

ENTSO-E Working Group

Survey on Ancillary Services Procurement & Balancing market design

September 2012



Reliable Sustainable Connected

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Introduction (1)

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

Introduction (2)

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

Legend	
-	Grey
Central Dispatch	Red
Self-Dispatch - Portfolio Based	Blue
Self-Dispatch - Unit Based	Cyan





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

Legend	
-	Grey
Financial Only	Green
Legal + Financial	Cyan



Exemptions

Legend	
-	Grey
None	Red
RES	Green
Other	Cyan



**Other – Belgium*
Special regimes for off-shore wind and new entrants respectively

Number of Imbalance Portfolios

Legend	
-	Grey
1 Portfolio	Red
2 Portfolios	Blue
> 2 Portfolios	Cyan



Settlement Time Unit

Legend	
-	Grey
15 min	Red
30 min	Green
1 hour	Purple
*Other	Cyan



**Other – Italy*

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**

Number of Prices

Legend	
-	Grey
Single Pricing	Red
Dual Pricing	Blue
Other	Cyan



**Other – Countries with 2 Portfolios
Generation is **Dual Pricing**
Consumption is **Single Pricing***

Main component of Imbalance Prices If 1 portfolio* - Aggravating imbalances

Legend	
-	Grey
Average Control Energy Price	Yellow
Marginal Control Energy Price	Green
Day-Ahead Market Price	Blue
Intraday Market Price	Purple
Other	Cyan



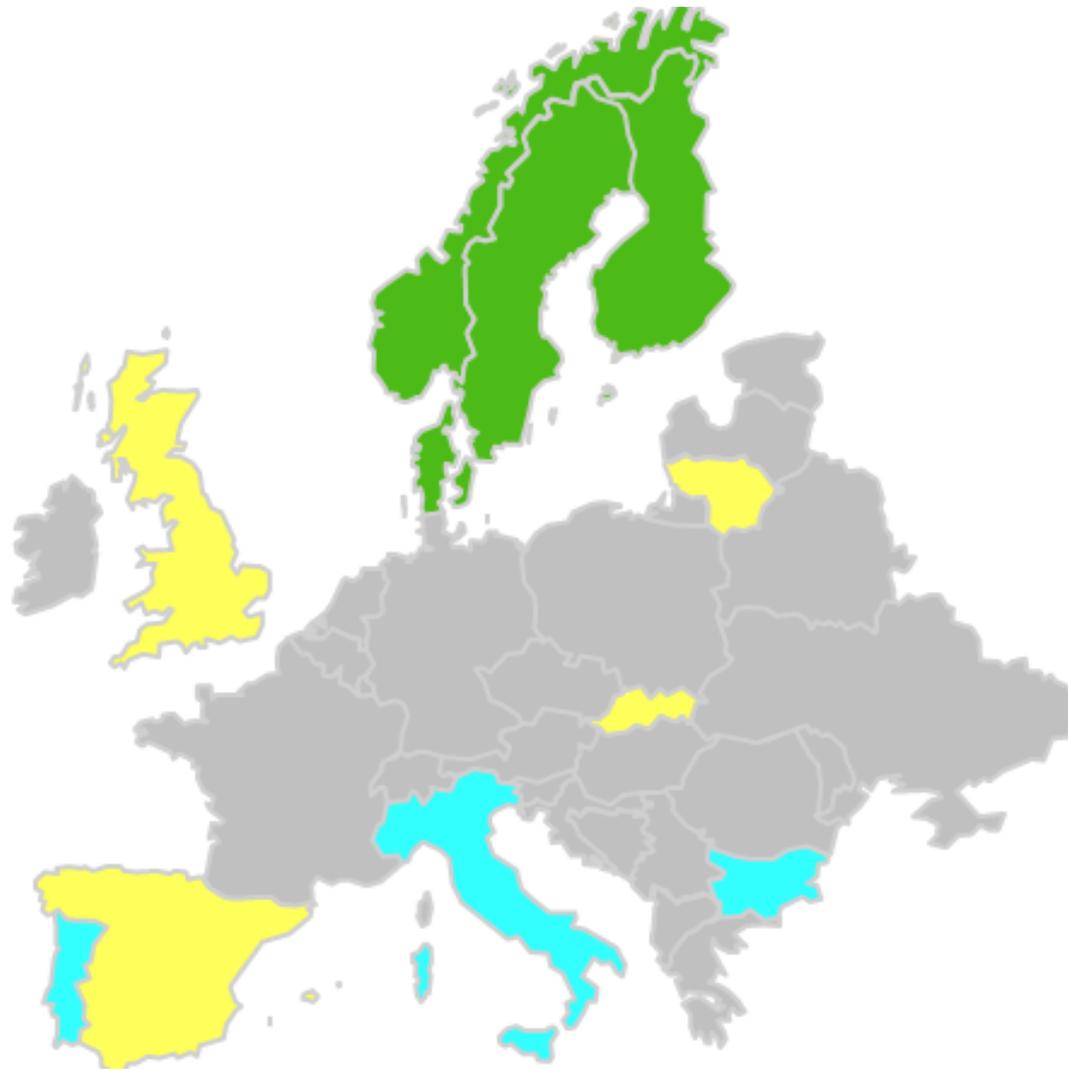
Main component of Imbalance Prices If 1 portfolio* - Reducing Imbalances

Legend	
-	Grey
Average Control Energy Price	Yellow
Marginal Control Energy Price	Green
Day-Ahead Market Price	Blue
Intraday Market Price	Purple
Other	Cyan



Main component of Imbalance Prices
If 2 portfolios* - For generation "aggravating imbalance"

Legend	
-	Grey
Average Control Energy Price	Yellow
Marginal Control Energy Price	Green
Day-Ahead Market Price	Blue
Intraday Market Price	Purple
Other	Cyan



Main component of Imbalance Prices
If 2 portfolios* - For consumption "aggravating imbalance"

Legend	
-	Grey
Average Control Energy Price	Yellow
Marginal Control Energy Price	Green
Day-Ahead Market Price	Blue
Intraday Market Price	Purple
Other	Cyan



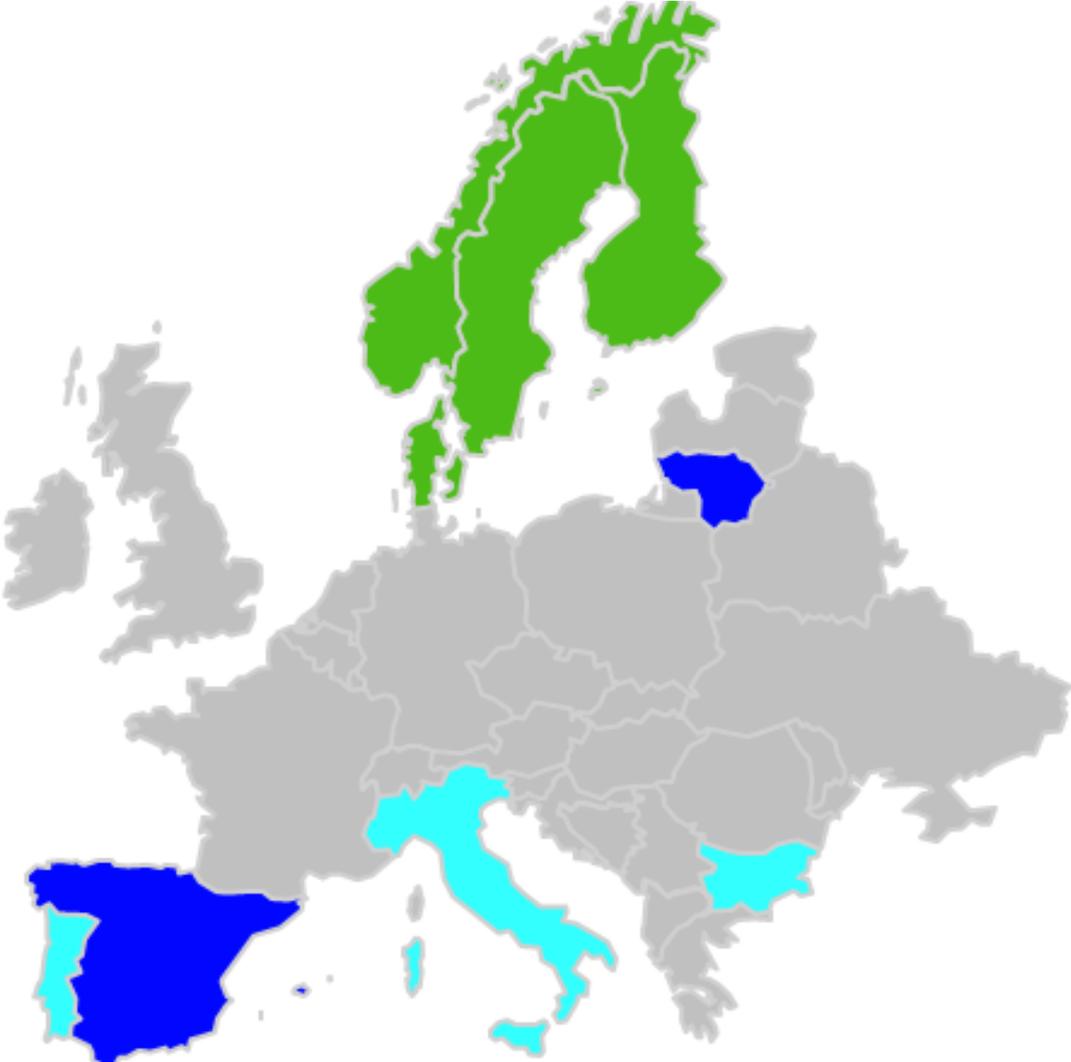
Main component of Imbalance Prices
If 2 portfolios* - For generation "reducing imbalance"

