International Energy Agency

Ensuring capacity mechanisms support markets

Manuel Baritaud
Senior Energy Analyst
Gas Coal & Power Markets Division

Stakeholder Forum, generation adequacy, capacity mechanisms and the internal market in electricity
Brussels, 8 March 2013

© OECD/IEA 2013

Electricity security

Fuel Security

- Ensure continued fuel supply of gas, coal and uranium

Adequacy

- Generation capacity
- Network infrastructure

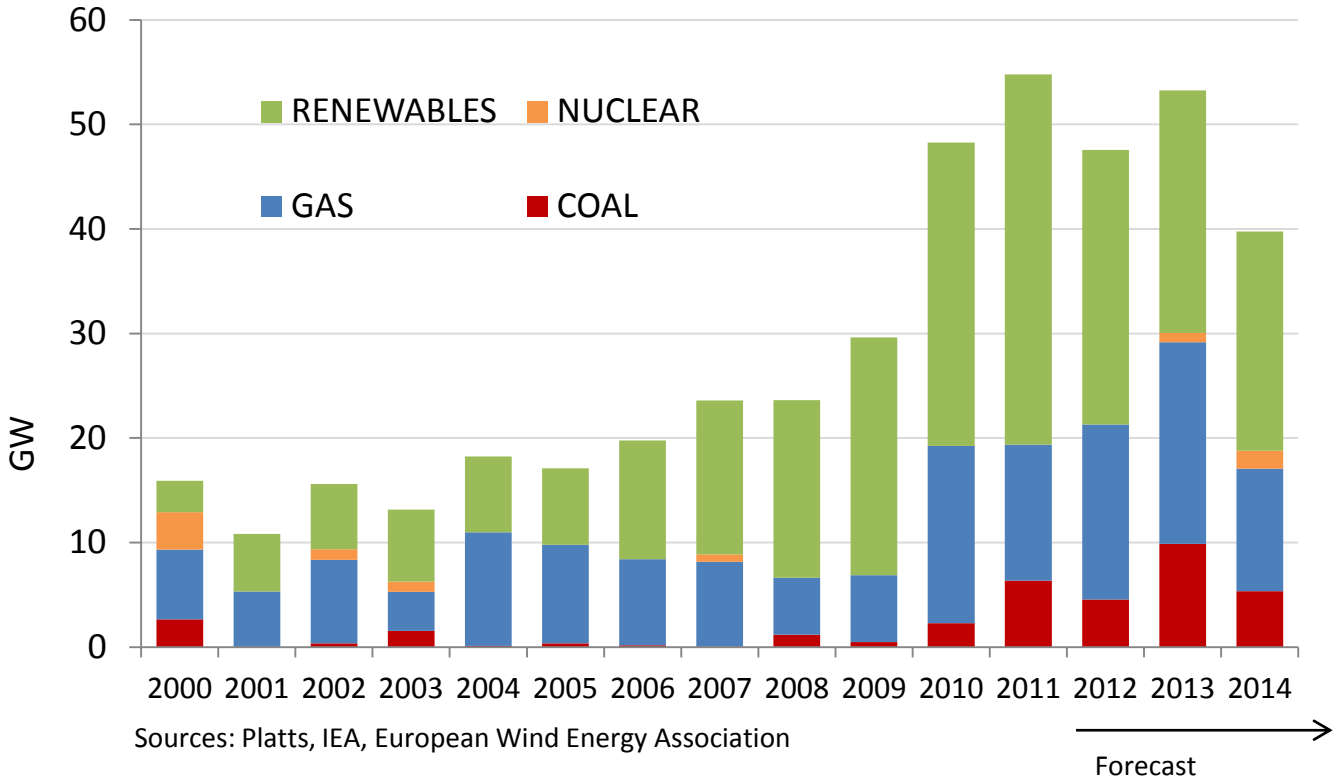
System Security

- Network operations
- Emergency protocols

© OECD/IEA 2013

Investment trend with current market arrangement

Europe, new generating capacity completed or under construction, by year of first generation and by fuel group, 2000-14

