Smart Grids aus der Sicht der europäischen Netzbetreiber

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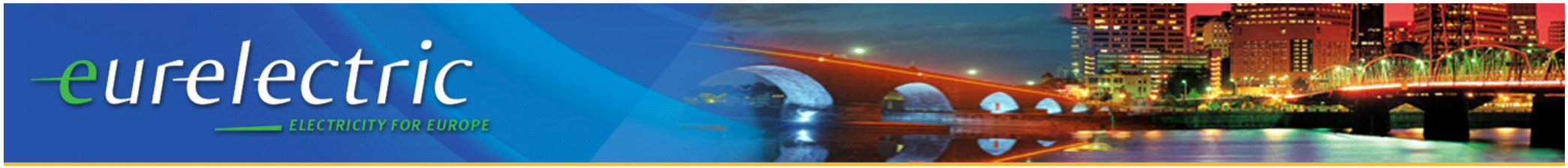
ELECTRICITY FOR EUROPE

e-control
09 March 2010



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EURELECTRIC represents the whole value chain of the European electricity industry

Generation > Trading/ Wholesale > Retail > End-customers

Transmission > Distribution

(MoU with TSOs)

Highlights

1. The regulatory framework should adapt to the new challenges
   - DSOs have a new mission – The regulatory framework must adapt to this
   - Not all technology related activities must be regulated – regulation must also facilitate a market development
   - Adding “smartness” to the regulatory framework
2. Smart Grids Case Studies
3. Implications for the wholesale and retail market

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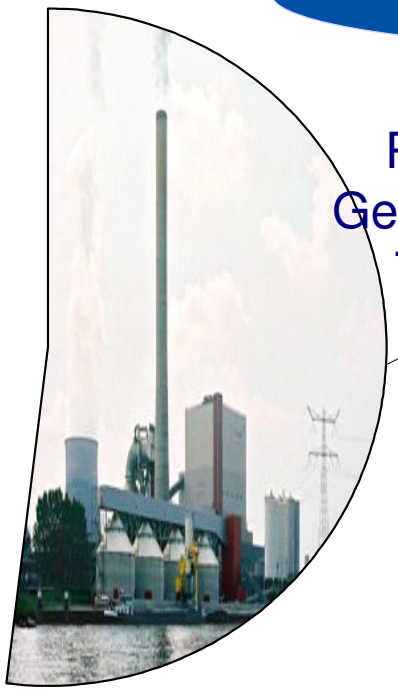
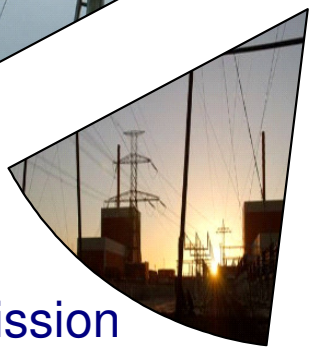
The IEA sees about 6 600 billion USD investments into the global power grid by 2030

Extension and renewal

Distribution
4 500



Power
Generation
7 100



Transmission
2 100

∑ 13 700

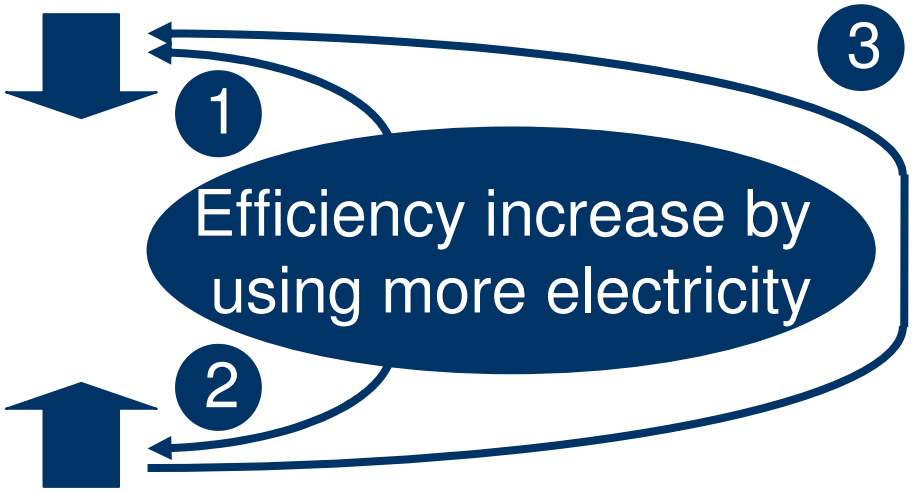
Cumulative rounded
in billion USD (without inflation)
Years 2008-2030

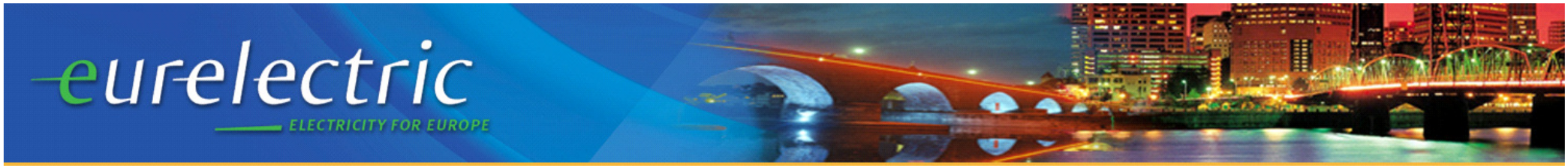
Source: IEA World Energy Outlook 2009; p.106; own calculations

The role of electricity: The 20-20-20 targets are interlinked

- 20% reduction in CO2 emissions
- 20% increase in energy efficiency
- 20% contribution of renewables in the energy sector (resulting in 35% for the electricity sector)

Triple benefit of using electricity:





Stronger case than ever for DSM (Demand Side Management)

- **More useful:** More intermittent power (renewables) that needs to be balanced -> volatile power prices
- **More to play with:** Higher energy efficiency increases electricity demand (electric vehicles, spatial heating…) and distributed generation
- **Better tools:** New Information and Communication Technologies available to steer demand based on demand analysis

Balancing intermittent power requires network investments in one way or the other

- Better **connection of markets** in order to get a better balance of generation and consumption
- Better physical interconnection of the transmission grid and new lines in order to allow **wide area transmission and balance**
- Increased use of **energy storage** options
- Installation of additional **peak power plants**
- Increase of capacity and interconnection of **distribution grids**
- **Fostering Demand Side Management**

The requirements of the 20/20/20 targets, customer needs and electric vehicles integration will change DSO mission

New Challenges:

- Higher share of distributed and/or intermittent generation (renewables)
- Consumers participating actively in the market (producing, managed load)
- Energy efficiency targets
- Moving load (electric vehicles)

In addition to Traditional mission:

