METIS Technical Note T4

Overview of European Electricity Markets

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1. INDIVIDUAL COUNTRIES

1.1. BELGIUM

At present	Expected changes
Power market **Market Organization:** ▪ Intra-day and Day-ahead markets operated by Belpex; ▪ Future market operated by Eex (product: Belgian Financial Futures). **Trading volumes (2014)**: ▪ Day ahead market:19.8 TWh, 26% of the Belgian grid load; ▪ Intraday market: 0.8 TWh, 1% of the Belgian grid load; ▪ Future: 0.04 TWh, 0.05% of the Belgian grid load **Day ahead market:** ▪ Single hours or block of hours exchanged every calendar day, fixing through auctions; ▪ Gate closes at 2.00pm day ahead; ▪ Price range: [-500€/MWh; 3000€/MWh]. **Intraday market:** ▪ Continuous trading mechanism 24/7; ▪ Hourly blocks and freely definable block bids; ▪ Each instrument becomes available for trading the day before delivery, at 14:00, and closes 5 minutes before its actual delivery; ▪ Price range: [-9999.99€/MWh; 9999.99€/MWh]. **Imbalance settlements:** ▪ Operated by Elia, the Belgian TSO; ▪ Dual prices depending on whether or not the Access Responsible Party (ARP) (the term used for a Balancing Responsible Party) is out of balance in the same direction as the system, or not. ▪ Imbalance prices generally reflect the cost of the offsetting regulation, but a premium (α) is added on or subtracted, as an added incentive, when the total system imbalance exceeds 140MW. ▪ α = average of system imbalance price in the last 2 hours	

- The relevant prices are set out in the table below.

ARP position	System in surplus	System in deficit
Net injections	Marginal Decremental Price (+ α)	Marginal Incremental Price
Net offtake	Marginal Decremental Price	Marginal Incremental Price (- α)

International power trading

- Central West Europe (Belgium, Netherlands, Luxembourg, France, Germany):
- Allocation of annual and monthly capacity through joint auction rules organised by the auction office JAO.EU;
- Implicit allocation of daily capacity through market coupling
- French-Belgian border: Joint mechanism for the allocation of intra-day capacity

  Dutch-Belgian border: Implicit allocation using the Elbas trading system

- 1000 MW subsea electricity interconnector between the Belgian and UK electricity transmission systems to be opened in 2018.

Reserve products and remuneration

Primary Reserve:

- Both primary and secondary reserves are procured using STAR (Short-Term Auctioning of Reserves), a monthly tendering process in which bids are selected based on a cost-optimising algorithm subject to meeting grid stability constraints;
- Pay-as-bid, €/MW/hour of availability
- There are several primary reserve products, both symmetric and asymmetric;
- 0-30 seconds delivery

Secondary reserve:

- Participation through short-term auctions for generators (see above);
- Different up and down products;
- Payments for both capacity (€/MW/hour of availability) (140 MW) and activation (€/MWh); activation is based on a balancing market in which non-contracted capacity can bid and cheapest offers are selected;
- Pay-as-bid remuneration;
- Elia part of the IGCC (International Grid Control Cooperation): exchanges imbalances with other participating TSOs prior to activating secondary reserves;

- From 01.01.2016, tertiary reserves will be procured through both annual and monthly rounds of bidding. At least 700 MW will be procured annually. At least 70 MW will be procured monthly.

▪ 30 second activation for delivery for at least 15 minutes. **Tertiary reserves:** ▪ Procurement through annual auctions; ▪ Separate products for generators and 'Dynamic profile' (which can include load); Interruptible supply contracts are also offered separately; ▪ Separate payments for hours of availability, start-up and energy supplied; ▪ Both activated manually at Elia's request; Pay-as-bid remuneration.	
Capacity Remuneration Mechanism ▪ Energy-only market but introduction of a strategic reserve in 2014 to accompany the shutdowns of power stations and cover the structural shortages in generation in the winter period (1 November to 31 March). **Functioning of the strategic reserve:** ▪ Managed by Elia and renewed each year through a tendering process; ▪ Two types of participants: Strategic Generation Reserve (SGR) supplied by generators in the Belgian control area that have already been shut down; Strategic Demand Reserve (SDR) consists in load shedding supplied by demand-side management offers. **Remuneration of the strategic reserve:** ▪ For the SGR, remuneration covers the expenses incurred by the supplier in generating the energy at Elia's request and takes account of the cost of the fuels and overheads, and of the period of activation and the volume injected in MWh; ▪ For the SDR, remuneration covers the availability of the contracted capacity and the activation of the SDR	▪ Ongoing analysis by the regulator on whether the strategic reserve is the correct answer to security of supply issues in the long term – introduction of a full-fledged capacity mechanism not ruled out

1.2. **FRANCE**

<table>
<tr><th>At present</th><th>Expected changes</th></tr>
<tr><td>

Power market

- Power traded OTC and on exchanges (EPEX Spot for intradray and day-ahead, EEX Power Derivatives for futures)

Trading volumes:

- 97 TWh day-ahead and intraday (17% demand) and 673 TWh forward (115% demand)

Day ahead:

- Clearing price auction operated by EPEX Spot France; [-500€/MWh; +3000€/MWh]; with order book closure time 12 noon

Intraday:

- EPEX Spot France; 7/7 continuous trading; (flexible execution); single hours or blocks of hours; gate opens at 03.00 pm the previous day, and closes 30 minutes before delivery; price range [-9999€/MWh;+9999€/MWh]

Imbalance settlement:

- Operated by RTE; for all generators active on wholesale market (not RES to date); half-hourly; price differs across player:

<table>
<tr><th colspan="3">Imbalance costs and revenues for ER producers (differential between injections and withdrawals)</th></tr>
<tr><th>Market balance
Generator balance</th><th>Upward adjustment trend</th><th>Downward adjustment trend</th></tr>
<tr><td>Positive differential price (injection > withdrawal)
The TSO ("RTE") pays the ER producer</td><td>EPEX Spot price</td><td>Minimum of Weighted average price of downward adjustment offers / (1+k) and EPEX Spot price</td></tr>
<tr><td>Negative differential price (injection < withdrawal)
The ER producer pays the TSO ("RTE")</td><td>Maximum of Weighted average price of upward adjustment offers / (1+k) and EPEX Spot price</td><td>EPEX Spot price</td></tr>
</table>

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- Day-ahead: n/a
- Intraday: n/a
- Balancing: RES generator to face balancing responsibility (phased in across technologies, from 01/01/16)

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International power trading

- Interconnection capacity is allocated through auctions and used according to nominations by market parties – non-nominated capacity is resold at daily allocations
- Explicit auctions for yearly and monthly allocation
- Implicit auctions for day-ahead allocation with Belgium and Germany, explicit with other neighbouring countries
- Explicit auctions intraday
- TSO determines NTC on each interconnector

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- Day-ahead target model achieved.
- Intraday: move to implicit coupling yet to be implemented (EU deadline 2016)

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Reserve products and remuneration

- Managed by RTE

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</table>

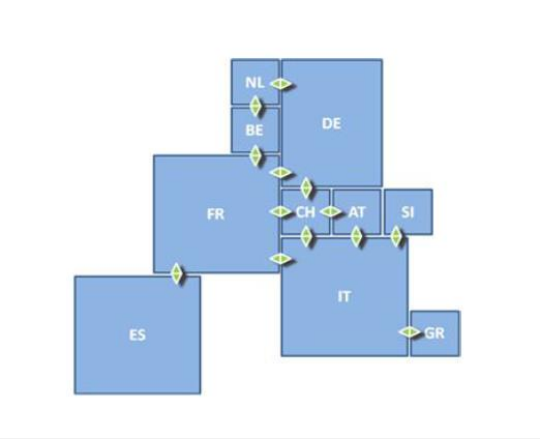
FCR/Primary Reserve: ▪ 600MW; mandatory provision by all new generation capacity >= 40MW (formerly 120 MW) connected to the transmission grid; 30-sec activation delay; adjustments up or down **aFRR/Secondary reserve:** ▪ Between 500 MW and 1000 MW depending on time of year; mandatory provision by all generation units with capacity >=120MW; 15-min activation; adjustments up or down ▪ Payments are made according to reserved capacity (€/MW) and adjustments effectively required (€/MWh), with reference prices set every year according to RTE rules. **Mécanisme d'ajusterment/Tertiary reserves:** ▪ Capacity >=10MW, incl. distribution-connected capacity ▪ **mFFR/Rapid reserve:** 1000 MW; mandatory provision by FR generators and DSR; 13-min activation ▪ **RR/Complementary reserve:** 500 MW; mandatory provision by FR generators and DSR; 30-min activation ▪ **RR/Demand reserve:** mandatory for French DSR if required by RTE; 750 MW; activation <2h ▪ Other possible reserves procured by RTE from FR and foreign generation and DSR capacity ▪ All capacity activated under the tertiary reserves is paid as bid.	▪ No planned changes
Capacity Remuneration Mechanism ▪ CRM in place – first delivery year (DY) 2017; ▪ Decentralised supplier obligation with certificate trading; Certificates awarded based on actual availability from 07.00 to 15.00 and 18.00 to 20.00 in peak days (PP2) designated by RTE each DY (10-15 days with expected system stress) ▪ All generation and DSR capacity participate; Registration from DY-4, up to DY-3 for operating capacity, up to DY-1 for new capacity and DSR ▪ Penalties in the event of imbalance between certified and available capacity; with price cap on maximum price per MW, set by the regulator as the maximum price for the construction of new capacity.	▪ Currently, implicit participation of interconnected capacity via derating of peak demand requirement to reflect import contribution to meeting peak demand; ongoing consultation on explicit interconnection participation – no timeline for change yet

1.3. GERMANY

At present	Expected changes
Power market ▪ There are two power exchanges in Germany: EPEX SPOT for day-ahead and intraday markets and EEX for forward products. **Day-ahead market:** ▪ Uniform pricing, 164 registered participants. ▪ The auction takes place at 12pm every day for delivery the following day, in 24 hour intervals. ▪ Prices must be between -500 and 3000 €/MWh. Volume traded in 2013: 245 TWh (41% of gross electricity consumption, which was 599.8 TWh). ▪ Average price in 2013: €37.8 base, €43.1 peak. 260 TWh were traded OTC. **Intraday market:** ▪ Uniform pricing, 15 minute contracts. ▪ The intraday continuous auction is traded for delivery on the same or day-ahead for periods of multiple hours, an hour, or 15 minutes. Each block can be traded until 30 minutes before delivery begins. ▪ Starting at 3pm on the current day, all hours of the following day can be traded. Starting at 4pm on the current day, all 15 minute periods of the following day can be traded. Trading is continuous, 24/7. ▪ Prices must be between +- 3000 €/MWh. ▪ Volume traded in 2013: 19 TWh on auction, 29 TWh traded OTC. **Futures market:** ▪ 669 TWh traded on EEX, around 3000 TWh traded OTC. **Imbalance settlement:** ▪ The tariff system for the settlement of imbalances is a single pricing system where prices for balancing group deviations are calculated on a 15 minute basis. ▪ Prices are determined by summing the TSO's payments for, or revenues from, secondary and tertiary control (the latter is also referred to as minutes reserve) and dividing by the system energy imbalance (capped at the level of the most expensive selected bid). There is a single price per 15 min; no price spread between positive and negative balancing derivations. Prices are transparent and published on the TSO's website accessible to all participants.	

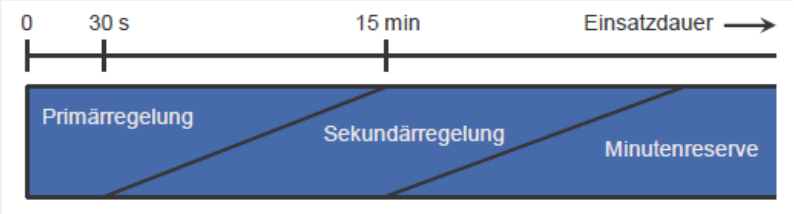
International power trading

- Market coupling of day-ahead market within CWE and NWE. Germany is also part of the market coupling project for the intraday market of these markets plus Austria and Switzerland.
- Market coupling is the default, with shadow auctions (explicit auctions used on market coupling borders to allocate the daily capacity by the joint auction office in case of unavailability of market coupling) as back up.
- These explicit auctions take place via www.casc.eu, with the following groupings, and close at 9am the day before delivery:



Reserve products and remuneration

- Reserve contracts are auctioned by the TSOs. There are three products: Primary Control Reserve (PCR), Secondary Control Reserve (SCR) and Tertiary Control Reserve. Tertiary reserve is also called Minutes Reserve Energy.



Primary:

- 550 MW, provided by all synchronously connected TSOs inside the UCTE (European interconnected power system) area. To be activated within 30sec, for up to 15 minutes.

Secondary:

- +2122 MW / -2081 MW, direct and automatic activation by the affected TSO. To be activated within 5 minutes, for between 30 seconds and 15 minutes.

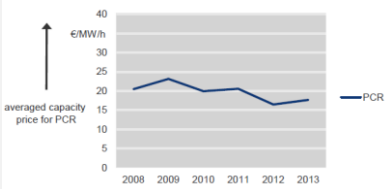
Tertiary:

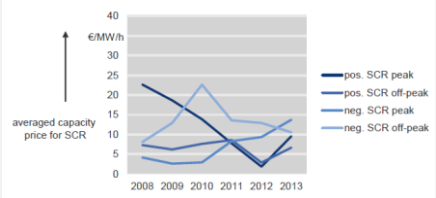
- +2900 / - 3200, telephonic and schedule-based request of the

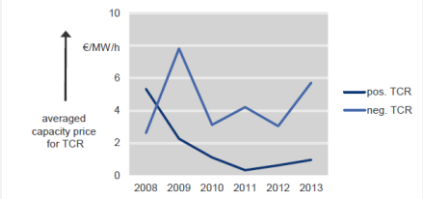
affected TSO. To be activated from 15 minutes for up to four quarter hours or up to several hours in the event of several disturbances.

- Currently, 14 entities are prequalified to provide primary, 20 to provide secondary and 36 to provide tertiary control reserves.
- Control reserve is tendered on www.regelleistung.net which is operated by the TSOs. The regulator determines market rules and access conditions for each control-reserve quality after consults TSOs and bidders.
- The table and charts below provide more detail on the underlying products traded within each type of reserve.

