International Energy Agency
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Contribution of Renewables to Energy Security

Cédric PHILIBERT

Renewable Energy Division

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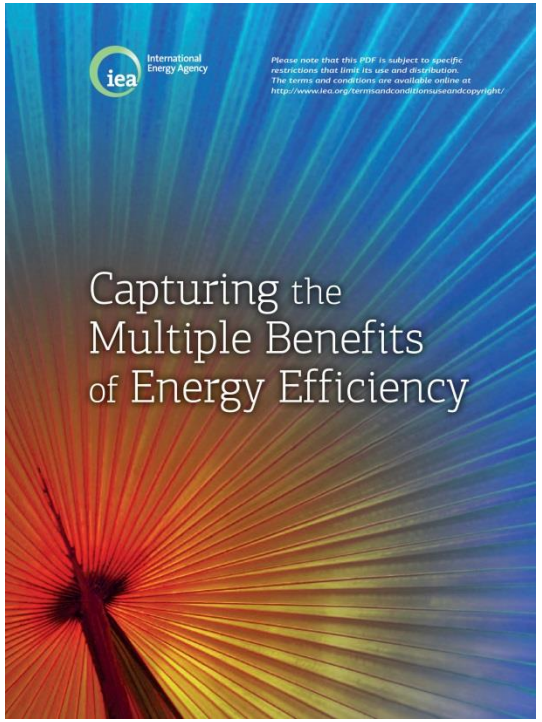
What Energy Security is about

- IEA defines energy security as the uninterrupted availability of energy sources at an affordable price.
  - short-term energy security focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance.
  - long-term energy security mainly deals with timely investments to supply energy in line with economic developments and environmental needs;
- Improved security: reducing risks & increasing resilience
  - Fossil fuels, notably oil and gas: availability, accessibility (political risks), affordability, acceptability
  - Renewables, electricity: availability and system failure risks
- Reducing market concentration, diversifying suppliers

Energy Efficiency comes first

- For most IEA countries, the energy savings from efficiency measures over the longer term exceed the output from any other fuel source
- In emerging economies today, rapid demand growth leading to energy security concerns
- EU also a leader:
  - Range of measures over past decade
  - Now longer-term commitments to 2020/2030
  - Current added geopolitical impetus



Published today!

Energy security – key drivers and challenges for renewables

Benefits

- **Diversification**
  Balanced RE Portfolio key element for diversified mix in electricity, transport and heating sector
- **Domestic supply**
  Reduced import bills and lower fossil fuel price risk
- **Long-term security**
  Climate change mitigation and local pollution reduction

Risks

- **Exposure to weather and climate variability and uncertainty**

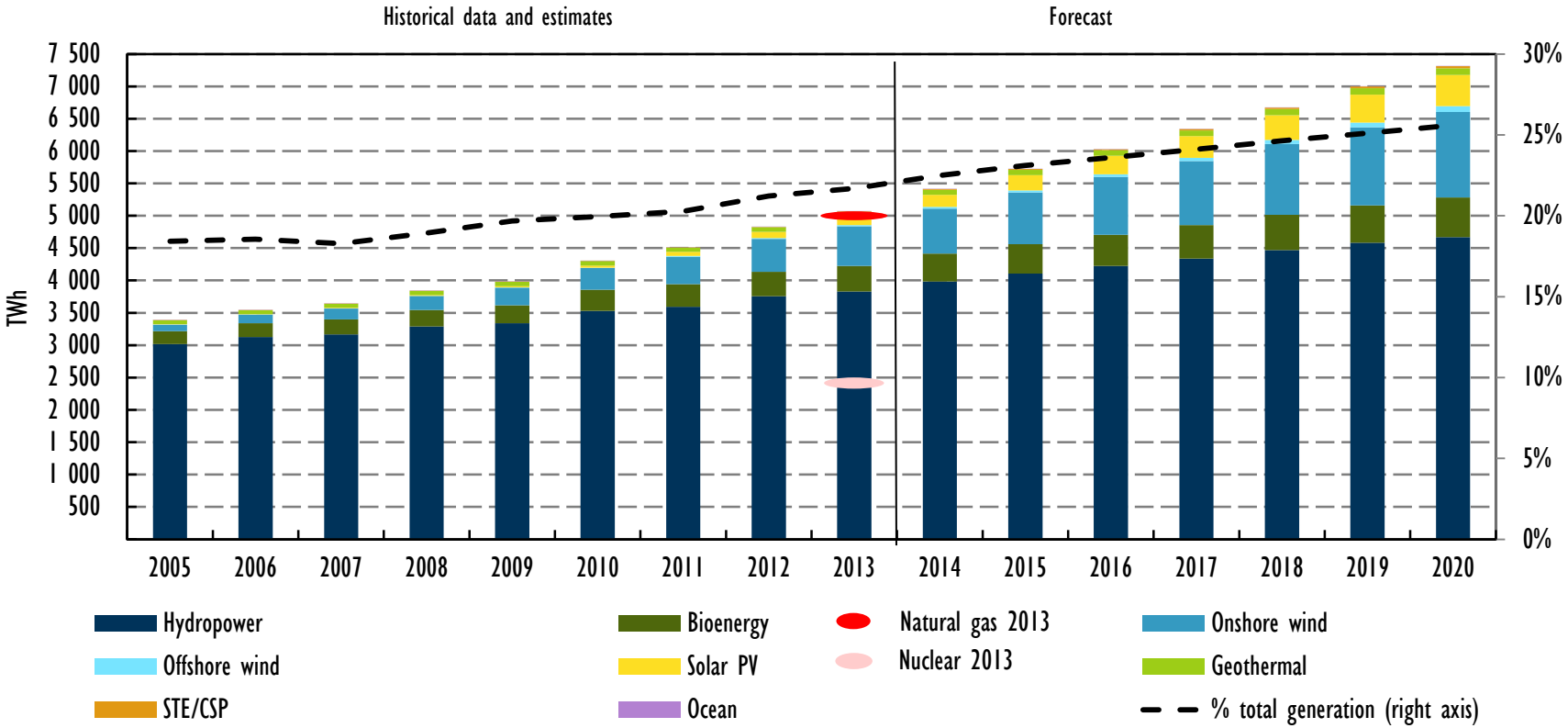
System flexibility

- **System-wide approach to renewables integration**
  - Smarter and stronger grids
  - Improved demand side response
  - Increased storage capacity
  - More flexible (RE) generation

