



GLOBAL TRENDS IN ENERGY MARKET REGULATION



Finnish Energy Conference

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Innovation by experience





Contents

- A bit of History
- The General Design of Electricity Markets, agreements and disagreements
- The New Challenges
- Conclusions



A bit of history- The models of the Power Sector

- Practically every country has defined its own model of the power sector. However, it would possible to group these models in three categories:
 - The traditional vertically and horizontally integrated utilities, almost exclusively before the 1990's
 - Integrated utility that produces energy but also buys from Independent Power Producers.
 - The market model, initially developed in the 1990's and which was implemented in most of developed economies



Drivers of the Change to the Market Model

Strategy

Efficiency through competition in generation and retail

Regulation for activities not appropriate for competition, specifically networks

Objectives

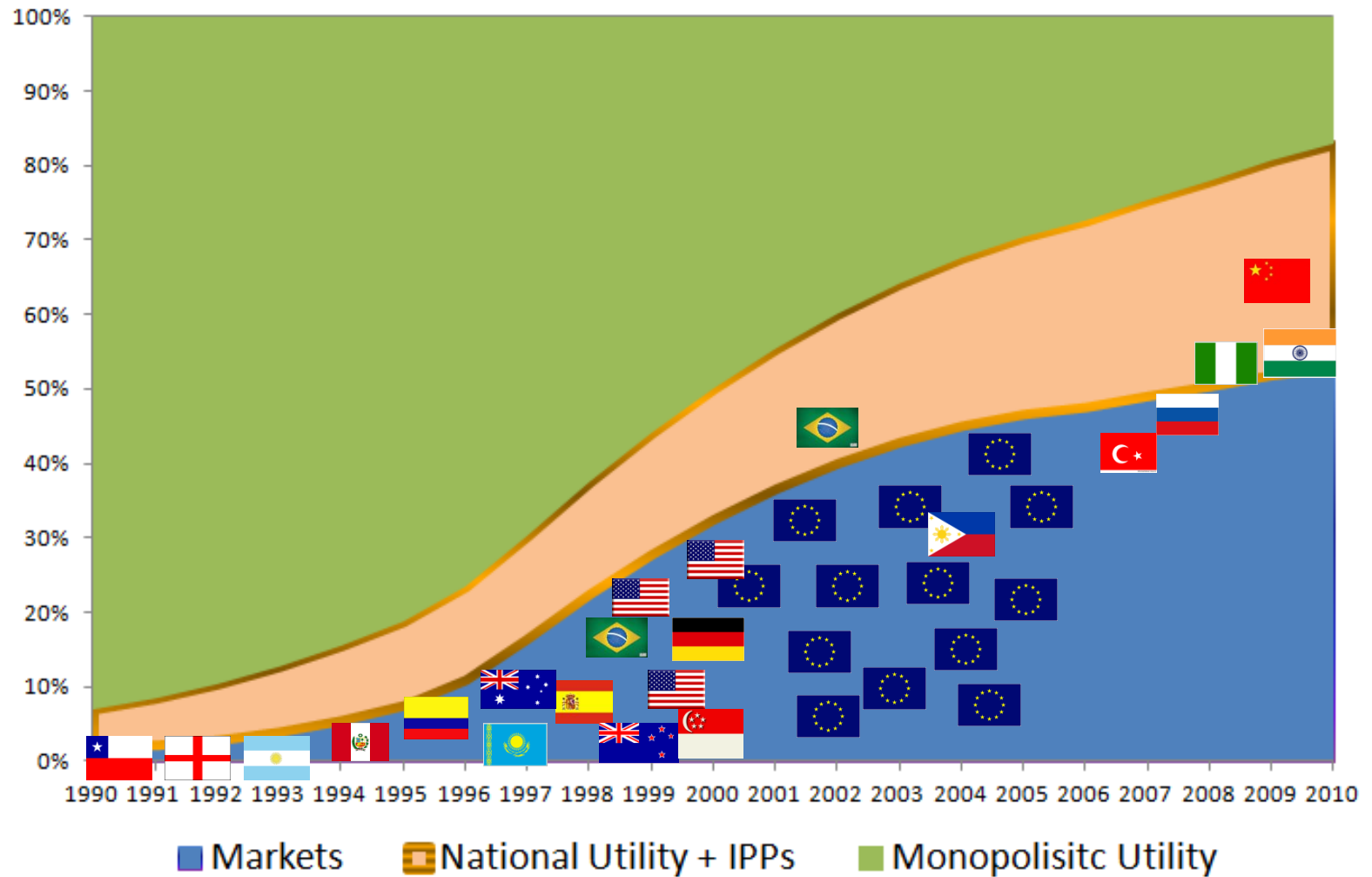
Search for efficiency, as the traditional model had no incentives for reducing costs and making prudent investments

Facilitate the financing of the sector, introducing dynamic and creditworthy players

Increased efficiency and appropriate financing ultimately should lead to lower tariffs and better service quality for end users