Legend	
-	Grey
Average Control Energy Price	Yellow
Marginal Control Energy Price	Green
Day-Ahead Market Price	Blue
Intraday Market Price	Purple
Other	Cyan



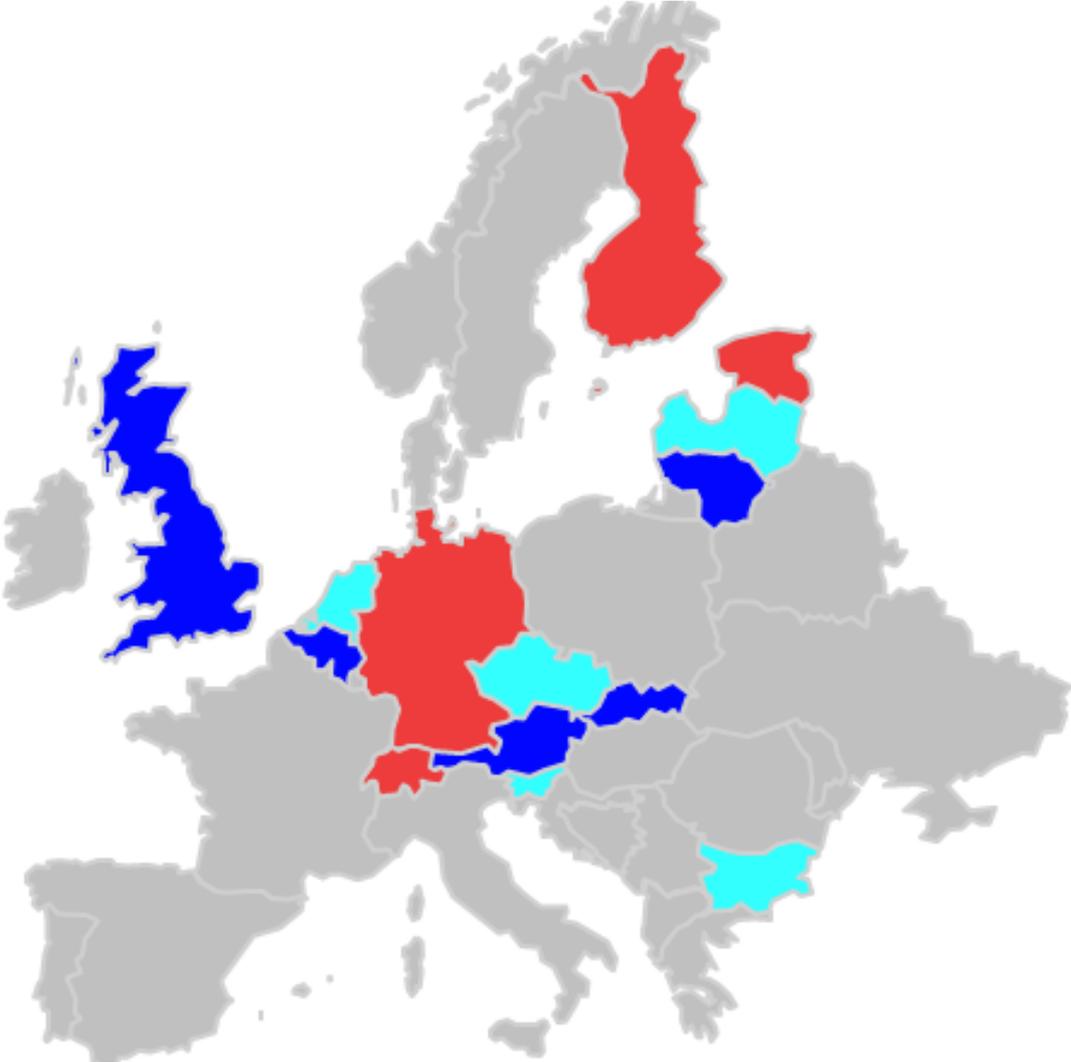
Main component of Imbalance Prices
If 2 portfolios* - For consumption "reducing imbalance"

Legend	
-	Grey
Average Control Energy Price	Yellow
Marginal Control Energy Price	Green
Day-Ahead Market Price	Blue
Intraday Market Price	Purple
Other	Cyan



Main component of Imbalance Prices
Additional Components

Legend	
-	Grey
Constant Component	Red
Variable Component	Blue
Other	Cyan



Is there a minimal incentive?

Legend	
-	Grey
N/A	Red
Yes	Blue
No	Cyan



FCR – Control Energy Prices used

Legend	
-	Grey
N/A	Red
Yes	Blue
No	Cyan



FRR (Automatic) – Control Energy Prices used

Legend	
-	Grey
N/A	Red
Yes	Blue
No	Cyan



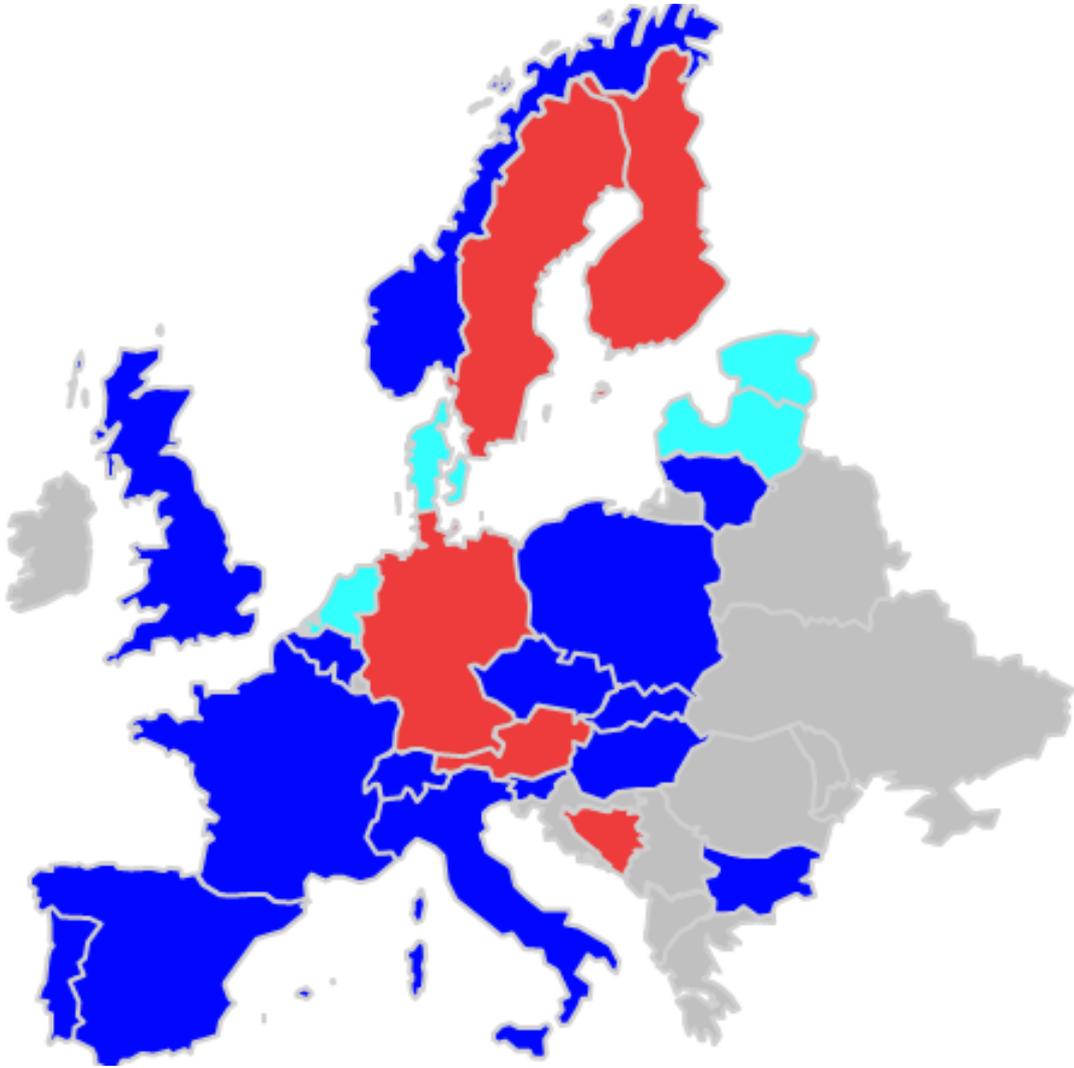
FRR (Manual) – Control Energy Prices used

Legend	
-	Grey
N/A	Green
Yes	Cyan



RR – Control Energy Prices used

Legend	
-	Grey
N/A	Red
Yes	Blue
No	Cyan



Start/Stop costs in Imbalance Charges

Legend	
-	Grey
Not Included	Green
Implicitly Included	Cyan



Publication

Legend	
-	Grey
N/A	Yellow
Prior to Delivery	Red
< 1 hour after delivery	Green
< 1 day after delivery	Blue
< 1 week after delivery	Orange
> 1 week after delivery	Cyan