More secure and resilient system

Strong momentum for renewable electricity

Global renewable electricity generation

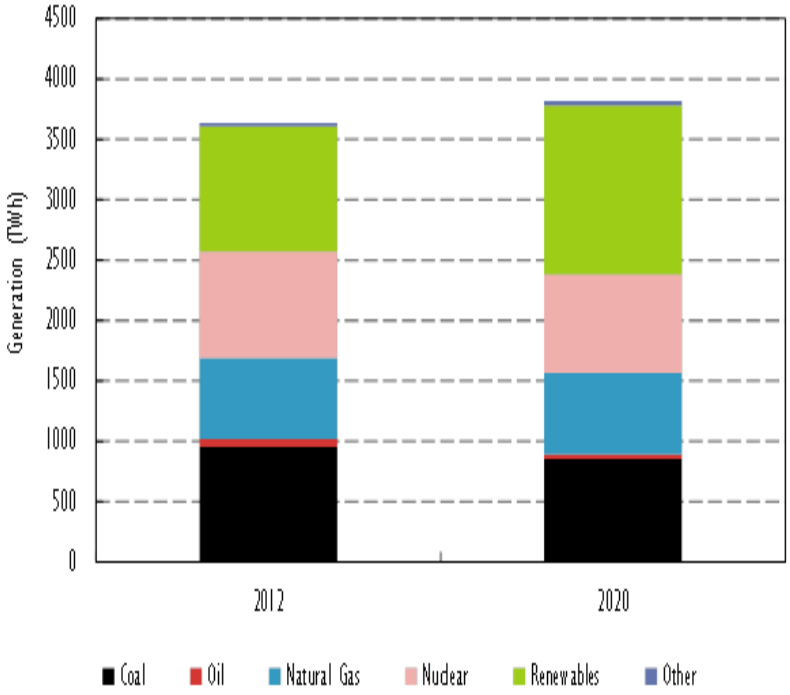


- **Renewable electricity projected to scale up by 45% from 2013 to 2020**

Renewables are predominant source of new power generation in Europe

- Driven by ambitious de-carbonisation aims, diversification and conventional plant retirements, renewable growth to exceed total power growth over 2013-20
- Rapid renewable deployment has, in some cases, been associated with high support costs
- In the face of weak demand, rapid renewable growth may require scaling down part of existing system, which can put incumbent utilities under severe pressure
- <u>These concerns are increasing policy and regulatory uncertainty in Europe</u>

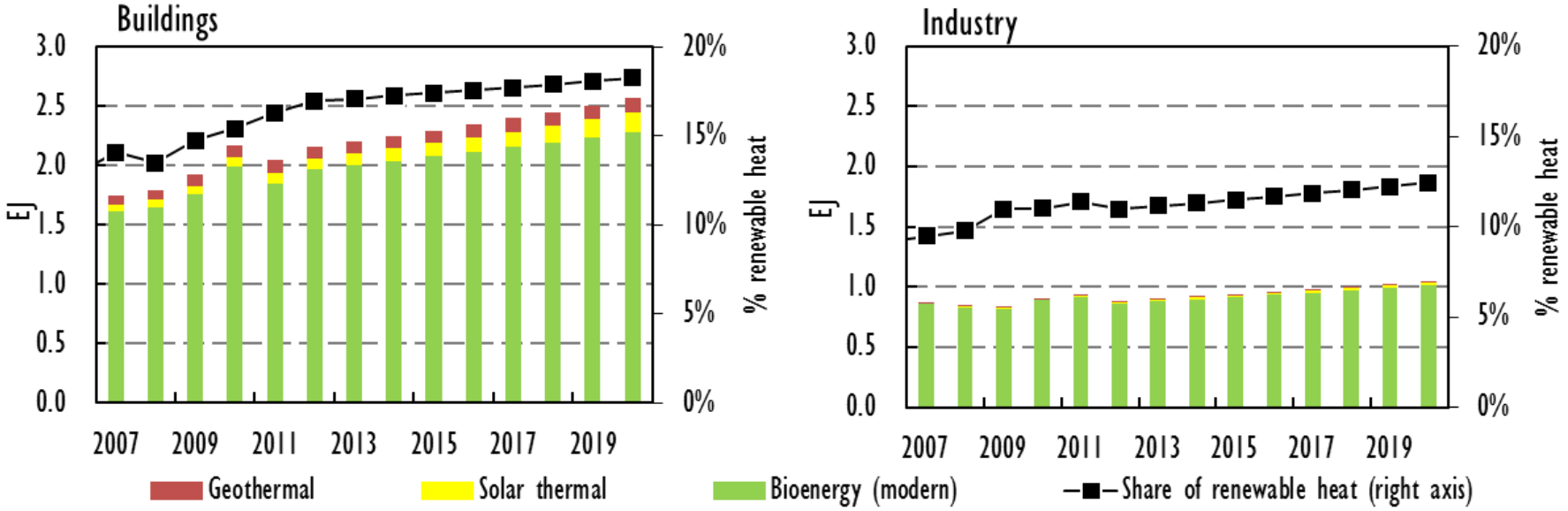
OECD Europe historical & projected shares of power generation mix



Source: Medium Term Renewable Energy Market Report 2014

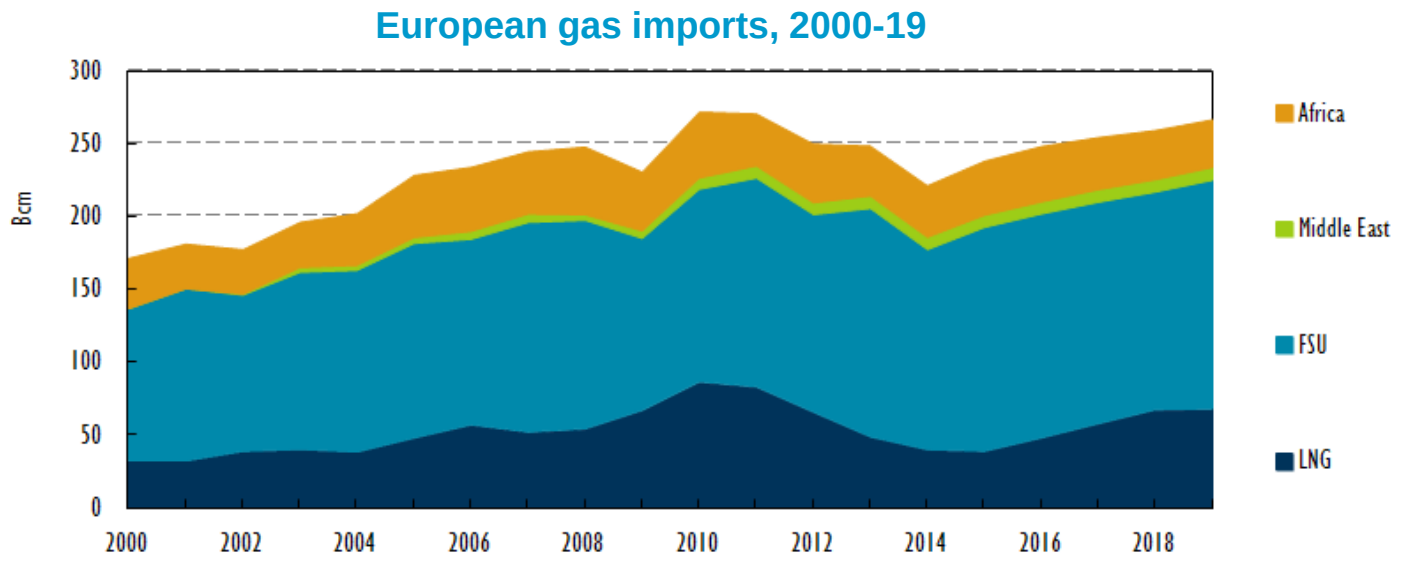
Role of renewable use in heat also increasing, but policy uncertainties growing

