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How to Liberalize a Thousand TWh Market?

– Restructuring the Russian Power Sector

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Laura Solanko[1]

How to Liberalize a Thousand TWh Market?
– Restructuring the Russian Power Sector

Abstract

This paper discusses the Russian electricity reform process up until late 2010. In particular, the paper situates the Russian reform in the international context by comparing it with the experiences of other countries. Further, the paper strives to underline the importance of the reform for the Russian economy at large – both as an inevitable step to avoid a looming energy crisis and as a striking example of implementing a liberal, large-scale economic reform in Putin's Russia.

Keywords: electricity reform, Russia

[1] This paper was partly prepared during my stay as a visiting researcher at the Finnish Institute of International Affairs, whose hospitality is gratefully acknowledged. The somewhat longer version has been published as FIIA Working Paper, available at www.fiia.fi/en/publications.

1 Introduction

As was the case in most developing and transition countries, Russia's electricity sector was dominated by a vertically integrated, state-controlled monopoly. The common problems of ageing infrastructure, large distribution losses, very low retail tariffs, inefficient management and increasing tightness of supply encouraged many countries to embark on large reforms to liberalize their power sectors during the 1990s. In Russia, the reform started somewhat later, but to the surprise of many it has since proceeded very swiftly.

This paper provides an overview of the reform process and an update on the current situation in late 2010. In particular, the paper situates the Russian reform in the international context by comparing it with the experiences of other countries. Further, the paper strives to underline the importance of the reform for the Russian economy at large – both as an inevitable step to avoid a looming energy crisis and as a striking example of implementing a liberal, large-scale economic reform in Putin's Russia.

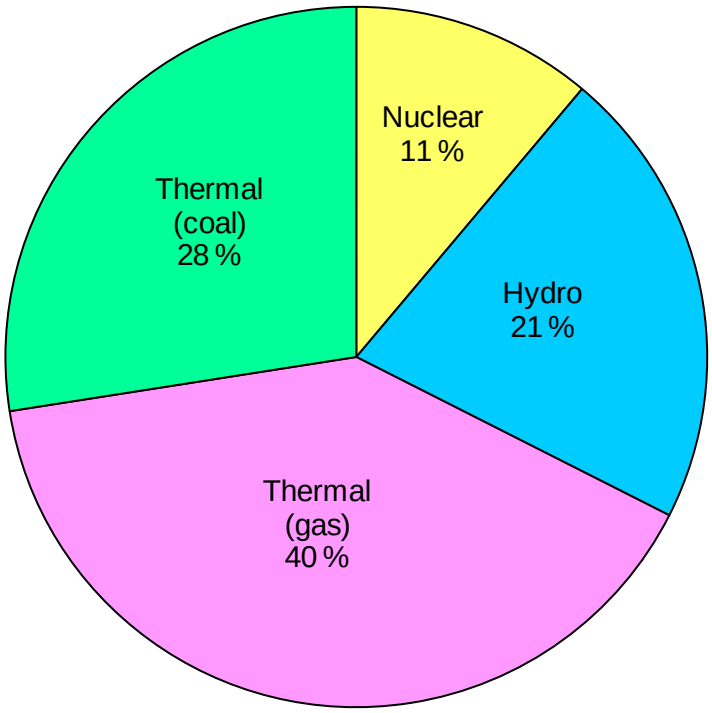
The paper is structured as follows; section two briefly describes the macroeconomic background to the Russian power sector reform. The third section highlights lessons from earlier power sector reforms in other countries and gives a brief overview of the reform process in Russia. The fourth section records the outcomes of the creation of separate generation companies. Section five discusses the overall design of the electricity market structure in Russia: the regulatory framework, the trading arrangements, the principles of the transmission tariffs and the creation of the financial markets. The sixth section compares the power sector reform with many other less successful reforms in Russia and points to a number of potential weaknesses in the Russian reform.

2 Background

Russia is, after the US, China and Japan, the world's fourth largest electricity producer. The total electricity generation increased by 2% per annum in 1999-2009, reaching 1040 TWh in 2008 (BP, 2010). Russia is a net exporter of electric energy, but unlike in other energy commodities, electricity exports are not at all important for the system as a whole. In 2008-2009, net exports were 17 TWh, constituting a meagre 1.5% of the total generation (MinEnergo, 2010).