Evolution of Each Model - Energy Generated



Common Characteristics of Electricity Markets

Multiple sellers and buyers with open access to transmission and distribution networks

Medium and long term market based on bilateral contracts and/or Power Exchanges

Short term (spot) market based on offers of sellers and (in some cases) buyers. Bilateral or auctions



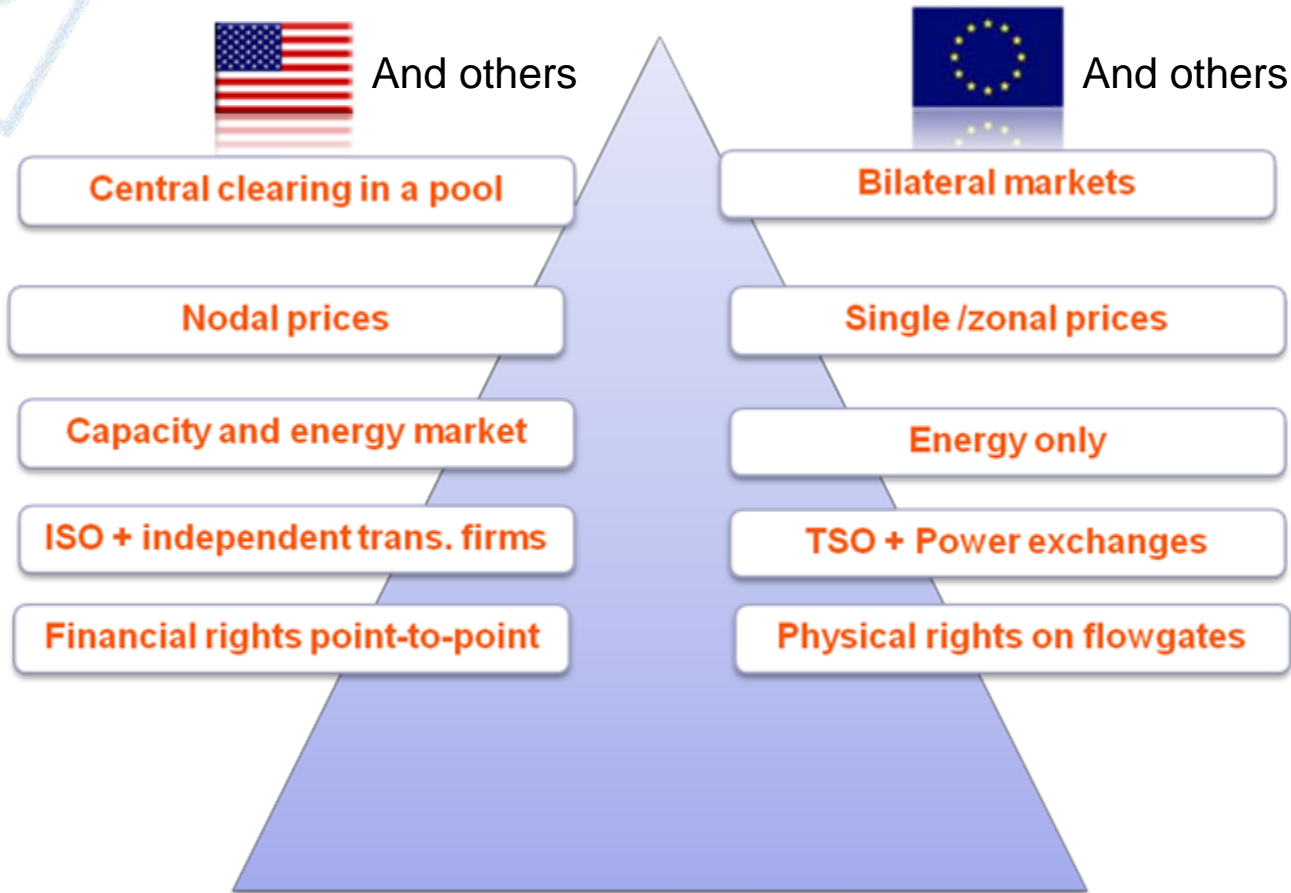
A System Operator manages the transmission system and the real time markets

Qualified (up to 100%) end-consumers allowed to buy in the wholesale or retail market

Transmission and distribution remain regulated activities



Lack of an agreed “best practice” design of the markets



Some common (unsolved) problems

Market Power: almost all the markets show prices above the “competitive level”,

Benchmarks are the prices based on variable costs. In a truly competitive market sellers optimise their bids offering their variable cost,

Consequence of characteristics of the electricity (non-storable, almost no real time demand response) and high concentration of ownership,

Lack of effective solutions:

- . US: ex-ante mitigation measures
- . EU: low activity, some ex-post actions by competition authorities
- . LA: obligation to bid variable costs

Transmission expansion: the chicken and the egg problem when expansion is planned independently of generation decisions

Without nodal prices, lack of signals for efficient locating of plants

Security of supply: market signal given by energy (and capacity) prices does not allow ensuring socially-efficient level of security

Political/regulatory intervention distorts markets



And other problems only partially solved

Regional integration: some level of success in the EU, where regional market is functioning, but very slow increase of cross border capacity.

