

# **RE-POWERING MARKETS**

**Market design and regulation  
during the transition to low-carbon power systems**

**CEEM Workshop on Market Design for Low-carbon electricity generation**

**Université Paris-Dauphine  
14 March 2016**

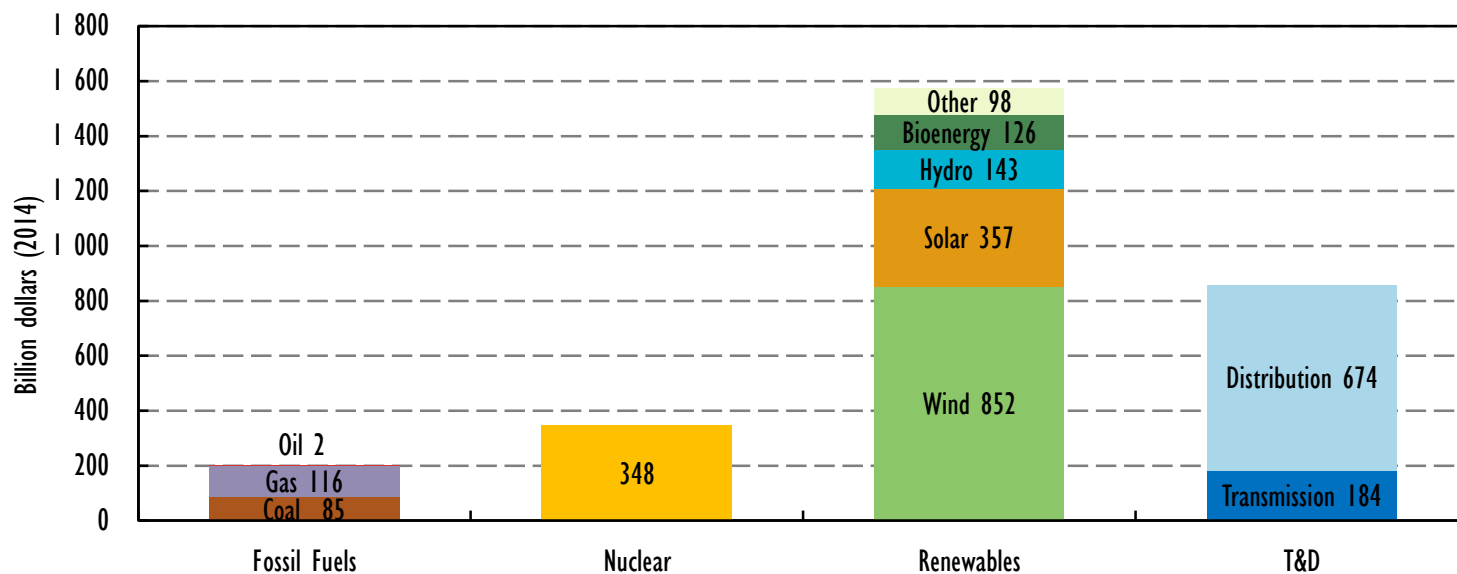
# Power markets must evolve to facilitate a low-carbon transition



- **A power market transformation is already underway**
  - *Demand is stagnating in OECD Europe*
  - *Renewables met 62% of growth in capacity in OECD Europe since 2000*
  - *New technologies progressing (smart grids, demand response, storage)*
- **Electricity security is becoming more critical**
- **The massive investments required call for an improved market framework**
  - *Carbon pricing and low-carbon investments*
  - *Integration of wind & solar power, design of short-term markets*
  - *Reliability and adequacy, scarcity pricing and capacity markets*
  - *Demand response*
  - *Network investments & regulation*
  - *Retail pricing*

# Low-carbon power and networks require the largest investment

Power-sector cumulative investment by type,  
450 Scenario, OECD Europe, 2015-2040



