



Conceptual challenges and possible solutions

# From the camel curve, to the duck curve, and back!?

22.05.2015

**Dr. René Bohnsack**  
**Assistant Professor for Strategy and Innovation**  
University of Amsterdam Business School  
University of St.Gallen  
Manchester Business School

Email: [r.bohnsack@uva.nl](mailto:r.bohnsack@uva.nl)  
Mob: +49 179 1063888

Please do not distribute without the consent of the authors.

Based on a paper of  
Thorsten Helms<sup>1</sup>, Moritz Loock<sup>1</sup>, René Bohnsack<sup>2\*</sup>

<sup>1</sup> University of St. Gallen  
Institute for Economy and the Environment  
Tigerbergstrasse 2, 9000 St. Gallen, Switzerland

<sup>2</sup> University of Amsterdam Business School  
Plantage Muidergracht 12, 1018 TV Amsterdam, The Netherlands

# Climate Etc.

[← JC's bookshelf](#)

[Climate dynamics of clouds →](#)

## More renewables? Watch out for the Duck Curve

Posted on [November 5, 2014](#) | [462 Comments](#)

by [Planning Engineer](#)

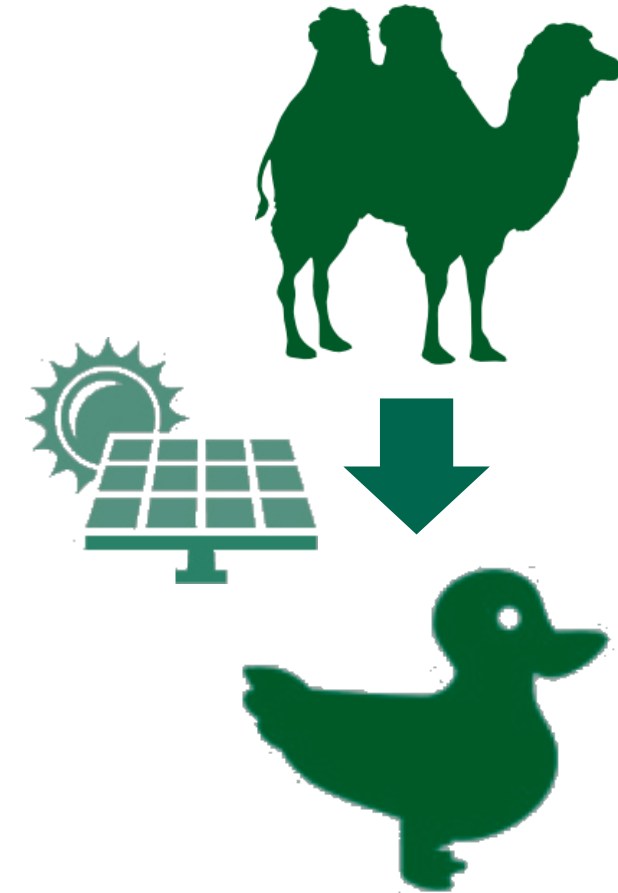
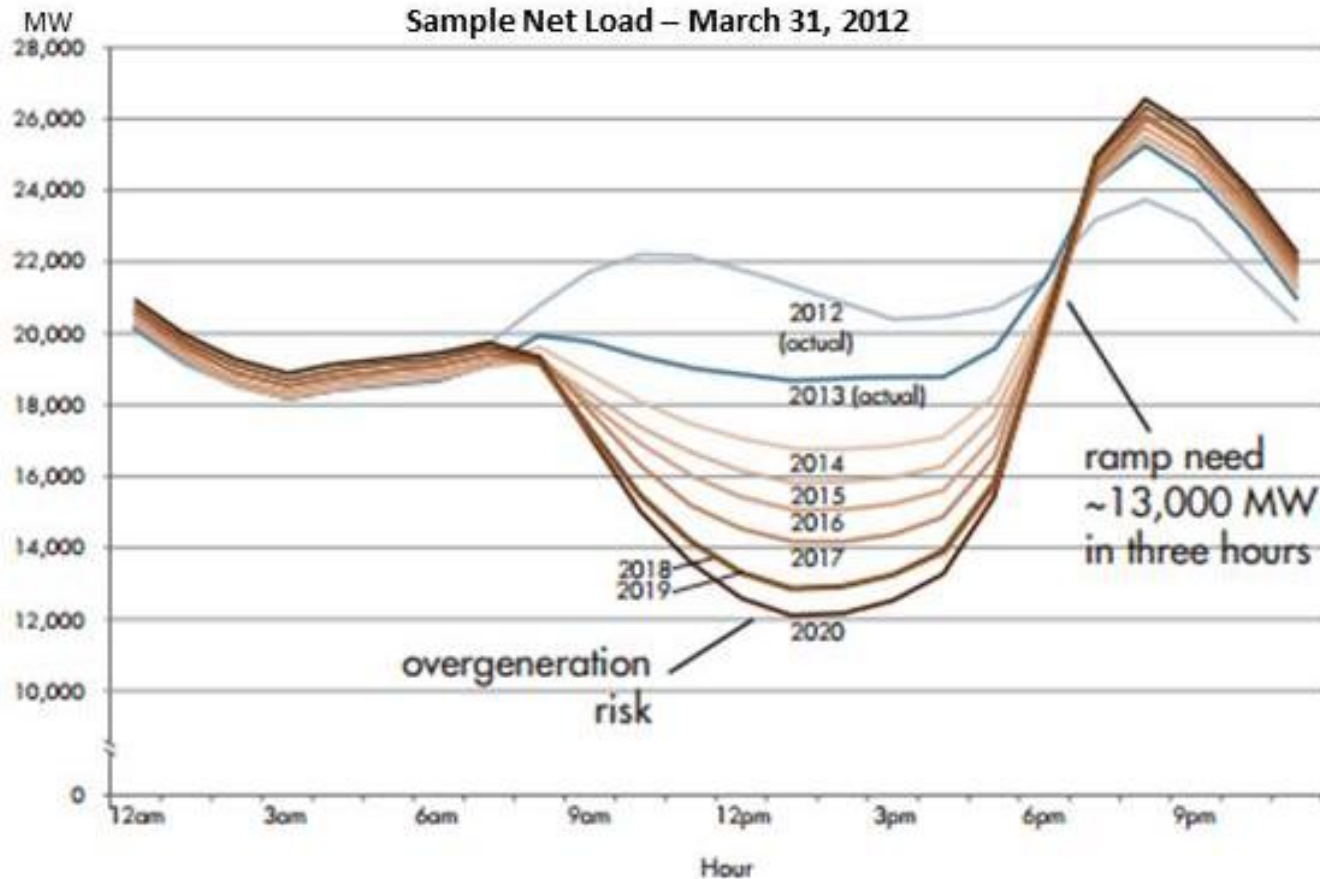
It can be very misleading to compare the energy costs for wind and solar to the energy costs for more conventional generation technology and assume the difference is the cost of providing for “clean” energy.