Complaint Period

Legend	
-	Grey
N/A	Yellow
<= 1 Day	Red
<= 1 Week	Green
<= 1 Month	Blue
<= 1 Year	Orange
> 1 Year	Cyan



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 quantities and the realized quantities 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

Legend	
-	Grey
BRP	Red
ISR	Green
* Other 1	Purple
* Other 2	Cyan



* 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

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

- 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 – Procurement Scheme

Legend	
-	Grey
N/A	Yellow
Mandatory Provision	Green
Bilateral Market	Blue
Organised Market	Purple
Mandatory Offer	Cyan



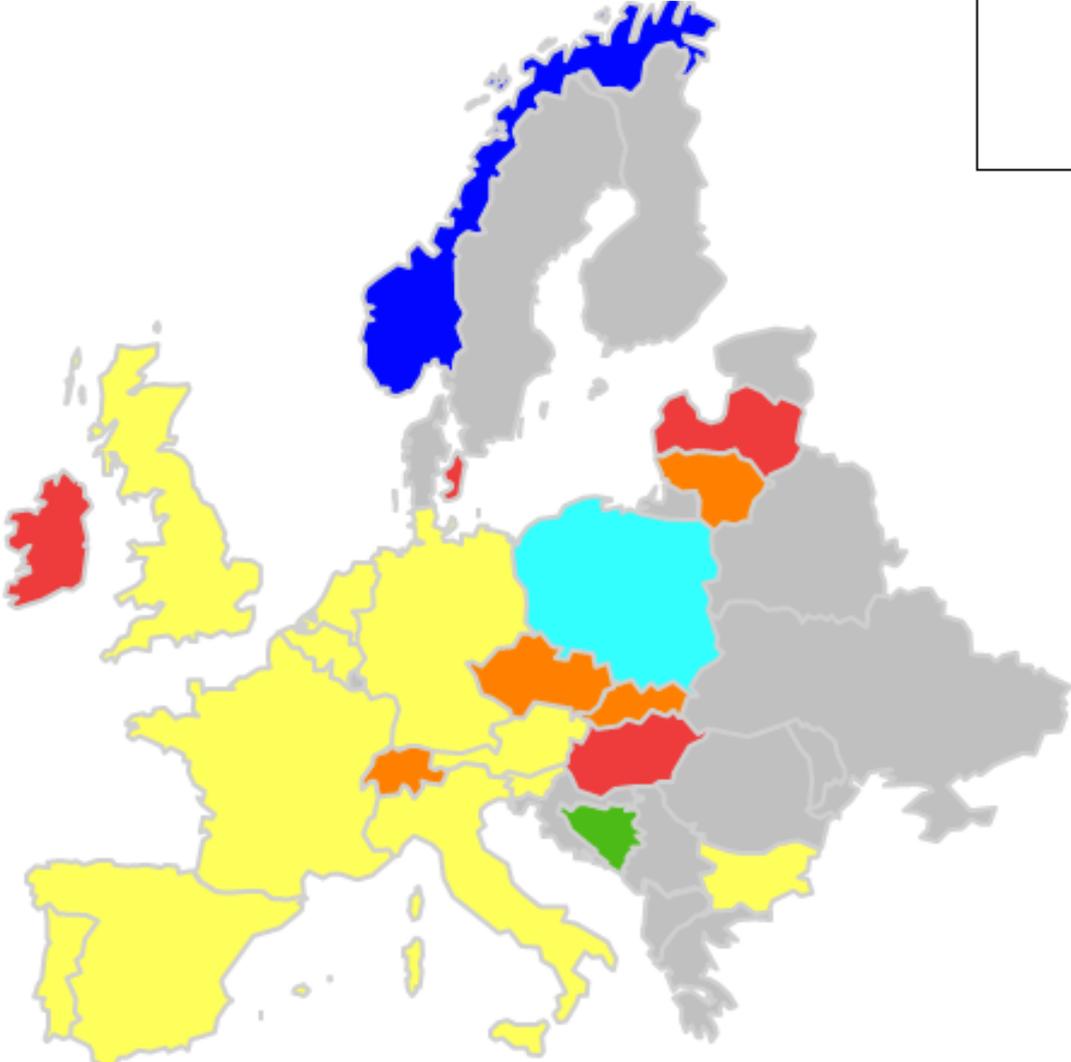
Replacement Reserve – Capacity – Minimum Bid Size

Legend	
-	Grey
N/A	Yellow
No minimum bid size	Red
$\leq 1\text{MW}$	Green
$\leq 5\text{MW}$	Blue
$\leq 10\text{MW}$	Orange
$> 10\text{MW}$	Cyan



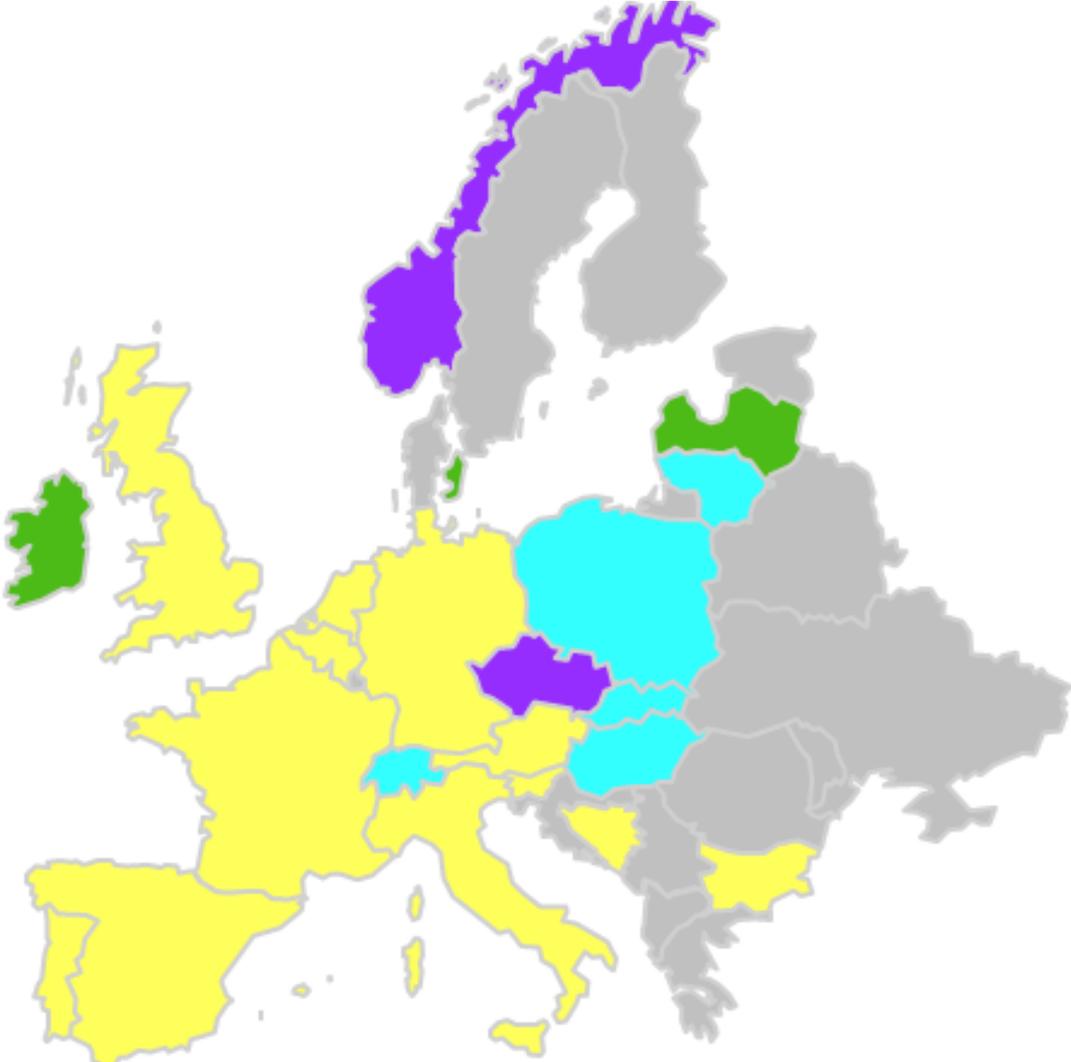
Replacement Reserve – Capacity – Timeframe for Product

Legend	
-	Grey
N/A	Yellow
Year or more	Red
Month(s)	Green
Week(s)	Blue
Day(s)	Orange
Hour(s)	Cyan



Replacement Reserve – Capacity – Timing for offers for capacity

Legend	
-	Grey
N/A	Yellow
Year or more	Green
Month(s)	Blue
Week(s)	Purple
Day(s)	Cyan



Replacement Reserve – Capacity & Energy – Provider

Legend	
-	Grey
N/A	Red
Generators Only	Blue
Generators + Load	Cyan



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

Legend	
-	Grey
N/A	Red
Pay as Bid	Green
Marginal Pricing	Purple
Regulated Price	Cyan



Replacement Reserve – Capacity – Cost Recovery Scheme

Legend	
-	Grey
N/A	Red
100% Grid Users	Green
100% BRP	Purple
Mix of Grid Users and BRP	Cyan



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	
-	Grey
N/A	Red
Real-Time Monitoring	Green
Ex-Post Check	Purple
Hybrid	Cyan