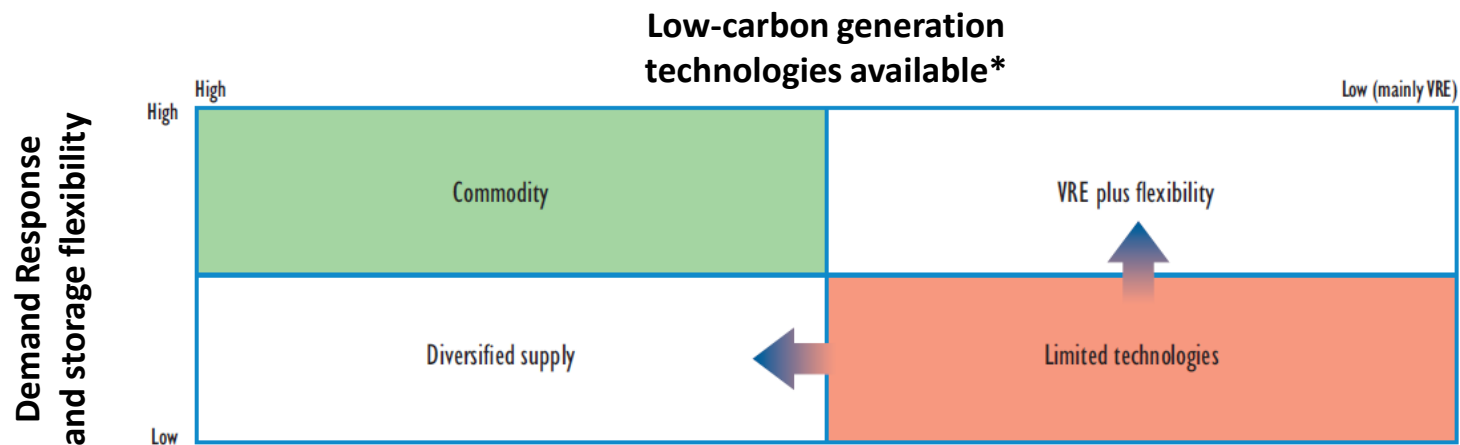
***Massive investment needed during the transition will take place in competitive markets. Their design is key for decarbonisation while ensuring electricity security.***