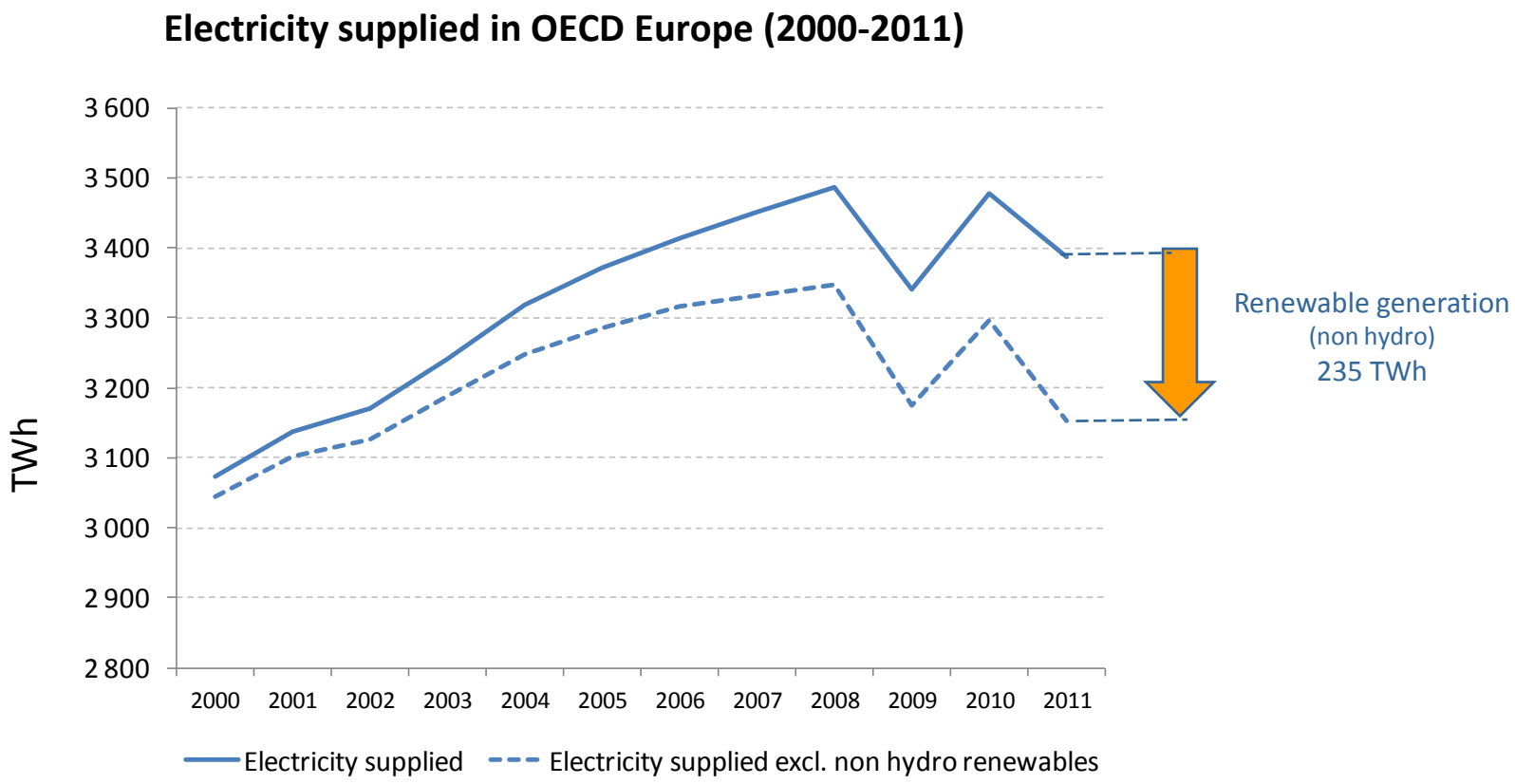


Sources: Platts, IEA, European Wind Energy Association

To date, electricity markets in Texas (ERCOT), Australia and most of Europe ensured generation adequacy.