Thermal generation accounts for a very high proportion of total electricity generation in Russia. Over 60% of electricity is generated in thermal power plants, with hydro-electric and nuclear power making up the rest (see Figure 1). The breakdown of electricity generation capacity between thermal, hydro and nuclear is close to the EU average, with a slightly smaller role for nuclear in Russia. The fuel mix in thermal generation is, however, different. In Russia, two-thirds of the thermal power plants are gas-fired with the share of hard coal being less than one-third. Therefore, about 40% of the total electricity generation relies on natural gas, which makes the availability and domestic pricing of gas critically important for the power sector. The EU countries, on the other hand, are still powered by coal. Over half of thermal electricity generation in the EU-27 relies on coal and only about one-third uses the less carbon-intensive fossil fuel, natural gas (EU DG TREN, 2009). Russia uses extensively combined heat-and-power (CHP) production, which accounts for about half of the thermal generation capacity and a third of the total installed capacity.

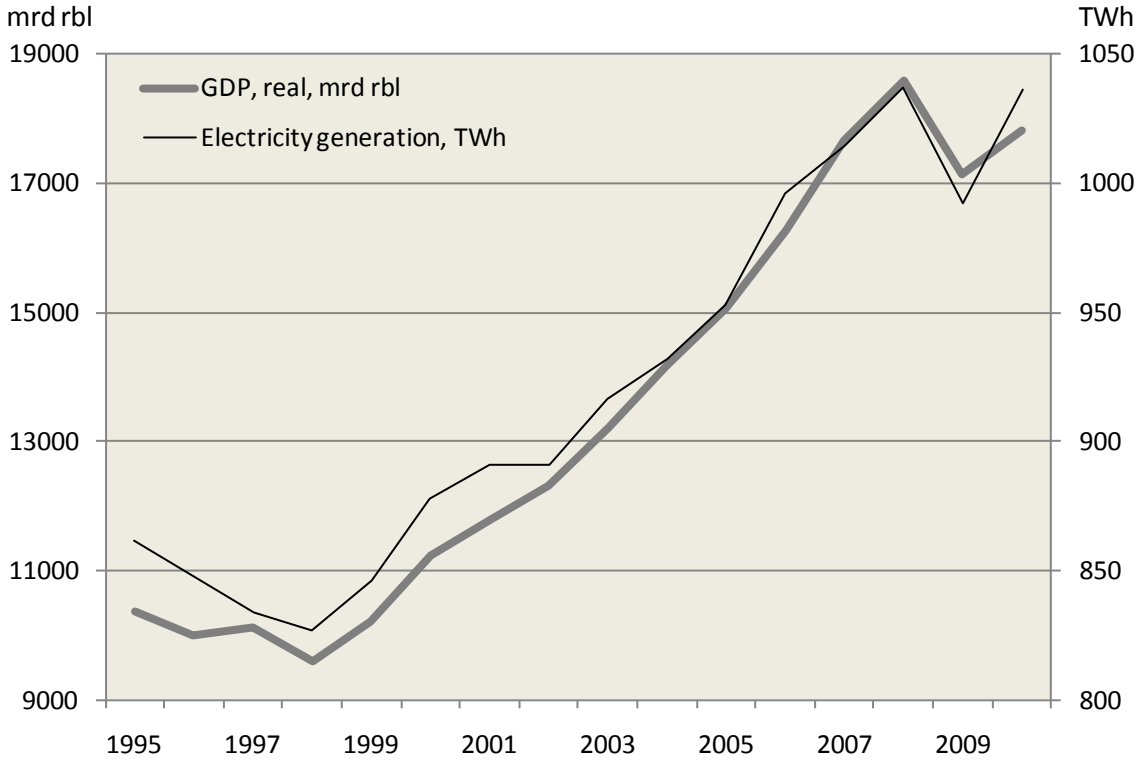
Figure1 Electricity generation capacity by fuel in Russia
(Generation capacity, 2006, % of total)



Source: Dementiev, 2007.

Electricity consumption tends to correlate with economic growth, and electricity generation in Russia decreased substantially during the post-Soviet depression of 1991-1998. After the economic and financial crisis in 1998, the Russian economy started to grow at an unprecedented rate, with the annual GDP growth averaging 6% in 1999-2008. Consequently, electricity consumption quickly picked up (see Figure 2). Due to underutilized existing capacities, electricity generation could readily be increased to satisfy the increasing demand at first. It soon became evident, however, that the transmission and distribution networks in particular were no longer in good enough condition to reliably handle the increasing demand. The existing generation capacity was also in dire need of replacement and expansion. Before 1990, the generating capacity age in Russia was in line with other European countries. Since then, almost no new investments have been made, and the repair and maintenance expenses have also been reduced to a minimum. As a result, depreciation ratios reflecting the share of capacities that have exceeded their original technical lifetime have increased rapidly. In 1998 the depreciation ratio of the electricity sector infrastructure was around 50%, while three years later it had increased to around 60% (IEA 2005, Chubais 2002). Russia's Energy Strategy 2020 from the year 2003 puts depreciation ratios up to 65%.

Figure 2: Real GDP and electricity generation, 1995-2009, (GDP at 2003 prices)



Source: Rosstat, BOFIT.