# Aligning electricity market design and decarbonisation: what does it take?



## Market-technology matrix

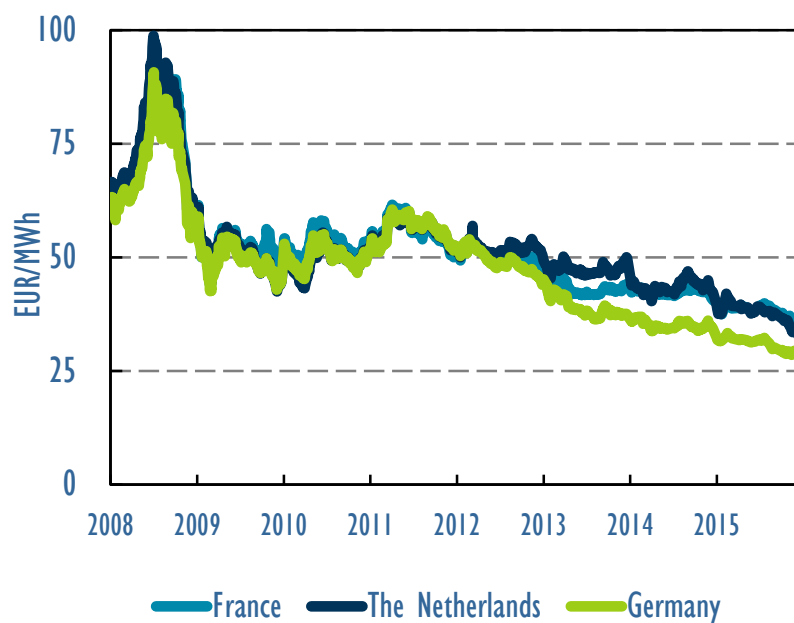


\* Nuclear, CCS, Hydro, Biomass, Wind and solar power

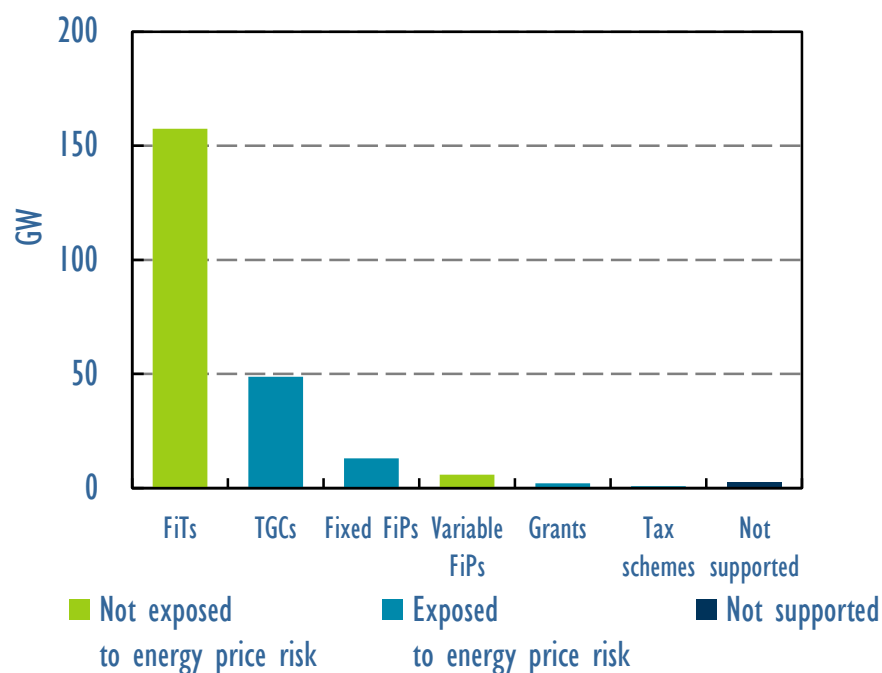
*For the long term, the design of electricity markets hinges on the portfolio of technologies available and improvements are likely to be evolutionary*

# Current wholesale prices and long-term risks call for continuing support

Wholesale electricity prices  
CWE, 2008-2016



Renewable capacity by support instruments  
OECD Europe, 2005-14



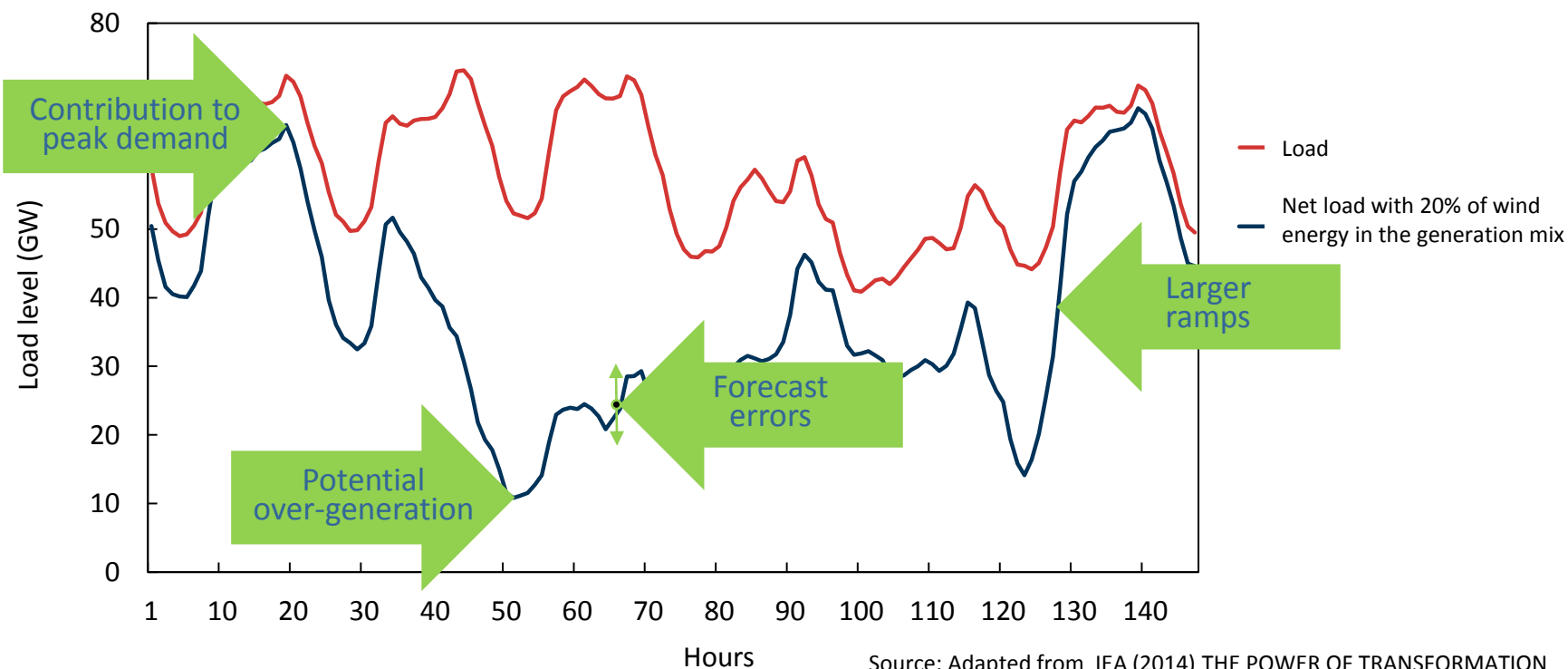
**Long-term arrangements are still needed to make up the difference in low-carbon generation costs and to keep financing costs low for capital-intensive investments.**