OECD Europe modern renewable energy use for heat in buildings and industry, 2007-20



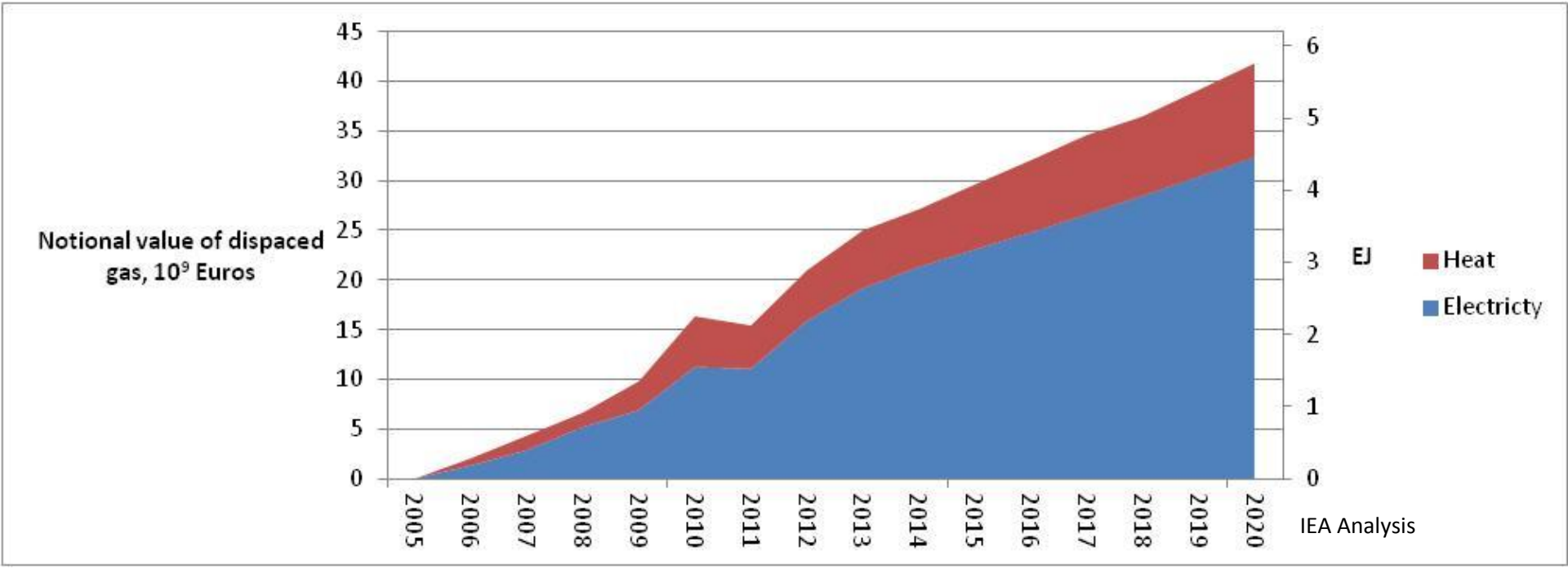
- EU 2020 targets and country support policies driving increased uptake of modern renewables use in heat
- Buildings renewable heat to grow 2.2%/year, provide 18% of total heat by 2020
  - Industry sector's use of renewable heat more limited due to lack of policy incentives
- Uncertainty over post-2020 EU policy framework for renewable heat

Russian gas imports remain important component



- Even with anemic demand, Europe gas imports increase due to production drop
- Russia remains a large supply source, even contribution is lower than 2013 peak
  - No significant upside expected from North African or Middle East (Iran) gas
- A major uncertainty remains the quantity of LNG coming back to Europe which acts as the residual market
  - Higher Asian demand could prompt higher Russian exports to Europe

Notional savings in gas imports for EU could exceed 40 Billion €/yr by 2020



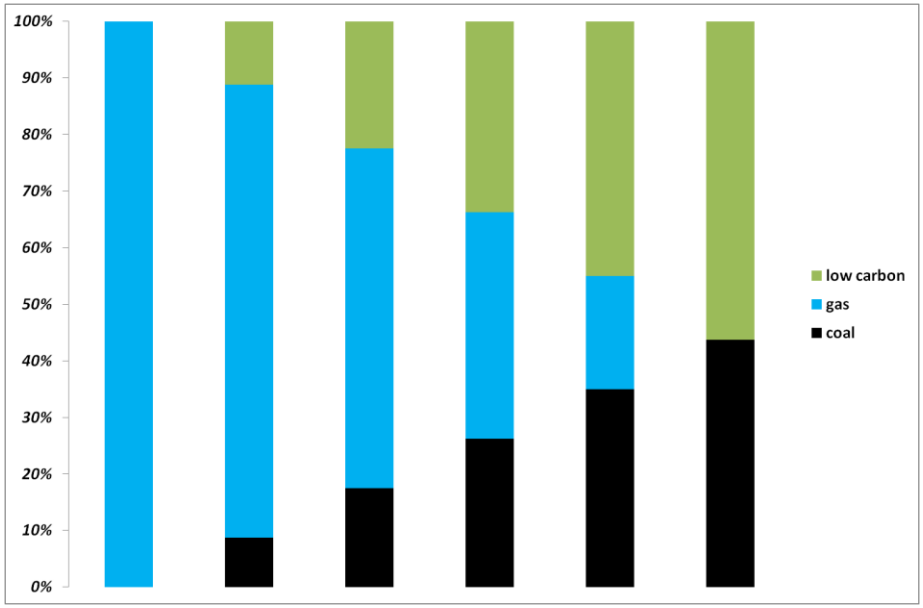
Assumes: 50% gas to electricity conversion efficiency. Gas price 10$/MBTU. 1.3 $/Euro

- Additional production of 617 TWh_e electricity and 361TWh_{th} of renewable heat between 2005 and 2020
- Real impact on fossil fuel needs complex, and requires more intensive study

An additional, indirect energy security benefit?