The increasingly poor condition of the infrastructure has been reflected in increasing losses. Transmission and distribution losses were 8% of electricity generation in 1990 and 12% in 2002 (IEA, 2005), whereas in 2008 the share had further increased to 13% (Gromov, 2009). These levels correspond to the average levels in most CIS countries, but they are still much lower than in some other large developing countries like Brazil, Mexico and India.2 The losses in lower-level distribution networks are typically much higher than average. In some regions, notably in North Caucasus, losses due to poor infrastructure, neglect or outright theft have amounted to over 30% (Shvets, 2010).

Electricity consumption of 7 MWh per capita in Russia is almost on a par with the EU-27 average of 6.8 MWh. Electricity generation, transmission and consumption is, however, grossly inefficient in comparison with the rest of the world. High energy intensity is endemic to all sectors of the Russian economy. A recent World Bank study estimated that Russia could cut back on up to 45% of its current total primary energy consumption. Russia ranks among the top 25 energy-intensive countries in seven major areas of economic activity, including manufacturing, transport, trade and agriculture (World Bank, 2008).

There are arguably several reasons for the high energy intensity of the Russian economy. It is partly attributable to Russia's vast geographic size, as well as its cold climate. Further, the structure of Russia's industry is still tilted towards heavy, energy-consuming industries. Russia's relatively

[2] In Western European countries transmission and distribution losses are typically around 4% of total electricity output. Data is from WDI database http://data.worldbank.org.

high GDP, geographical size, cold climate and industrial structure are estimated to account for three-quarters of its energy consumption, while roughly one quarter of its current consumption is due to other factors (World Bank, 2008).

One explanation for the high electricity intensity (that is, low energy efficiency) is the pre-reform tariff policy. As in most developing and transition economies, electricity and heat prices are subject to government regulation. The wholesale tariffs were set by the Federal Tariff Commission and its regional branches administered the actual retail prices. Tariffs were generally very low and over the 1990s the government exercised its control over energy prices to contain inflation and to maintain the competitiveness of the domestic industries. There was also a clear element of cross-subsidization in electricity tariffs. As one means of elementary social security, the residential tariffs were much lower than the industrial ones. For cost recovery, the price difference should be the opposite. As a result, electricity prices rose much slower than inflation, the power companies generally performed poorly and investments dropped dramatically (IEA, 2005).

Increased energy efficiency notwithstanding, if electricity consumption were to increase by 2% per annum for the next ten years as well, domestic consumption in 2020 would be almost 20% higher than in 1990. Generating and distributing such volumes with the capacities commissioned in the late Soviet period would clearly be impossible. Given Russia's climate and huge distances, an unreliable power supply could seriously hamper economic growth. Therefore, something had to be done to attract massive new investments to the power sector. Securing economic growth and steadily increasing living standards has been a crucial part of the social contract of the Russian leadership and the population since the early 2000s. Serious electricity shortages or blackouts would clearly violate that contract. Further, there is evidence from other countries that a poor power supply significantly reduces private investments in the economy (Reinikka and Svensson, 2002).

3 The reform set-up

3.1 The international experience in power sector reforms

Historically, electricity generation emerged as a private initiative everywhere, but governments almost universally assumed control of the power sector by the end of the 1950s. Only a few countries, notably the United States, left the sector largely in private hands. The reasoning was both economic and political. The power sector was seen as a prime example of an industry characterized by economies of scale and large, long-term investments requiring state participation. Electricity was also deemed increasingly important in facilitating industrialization and economic growth. Such an important sector, generating lots of jobs, was often deemed too sensitive to be left in the hands of private profiteers (Heller and Victor, 2007).

The problems of increasingly tight access to power grids, lack of reserve capacity, poor management, low tariffs, cross-subsidization, the fiscal burden and the resulting lack of investments were not unique to the Russian power sector. Similar problems were faced by the vast majority of developing countries. In many countries, state-dominated power systems had over time become vastly inefficient and rigid, requiring direct or indirect subsidies as regulated tariffs covered only a small fraction of the total costs. Williams and Ghandan (2006) estimate that in Poland pre-reform residential tariffs covered only 1% of the cost of supply, whereas in India tariffs covered 70%-80% of supply costs.

The burden was shouldered by state budgets. The mounting costs of subsidies made new investments financially unfeasible, further eroding the efficiency of the power sector. Many

developing countries embarked on power sector reforms during the 1990s in order to improve the financial management and technical delivery in electricity provision. The reformers typically sought to privatize some parts of the formerly state-owned power systems as the state alone was understood to be unable to provide the necessary funding for new capital.