The power grid requires so much more support than the injection of energy. Unfortunately wind and solar do not provide support “services” as well as many other generation resources do. Accounting and providing for these extra “services” should be part of any comparison of resource types and inform any directives or plans impacting the provision of electric power. To the degree that wind and solar resources make up a larger portion of the supply mix, significant costs will be incurred to maintain system functionality and reliability. This posting is focuses solely on how various resources impact just one of these “services”, the balancing of system loads and resources.



# Context

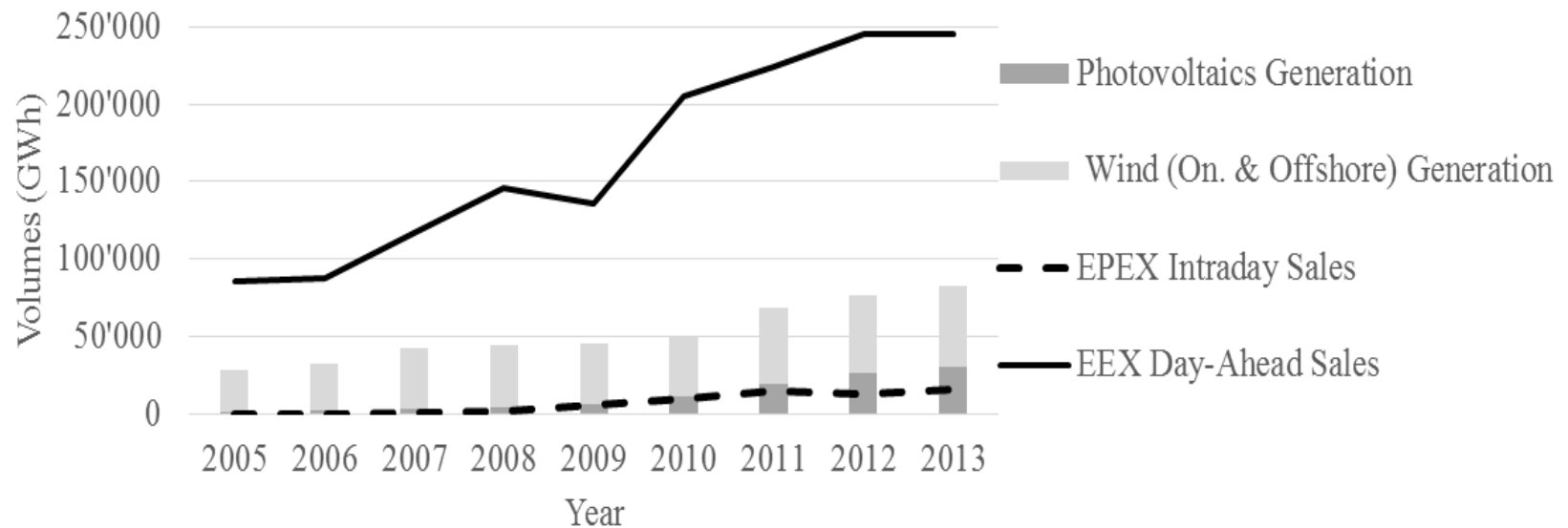
## Increasing ramping needs and risks of overgeneration