Central America market running in the initial stage, several years delay in the implementation of the final stage

Good progress in US and Canada

But in many cases extremely slow integration:

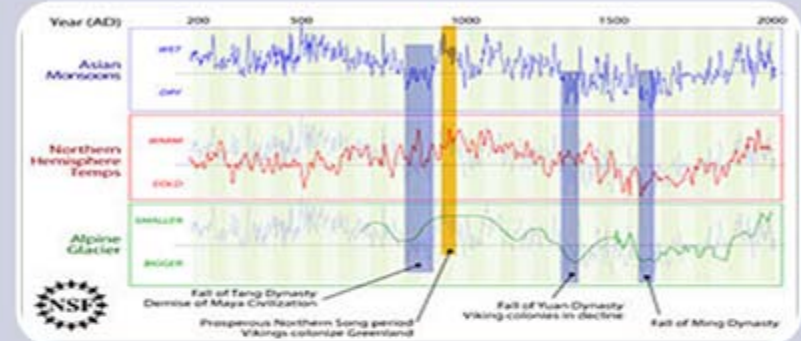
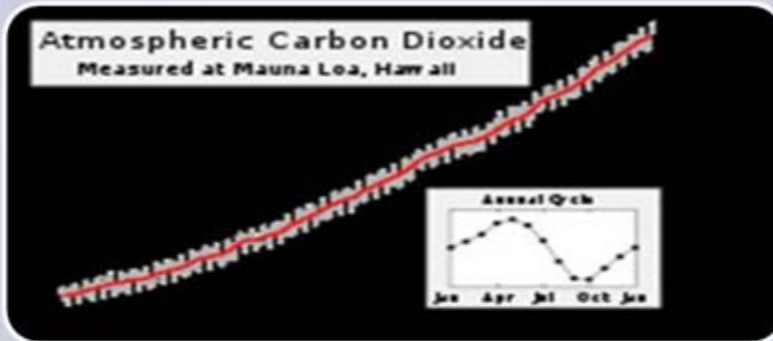
- . Mekong
- . CIS
- . Central Asia (in a regressive stage)
- . South America
- . WAPP
- . EAPP
-

Market Operation: still (well) coordinated rather than joint operation.

Lack of integrated ancillary services and balancing markets



But in parallel with markets' evolution



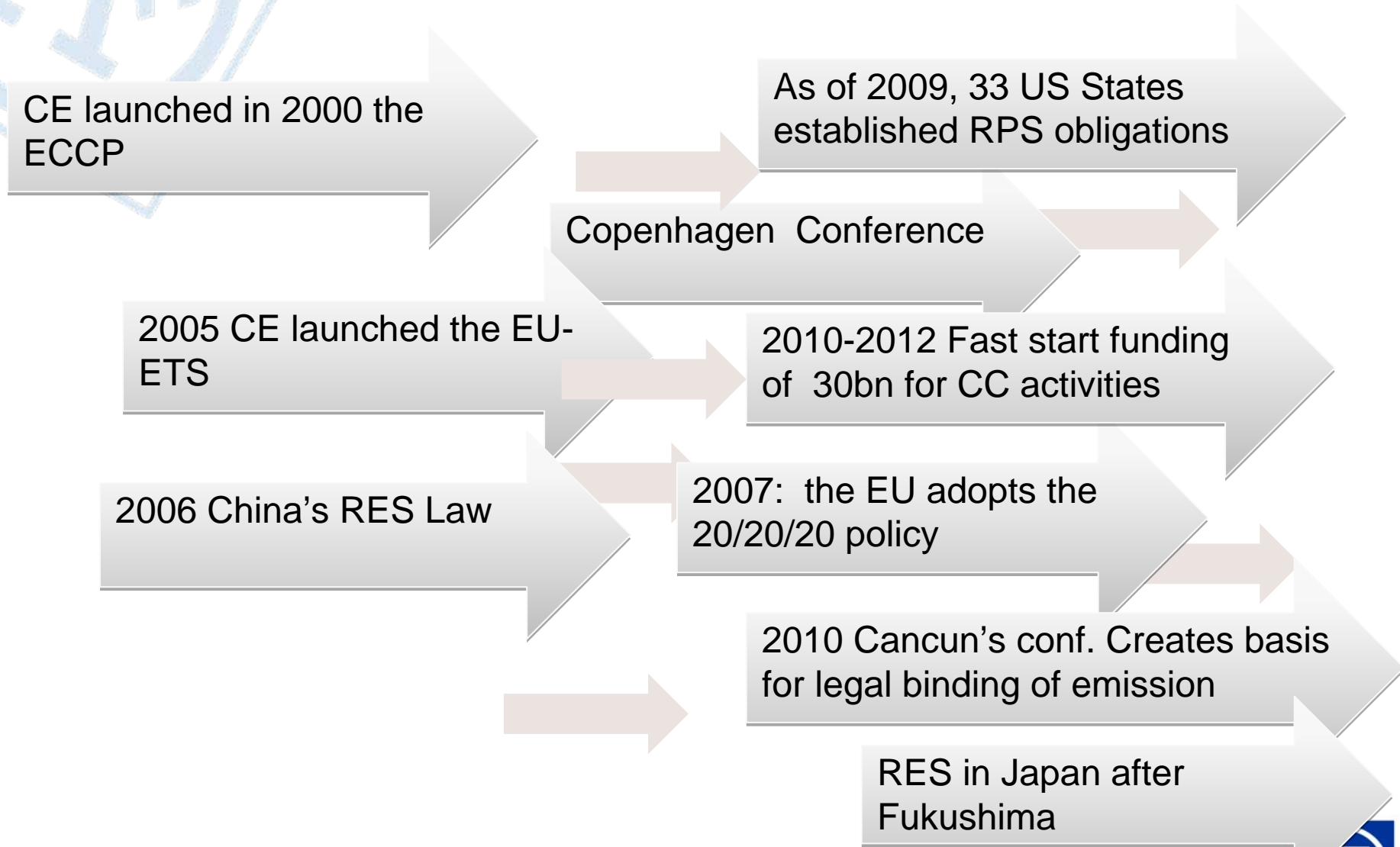
The Intergovernmental Panel on Climate Change was created in 1988.