	PCR	SCR	TCR
tender period	weekly	weekly	daily
tender time	as a rule on Tuesdays (W-1)	as a rule on Wednesdays (W-1)	as a rule Mo-Fri, 10 a.m.
product time-slice	none (total week)	peak: Mo-Fri, 8 a.m. to 8 p.m., without public holiday off-peak: residual period	6 x 4 blocks of hour
product differentiation	none (symmetric product)	positive / negative SCRL	positive / negative TCR
minimum bid amount	1 MW	5 MW	5 MW (submission of bid for a block of max. 25 MW possible)
increment of bid	1 MW	1 MW	1 MW
call for tender	capacity price merit-order	energy price merit-order	energy price merit-order
remuneration	pay-as-bid (capacity price)	pay-as-bid (capacity price and energy price)	pay-as-bid (capacity price and energy price)







Capacity Remuneration Mechanism

- Currently, there is an energy-only market with additional strategic reserves to protect against regional and seasonal shortages called 'network reserve'. This is contracted by the TSOs and was introduced in 2013 after experiencing severe regional capacity shortages. These rules are limited until the end

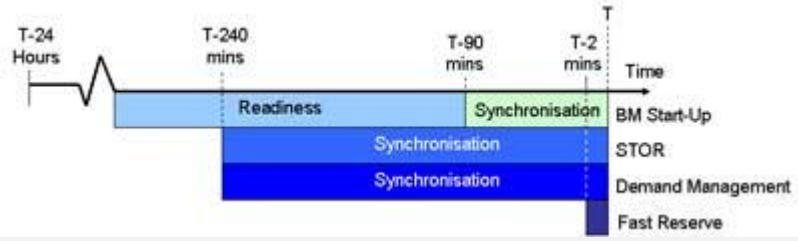
- A decision is expected imminently (in October), with legislation taking

	of 2017. ▪ A white paper published in July 2015 sets out a proposal for an energy-only market plus a capacity reserve – 'an energy market 2.0'. This will allow price signal to range freely without state intervention. There will be an agreement with neighbouring countries to prevent state intervention from abroad. A capacity market is not being considered. ▪ A capacity reserve of 5% of peak consumption (about 4 GW of capacity) will be kept ready to go into stand-by, including 2.7 GW of lignite plants. Power stations in this reserve will not participate in the market during normal operations.	effect by early 2016. ▪ A market solution was seen to be preferred so as to minimise state intervention.

1.4. GREAT BRITAIN

At present	Expected changes
Power market ▪ Power traded OTC and on exchanges (APX Power UK and N2EX for intradray and day-ahead, NASDAQ OMX and ICE for futures) **Volumes traded:** ▪ ≈300TWh day-ahead and ≈780TWh OTC (mainly forwards) **Day ahead:** ▪ Clearing price auction for hourly period, block bids possible; [-500€/MWh; +3000€/MWh]; with order book closure time 11am **Intraday:** ▪ 30 minute blocks, single or block bids, generally opens 49.5 hrs ahead of delivery (4 hr blocks open ahead 7 days rolling); closes 1 hour before delivery; price range [£0/MWh;£2000/MWh] **Imbalance settlement:** From 5 November 2015, GB will move to single imbalance price based on the average price of the 50MW of most expensive balancing actions taken by the System Operator during the period. Settlement periods are 30 minutes.	▪ Day-ahead: n/a ▪ Intraday: n/a Balancing: n/a
International power trading ▪ All interconnectors use a mixture of explicit and implicit auctions, allowing for coupling. ▪ IFA has yearly, seasonal, quarterly, monthly, weekly, daily and intraday products sold by explicit auction separable by direction. Daily implicit auctions for capacity also exist. ▪ Britned has explicit capacity auctions, but any unsold or unused capacity is made available for implicit auction, which is operated by APX. Explicit products include annual, quarterly, monthly, multi-day and intraday. ▪ Moyle and EWIC have explicit, yearly, seasonal, quarterly, monthly, daily and intraday product auctions separable by direction. Unused capacity is made available for implicit auction after 9:30am the day prior to delivery.	▪ Irish ISEM reform aimed at delivering implicit intraday trading across Irish interconnectors

Reserve products and remuneration



Fast reserve (primary):

- Delivery rate > 25MW/minute; sustainable > 15 minutes; minimum of 50MW; tendered; usually availability Fee (£/h) and utilisation fee (£/MW/h); 280MW contracted

STOR (secondary):

- >= 3MW generation or demand reduction; sustainable > 2 hours ; tendered; availability Fee (£/h) and utilisation fee (£/MW/h); 2894MW contracted

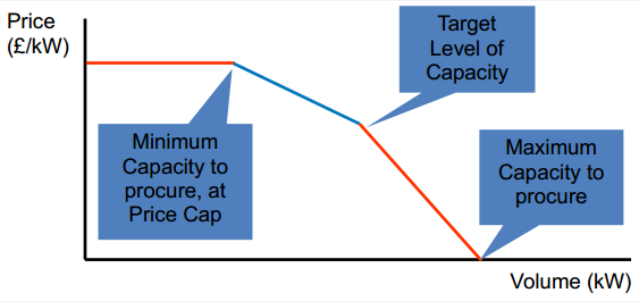
BM Start-Up (tertiary):

- Can synchronise within 89 minutes from instruction; able to terminate process at any time prior to reaching Hot Standby; bilateral contract; up to three BM Start-Up Payment rates (£/h) and a Hot Standby Payment (£/h)

- No planned changes

Capacity Remuneration Mechanism

- Centrally-procured capacity auction four years ahead of delivery year, with supplementary auction one year ahead to tweak position and allow demand side participation.
- Demand curve is constructed around target capacity to achieve 3 hour annual Loss of Load expectation. Price is capped at Net Cost of New Entry (£75/kW/year). Existing capacity wishing to participate must accept any price greater than Price-Taking Threshold (£25/kW/year). Payments based on centrally de-rated capacity
- Interconnection eligible to bid based on derating that accounts for risk of not flowing.



- Contracted capacity is liable for penalty payments if it is not found to be generating at moments of system stress in delivery year.

- Has been approved by EC

1.5. **ITALY**

At present	Expected changes
Power market ▪ Spot Electricity Market (MPE) and the Forward Electricity Market (MTE), run by Gestroe Mercati Energetici (GME) as the central counterparty. ▪ Trading on the power exchange is not mandatory, OTC transactions are allowed **Volumes traded:** ▪ Day-ahead market: 2014: 282 TWh, (91% of total energy demand, 309 TWh), average price 52.08 €/MWh. ▪ Intraday market: 2014: 22.8 TWh (7.3% of total energy demand), average price in the four sessions varied between 51.03 (in MI2) to 59.46 €/MWh (in MI4) (see description below) **Day ahead**: ▪ Hourly energy blocks are traded for next day in the MGP (Mercato del giorno prima). ▪ The MGP is a day-ahead auction (rather than a continuous trading market) in which GME acts as the central counterparty to all trades. ▪ Bids and offers are placed from 8 a.m. of the ninth day before the day of delivery until the bidding window closes at 12 p.m. of the day before the day of delivery. ▪ After the bidding window closes, bids and offers are cleared for each hour taking into account transmission capacity limits between zones. Where these constraints are binding, the market effectively splits and distinct zonal clearing prices are determined. There are 6 geographic zones. ▪ Generators are paid the relevant zonal price. All load is charged a single national clearing price, the "Prezzo Unico Nazionale" (PUN), equal to the volume-weighted average of the zonal prices. **Intraday**: ▪ Allows market participants to modify schedules defined in the day-ahead market. ▪ Takes the form of 5 auctions (MI1- MI5), which operate almost identically to the day-ahead MGP. Unlike the MGP, load must now pay the relevant zonal price.	▪ Currently, day-ahead market is a physical auction market. The EU target model is a price coupled power exchange auction. Supply and demand would face the same price. ▪ The intraday market would need to transition to a continuous trading model. ▪ Imbalance settlement is marginal pricing in EU target model

	Bidding window opens	Bidding window closes	Results published
MI1	12.55pm on D-1	3pm on D-1	3.30pm on D-1
MI2	12.55pm on D-1	4.30pm on D-1	5pm on D-1
MI3	5.30pm on D-1	3.45am on D	4.15am on D
MI4	5.30pm on D-1	7.45am on D	8.15am on D
MI5	5.30pm on D-1	11.30am on D	12pm on D

Futures:

- Bilateral forward market form day-ahead until 2 years ahead
- Centralised power exchange on IDEX and EEX
- Centralised power exchange on MTE, managed by GME

Imbalance settlement:

- There are different imbalance prices depending on whether an imbalance is adding to or reducing the overall area imbalance.
- Helpful imbalances are cashed out at the relevant day-ahead price. Harmful surpluses receive the minimum of: the lowest accepted offer for balancing energy in the relevant area and the relevant day-ahead price for supply. Harmful deficits must pay the maximum of: the highest accepted bid for balancing energy in the relevant area and the relevant day-ahead price for demand.
- Special rules apply for non-dispatchable renewable generators.

Balancing market:

- The Italian balancing market takes the form of five different bidding windows for up/down regulation. Offers are then called in real-time.
- All but the first bidding window open at 10:30pm on D-1 and close 1.5hrs ahead of delivery.

  This market is used to provide secondary control and to balance the grid in real time.

International power trading

- From 2015, Italy has been coupled with **Austria, France and Slovenia** as part of Multi-Regional Coupling (MRC). Capacity is allocated implicitly through day-ahead markets.
- Italy also has interconnection capacity with Greece and Malta.
- Italy is one of the most interconnected European countries and imports a higher proportion of its energy than any other European country – 13.2% of demand in 2012.
- Explicit capacity allocation via CASC for all capacity based on a Use It or Sell it principle.

- Market coupling with Switzerland is delayed due to ongoing bilateral negotiations between Switzerland and the EC.
- Market coupling with Greece will be ready for market coupling at a later date.
- Italy is part of

	the cross-border intraday market project (XBID) to create an integrated intraday cross-border market, with an aim to go live by July 2017. ■ Interconnection capacity to Montenegro is under construction.
Reserve products and remuneration **Primary reserve:** ■ Automatic activation; 100% within 30 seconds ■ Mandatory service for all production units. Each production unit must make available 1.5% maximum power (10% in the islands) as part of connection obligations. **Secondary reserve (FRR):** ■ Automatic activation within 15 minutes ■ Secondary and Tertiary reserve are procured through the ex-ante MSD market. Like the other Italian markets, this takes the form of a bidding window and auctions. The bidding window opens at 12:55 D-1 and closes at 5:30pm D. Results for different time periods are posted at 21:10 D-1, 6:15 D, 10:15 D and finally at 14:15 D. ■ Pay-as-bid ■ Includes specific offers for FRR use (€/MWh) and a start-up fee (€) for thermal generators. **Tertiary reserve:** ■ Offers for tertiary reserve (Replacement Reserve) are also made and accepted through the ex-ante MSD market described above. ■ Pay-as bid; energy (€/MWh) and thermal startup (€) payments. ■ Manual activation within 120 minutes, no energy limitations. Sized according to multiple generation failures and load/RES forecast uncertainty.	
Capacity Remuneration Mechanism **Current system:** ■ Currently a temporary system in place in which an administered payment is made to those	

operators who make their capacity available to Terna.

- This capacity payment is made up of two parts: (1) a basic remuneration determined in advance, based on forecasts of supply and demand for each hour of the next day and (2) a top-up payment if the weighted average price on the day-ahead market is less than 20% of a regulatory reference price. This second part is only paid if the relevant capacity is located in a low price zone.

New system:

- A new Reliability Option based CRM is set to be implemented. It was approved by the TSO in June 2014 and the first auction is scheduled to be held in 2017.
- Reliability Options will purchased by Terna in a series of auctions. For each MW of capacity purchased, operators will receive an annual premium (€/MW). In exchange, they will be obligated to pay Terna any positive difference between the spot price and the strike price set in the auction contracts (i.e. whenever the spot price exceeds the strike price). The regulator will redistribute any money received in this was to consumers in the form of discounts on utility bills.
- Three different types of auction will be held. Different auctions will be held for each zone.
- Main auction: Held annually with time to delivery of 4 years, delivery period of 3 years.
- Complementary auction: Time to delivery of 4 years, delivery period of 1 and 2 years.
- Adjustment auction: Intended to modify positions closer to delivery; held annually for delivery period of 1 year.
- In addition, secondary trading will be facilitated

1.6. NETHERLANDS

At present	Expected changes

Power market

- Electricity is traded through APX, the power spot exchange. APX organises the day-ahead and intraday market for the Netherlands, UK and Belgium. There is also an OTC Bilateral facility on APX for OTC bilateral trades.

Volumes traded:

- In 2013, 47.3 TWh were traded on the day-ahead market and 0.7 TWh on the intraday market.

Day-ahead:

- Trading for base load, peak and off-peak energy takes place on one day for delivery the next day.
- Orders are submitted electronically, after which supply and demand are compared and the market price is calculated for each hour of the following day. Hourly contract and flexible block contracts can be traded.
- Prices can range from -500 to 3000 €/MWh.
- The average base price in 2013 was € 51.9/MWh, and the price level is relatively stable.
- The table below sets out the timings of the DAM.

Time Activity	(Time: GMT +01:00)
Day prior to day of operation	- Until 12h00 receive bids from Participants - 12h00 market closure - Immediately after matching and until 12h42 individual matching results available - Preliminary Results published at 12:42 - Results are Final at 12:55 - Daily settlement at 16h00 - 13h00 APX Group submits spot schedules (E-programs) to TSO - Between 12h42 - 13h05 the APX Index is published on the website
Every business day	- Financial clearing

Intraday:

- Member continuously trade power products in hourly intervals as well as freely definable block orders up to 5 minutes prior to delivery.
- Prices can range from -99,999.90 to 99,999.90 €/MWh.

Imbalance settlements:

- Imbalance prices reflect the marginal costs of either the upward or downward regulation needed for the time period.
- Where both upward and downward regulation are used in the same settlement period, imbalances are charged the marginal cost of the

correcting form of regulation (i.e. imbalances requiring upward regulation are charged the marginal cost of upward regulation and vice versa).

- Where no regulation services are used, the imbalance price is the price is the average for the first bid in both directions.