- Transport electricity from G to L
- Ensure reliability

What is a smart grid?
Alternative definition

+ Network reinforcement and interconnection
+ Network automation
+ Distributed Generation
+ DSM
+ Data management

= Smart Grids

Evolution

Revolution

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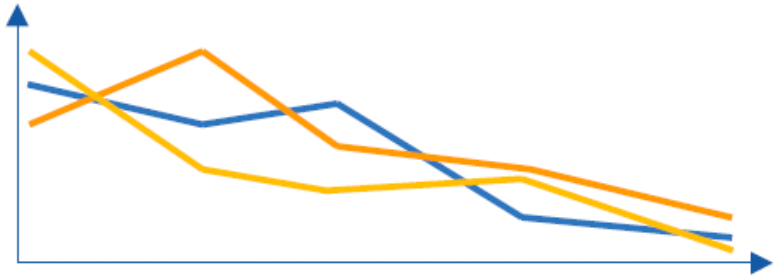
Smart metering

- Smart meters
- AMI and customer information portal
- Tariffs and billing systems
- Database for network information

Power management

- Integration of distributed generation
- Preparations for large market penetration of EV/PHEV
- Power flow and power balance control
- Island operation



Fault management

- Network automation equipment
- Smart assets (substations, cables etc.)
- Self-sectioning/self-healing network
- Outage management systems
- Mobile equipment (generation, transformer, switchgear etc.)

Asset management

- Monitoring and diagnostics
- Decision support tools (risk based analysis)
- Net and asset strategy planning tools

Communication and system integration

- Communication infrastructures
- Communication standards
- System integration
- Cyber security

Electrical grids play an important role

- The future will be greener, however, it also will be more electric
- Smart grids for smart customers
- If you like renewables you also have to have like electrical lines

The main traditional rationale behind regulation is to prevent the abuse of a monopoly position and will have to be extended…

Utility	Customer/ Network user
Cost compensation Investment incentive Cover capital cost	Low prices Quality

…the climate package and the evolving retail market adds elements to the regulatory scope

Utility	Customer/ Network user
Cost compensation Investment incentive Cover capital cost	Low prices Quality
New Mission (EU market and climate packages):	
Supplier	**Society / Environment**
New products Processes (Customer switching)	Reduce emissions Renewables integration Increase energy efficiency

Regulatory framework must consider the new mission of DSOs

- Integrating environmental goals on distribution level
- Incentivising smart grids that enable the creation of a better functioning retail market place
- Removing barriers for investing in technological innovation

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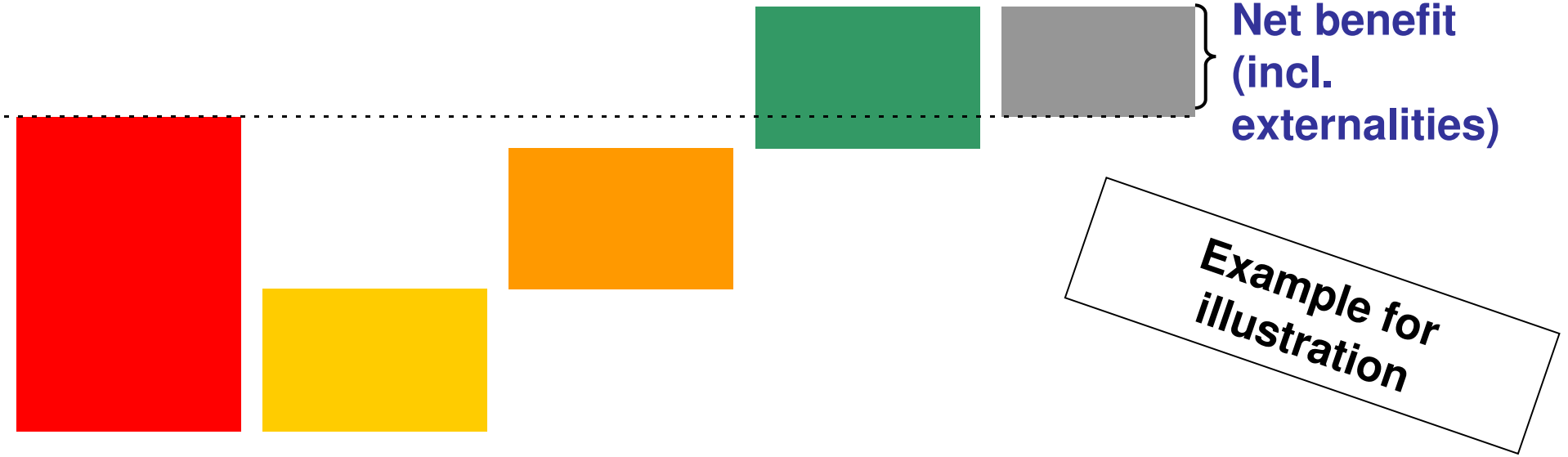
There are areas where regulation is essential

- Economies of scale
- Externalities
- Setting standards enabling interoperability

Investments for smart grids might benefits several parties but are often only done by DSOs



Unbundling rules need to be respected when implementing smart grids

- Existing **unbundling rules** pose a challenge for synchronisation of network investments and the creation of new services.
- **Interoperability** standards enable the market to compensate for lack of synchronisation due to existing functional and information unbundling
- Not everything must be regulated but **regulation is needed to create the right environment** for a market to be developed

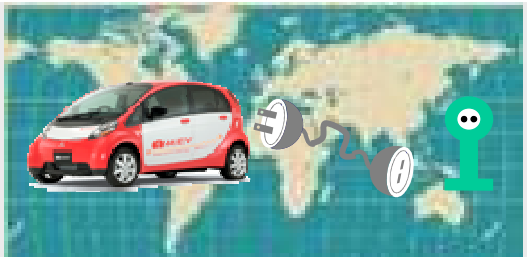
A stable and predictable regulatory framework ensures market development and avoid stranded investments

- Danger of stranded investments (smart meters)
- For customers to put trust in new technologies data protection issues must be addressed in a credible and predictable manner
- In order to give equal access to new players in the new market interoperability of technology is key for success.

Example Electric Vehicles: Standardization benefits customers, utilities and car manufacturers

Benefits from standardization

For customers



- **High convenience**
  - **One single solution worldwide**
  - **No adapters** or different cables needed
- **Faster** electric vehicle **run-up/market success**
- **No retrofit costs** for adopting to new charging systems

For Utilities/ Automobile Manufacturers *)

- **Cost benefits**
  - **No sunk costs** for proprietary interim solutions
  - **Shared** development and standardization **costs**
  - **Economies of scale**

*) in particular OEMs (original equipment manufactures)

Electric vehicles

EURELECTRIC supports an OEM/Utility standardisation initiative started end of 2008 to accelerate and improve standards definition

- **Draft Proposal accepted as pre-standard**
- **Initiative will be converted into official ISO/ IEC standardisation groups**

Within the Framework of the Task Force Electric Vehicles EURELECTRIC participates in this initiative.