Replacement Reserve – Capacity – Secondary Market for Reserve Obligations

Legend	
-	Grey
N/A	Green
No	Cyan



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

Replacement Reserve – Energy – Procurement Scheme

Legend	
-	Grey
N/A	Red
Mandatory Offers	Blue
Market	Cyan



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 – Activation Rule

Legend	
-	Grey
N/A	Red
Pro-Rata (Parallel Activation)	Blue
Merit Order	Cyan



Replacement Reserve – Energy – Minimum Bid Size into Balancing Market

Legend	
-	Grey
N/A	Yellow
No minimum bid size	Red
$\leq 1\text{MW}$	Green
$\leq 5\text{MW}$	Blue
$\leq 10\text{MW}$	Orange
$> 10\text{MW}$	Cyan



Replacement Reserve – Energy – Timeframe for Product

Legend	
-	Grey
N/A	Red
Hour (or Blocks)	Green
30 minutes	Purple
15 minutes	Cyan



Replacement Reserve – Energy – Gate Closure for Energy

Legend	
-	Grey
N/A	Yellow
> D-1	Green
D-1	Blue
> H-1	Purple
<= H-1	Cyan



Replacement Reserve – Energy – Settlement Rule

Legend	
-	Grey
N/A	Yellow
Pay as Bid	Green
Marginal Pricing	Blue
Regulated Price	Purple
Hybrid	Cyan



Replacement Reserve – Energy – Cost Recovery Scheme

Legend	
-	Grey
N/A	Red
100% Grid Users	Green
100% BRP	Purple
Mix of Grid Users and BRP	Cyan



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 – Procurement Scheme

Legend	
-	Grey
N/A	Yellow
Mandatory Offers	Red
Mandatory Provision	Green
Mandatory Provision without Reservation	Blue
Bilateral Market	Purple
Organised Market	Orange
Hybrid	Cyan



FRR (Automatic) – Capacity – Minimum Bid Size

Legend	
-	Grey
N/A	Yellow
No minimum bid size	Red
$\leq 1\text{MW}$	Green
$\leq 5\text{MW}$	Blue
$\leq 10\text{MW}$	Orange
$> 10\text{MW}$	Cyan



FRR (Automatic) – Capacity – Timeframe for Product

Legend	
-	Grey
N/A	Yellow
Year or more	Red
Month(s)	Green
Week(s)	Blue
Day(s)	Orange
Hour(s)	Cyan



FRR (Automatic) – Capacity – Timing for Offers for Capacity

Legend	
-	Grey
N/A	Yellow
Year or more	Green
Month(s)	Blue
Week(s)	Purple
Day(s)	Cyan



FRR (Automatic) – Capacity & Energy – Provider

Legend	
-	Grey
N/A	Red
Generators Only	Blue
Generators + Load	Cyan



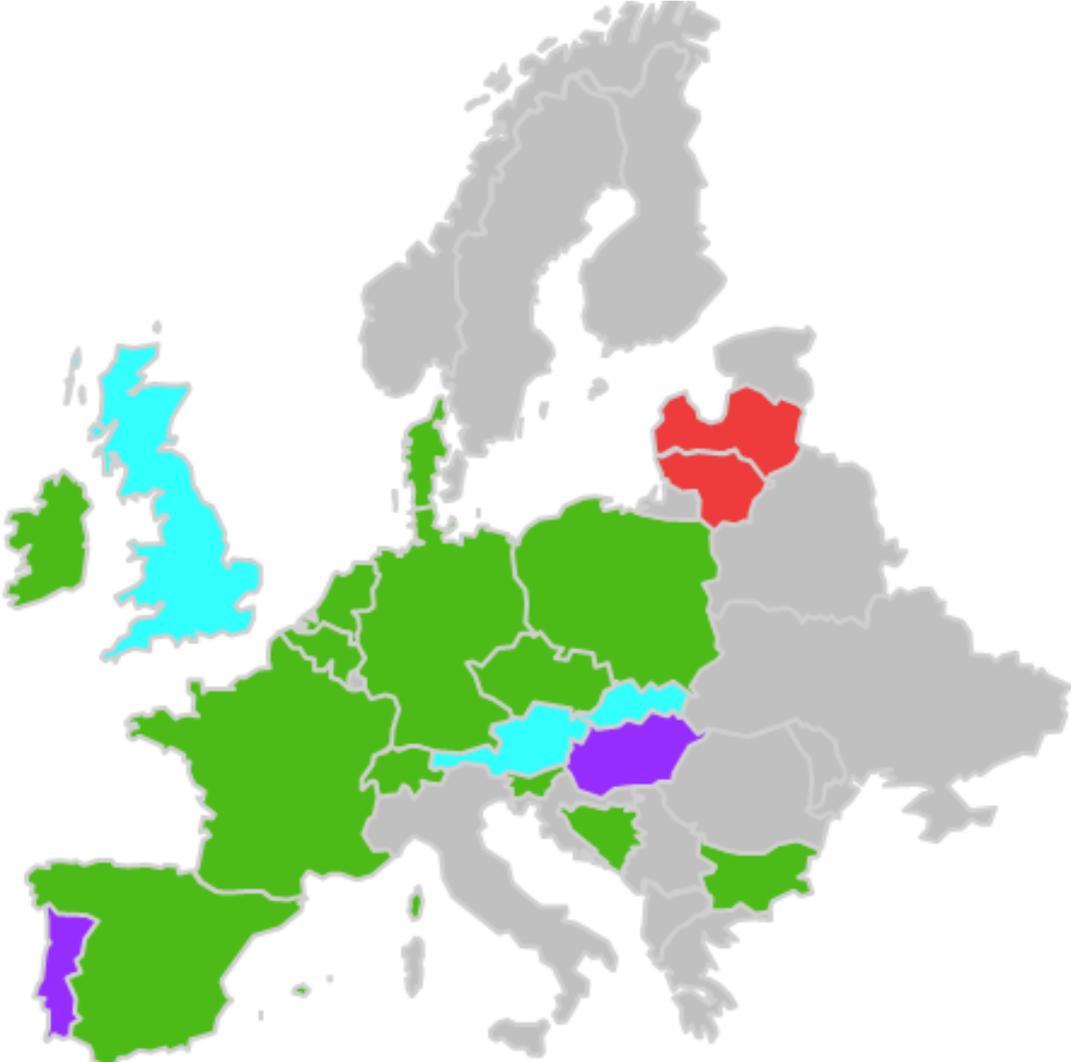
FRR (Automatic) – Capacity – Settlement Rule

Legend	
-	Grey
N/A	Red
Pay as Bid	Green
Marginal Pricing	Purple
Regulated Price	Cyan



FRR (Automatic) – Capacity – Cost Recovery Scheme

Legend	
-	Grey
N/A	Red
100% Grid Users	Green
100% BRP	Purple
Mix of Grid Users and BRP	Cyan



FRR (Automatic) – Capacity & Energy – Monitoring

Legend	
-	Grey
N/A	Red
Real-Time Monitoring	Green
Ex-Post Check	Purple
Hybrid	Cyan



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

Legend	
-	Grey
N/A	Red
Mandatory Offers	Green
Market	Purple
Hybrid	Cyan



FRR (Automatic) – Energy – Activation Rule

Legend	
-	Grey
N/A	Red
Pro-Rata (Parallel Activation)	Blue
Merit Order	Cyan



FRR (Automatic) – Energy – Minimum Bid Size into Balancing Market

Legend	
-	Grey
N/A	Red
No minimum bid size	Green
$\leq 1\text{MW}$	Purple
$\leq 5\text{MW}$	Cyan



FRR (Automatic) – Energy – Timeframe for Product

Legend	
-	Grey
N/A	Red
Hour (or Blocks)	Green
30 minutes	Purple
15 minutes	Cyan



FRR (Automatic) – Energy – Gate Closure for Energy

Legend	
-	Grey
N/A	Yellow
> D-1	Green
D-1	Blue
> H-1	Purple
<= H-1	Cyan



FRR (Automatic) – Energy – Settlement Rule

Legend	
-	Grey
N/A	Yellow
Pay as Bid	Green
Marginal Pricing	Blue
Regulated Price	Purple
Hybrid	Cyan



FRR (Automatic) – Energy – Cost Recovery Scheme

Legend	
-	Grey
N/A	Red
100% Grid Users	Green
100% BRP	Purple
Mix of Grid Users and BRP	Cyan



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 – Procurement Scheme

Legend	
-	Grey
N/A	Red
Mandatory Provision	Green
Bilateral Market	Purple
Organised Market	Cyan



FRR (Manual) – Capacity – Minimum Bid Size

Legend	
-	Grey
N/A	Yellow
No minimum bid size	Red
$\leq 1\text{MW}$	Green
$\leq 5\text{MW}$	Blue
$\leq 10\text{MW}$	Orange
$> 10\text{MW}$	Cyan