The scientific evidence brought up by the first IPCC Assessment Report of 1990 unveiled the importance of the climate change issue

The IPCC Second Assessment Report of 1995 provided key input to the way the Kyoto Protocol was adopted in 1997. New Assessments came out in 2001 and 2007.

Kyoto Protocol in 1997 set binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions

Impressive list of CC-related actions



Impact on the Power Sector

- The power sector is responsible for 40% of CO₂ emissions.
- An important part of the CC mitigation policy involves the power sector



Increased participation of RES in the generation mix
Regional transmission to support



Increase energy efficiency



Cap CO₂ emissions, carbon trading
Develop carbon free technologies (CSS, storage)



Demand side actions: Facilitate electric car, smart grids, smart metering, etc



The new challenges

Still without solutions to the previous problems, markets need to solve additional challenges created by developing a low carbon power sector

Energy efficiency:

Which is the most efficient manner to introduce EE
How to create effective incentives to EE
How to plan when future demand is much more unpredictable?
How to incentive demand side participation?

Increased penetration of RES:

How to incentive investments?
How to connect large volumes of spread intermittent generation?
How to plan networks development?
How to protect system security?

Carbon caps, carbon trade and carbon free technologies

- CO2 has a cost,
- Will CCS be commercially-viable?
- Need to plan with uncertainty
- Has Fukushima definitively killed nuclear plants?

Network issues

- Connect and manage charging of electric cars
- Use of smart networks with smart metering
- Regional transmission for spread RES generation



Addressing the new challenges – RES penetration

- **Energy Policy** is increasingly focused on within Climate Change mitigation (and adaptation) actions,
- **This is a priority** for the power sector,
- **And markets have to adapt to this policy.** The main impacts are:
 - RES is subsidized by different mechanisms, and conventional generation has to adapt to this issue
 - Large volumes of zero variable cost RES impact on market prices, common hours with zero or negative price
 - Investments in RES are highly dependant of (changing) promotion policies, so there is uncertainty on their impact on prices and the dispatch of conventional generation,
 - Increased price volatility
 - Need of additional volumes of ancillary services



