ENTSO-E Working Group

Survey on Ancillary Services
Procurement & Balancing market design

September 2012
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ENTSO-E Ancillary Services Procurement & Imbalance Charges Survey

The purpose of this survey is to provide an overview of the different market arrangements in place throughout Europe with regard to Ancillary Services and Imbalance Charges. The maps illustrate how different approaches have been taken to the design elements of Ancillary Services and Imbalance Charges across Europe.

This update for 2012 includes a number of improvements and has been extended to cover imbalance charges.

The Ancillary Services Working Group members who responded to the questionnaire are as follows:

Austria, Belgium, Bosnia & Herzegovina, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland & NI, Italy, Latvia, Lithuania, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, United Kingdom.

Note: please print in colour for distinction between answers
The results highlights the great diversity of arrangements that exist for ancillary services and imbalance charges across Europe - which will be one of the biggest challenges when designing XB Balancing schemes.

This document is expected to inform the works on the Network Code Balancing and related consultations. It is meant as a quite comprehensive but user-friendly set of information on the existing arrangements.

Caveats:
• This is a relatively high-level exercise (not all details are captured).
• When developing a single set of definitions for the purpose of this survey, we experienced the difficulty to match the various concepts used in different countries. As a consequence, in some specific cases, the position of a country in a certain group might be debatable.
• This is based on information updated in September 2012 and describes the mechanisms in place in 2012, irrespective of any updates which might already be foreseen for the future.
Type of Market Design

- Central Dispatch
  - Dispatch instructions issued by the TSO to all parties. The TSO carries out the commitment process based on selected criteria (usually minimum production cost)

- Self-Dispatch - Portfolio Based Balancing
  - A portfolio of units/generators (or other plant types) follow an aggregated schedule of actions to start/stop/increase output/decrease output in real time, including aggregated incremental instructions by the TSO

- Self-Dispatch – Unit Based Balancing
  - Generators follow a schedule of actions to start/stop/increase output/decrease output in real time, including plant-per-plant incremental instructions by the TSO
Balancing Process in Place
Imbalance Charges

Please note:

- Imbalance Charges do not apply to a number of countries which is why they remain grey.
- Also some countries only have one portfolio in place meaning they are on a different map to those that have more than one.
Nature of the Balancing Obligation
Exemptions

*Other – Belgium
Special regimes for off-shore wind and new entrants respectively
Settlement Time Unit for Generation licensed to participate in the AS market is **15 min**
Settlement Time Unit for Consumption and Generation not licensed to participate in the AS market is **1 hour**

*Other – Italy*
Number of Prices

Legend

- Single Pricing
- Dual Pricing
- Other

*Other – Countries with 2 Portfolios
Generation is Dual Pricing
Consumption is Single Pricing
Main component of Imbalance Prices
If 1 portfolio* - Aggravating imbalances
Main component of Imbalance Prices
If 1 portfolio* - Reducing Imbalances
Main component of Imbalance Prices
If 2 portfolios* - For generation "aggravating imbalance"
Main component of Imbalance Prices
If 2 portfolios* - For consumption "aggravating imbalance"
Main component of Imbalance Prices
If 2 portfolios* - For generation “reducing imbalance"
Main component of Imbalance Prices
If 2 portfolios* - For consumption “reducing imbalance”
Main component of Imbalance Prices
Additional Components
Is there a minimal incentive?
FCR – Control Energy Prices used
FRR (Automatic) – Control Energy Prices used
FRR (Manual) – Control Energy Prices used

Legend
- N/A
- Yes
RR – Control Energy Prices used
Start/Stop costs in Imbalance Charges
Settlement

• Settlement
  – The financial scaling of the imbalance charges

• Balance Responsible Party (BRP)
  – A party that has a contract proving financial security and identifying balance responsibility with the imbalance settlement responsible of the market balance area entitling the party to operate in the market.