Principals of electric vehicle/ grid standards can be transferred to smart grids components

- Open communication standard (TCP / IP)
- All market stakeholders can use protocol to communicate
- Several software provider can be used ensuring competitive prices that keep cost and tariffs low
- Standards offer investment security and give market opportunities to new players

Example: DSM requires the "right" smart devices

Conventional meter	Simple Smart Meters (AMR)	Advanced Smart Meter SmartGrids / DSM
• Deferred information on consumption •Annual billing	• Accurate and timely consumption Information • Peak pricing •More frequent billing	• Real time metering ▪Bi-directional flow of information; contribution to energy balance ▪ Highly flexible pricing models connected to the availability of energy
• Energy efficiency actions not directly effective on bill	• Consumer needs to actively response to info to reduce bill	• Permanent reduction of bill without permanent consumer decisions

Energy suppliers can use meters to extend their services

- meters according to legal requirements as pre-requisite for new services
- system is modular and extendable

EXAMPLE

regulated

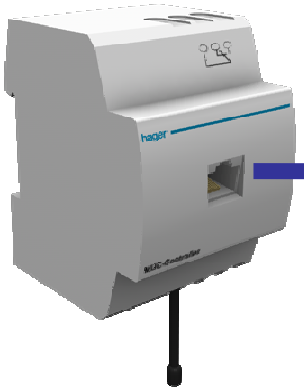
Electricity meter

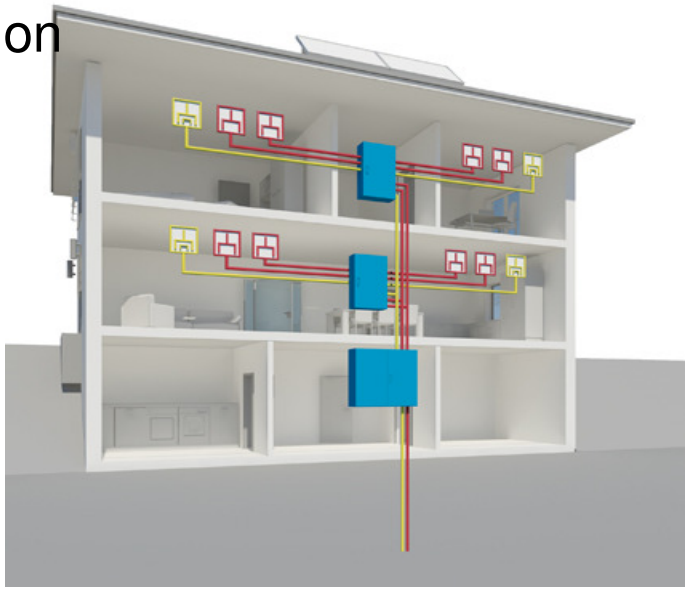
Gas meter

Water, Heat
(not included in directive)

Non-regulated (but based on standards)

Multi **U**tility **C**ommunication Controller





Smart Home

Suppliers' and new service providers' roles should be defined and let the market work

- The roles of the meter operation and metering service have to be defined and assigned
- As soon as smart meters play a physical role with respect to system stability this also has to be reflected in the regulatory framework
- Concerning costs it should be defined who pays for customer information, more frequent billing or energy balancing
- New roles like (data) exchange agent have to be defined

Not all technology related activities must be regulated – regulation must also facilitate a market development…

- When geographical or coordinated roll out of smart grids elements offers cost advantages it should be done by one company e.g. the DSO
- Interoperability standards enable the market to compensate for lack of synchronisation due to existing functional and information unbundling
- Not everything must be regulated but regulation is needed to create the right environment for a market to be developed

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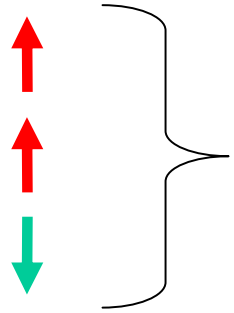
The cost and risks incurred cannot all be covered by the market or existing recovery mechanisms

- Risk
- Capital cost
- Operating cost



expected effects

Ideas for adding "smartness" to the regulatory framework (1/2)

- Internalise positive externalities
- Foster collaboration projects among stakeholders
- Tariff of use – reallocate network tariffs among stakeholders

Ideas for adding "smartness" to the regulatory framework (2/2)

- **Performance based ratemaking** (guaranteed/overall standards)
- **Smart Grids factor** in regulation formula (direct effect on DSOs revenues)
- **Load revenues** – charge customers for actual load (capacity tariff €/kW)

Conclusion

Regulation must…

- **Open new market opportunities for existing suppliers and new players**
- **Empower the customers to make use of new possibilities**
- **Contribute to define the right market model**
- **Incentivise investments in new technologies with positive externalities**

