

# Russian electricity market – a review

## Russian electricity market overview

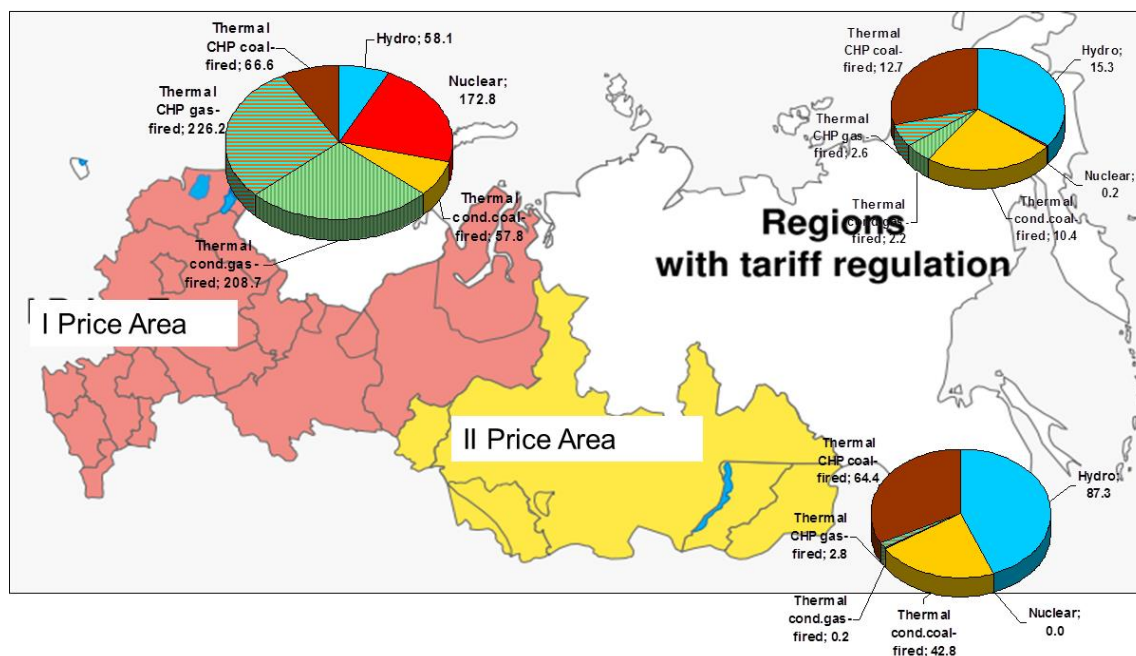
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### Introduction

Russian electricity market reform resembles in many ways to any other electricity market reform: during 2003-2008 the vertically integrated energy monopoly RAO UES was restructured so that competitive elements (generation and sales) and natural monopoly elements (transmission, distribution and system dispatching) were separated and a competitive wholesale market (firstly, the day-ahead electricity spot exchange followed by the capacity and ancillary services markets later) was launched. The Russian electricity spot market design is based on the nodal market model which is also adopted in the USA. The European electricity market reform is based on Zonal market design, which requires relatively strong transmission capacity to support the large zones of unified prices (e.g. whole of Finland). The zonal market design is based on principle of decentralized optimization (bids to the power exchange determine the optimal dispatch) while the nodal system is based on centralized optimization (optimal dispatch is calculated by the market or/and system operator on basis on bids of the generators, estimated demand and other technical data).

### Russian electricity market a general overview

The Russian wholesale competitive market is covering huge geographical area and due to its size and insufficient transmission capacity the whole market is split into two price areas: European part forms independent price area (price area 1) from the Siberian part of the country (price area 2). In addition to these two competitive pricing areas energy systems in some regions at the Far East and the Northern European part (Komi and Arkhangelsk) are still remain regulated areas. This article focuses mainly on the European price area.



European price area has a gas-dominated electricity generation structure – in 2012 434 TWh from the gas-fired plants formed 55% of gross electricity production in the area (796 TWh in total). Nuclear plants adds 22% (177 TWh). Hydro plants are used for the regulation and generated 63 TWh. The rest of electricity was produced by the coal-fired plants, but most of them are multi-fired and use both coal and gas.