• ISR
  – A party that is responsible for settlement of the difference between the contracted quantifies and the realized quantifies of energy products for the BRPs in a Market Balance Area CRR

• Trade Responsible Party (TRP)
  – A party who can be brought to rights, legally and financially, for any imbalance between energy nominated and consumed for all associated Accounting Points

• CRR
  – A party who can be brought to rights, legally and financially, for any imbalance between energy nominated and consumed for all associated Accounting Points
Settlement

* Other 1 – Denmark
Generation is PRP
Consumption is CRR

* Other 1 – Portugal
Generation is PRP
Consumption is TRP
Ancillary Services
Replacement Reserve

- Operating reserves used to restore the required level of operating reserves to be prepared for a further system imbalance.
- This category includes operating reserves with activation time from 15 minutes up to hours.
- Please see table below for further details
Frequency Restoration Reserve

- Operating reserves necessary to restore frequency to the nominal value and power balance to the scheduled value after sudden system imbalance occurrence.
- This category includes operating reserves with an activation time typically up to 15 minutes (depending on the specific requirements of the RG).
- Operating reserves of this category are typically activated centrally and can be activated automatically or manually.
- Please see table below for further details
Frequency Containment Reserve

- Operating reserves necessary for constant containment of frequency deviations (fluctuations) from nominal value in order to constantly maintain the power balance in the whole synchronously interconnected system.

- Activation of these reserves results in a restored power balance at a frequency deviating from nominal value.

- This category includes operating reserves with the activation time typically of 30 seconds (depending on the specific requirements of the RG).

- Operating reserves of this category are usually activated automatically and locally.