© OECD/IEA 2013

Does Europe need new investments?

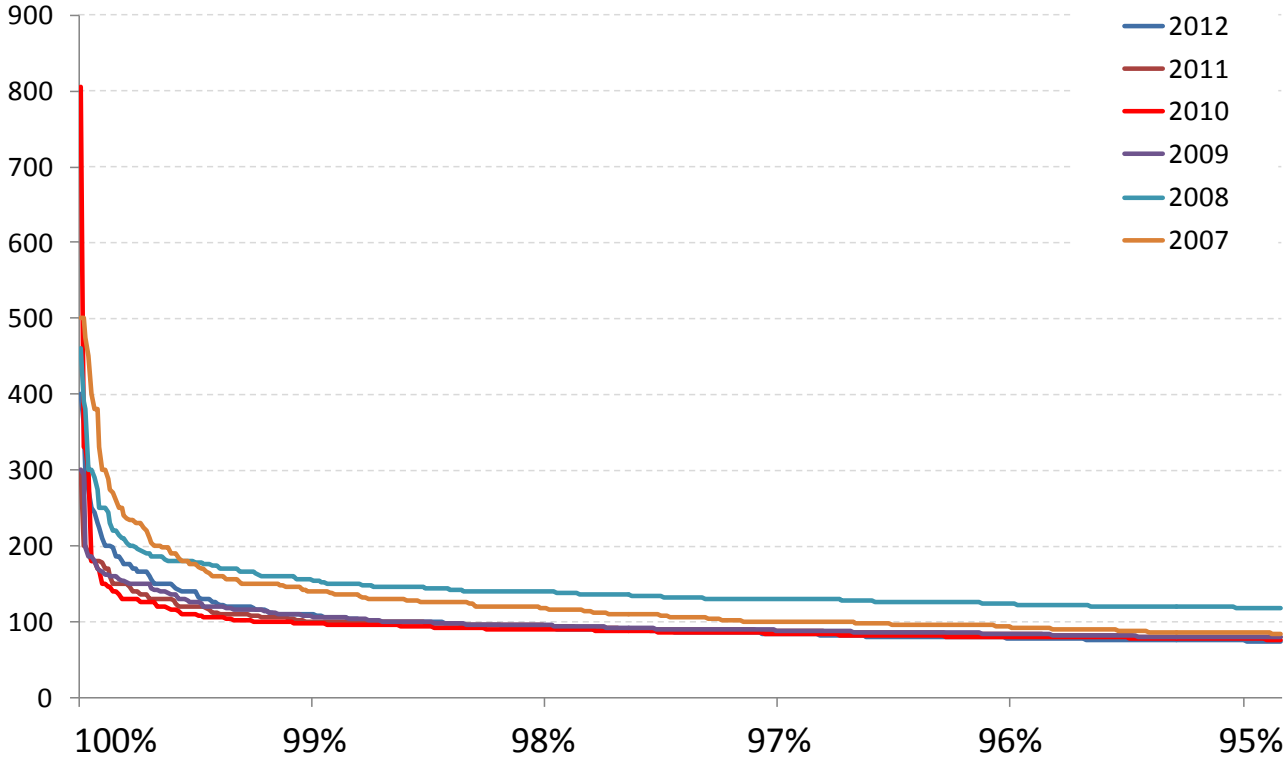


In Europe, 'residual' electricity supply (*i.e.* net of non-hydro renewables) decreased by 6% between 2008 and 2011.

© OECD/IEA 2013

Do restrictions on peak prices prevent investments?