There are some specific features affecting to the electricity supply profile in the European pricing zone. First, 64 GW of total 121 GW thermal capacities are CHP plants. Although, most of these plants are not back-pressure type and have technical possibilities to vary their output, their must-run requirements strongly affect on the optimization of other generators. Second, capacities have relatively low utilization rates – 55% in the average, 80% for nuclear and 53 % for thermal plants. Third, in spite of the large CHP share, thermal generation has low efficiency - 38% in average, 40% for gas-fired and 34% for coal-fired plants.

Actual investment plans assume the considerable capacity additions in the European pricing zone. 17 GW was already commissioned during 2008-2013 and 16 GW will be put in operation during 2014-2018, incl. 4.6 GW of nuclear and 11 GW combined cycle gas-fired plants and CHP. Together with the slowing of demand growth, these capacity additions will form the large surplus in the market (reaching 8.5-10.5 GW in 2015-2017). This factor as well as lower fuel costs of new gas-fired generation will create the effective pressure on the further electricity spot prices' growth.

### **The main institutions in the Russian electricity market**

The Russian wholesale electricity market is divided between:

- competitive nodal energy market trading electricity hourly in day-ahead basis
- competitive nodal balancing market trading deviations from day-ahead market schedule
- year-ahead competitive zonal capacity market
- RAB<sup>1</sup>-based regulated long-term capacity supply contracts for new capacities
- regulated contracts for electricity and capacity to residential consumers
- bilateral energy and capacity contracts between market participants (plays a marginal role now)

According with Federal Antimonopoly Service data, in 2012 77% of electricity and 60% of capacity was sold at the wholesale level through the centralized competitive mechanisms. Near 20% of electricity and 36% of capacity obtained regulated tariffs and only 3% of electricity and 4% of capacity was sold through the bilateral contracts.

Several institutions in Russia provide the stable and effective functioning and development of this very complicated market structure (Fig. 1).

The top legislative power lies within Ministry of Energy (<http://minenergo.gov.ru/>). The Ministry initiates the necessary revision of current legislative basis of power sector operation and development and market functioning and reform. It also includes the aspects of technical regulation base. The Ministry also targeting the long-term industry and market development national energy policy indicators for the power sector development, incl. pricing, fiscal and environmental taxation, requirements for energy mix diversification, fuel efficiency, technological renewal, emission rates ,etc.

The implementation body of the legislation is called Market Council (<http://www.en.np-sr.ru/>) which is a non-profit self-regulatory organization, consisting of representatives of all parties of the Russian electricity market. Council performs tasks of legislative implementation and develops the overall market functioning. Its main aims include: supporting and developing the operation of the wholesale market trading infrastructure, ensuring efficient linkage between wholesale and retail markets, creating favorable terms for attracting investments to the electric power industry etc. Council takes part in the elaboration of wholesale and retail electricity and capacity market rules, develops and approves the Wholesale Market Trading System Accession Contract and Wholesale Market Regulations, maintains the Register of Wholesale Market Participants, carries out market dispute resolution, controls

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<sup>1</sup> Regulated Asset Base