- Please see table below for further details.
<table>
<thead>
<tr>
<th>Sync. Area</th>
<th>Process</th>
<th>Product</th>
<th>Activation</th>
<th>Local/Central</th>
<th>Dynamic/Static</th>
<th>Full Activation Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>BALTIC</td>
<td>Frequency Containment</td>
<td>Primary Reserve</td>
<td>Auto</td>
<td>Local</td>
<td>D</td>
<td>30 s</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Frequency Containment</td>
<td>Primary Reserve</td>
<td>Auto</td>
<td>Local</td>
<td>D</td>
<td>20 s</td>
</tr>
<tr>
<td>Iceland</td>
<td>Frequency Containment</td>
<td>Primary Control Reserve</td>
<td>Auto</td>
<td>Local</td>
<td>D</td>
<td>variable</td>
</tr>
<tr>
<td>Ireland</td>
<td>Frequency Containment</td>
<td>Primary operating reserve</td>
<td>Auto</td>
<td>Local</td>
<td>D/S</td>
<td>5 s</td>
</tr>
<tr>
<td>Ireland</td>
<td>Frequency Containment</td>
<td>Secondary operating reserve</td>
<td>Auto</td>
<td>Local</td>
<td>D/S</td>
<td>15 s</td>
</tr>
<tr>
<td>NORDIC</td>
<td>Frequency Containment</td>
<td>FNR (FCR N)</td>
<td>Auto</td>
<td>Local</td>
<td>D</td>
<td>120 s - 180 s</td>
</tr>
<tr>
<td>NORDIC</td>
<td>Frequency Containment</td>
<td>FDR (FCR D)</td>
<td>Auto</td>
<td>Local</td>
<td>D</td>
<td>30 s</td>
</tr>
<tr>
<td>RG CE</td>
<td>Frequency Containment</td>
<td>Primary Control Reserve</td>
<td>Auto</td>
<td>Local</td>
<td>D</td>
<td>30 s</td>
</tr>
<tr>
<td>UK</td>
<td>Frequency Containment</td>
<td>Frequency response dynamic</td>
<td>Auto</td>
<td>Local</td>
<td>D</td>
<td>Primary 10 s / Secondary 30 s</td>
</tr>
<tr>
<td>UK</td>
<td>Frequency Containment</td>
<td>Frequency response static</td>
<td>Auto</td>
<td>Local</td>
<td>S</td>
<td>variable</td>
</tr>
<tr>
<td>BALTIC</td>
<td>Frequency Restoration</td>
<td>Secondary emergency reserve</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>15 Min</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Frequency Restoration</td>
<td>Secondary Control Reserve</td>
<td>Auto/Manual</td>
<td>Local/Central</td>
<td>D/S</td>
<td>5 Min</td>
</tr>
<tr>
<td>Iceland</td>
<td>Frequency Restoration</td>
<td>Regulating power</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>10 Min</td>
</tr>
<tr>
<td>Ireland</td>
<td>Frequency Restoration</td>
<td>Tertiary operational reserve 1</td>
<td>Auto/Manual</td>
<td>Local/Central</td>
<td>D/S</td>
<td>90 s</td>
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<td>Ireland</td>
<td>Frequency Restoration</td>
<td>Tertiary operational reserve 2</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>5 Min</td>
</tr>
<tr>
<td>Ireland</td>
<td>Frequency Restoration</td>
<td>Replacement reserves</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>20 Min</td>
</tr>
<tr>
<td>NORDIC</td>
<td>Frequency Restoration</td>
<td>Regulating power</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>15 Min</td>
</tr>
<tr>
<td>RG CE</td>
<td>Frequency Restoration</td>
<td>Secondary Control Reserve</td>
<td>Auto</td>
<td>Central</td>
<td>D</td>
<td>≤ 15 Min</td>
</tr>
<tr>
<td>RG CE</td>
<td>Frequency Restoration</td>
<td>Direct activated Tertiary Control Reserve</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>≤ 15 Min</td>
</tr>
<tr>
<td>UK</td>
<td>Frequency Restoration</td>
<td>Various Products</td>
<td>Manual</td>
<td>D/S</td>
<td>N/A</td>
<td>variable</td>
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<tr>
<td>BALTIC</td>
<td>Replacement</td>
<td>Tertiary (cold) reserve</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>12 h</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Replacement</td>
<td>Replacement reserves</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>20 min</td>
</tr>
<tr>
<td>Iceland</td>
<td>Replacement</td>
<td>Regulating power</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>10 Min</td>
</tr>
<tr>
<td>Ireland</td>
<td>Replacement</td>
<td>Replacement reserves</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>20 Min</td>
</tr>
<tr>
<td>NORDIC</td>
<td>Replacement</td>
<td>Regulating power</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>15 Min</td>
</tr>
<tr>
<td>RG CE</td>
<td>Replacement</td>
<td>Schedule activated Tertiary Control Reserve</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>individual</td>
</tr>
<tr>
<td>RG CE</td>
<td>Replacement</td>
<td>Direct activated Tertiary Control Reserve</td>
<td>Manual</td>
<td>Central</td>
<td>S</td>
<td>individual</td>
</tr>
<tr>
<td>UK</td>
<td>Replacement</td>
<td>Various Products but the main one is Short Term Operating Reserve (STOR)</td>
<td>Manual</td>
<td>D/S</td>
<td>N/A</td>
<td>from 20 min to 4 h</td>
</tr>
</tbody>
</table>
• Procurement Scheme
  – How the services are procured

• Activation Rule
  – How the frequency restoration reserves are activated i.e. by a Pro-Rata system or on the basis of a Merit Order (cheapest being activated first)

• Minimum Bid Size
  – The minimum bid size into the balancing market

• Timeframe for Product
  – The minimum timeframe for which the product can be bid into the market or to which general agreement refers to

• Timing for offers for Capacity/Gate Closure for Energy
  – The timeframe for which the capacity is procured (Procurement Cycle) and for which the energy is procured (gate closure)
• Capacity & Energy Provider
  – Generation/Combination of Generation and Load

• Settlement Rule
  – The pricing rules for settlement

• Cost Recovery Scheme
  – From whom are the costs recovered

• Capacity & Energy Monitoring
  – Refers to the type of monitoring in place by the system operator to ensure performance of plant

• Secondary Market for Reserve Obligations
  – This is where a market for reserves can exist between other parties other than the TSOs
Procurement Scheme

• Mandatory Offers
  – Generators connected to the grid are obligated to offer the remaining capacity/available capacity