Some OECD countries had initiated power sector reforms as early as the late 1980s and early 1990s. The motivation for the reforms in the OECD countries was, however, different from the developing and transition countries. In most OECD countries, the aim was to liberalize the sector in order to increase its cost effectiveness and, in so doing, to minimize pressures to increase end-consumer prices. Differing motivation and institutional capabilities notwithstanding, their experiences were used as a reference point for reforms across the developing as well as the developed world.

International financial institutions, notably the World Bank, became pivotal in disseminating advice and best practices. The electricity sector had historically been a major target for World Bank lending, accounting for 15% of the Bank's total lending from 1947-1991(Gratwick et al., 2008). The Bank's contribution to the reforms worldwide was sizable and its basic guidelines for power reform became known as the standard, or the textbook model of reform. That "standard model" is largely understood to include the corporatization and commercialization of power sector assets, introducing an independent regulator, unbundling the incumbent utility and possibly privatizing generation and distribution assets. For a fuller discussion see, for example, Besant-Jones 2006.

The institutional challenges involved in designing the reform strategies in developing countries are understood to be much greater than those in the OECD economies. It is therefore not surprising that in many developing countries reforms have rarely followed the World Bank's textbook model to the letter. About 70 of the 150 developing and transition countries have embarked on power sector reforms since the early 1990s, but less than 20 have thus far created liberalized power markets (Besant-Jones, 2006). Most power sector reforms are still partial and incomplete. In fact, the experience of the developing and transition countries suggests an emergence of hybrid power markets where many parts of the power sector are still politically managed (Gratwick et al 2008, Heller and Victor 2007).

The introduction of competitive markets in power generation has resulted both in successes (Scandinavia) and in failures (California), pointing to the importance of proper reform design. A common element in many less successful reforms has been the lack of real competition in power generation. In some OECD countries, privatized generation companies have been able to misuse their market power to increase electricity prices to unrealistic levels, for example. A poorly regulated oligopoly is indeed often worse than a state-controlled monopoly (Woo, 2003). Other common features behind undesired outcomes in liberalized markets have been very thin or nonexistent financial markets (trading in forwards and futures that are critical for risk management) (Amundsen-Bergman 2006) or capacity shortages (Woo, 2003). In developing economies the reforms have been hampered by poor regulations, a non-independent judiciary, regulated factor markets and the lack of transparency – common obstacles for any wide reform in these countries (Heller and Victor, 2007).

Russia was, in fact, a late-comer to the global power reform movement. Reforming the large infrastructure sectors – power, natural gas and the railroads – was indeed a frequent topic in the discussions between the Russian authorities and international organizations like the World Bank and the IMF during the 1990s. What is more, the state-owned vertically integrated monopoly was listed on the Russian stock exchange and partially privatized. But the real reforms did not seem to be going anywhere before the early 2000s.

3.2 Reform implementation in Russia

In Russia, the power sector was controlled by the state-owned holding company RAO UES, which was created in 1992 to replace the Soviet ministerial structures. The holding company controlled, but did not fully own, 72 vertically integrated local power companies (*oblenergos*) accounting for 70% of Russia's electricity generation. The remaining share was divided between another state monopoly, Rosatom, responsible for nuclear power, and a few small, independent power companies. To underline its central role in the sector, RAO UES owned practically all of the transmission and distribution networks in the country (Engoian, 2006).

It was therefore clear that reforming the power sector would first and foremost involve reforming RAO UES. The task would be a huge one. RAO UES was one of the largest companies in the country, employing almost 600,000 people and reportedly producing at one point over 6% of Russia's GDP (Engoian, 2006). Moreover, direct state ownership in the holding company was only 52%, with minority shareholders including both domestic and foreign investors (see Figure A1 in the Appendix). Both the holding company RAO UES and several of its *oblenergos* were listed on the Moscow stock exchange. The purely practical and technical challenge of any reform would be to reform and restructure each and every one of the 72 *oblenergos* in addition to restructuring the holding company itself. As Russia's regional governments typically owned large minority shares in the *oblenergos*, the reform process would necessarily face intense lobbying, not only at the federal but also at the regional levels.

The reform was driven fundamentally by the need to attract new, private and possibly foreign investments to the power sector. The state alone could not possibly bear the costs needed to maintain, upgrade and enlarge power generation and transmission. Therefore the reform had to be designed to provide a reasonably attractive environment for private investments. This was particularly well understood inside the state monopoly, RAO UES, which was headed by a renowned reformer and former prime minister, Anatoly Chubais. The team of reformers around Chubais became the driving force for the reform, strongly arguing that if unreformed, the Russian power sector would simply become a hindrance to future economic development. The urgency over power sector reform helped to keep it on the domestic political agendas, even if the two other large-scale infrastructure reforms (natural gas and railroads) seemed to lose momentum by the early 2000s. After intense discussions and dozens of alternative models presented in 1999-2001, the Russian government finally approved an ambitious reform plan in July 2001. The basic principles of the reform closely mirrored the World Bank's standard model for reform, including unbundling the incumbent monopoly, creating an independent regulator, privatizing generation and liberalizing electricity prices. In March 2003, the Russian Duma approved a legal package of two new laws and modifications to four existing ones, creating the legal basis for the reform. Simultaneously, in April 2003, the Government approved the Energy Strategy 2003-2020 (ES-2020), which is a political document describing political intentions in the sphere of energy policies. The ES-2020 clearly confirmed the Government's support for the reform.

