European Power, Gas, Renewables & Coal

Capacity mechanisms in Europe

March 2015
WHAT WE DELIVER

Our core workflows encompass every critical domain of business expertise.

These cross-functional solutions integrate research, analysis and information into an end-to-end problem-solving platform that enables strategic planners, engineers and operational leaders to make critical business decisions.
IHS INDUSTRIES

AEROSPACE & DEFENSE
100+ years’ experience delivering unrivaled news, insight and intelligence on defense and security equipment, markets, industries and risk

CHEMICAL
Over 200 leading industry authorities creating integrated views and analysis across more than 300 chemical markets and 2,000 processes for 95 industries

FINANCE
Research on 200+ countries and territories with harmonized indicators from IHS analysts and economists

TECHNOLOGY
World’s largest electronics component database with more than 350 million parts

AUTOMOTIVE
The world’s largest team of automotive analysts with hundreds of experts located in 15 key markets around the world covering the entire automotive value chain

ENERGY
Insight, analytics and advisory services for the world’s entire energy value chain – from well-head to burner tip, upstream to downstream

MARITIME
World’s largest maritime database with an information gathering heritage of 250+ years with comprehensive information on all vessels 100 GT and over
Key Messages

- Europe is heading towards a patchwork of un-coordinated national capacity mechanisms
- Design choices are driven by national needs, as well as different theoretical assumptions
- To reduce inefficiency, mechanisms need to be harmonized by mitigating spill-over or by moving towards a harmonized design.
Patchwork of Capacity Mechanisms
## Overview of recent developments in EU

<table>
<thead>
<tr>
<th>Country</th>
<th>Recent and current reforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>Introduced strategic reserve, tender for new plants, plan for rolling black-outs and consultation on market design.</td>
</tr>
<tr>
<td>Denmark</td>
<td>Introduction of strategic reserve in East Denmark until 2020</td>
</tr>
<tr>
<td>Estonia</td>
<td>Construction of new strategic reserve plant by Elering.</td>
</tr>
<tr>
<td>France</td>
<td>Decentral capacity market adopted. Drafting rules for interconnection. Trading expected in November.</td>
</tr>
<tr>
<td>Germany</td>
<td>Temporary strategic reserves until 2017 (cold reserve and re-dispatch reserve). Likely to reject capacity markets.</td>
</tr>
<tr>
<td>Great-Britain</td>
<td>Capacity market and temporary strategic reserve.</td>
</tr>
<tr>
<td>Greece</td>
<td>Plans to reduce capacity payments.</td>
</tr>
<tr>
<td>Ireland</td>
<td>Working on new market design (i-SEM), including capacity market for reliability options</td>
</tr>
<tr>
<td>Italy</td>
<td>Introduction of reliability market and modification of temporary capacity payments to incentivize flexibility</td>
</tr>
<tr>
<td>Nordics</td>
<td>Phase out of strategic reserve by 2017 but revised share of Demand Response.</td>
</tr>
<tr>
<td>Poland</td>
<td>Strategic reserve contracted from existing plants. Debate capacity markets.</td>
</tr>
<tr>
<td>Portugal</td>
<td>Re-instating availability payment after suspension during the EU-financial bailout program</td>
</tr>
<tr>
<td>Spain</td>
<td>Discussion over modification of capacity payments scheme or move to capacity market</td>
</tr>
</tbody>
</table>

Note: CRM = Capacity Remuneration Mechanisms
Source: IHS Energy
Upcoming developments

European countries are re-designing their electricity markets.

We will see capacity auctions in *existing markets* opening up to foreign generators, as well as consultations and decisions on a series of potential *new capacity markets*.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Great-Britain</td>
<td>Capacity Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>Capacity Obligation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>Capacity Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>Capacity Markets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>Capacity Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>Capacity Market?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>Capacity Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Commission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Existing markets**
- Great-Britain: SBR Round 2
- France: Capacity Register
- Italy: Auction for 2019/20?
- Germany: White Book
- Ireland: Consultation 1
- Belgium: Consultation Response
- Poland: Legislation in 2015/16?

**Consult. on new markets**

Source: IHS Energy
Reasons driving mechanism choice
CRM choice is based on different national needs

CRM choices are driven by different national needs, in terms of the *risks* which need to be addressed and the *urgency* of the action.