Question: How to smoothen the duck curve?

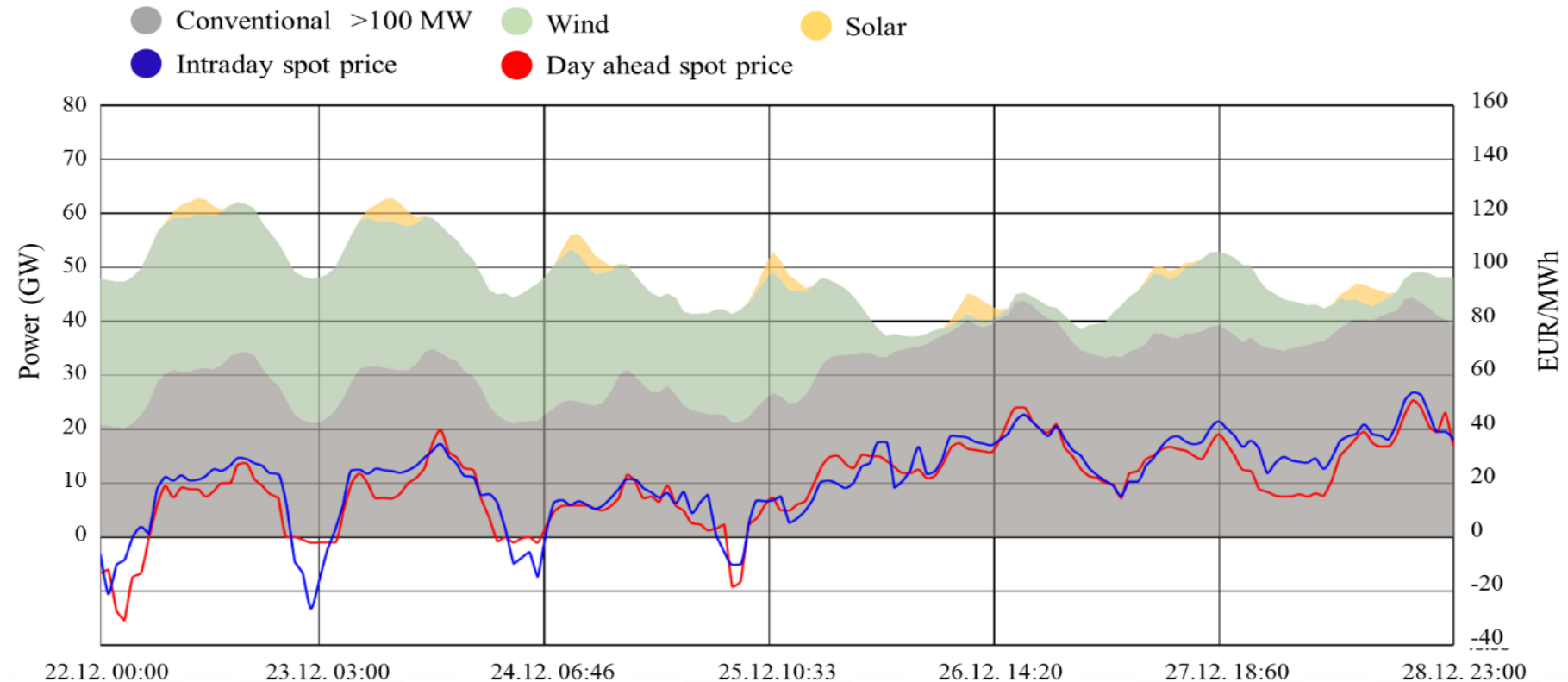
# Context Trends

- ... **Increasing share** of renewable energies
- ... Increasing **volatility** in the market
- ... Increasing **short-term trading**