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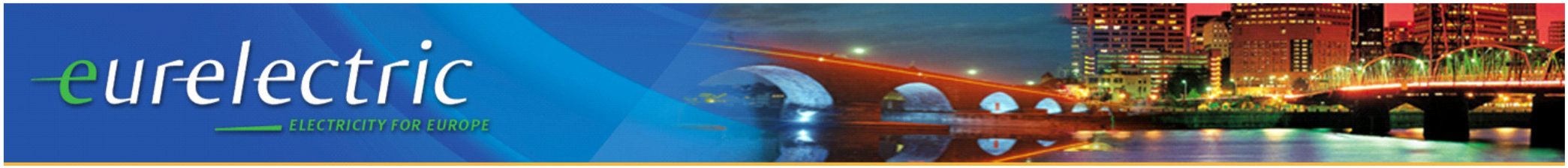
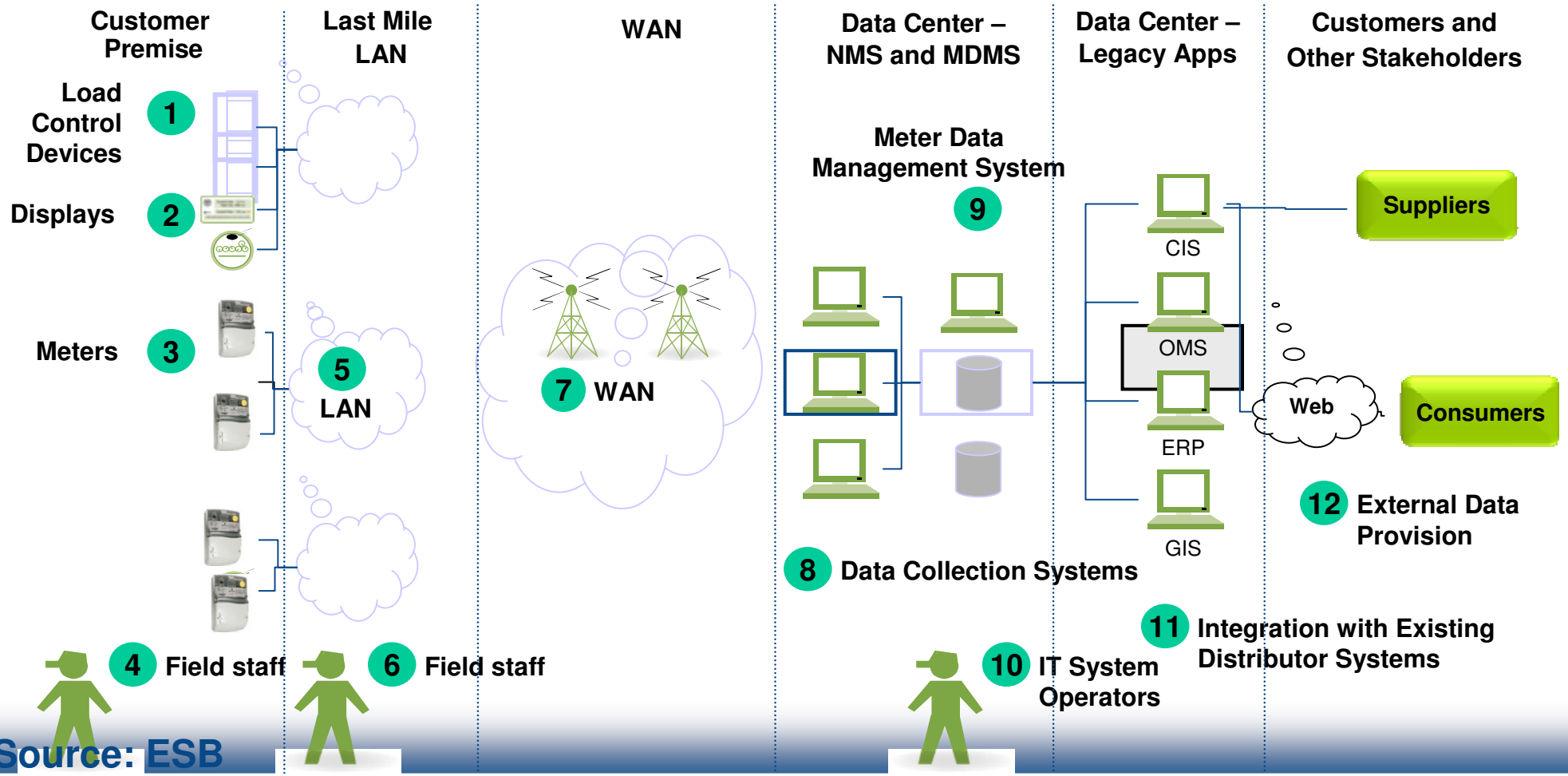


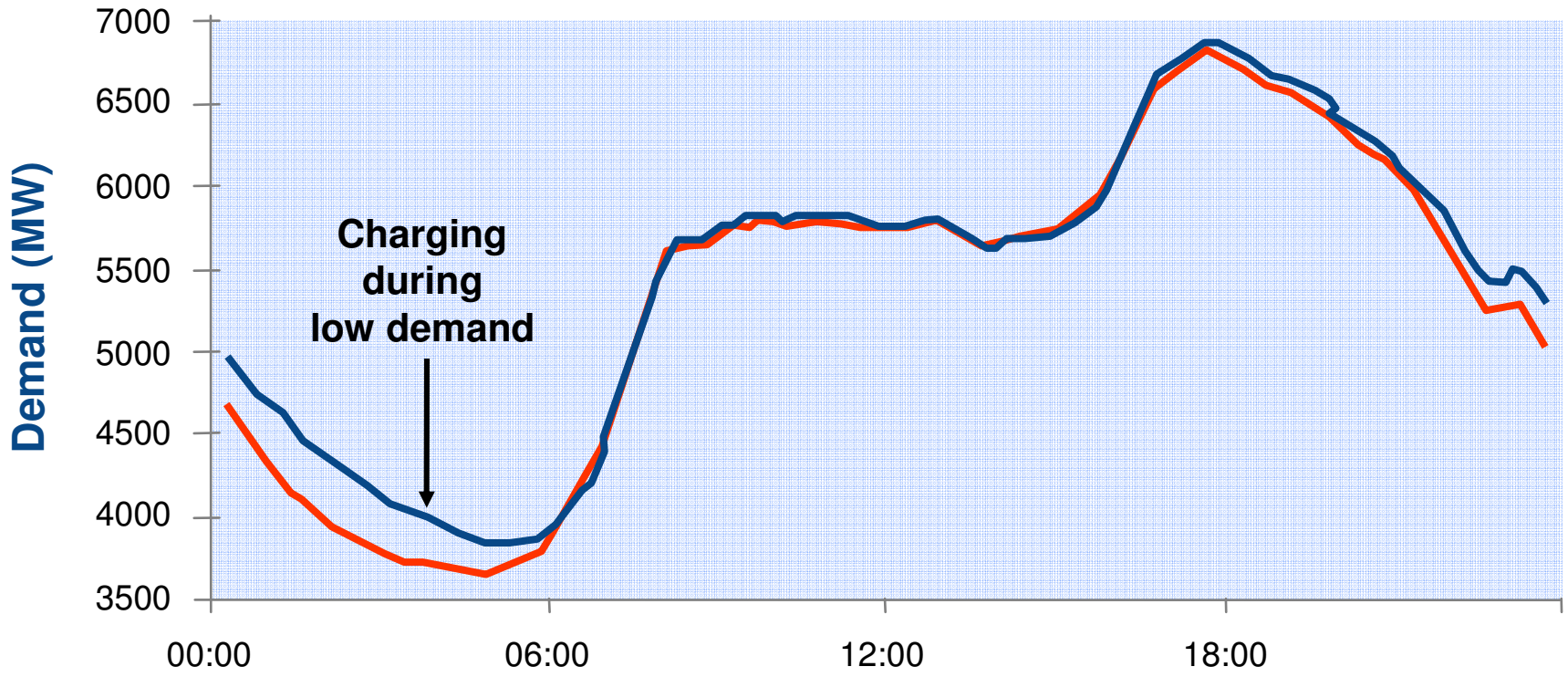
Case Study: ESB (Ireland)

A.M.I. is more than just meters – it's a complex integration of an engineered system of sensors, devices, communications, and software technologies



