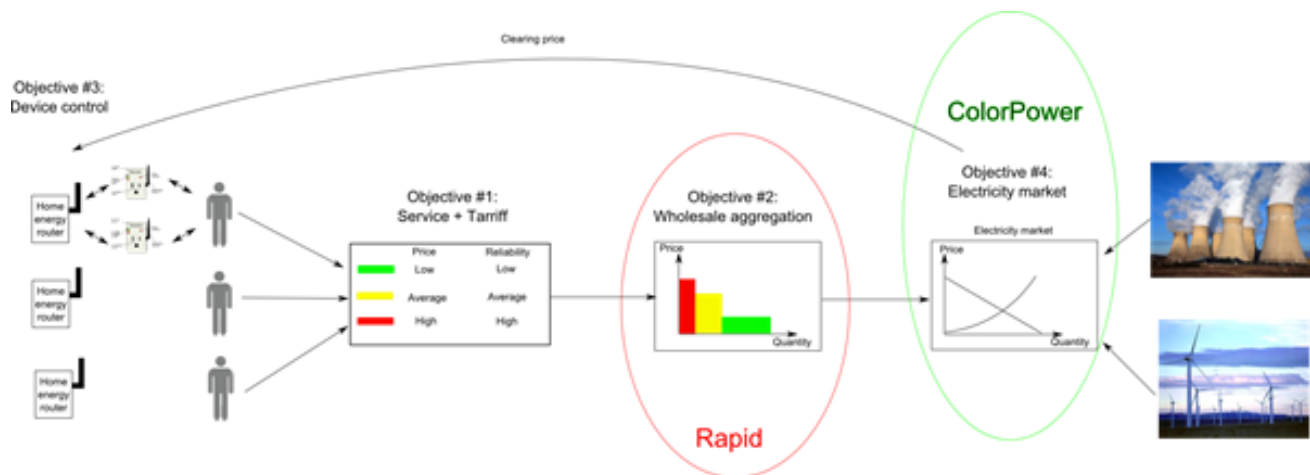
Renewable Energy Integration

Research question: How should we operate energy systems on a minute-by-minute / hourly / daily basis in order to balance unpredictable renewable supply?



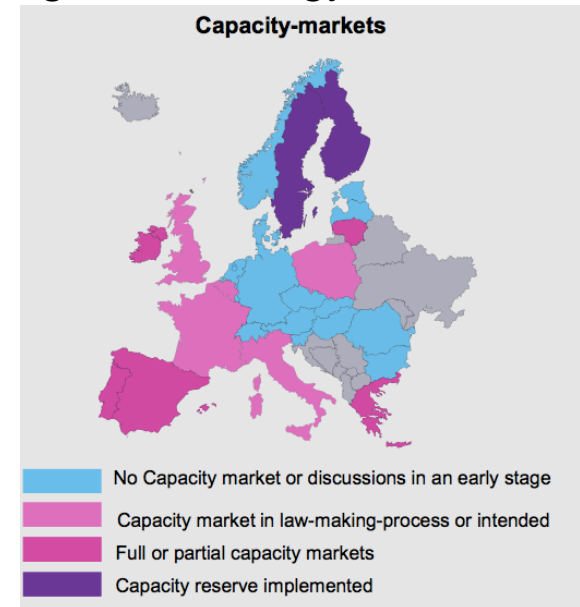
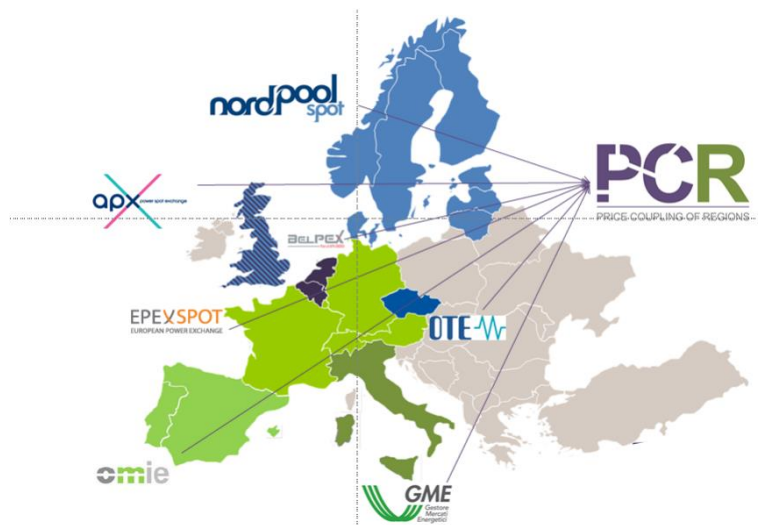
Demand Response

Research question: How should residential demand response aggregators define their services? What are the impacts of demand response mobilization on renewable energy integration and markets?