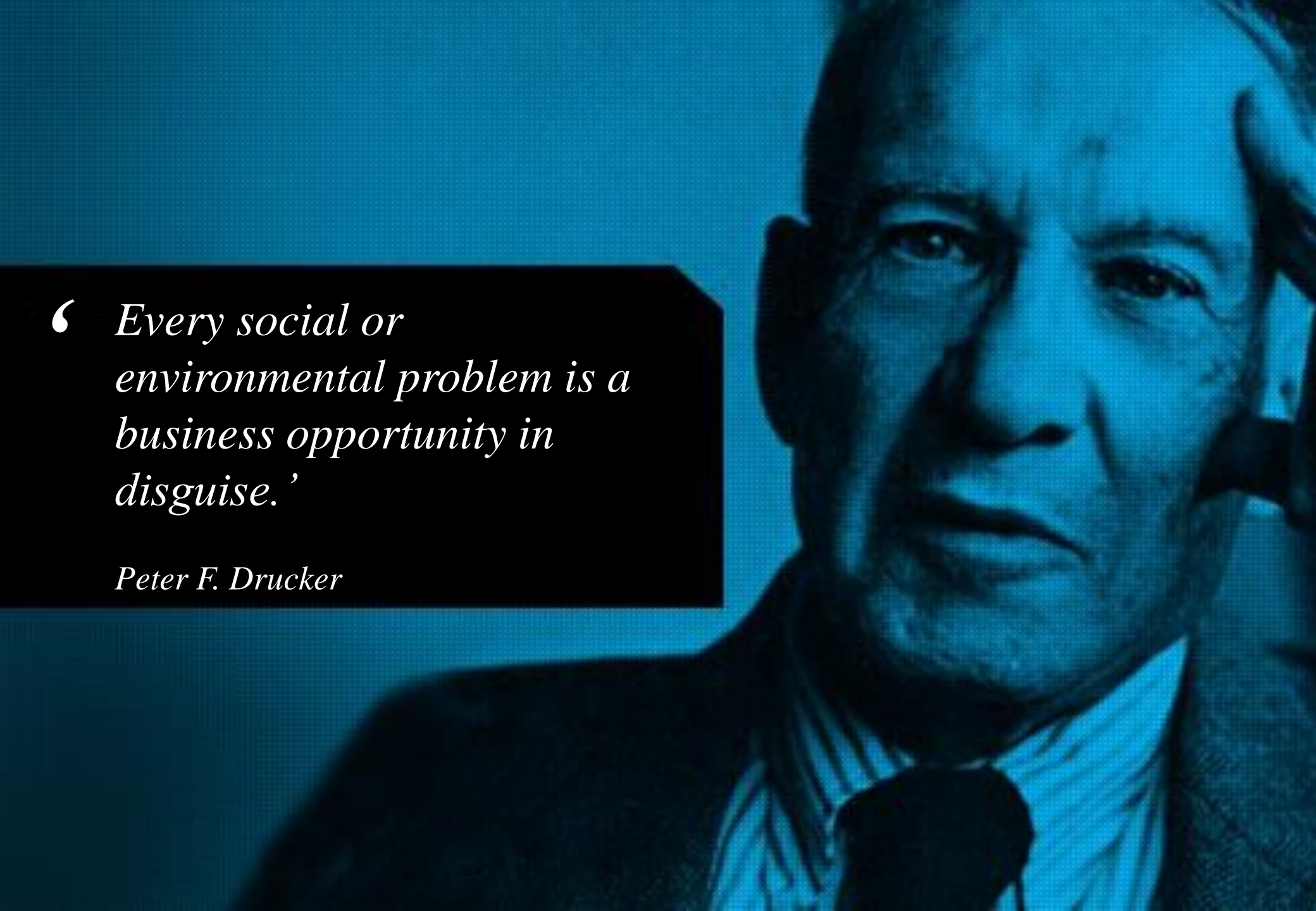


# Context

## Trends cont'



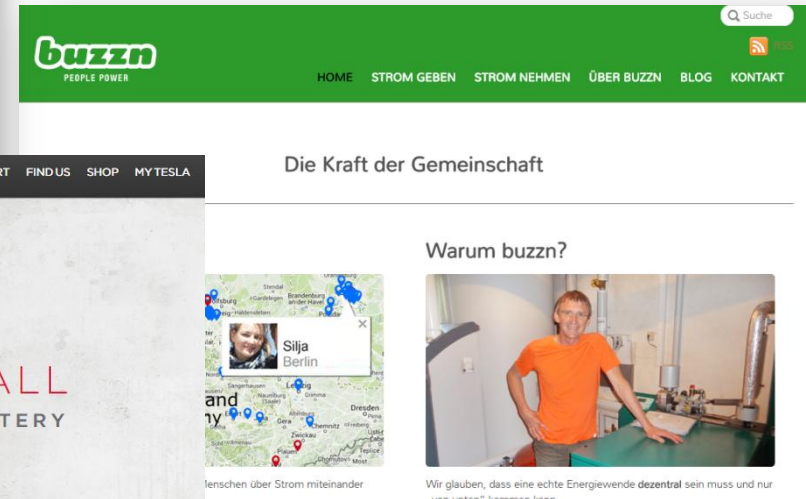
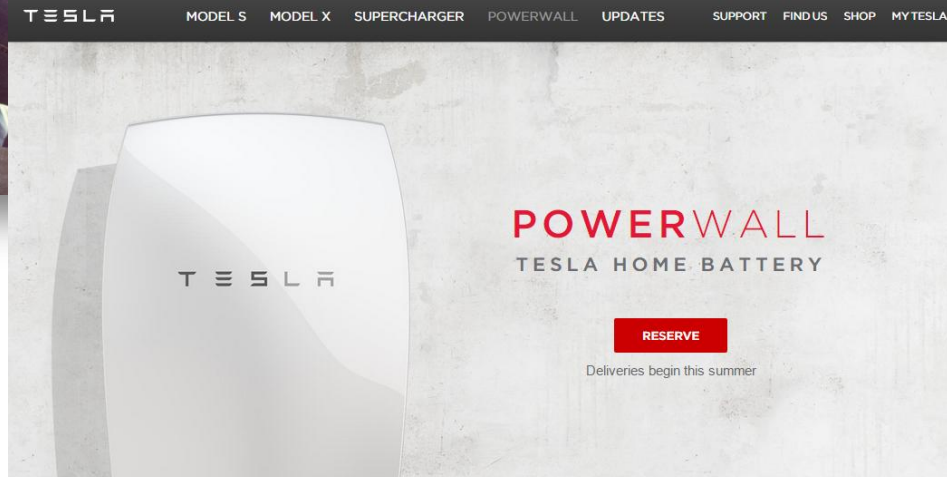
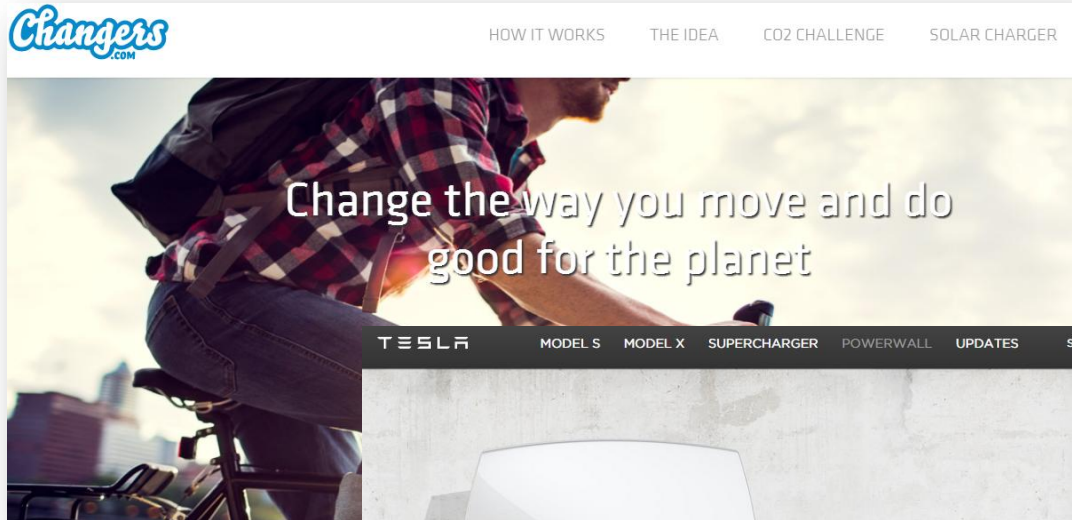
**Fluctuating share of renewables results in fluctuating prices**



*‘ Every social or  
environmental problem is a  
business opportunity in  
disguise.’*