- Renewables offer the possibility to use some more coal and less gas for same CO_2 emissions
- Even if not materialised, this possibility limits the market power of gas suppliers, adding to energy security

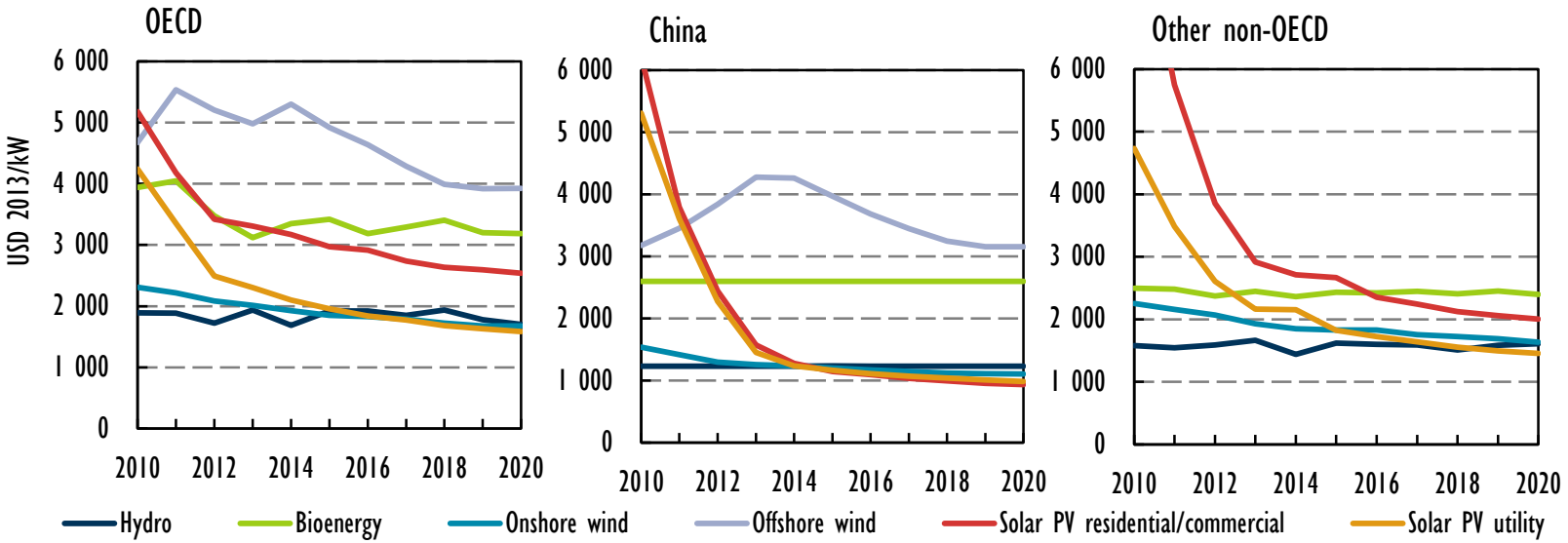
Power mixes with same per-kWh CO2 emissions



- Even if some more coal is temporarily used, climate change mitigation requires early deployment of renewables as it unlocks their long term potential

Unlocking the mitigation potential of renewables

Weighted average annual renewable investment costs

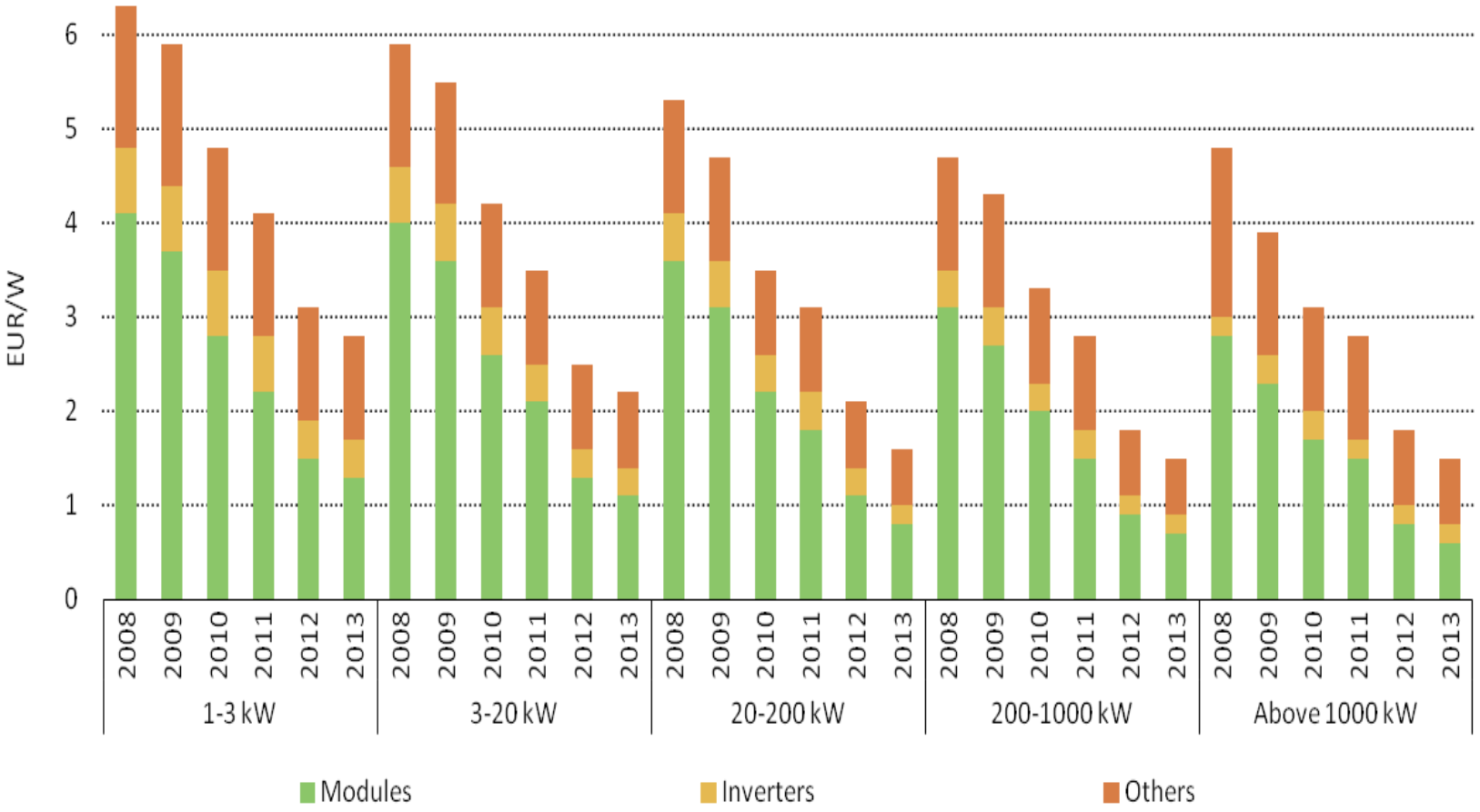


Notes: Average unit investment costs are based on gross additions, which include capacity refurbishments that are typically lower cost than new capacity. Costs vary over time due to technology changes as well as where deployment occurs in a given year..