# Integrating high shares of wind and solar



## New operational requirements with high shares of renewables

(data for Germany using scaled wind data)

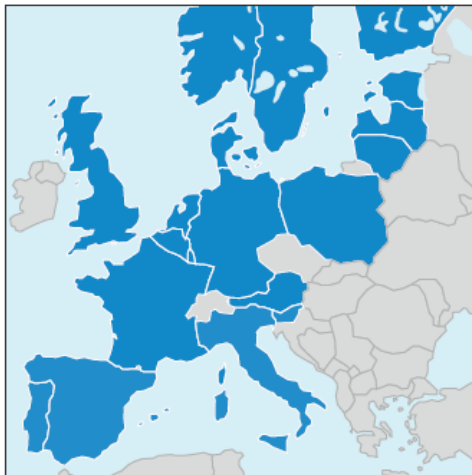


***Participation into markets provides an important feedback loop by revealing the value of different low-carbon technologies.***

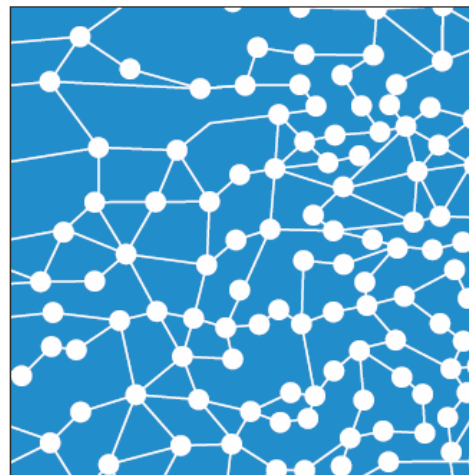
# When and where to operate and invest?



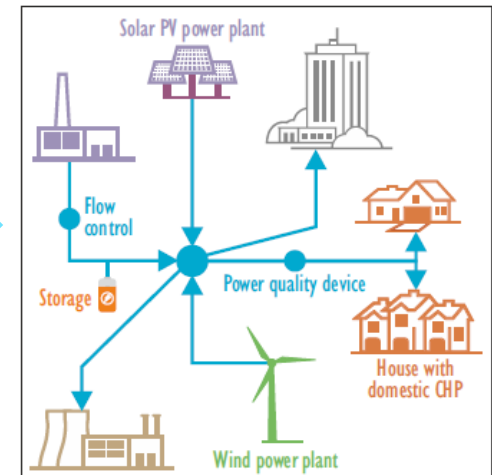
Continental markets



Locational markets



Local, distributed market



*Markets prices with a high geographical and temporal “resolution” can provide incentives for efficient and secure coordination of more complex power resources.*