*Peter F. Drucker*

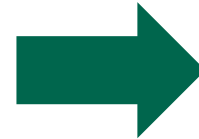
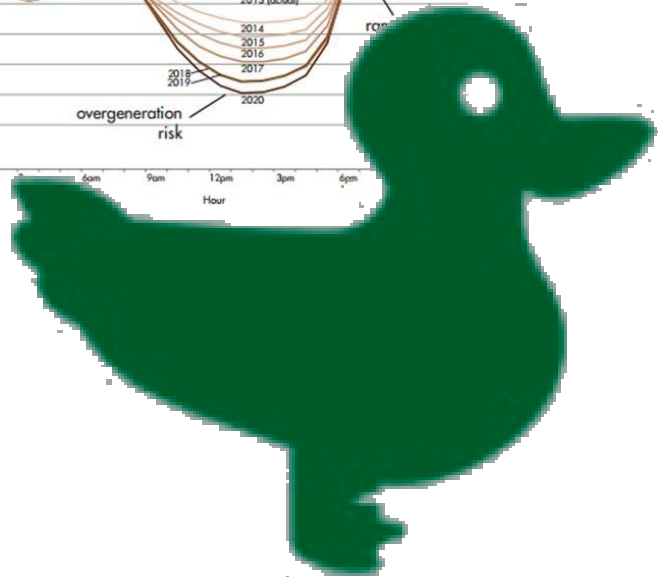
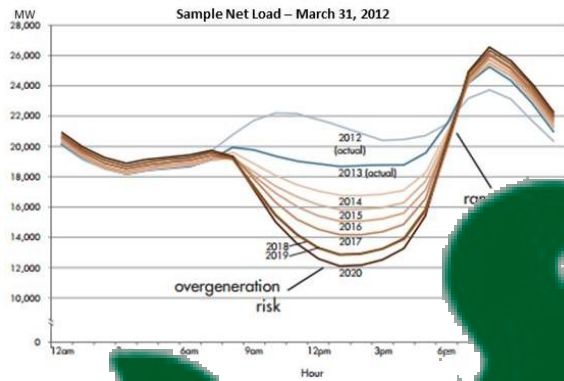
# Increasingly new business models in the energy market



## Energy Storage for a Sustainable Home

Powerwall is a home battery that charges using electricity generated from solar panels, or when utility rates are low, and

# New Opportunity from the duck curve: flexibility!



## Flexibility creates value!



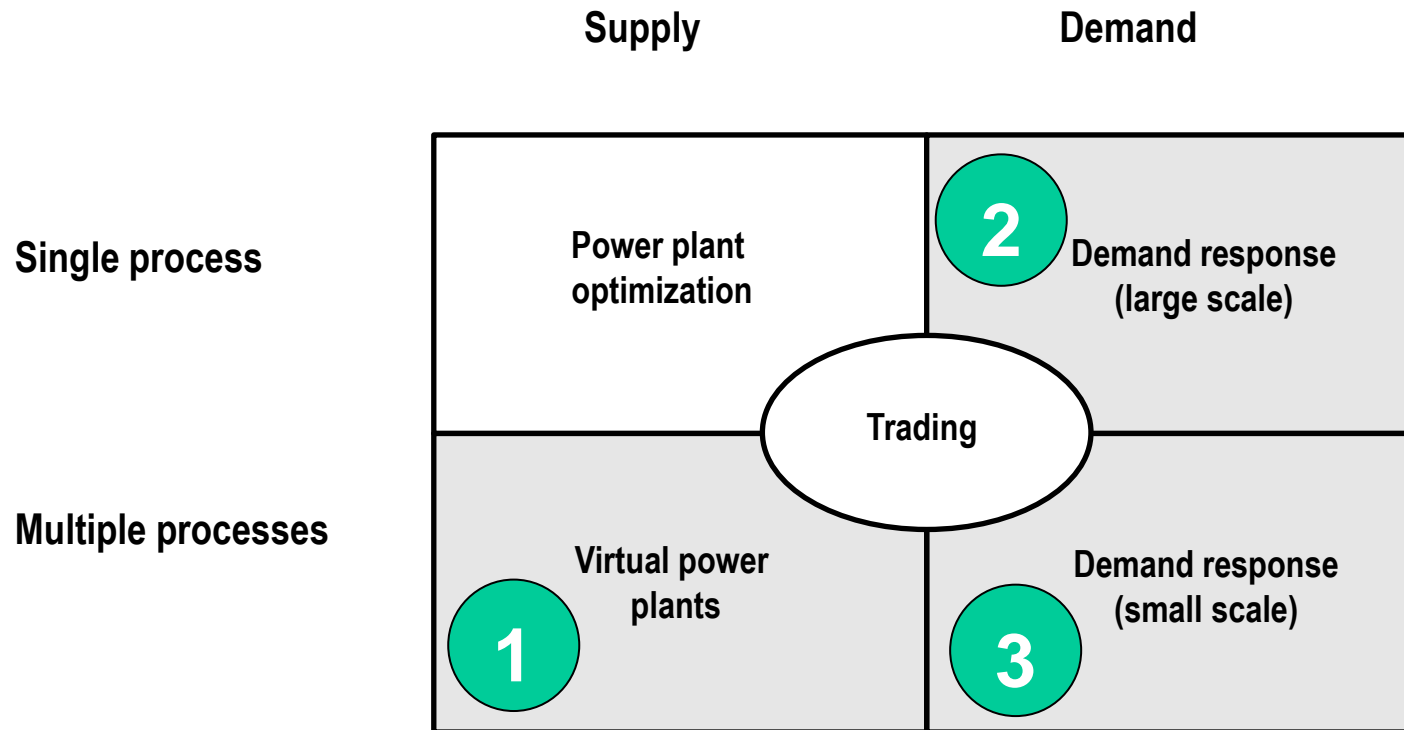
# Study in the energy industry on flexibility based business models