Addressing the new challenges – RES penetration

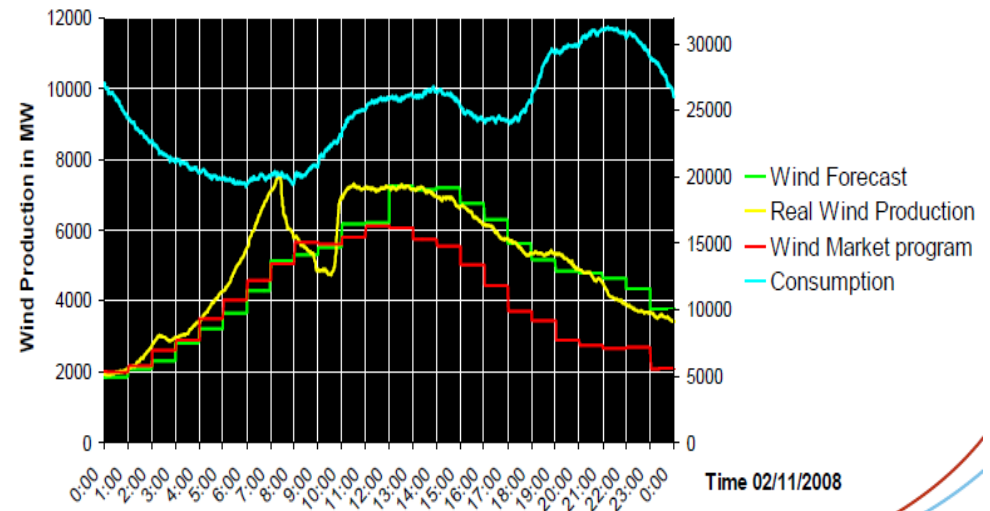
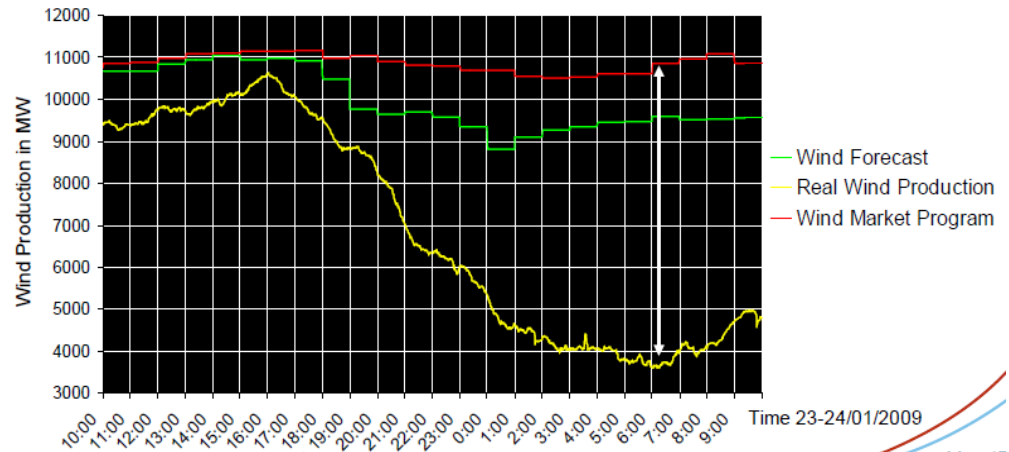
- **The impact depends on the RES technology:**
 - Bio-mass, bio-gas, tidal, waste to energy, and geothermal are predictable and dispatchable, so the impact on operation is similar to conventional generation,
 - Wind and solar are not fully-predictable and non-dispatchable, so system operation should be able to manage this characteristic
 - Wind, solar, small hydro, bio-gas...: large number of small plants spread over large territories, and in some cases far from locations of demand
 - Transmission systems should be more flexible, prepared to adapt to intermittent generation changing patterns
- **Most of the challenges are related to facilitating** a high penetration of intermittent RES, mainly wind. This is an abundant resource with a cost profile which means this technology is close to not requiring subsidy support.



Managing Intermittent RES

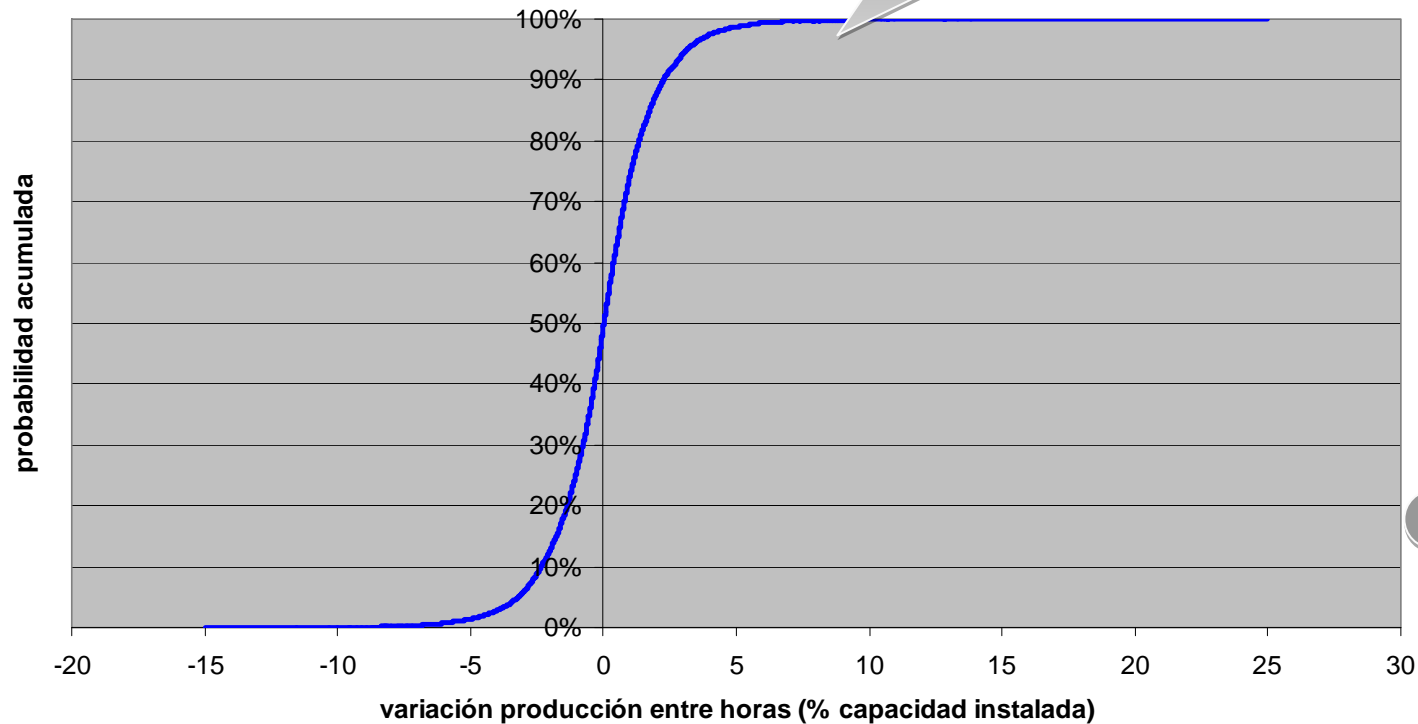
Although substantially improved, wind forecasts are not totally accurate. In some cases errors may be significant and jeopardize system security. Additional reserves are necessary