# High Vs Low resolution markets

	High resolution	Low resolution
Example of market	PJM	Germany
Power market platform	System operator	Power exchange
Bidding information	Unit/plant, complex bids	Portfolio, aggregated bid
Geographic resolution	Nodal	Single national price
Primary market	Real-time	Day-ahead
Real-time balancing prices	Single marginal price	Asymmetric prices
Dispatch interval	5 minutes	15 minutes or longer
Operating reserves	Co-optimised with energy	Separate markets



# Reliability is regulated in most countries



## ■ Consistent market frameworks needed for electricity security, including

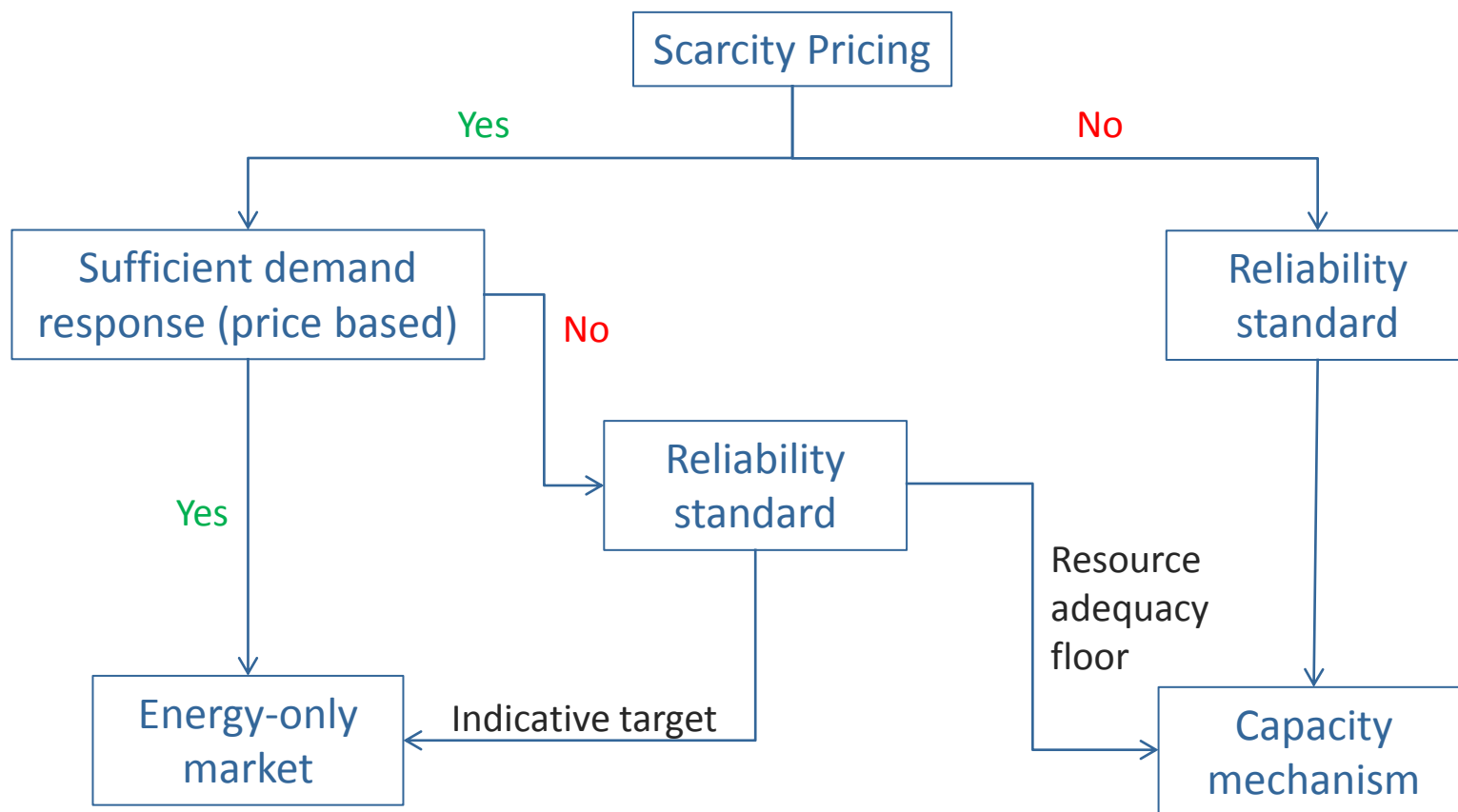
- *Reliability standard*
- *Scarcity pricing during capacity shortage*
- *and possibly capacity mechanism*