Source: ESB

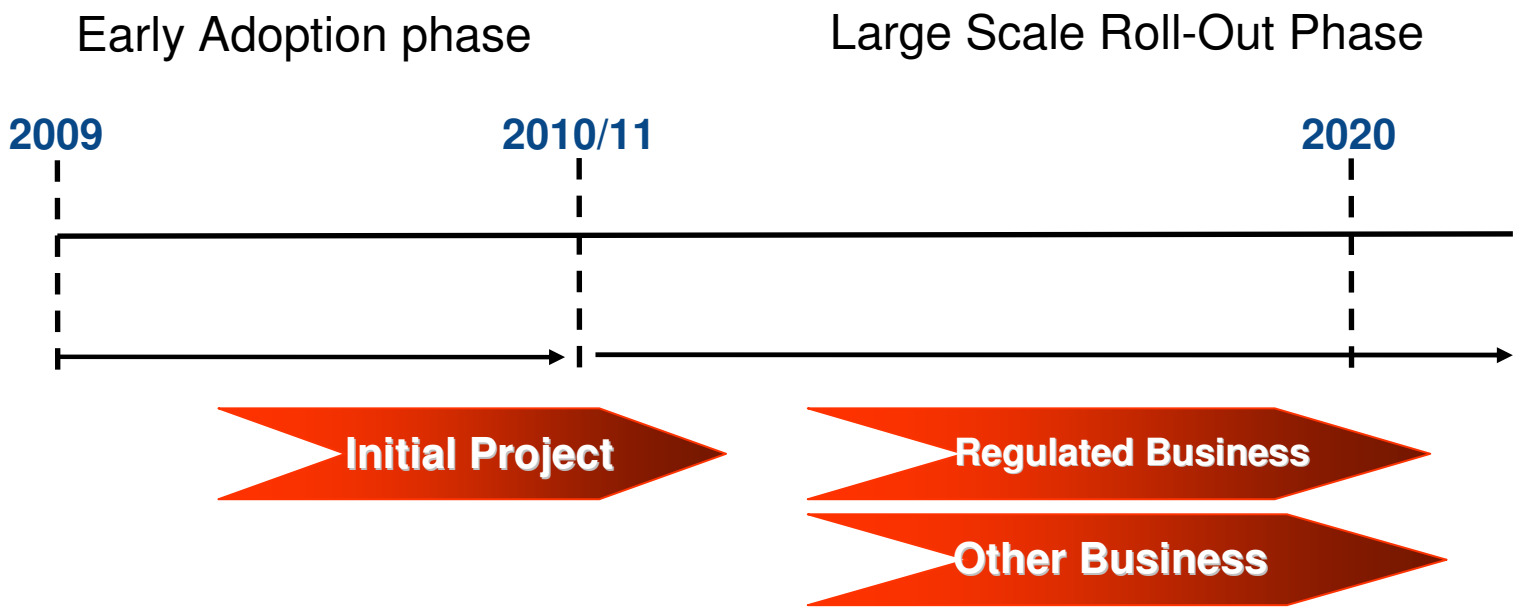
Can the Electricity Grid cope with EVs?



Electrical demand on an average day in 2020

Source: ESB

Electric Vehicle Implementation in Ireland



- Ensure supply of EV's to Ireland !
- Demonstration: Cars + Charge I/S
- Identify IT /Market System Options
- Link to Smart Networks
- R&D

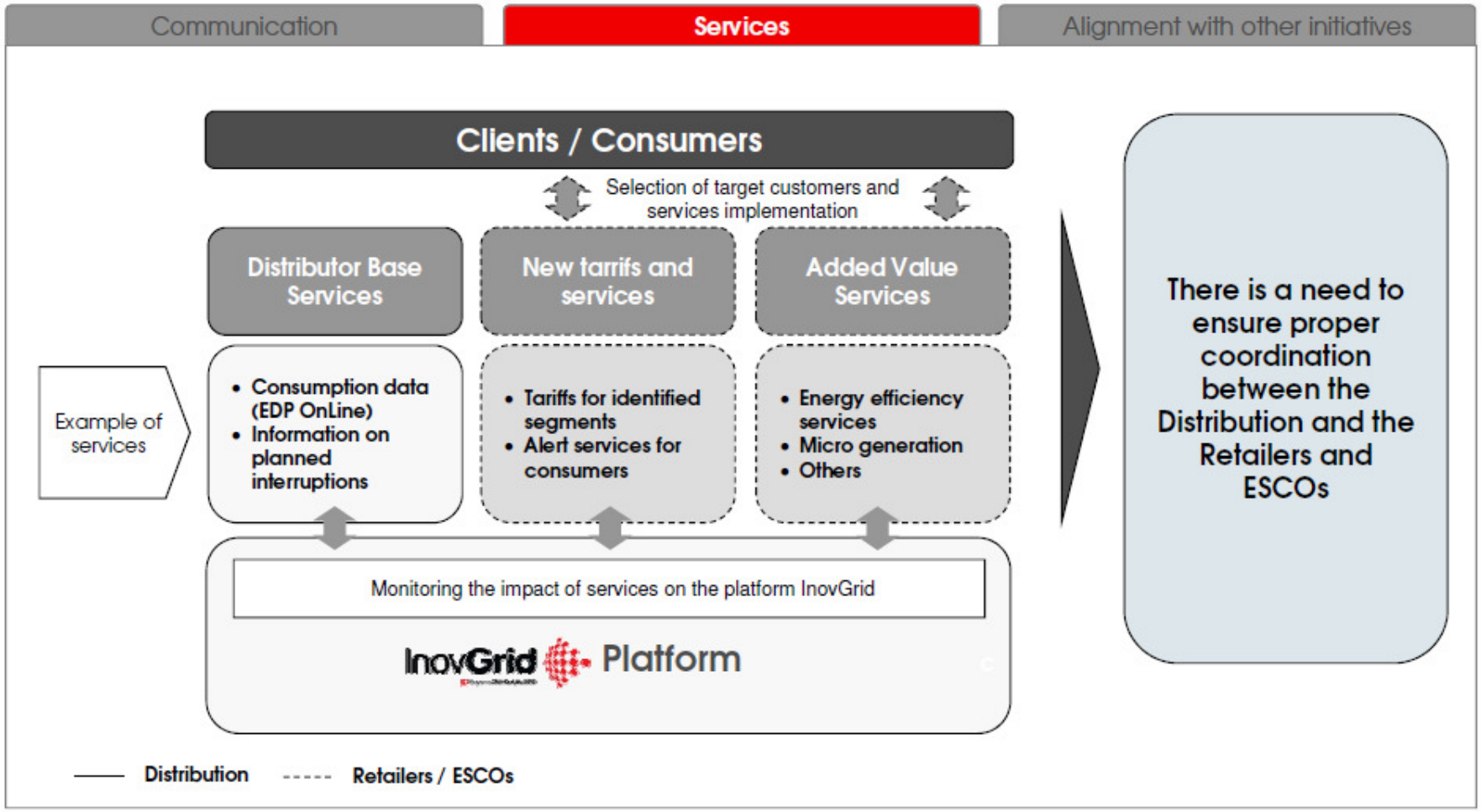
- Secure large scale penetration
- Address scale infrastructure requirement
- Address System Issues - storage/demand