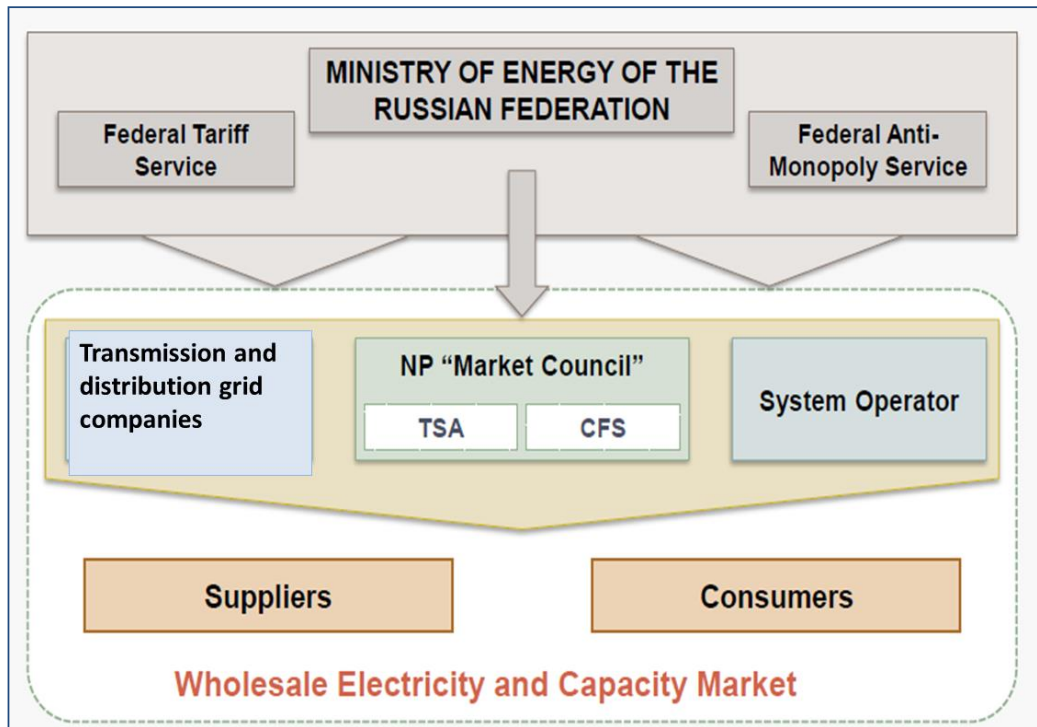
the adherence of market participants to WECM Rules. Integrating all groups of market entities (in the form of corresponding Chambers), Council acts as the unique negotiation platform and in fact performs the function of think tank for market improvements.

Trading System Administrator is the Market Operator of the largest day-ahead spot electricity market. It forms the informational and communication infrastructure for the day-ahead exchanges, provides the main supply and demand optimization process of bids, forms the optimal commercial balances, calculates hourly nodal prices and performs all necessary financial transactions between suppliers and consumers (through the Center of Financial Settlements).

System Operator forms the main technological infrastructure for the operation and development of wholesale electricity and capacity markets. Together with the Market Council and ATS it performs a full range of activities necessary for the functioning of market mechanisms and to ensure reliable power system in accordance with the Rules of the wholesale market. At the electricity market SO ensures the choice of on-line generating equipment for the week ahead, maintains of the actual calculation model for the optimization of suppliers at the day ahead market, operates the balancing market providing calculation and implementation of generating mode profiles under the real-time control of the UPS functioning. At the capacity market SO technically organizes and performs the competitive capacity selection procedures, provides all information for the market (zonal representation, capacity requirements, transmission limitations) and control for the availability of capacities. At the system services market SO formulates the technical requirements to the suppliers of services, technically organizes and performs the competitive selection procedures, signs contracts for supply and provides payments for these services

Federal Tariff Service remains an important actor affecting the market situation. In spite of the shrinking of the direct regulation area at the wholesale market. At the wholesale level FTS is responsible for setting regulated tariffs for electricity and capacity supplied for the residential consumers as well as tariffs for the electricity supply in the non-competitive pricing zones. FTS also set electricity and capacity tariffs for different types of generators that are temporarily excluded from competitive pricing such as forced or must-run generators and 15% marginal most-expensive generators taken in capacity supply curve. FTS also set cap prices in separate zones of capacity market with the weak competition. Finally, FTS regulates tariff for the wholesale market infrastructure entities: Trading System Administrator (Market Operator) and System Operator.

Federal Antimonopoly Service plays a very important role in monitoring and active opposition to the distortion of competition. Based on the national antimonopoly legislation, FAS investigate the risks and cases of monopolization and preventions to the market power at the wholesale and retail markets. In addition to this general function, FAS performs a special control at the capacity market estimating the weakness of competition in the capacity pricing zones and deciding to set cap prices, estimating of the affiliated suppliers and estimating the economic reasonability of bids.



### Russian energy market

The nodal energy market model adopted in Russia differs in many ways from the one in Nordic countries.