## ■ Reliability standards

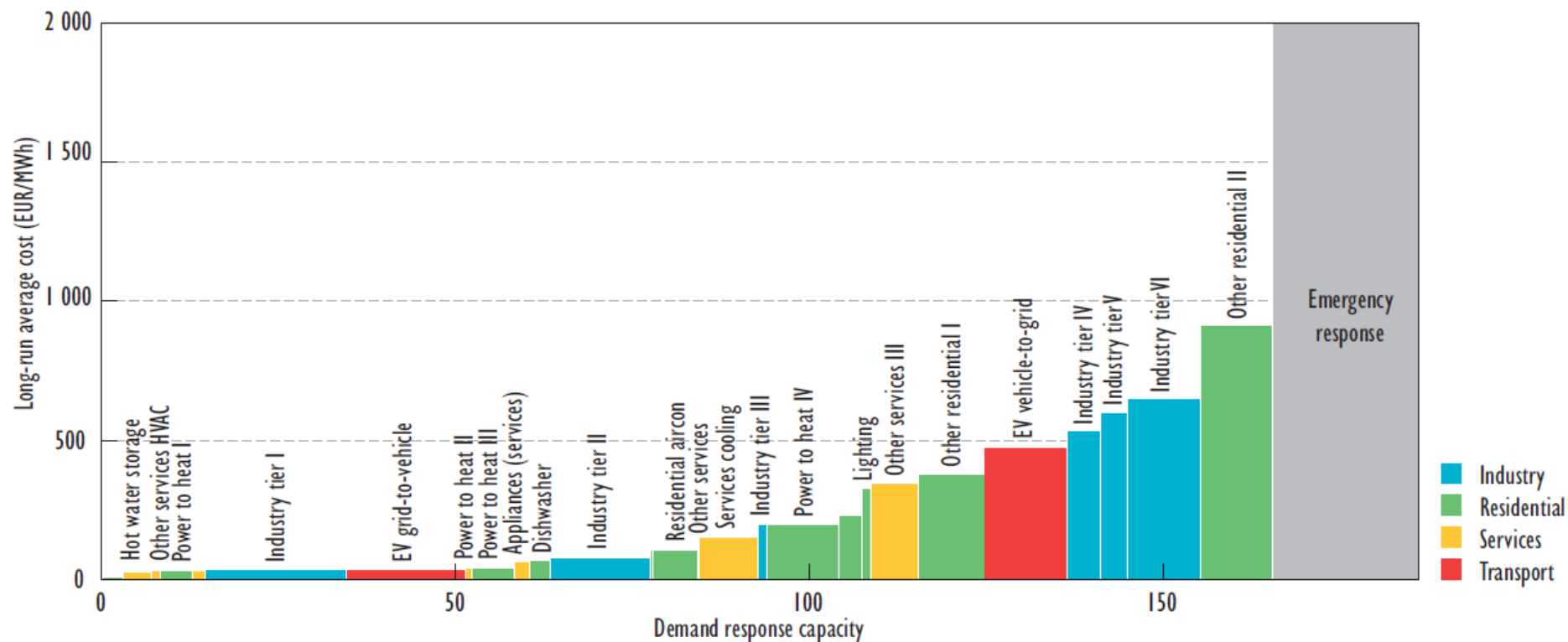
- *Loss of Load Expectation 3hr/year in France and the UK*
- *"1-in-10" standard in North America*
- *Maximum Expected Unserved Energy of 0.002% in Australia*