Price duration curve for EPEX Spot, Germany during hours above the 95th percentile, 2007-2012



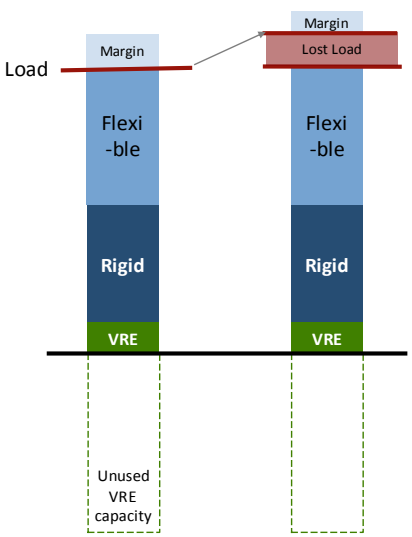
Peak prices are important for the commercial viability of peak generation but price caps are rarely reached.

© OECD/IEA 2013

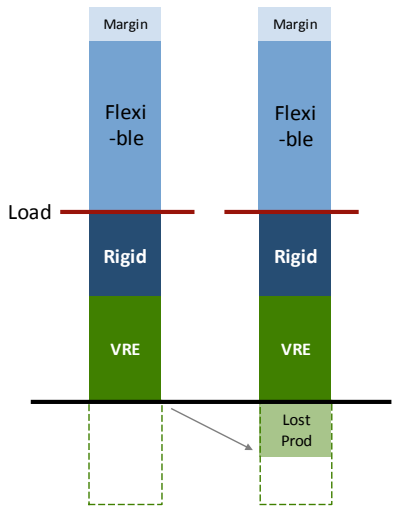
What kind of flexibility is needed?