Source: Medium Term Renewable Energy Market Report 2014

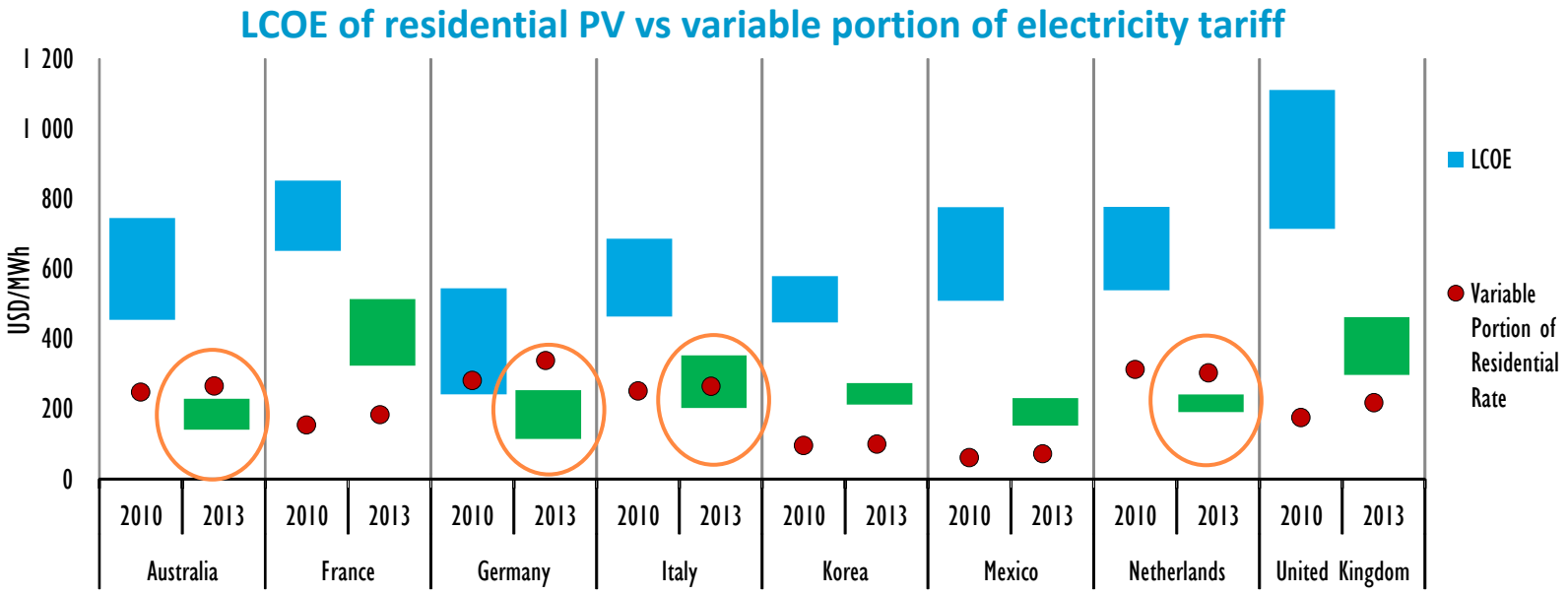
- **With scale up of deployment and learning, investment costs of most dynamic technologies (solar PV and land-based wind) continue to fall**
- **New deployment can be done at much lower costs than in the past**

The price of PV systems fell rapidly…



- ***PV system prices in Italy: divided by 3 in 6 years***

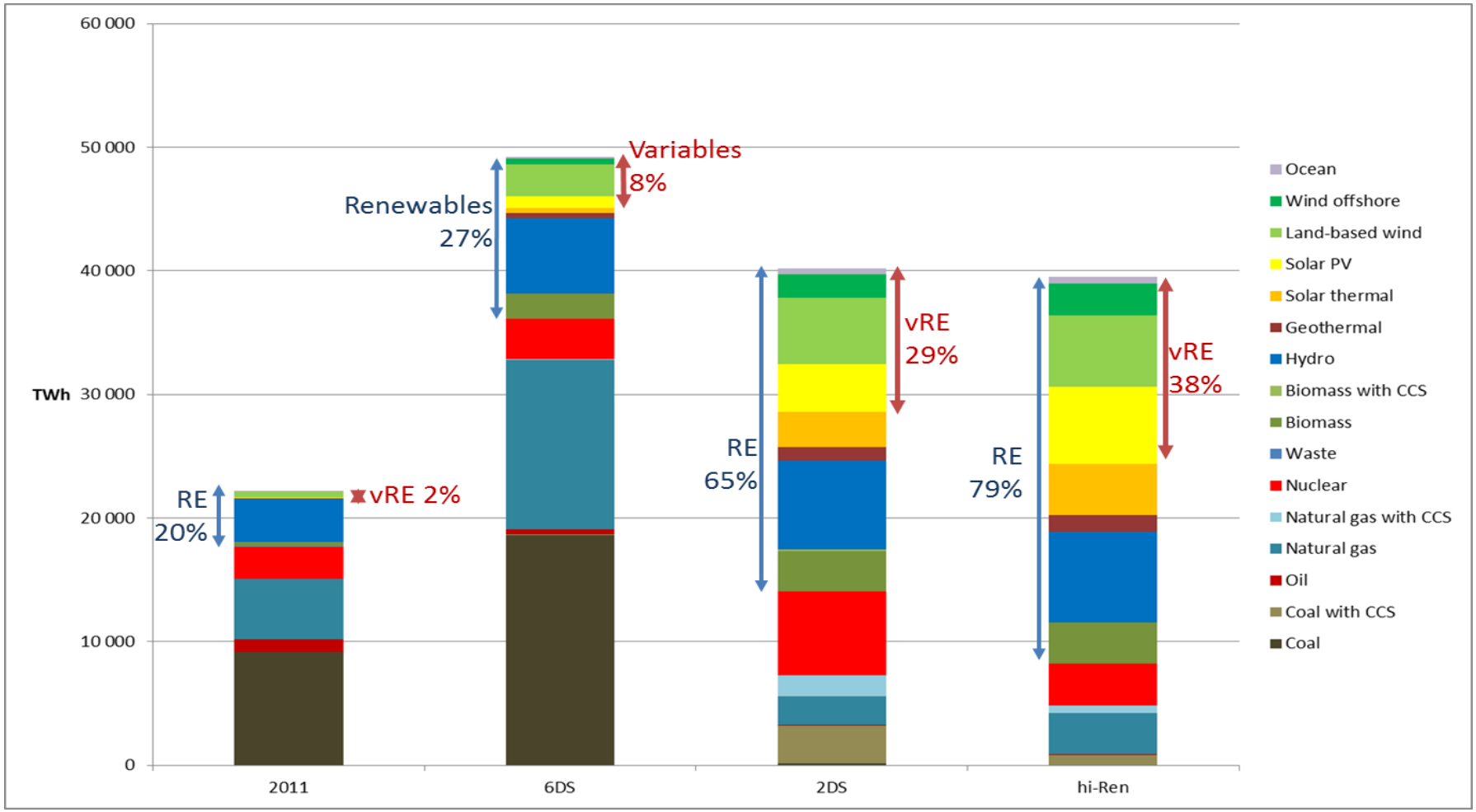
Socket parity emerging as potential deployment driver for distributed PV