Wind has to operate jointly with inflexible generation like nuclear. In some cases the System Operator needs to curtail wind generation.



Wind Production is Stochastic

Reserves should be designed for the worst case scenario

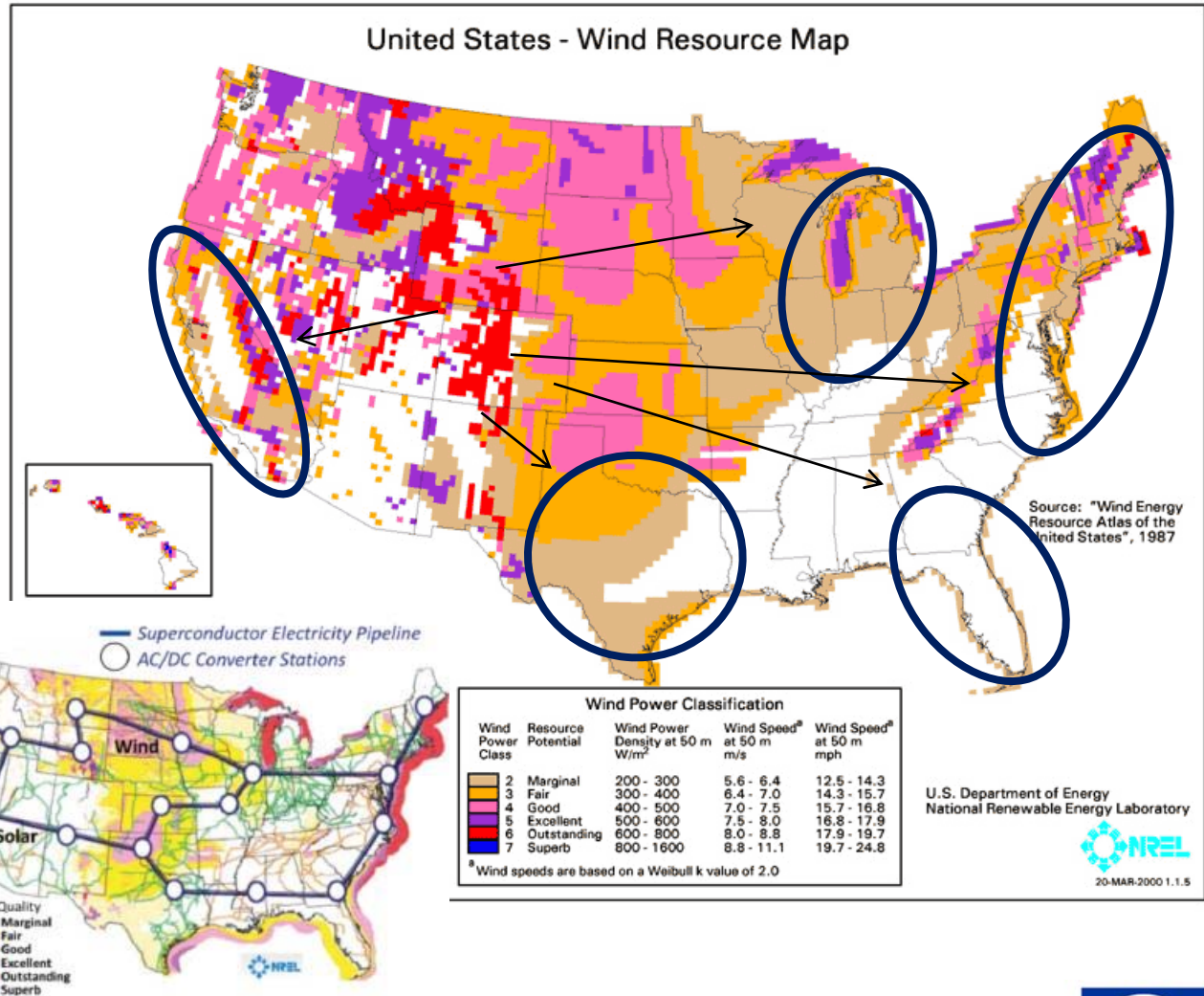


Need for incentives to have enough reserves available



Wind location

Wind resources are spread over vast territories. Need to adapt the transmission system to collect and transmit large volumes of generation from a large number small plants