Balancing market:

- Obligation to participate for generators larger than 60 MW. Minimum bid size 4 MW, maximum bid size is 200 MW. Bids also contain minimum activation time, location (for re-dispatch use) and regulation rate.
- Bids are valid for at least four 15-minute settlement periods.

  Energy price is a uniform marginal price.

International power trading

- Market coupling of day-ahead market with NWE countries (CWE, GB and Nordic countries).
- The intraday market is coupled with the Belpex Continuous Intraday Market (Belgium) and the Nord Pool Spot intraday markets in the Nordic region.
- With Germany, a cross border capacity allocation is performed and energy is traded explicitly.

Reserve products and remuneration
Primary reserve:

- The TSO auctions primary reserve on the market. Until 2014, this was mandatory and without remuneration.
- Under the new liberalised system, the winning bidders get only a capacity payment and not a payment for the energy. Primary control is mandatory for those with >5MW of capacity, and activated within 30 seconds.
- Part of the total required capacity is auctioned collectively with the German and Swiss TSOs, while the rest is procured by a separate auction with only Dutch suppliers.

Secondary and tertiary reserve:

- The table below provides an overview of the secondary and tertiary reserve products traded in the Netherlands.

TABLE I
MAIN CHARACTERISTICS OF THE OPERATING RESERVE CAPACITIES THAT ARE CURRENTLY TRADED IN THE NETHERLANDS [3], [6], [9]

Capacity	Regulating	Reserve Balancing/Other purposes	Emergency
Type	Secondary	Tertiary	Tertiary
Bid size	≥4 (MW)	≥4 (MW)	≥20 (MW)
Activation method	Automatic	Automatic/manual	Manual
Deactivation method	N/A	Systematically at end of 1st full PTU	Manually at end of PTU
Activation ramp rate	≥7 (%/min.)	≥100 (%/PTU)	≥100 (%/PTU)
Activation minimum step	1 (MW)	Full	Full
Activation duration	≥4 (sec.)	15 (min.) / ≥4 (PTU)	≤15 (min.)

- As shown, the TSO uses two types of tertiary reserve: contracted reserves (reserve capacity) receive a capacity price (pay-as-bid), and are obliged to bid daily into the balancing market; non-contracted reserves (emergency capacity) receive no remuneration except through their bids into the balancing market.
- Volumes: Emergency reserve: 300 MW, contracted tertiary reserve: 350 MW, total offered reserve capacity: up to 3800 MW

Timing:

- Annual tender for contracted reserves
- Daily auctions for the balancing mechanism: Bids must be received by TenneT by 14:45 D-1

After approval the bids that did not get TenneT's approval can be revised. The deadline for revising bids ends 1 hour before operation.

Capacity Remuneration Mechanism

- Currently an energy-only market. The Dutch government has no current intentions to implement a CRM. Security of supply is assured – renewable penetration is low at just over 10%.

- Both the government and the energy regulator, ACM, consider that a CRI is a second-best option and security of supply should first be addressed by resorting to alternative solutions.

1.7. **POLAND**

At present	Expected changes
Power market ▪ Sale and purchase of electricity is performed mainly through POLPX, the Polish Power Exchange and only licensed energy market, in the form of standard transactions and contracts. In 2010, an obligation to sell electricity publicly on an exchange rather than OTC was introduced. **Volumes traded:** ▪ The total volume of transactions concluded in 2014 on all POLPX's electricity markets (intraday, day-ahead and future) was 186.7 TWh (100% of demand). Of this, 23.7 TWh were traded on the day-ahead market and 85.4 GWh on the intraday market. **Day ahead:** ▪ The market is open from 9am to 2.30pm on a day preceding delivery date (day n-1). Hourly contract periods. The average hourly price in 2014 was 179.86 PLN/MWh. **Intraday:** ▪ Gate is open from 3.30pm on day n-1 until 10pm on day n. Gate closure is three hours before delivery. **Imbalance settlements:** ▪ The Polish TSO makes transactions on the balancing market and the imbalance price is the marginal price from the balancing market. **Balancing market:** ▪ There is a mechanism of active participation in the balancing market for participants possessing reception equipment and installations. In 2014, total volume of electricity purchases on the balancing market was 5.4 TWh, with a weighted average monthly price between 172-268 PLN/MWh.	
International power trading ▪ Poland has synchronised interconnection with the **German, Czech and Slovak** systems (all part of the CEE region). Coordinated capacity allocation for the whole of the next subsequent year and month (annual and monthly capacities) and for the individual trading hours on the next subsequent day (day ahead capacities) is organised by the Czech Central Allocation Office (CAO). ▪ Nomination of capacity under annual and monthly auctions is made from 12pm to 5pm on two days prior to delivery on a Use It or Sell It basis. Sales contracts may be submitted from 3.30pm on day n-1	▪ Poland intends to join the Central East Europe Flow-Based Market Coupling project (CEE FBMC), which will introduce day-ahead market coupling between Poland, Czech

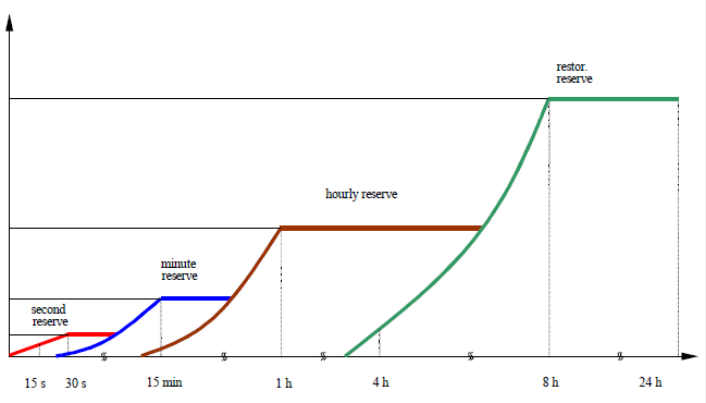
until 10pm on day n, provided that nominations are made at least one hour in advance.

- On the interconnection with **Sweden,** allocation is carried out under implicit auctions within a market coupling mechanism. The auctions are performed by POLPX and the Swedish power exchange, Nord Pool Spot AS. The rules are agreed by both countries' power exchanges and TSOs.
- On the interconnection with **Ukraine**, allocation is carried out under unilateral monthly explicit auctions.

Republic, Slovakia, Hungary and Romania.

Reserve products and remuneration

- Ancillary control services necessary to secure adequate system reliability are traded on the technical market, which is run by the TSO who purchases these services.
- The rates applicable to the charges for the reserve products are fixed for a term of 12 months (from July 1 of the year of the services purchase through to June 30 of the next year) and are determined through competitive bidding or, if the bidding process fails because the clearing price is above regulatory threshold, by negotiations.
- Payments usually take the form of a payment for being held in readiness, and a payment for activation.



- It is required that the access time of the hourly reserve does not exceed than 15 minutes. Gross power offered in each reserve should not be lower than 5MW and the ramping rate should not be lower than 2MW/min within the control range of the unit operation.
- Restoration reserve should activate within 8 hours.

Primary control:

- Automatically responds to the frequency change in the power system by providing (in under 30s) the power obtained from every generating unit that is taking part – it automatically activates the second reserve.
- All generating units connected to the grid or distribution network

with installed capacities of at least 100MW must be fitted with the primary control equipment. **Secondary and Tertiary:** ▪ [no further information available]	
Capacity Remuneration Mechanism ▪ The Energy Regulatory Office is responsible for organizing and conducting tenders for the construction of new capacity or implementation of initiatives to reduce consumption. So far, there have not been any circumstances to justify such tenders. ▪ There is a need for enhanced demand side response and the TSO is already working with large industrial users to develop system management. In 2013, the TSO introduced DSR contracts. ▪ Poland is considering developing capacity market measures, but at present the market remains energy-only. Cold intervention reserve contracts have been awarded for 830 MW in total, in case of a capacity shortfall. The service will start in 2016 and the TSO will pay approx. €5/MW for every hour of keeping the units in stand-by. ▪ In January 2014, the operational power reserve mechanism was introduced by the TSO, in the face of threats to reduce the existing excess of generation capacity of conventional sources. The mechanism ensures that operational power reserve (excess capacity over power sales agreements) is purchased by the TSO from 2015 at 37.28 PLN/MWh to the level required by the reserve system. The price for the reserve was designated as the average technical fixed cost of generation companies (excluding depreciation) allocated to the peak hours (from 7am-10pm for all working days), indexed with inflation. Generation companies with reserves not covered by sales agreements who have reported their reserves to the TSO receive remuneration equal to the reserve price while not generating energy.	▪ An industry proposal for a CRM was put forward by energy companies and the TSO in 2014, proposing two possible types: a centralised capacity mechanism and a decentralised market. Both would be supported by contracts for difference. ▪ The proposal assumes the CRM could be in force in 2016. However, capacity problems are not expected until 2023, and so reforms may not take place until 2017, in order to observe the performance of the UK CRM.

1.8. ROMANIA

At present	Expected changes
Power market **Market Organization:** ▪ For the wholesale market, intra-day and day-ahead power traded on the centralised platforms operated by the Romanian electricity and gas exchange, Opcom, a subsidiary of the TSO Transelectrica. ▪ Futures traded both on the OTC Market and the Centralised Market for Electricity Bilateral Contracts, operated by Opcom; **Trading volumes (April 2015)**: ▪ Spot (day-ahead+intraday): monthly 1,770 GWh, 43.8% of internal demand; ▪ Forward: Centralized market for electricity bilateral contracts: monthly 3,261GWh, 81% of internal demand; OTC: monthly 1,155 GWh and 28.6% of internal demand. **Day ahead market:** ▪ Single hours or block of hours exchanged every day for each hourly interval within the next delivery day; ▪ Gate closes at 11.00 am on the day ahead of delivery; ▪ Price range: [-500€/MWh; 3000€/MWh]; ▪ Coupled with the Czech Republic, Slovakia and Hungary through price coupling mechanism. **Intraday market:** ▪ Continuous trading mechanism; ▪ Gate opens at 00:00 of the present day; ▪ Time to delivery at gate closure: 30min. **Imbalance settlements:** ▪ A participant may transfer its balancing responsibility to a Balance Responsible Party (BRP) or become a BRP; ▪ If a BRP is in negative imbalance, it has to buy the quantity needed from the TSO at the hourly price for power deficit; ▪ If a BRP is in positive imbalance, it has to sell the excess energy to the TSO at the hourly price for power surplus; [No more information on how imbalance prices are defined]. **Balancing market (BM):** ▪ Operated by TSO; ▪ Mandatory for all the generators active on the wholesale market, who must offer all available capacity; Tendering process starts after DAM closing in D-1 day. BM	

participants must submit daily offers for the amount of balancing energy they can make available in each dispatching interval (60 minutes) to increase and reduce power. All valid offers on the balancing market establish the obligation of a BM participant to deliver the amount tendered on BM when it receives order from the TSO. Only actually delivered quantities of balancing energy are paid on the BM.	
International power trading ▪ Interconnection capacity for the importation of electricity is allocated based on auctions according to European rules. ▪ Czech Republic, Slovakia and Hungary: Implicit auctions through market coupling with DAM (price coupling mechanism); ▪ Hungary, Bulgaria and Serbia: Explicit auctions for yearly, monthly, daily and intra-day allocations; ▪ Ukraine and Moldova: Explicit auctions for daily and intra-day allocation using the principle of netting and subject to the written approval of the TSO in Ukraine.	▪ Romania's interconnection level is 7%, below the 10% European target for 2020
Reserve products and remuneration ▪ Technological system services managed by Transelectrica; ▪ Secondary, fast tertiary and slow tertiary reserves concluded through regulated contracts or on the Ancillary Services market operated by Opcom; ▪ Remuneration: reserves purchased at a regulated tariff and re-invoiced to the ANRE-licensed electricity suppliers that benefit of such services in the end, except for the active energy component covering the grid losses. **Primary Frequency Control Reserve:** ▪ Description: Bring frequency to a level close to the preset values in less than 30 sec; ▪ Participants: Mandatory provision by all electricity generators; ▪ Adjustments up or down. **Secondary Control Reserve:** ▪ Description: Bring frequency to the preset values in less than 15 minutes; Participants: Mandatory provision upon Transelectrica's request; ▪ Adjustments up and down; ▪ Paid on a pay-as-cleared basis. **Tertiary control reserve*:*** ▪ Two types: fast tertiary reserve: load synchronisation and charging in less than 30 minutes; slow tertiary reserve: start-up and load	

takeover in less than 7 hours; ▪ Participants: Mandatory provision upon Transelectrica's request; ▪ Adjustments up or down. ▪ Balancing products corresponding to the fast and slow tertiary product reserve are paid on a pay-as-bid basis.	
Capacity Remuneration Mechanism ▪ Energy-only market: No capacity payments to power plants in the day-ahead and intraday markets, but balancing market reserve capacity contracting in advance	

1.9. **SPAIN**

At present	Expected changes
Power market **Market organization:** ■ Day-ahead, intraday and futures are traded through an organized market. Day-ahead and intraday are traded at OMIE (the market operator for Spain and Portugal). ■ Standardized futures are traded through OMIP. Other forward products (baseload and peakload monthly forwards) are traded OTC (at OMIP clearing hour and BME Clearing). **Trading Volumes:** ■ Spot traded volume (2014, Spain + Portugal): 223,845 GWh (76% of demand). ■ Intraday traded volume (2014, Spain + Portugal): 34,811 GWh (12%). Forward traded volume (2014, Spain + Portugal): 52,860 GWh (18%). **Day-ahead market:** ■ Operated by OMIE, through a system marginal price auction (single price). Electricity is traded in hourly units. ■ The auction takes place once a day; at 12pm the auction is conducted for the 24 hours of the next day. ■ Price range: (0-113.92) €/MWh. Average price: 42 €/MWh. Standard deviation: 19 €/MWh. **Intraday:** ■ Operated by OMIE, through a system marginal price auction (single price). Traded in hourly units. ■ There are 6 intraday markets. The first on closes at 18:45 on D-1. The second at 21:45 on D-1. The third at 01:45 on D. The fourth at 04:45 on D. The fifth at 08:45 on D. The sixth at 12:45 on D. (where D is the day of delivery).	■ OMIP and OMIE are planned to merge into a single operator. ■ The organization of the market is in line with the EU target model.