**Urgency:**

- **Next year**
  - Energy Only Market (DE, NL)
  - Strategic Reserve (BE, GB, DE, SE)
  - Tenders for Capacity (BE, EE)

- **Long-term**
  - Capacity Payment (IE, ES)
  - Capacity Market (GB, IT, FR, IE)

**Risk:**

- Closure of exist. plants
- Invest in new plants
- None

Note: CRM = Capacity Remuneration Mechanisms

Source: IHS Energy
CRM choice is based on different theoretical assumptions

The preferred CRM is a result of different theoretical assumptions about a number of key criteria*:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of lost load:</td>
<td>The cost of a MWh unsupplied energy to society.</td>
</tr>
<tr>
<td>Risk aversion:</td>
<td>The amount of additional profits which investors need to compensate them for a higher revenue uncertainty.</td>
</tr>
<tr>
<td>Regulatory error:</td>
<td>The extent to which the regulator will is unable to anticipate future system needs and evaluate performance of new technologies.</td>
</tr>
<tr>
<td>Competition level:</td>
<td>Extent to which market prices reflect the marginal production cost.</td>
</tr>
</tbody>
</table>

CRM choice is based on different theoretical assumptions

The preferred CRM is a result of different theoretical assumptions about a number of key criteria:

<table>
<thead>
<tr>
<th>Preferred CRM:</th>
<th>Value of lost load:</th>
<th>Risk aversion:</th>
<th>Competition level:</th>
<th>Regulatory error:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Only Market</td>
<td>Low</td>
<td>Low</td>
<td>Spot Market: High</td>
<td>Spot Market: Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Forward Market: Low</td>
<td>Forward Market: High</td>
</tr>
<tr>
<td>Strategic Reserve</td>
<td>High</td>
<td>Low</td>
<td>Spot Market: Medium</td>
<td>Spot Market: Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Forward Market: Low</td>
<td>Forward Market: High</td>
</tr>
<tr>
<td>Capacity Payment</td>
<td>High</td>
<td>High</td>
<td>Spot Market: Low</td>
<td>Spot Market: Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Forward Market: Low</td>
<td>Forward Market: Low</td>
</tr>
<tr>
<td>Capacity Market</td>
<td>High</td>
<td>High</td>
<td>Spot Market: Low</td>
<td>Spot Market: Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Forward Market: High</td>
<td>Forward Market: Low</td>
</tr>
</tbody>
</table>

When the preferred CRM choice does not match the national needs, countries tend to develop different CRMs at the same time, such as in GB and DE.

Note: CRM = Capacity Remuneration Mechanisms; 
Source: IHS Energy
Learnings from GB and way forward
Learnings from the first capacity market auction in GB

Main Results:

- 19.3 £/MW y clearing Price
- 49.3 GW out of 65GW contracted
- 2.6 GW new plants contracted
- 8.5 GW existing plants rejected

Learnings:

- Low clearing price as a result of over-subscribed auction and sensitivity of of CRM prices to future revenue assumptions
- Plants delaying refurbishment to compete in the auction
- Existing plants in region with high TNUoS displaced by new plants in region with low TNUoS.
- Flexible capacity additions from peakers, storage and DSM

### Results of T-4 Capacity Auction in GB

- **Existing gas**
- **Existing coal**
- **Existing nuclear**
- **New CCGT**
- **New small peakers and storage**
- **DSM**
- **Other**

### Average CRM price impact of 10% changes

- Refurbish cost down
- Power price stdev up
- Clean dark spread up
- Clean spark spread down

Source: IHS Energy
If the patchwork continues, countries need to address spill-over impacts from CRMs

**Spill-over:**

- Capacity markets depress price in neighboring countries, lowering consumer cost but increasing plant closures.

- National capacity markets may favour new plants in more expensive locations.

- Capacity may be exported during scarcity conditions.

- Independent national capacity targets lead to overprocurement.

**Solutions:**

- Strategic reserve to prevent capacity shortfall.

- Allow remuneration of foreign plants.

- Adjust dispatch rules, or buy option contracts and increase national VOLL.

- Account for contribution of plants contracted by neighboring countries.
In a harmonized approach, Europe needs to agree forward market rules and products but not quantities

General recommendations:
• Greater role for forward contracts
• Increase role for consumers to determine security standards

Questions that *need* to be harmonized:

- Option contracts?
- Align delivery time windows between countries?

- Technology neutral, i.e. open to DSM and generation?
- Regional, i.e. facilitate arbitrage between countries?

Questions that *do not need* to be harmonized:
• How much capacity / flexibility should be procured?
Europe at a cross-roads

There are different ways to achieve energy security, each of them with its own advantages.

However, choosing separate ways will risk to split the internal energy market.