Many observers both inside and outside Russia expressed doubts about the reform process, and indeed implementation seemed to lag behind schedule in 2004-2005. But the final impetus and broad-based political support for the reform came during the bitterly cold winter of 2005-2006. With temperatures plummeting close to all-time lows in Moscow and Central Russia (-31 degrees) in January 2006, electricity and heat demand peaked. In several locations the old transmission and distribution networks worked at loads surpassing their theoretical maximums, while the power generators were running full loads. As power consumption rose everywhere in the country, generators were suddenly faced with fuel shortages. As natural gas supplies were increasingly tight, many thermal generators were forced to use more expensive fuel oil. It has been rumoured that the

electricity distribution network in Moscow City was expected to fail at any moment, sparking preparations for the massive forced evacuations of certain suburbs of the capital city. The desperate plight of the power sector caused by increasing demand and lack of investments was painfully clear to the political leadership (Kolesnikov, 2009).

As a result, the winter months of early 2006 finally secured broad-based political support for the power sector reform. The reform was clearly seen as a necessity, not as an ideological move towards privatization or liberalization of the economy. During the latter part of 2006 RAO UES approved a renewed investment programme for the years 2006-2010 and the government finally approved the package of decrees necessary for the reform implementation (Skyner, 2010). Despite the fact that the implementation of power sector reforms has been slow and partial in almost all developing countries, the Russian power sector reform has proceeded at an unprecedented rate since summer 2006.

Following the World Bank textbook model, the incumbent power companies were firstly unbundled into competitive and monopolistic functions. The competitive functions were to include generation and power sales, whereas dispatching, transmission and distribution were defined as at least partially monopolistic functions, not suitable for market competition. Central dispatching and system operations as well as the high-voltage transmission grid were to be transferred to brand-new state-owned companies. Generation assets were to be restructured into a large number of competitive generation companies. New electricity sales companies would be formed in a similar way. To motivate new investments, electricity pricing would be gradually liberalized and a separate capacity market was to be created.

As a final step, the government approved a general plan (GenShema-2020) for the electricity sector in spring 2008, a few months before the old RAO UES monopoly was dissolved. GenShema-2020 includes, among other issues, a consumption forecast and investment plans for both generation and transmission, as well as distribution sectors. Finally, an updated version of the Energy Strategy (ES-2030) confirming support for the power sector reform was approved in late 2009.

As a result, the Russian power sector to date, as of late 2010, has a fully state-owned System Operator SO-EES and a majority state-owned high-voltage transmission grid company, FSK EES. In most countries, the functions of these two are combined into one transmission system operator (TSO), fully or partially owned by the state. The Russian state is also a majority shareholder in 11 regional distribution grid companies through a distribution holding company, MRSK Holding. The state will retain the controlling share in the transmission company, whereas some distribution companies may be partially privatized in the future. The power generation assets of RAO UES have been divided between 22 newly created generation companies, 20 of which have been privatized. The state retained its complete control of nuclear and hydro power generation. (See Figure A2 in the appendix.)

4 Securing investments in power generation

Careful planning of the design of the future corporate structure was a crucial element in the reform. Finally, two types of generation companies were formed. Wholesale electricity generating companies (OGK) consist of power plants specialized in electricity generation. Their plants are located around the country to prevent the creation of local electricity monopolies. Regional generating companies (TGK), on the other hand, generate both electricity and heat and their assets consist mainly of combined heat and power (CHP) plants. TGKs' assets are typically located in a small number of neighbouring regions. All large hydro-power plants were combined into a new hydro-power company, RusHydro. A fair amount of work went into ensuring that the companies

would be as uniform as possible in terms of total power generation capacity, value of fixed capital and depreciation ratios of their installed capacity. The restructuring process started back in 2003, and the first new generating companies were established in 2004. By the end of 2006, six wholesale and 14 regional generation companies were created. The remaining generation assets of RAO UES, including a new if relatively small power plants, were combined with yet another new generation company, InterRAO. InterRAO was initially a very small state-owned vehicle responsible for electricity exports and some minor international operations.