	SESSION 1º	SESSION 2ª	SESSION 3ª	SESSION 4ª	SESSION 5ª	SESSION 6ª
Session Opening	17:00	21:00	01:00	04:00	08:00	12:00
Session Closing	18:45	21:45	01:45	04:45	08:45	12:45
Matching Results	19:30	22:30	02:30	05:30	09:30	13:30
Reception of Breakdowns	19:50	22:50	02:50	05:50	09:50	13:50
Publication PHF	20:45	23:45	03:45	06:45	10:45	14:45
Schedule Horizon (Hourly periods)	27 horas (22-24)	24 horas (1-24)	20 horas (5-24)	17 horas (8-24)	13 horas (12-24)	9 horas (16-24)

■ Price range: On average, it is about 0 €/MWh, and typically below zero.

Imbalance settlement:

■ The price is set by system marginal price on the balancing

market. **Balancing market:** The service is called *gestión de desvios*. It is organised by REE, the TSO, and traded in hourly units. Generators and pumped storage participate.	
International power trading ▪ Spain/Portugal: Capacity is allocated through implicit auction. OMIE operates the market for both Spain and Portugal. Since March 25th 2014, financial transmission rights (FTRs) have also been auctioned. This is the first European capacity allocation mechanism based on FTR. ▪ In 2014, OMIE was coupled with the Central and Northern European markets, as part of a Europe-wide market coupling process. This coupling process will allow infrastructure between Spain and France to be used more efficiently, although the interconnection is already used at nearly full capacity. Currently, capacity between Spain and France is explicitly auctioned. ▪ Currently, there are limited exports (notwithstanding Portugal) despite excess generation capacity due to the isolation of the peninsular electricity system which is poorly connected to the rest of Europe.	▪ Next step is integrating the intraday market with the rest of Europe (especially relevant for renewables integration). ▪ The problem of sufficient interconnection capacity should diminish in the future, with the new electricity line across the Pyrenees
Reserve products and remuneration **Primary reserve:** ▪ Its purpose is to automatically correct for small deviations between generation and consumption. It is compulsory for all generators to participate. ▪ Timeline for activation is 30 seconds up to 15 minutes, and it is not remunerated. **Secondary reserve:** ▪ Its purpose is to correct for derivations from dispatch programmes. All generators except for non-manageable resources such as renewables participate. The total reserve requirement is around 4000 GWh/year. ▪ Timeline for activation is 100 seconds up to 15 minutes. Both capacity and energy are remunerated. ▪ Capacity is paid according to the marginal price (calculated from the offers made by generators). Energy used is paid according to the price which would have had to be paid if tertiary reserve energy would have been used instead.	▪ It is expected that renewables will soon be required to participate as well.

Tertiary reserve:

- Used to substitute secondary reserve, as it is being used. All generators except for non-manageable resources such as renewables participate. Total reserve requirement is around 8000 GWh/year.
- Timeline for activation is 15 minutes up to 2 hours.
- Only energy is remunerated, based on the marginal price of tertiary reserve, calculated from the offers made by generators for this service.

Slow reserve:

- This is running reserves of connected thermal units; timeline for activation is 30 minutes up to 4 or 5 hours.

Capacity Remuneration Mechanism

- Security of supply is not only an issue of generation adequacy, but also of transmission adequacy in Spain. Congestion on transmission networks has led to blackouts in the past, despite adequate generation.
- Spain introduced capacity payments in 1997, with the current system in place since 2013. The capacity payments address system flexibility issues and reduce investment risks. As such, there are two capacity payments, which are called "Investment incentive" and "Availability incentive"
- **Availability incentive:** Aim to secure capacity in the medium term (up to 1 year). 5.120 €/MW/Year, where the MW is the reliable capacity of the plant: 91% for coal and CC, 87% for diesel and 23.7% for hydro and pumped-storage. The other technologies don't receive anything.
- **Investment incentive:** Aim to help generators recover their investment costs (these payments are for new projects only). Capacity payment for new plants, capped at 28,000 €/MW per year for the first 10 years. The actual payment is decided by the Spanish competition authority (CNMC) based on a capacity price curve as a function of the reserve margin, i.e. the CNMC sets the price curve of capacity and the market chooses its amount by entry. Due to low demand, capacity payments were lowered in 2012 and 2013: from 28,000 €/MW per year to 23,400 €/MW per year in 2012, and even further to 10,000 €/MW per year in 2013.
- Both prices are set administratively.

- The design of the mechanisms has been criticised by some stakeholders. There is no apparent desire on the part of the administration to change the mechanisms in the short run.

1.10. **SWITZERLAND**

At present	Expected changes
Power market **Market organisation:** ▪ Day-ahead and intraday markets are traded on EPEX, the power exchange for Germany, Switzerland, Austria and France. ▪ Futures are traded on EEX. **Trading volumes (2014):** ▪ 20.5 TWh traded on the EPEX day-ahead market (36% of demand, at 57 TWh) ▪ 1.1 TWh traded on the EPEX intraday market (2% of demand) ▪ The average base price on the day-ahead market was 36.79 €/MWh **Day-ahead market:** ▪ The daily auction takes place at 11am every day for delivery the following day in hourly intervals ▪ Base and peak load traded ▪ The minimum volume increment is 0.1 MW for individual hours and blocks. ▪ Price must be between -500 and 3000 €/MWh ▪ Blocks are used to link several hours on an all-or-none basis: either the bid is matched on all of the hours or it is rejected **Intraday market:** ▪ Electricity is traded for delivery on the same or the following day for periods of 15 minutes, 1 hour or blocks of several hours. ▪ Trading for all products ends 60 minutes before delivery. ▪ Final notification for settlement occurs either 45 minutes or 15 minutes ahead of delivery depending on what type of balancing group is reporting. ▪ Starting at 3pm on the day before delivery, all hours of the following day can be traded. Starting at 4pm on day before delivery, all 15 minute periods of the following day can be traded. ▪ Base and peak load traded. ▪ Prices must be between -9,999.99 to 9,999.99 €/MWh. ▪ Minimum volume increment is 0.1 MW, minimum price increment is 0.1 €/MWh ▪ Trading is continuous and 24/7 ▪ Intraday OTC trades can also be registered for clearing through the trading system	▪ There is talk of possible reform of the imbalance pricing formula, but this is at an early stage.

Imbalance settlement:

- Balance energy is the difference between the scheduled sum of energy and the measured sum of actual energy. The settlement period is 15 minutes.
- The price mechanism is as follows:
- (where BGV is Bilanzgruppenverantwortliche, i.e. the Balancing Responsible Party, P_{spot} is the spot price, P_{sek} is the price paid for secondary reserve. P_{ter} is the price paid for tertiary reserve and sek+ and sek- refer to up and down regulation respectively)

Billing Unit	short (deficit)	BGV pays $(A + P_1) * \alpha_1$
	long (surplus)	BGV receives $(B - P_2) * \alpha_2$

$A = \max (P_{spot}; P_{sek+}; P_{ter+})$ $B = \min (P_{spot}; P_{sek-}; P_{ter-})$

With Alpha factors as following	α_1	1.1
	α_2	0.9
With base price as following	P_1	1 ct/kWh
	P_2	0.5 ct/kWh

Note:

1. Within the calculation of the prices A and B, the prices of P_{sek} and P_{ter} will only be used, if a use of secondary reserves or tertiary reserves occurred in the relevant direction
2. If the price $(A+P_1)$ results in a negative price, the Alpha factor α_1 will be replaced by the Alpha factor α_2. IF the price $(B-P_2)$ results in a negative price, the Alpha factor α_2 will be replaced by the Alpha factor α_1.

Balancing market:

- Bids are obligatory for capacity paid under the tertiary reserve mechanism (see below) and cover 4-hour periods. Non-obligated parties may also bid into the balancing market.
- There are daily tenders held the day before delivery. Prices are given as EUR/MWh and can be adjusted intraday up to the bid deadline. Pay-as-bid market.
- Minimum request duration of 15 minutes, but unlimited deployment must be guaranteed.
- Minimum bid is 5 MW.

International power trading

- Currently, no market coupling due to negotiations with the EC.
- **Germany and France:** explicit yearly, monthly and daily auctions. Intraday implicit allocations. [Note: There are some legacy bilateral capacity contracts for CH-FR interconnection that still exist, but these are due to expire in a few years, after which this capacity will be added to the normal allocation processes.]
- **Italy:** Explicit yearly, monthly and daily auctions. Explicit intraday auctions
- **Austria:** Explicit capacity auctions
- Explicit auctions for all countries run by casc.eu

- Subject to completion of negotiations, plans to couple with Italy and CWE (via EPEX).

Reserve products and remuneration

- Reserve products are tendered for by Swissgrid, the TSO, and synchronise with the electricity grid of the UCTE in Europe.

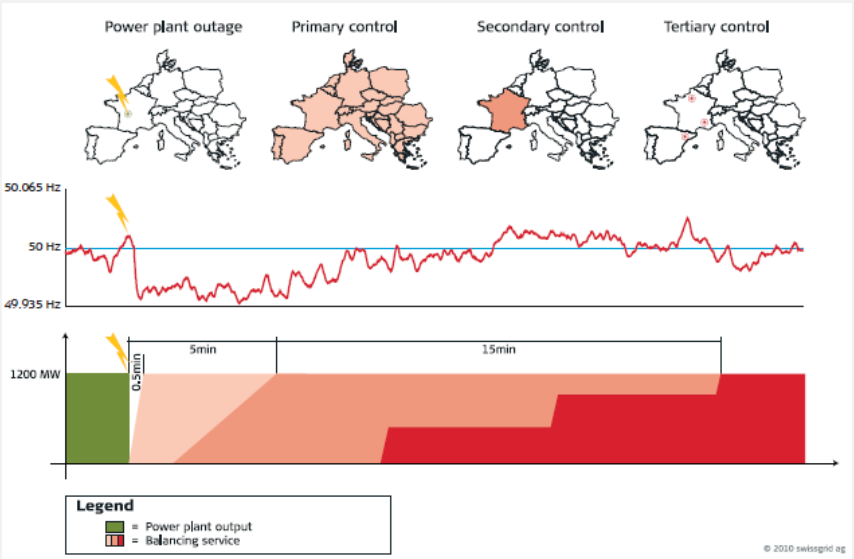


Figure 1: Example of a power plant outage in France

Primary control:

- Tender period: weekly
- Realised by a combined auction between Austria, Germany, the Netherlands and Switzerland.
- Volume required: 71MW
- Capacity is remunerated at the bid price for the MWs contracted (pay-as-bid)
- No remuneration for primary control energy delivered
- Maximum offer size is 25 MW per bid

Minimum bid is 1 MW with increments of 1 MW

- Product is symmetric, so must handle both up/down regulation

Secondary control:

- Quantity awarded is calculated by means of a stochastic optimisation of bids, taking account of system security requirements (expressed as power deficit probabilities)
- Volume: c.400 MW
- Maximum offer size is 50 MW per bid
- Product is symmetric, so must handle both up/down regulation
- Tender period: weekly
- Capacity is remunerated at pay-as-bid price.
- Energy is remunerated based on the prevailing SwissIX energy price adjusted by 20% up or down in favour of the reserve provider as set out in the chart below.

Energy price (P) is	Reserve increases output	Reserve decreases output
Positive	Reserve receives P + 20%	Reserve pays P – 20%
Negative	Reserve receives P – 20%	Reserve pays P + 20%

- Energy settled according to post scheduling, obtained from control signal averaged over a period of 15 minutes
- Minimum bid size is 5 MW, with 1 MW increments.

Tertiary control (power):

- There are separate products for up and down regulation.
- Maximum offer size is 100 MW per bid.
- Minimum offer is 5 MW with 1 MW increments.
- Tender periods: Each day of a week between midnight-4am, 4am-8am, 8am-midday, 4pm-8pm, 8pm-midnight
- Capacity remunerated at the bid price for the relevant power.
- Energy is remunerated as described in the Balancing Market section above.

Capacity Remuneration Mechanism

- Energy-only market, with no capacity mechanism.
- In 2014, the regulator EICom advised against the introduction of capacity mechanisms in Switzerland, but also that Swiss producers should have free access to capacity markets that are formed within the EU

2. COUNTRY CLUSTERS

2.1. THE BALKANS: BOSNIA, CROATIA, FORMER YUGOSLAV REPUBLIC OF MACEDONIA (FYRoM), MONTENEGRO, SERBIA, SLOVENIA AND BULGARIA

At present	Expected changes
Power market **Bosnia** ▪ **Power exchange**: No organized market or power exchange, wholesale electricity traded through bilateral agreements between the incumbent utilities and registered traders. Managed by the TSO ISO BiH (Independent System Operator in Bosnia and Herzegovina). Wholesale prices still regulated. ▪ **Trading volumes**: [no info as no organised market] ▪ **Day-ahead market:** [no market, bilateral agreements] ▪ **Intraday market**: [no market, bilateral agreements] ▪ **Imbalance Settlement:** Settlement time unit: 1 hour. Balance responsible parties: the three power utilities, each responsible for the imbalances of its own dominion. Market-based procedures for covering losses and cost-reflective imbalance charges have been introduced by the new Market Rules approved by SERC in May 2015 and will be applied as from 1 January 2016. **Croatia** ▪ **Power exchange**: managed by CROPEX, the Croatian Power exchange. Not functioning yet, wholesale electricity still traded through bilateral agreements only. CROPEX and North Pool Spot signed a cooperation agreement in June 2015 to create the first competitive Croatian day-ahead power market. This market will possibly be extended to include an intraday market at a later stage. ▪ **Trading volumes**: [no info as no organised market] ▪ **Day-ahead market:** [no market, bilateral agreements] ▪ **Intraday market**: [no market, bilateral agreements] ▪ **Imbalance settlement:** managed by the TSO HOPS. Settlement time unit: 1 hour; single pricing independent of whether the deviation direction of a specific BRP is the same as the deviation direction of the system. **Former Yugoslav Republic of Macedonia** ▪ **Power exchange**: No organized market or power exchange. Wholesale electricity traded through bilateral agreements,	

managed by the TSO MEPSO.