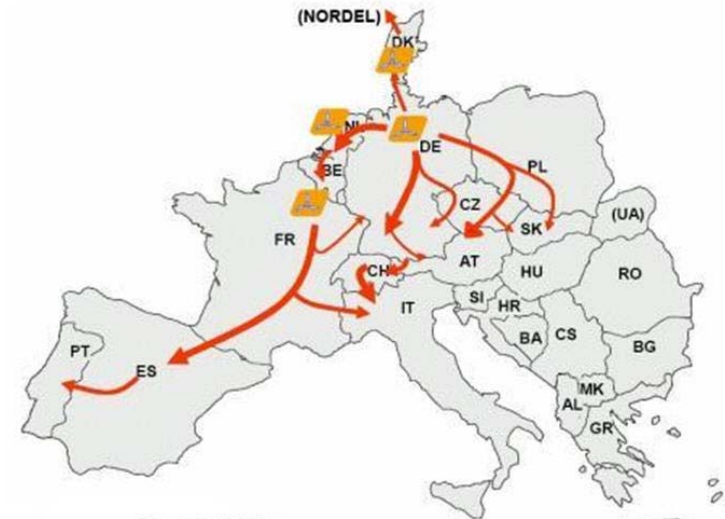
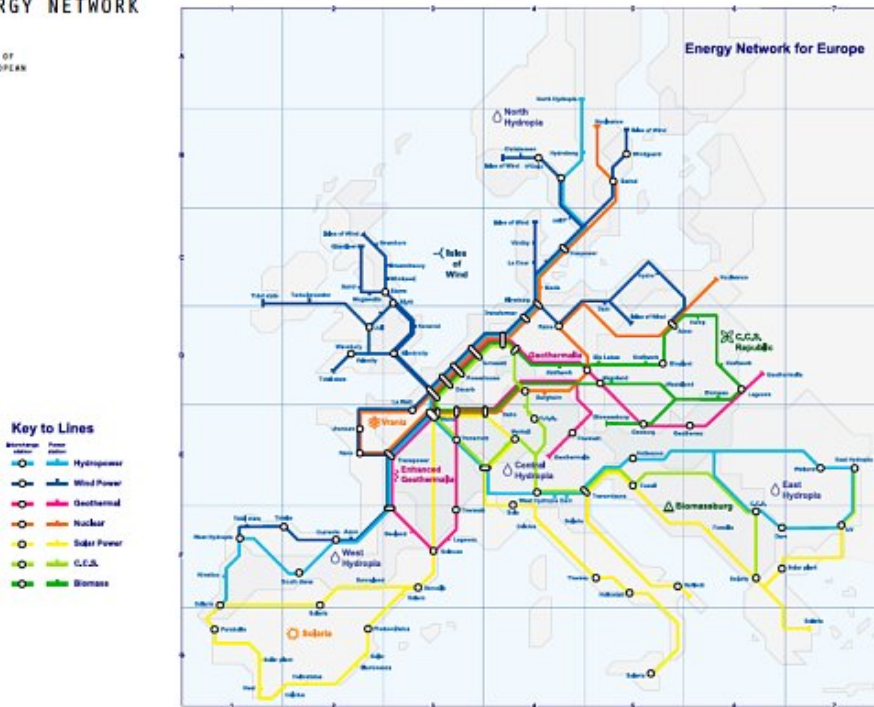
European Grid for high wind penetration

EU transmission for high RES

Functioning with High wind in the North Sea

EU ENERGY NETWORK

DIAGRAMMATIC REPRESENTATION OF INTEGRATED EUROPEAN POWER GRID.