# Are capacity mechanisms necessary?

## A guide for decision makers



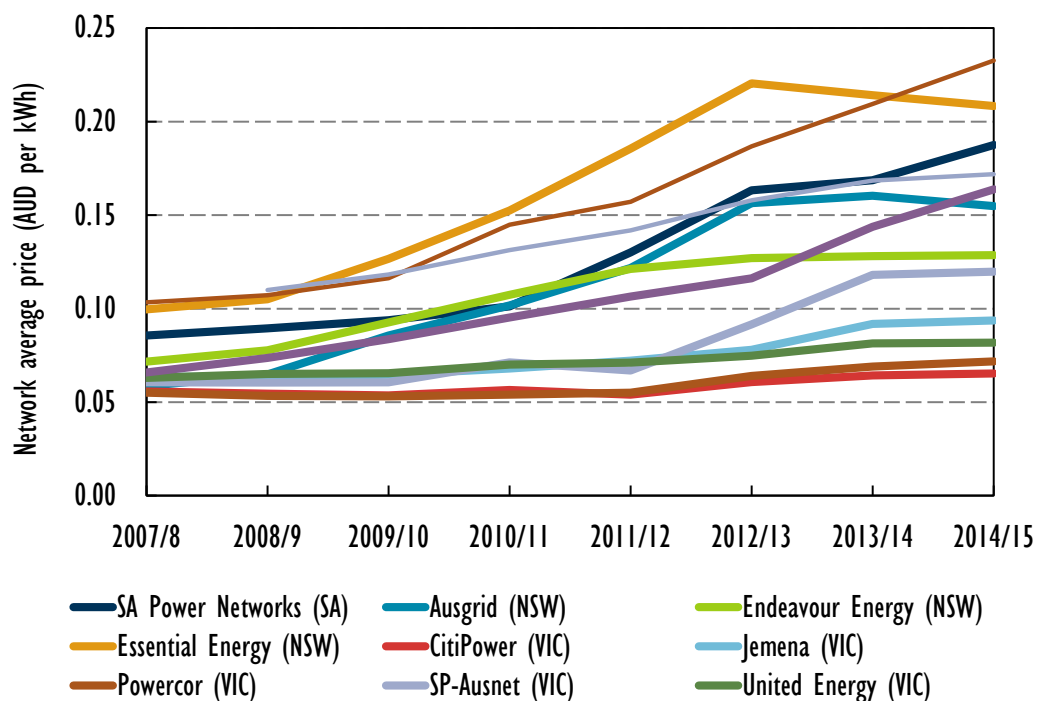
# Demand response potential



**In the European Union, demand response potential could exceed 150 gigawatts (GW) by 2050**

# Network regulation

## Distribution network tariff development in Australia, 2007-2015

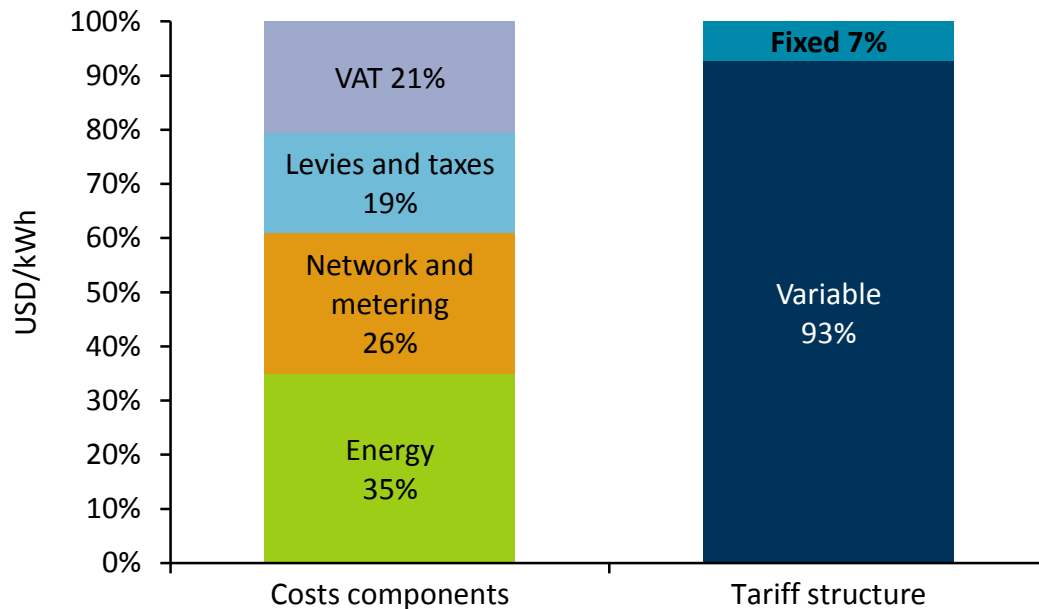


***Decarbonisation involves a modernised regulatory framework to accommodate the deployment of renewables and distributed energy resources***



# Modernizing retail tariffs

## Cost components and tariff structure of selected retail electricity prices (average for Paris, Berlin and Amsterdam)



***Prices have to better reflect the underlying level and structure of costs in order to induce efficient investment in solar PV and batteries on the consumer side.***

# Conclusion: Re-powering markets



- **Decarbonisation of the power sector is forcing a rethinking of electricity market design**
- **Incremental changes – re-powering - can facilitate the transition:**
  - *Short-term markets with detailed and transparent information on when and where to operate and invest*
  - *Consistent framework for low carbon support, CO2 pricing and markets*
  - *Electricity security requires reliability standards and pricing scarcity right, with capacity mechanisms providing an additional safety net*
- **A comprehensive market framework balances rules set by regulators and competitive markets**
- **Many recommendations are relevant outside Europe, including IEA partner countries**

# Overview of market frameworks for decarbonisation



Objective	Policy	Type of regulation	Competitive markets