- **Trading volumes**: [no info as no organised market]
- **Day-ahead market:** [no market, bilateral agreements]
- **Intraday market**: [no market, bilateral agreements]
- **Imbalance Settlement:** Managed by the TSO MEPSO Settlement time unit: 1 hour. There are 41 balancing groups involved in settlement. Undertakings with an obligation to provide public services (including regulated generation, distribution and supply) are exempted from the imbalance charges. The imbalance settlement price is calculated based on the Hungarian day-ahead market price (HUPX), multiplied by a correction factor defined by the Regulator.

Montenegro

- **Power exchange**: No organized market or power exchange, wholesale electricity traded through bilateral agreements. Managed by the State-owned electricity market operator COTEE established in 2011. Price of domestic generation still regulated; phasing-out plan for wholesale price regulation that would gradually close the gap between the price set by the regulator and the reference market price.
- **Trading volumes**: [no info as no organised market]
- **Day-ahead market:** [no market, bilateral agreements]
- **Intraday market**: [no market, bilateral agreements]
- **Imbalance Settlement:** provision of balancing services and imbalance pricing are regulated. Settlement time unit: 1 hour. The imbalance settlement price is derived from the price of activated tertiary regulation in a cost-reflective manner. COTEE is responsible for the calculation of imbalances and ensuring the financial settlements.

Serbia

- **Power exchange:** No organized market or power exchange currently, wholesale electricity still traded through bilateral agreements. The power exchange operator SEEPEX, a joint-stock company with 75% of the shares owned by the TSO EMS and 25% by EPEXSPOT, was registered in July 2015 and is expected to become operational at the start of 2016.
- **Trading volumes**: [no info as no organised market]
- **Day-ahead market:** [no market, bilateral agreements]
- **Intraday market**: [no market, bilateral agreements]
- **Imbalance settlements:** Settlement time unit: 1 hour; single pricing. The main component of the imbalance price is the average cost of balancing services (like Germany).

Slovenia

- **Power exchange**: OTC transactions as well as the day-ahead, intraday, and balancing markets are operated by BSP South pool.
- **Volumes traded**: 4.4 TWh traded on day-ahead (2012), intraday introduced October 2015, and volume traded in that month was 21,608 MWh.
- **Day ahead market:** Price range: [0 €/MWh; 3000 €/MWh] ; gate closes at 12.00 am.
- **Intra-day market**: Hourly and 15-min products, continuous trading; price range: [-9999,99 € and 9999,99 €]; time to delivery at gate closure: 1h
- **Imbalance Settlement:** Settlement time unit: 1 hour; dual pricing. Main component of the imbalance price for imbalances which are opposite in direction to the system imbalance: the DAM price; main component of the imbalance price for imbalances that worsen the system imbalance: the average cost of control energy (like France).
-

Bulgaria

- **Power exchange**: managed by The Independent Bulgarian Energy Exchange (IBEX) created in 2014. Electricity still traded through bilateral agreements only. IBEX and North Pool Spot signed a cooperation agreement in April 2015 to create the first competitive Bulgarian day-ahead power exchange. The DAM is planned to become operational by the end of Q4 2015. An intraday market is also planned to be created, but no provisional date for opening.
- **Trading volumes**: [no info as no organised market]
- **Day-ahead market:** [no market, bilateral agreements]
- **Intraday market**: [no market, bilateral agreements]

Imbalance settlement: [settlement period: not found]; balancing energy is obtained from both the public supplier and through accepted offers and bids submitted by trading participants. The imbalance settlement price when the system is in deficit is the average of 1) the cost of producing balancing energy by the public supplier, and 2) the average price of accepted offers from market participants, weighted by the quantity of balancing energy purchased from each of these two sources. The imbalance settlement price when the system is in surplus is the average of 1) the price at which excess energy in the system is sold by the TSO to the public supplier, and 2) the average price of accepted bids made by market participants, weighted by the quantity of balancing energy sold to each.

International power trading

- **Market coupling:** In February 2015, the Italian-Slovenian border has been coupled with Multi-Regional Coupling (MRC)
- **Explicit auctions:**
  - between Croatia and Slovenia
  - between Croatia and Hungary
  - between Bosnia and Croatia
  - between Bosnia and Montenegro
- **Interconnections:**
  - between Bosnia and Croatia
  - between Bosnia and Montenegro
  - between Bosnia and Serbia
- Interconnections planned between FYRoM and Kosovo and between FYRoM and Albania, to be completed in 2015. Interconnection planned between Italy and Montenegro, to be completed in 2015.

Croatian, Slovenian and Bosnian TSOs constitute the control block SLO – HR – BIH within the UCTE grid.

- Albania, Bosnia, Montenegro, FYRoM, Serbia, Kosovo and Croatia agreed to set up a joint regional power market in 2016
- Planned power interconnections:
  - between Albania and FYRoM,
  - between Serbia, Montenegro and Bosnia
  - between Slovenia and Hungary (2016)
  - between Italy and Slovenia (HVDC line, not expected to be completed before 2022.)

Reserve products and remuneration

Bosnia

- **Primary Reserve:** Procurement of capacity and energy through mandatory provision. Providers are generators only.
- **Secondary Reserve:** Mandatory provision of capacity, where generators connected to the grid are obliged to reserve a certain amount of capacity to meet TSO requirements and are given a fixed availability price set by the TSO. Generators must offer all their remaining capacity for balancing energy. Providers are generators only. Activation rule is pro-rata (parallel activation). Activation time is within 90s.
- **Fast tertiary Reserve:** Mandatory provision of capacity, energy procured through mandatory offers. Providers are generators only. Activation rule is pro-rata (parallel activation). Activation

time is between 5min and 15 min; Price is regulated.

Croatia

- **Primary Reserve:** Energy and capacity procured through mandatory offers. Providers are generators only.
- **Secondary Reserve:** Procurement through pre-contracted offers only**.** No minimum bid size. Providers are generators only. Activation rule is pro-rata (parallel). Activation time is between 90s and 5min.
- **Fast tertiary reserve:** Procurement through pre-contracted offers only. No minimum bid size. Providers are generators only. Activation rule is pro-rata (parallel). Activation time is between 5min and 15min.
- **Slow tertiary Reserve:** Procurement through pre-contracted offers only. No minimum bid size. Providers are generators only. Activation rule is merit order.

Former Yugoslav Republic of Macedonia

- FYRoM, Serbia and Montenegro form the SMM control block whose balance is managed by CGES, the Montenegrin TSO.
- **Primary Reserve:** Mandatory provision of capacity and energy.
- **Secondary Reserve:** Any production unit with fast response capabilities can take part in the secondary control if required by TSO. [apparent mandatory provision, but no available information on the procurement scheme]. Direct consumers can also participate in secondary control reserve by way of controllable loads.
- **Tertiary Reserve:** Any production unit with suitable capabilities (activation within 15 minutes at most) can take part in the tertiary control if required by TSO. Direct consumers can also participate in provision of tertiary reserve by way of controllable loads.

Montenegro

- Due to the size of the system, there is a limited number of dispatchable units and only one Balance Service Provider, the power utility EPCG.
- **Primary Reserve:** Mandatory obligation for all dispatchable units, provided free of charge.
- **Secondary Reserve:** Reservation of balancing capacity for secondary reserve is not market-based. Quantity FRR services (energy) are defined in the Ancillary Services Contract concluded between the TSO and BSP. [One source suggests that EPCG is not compensated for providing this service, but it is not clearly formulated]
- **Tertiary Reserve:** Reservation of balancing capacity for tertiary

reserve is not market-based. Quantity FRR services (energy) are defined in the Ancillary Services Contract concluded between the TSO and BSP.

Serbia

- **Primary Reserve (FCR):** Capacity and energy are procured through mandatory offers. Providers are generators only.
- **Secondary Reserve:** Capacity is procured through pre-contracted offers only. Energy is procured through pre-contracted and mandatory offers. Providers are generators only. Activation rule is pro-rata (parallel activation). Activation time is below 1min. No minimum bid size.
- **Fast tertiary Reserve:** Capacity and energy are procured through pre-contracted offers only. Providers are generators only. Activation rule is pro-rata (parallel activation). Activation time is between 5min and 15min. No minimum bid size.
- **Slow tertiary Reserve:** Capacity and energy are procured on the bilateral market. Providers: Generators + Pump Storage units pumping + Load. According to a multiple choice ENTSO-E survey, the minimum bid size is below 1MW. Regulated price for capacity procurement. Remuneration for energy is pay as bid.

Slovenia :

- **Primary Reserve:** Capacity is procured through mandatory provision without reservation; energy is procured through mandatory offers. Providers are generators only.
- **Secondary Reserve:** Capacity is procured on the bilateral market. Energy is procured through pre-contracted and free offers. According to a multiple choice ENTSO-E survey: the minimum bid size is below 1MW; providers are generators only; activation time is between 5min and 15 min; activation rule is pro-rata (parallel activation); remuneration is pay as bid.
- **Fast tertiary Reserve:** Capacity is procured through an organised market; energy is procured through pre-contracted offers only. According to a multiple choice ENTSO-E survey: the minimum bid size is below 1MW; providers are generators + pump storage units pumping + load; notification is provided between 15 min and one hour ahead of delivery; activation rule is merit order list; remuneration is pay as bid.
- **Slow tertiary Reserve:** According to a multiple choice ENTSO-E survey: the minimum bid size is below 1MW; providers are generators + load; notification is provided 15 min ahead of delivery; activation rule is merit order list; remuneration is pay as bid.

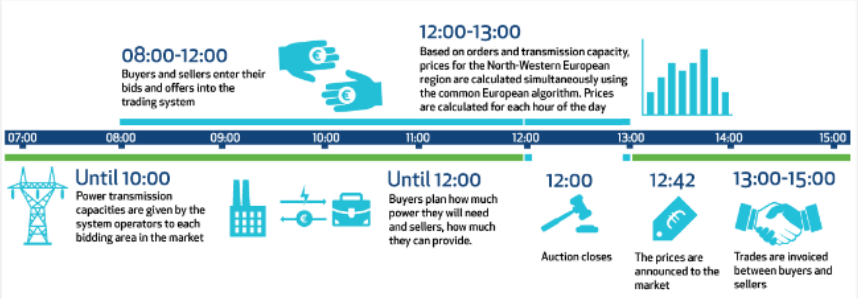
Bulgaria

- Balancing market for energy, capacity procured through auctions

and bilateral contracts ▪ **Primary Reserve:** [we could not find more detail on the procurement scheme or activation time] ▪ **Secondary Reserve:** [we could not find more detail on the procurement scheme or activation time] ▪ **Tertiary Reserve : [we could not find more detail on the procurement scheme or activation time]**	
Capacity Remuneration Mechanism ▪ **Bulgaria:** No CRM at present, Energy-only market ▪ **Others:** No CRM at present, Regulated market restrictions	

2.2. THE BALTICS: ESTONIA, LATVIA AND LITHUANIA

At present	Expected changes
Power market ▪ Day-ahead and intraday markets operated by Nord Pool Spot for all Baltic countries, along with Nordic countries, Germany and UK **Volumes traded on Nord Pool Spot**: **Estonia:** ▪ Day ahead (2014): 7 TWh bought and 9.8 TWh sold (85% and 120% of total demand, 8.2TWh) ▪ Intraday (2013): 109 GWh bought and 58 GWh sold (1% of demand) **Latvia:** ▪ Day ahead (2014): 5.1 TWh bought and 2.8 TWh sold (69% and 38% of total demand, 7.4 TWh) ▪ Intraday (2013): 56 MWh bought and 6 MWh sold (0% of demand) **Lithuania:** ▪ Day ahead (2014): 10.8 TWh bought and 6.9 TWH sold (100% and 64% of total demand, 10.7 TWh) ▪ Intraday (2013): 6 MWh bought and 56 MWh sold (0% of demand **Day ahead:** ▪ Elspot day-ahead market, energy traded by the hour (single hours, block orders and flexible hour orders) ▪ Gate opens 12 days before delivery and closes at 12pm on D-1. ▪ Maximum block order size is 500MW. ▪ Prices can range from -500 to 3000 €/MWh ▪ There is a system price and an area price (hourly). Both are calculated by marginal pricing. The system price is for the Nordic market and disregards transmission capacity. The area price is the marginal price for each bidding area, taking into account transmission capacity limitations and congestion ▪ Finland, Estonia, Lithuania and Latvia constitute separate bidding areas. Norway has 5 bidding areas, Denmark has 2 (east and west) and Sweden has 4. When there are constraints in transmission capacity between two bidding areas, the bidding areas may get different prices – this is the area price.	



Intraday:

- Elbas intraday market, continuous intraday trading across the Nordic and Baltic regions as well as Germany and the UK. Open 24/7, offering 15 minutes, 30 minute, hourly and block products.
- Prices are set on a first come first served basis, where the lowest sell price and highest buy price take priority
- Gate opens usually at 2pm on D-1, once Elspot prices are published, and closes 60 minutes before delivery

Imbalance settlements:

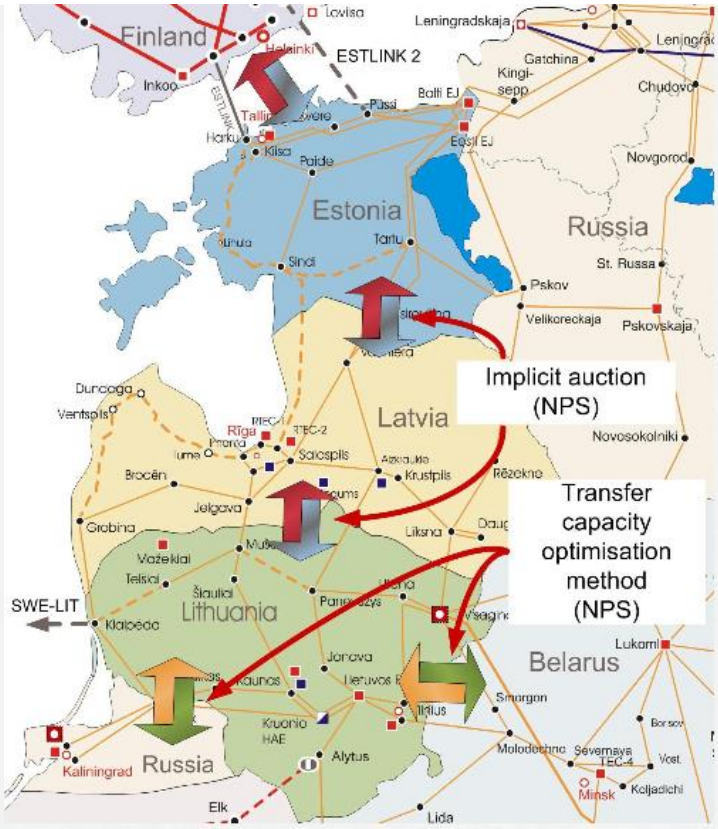
- **Baltic imbalance settlement** agreement is in place between the Baltic SOs, which allows imbalances to be netted and costs allocated. An SO with an imbalance that can be netted off the wider regional imbalance faces an imbalance price equal to the arithmetic average of the Estonian, Latvian and Lithuanian Elspot price. The cost of balancing the residual regional net imbalance is divided among the SOs based on their share of remaining net imbalance.
- **Latvia:** Balancing is performed by the TSO. The price is calculated and published monthly. The price is a weighted average of the regulated power price, the price of emergency reserves used and the price of balancing energy used. Parties that oversupply power receive 0.97 times the imbalance settlement price. Parties that undersupply power must pay 1.03 times the imbalance settlement price.
- **Lithuania:** Parties that oversupply power receive 0.98 times the imbalance settlement price. Parties that undersupply power must pay 1.02 times the imbalance settlement price. [no further info available on how the reference imbalance settlement price is calculated]

  Estonia: The imbalance settlement price is set by the TSO. It is designed to cover any justified expenses incurred in: the purchase of regulating capacity, the purchase of balancing energy, the costs of balance settlement and the cost of any capital held for carrying out balancing functions.