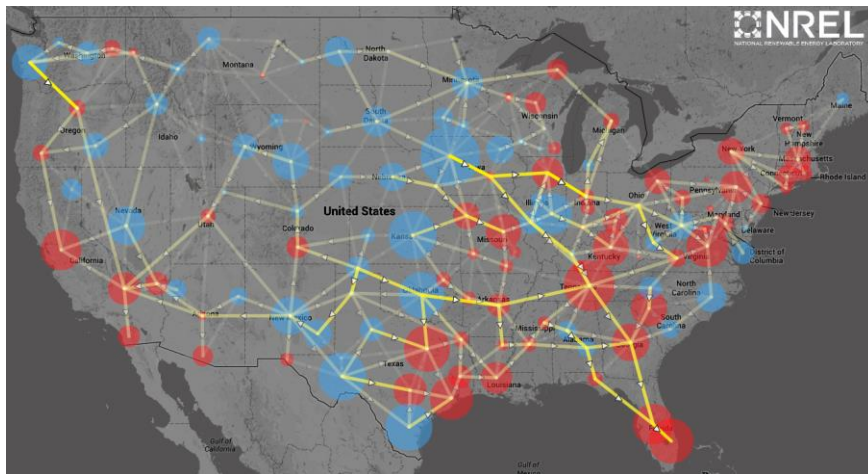
European Market Design

Research question: How can European electricity markets coordinate their operations and provide incentives for achieving the right technology mix?



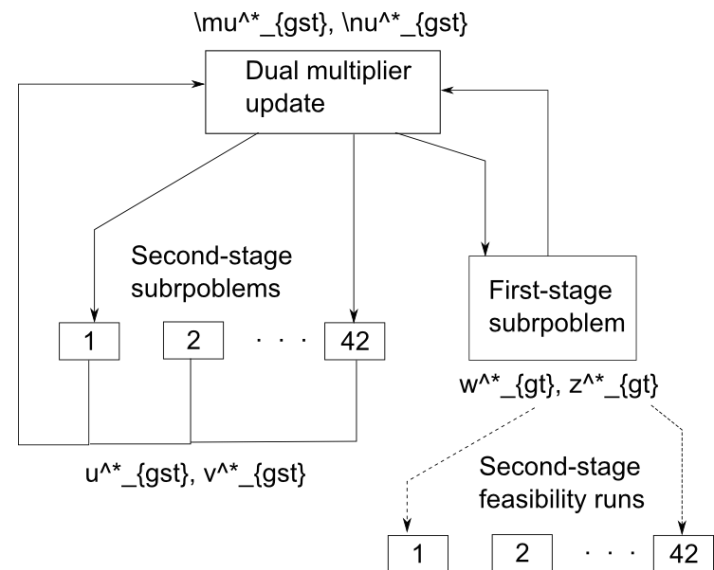
Energy System Expansion

Research question: How should we expand energy systems in order to bring renewable sources to load centers at least cost?



Computation

Research question: How can we use distributed computing in order to design algorithms that can provide good-enough solutions rapidly?



Teaching

Goals

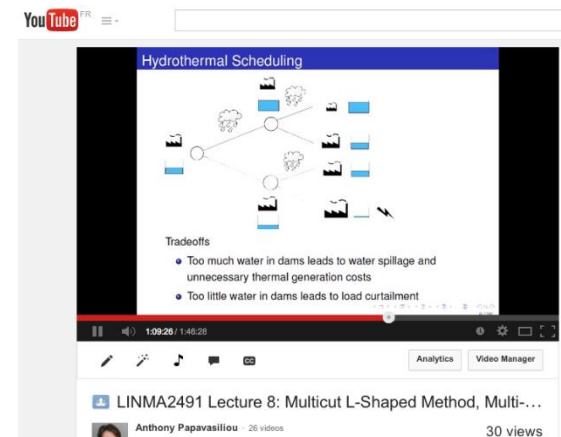
- Strengthen Belgian engineers in an important area of competency
- **Open access:** slides and lecture videos are available online

Two Masters Courses in English offered in department of Applied Mathematics

- Quantitative Energy Economics
- Operations Research



Operations Research lectures on YouTube



Events

- CORE 50th anniversary, 27/05/2016
'Computational Challenges in Energy'
 - Mario Pereira (PSR, Brazil)
 - John Birge (University of Chicago)
 - Alex Shapiro (Georgia Tech)
 - Andy Sun (Georgia Tech)
- Workshop with Professor William Hogan (Harvard University), June 17, 2016



CORE Energy Team

- Yves Smeers: emeritus professor, CORE
- Mathieu Van Vyve: professor, CORE
- Philippe Chevalier: professor, CORE president, founder of n-Side
- Per Agrell: professor, CORE
- Francois Glineur: professor, CORE
- Thierry Brechet: professor, CORE



International Collaborations

- Access to LLNL high performance computing cluster (#3 in TOP500)
- Summer internships at the University of California at Berkeley and LLNL



Ongoing Projects

- Study on the remuneration of capacity in conditions of scarcity
 - Sponsor: CREG
- ColorPower
 - Sponsor: Electrabel
- Modeling the Value of Flexibility at Sub-Hourly Time Scales.
 - Sponsor: Electrabel
- PhD and post doc openings:
http://perso.uclouvain.be/anthony.papavasiliou/public_html/openings.html



WE WANT YOU!



GDF SUEZ Chair

ENERGY ECONOMICS AND ENERGY RISK MANAGEMENT

Thank you

For more information

- http://perso.uclouvain.be/anthony.papavasiliou/public_html/home.html
- anthony.papavasiliou@uclouvain.be