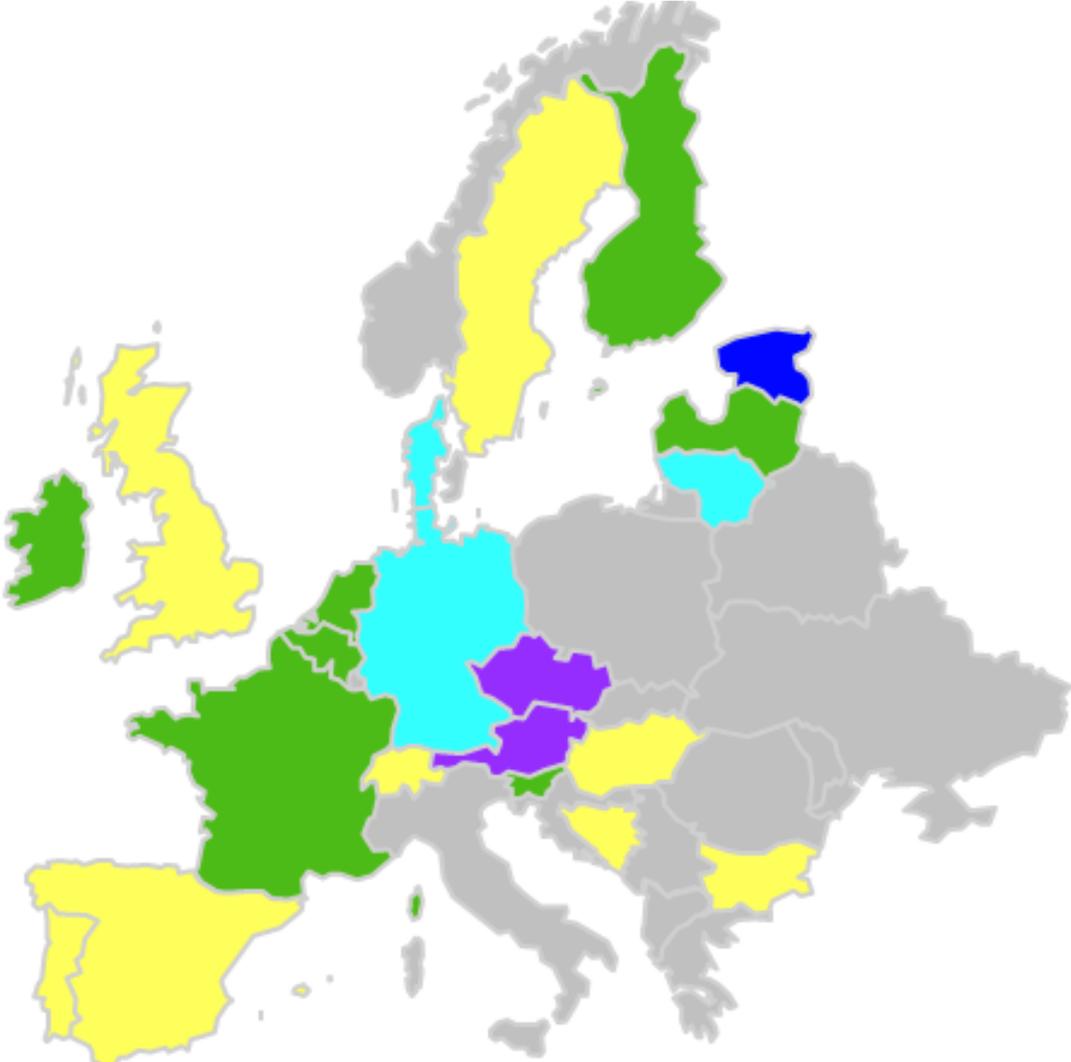
FRR (Manual) – Capacity – Timeframe for Product

Legend	
-	Grey
N/A	Yellow
Year or more	Red
Month(s)	Green
Week(s)	Blue
Day(s)	Orange
Hour(s)	Cyan



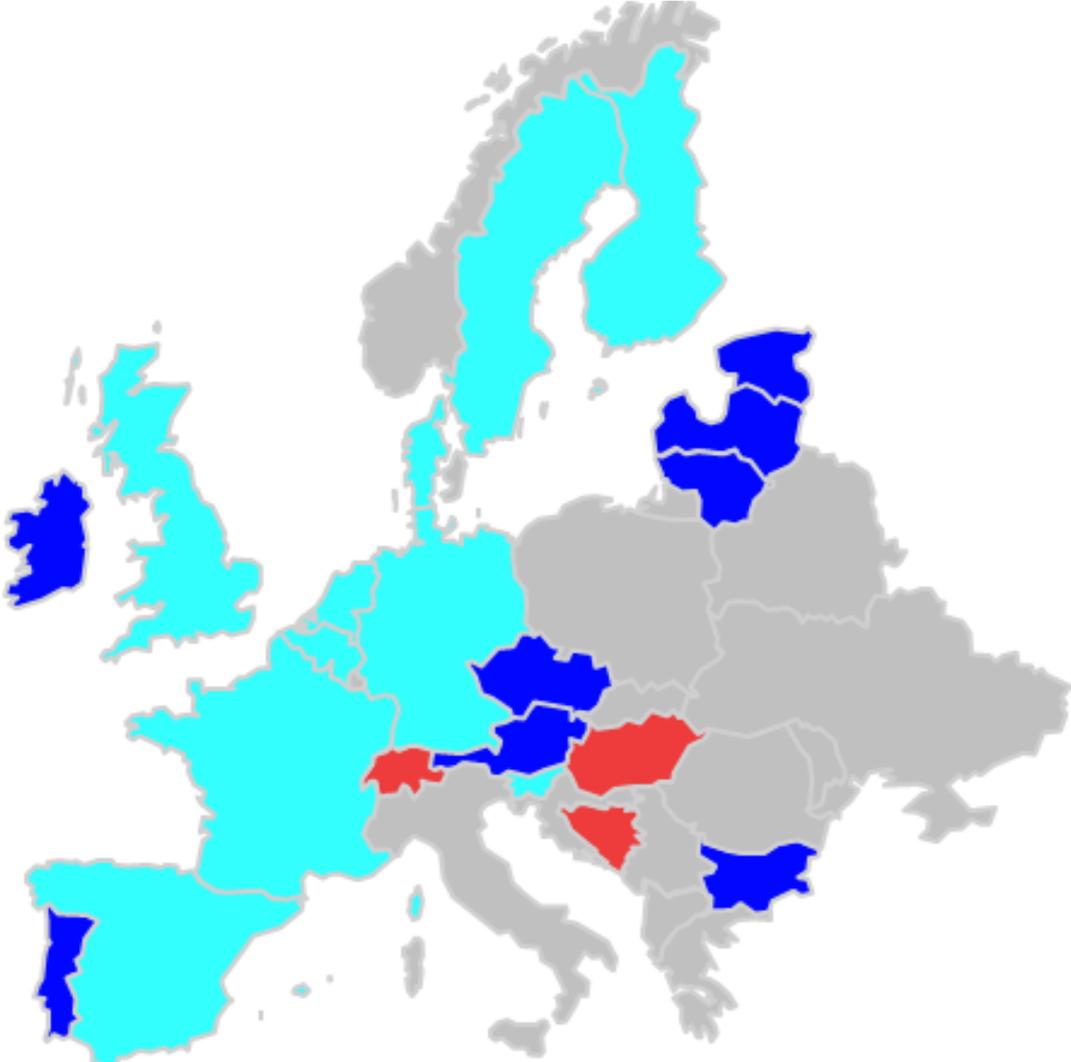
FRR (Manual) – Capacity – Timing for Offers for Capacity

Legend	
-	Grey
N/A	Yellow
Year or more	Green
Month(s)	Blue
Week(s)	Purple
Day(s)	Cyan



FRR (Manual) – Capacity & Energy – Provider

Legend	
-	Grey
N/A	Red
Generators Only	Blue
Generators + Load	Cyan



FRR (Manual) – Capacity – Settlement Rule

Legend	
-	Grey
N/A	Red
Pay as Bid	Green
Marginal Pricing	Purple
Regulated Price	Cyan



FRR (Manual) – Capacity – Cost Recovery Scheme

Legend	
-	Grey
N/A	Red
100% Grid Users	Green
100% BRP	Purple
Mix of Grid Users and BRP	Cyan



FRR (Manual) – Capacity & Energy – Monitoring

Legend	
-	Grey
N/A	Red
Real-Time Monitoring	Green
Ex-Post Check	Purple
Hybrid	Cyan