International power trading

- Capacities are allocated by means of implicit auction provided by Nord Pool Spot (NPS) for day-ahead and intraday market:

- Limited PTR rules to be replaced in



- Limited physical transmission rights (PTR) auction on Estonian-Latvian border yearly and monthly organised by the TSOs.
- Day-ahead market coupling with NWE through NPS: includes CWE, GB, the Nordic countries, the Baltic countries, and the SwePol link between Sweden and Poland

2016 by European Harmonised Allocation rules and Estonian-Latvian border Regional Annex.

- NPS is part of the XBID project to create a joint integrated intraday cross-border market – aiming to go live by July 2017

Reserve products and remuneration

Primary reserve:

- The regional Group Baltic, which is made up of the Estonian, Latvian and Lithuanian TSOs have a sub-group, Synchronous Operation (SG SO). This sup-group manages all technical aspects related to ancillary services and balancing mechanisms/market management within the Baltic power systems
- [no further info available on characteristics, procurement and remuneration]

Estonia:

- **Secondary reserve (FRRa):** [no available info on this]
- **Tertiary reserve (FRRm):** Manual activation, bilateral market between users and TSO. No minimum bid. Remuneration for capacity and energy is pay-as-bid. Activation rule is merit order. Activation within 15 minutes
- **Tertiary reserve (RR):** [No available info on this]

Latvia:

- **Secondary reserve (FRRa):** [no available info on this]
- **Tertiary reserve (FRRm):** Manual activation, bilateral market between users and TSO. Minimum bid 1 MW. Agreement made 1 month or more in advance. Remuneration for capacity is marginal pricing, for energy is pay-as-bid. Activation rule is merit order. Activation greater than 15 minutes
- **Tertiary reserve (RR):** Bilateral market for procurement. Minimum bid greater than 10 MW. Remuneration for capacity and energy is marginal pricing. Activation rule is merit order. Activation within an hour

Lithuania:

- **Secondary reserve (FRRa):** [no available info on this]
- **Tertiary reserve (FRRm):** Manual activation, bilateral market between users and TSO. Minimum bid 5 MW. Agreement made 1 year ahead of real time. Remuneration for capacity is regulated price, for energy is pay-as-bid. Activation rule is merit order. Activation within 15 minutes
- Tertiary reserve (RR): Bilateral market for procurement. Minimum bid 5MW. Remuneration for capacity is regulated price, for energy is pay-as-bid. Activation rule is merit order. Activation within an hour.

Capacity Remuneration Mechanism

- No CRM currently in place in any Baltic country.

Estonia:

- The TSO has built emergency reserve power plants (ERPPs) with a total capacity of 250 MW. They are for emergency use only and not used on a day-to-day basis to produce electricity for the market. The plants can reach full capacity in less than 10 minutes and maintain full power for at least 120 hours. Prior to this, emergency reserve had been purchased from Latvia.

2.3. CENTRAL AND EASTERN EUROPE: CZECH REPUBLIC, SLOVAKIA, AUSTRIA AND HUNGARY

At present	Expected changes

Power market in the region

- Power exchange central Europe (PXE) offers futures trading and OTC clearing in Czech, Slovak, Hungarian, Polish and Romanian electricity.
- In 2013, 85% of trades on PXE were for delivery in the Czech Republic, 12% for Hungary and 3% for Slovakia. In total, 30 TWh was traded on the PXE futures market in 2013. This was 23% of total energy consumption (128 TWh) in the Czech Republic (62.7 TWh), Hungary (39 TWh) and Slovakia (26.7 TWh) in 2013.
- Czech and Slovak power exchanges are publicly owned

Czech Republic:

- **Volumes traded:** In 2013, 12.2 TWh traded on day ahead market, 417 GWh on intraday, 11 GWh on the block market and 102 TWh through bilateral trading
- **Day ahead** and **intraday** power exchanges run by OTE
- **Imbalance settlement:** The imbalance price is the highest price paid for regulating energy during the respective hour. If this price is lower than a regulated level, the regulated price level shall apply. In the event that no regulating energy was purchased during the hour, the imbalance price defaults to a regulated level.

	Block market	Day-ahead market	Intra-day market	Balancing market with regulating energy
Type of market	Continuous matching	Daily auction	Notice board	Notice board
Traded period	12 or 24 hours	1 hour	1 hour	1 hour
Minimum tradable volume	1 MW x 12 or 24 hours	1 MWh	1 MWh	1 MWh
Maximum tradable volume	50 MW x 12 or 24 hours	99,999 MWh	99,999 MWh	99,999 MWh
Smallest quantity increment	1 MW x 12 or 24 hours	0.1 MWh	0.1 MWh	0.1 MWh
Trading currency	CZK	EUR	CZK	CZK
Minimum price	CZK 1/MWh	EUR -3,000 /MWh	CZK -99,999/MWh	CZK -99,999/MWh
Maximum price	CZK 9,999/MWh	EUR 3,000/MWh	CZK 99,999/MWh	CZK 99,999/MWh
Smallest price increment	CZK 1/MWh	EUR 0.01/MWh	CZK 1/MWh	CZK 1/MWh
Zero price option	NO	YES	NO	NO
Market opens at	9:30 D-5	unlimited	15:00 D-1	H-1:00
Market closes at	13:30 D-1	11:00 D-1	H-1:00	H-0:30

Slovakia:

- **Volumes:** Total demand: 28.7 TWh in 2013, 28.3 TWh in 2014. No information available on total volume/price of trades for Slovakia.
- **Day ahead:** Most trade takes place OTC, through the clearing agent OKTE. 10% is traded on day-ahead exchange platforms, the biggest of which is PXE.
- **Intraday** trading: [no further info available, there does not appear to be a domestic intraday exchange (all bilateral)]

- On OKTE, prices can range from -3000 to 3000 €/MWh
- **Imbalance settlement:** See formulas below

Positive payment (received by party when oversupplying grid)	$PO_i = O_i * cc$ (in €)
Negative payment (paid by party when undersupplying grid)	$PO_i = O_i * cc * kzpo$ (in €)

Where:
i is the index of all balancing parties
PO_i: payment to i-th party for a given settlement period,
O_i: imbalance of i-th party in MWh for a given settlement period,
cc: clearing price of imbalance in €/MWh for the given settlement period [no more info on how this is calculated],
Kzpo: coefficient of negative payment for imbalance, **$kzpo_k = (NRE-PO_+) / PO_-$**,
NRE: total costs (in €) paid for regulating energy, including the costs of imported emergency assistance energy, for a given settlement period,
PO+: the sum of all positive payments by all parties,
PO-: the sum of all negative payments by all parties if the kzpo coefficient is set to 1.

Hungary:

- Futures and day-ahead power exchange currently run by HUPX. Currently no intraday exchange (all bilateral), but will be introduced on HUPX.
- **Volumes traded:** In 2014, 12.6 TWh trade on the day ahead market (30% of total demand, 42.5 TWh). Average base price of 40.50 €/MWh. Trimmed mean price OTC was 40.74 €/MWh. 3 TWh traded on the futures market in 2014 (7% of total demand), with 179 GWh of OTC deals
- **Day-ahead:** electricity traded for the next day in individual hour intervals. Auction takes place at 11am on D-1. Price between -500 and 3000 €/MWh.
- **Intraday:** [no info, all bilateral at present]
- **Futures:** continuous electricity trading up to 2-3 business days prior to the expiry date. Trading each day from 8:50-16:15. Prices between 0.01 and 9999 €/MWh
- **Imbalance settlement:** settlement period is 15 minutes, dual pricing. Imbalance price is a weighted average of average control energy prices and day-ahead market prices.

Austria:

- **Power exchange:** EXAA. Electricity is traded on a day-ahead basis for delivery in Austria or Germany. The two markets are fully coupled and form a single price zone, and so electricity can also be

traded at EPEXSPOT on an intraday and day-ahead basis – see Germany file.

- **Futures** are similarly traded at EEX for AUSTRIA/Germany.
- **Volumes traded (2014):** 26.4 TWh traded on the DE/AT intraday market, 289.3 TWh traded on the DE/AT day-ahead market with average price 32.89 €/MWh. [Cannot distinguish what was for DE and what was for AT]
- **Day-ahead market** run by EPEXSPOT with Germany: **see Germany paper.**
- **Intraday market:** EPEXSPOT, continuous market, traded for delivery the same or next day in 15 minute contracts (as of October 2015), single hours or blocks of hours. Gate opens at 3pm on D-1 and closes 30 minutes before delivery. Prices range from -9,999.99 to 9,999.99 €/MWh. Execution restrictions possible: immediate or cancel, fill or kill, all or none, and iceberg.
- **Imbalance settlement:** The imbalance settlement price is calculated in 15 minute intervals using a formula that accounts for the cost of balancing energy, the exchange price of energy and the size of the overall system imbalance.

  Balancing market: energy sourced by means of weekly tenders on EXAA, which is then cleared and settled by APCS

International power trading

- Market coupling between Czech, Slovak, Hungarian and Romanian day-ahead markets
- Austria is coupled with NWE through Germany
- Czech TSO, CEPS, manages intraday interconnection capacity auction on the Damas portal between CZ, AT, SK, NL, DE, PL and HU.
- Intraday capacity allocation between HU and RO.
- Explicit auctions with Austria are managed by the following bodies

	Border of APG Control Area (export/import) with:					
	Czech Republic	Hungary	Slowenia	Italy	Switzerland	Germany
Yearly, monthly and daily auction	Central Allocation Office Freising			Capacity Allocating Service Company (CASC.EU)		No declared congestion
Intraday Capacities	Damas-Portal von CEPS		ELES	CASC.EU	APG	APG

Reserve products and remuneration

Czech Republic:

- 90% of reserve is procured by the TSO through tender; remuneration is pay-as-bid. The rest is purchased on the day-ahead market for ancillary services. Remuneration here is the hourly

marginal price.

- **Primary** control is activated within 30 seconds, **secondary** within 10 minutes.
- **Tertiary** reserve is split into minute reserve available within 5, 15 and 30 minutes. For minute reserve within 5 minutes, the minimum capacity provided by one unit is 30MW. For minute reserve available within 15 or 30 minutes, the minimum capacity is 10 MW and the maximum is 70MW. Guaranteed duration of provision is 4 hours for reserve available within 5 minutes and unlimited for reserve available within 15 or 30 minutes.

Slovakia:

- **Primary reserve (FCR):** Up to 5MW, pay-as-bid for capacity, regulated price for energy
- **Secondary reserve (FRRa):** Pro rata activation (parallel activation), minimum bid 5-10 MW, activated within a minute, remuneration is pay-as-bid for capacity, regulated price for energy
- **Tertiary reserve (FRRm):** merit order activation, minimum bid is 5MW, remuneration is pay-as-bid
- **Tertiary reserve (RR):** voluntary participation, minimum bid 5 MW, remuneration is pay-as-bid, merit order activation

Hungary

- **Primary reserve (FCR):** Up to 1 MW, pay-as-bid
- **Secondary Reserve (FRRa):** Mandatory participation, merit order activation, no minimum bid, activated within 15 minutes, remuneration is pay-as-bid
- **Tertiary reserve (RR):** mandatory participation, minimum bid 1MW, remuneration is pay-as-bid, merit order activation, activation within 15 minutes

Austria:

- Primary control must be available within 30 seconds, secondary within 5 minutes and tertiary within 10 minutes
- All control tendered by APG, the TSO, weekly.
- Suppliers are responsible for obtaining tertiary control.
- **Primary control** reserve of +/-3000 MW is constantly maintained on the ENTSO-E RGCE (Regional Group Continental Europe) grid. The APG control area is required to provide +/-70-80 MW of primary control capacity. Remuneration is pay-as-bid. Procured along with Swiss, Dutch, German and Danish TSOs: PRL DACH-NL scheme. Must be available within 30 seconds.
- **Secondary control** is automatically activated to free up the primary control so that it can return to network balancing. Secondary control is activated when a system imbalance lasts for longer than 30 seconds or it is anticipated that this will be so. Must be available

within 5 minutes. The capacity must be sufficient to compensate for an outage of the largest generating unit in the control area. The cost of secondary control energy is payable by generators with an installed max capacity of over 5 MW. APCS passes on the cost of the secondary control services to the balance groups on a cost reflective basis, as a component of the overall balancing charges. There are separate availability and energy payments. Remuneration for energy is pay-as-bid and activation occurs in merit order.

- **Imbalance Netting Cooperation:** cross-border cooperation on secondary reserve with Slovenia. IGCC: cross-border cooperation on secondary reserve with 9 other TSOs, including Germany, Czech Republic, Denmark, Netherlands and Belgium.