Source: ESB

Case Study: EdP (Portugal): Inovgrid

Controlled deployment – Services

When developing new tariffs and services, it is essential to ensure a good articulation between distribution, retailers and ESCOs



Controlled deployment – Other initiatives

There are also several complementary initiatives under way, and it is necessary to ensure a good relationship with the overall project

Communication | Services | **Alignment with other initiatives**

Other indicatives

Electric Vehicle	• Development of a study to determine the best location for the charging stations, by the University of Minho • Ongoing installation of the first charging station in Praça do Sertório
Micro generation	• Held first contact with DGEG elements to eliminate or reduce restrictions on micro generation in Évora • It was suggested the development of a concrete project (EDP Innovation) to present to the Secretary of State
Public Lighting	• Ongoing evaluation of projects to renew the public lighting in symbolic places in Évora, in line with the city council • Implementation of the Protocol with the National Association of Portuguese Municipalities (ANMP) for modernization of public lighting, with efficiency gains

To ensure the alignment between the defined initiatives, namely actions to develop on the field

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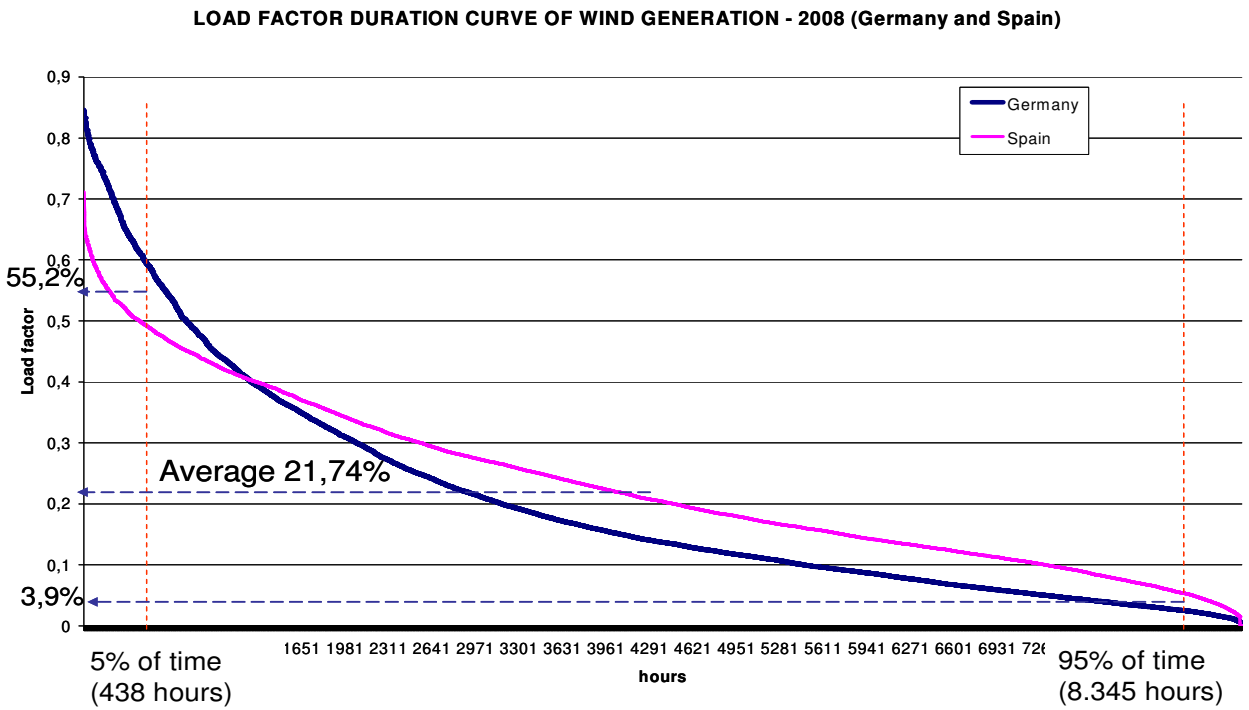
Aggregate distributed generation will allow prosumers and small producers to sell in the wholesale market

- VPPs create a single operating profile from a composite of the parameters characterizing each distributed generator
- flexible representation of a portfolio of distributed generators to make contracts in the wholesale market and offer services to the system operator
  - Capture the value of flexibility
  - Increasing value of assets through the markets
  - Reduce financial risk through aggregation
  - Improve the ability to negotiate commercial conditions

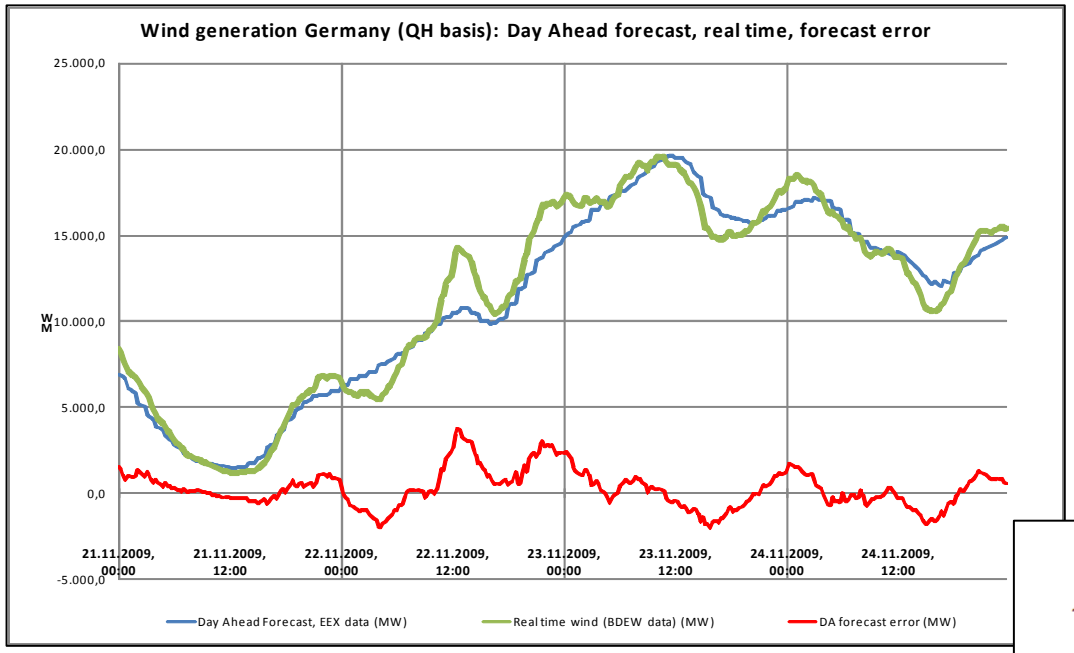
Source: Fenix Project (with adoptions)