• Mandatory Provision
  – Generators connected to the grid are obligated to reserve a certain amount of capacity in order to meet TSO requirements, for a fixed price set by TSO, NRA or for free

• Mandatory Provision without Reservation
  – Generators are mandated to provide balancing services without reservation of capacity

• Bilateral Market
  – A grid user and TSO negotiate a contract regarding the offered service and price/price system

• Organised Market
  – There is no contract or obligation for a grid user to offer the reserve (before the offer). The grid user can voluntary participate in the market (e.g. tender, auction, market platform (like PX)) and bid a price or customize his offer (e.g. the volume, timeframe). The market result may lead to a bilateral contract.

• Hybrid
  – Combination
Replacement Reserves - Capacity

- Procurement Scheme
- Minimum Bid Size
- Timeframe for Product
- Timing for offers for Capacity
- Capacity & Energy Provider
- Settlement Rule
- Cost Recovery Scheme
- Capacity & Energy Monitoring
- Secondary Market for Reserve Obligations
Replacement Reserve – Capacity – Minimum Bid Size

Legend
- N/A
- No minimum bid size
- \( \leq 1\text{MW} \)
- \( \leq 5\text{MW} \)
- \( \leq 10\text{MW} \)
- \( > 10\text{MW} \)
Replacement Reserve – Capacity –
Timing for offers for capacity
Settlement Rule

• Pay as Bid
  – Contracted parties who provide a service are paid based on their offer price

• Marginal Pricing
  – Marginal pricing is the change in total cost that arises when the quantity produced changes by one unit

• Regulated Price
  – Price for this service is based on a price that is set by the relevant regulatory authority

• Hybrid
  – Combination
Replacement Reserve – Capacity – Settlement Rule
Replacement Reserve – Capacity – Cost Recovery Scheme

Legend

- N/A
- 100% Grid Users
- 100% BRP
- Mix of Grid Users and BRP
Monitoring

• Ex-post Check
  – Is monitoring of performance of plant carried out after the event?

• Real-time Monitoring
  – Monitoring of delivery of ancillary services in real time
Replacement Reserve – Capacity & Energy – Monitoring

Legend
- N/A
- Real-Time Monitoring
- Ex-Post Check
- Hybrid

[Map of Europe with various regions shaded in different colors to indicate monitoring methods.]
Replacement Reserve – Capacity – Secondary Market for Reserve Obligations
Replacement Reserve - Energy

- Procurement Scheme
- Activation Rule
- Minimum Bid Size into Balancing Market
- Timeframe for Product
- Gate Closure for Energy
- Settlement Rule
- Cost Recovery Scheme
Activation Rule

• Pro-Rata (Parallel Activation)
  – In Proportion (Parallel Activation)

• Merit Order
  – A merit order is a way of ranking available sources of energy in ascending order of their short run marginal costs of production, so that those with the lowest marginal costs are the first ones to be brought online to meet demand
Replacement Reserve – Energy – Minimum Bid Size into Balancing Market

Legend:
- N/A
- No minimum bid size
- <= 1MW
- <= 5MW
- <= 10MW
- > 10MW
Replacement Reserve – Energy – Timeframe for Product
Frequency Restoration Reserve – Automatic - Capacity

- Procurement Scheme
- Minimum Bid Size
- Timeframe for Product
- Timing for offers for Capacity
- Capacity & Energy Provider
- Settlement Rule
- Cost Recovery Scheme
- Capacity & Energy Monitoring
FRR (Automatic) – Capacity – Timeframe for Product
FRR (Automatic) – Capacity – Timing for Offers for Capacity
FRR (Automatic) – Capacity & Energy – Provider

Legend
- N/A
- Generators Only
- Generators + Load

[Map of Europe showing regions with varying colors representing different levels of FRR capacity and energy provider status]
FRR (Automatic) – Capacity – Cost Recovery Scheme

Legend

- N/A
- 100% Grid Users
- 100% BRP
- Mix of Grid Users and BRP
Frequency Restoration Reserve – Automatic - Energy