Tertiary control also known as minutes reserve. Activated manually when the deviation lasts for longer than 15 minutes. Must be available within 10 minutes. The energy price is used to create the merit order list, and remuneration is then pay-as-bid.

Capacity Remuneration Mechanism

- **Austria:** No CRM at present, energy-only market
- **Czech Republic:** No CRM at present, energy-only market
- **Slovakia:** No CRM at present, energy-only market

Hungary: No CRM at present, energy-only market

2.4. ISLANDS: ICELAND, MALTA AND CYPRUS

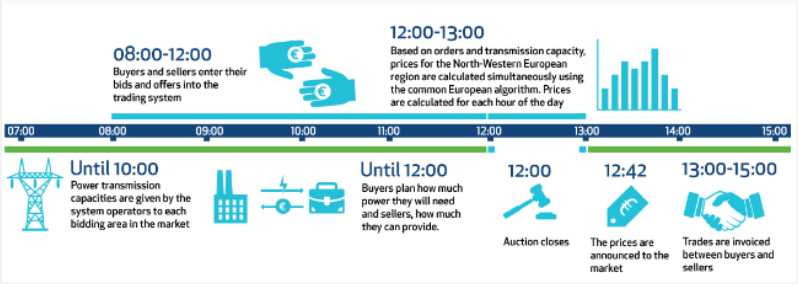
At present	Expected changes
Power market in the region **Iceland:** ▪ **Power market:** Wholesale electricity traded through bilateral contracts only. Organised power exchange was planned to be launched in November 2008, but market opening postponed due to the economic crisis. ▪ **Trading volumes**: [no info as no organised market] ▪ **Day-ahead market:** [no market, bilateral agreements] ▪ **Intraday market**: [no market, bilateral agreements] ▪ **Imbalance settlement:** The tariff system for the settlement of imbalances is a single pricing system. The imbalance settlement period is 1 hour. Any deviation from the schedule is to be settled according to the balancing energy price, which is determined every hour and is the price of the highest up- or down-regulation bid accepted for this period, depending on the direction of the system imbalance. Information on the balancing energy price for any given hour is accessible on the TSO website at the latest by 11:00 AM on the following day. **Malta** ▪ **Power market:** The vertically integrated power utility Enemalta PLC enjoys legal monopoly in electricity supply and is currently the main producer of electricity, the DSO, and the TSO. In the absence of another large independent electricity producer, there is no wholesale power market. ▪ **Trading volumes**: [no info as no organised market] ▪ **Day-ahead market:** [no market] ▪ **Intraday market**: [no market] ▪ **Imbalance settlement:** Balancing between generation and demand is carried out by Enemalta PLC. [cannot find more info] **Cyprus** ▪ **Power market**: No wholesale market is currently operating in Cyprus. The Electricity Authority of Cyprus (EAC) acts as the main generator and the TSO. EAC also distributes power from some privately-owned renewables installations. ▪ **Trading volumes**: [no info as no organised market] ▪ **Day-ahead market:** [no market] ▪ **Intraday market**: [no market] **Imbalance settlement:** No balancing market or imbalance	▪ No new date settled so far for the opening of the Icelandic power exchange.

settlement, all done internally [cannot find more info].	
International power trading ▪ None of the 3 islands is part of the synchronous continental system. ▪ **Iceland:** Iceland is not integrated and not interconnected with any neighbouring power systems. ▪ **Malta:** Malta has been interconnected with Sicily since April 2015. ▪ **Cyprus:** Cyprus is not integrated and not interconnected with any neighbouring power systems.	▪ Subsea cable project to connect Iceland and the UK, jointly run by National Grid Interconnector Holdings Limited (UK) and Landsvirkjun (IS). Currently in the feasibility phase ▪ Interconnector between Cyprus, Greece and Israel is at the feasibility stage.
Reserve products and remuneration **Iceland:** ▪ **Primary reserve (FCR):** broken down into Spinning reserves for frequency control (for frequency control within the range 49.8–50.2 Hz) and Spinning reserves for disturbance recovery (for frequency control outside the range 49.8–50.2 Hz). The TSO procures spinning reserves for frequency control through purchases from producers connected to the grid. ▪ **Secondary and Fast Tertiary reserve (FRRa and FRRm):** Both types of reserves are procured through bilateral contracts with regulated price. To enter a reserve procurement contract, power plants have to be able to generate energy continuously for at least 36 hours. Activation time is 1 hour. **Malta** ▪ [no information available: assume all is settled internally at Enemalta] **Cyprus** ▪ [no information available: assume all is settled internally at EAC]	
Capacity Remuneration Mechanism ▪ **Iceland** is an energy-only market. ▪ **Malta:** no CRM in place. ▪ Cyprus: no CRM in place.	

2.5. THE NORDICS: SWEDEN, NORWAY, DENMARK AND FINLAND

At present	Expected changes
Power market ■ Day-ahead and intraday markets operated by Nord Pool Spot for all Nordic countries, along with Baltics, Germany and UK **Volumes traded on Nord Pool Spot:** **Sweden:** ■ Day-ahead (2014): 130 TWh bought, 141.7 TWh sold (96% and 105% of total demand, 135.5 TWh) ■ Intraday (2013): 1.5 TWh bought and sold (1% of total demand, 139.6 TWh) **Norway:** ■ Day-ahead (2014): 126.4 TWh bought, 137.8 TWh sold (100% and 110% of total demand, 125.2 TWh) ■ Intraday (2013): 191.9 GWh bought, 263.9 GWh sold (<1% of total demand, 127.8 TWh) **Denmark:** ■ Day-ahead (2014): 29 TWh bought, 25.4 TWh sold (87% and 76% of total demand, 33.3 TWh) ■ Intraday (2013): 613.4 GWh bought, 650 GWh sold (2% of total demand, 32.4 TWh) **Finland:** ■ Day-ahead (2014): 52.7 TWh bought, 36.9 TWh sold (63% and 44% of total demand, 83.3 TWh). The rest is traded via OTC bilateral agreements. ■ Intraday (2013): 620.8 GWh bought, 768.3 GWh sold (1% of total demand, 84 TWh) **Day-ahead:** ■ Elspot day-ahead market, energy traded by the hour (single hours, block orders and flexible hour orders) ■ Gate opens 12 days before delivery and closes at 12pm on D-1. ■ Maximum block order size is 500MW. ■ Prices can range from -500 to 3000 €/MWh ■ There is a system price and an area price (hourly). Both are calculated by marginal pricing. The system price is for the Nordic market (Norway, Sweden, Denmark and Finland), and disregards transmission capacity. The area price is the marginal price for each bidding area, taking into account transmission capacity limitations and congestion	■ Harmonized Nordic balance settlement to be implemented in 2016 between Finland, Sweden and Norway.

- Within Norway, there are 5 bidding areas. Within Denmark there are two (east and west). Within Sweden there are four. Finland is in a bidding area with Estonia, Latvia and Lithuania.



Intraday:

- Elbas intraday market, continuous intraday trading across the Nordic and Baltic regions as well as Germany and the UK. Open 24/7, offering 15 minutes, 30 minute, hourly and block products.
- Prices are set on a first come first served basis, where the lowest sell price and highest buy price take priority
- Gate opens usually at 2pm on D-1, once Elspot prices are published, and closes 60 minutes before delivery

Imbalance settlements:

- **Sweden:** The imbalance settlement is based on reported measurements and calculated and charged by the TSO. Set bi-monthly, two-price settlement. Two-price settlement: imbalances in the same direction as the system's total imbalance are settled at the area's regulating power price, while imbalances in the opposite direction (which remedy the imbalance) are settled at the area's electricity spot price.
- **Norway:** Balance must occur within each of the 5 bidding areas. Imbalance settlement occurs weekly (i.e. the payment process occurs weekly) based on a single imbalance price. The imbalance price is equal to the marginal market price for balancing energy.
- **Denmark:** Imbalance settlement occurs monthly, two-price settlement. Oversupply is paid the lowest accepted bid price for balancing energy. Undersupply is charged the highest accepted bid price for balancing energy.
- **Finland**: Imbalance settlement occurs monthly. Production and consumption are balanced separately. Production imbalances face a two-price system in which imbalances contributing to overall system imbalance face the marginal price of up/down regulation and imbalances that are helpful face the Elspot FIN price. Consumption imbalances face a single price equal to the marginal price of up or down regulation (depending on the direction of the overall system imbalance).

Balancing market variables	Norway	Sweden	Finland	Denmark	Harmonization Nordic region as from January 1st, 2009
Balance responsibility					
Program Time Unit (PTU)	60 minutes				
Scope of balance responsibility	entire market	entire market	entire market	most of wind power by TSO	
GTC for first energy program	19:00 D-1 / W-1[a]	16:00 D-1	16:30 D-1	15:00 D-1	
GTC for final energy program	on agreement / afterward[a]	one minute before	20 minutes before	one hour before	45 minutes before
Types of balances	total	consumption, production, planned	total	consumption, production, trade	production, consumption (incl. trade)
Closed/open portfolio position	not applicable	open / closed [c]	not applicable	closed	
Imbalance settlement					
Frequency of settlement	weekly	bi-monthly	monthly	monthly	
Main imbalance pricing mechanism	marginal				
Regulation states	main direction				
Single/dual pricing	single				
One/two-price settlement	one	two	two	two	two (produc.); one (consum.)
Alternative imbalance pricing	none	during shortage situations	during shortage situations	none	

International power trading

- Day-ahead market coupling with NWE through Nord Pool Spot (NPS): includes CWE, GB, the Nordic countries, the Baltic countries, and the SwePol link between Sweden and Poland
- Explicit capacity auction between Finland and Russia, 1300 MW of capacity made available
- Explicit annual and monthly auctions between Denmark and Germany run by CASC.EU

- NPS is part of the XBID project to create a joint integrated intraday cross-border market – aiming to go live by July 2017
- Development of a new interconnection cable between Sweden and Lithuania, NordBalt
- NordLink cable between Norway and Germany in construction, to be completed 2019 and interconnector between Norway and the UK to be completed 2021 (NSN)

Reserve products and remuneration

Regional overview:

	Primary reserves (FCR-N/FCR-D)	Secondary reserves (FRR-A/LFC)	Tertiary reserves (FRR-M)
DS participation	No regulation	No regulation	No regulation
Marked design	Capacity auction, symmetric for upward and downward ramping. Hourly, weekly and/or yearly resolution	Capacity auction, separate or symmetric for upward and downward ramping.	Volume auction, separate for upward and downward ramping. Hourly resolution
Activation	Automatic activation based on frequency	Remote activation by TSO	Manual activation by provider
Response time	< 1 minute	2-15 minutes	< 15 minutes
Minimum volume	0.1-1 MW	0.3-5 MW	10 MWh/h (lower in critical situations)
Duration	< 15 minutes	Depends on circumstances	15 minutes – 1 hour per bid (duration depends on circumstances)

- **Primary reserve:** The TSOs within the Nordic Synchronous area (ENTSO-E RG Nordic grid) are jointly responsible for the supply of frequency control normal operation reserves. The procurement of primary reserves in Eastern Denmark is performed in collaboration with the Swedish TSO. Western Denmark is part of the synchronous grid of Continental Europe, and must separately supply primary reserves corresponding to its share in that synchronous area.
- **Secondary reserves:** Distinct markets exist in Finland and in Western Denmark. The Norwegian and Swedish TSOs are currently conducting a pilot project for a joint market for secondary reserves (FRRa).
- **Tertiary reserves (FRRm):** implemented through a common market for Norway, Sweden, Denmark and Finland.

Sweden:

- **Primary reserve (FCR):** minimum bid 0.3 MW, capacity remuneration is pay-as-bid, energy remuneration is marginal price.
- **Secondary reserve (FRRa):** capacity remuneration pay-as-bid, energy remuneration is marginal pricing, activation rule is pro rata (parallel activation), activation within 5 minutes.
- **Tertiary reserve (FRRm):** minimum bid >10MW, capacity remuneration is pay-as-bid, energy remuneration is marginal pricing, activation is merit order, activation within 15 minutes.

Norway:

- **Primary reserve (FCR):** minimum bid 1MW, capacity and energy remuneration are both marginal pricing.
- **Secondary reserve (FRRa):** capacity and energy remuneration are marginal pricing, activation rule is pro rata (parallel activation), activation within 5 minutes.

- Common market for primary reserve (FCR) with Germany, the Netherlands, Switzerland and Austria from 2016
- Nordic market for secondary reserve (FRRa) to be implemented 2016/7

Trading in tertiary reserve (FRRm) between the Nordic and continental synchronous area (Germany) to be implemented 2017

- **Tertiary reserve (FRRm):** minimum bid >10MW, capacity and energy remuneration are marginal pricing, activation is merit order, activation within 15 minutes.

Denmark:

- **Primary reserve (FCR):** bought by TSO at daily auctions. The first half of the activated reserve must be supplied within 15 seconds and the second half within 30 seconds. To be maintained for up to 15 minutes. Minimum bid 0.3MW. Activation is merit order. Remuneration is marginal pricing for capacity.
- **Secondary reserve (Load Frequency Control, FRRa):** bought by TSO on a monthly basis. Activation is within 15 minutes and it must be possible to maintain regulation continuously. Remuneration for energy is agreed individually by the bidder and the TSO based on the bid submitted and any subsequent negotiations, for capacity it is pay-as-bid. Activation rule is pro rata (parallel activation).
- **Tertiary reserve (manual reserve, FRRm):** put up for sale at daily auctions. Must be supplied in full within 15 minutes of activation, minimum bid is 10 MW and maximum bid is 50 MW. Activation rule is merit order. Remuneration is marginal pricing.

Finland:

- **Primary reserve (FCR):** Foreign bidders can bid into the market. Remuneration is marginal pricing.
- **Secondary reserve (FRRa** Remuneration is pay-as-bid for capacity, marginal pricing for energy. Activation rule is pro rata and activation must be within 5 minutes.
- Tertiary reserve (FRRm): The TSO procures this from its own reserve power plants (total capacity of 935 MW) and through long-term bilateral agreements. Minimum bid >10 MW. Remuneration is pay-as-bid for capacity, and marginal pricing for energy. Activation rule is merit order and activation is within 15 minutes.

Capacity Remuneration Mechanism

- No CRM currently in place in any Nordic country.