In Russia there exists unit commitment process which is kind of 'preliminary' selection process of generators wishing to participate at the wholesale day-ahead market, ATS. The Unit Commitment process occurs on weekly basis as part of the central optimization process. Large part of the generation (near 65% at present) is, however, categorized as 'must run' generations and these do not participate at the unit commitment process. Such must run plants are nuclear plants, large hydro plants, CHP plants that are run by the heat need and some plants that are run for reliability reasons outside the unit commitment process. In the unit commitment process the demand side is non-flexible; it is estimated and fixed by the system operator. Consumers can bid in the day-ahead market, but large industrial consumers often choose not to do so and hence the demand side is very passive on Day-ahead market. The unit commitment process can be thought as preliminary data gathering for the system operator and screening process of generators which will participate at the Day-Ahead market.

Those plants that pass the unit commitment process can participate the Day-Ahead market (Fig.2) based on a competitive selection (auction) of price bids of suppliers and buyers with delivery on the day following the day of the auction. Day-Ahead Market run by the TSA as the Market Operator. The Supply of the bids to TSA are made by 13.30 (Moscow time, D-1). The weekly unit commitment price offers are used as upper limits for the TSA bids. Buyers' demand forecasts are to be submitted to the system operator five hours before gate closure. The TSA nodal prices are published at 17.30 (Moscow time).

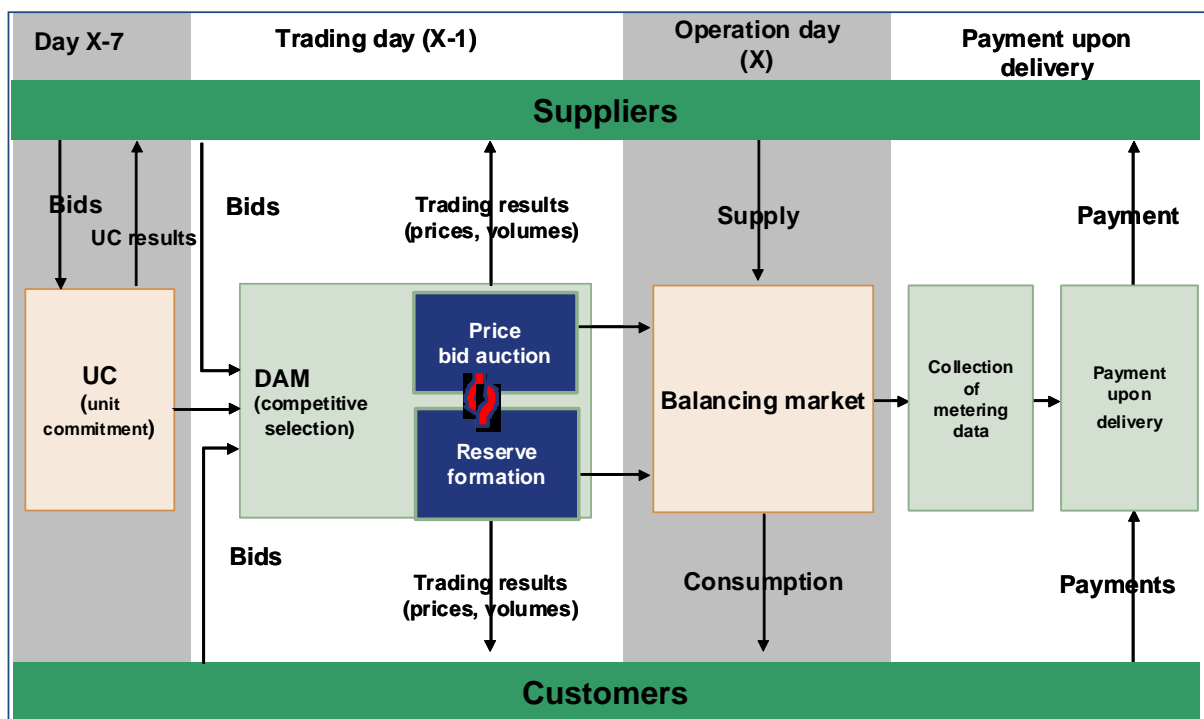


Fig. 2 – Cycle of spot competitive energy pricing (unit commitment – day-ahead market – balancing market)

### Balancing market

The balancing market of electricity in Russia is an aftermarket to the day-ahead market (Fig. 2). It is a real-time market organized by the System Operator (SO) with the main objective of minimizing the costs of deviations of actual electricity consumption and production from the planned day-ahead market trade schedule. The auctions of participants' offers in the balancing market are held by the SO twelve times during the day of actual delivery of electricity. In the balancing market auctions, the SO utilizes the same concept of bid-based, security constrained economic dispatch with nodal prices which is employed in the day-ahead electricity market of Russia. The nodal prices obtained in result of optimization in the balancing market auctions are called "indicators of balancing market" (later referred to as BM price in Table 1). Similar to the day-ahead market's nodal prices they also include the marginal costs of energy, losses and transmission congestions.