FRR (Manual) – Capacity – Secondary Market for Reserve Obligations

Legend	
-	Grey
N/A	Red
No	Blue
Yes	Cyan

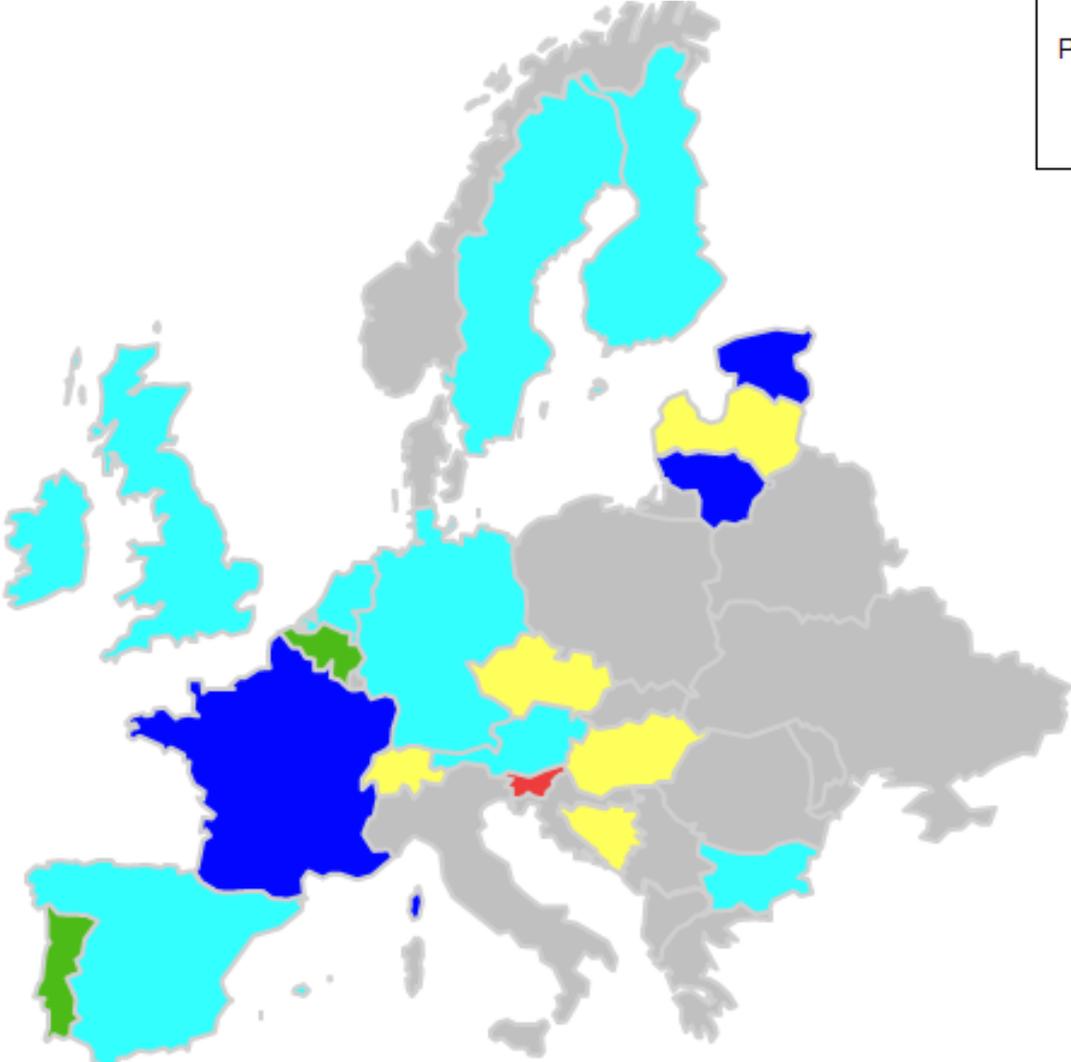


Frequency Restoration Reserve – Manual - Energy

- 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 – Procurement Scheme

Legend	
-	Grey
N/A	Yellow
Pre-Contracted Offers only	Red
Pre-Contracted & Mandatory Offers	Green
Pre-Contracted & Free Offers	Blue
Hybrid	Orange
Market	Cyan



FRR (Manual) – Energy – Activation Rule

Legend	
-	Grey
N/A	Red
Pro-Rata (Parallel Activation)	Blue
Merit Order	Cyan



FRR (Manual) – Energy – Minimum Bid Size into Balancing Market

Legend	
-	Grey
N/A	Yellow
No minimum bid size	Red
$\leq 1\text{MW}$	Green
$\leq 5\text{MW}$	Blue
$\leq 10\text{MW}$	Orange
$> 10\text{MW}$	Cyan



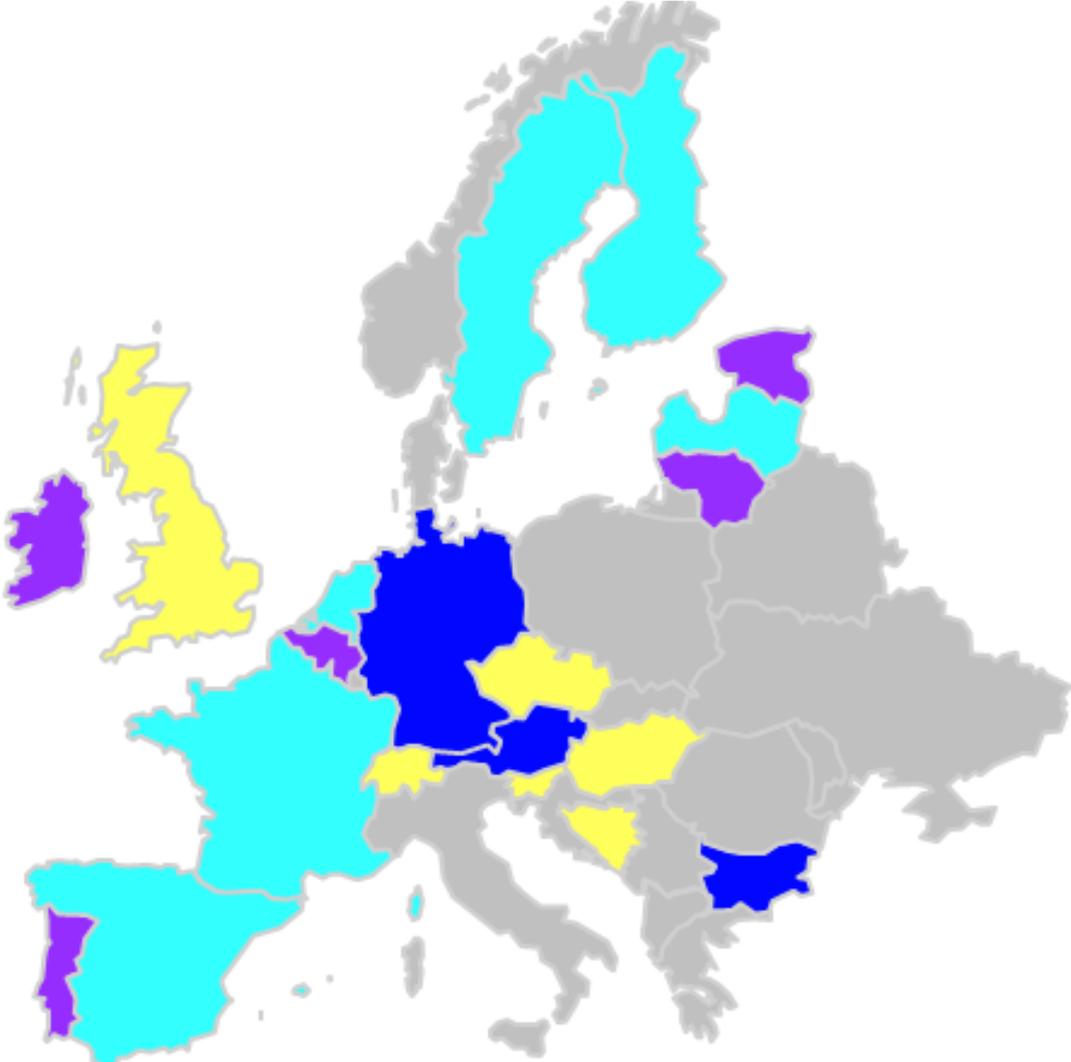
FRR (Manual) – Energy – Timeframe for Product

Legend	
-	Grey
N/A	Red
Hour (or Blocks)	Green
30 minutes	Purple
15 minutes	Cyan



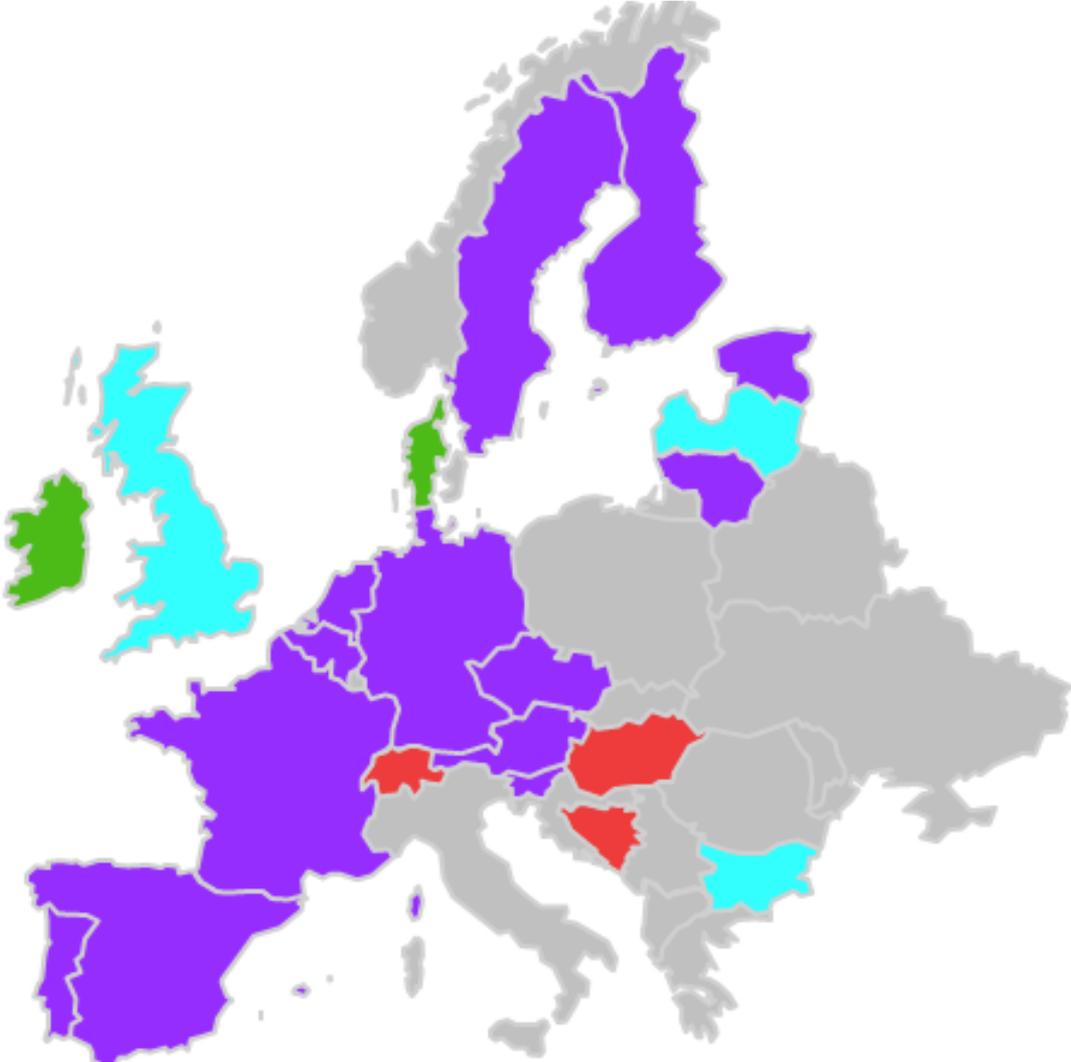
FRR (Manual) – Energy – Gate Closure for Energy