- Economic attractiveness from offsetting electricity bill requires self-using most of the PV electricity
  - Currently limits potential, in particular for households
- Reaching socket parity is a driver for private actors
  - But PV may still have significant impact on total system costs, in particular depending on allocation of fixed network costs

Decarbonising the electricity mix

ETP 2014



- *Renewables generate 65 to 80% of global electricity by 2050 in climate-friendly scenarios*

International Energy Agency

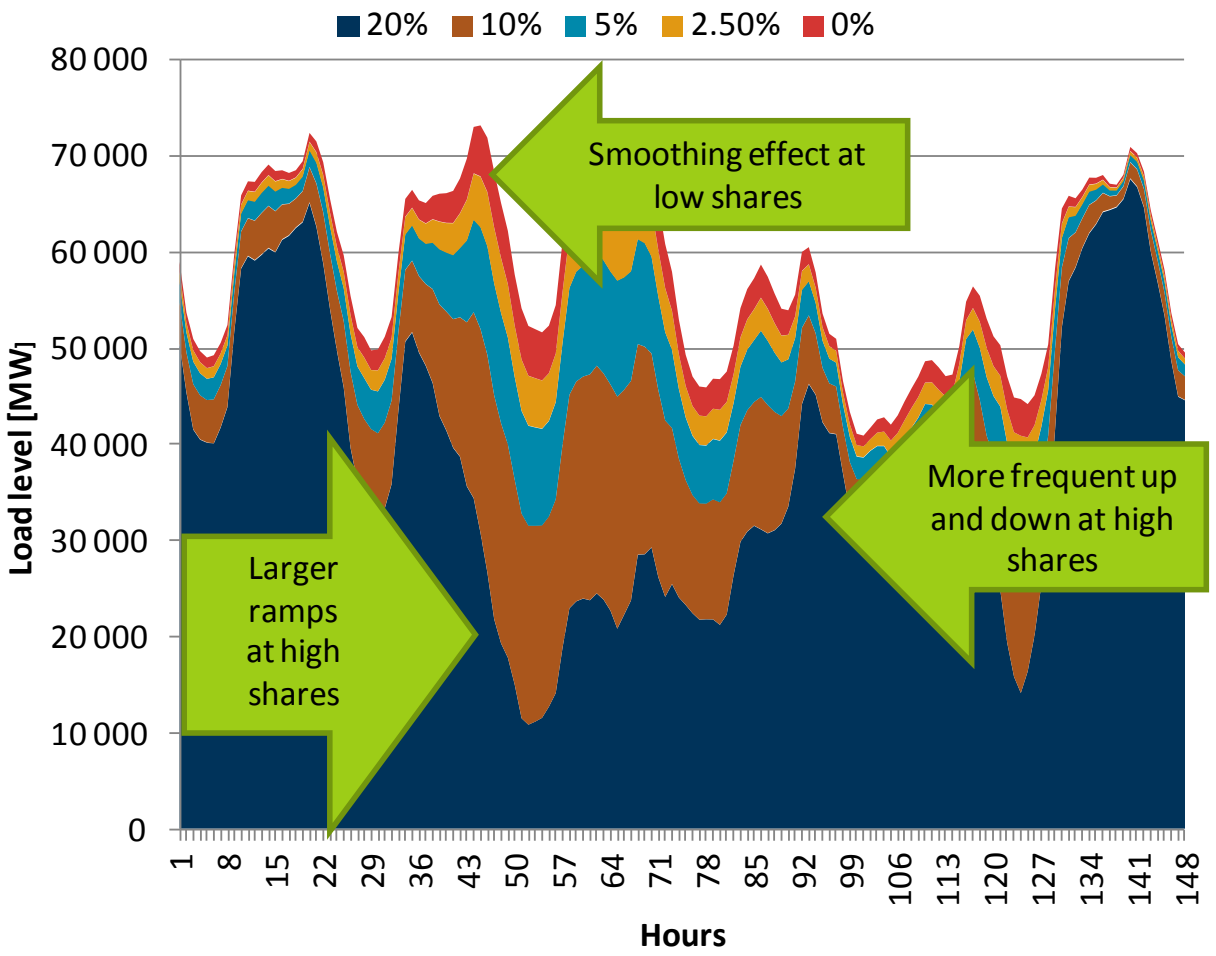
Energy security relative to oil

- Is still a very important issue!
- Energy efficiency in transport system is one key
- (renewable) electrification of transports another
- Even low shares of biofuels contribute

Energy security risks of renewables: balancing

- Higher uncertainty
- Larger and more pronounced changes

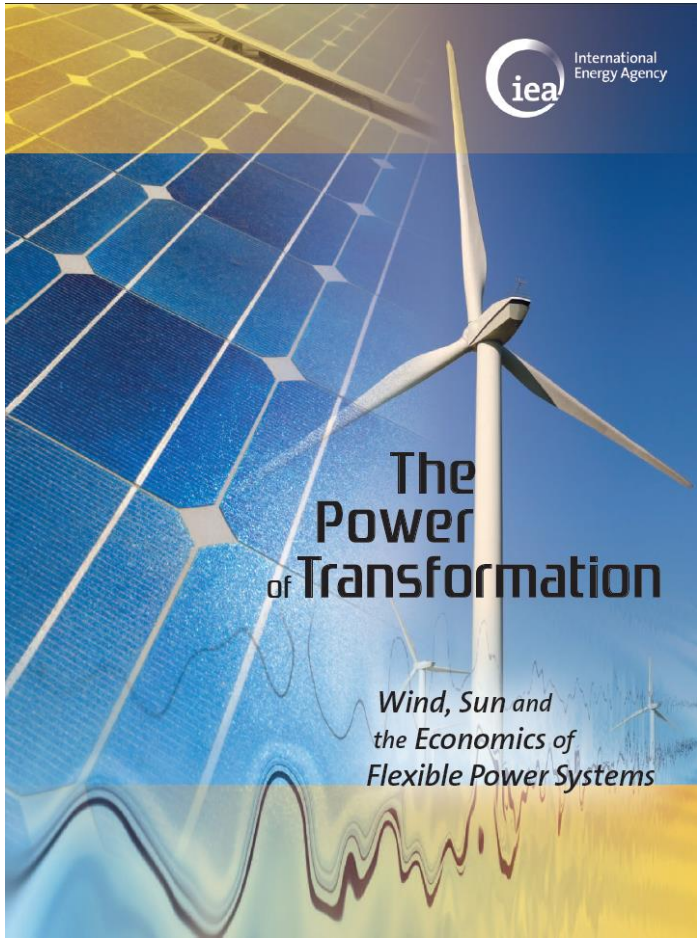
Net-load at different annual VRE shares



Note: Load data and wind data from Germany 10 to 16 November 2010, wind generation scaled, actual share 7.3%. Scaling may overestimate the impact of variability; combined effect of wind and solar may be lower, illustration only.