Overview of operating challenges with high shares of variable Renewable energy

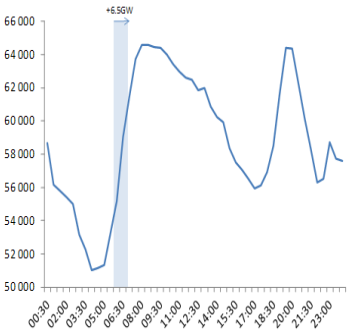
Peak load adequacy



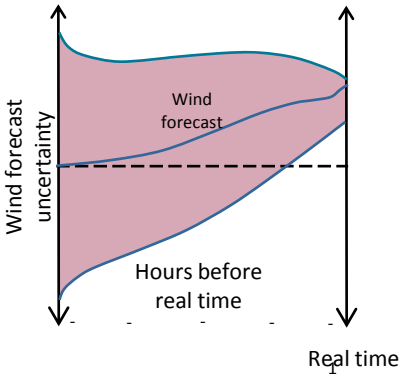
Minimum Load balancing



Ramp rates of residual demand



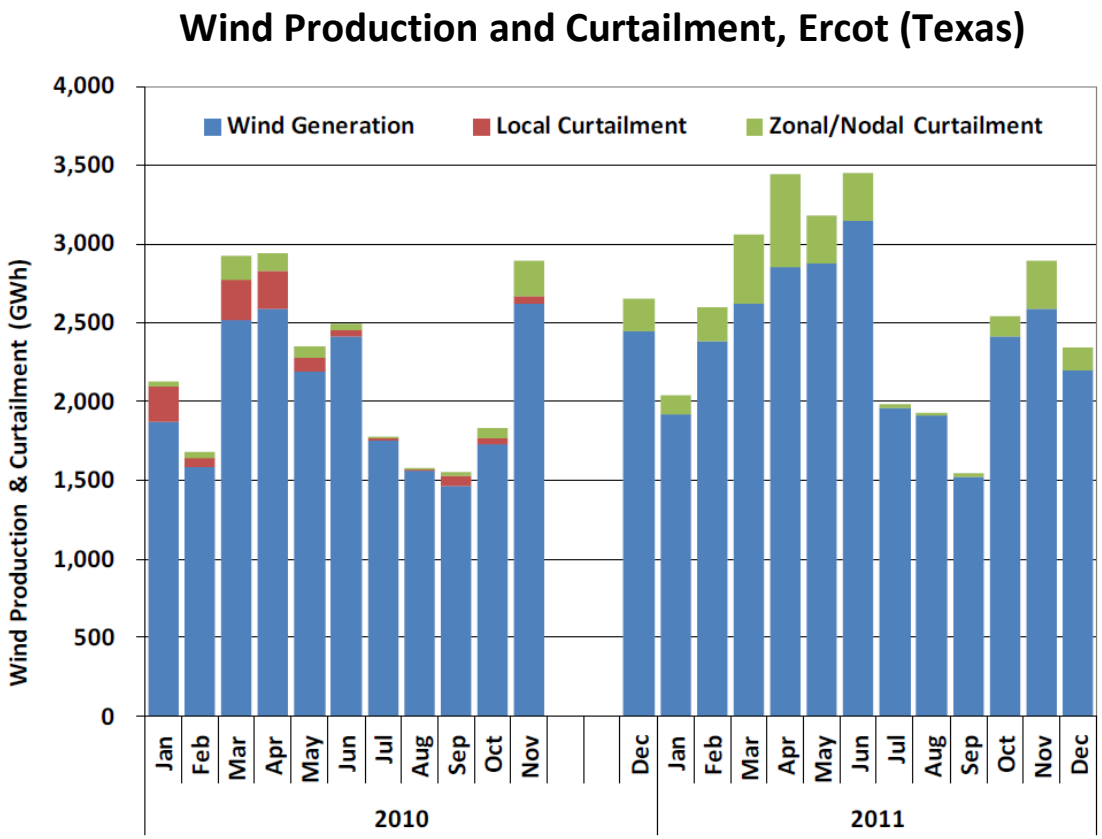
Predictability of renewables



Renewables themselves can contribute to provide flexibility.

© OECD/IEA 2013

Wind and solar power plants will need to provide flexibility in order to secure system operations



Source: Potomac Economics, ERCOT SOM report 2011

A market platform for flexible services can create a level playing field for all technologies, including renewables.

© OECD/IEA 2013

Options to address generation investment and operations issues

Basic package

Possible optional measures

A Improved Climate and Low-Carbon Policies

- Improve certainty/credibility of energy policies
- Design of low carbon support instruments

Ex:
- UK carbon price floor
- US Clean Energy Standards
- Renewable premium in Germany

B Better Energy Markets

- Remove restrictions on electricity prices
- Locational Marginal Pricing (LMP)
- Develop missing markets
- Integrate day ahead, intraday, balancing and reserve markets

Ex: ERCOT, ISO-NE, Australia

C Standards & Procedures

- Reliability criteria
- Generation adequacy forecasts (planning)
- Technical flexibility and controllability requirements

D Targeted Contracting

Contracts to:
- avoid mothballing of existing assets
- trigger new investments
- relieve congestions
- promote demand side response

Ex: Strategic reserve

E Market-wide Capacity Mechanism

- Capacity payments
- Central buyer of capacity
- Decentralised capacity market
- Combined capacity and flexibility market

Ex: PJM, ISO-NE, Spain, France

© OECD/IEA 2013

Targeted contracts are not new

Targeted contracts

- **Reliability Must Run units in the United States**
- **Strategic reserves in Sweden and Finland**

Pros	Cons
• Effectiveness • Simplicity • Short lead time (Quick to implement) • Direct costs (does not create rents) • Adaptability (quick to unwind)	• Proportionate? • Indirect costs (creates distorsions)

Targeted contracts have the potential to be a temporary fix, compatible with a well-functioning energy market in the longer run.

