Electricity Market Design under Long-Term Decarbonisation

Paris, 8 October 2014

David Hunter, EPRI
Manuel Baritaud, IEA
IEA Electricity Security Advisory Panel (ESAP)

- Launched in 2014: 1st High Level Plenary meeting in June 2014
- Set up a working group on electricity security and market design
- Unique platform for stakeholders (system operators, regulators, traders, utilities...)
- Exchange experiences and best practices among IEA countries
- Support IEA work programme on Electricity Security and market design
Workshop electricity market design under long term decarbonisation

- Carbon pricing (Cf. IETA-IEA-EPRI workshop)
- Challenges in competitive markets
- What can we learn from modelling?
- What can we learn from experiences
Workshop electricity market design under long-term decarbonisation

- Long-term decarbonisation objective: 2050

1. Energy-only market
   - High capex/low marginal costs
   - Low load factor

2. Existing markets
   - Low-carbon support schemes
   - Capacity markets

3. Long term market design
   - Unified framework?
The world faces a challenge

Energy’s carbon intensity is stuck AND we need to decouple economic growth from energy use
Electricity can power sustainable growth

But the source of electricity is of utmost importance
Electricity can power sustainable growth

The 2DS pathway disconnects primary energy used in generation from emissions
The electricity sector faces an evolving landscape and many challenges:

- Depressed wholesale prices
- Environmental & regulatory policy
- New technologies
- Influx of natural gas (US)
- Intermittent renewables
- Distributed generation
- Customer requirements
- New entrants

Source: FirstEnergy, RWE
In detail:

- Declining conventional generation revenue
- Overgeneration
- Little relationship between prices and value/costs
Utilities of today – challenged by declining conventional generation revenue. Example: RWE
Overgeneration is the Most Significant Integration Challenge

- Chart shows increasing overgeneration above 33%
  - Overgeneration is very high on some days under the 50% Large Solar case
  - Fossil generation is reduced to minimum levels needed for reliability
- Renewable curtailment is a critical strategy to maintain reliability
  - Reduces overgeneration
  - Mitigates ramping events

Source: PG&E (with modifications)
The value of variable renewables decreases with increasing concentration

Contribution of solar to EU residual load curve

∫ underneath = capacity factor ~ 13%

Solar’s percent contribution to capacity decreases as more is added, but pricing supports are constant
New EU-REGEN model gives key policy insights

- Jointly developed by EPRI and Ifo Institute, Munich
- Selected model characteristics:
  - Optimized investment/rental with high-resolution dispatch
  - Renewable resources and load based on hourly shapes
  - Continental scope with country-specific detail and cross-border power flows
- Based on US-REGEN model developed with 13 US member companies
- Wide range of applications in energy and environmental policy and technology issues
Different designs of power systems

- **Non-contracted asset in merchant environment**
  - Energy Only Market (EOM)
  - EOM & Capacity Auctions
    - Adapted to countries with fast growing residual demand. Price spikes driving economical investment
    - Adapted to sluggish residual demand. Capacity remuneration and price spikes driving investment in the eligible assets

- **Contracted asset in non-merchant environment**
  - EOM & Capacity Payment
  - PPA
    - Adapted to countries:
      - still developing their power infrastructures,
      - governmental guaranties required
      - subsidies for power, when power is a driver of health/economic development
    - Security of supply is a key issue

- **Hybrid Markets**
  - Risk that prices won’t enable operators to recover their costs
  - Regulatory risk
The key choice is to decide where we should be sitting on the carbon pricing vs. direct low carbon support policy spectrum.

Policy options:

- Carbon pricing solutions
- Support payment solutions

- Absolute Market
- Dual Support
- Coordinated European Planning
- Building National Solutions
New renewable support scheme

Low O&M costs (wind, PV...)

Specific Compensation adjustment based on the current performance of each facility

Specific compensation (€ / year)

Operating limit
Minimun equivalent operating hours
Equivalent operating hours (h) “full load”
Historical Evolution of Contracted Power in Auctions (New Energy, Reserve and Alternative Sources) - by Source (MWmedium)

Source: CCEE
Who?
Key takeaways:

- The electric grid is part of the solution
- Demand side response must be part of the equation
- Market design must adapt to new technologies
- Available financing depends on risk
- Prices need to better align with value
- No consensus on more or less market intervention