### Russian Capacity market

The basic idea of capacity market is that it provides compensation for the fixed costs of generation and thus gives incentives for the investment. Such mechanism is needed when the energy price (regulated or competitive) is not too high in the long-term to provide the spark spread adequate to the required return for the investments. In energy only market investment incentives originates from (in theory) free marginal pricing which indicates *ex-post* capacity scarcity via high spot prices. In practice, some sort of capacity remuneration is also implemented in energy-only markets as well. In Finland, for example, there are 600 MW power reserve market which is form of capacity remuneration mechanism.

The current capacity market in Russia is organized by System Operator on a monthly basis as a general zonal optimization procedure ensuring the least-cost meeting of capacity requirements based on the bids of generators. Those generators that receive capacity remuneration have obligation for the System operator to be available (to provide the amount of capacity they get the remuneration for). Capacity payments for the generators are collected from the customers. Domestic consumption pays for capacity in accordance with the peak consumption. Export is

viewed as demand, and there is symmetrical treatment of export and domestic consumption. Import doesn't get capacity remuneration (because it cannot guarantee availability).

Capacity market is the zonal market with 23 free capacity flow zones defined by SO in 2013 based on the grid congestion and system reliability analysis. Unified price is set for all generators in the zone based on the marginal bid. Cap price mechanism is used to prevent the market power effects in the zones with weak competition. At present, near 40% of total capacity remunerated at the market still traded at cap prices. As a result, the competitive capacity prices remain close to the cap price levels (set in 2013 at 36000 euro/MW for European Russia zone). Strengthening of the competitiveness at the capacity market is strongly related with the elimination of transmission congestions. It will allow decreasing the amount of Free Capacity Flow Zones (4-8 zones are considered as target).

Most of new capacities commissioned after 2008 participate at the capacity market with zero price because they obtain special regulated RAB-based tariffs under Capacity Supply Contracts (10 years long for thermal and 20 years long for nuclear and hydro plants). Capacity supplied through the bilateral agreements (with free or regulated pricing) is also accounted at zero prices at the market. 15% of the most expensive bids are not accounted in price setting and obtain the individual capacity tariff. Finally, generators that are not selected in the annual capacity market auction, but are forced to provide capacity (heat, system reliability, etc.), also get individual tariffs. All types of capacity tariffs except bilateral contracts are higher than competitive price. As a result, the average weighted capacity price in 2013 was almost 50% higher than competitive price (5300 euro/MW).

Cumulative share of capacity payments is about 25-28 % of total wholesale price in the 1<sup>st</sup> (European) pricing zone (Table 1).

Table 1 – Wholesale prices (and its energy part from the Day-Ahead Market) in 1<sup>st</sup> pricing zone and NW regions in 2013, EUR/MWh

	European zone		St.Petersburg region		Karelia region		Kola region	
	total	energy	total	energy	total	energy	total	energy
Jan	30.5	21.9	30.5	21.0	26.7	19.1	23.7	15.3
Feb	32.3	23.1	32.3	22.9	29.6	21.5	27.5	17.0
March	30.9	22.9	30.6	22.6	28.8	21.7	27.2	19.1
Apr	31.9	23.6	31.5	22.9	28.8	21.7	27.3	18.6
May	30.8	22.9	31.3	23.1	25.8	20.3	26.8	17.9
June	32.6	24.8	31.8	24.1	28.1	22.9	28.7	20.3
July	36.4	28.5	36.8	28.3	31.9	26.7	29.9	22.4
Aug	36.7	29.5	37.2	29.0	32.3	27.8	32.0	22.9
Sept	35.8	27.4	35.5	26.7	33.0	26.4	32.1	24.1
Oct	35.6	27.1	34.8	25.2	32.3	25.2	31.3	22.6
Nov	35.0	25.0	33.9	22.9	31.1	21.9	29.5	19.1
Dec	34.3	25.0	33.1	23.1	31.0	21.9	30.2	19.6

Actual operation of capacity market will not provide the main purpose of its creation – the market rules and prices still not generate the proper signals for the investments. The most investments are not market-driven and made under administrative mechanisms of tariff guarantees. As a result, different variants of further capacity market evolution are considered nowadays:

First alternative assume the transition from annual to the long-term (4 years ahead) single capacity market with common marginal pricing both for existing and new capacities.