The generation companies were privatized through share issues and the divestment of RAO UES holdings just in time, in the autumn of 2007 and the spring of 2008. When the generation companies were privatized, the new owners committed themselves to the ambitious investment plans drawn up for the companies by RAO UES. The global financial crisis hit the Russian economy a severely and GDP contracted by 8% and electricity consumption by 5% in 2009. The forecasts for future GDP growth were cut radically, together with the expectations of energy consumption growth. Consequently, the generation companies felt that their investment obligations were excessive and many turned to the government to get these obligations reduced. In some cases, investment obligations were actually reduced compared to the original plan, but in most cases only the deadlines for commissioning new capacities were delayed. Clearly, the economic downturn together with increasing focus on energy efficiency in Russia, has helped to reduce the electricity consumption forecasts. The fear of supply shortages seems to have eased dramatically as production forecasts have increased and consumption forecasts have come down.

The combined electricity generation capacity of wholesale and regional generating companies totals over 100 GW, which is about half of the total generation capacity in Russia (See Table 1). RosHydro and the state-owned nuclear company together account for slightly more than 10% of the country's generation capacities. The state also retained control of power generation in the Far East and in a number of isolated areas. In addition to the large generation companies spun off to form RAO UES, smaller, regional power companies still operate in Bashkortostan, Tatarstan, Novosibirsk and Irkutsk oblasts. About a quarter of the power generation capacity in Russia will also be under direct state ownership after the reform is completed. Apart from three regional generation companies in Siberian Russia, all thermal generators use gas as their main fuel, with the share of coal in the fuel mix varying from 0% to 44% (UBS, 2006).

Currently, the single largest owner is undeniably the national gas giant, Gazprom. It is the majority shareholder in four generating companies whose combined capacity accounts for a third of the total capacity of the privatized generating companies. Generating companies managed by Gazprom account for 16% of total electricity production and include the most important companies strategically, namely those responsible for producing power and heat for the capital cities, Moscow and St. Petersburg. Gazprom has an apparent interest in the sector, as it is a major supplier of fuel. But it is also clear that its presence as a strategic owner in the capital cities has strong political backing from the political leadership. Even though electricity generation was never included in the list of strategic industries approved by the Russian government in May 2008, there is a common understanding that ownership of the power system in the capital cities (Moscow and St. Petersburg) is a strategic asset. The political risks stemming from a failure in these cities would be extremely high and therefore Gazprom was probably considered as the only alternative. In other generation companies the political risks were considered much smaller.

Contrary to other energy-related sectors (notably oil and gas) in Russia, foreign companies were given an equal access to power generation. Currently the generation companies under foreign majority ownership account for about a tenth of the power generation capacity.

Table 1: Capacities of the generation companies and initial investment obligations

Generation company's name	Initial largest owners	Installed electricity generation capacity, 2007, GW	Investment obligation 2008-2012, GW
OGK-1	FGC, Roshydro	9.5	3.5
OGK-2	Gazprom	8.7	2.8
OGK-3	Norilsk Nickel	8.5	2.1
OGK-4	Eon (Germany)	8.6	2.4
OGK-5	Enel (Italy)	8.7	1.8
OGK-6	Gazprom	9.1	1.9
TGK-1	Gazprom, Fortum (Finland)	6.2	4.4
TGK-2	Sintez	2.5	1.5
TGK-3 Mosenergo	Gazprom, Moscow City	10.7	4.2
TGK-4 Kvadra	Onexim (Prohorov)	3.3	1.4
TGK-5	IES (Vekselberg)	2.5	0.4
TGK-6	IES, FGC	3.1	0.5
TGK-7 Volskaja TGK	IES, FGC	6.9	0.5
TGK-8 Southern TGK	Lukoil	3.3	1.5
TGK-9	IES	3.3	1.7
TGK-10	Fortum (Finland)	2.8	2.3
TGK-11	SUEK, E4, Lukoil	2	0.5
TGK-12 Kuzbassenergo	SUEK	4.4	1.1
TGK-13 Yenisei TGK	SUEK	2.5	0.5
TGK-14*	Energopromsbyt (RZD & ESN)	0.6	0.05
OGKs and TGKs together		***107***	***35***
Independent regional thermal generators (e.g. Eurosibenergo)	regional governments plus private domestic	34	n.a.
Far East	Federal and regional governments	9	0.8
Other isolated areas plus stand-alone generation	mostly private domestic companies plus InterRAO**	17	n.a.
RosHydro	Federal government	25	4.9
RosAtom	Federal government	23	n.a.
Total domestic		**215**	

Source: RAO UES. Information on non-RAO UES assets from UBS, 2008, n.a. = not available.
*In autumn 2010 InterRAO was reportedly negotiating over TGK-14 shares.