Low-carbon investments	<i>Carbon pricing</i>	<ul style="list-style-type: none"> <li>Carbon regulation</li> </ul>	<ul style="list-style-type: none"> <li>Carbon price (trading scheme)</li> <li>Long-term contracts</li> </ul>
	<i>Additional policy: Support schemes</i>	<ul style="list-style-type: none"> <li>Low-C long-term support</li> </ul>	<ul style="list-style-type: none"> <li>Auctions set support level</li> <li>Integration in markets</li> </ul>
Operational efficiency / Reliability and adequacy	<i>Short-term energy markets</i>	<ul style="list-style-type: none"> <li>Market rules</li> <li>Scarcity pricing</li> <li>Reliability standards</li> </ul>	<ul style="list-style-type: none"> <li>Energy prices with a high geographical resolution</li> <li>Energy prices with a high temporal resolution</li> <li>Dynamic pricing offers</li> </ul>
	<i>Additional policy: Capacity markets</i>	<ul style="list-style-type: none"> <li>Capacity requirements</li> <li>Demand response product definition</li> </ul>	<ul style="list-style-type: none"> <li>Capacity prices</li> <li>Demand response participation</li> </ul>
Network efficiency	<i>Regulation</i>	<ul style="list-style-type: none"> <li>Regional planning</li> <li>Network cost allocation</li> </ul>	<ul style="list-style-type: none"> <li>Congestion revenues</li> <li>Transmission auctions</li> </ul>
Consumption	<i>Retail pricing</i>	<ul style="list-style-type: none"> <li>Network tariff structure</li> <li>Taxation and levies</li> </ul>	<ul style="list-style-type: none"> <li>Retail competitive prices</li> <li>Distributed resources</li> </ul>



# Thank you

<http://www.iea.org/topics/electricity/publications/re-poweringmarkets/>