The Grid Integration of Variable Renewables Project - GIVAR

- **Third project phase**
  - **7 case studies covering 15 countries, >50 in-depth interviews**
  - **Technical flexibility assessment with revised IEA FAST tool 2.0**
  - **Detailed economic modelling at hourly resolution**



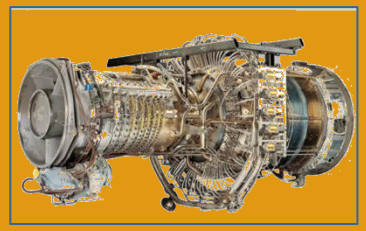
Three pillars of system transformation

Technology spread

Geographic spread

Design of power plants

System friendly VRE

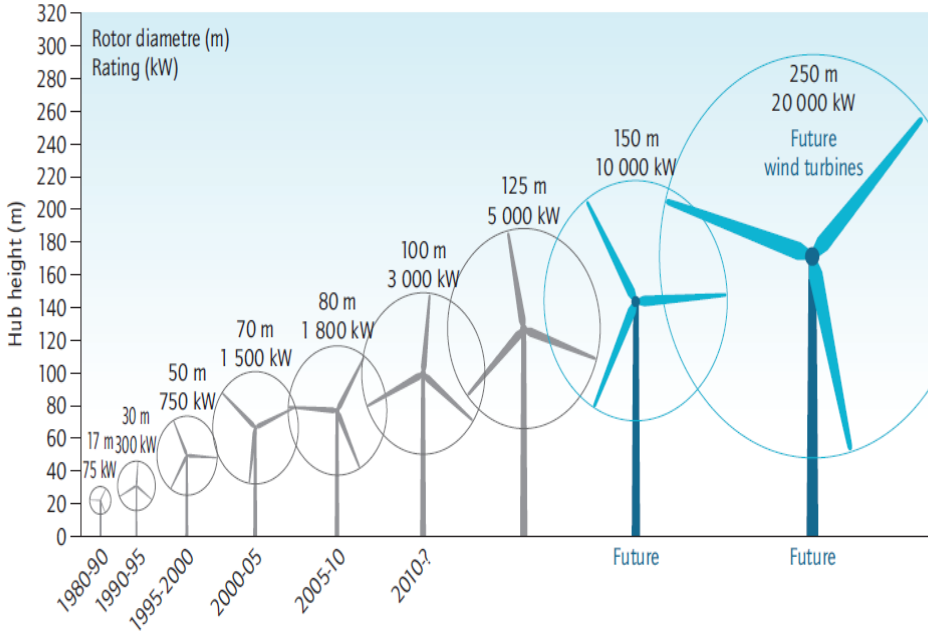


Investments

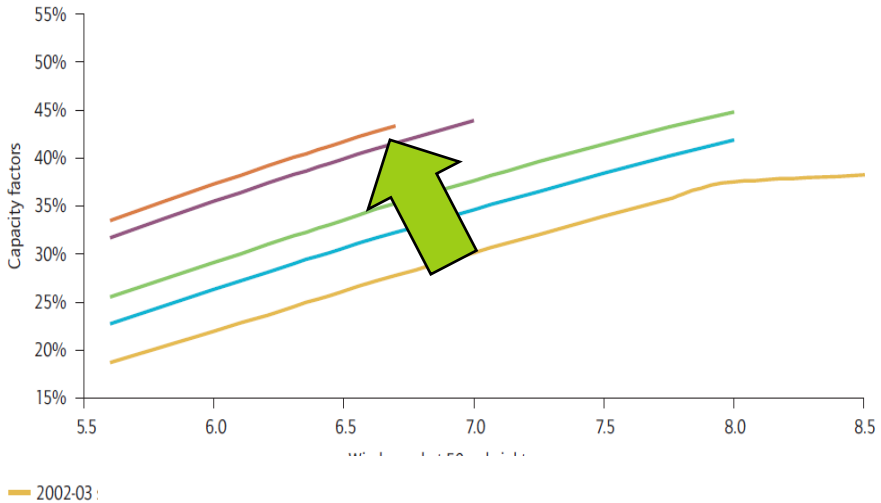
Operations

Technology evolution

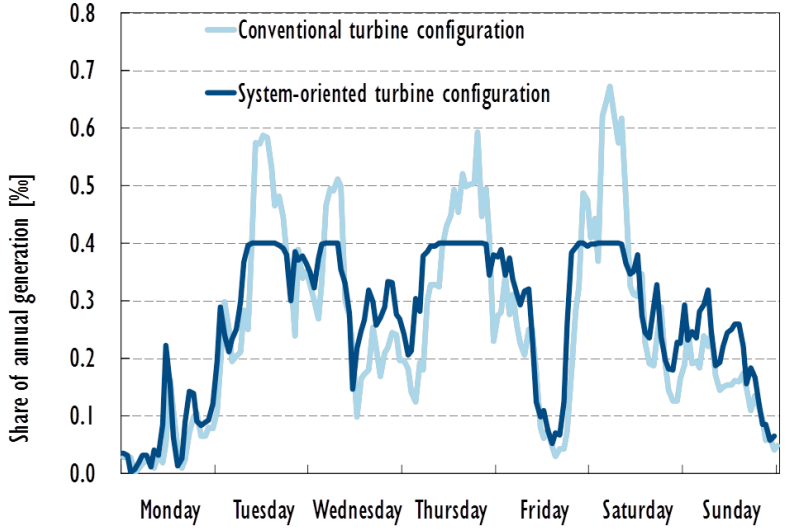
Turbine size



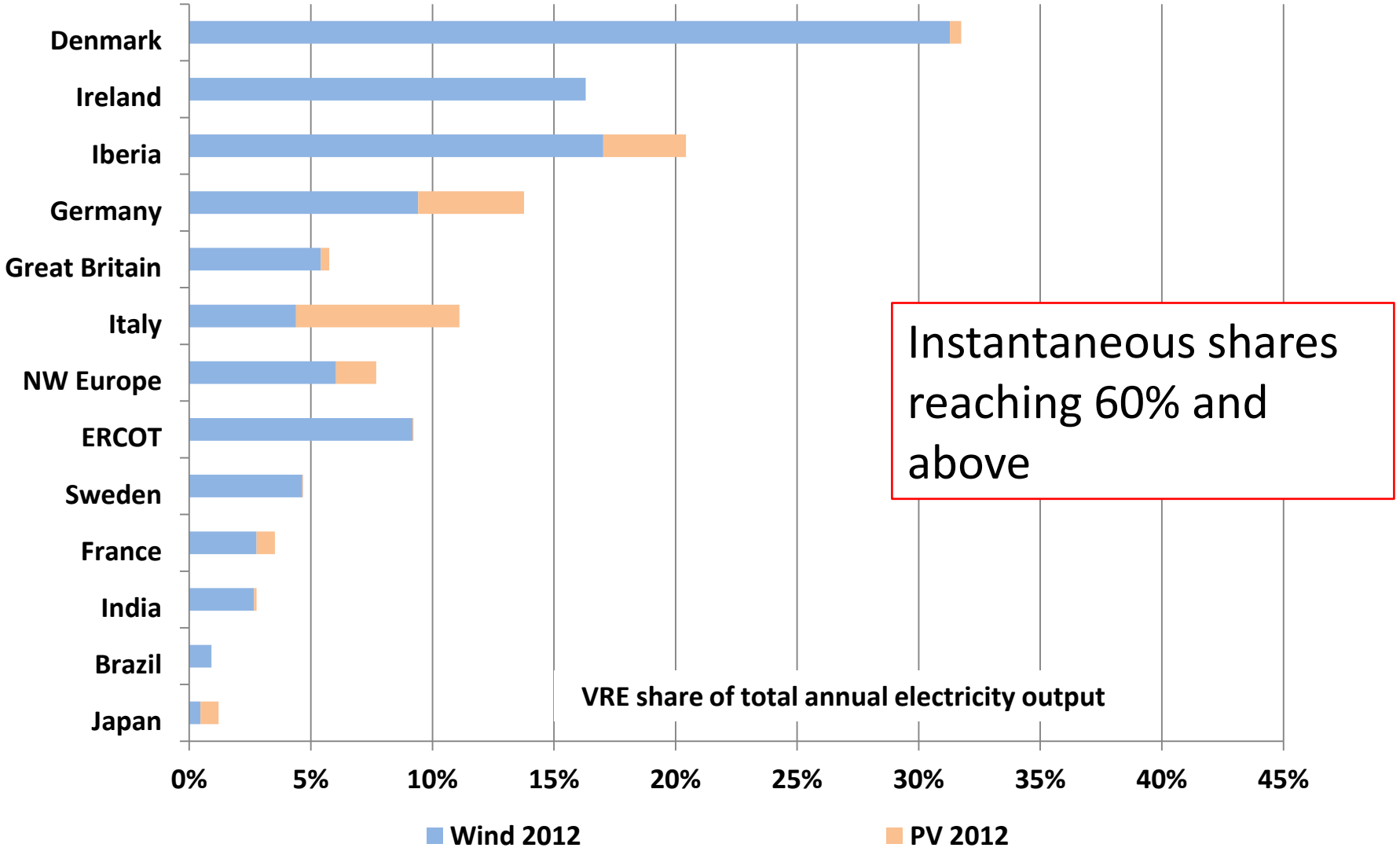
Capacity Factors



- **Growth in size, height and capacity**
  - **Greater capacity factors**
  - **Using sites with lower-speed winds**