© OECD/IEA 2013

Designing capacity markets is complex

Choosing capacity market parameters presents many challenges

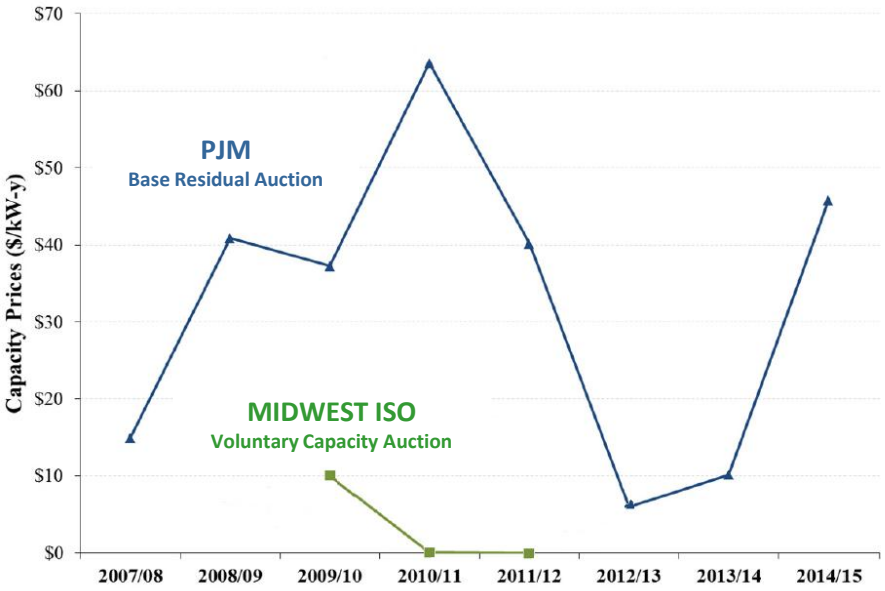
Capacity definition	Peak generators, dispatchable plants, intermittent sources, demand response
Horizon and duration	Annual to multiple years, period of capacity availability (definition of peak period)
Capacity Requirements	Uncertain demand forecasts, coherence with reliability standard
Network Constraints	Definition of locational capacity requirements
Cost of New Entry	New power plant, mothballed plants, power uprate, demand side
Energy Revenues	*Ex ante* or *ex post* determination
Capacity Demand Curves	Fixed capacity requirements Vs variable demand slope to smooth revenues
Capacity Cost Recovery	Suppliers or socialized payments?
Penalties	Control of availability, outage rates, penalties

Source: Adapted from Hogan, 2011

© OECD/IEA 2013

Cross border trade of capacity

PJM and MIDWEST ISO Capacity prices



Gains from cross border capacity trades

- Price differential: US$ 30/kW-y
- Capacity transfer capability: c. 6000 MW
- Actual capacity sales: 400 MW net (900 MW gross)
- Potential gain for PJM: **$ 1.5 billion per year***

* Source: The Brattle Group (2011) MISO-PJM Capacity Market Seam, Preliminary Issue Description

Efficient cross border trading of capacity can deliver huge economic benefits.

© OECD/IEA 2013

Barriers that hinder cross border trade of capacity

- **Available Capacity Transfer Capability**

  e.g. **MISO-> PJM:**
  Capacity transfer capability is c. 6000 MW, but market participants hold only 1200 MW

- **Reservation and use of long term transmission services**

  e.g. **MISO-> PJM: Out of 1200 MW held, half were used to support capacity sales**
  Netting of capacity?