More renewables make more backup capacity necessary

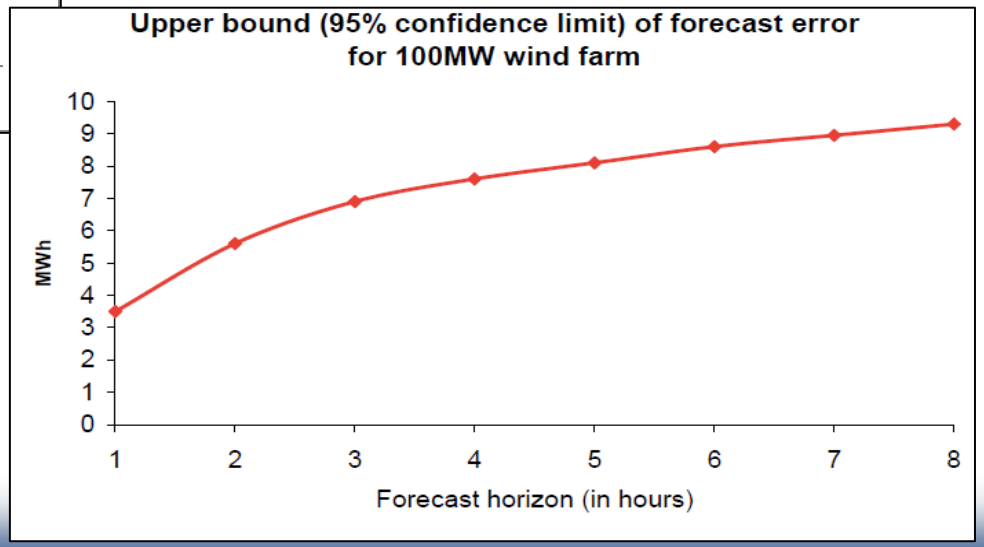


- Only 3.9% installed wind capacity has same (95%) firmness/availability as “conventional” plants
- Close to 45% of installed wind capacity has a level of firmness lesser than 5% and need permanent backup
- Between 3.9% and 55.2% of installed wind capacity needs backup on intermittent basis

There is a need for more flexibility



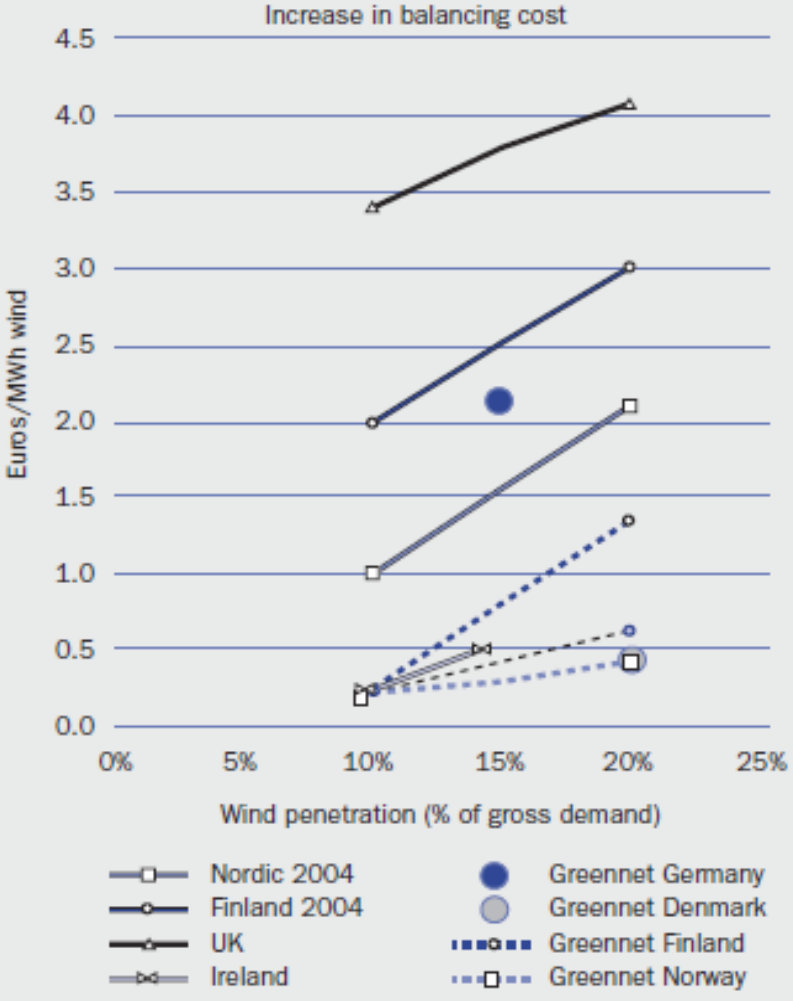
Between day ahead and real time, there are still huge differences, that only can be solved via more availability of flexible plants



Flexibility options:

- **Gas** procurement, gas storage as well as grid access
- **Electricity** storage solutions
- **Demand** side management

Impact on balancing



Source: EWEA report:The Economics of Wind Energy

Some studies show “moderate” costs (4€/MWh) but more quantitative analysis is needed to include all system cost components:

Energy cost is only one part

Downwards regulation will require to reduce conventional plants to their P_{min} or even baseload plants in order to keep flexible CCGT

Keeping out of the money flexible plants creates a capacity cost (socialised via grid tariffs)

Shift from low to high RES penetration requires additional investment of flexible plants which will only be (economically) built if balancing prices justify their investment

Reduction of balancing costs can be achieved via a well functioning XB intraday market