5 Electricity market structure gradually taking shape

A prerequisite for successful privatization is that electricity prices fully cover the costs of production and transmission as well as provide a fair return for investors. Up to 2006 all electricity and heat was sold at regulated prices. The Federal Tariff Service (FTS) sets wholesale electricity prices and the transmission fees. FTS also sets the minimum and maximum price for retail electricity and heat. The actual consumer prices are set by Regional Energy Committees within the limits set by FTS (IEA, 2005). The power sector reform meant gradual increases in tariff prices and finally full price liberalization. The reform outlined a gradual decrease in the share of wholesale electricity sold at regulated prices for 2007-2011. The first steps were taken in 2007, and by Jan 2009 30% of industrial electricity consumption was at market prices. The share gradually increased to 50% in mid-2009 and to 80% in mid-2010. During this transition period enterprises would get a fixed share of their electricity via regulated bilateral agreements and the remainder via the markets. During that period both household and industrial tariffs were raised by some 20% annually. From January 1, 2011 all industrial electricity consumption will be purchased via wholesale electricity markets at market prices.

There are a number of important exceptions in the liberalization process, however. First, household consumption prices will remain regulated. Tariffs for household consumption have risen significantly, but the level is still far below the industrial price. This cross-subsidization is likely to remain for some time. Household electricity prices are expected to be liberalized in 2014 at the earliest. As household consumption is only 10%-15% of total electricity consumption, the burden of cross-subsidization is not overwhelming.

Second, heat tariffs will remain regulated. Heat tariffs for residential and industrial users are set by the Regional Tariff Commissions, following the guidelines issued by the Federal Tariff Commission. Centralized district heating is by far the most widely used form of heating in Russia, especially in larger cities where district heating coverage is close to 100%. On average across all the Russian regions, almost 80% of the population have access to central district heating (Freinkman and Plekhanov, 2009). About half of the district heating is produced by cogeneration in the large CHP plants. Capacity-wise, half of the Russian thermal generators are CHP plants, producing both electricity and heat. Therefore, during the heating season (September/October to April) about one half of thermal generation is dedicated to producing a regulated, good supply in fixed quantities irrespective of the current electricity market price. During the heating season, almost all CHP plants are turned into baseload, "must run" plants (Russel, 2007).

Once generated, heat (that is, hot water) is transmitted via pipeline networks to end consumers. Heat distribution networks are badly in need of repair and refurbishment, with large losses and frequent delivery disruptions. Freinkman and Plekhanov (2009) report that on average district heating networks experienced 21.3 breakdowns per 100 km in 2006, with extremely wide regional variation.

Finally, twelve Russian regions (the Far East, Kaliningrad, the Komi Republic and Arkhangelsk) are, due to poor transmission connections and a very concentrated generation structure, declared non-price zones. Therefore electricity prices for all consumers in these regions will remain regulated. The electricity consumption in these regions amounts to approximately 5% of the total national consumption. In addition, North Siberia, a geographically huge but sparsely populated area, is not part of the unified energy system at all and is excluded from wholesale trade altogether. In all, about 80% of Russia's total electricity consumption will be traded at liberalized prices from January 2011 onwards.

The structure of the wholesale electricity market is gradually taking shape. The target model is a unique and very sophisticated combination of two markets; one for electric energy and the other

for generation capacity. Broadly speaking, electric energy markets are designed to cover the operating costs of electricity generation, whereas the proceeds from the capacity market should cover the fixed costs of generation. Anyone buying electricity in the wholesale markets has to buy both electric energy and capacity. [3]

Electric energy is traded in spot markets consisting of day-ahead and balancing markets. The day-ahead market is based on a bid auction. Producers submit their bids to the electricity market operator ATS a day ahead of the actual delivery of electricity for each hour of the following day. Prior to setting the clearing price, ATS takes into account transmission and distribution capacities for each point of delivery. Deviations in actual consumption and generation from the volumes agreed in the day-ahead market are sorted out in the balancing market. Consequently, the resulting market price refers to a specified quantity in a specified location at a specified time. There are close to 8,000 locations (nodes) across the unified energy system in Russia. Most nodes are included in one of the five price hubs (ATS, 2010). Hubs, in turn, form geographical areas where electricity prices behave in a similar fashion. Three western hubs, Centre, South and Ural, together with a number of non-hub price nodes, form the First Price Zone. The second price zone includes the South and Eastern Siberian hubs. ATS publishes daily average prices for all price hubs and the two price zones.

In addition to electric energy, every market participant also has to participate in the capacity market. Capacity markets are designed to guarantee the power generators a certain minimum income stream irrespective of the energy prices. From the consumers' point of view, the capacity price can be seen as an insurance premium for securing adequate power supply in all circumstances. In principle, the basic idea behind a capacity market is simple. Generators offer capacity once a month in a uniform price auction. The system operator accepts the bids, the lowest price first, until the amount required within each specified area is procured.