- **Specifications of capacity products**

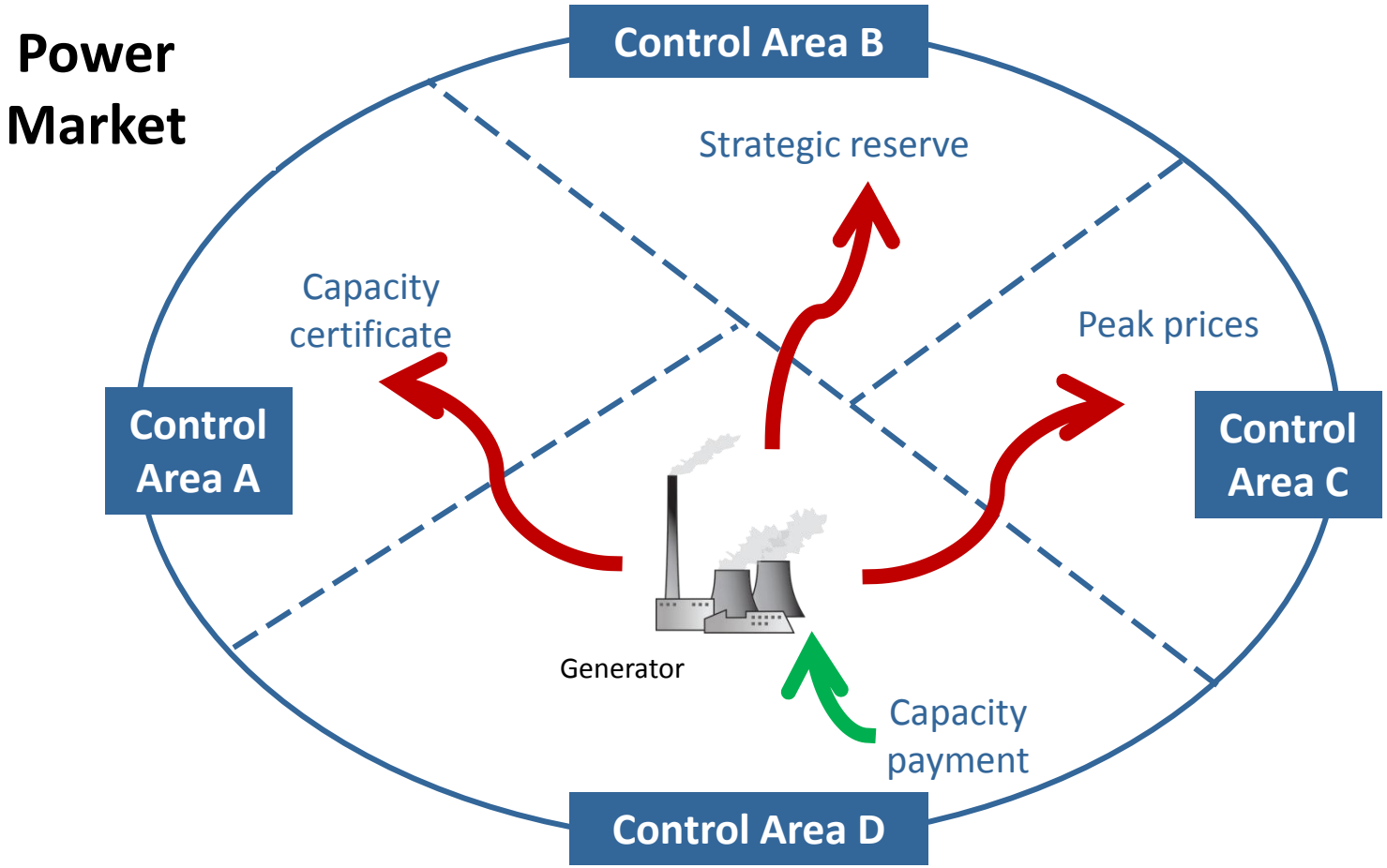
  Period during which capacity must be available (statistical peak demand?)
  Obligation to provide an energy offer

- **Degree of certainty in the delivery of external capacity**

  RTOs are more confident in capacity resources in their own control area footprint

© OECD/IEA 2013

Arbitraging between control areas

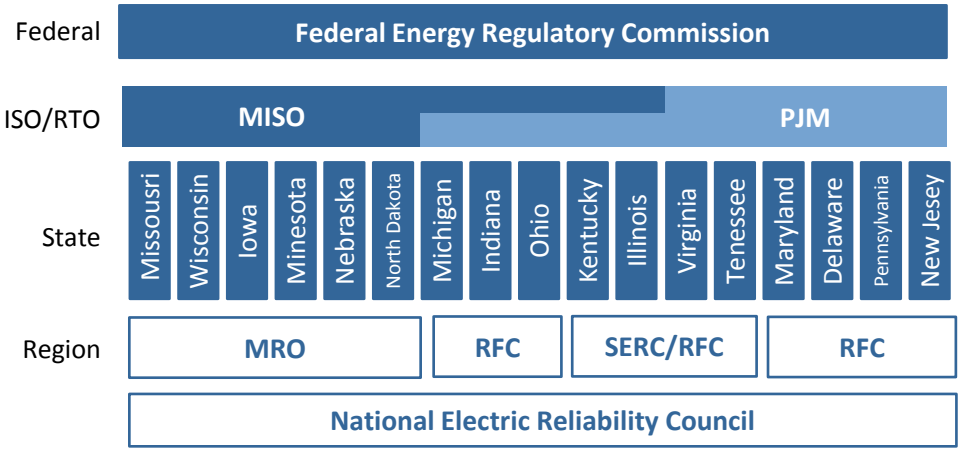


Inconsistencies of capacity mechanisms in different control areas create barriers to cross border trade of capacity.