Second alternative also assume transition to the long-term market but with the separate competitive bidding and pricing for existing and new capacities (consumers with active load or DG and grid projects for congestions etc. are also considered as new capacity supply options). Marginal pricing is applied for existing capacities only, new

capacities (selected by the market not administrative procedures) obtain their bid price or cap (RAB-based) tariff. This alternative is very close to the target capacity market formulated in the actual Wholesale Market Rules).

Third alternative assume the substitution of the existing competitive capacity market by the decentralized market based on the bilateral contracts with small centralized balancing (peak) capacity market. The duration of contracts must be adequate to the lag of investment decisions.

The outlined alternatives are still under discussion, all of them have some attractive features but also contain risks of improper pricing and excessive revenues for some types of generators or risks of inadequate (by time and price) signals for investments. Decision of future capacity pricing model will strongly affect on the wholesale price, but in the mid-term period there are other factors that will influence on its trend.

1). Low demand growth (1,8% per year by SO forecast to 2013-2019 that is more than optimistic) compared with intensive capacity additions (6-8 GW per year) will create the mid-term (2015-2017) capacity surplus in the whole UPS near 13-14 GW. Most of capacity additions are modern CCGT plants or CHP plants as well as nuclear. Intensive entering of new efficient capacities with lower fuel costs will press the future spot electricity price growth.

2). New gas pricing policy assume that gas prices will not continue to rise at 20% annually and their growth in the next 3-5 years will somewhere near the inflation. This is also creating the strong pressure on the further electricity price growth, mainly in the European price zone where gas dominates in the power sector fuel mix.

3). In the contrast to electricity spot price that will be tightened by oversupply and frozen gas prices, capacity payments will increase due to the increase of their non-competitive segment. In the nearest years most of units constructed under the Capacity Supply Obligations will be commissioned. Correspondingly, the volume of RAB-based payments for the investors will increase proportionally to the cumulative capacity additions. Taking in to account the extension of Capacity Supply Obligations to the 10 GW of RES plants, the total obligations to pay for these capacities will increase from 1.3 bln euro in 2012 to 5 bln in 2015 and 10 bln in 2020 (decreasing in the next years).

So, controversial factors will affect on future wholesale prices trend and it will create additional uncertainties for the effective interstate power exchange between Russia and Finland. The situation was already changed in the last years. Traditionally Russia exported annually near 10 TWh electricity to Finland (9.6 TWh in 2011). But in 2012 the net RU-FI export fall to 3.8 TWh due to the reverse electricity flows in the hours of peak prices.

## **Exports to Finland**

Export dynamics from Russia to Finland has changed due to Russian Capacity market rules that came in effect by end of 2011. Exports to Finland are treated as consumption and this is subject to capacity payment. The capacity payment is calculated for exports that occur in peak-hours which are determined by the SO. These peak hours are published for one year ahead by the SO:

*Peak hours for exports 2014*

Month	peak Hours
January	8-13 and 18-21
February	8-14 and 18-21
March	8-14 and 19-21
April	8-15 and 20-21
May	8-15 and 21
June	9-16.
July	9-17.
August	9-16 and 20-21
September	8-14 and 20-21
October	8-14 and 17-21
November	8-12 and 17-21
December	8-12 and 17-21

The exporter (Inter-Rao) has to pay capacity payment for exports that takes place during the peak hours on a working day (weekends are not subject to the capacity payment). As a result the export pattern to Finland has changed to reflect the increased cost due to the capacity payment component for these hours. Below figure presents example 16.4.2012 Russian-Finnish exports and FI area prices. The yellow-highlighted hours represents Russian peak hours.