Legend	
-	Grey
N/A	Yellow
> D-1	Green
D-1	Blue
> H-1	Purple
<= H-1	Cyan



FRR (Manual) – Energy – Cost Recovery Scheme

Legend	
-	Grey
N/A	Red
100% Grid Users	Green
100% BRP	Purple
Mix of Grid Users and BRP	Cyan



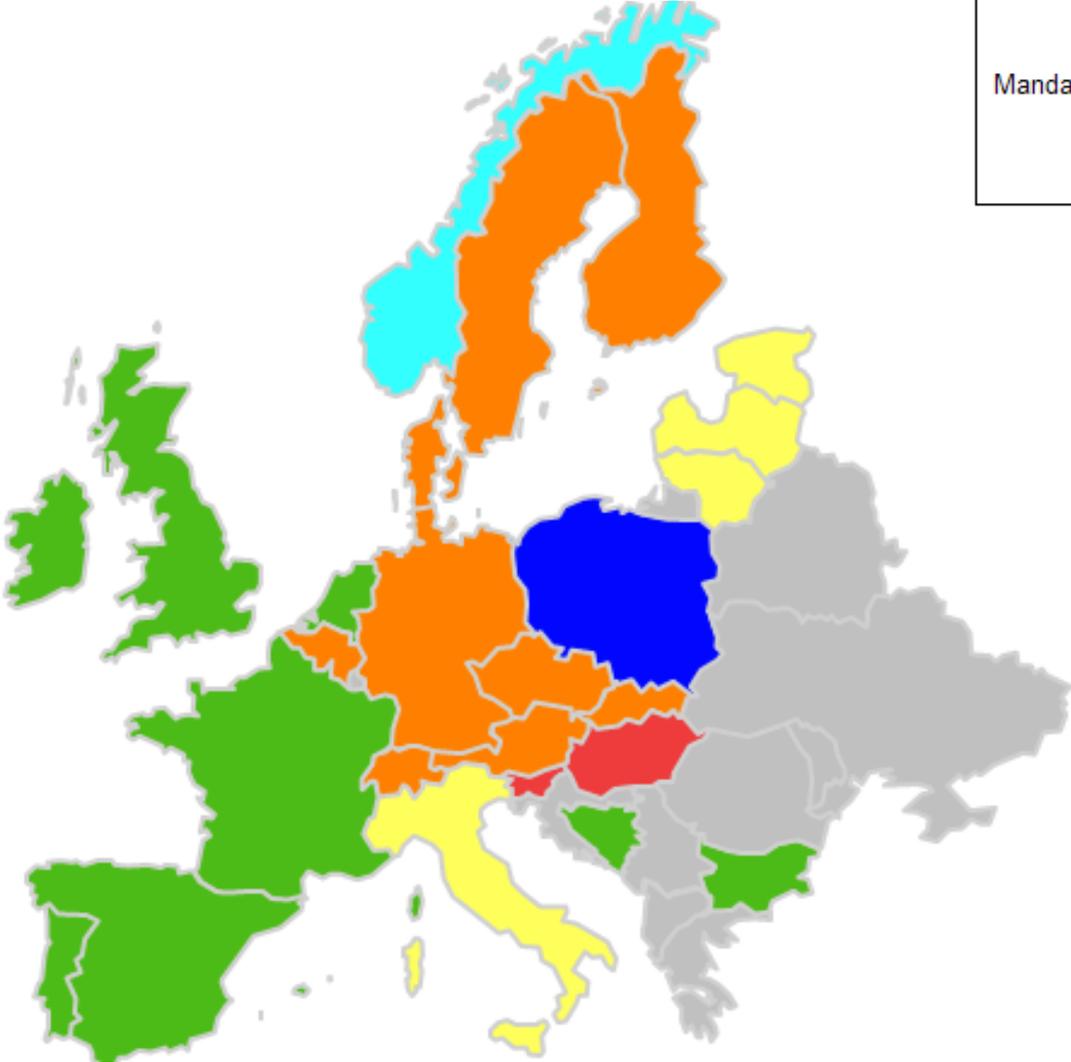
Frequency Containment Reserve - Capacity



- 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	
-	Grey
N/A	Yellow
Mandatory Offers	Red
Mandatory Provision	Green
Mandatory Provision without Reservation	Blue
Bilateral Market	Purple
Organised Market	Orange
Hybrid	Cyan



Frequency Containment Reserve – Capacity – Minimum Bid Size

Legend	
-	Grey
N/A	Red
No minimum bid size	Green
$\leq 1\text{MW}$	Purple
$\leq 5\text{MW}$	Cyan



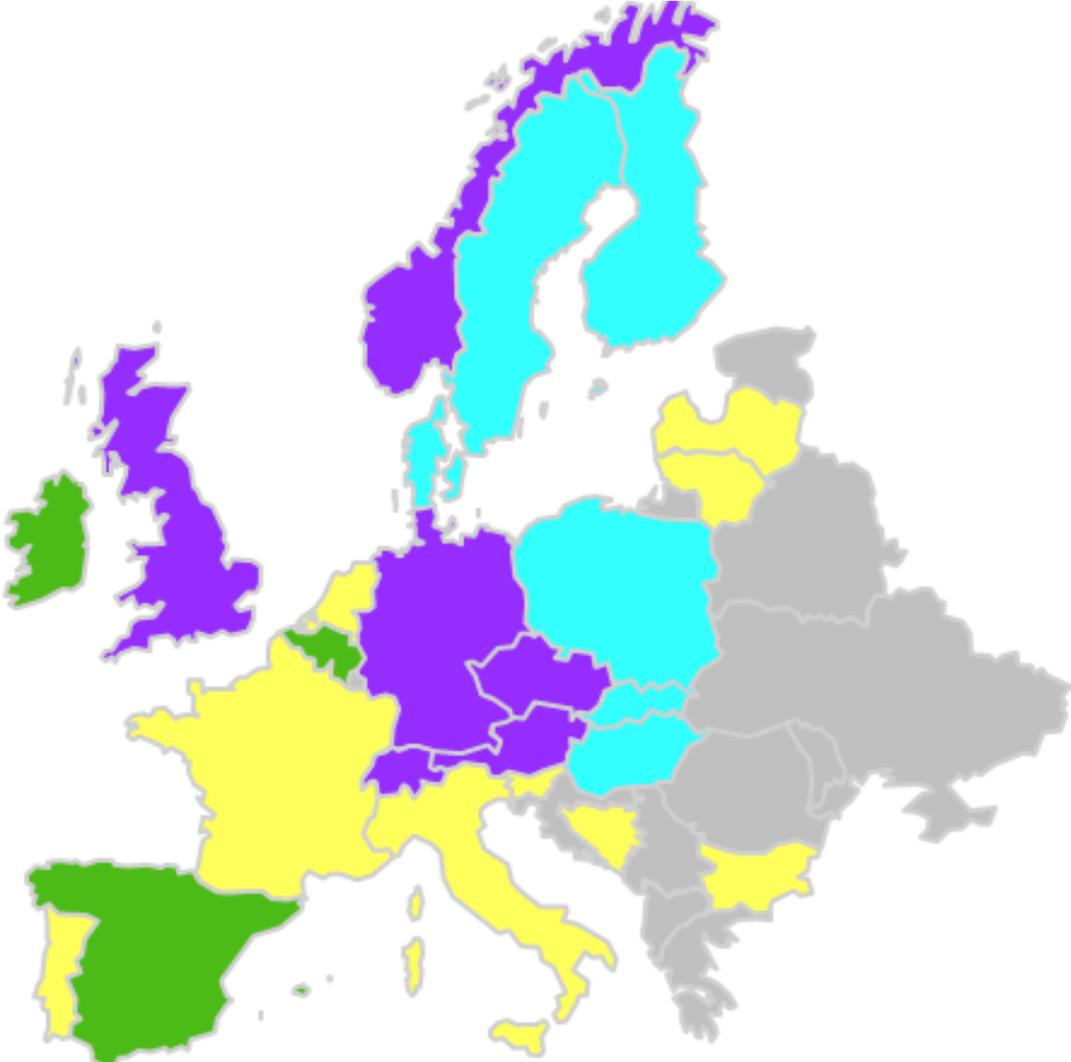
Frequency Containment Reserve – Capacity – Timeframe for Product

Legend	
-	Grey
N/A	Yellow
Year or more	Red
Month(s)	Green
Week(s)	Blue
Day(s)	Orange
Hour(s)	Cyan