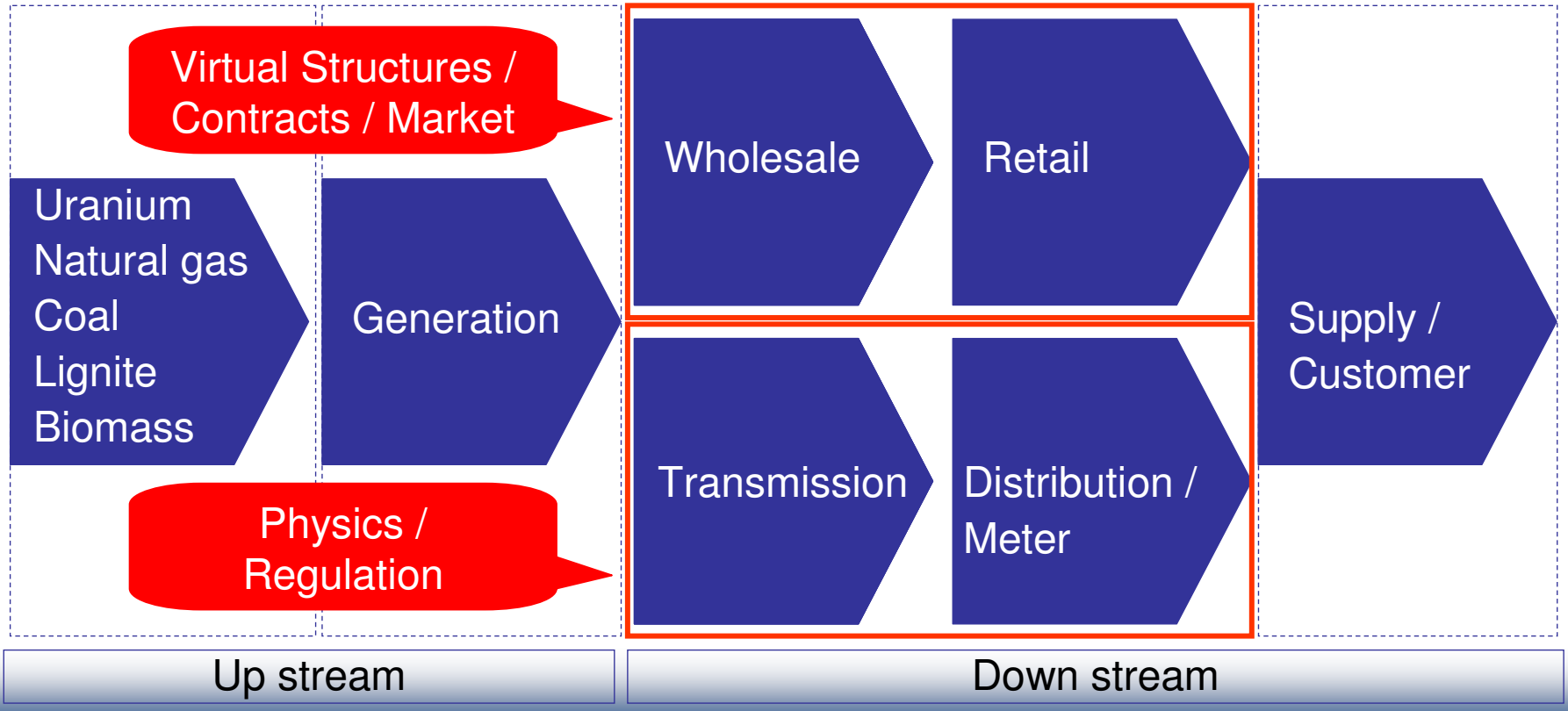
DSM as new option for balancing

Demand side management

- Primary control — no
- Secondary control — no
- Minute reserve — yes – 15 min interval
- Load shaving — yes – 60 min interval
- Load shift — yes – 60 min interval

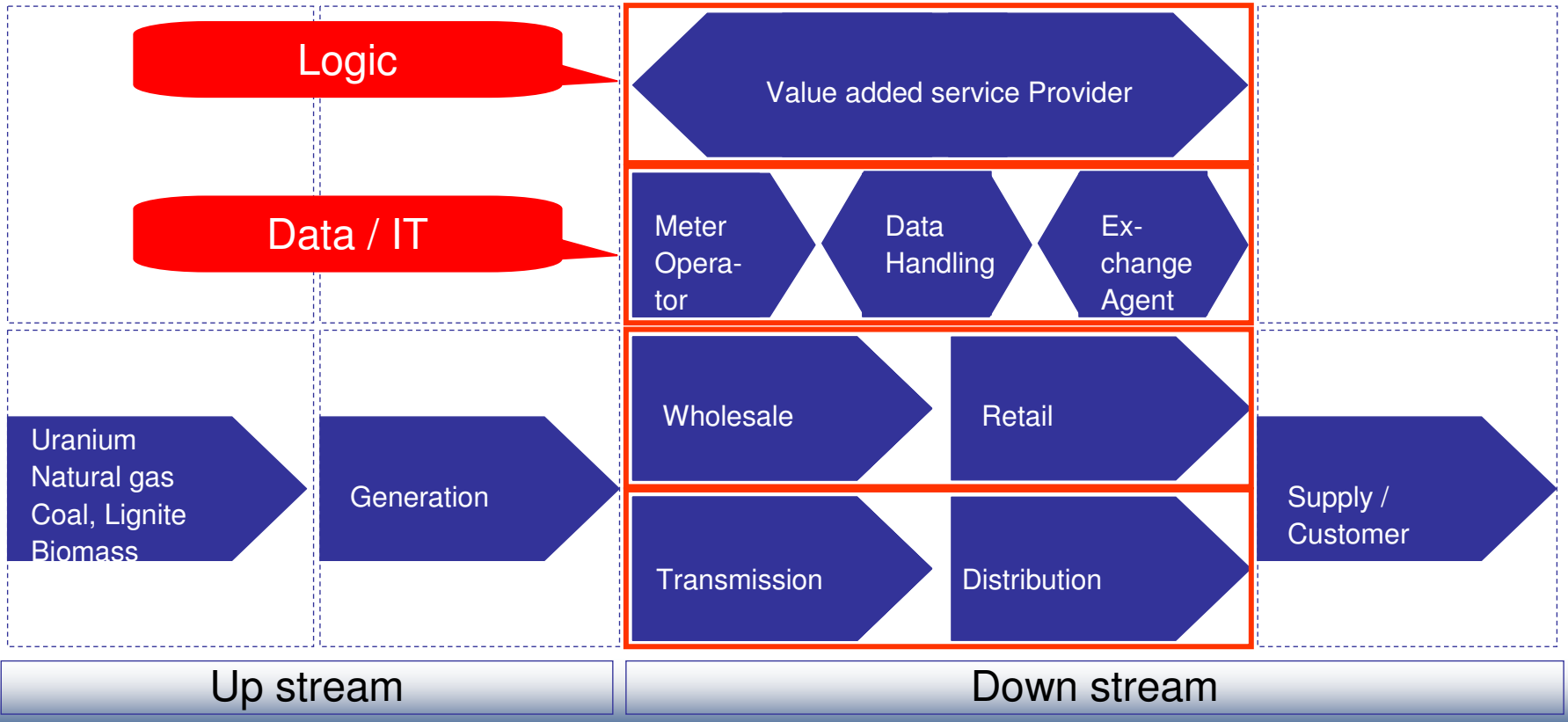
Generic Market Model

Market model today



Generic Market Model

Market model tomorrow



Further Information

Conference: How will Smart Grids change the the face of how we distribute and consume electricity

- EURELECTRIC 2 x ½ day Conference
- 13/14 April in Brussels

www.eurelectric.org

- Smart Metering position paper (2008)
- Upcoming: Smart Metering roll-out recommendations

Thank you for your attention !

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