  - **More regular output easing grid integration**



Current VRE shares and mid-term forecasts



Source: IEA statistics; note ERCOT = Electricity Reliability Council of Texas, United States

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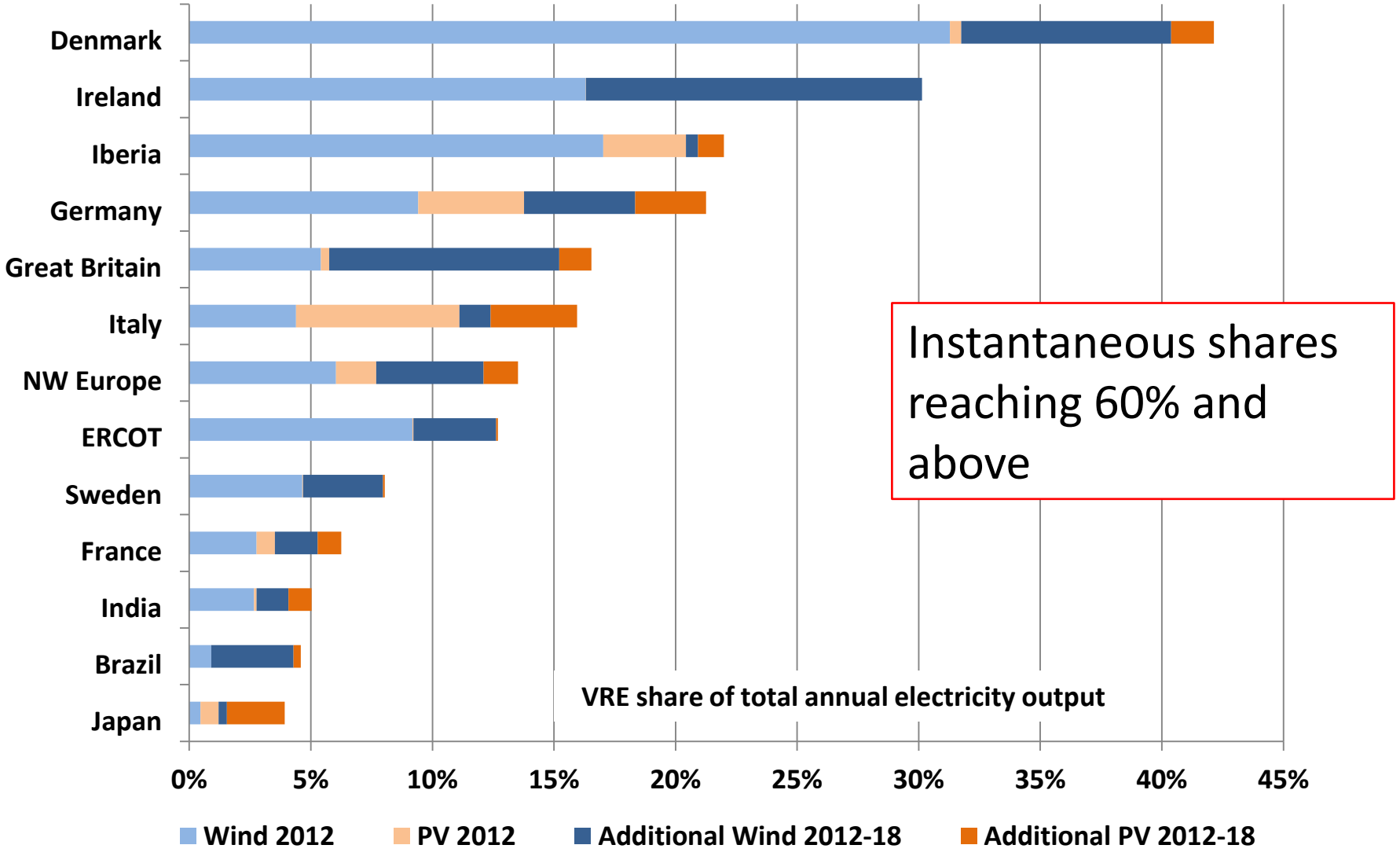

Instantaneous shares reaching 60% and above

Source: IEA estimates derived in part from IEA Medium-Term Renewable Energy Market Report 2013.

Main messages to policy makers

- Energy efficiency and renewables important for energy security
- Policy uncertainty main challenge for investors
- Given their capital intensive nature, efficiency and renewable investments, as well as supportive environment (grids, flexible generation, storage…) require market context that assures reasonable and predictable returns