- Procurement Scheme
- Activation Rule
- Minimum Bid Size into Balancing Market
- Timeframe for Product
- Gate Closure for Energy
- Settlement Rule
- Cost Recovery Scheme
FRR (Automatic) – Energy – Procurement Scheme
FRR (Automatic) – Energy – Activation Rule
FRR (Automatic) – Energy – Minimum Bid Size into Balancing Market

Legend:
- N/A
- No minimum bid size
- <= 1MW
- <= 5MW
FRR (Automatic) – Energy – Gate Closure for Energy
FRR (Automatic) – Energy – Settlement Rule
FRR (Automatic) – Energy – Cost Recovery Scheme
Frequency Restoration Reserve – Manual - Capacity

- Procurement Scheme
- Minimum Bid Size
- Timeframe for Product
- Timing for offers for Capacity
- Capacity & Energy Provider
- Settlement Rule
- Cost Recovery Scheme
- Capacity & Energy Monitoring
- Secondary Market for Reserve Obligations
FRR (Manual) – Capacity – Timing for Offers for Capacity
FRR (Manual) – Capacity – Cost Recovery Scheme

Legend
- N/A
100% Grid Users
100% BRP
Mix of Grid Users and BRP

Map showing the distribution of FRM capacity across different regions in Europe with a color-coded legend indicating the cost recovery scheme.
FRR (Manual) – Capacity – Secondary Market for Reserve Obligations
Frequency Restoration Reserve – Manual - Energy

- Procurement Scheme
- Activation Rule
- Minimum Bid Size into Balancing Market
- Timeframe for Product
- Gate Closure for Energy
- Settlement Rule
- Cost Recovery Scheme
FRR (Manual) – Energy – Activation Rule

Legend:
- N/A
- Pro-Rata (Parallel Activation)
- Merit Order

The map shows the distribution of countries within Europe with different activations rules for FRR (Manual) – Energy – Activation Rule. The legend indicates the criteria for these activations, with countries marked in blue, red, and grey representing different levels of activation.
FRR (Manual) – Energy – Timeframe for Product

Legend:
- N/A
- Hour (or Blocks)
- 30 minutes
- 15 minutes
FRR (Manual) – Energy – Gate Closure for Energy
FRR (Manual) – Energy – Settlement Rule

Legend:
- N/A
- Pay as Bid
- Marginal Pricing
- Regulated Price
- Hybrid
Frequency Containment Reserve - Capacity

- Procurement Scheme
- Minimum Bid Size
- Timeframe for Product
- Timing for offers for Capacity
- Capacity & Energy Provider
- Settlement Rule
- Cost Recovery Scheme
- Capacity & Energy Monitoring
- Secondary Market for Reserve Obligations
Frequency Containment Reserve – Capacity – Procurement Scheme

Legend:
- N/A
- Mandatory Offers
- Mandatory Provision
- Mandatory Provision without Reservation
- Bilateral Market
- Organised Market
- Hybrid

Map showing geographic distribution of procurement schemes across Europe.
Frequency Containment Reserve – Capacity – Minimum Bid Size
Frequency Containment Reserve – Capacity – Timeframe for Product
Frequency Containment Reserve – Capacity – Timing for Offers for Capacity
Frequency Containment Reserve – Capacity – Settlement Rule
Frequency Containment Reserve – Capacity & Energy – Monitoring
Frequency Containment Reserve – Capacity – Secondary Market for Reserve Obligations
Frequency Containment Reserve - Energy

- Procurement Scheme
- Minimum Bid Size into Balancing Market
- Timeframe for Product
- Gate Closure for Energy
- Settlement Rule
- Cost Recovery Scheme
Frequency Containment Reserve – Energy – Procurement Scheme
Frequency Containment Reserve – Energy – Minimum Bid Size into Balancing Market
Frequency Containment Reserve – Energy – Timeframe for Product
Frequency Containment Reserve – Energy – Gate Closure for Energy
Frequency Containment Reserve – Energy – Settlement Rule
Frequency Containment Reserve – Energy – Cost Recovery Scheme