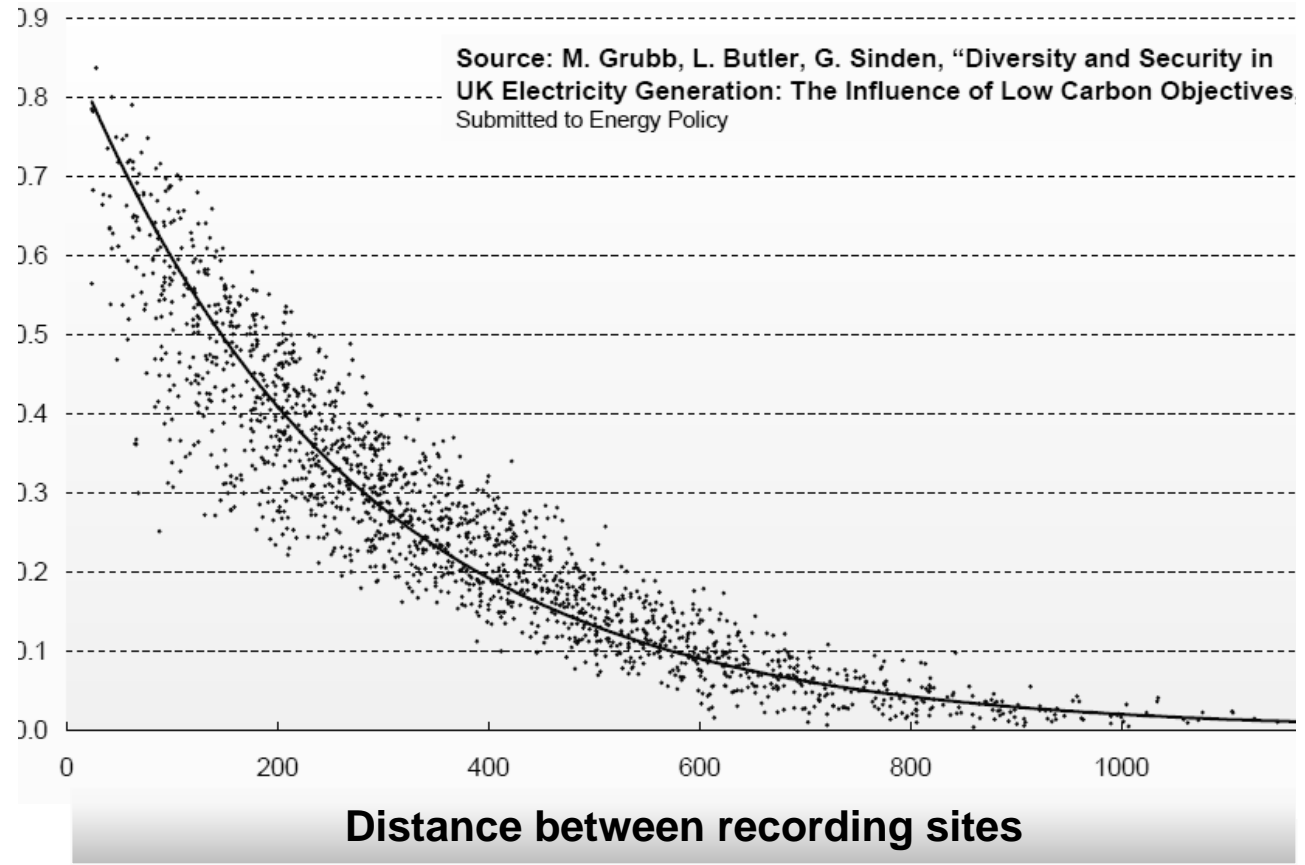


Source : ETSO



Flexible Operation of the Transmission System

Wind speed correlation decreases with distance. Transmission should manage bidirectional flows



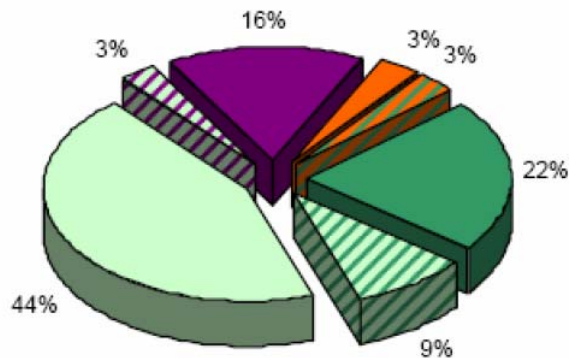
But transmission expansion – mainly regional – faces great difficulties

A long time is required to build overhead lines due to:

Complex authorization procedures.

Resistance from part of the population and environmental organizations.

Lack of incentives for TSOs.



- Finalised projects
- Construction phase
- Authorisation / Construction phase
- Authorisation phase
- Authorisation / Study phase
- Study phase
- Finalised / Study phase

A too high proportion of projects in the EU are in their authorization phase. This should be improved.



Conclusions

Electricity markets have produced good outcomes:

- lower costs for consumers (+ tax payers),
- investments necessary to meet the load growth,
- contestability
- increased transparency.

But there is still important room for improvement:

- standard market design;
- market power mitigation;
- coordination between security and costs;
- optimized transmission expansion



Conclusions

Climate change policies introduce new challenges:

- High penetration of intermittent RES
- Improved demand side management
- Flexibility to incorporate new technologies
- Incentives for reserves and low variable dispatch of conventional generation
- Connection of large volumes of widely-dispersed RES
- Smart and flexible transmission system

Solving these issues requires hard work and creativity, and admit that solutions are not simple. This is undoubtedly true, but in this case the cost of simplicity can be very high. Nothing captures this predicament better than the maxim: **“the easy road leads to the hard life and the hard road leads to the easy life.”**





Thanks for Your Attention

Questions?