© OECD/IEA 2013

Defining generation adequacy over a relevant area

PJM and MISO: States covered and NERC Regions



What is the relevant area?

- Adequacy forecasts at different scales: national / regional / state / ISO-RTO / zonal
- Different reliability metrics can be used
  - Installed generation capacity
  - Reserve margin above system peak
  - Reserve margin above peak of a load serving entity
  - Unserved Energy
  - Loss of load duration
- Accounting of external capacity

Ensuring reliability and generation adequacy with capacity markets requires developing procedures and institutions at the relevant area.

© OECD/IEA 2013

Wrap-up

- **Energy markets** have the potential to ensure security of supply, provided that a number of policy measures are pursued.
- **Capacity mechanisms**, nonetheless, introduced for several reasons:
  - Degree of uncertainty concerning climate policy
  - Regulations that restrict efficient electricity price formation
  - Depressed prices and cash flow uncertainty
- **"Targeted contracting"** can provide a temporary fix, but introduce distortions.
- **"Market-wide capacity markets"** can be effective to create a safety net, but are complex and can introduce other forms of distortions.
- **Cross border trade of capacity** can deliver huge economic benefits but will raise many challenges in a European context.
- **What is the relevant area** for assessing and ensuring generation adequacy?

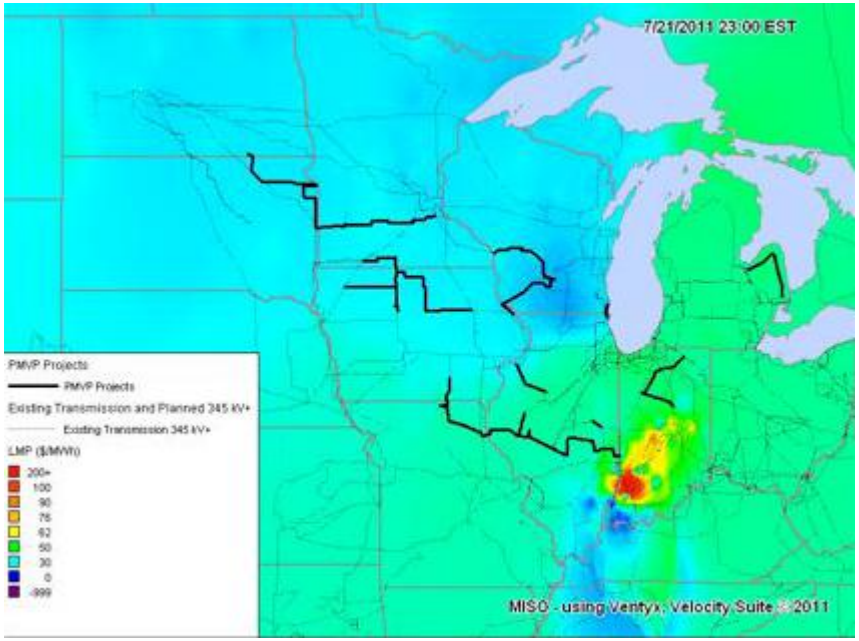
© OECD/IEA 2013

Back up slides

© OECD/IEA 2013

Locational signals

"A Day in the Life of the Grid", by Jon Wellinghoff, FERC



http://www.ferc.gov/EventCalendar/Files/20130219143531-Day%20in%20the%20Life%20of%20the%20Grid%202.13pdf.pdf

Benefits of Locational Marginal Pricing increase with high share of wind and solar

© OECD/IEA 2013