- Study: qualitative multiple-case study
- Industry reports, production data
- Interviewed 13 experts in the energy industry

Type/case	Company	Company description	Interviewees
Power plant optimization	B	Utility company (Top 4 power producers and traders in Switzerland)	Head of optimization
	D	Solution provider for power plant and grid optimization	Managing director
	A	Utility company (Top 4 power producers and traders in Switzerland)	Head of analysis trading
Trading	G	Utility company (Top 4 power producers and traders in Switzerland)	Head of trading
	B	Utility company (Top 4 power producers and traders in Switzerland)	Head of trading
Demand response/large consumers	C	Demand response aggregator	Manager board of executives
	K	One of the largest power consumers in Switzerland	Head of trading & sales energy
	F	VPP operator	Head of public relations
Virtual power plants (VPP)	I	Demand response aggregator and VPP platform provider	Managing director
	H	VPP operator	Head of portfolio management
Demand response/small consumers	K	Demand response and smart grid pilot project led by leading German utility company	Project lead
	J	Demand response platform provider	CEO
Industry experts	E	Innovation cluster and energy trading and optimization company	Industry expert

# Findings

## Timing-based business models



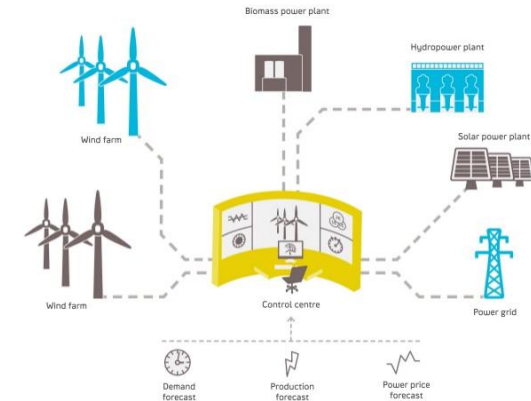
# Timing-based business models

## 1. Virtual power plants

- **Business model:** de-central combined solar and wind power
- **Value proposition:** Users earn a fee by providing flexibility
- **Examples:** Next, Lichtblick

*“The costs [of our business model] are mostly determined through... transaction costs. You have to **provide an IT platform**, you have to **illustrate processes**, and you need a **retail division**. You need to go to the client, communicate with him, and arrange a meeting. These are the four major blocks that I see.”*