Frequency Containment Reserve – Capacity – Timing for Offers for Capacity

Legend	
-	Grey
N/A	Yellow
Year or more	Green
Month(s)	Blue
Week(s)	Purple
Day(s)	Cyan



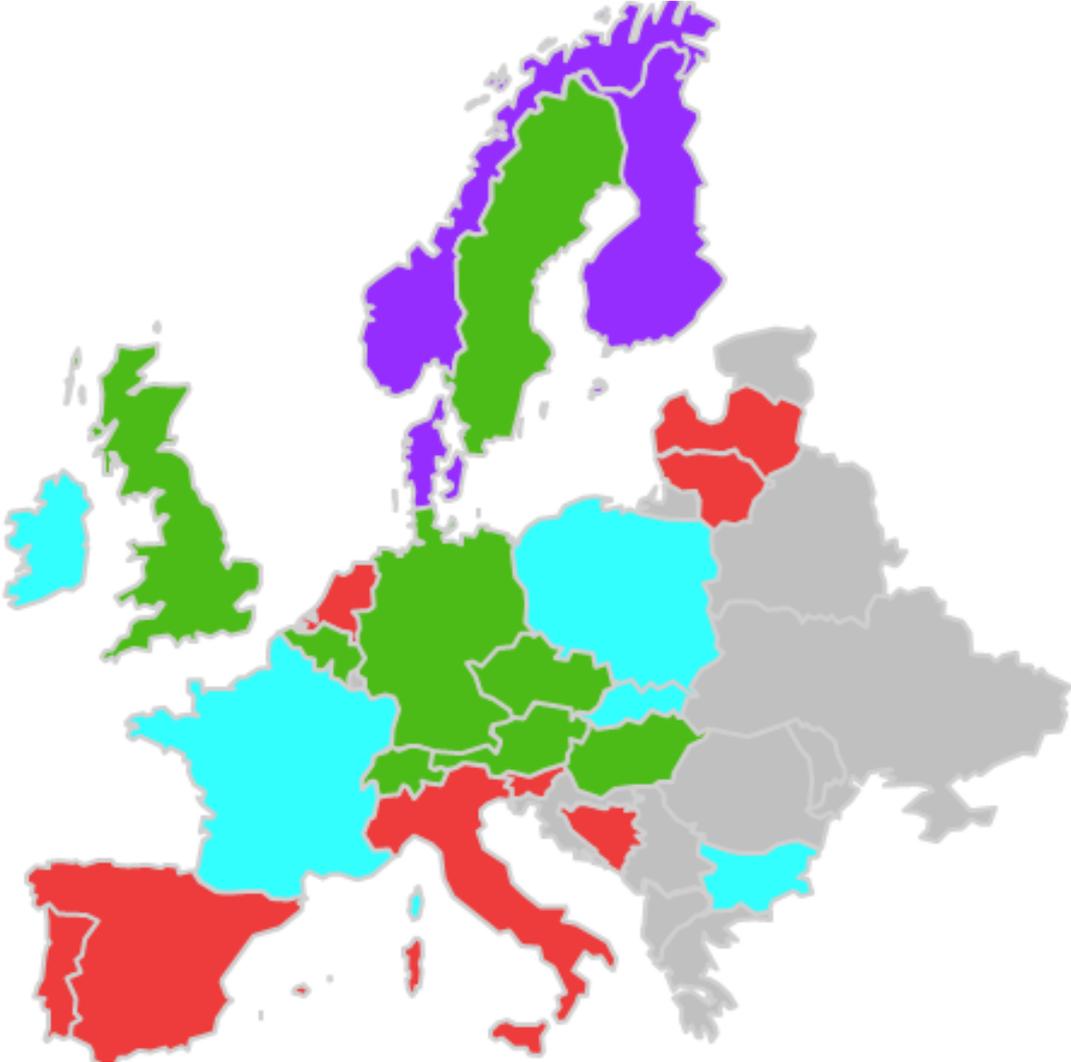
Frequency Containment Reserve – Capacity & Energy – Provider

Legend	
-	Grey
N/A	Red
Generators Only	Blue
Generators + Load	Cyan



Frequency Containment Reserve – Capacity – Settlement Rule

Legend	
-	Grey
N/A	Red
Pay as Bid	Green
Marginal Pricing	Purple
Regulated Price	Cyan



Frequency Containment Reserve – Capacity & Energy – Monitoring

Legend	
-	Grey
N/A	Red
Real-Time Monitoring	Green
Ex-Post Check	Purple
Hybrid	Cyan



Frequency Containment Reserve – Capacity – Secondary Market for Reserve Obligations

Legend	
-	Grey
N/A	Red
No	Blue
Yes	Cyan



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

Legend	
-	Grey
N/A	Red
Mandatory Offers	Green
Market	Purple
Hybrid	Cyan



Frequency Containment Reserve – Energy – Minimum Bid Size into Balancing Market

Legend	
-	Grey
N/A	Red
No minimum bid size	Green
$\leq 1\text{MW}$	Purple
$\leq 5\text{MW}$	Cyan



Frequency Containment Reserve – Energy – Timeframe for Product

Legend	
-	Grey
N/A	Red
Hour (or Blocks)	Blue
15 minutes	Cyan



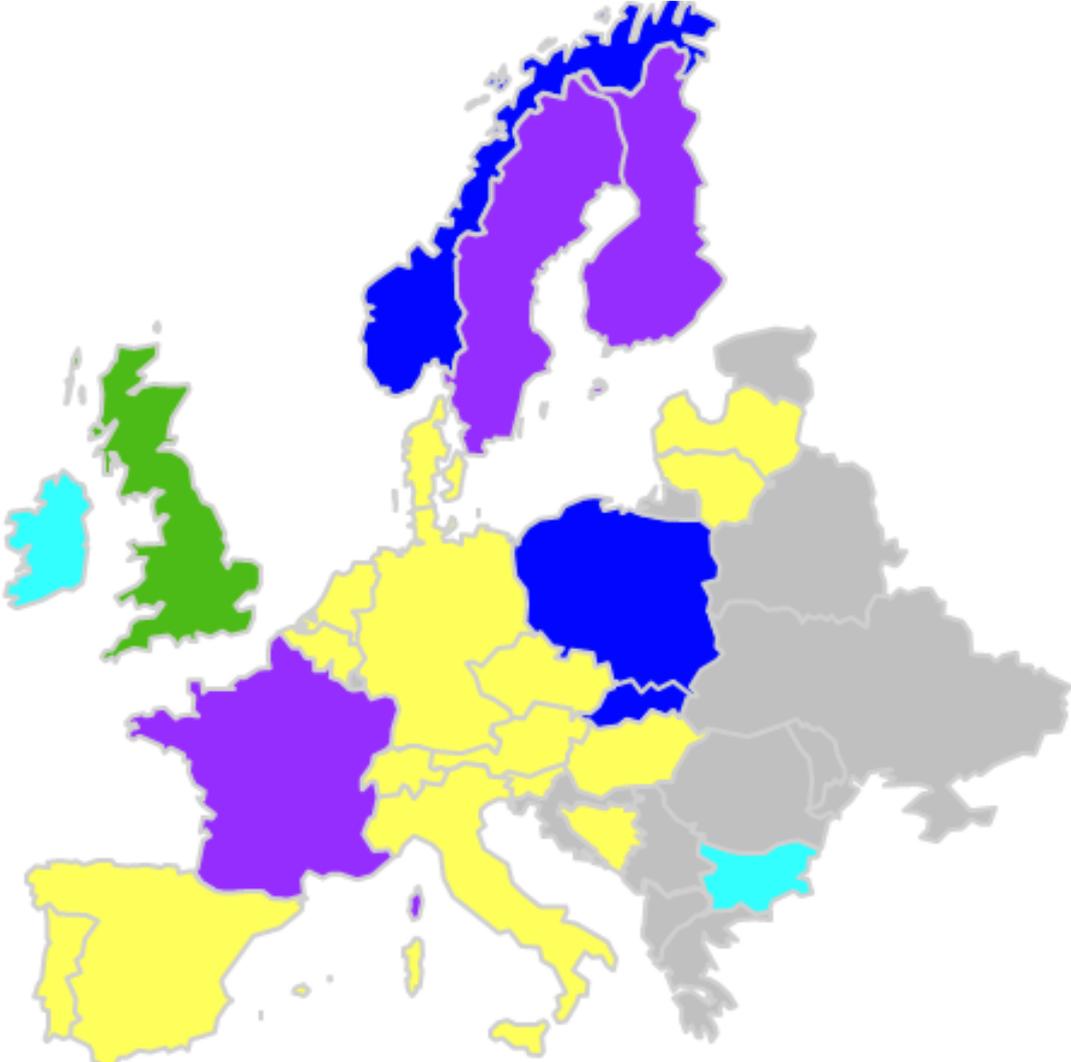
Frequency Containment Reserve – Energy – Gate Closure for Energy

Legend	
-	Grey
N/A	Red
> D-1	Blue
D-1	Cyan



Frequency Containment Reserve – Energy – Settlement Rule

Legend	
-	Grey
N/A	Yellow
Pay as Bid	Green
Marginal Pricing	Blue
Regulated Price	Purple
Hybrid	Cyan



Frequency Containment Reserve – Energy – Cost Recovery Scheme

Legend	
-	Grey
N/A	Red
100% Grid Users	Green
100% BRP	Purple
Mix of Grid Users and BRP	Cyan