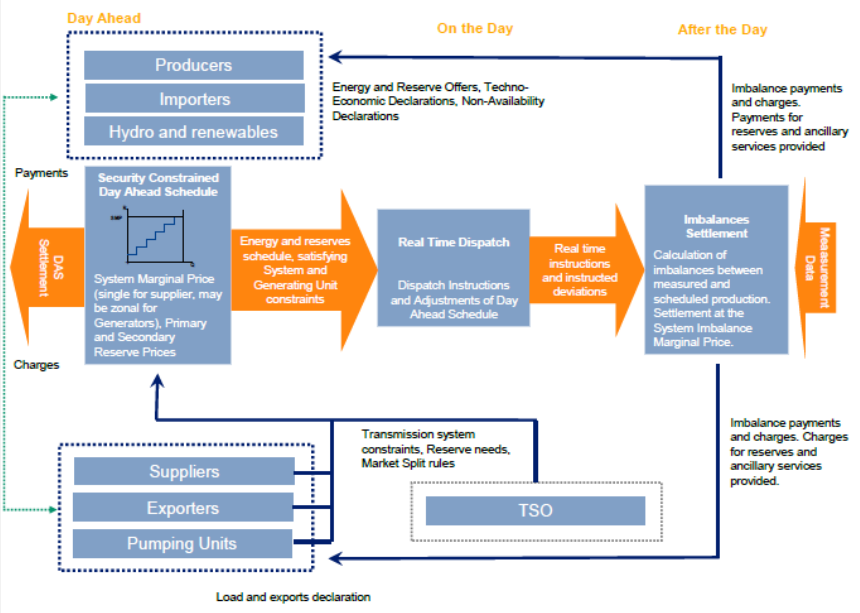
Norway:

- Norway has no intention of establishing a CRM: it is instead relying on market mechanisms and interconnectors with neighbouring states in order to ensure security of supply. It is feared that capacity mechanisms, even beyond Norway's borders could distort the market mechanism Norway relies on. This view is shared by the other Nordic countries, including Sweden and Finland (although both currently have strategic reserves).

2.6. WESTERN-LIKE: LUXEMBOURG, GREECE, IRELAND AND PORTUGAL

At present	Expected changes
Power market **Ireland:** ■ **Power market:** SEM electricity market for Ireland and Northern Ireland – includes a centralised all-island gross mandatory pool market. All electricity is bought and sold through a market clearing mechanism. Generators receive the system marginal price (SMP), payments through a capacity mechanism and constraint payments (paid when generators are constrained off) ■ **Volumes traded:** [could not find info on volumes traded, only on average prices]. The overall volume weighted average SMP was €61.97 in 2014. There were very small variations between day-ahead and intraday prices. Total demand in 2014 was 26.2 TWh ■ **Day-ahead and intraday:** Bids can be submitted from D-29, with available transfer capacity for each interconnector published at 10am on D-2. SEM publishes the SMP and the market schedule on D-1, which is split into two periods that participants can bid into: ex-ante 1 (gate closes 9.30am, SMP published at 11am) and ex-ante 2 (gate closes 11.30am, SMP published at 1pm). Within day bids can be submitted at 8am on D. SMP for within day trading published at 9.30am. ■ **Imbalance settlement:** an uninstructed imbalance payment is made to or by a participant in the case of an imbalance. Tolerance bands exist for both positive and negative imbalances. For over-generation up to and including the tolerance band, the generator is paid for each MWh at the minimum of SMP or dispatch offer price (DOP). For over-generation above this tolerance band, the generator is paid this, less a discount for over-generation. For under-generation down to the tolerance band the generator has to pay back, for each MWh, the maximum of the SMP and DOP. For undergeneration below this band, the generator has to pay back this plus a premium for under-generation. **Greece:** ■ **Power market:** Run by LAGIE, a gross mandatory pool. ■ **Volumes traded:** [no available find info on this]. Total demand in 2014 was 49.3 TWh ■ **Day-ahead**: An algorithm is used to determine the system marginal price and schedule for the entire energy market, which takes into account economic bids, cost data and technical characteristics of the generator units. Central dispatch of generation. Co-optimisation of energy and reserve. Max bid is €150/MWh.	**Ireland:** ■ The EU target model was not designed with centralised pool markets like the SEM in mind. Therefore the change required to implement the target model with SEM is much greater than for most other member states. The SEM committee has committed itself to implementing the target model by the end of 2016. ■ Transition to I-SEM (in line with target model) with forwards, day-ahead, intraday and balancing markets **Greece:** ■ Substantial gaps between Greek market and target model including: need for common platform for transmission rights, allow

- **Intraday:** no intraday trading.
- **Imbalance settlement:** generators receive nothing for oversupply, but pay the System Imbalance Settlement Price (the ex-post Pool algorithm price considering actual outturn data) for undersupply; hourly settlement period.



Luxembourg

- **Power Market:** no domestic power exchange, the Luxembourg wholesale market is fully coupled with the German market, within a single price zone. There is a specific transmission network for the industrial sector, which is connected to the Belgian and French grid. The corresponding energy transactions follow the rules of the Belgian power exchange.
- **Volumes traded:** in 2014, 8.61 TWh were traded within Luxembourg (day-ahead+intra-day)
- **Day ahead and intra-day:** the price for day-ahead transactions is the Epex Spot day-ahead market price for the German-Austrian area. Since 2014, intra-day nominations have been introduced in the Luxemburg control area so that suppliers can also procure energy on the intra-day market. [See the German one-pager for the description of the day ahead and intraday market]
- **Imbalance Settlement:** Imbalances settled every 15 min. Single pricing. Prices are cost-reflective and correspond to the average market price paid by the TSO to compensate the imbalance over the period (real-time pricing).

Portugal:

- **Power market:** Day-ahead and intraday markets (MIBEL) operated by OMIE and futures market operated by OMIP, with Spain: **see Spain for more details** and volumes traded.
- **Volumes traded:** In 2013, 54.5 TWh were traded in the Portuguese part of OMIE day-ahead market.

forward energy trading, day-ahead bids, algorithm and timing inconsistent with target model and price coupling, no intraday trading (or opportunities for rebidding for dispatch), and length of imbalance settlement period should reduce to 30 minutes.

▪ **Day-ahead:** [operated with Spain, see Spain for details] ▪ **Intraday:** [operated with Spain, see Spain for details] ▪ **Imbalance settlement:** The balancing market operates separately from the Spanish balancing market. Settlement unit is 1 hour. [no further information on detail on settlement available]	
International power trading ▪ **Ireland:** explicit long-term and daily capacity auctions with GB on Moyle and East-West interconnectors. Intraday coupling. ▪ **Greece:** explicit annual, monthly and daily auctions of interconnection capacity with Italy, Bulgaria, Albania, FYR FYRoM and Turkey. No capacity held back for day-ahead or intraday. **Luxembourg:** ▪ Interconnection at the German-Luxembourg border and the Belgium-Luxembourg border. ▪ Luxembourg is part of the Central West Europe cluster (Belgium, Netherlands, Luxembourg, France, Germany), with allocation of annual and monthly capacity through joint auction rules organised by the auction office JAO.EU, and implicit allocation of daily capacity through market coupling. **Portugal:** ▪ For Spain/Portugal, capacity is allocated implicitly. OMIE operates the market for both Spain and Portugal. Since March 25th 2014, financial transmission rights (FTRs) have also been auctioned. This is the first European interconnection capacity allocation mechanism based on FTR. ▪ In 2014, OMIE was coupled with the CWE and NWE, as part of a Europe-wide market coupling process.	▪ Interconnection project between Belgium and Luxembourg to increase the transfer capability between Luxembourg, Germany, Belgium and France
Reserve products and remuneration **Ireland:** ▪ **Primary reserve (FCR):** capacity procured a year in advance, remuneration is regulated price for capacity and energy ▪ **Secondary reserve (FRRa), Tertiary reserve (FRRm) and Tertiary reserve (RR):** Remuneration is regulated price **Greece:** ▪ Primary and secondary reserves procured alongside the creation of the day-ahead dispatch schedule (co-optimisation of energy and reserve). An availability price (capped at €10/MW) is paid to these reserves. Tertiary reserve is identified but not paid an availability price. Instructed increases in output are paid the System Imbalance Settlement Price (the ex-post Pool algorithm price considering actual outturn data). ▪ **Primary reserve (FCR):** mandatory offers for capacity and mandatory provision for energy, remuneration for capacity is marginal pricing.	

- **Secondary reserve (FRRa):** mandatory offers for capacity and mandatory provision for energy, remuneration for capacity is marginal pricing, activation rule is pro rate (parallel activation).
- **Tertiary reserve (FRRm):** mandatory provision without reservation, activation rule is merit order
- **Tertiary reserve (RR):** mandatory provision without reservation, activation rule is merit order.

Luxembourg:

- No domestic market for reserve procurement. **Primary, secondary and tertiary reserves** are procured through bilateral contracts between the TSO and generators, or through purchases in neighbouring balancing markets.

Portugal:

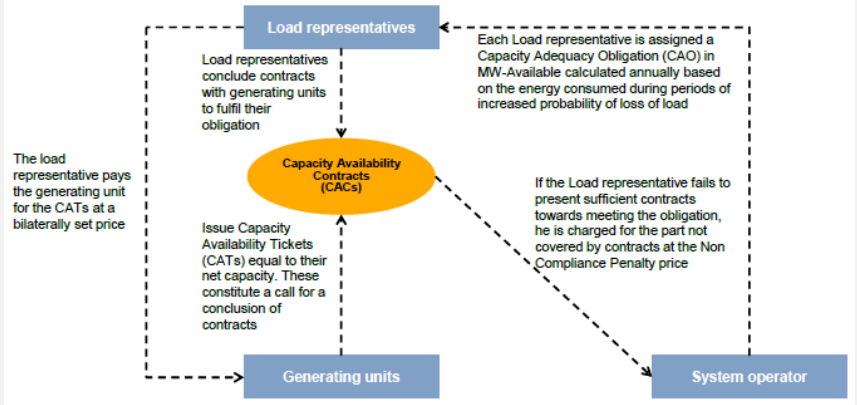
- **Primary reserve (FCR):** mandatory provision.
- **Secondary reserve (FRRa):** mandatory offers for capacity, minimum bid >10 MW, remuneration of capacity and energy using marginal pricing.
- **Tertiary reserve (FRRm):** no minimum bid size, mandatory offers of energy, activation rule is merit order, remuneration using marginal pricing.
- **Tertiary reserve (RR):** mandatory offers of energy, activation rule is merit order, remuneration using marginal pricing.

Capacity Remuneration Mechanism

- **Ireland:** Explicit capacity payments on SEM since 2007 – capacity settlements. A fixed pot of money is calculated based on an estimate of the fixed costs of a Best New Entrant peaking plant and the volume of capacity needed to meet capacity adequacy standard. This pot is then distributed pro-rata based on available capacity. Highest fixed remuneration in Europe
- **Greece:** In flux. Capacity payment similar to French scheme in place since 2006 (shown below), which has effectively been supplanted by a 'temporary' scheme since 2014. Under this scheme plants essentially receive regulated payment, with gas plant eligible for double payments notionally reflecting their flexibility benefit.

- Ireland: Auction of reliability options to be implemented in 2017 to replace the existing system

Figure 15 – Schematic of the Capacity Adequacy Mechanism



- **Luxembourg:** Energy-only market

  Portugal: Separate capacity payments for availability and investment introduced in 2011, suspended in 2012 and reinstated at a lower level from 2014.

Appendix A **Day-ahead and year-ahead NTCs**

The following two tables display net transfer capacities (NTCs) at day-ahead and year-ahead timescales between European countries. These capacities are for 1st January 2015 (day-ahead) and January 2015 (year-ahead). The data is from ENTSO-E's data portal.[1] These tables give a representative view of available capacities on interconnectors between European countries.

Figure 1. Day-ahead NTCs (MW)

From / To	AT	BA	BE	BG	CH	CZ	CZ+ DE+ SK	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	MK	NL	NO	PL	PT	RO	RS	SE	SI	SK	UA
AT					736	900											600		295											800		
BA																750																
BE													1400										1401									
BG															600																	
CH	1200							4000					1250						3710													
CZ	650							2800																	600						1700	
CZ+ DE+SK																																
DE					800	800			1550				1200										2399						179			
DK								585																1532					1821			
EE												1016									1000											
ES													1100													2200						
FI										1000																			2350			
FR			2300		3200			1800			1300			1500					2995													
GB													1500					780					1016									
GR																																
HR		700															1000											500		1500		
HU	600															1200											1000	1000			800	450
IE														750																		
IT	145				1910								1160		500															680		
LT																																
LV										1000										1200												
MK															350																	
NL			1401					2187						1016										700								
NO									1232														700						3545			
PL						400	1000																						300		550	
PT																																
RO																																
RS																600	1000															
SE									1650			2690												3196	600							
SI	950															1500			620													
SK						1200											900								500						400	
UA																																

Source: *Entso-E Transparency Platform*

Note: *All values are for 1/1/15, except DE to CZ and PL to CZ, which are for 2/1/15*

[1] Data accessed from https://transparency.entsoe.eu/content/static_content/Static%20content/legacy%20data/legacy%20data2015.html

Figure 2. Year-ahead NTCs (MW)

From \ To	AT	BA	BE	BG	CH	CZ	CZ+ DE+ SK	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	MK	NL	NO	PL	PT	RO	RS	SE	SI	SK	UA
AT																400						200							100			
BA													800											946								
BE																													200			
BG																																
CH																																
CZ																																
CZ+ DE+SK									2100																					615		
DE								2225																1632					1740			
DK												1016																				
EE													1000																			
ES										1000																				2300		
FI			1850								1100																					
FR																		530														
GB																																
GR																1000													150			
HR															1200														300			
HU														1000																		
IE																																
IT																																
LT																																
LV																																
MK																													100			
NL			946																						700							
NO									1632															700						3695		
PL							400																							600		
PT																																
RO																																
RS		100		100											150	300						100	100					150				
SE								615	950			1500													1500	600						
SI																																
SK																																
UA																																

Source: *Entso-E Transparency Platform*

Note: *All values are for January 2015*

[1] Data accessed from https://transparency.entsoe.eu/content/static_content/Static%20content/legacy%20data/legacy%20data2015.html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