*(Interviewee virtual power plant expert)*

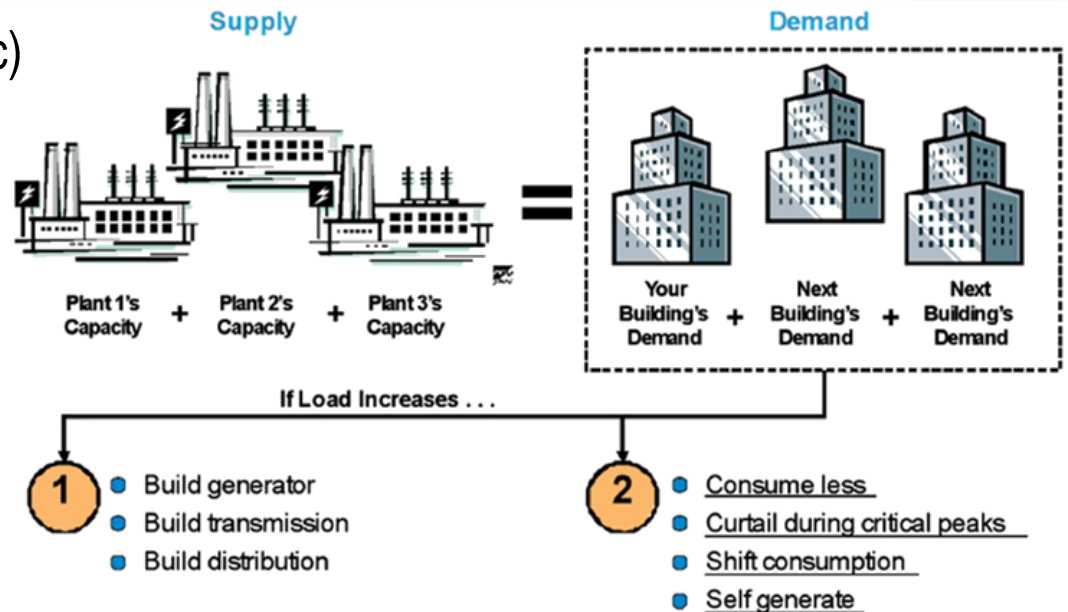


**Core activity:** synchronizing small supply units

# Timing-based business models

## 2. Large-scale demand response

- **Business model:** creates value by shifting demand towards times of high renewable energy generation
- **Challenge:** requires firms to **disrupt consumption processes** and patterns
- **Example:** Entelios (now Enernoc)



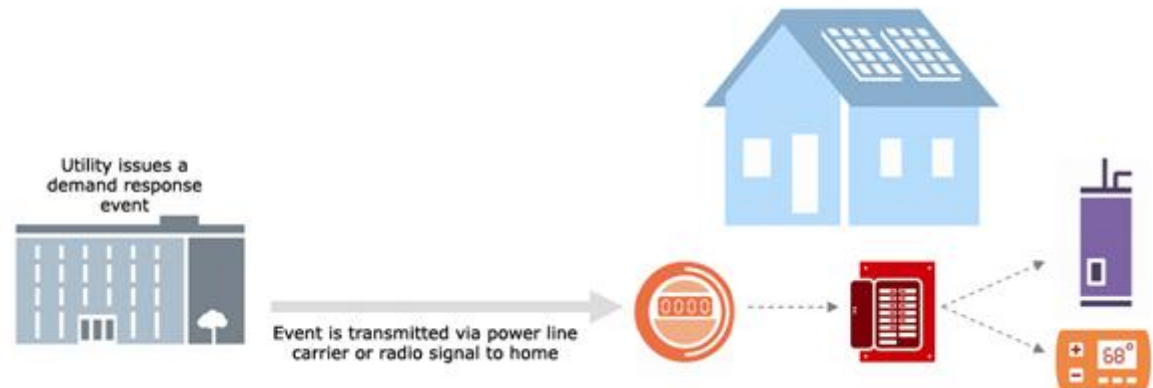
**Core activity:** guiding large scale users

# Timing-based business models

## 3. Small-scale demand response

- **Business model:** using ICT involving small consumers in demand response programs
- **Challenge:** high transaction and intervention costs
- **Examples:** MeRegio-Project, BeSmart program

*“the **customer** wants to have something, so that he changes his behavior. He **doesn't do anything for free**. And it needs to be a noticeable amount, so that he says: ‘Okay, there are at least 50 Euros of earnings per annum for me’.”*  
Expert demand response



**Core activity:** orchestrating multiple small users

# Model

## Timing-based business model

### ■ Opportunity drivers:

- Fluctuating supply and demand
- Storage limitations
- Required system stability

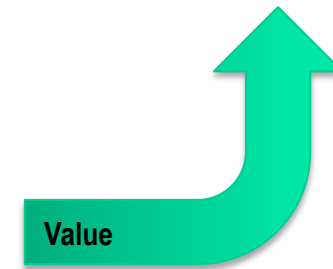
### ■ Value created:

- Reduced risk
- Leveraged flexibility
- Synchronization of demand & supply

New Business Models



	Supply	Demand
Single process	<i>Isolated timing</i> e.g. power plant optimization	<i>Guided timing</i> e.g. demand response of industrial partners
Multiple processes	<i>Synchronized timing</i> e.g. virtual power plants	<i>Orchestrated timing</i> e.g. demand response of private households



## Conclusion – smoothening the duck?

- **Renewable energy production has increased** fluctuating production which creates a stress on the grid
- **Opportunity for new ICT enabled business models that provide flexibility**
  - Power plant optimization, Trading, Virtual power plants, Large-scale demand response, Small-scale demand response
- **Create value:** reduce risk, leverage flexibility, synchronize demand and supply
- **Challenges ahead:**
  1. How to incentivize small scale users
  2. Intelligent synchronizing algorithms
  3. Forecasting future scenarios of flexibility





**Q&A?**

**Thank you!**