However, the efficiency of the Russian capacity market can be called into question. Being heavily regulated, it is hard to conceive what market signals it might be able to produce. To begin with, all the generation companies have agreed to an investment schedule for 2008-2012. This consists of legally binding investment obligations (that is, capacity delivery agreements) that the companies have to fulfil. Further, all new capacities, commissioned after 2006 and defined in the general plan (GenShema-2020) of the electricity sector, are entitled to capacity payments whose value is agreed jointly in the capacity delivery agreements. Any new capacities not defined in the GenShema will not be eligible for the capacity market. Therefore capacity prices are unlikely to incentivize any additional investments.

As a result, only old, existing capacities are traded in the market. And finally, the authorities are able to introduce price caps on the existing power capacity market. In October 2010, the price caps were set lower than the level of regulated capacity payments, reportedly in order to restrain growth in household electricity tariffs (Open Utilities Daily, 19.10.2010). Designing a smooth-functioning capacity market is a tremendous task, and here the Russian model seems to rely more on regulation than on market forces. Russian electricity production and transmission continues to be planned as a unified energy system.

Initially at least, capacity payments will provide at least a third of generating companies' income. The Russian Energy Ministry estimated that capacity payments accounted for about one half of their income in 2009 (MinEnergo, 2010). As the companies have few means of influencing their income from capacity payments, there is little room for any market signals to guide

[3] Capacity market variations are in use, for example, in the US, Spain and Italy. See Joskow (2008) and Batlle et al (2008) for discussion on capacity market design in these markets. Leautier (2010) analysis various models of capacity provision arrangements and concludes that a well-functioning capacity market may restore optimal investment incentives for electricity providers.

investments. In an economy suffering from a serious shortage of new capacities, this may not be much of a problem. But in the long run the system may need to be changed.

Transmission tariffs are set by an independent regulator, the Federal Tariff Service, FTS. Traditionally, the transmission and distribution tariffs were set by a cost-plus method: once a year the regulator determined the following year's tariff level based upon the anticipated operating costs. This is highly inefficient economically, providing no incentives to cut costs or increase efficiency. As envisaged in the reform plans, a move towards RAB-based (revenue asset base) tariffs is currently ongoing. The logic of the RAB method is that the tariff incomes of a utility are positively linked to the company's asset base, thereby encouraging new investments. The tariffs for the Federal Grid Company and for the inter-regional distribution companies will be based on the RAB method from 2011 onwards. Currently, heat transportation tariffs are also set under the cost-plus tariff principle. There are, however, plans to switch to RAB-based tariffs similar to those being introduced in electricity distribution.4

The Russian reformers clearly understood that the development of smooth-functioning financial markets is an important part of successful electricity sector liberalization. As evidenced in other countries, financial markets may provide the market participants with useful opportunities for hedging against price and/or quantity volatility, thereby smoothing out market volatilities (Amundsen et al., 2006). Creating at least the basic market instruments, such as forward and future contracts, was consequently seen as essential. The financial derivatives markets in Russia are only just taking shape, but an important milestone was reached in summer 2010 when the first trades in power futures contracts were concluded in the Moscow Energy Exchange market place.

6 Why to reform electricity, why not natural gas or railroads?

Relatively speaking, the Russian power sector reform is a remarkable achievement. In less than ten years, one of the world's largest electricity sectors has been completely overhauled, the looming electricity shortage has been avoided and the main goal of the reform – attracting new investments – seems to be attainable. Moreover, the Russian reform has been following the international "textbook model" of power sector reform very closely. The old monopoly structure was unbundled, what could be privatized was duly privatized, and the monopoly functions were grouped into new, state-controlled corporations.

What is also remarkable is that the concrete steps in implementation were taken during President Putin's second term (2004-2008), a period not generally considered conducive to any liberal economic reforms in Russia. The other large infrastructure reforms, like natural gas and railroad privatization, did not move up the political agenda. So how was a reform as complicated and politically sensitive as the power sector reform possible in Russia?

Naturally, there is no single answer, but good luck as well as a sense of perceived urgency both played a role. The electricity consumption growth forecast was set to exceed pre-reform domestic production capacities in the very near future. Shortages in the electricity or heat supply could have directly threatened the social contract promising increasing living standards for the population in exchange for no calls for political reform. A poorly functioning electricity sector has potentially much wider social consequences than, for example, poorly functioning railroads. Further, the need for the reform and new investments could be felt by the whole population of the capital on a single day. Many other sectors of the economy in dire need of reform, such as the

[4] A total of six regions will pilot RAB-based heat transportation tariffs from 2011, while more regions are expected to adopt RAB-based heat tariffs in 2012 or 2013. (Open Utilities Daily, 1.12.2010)

military or forestry sectors, could never wield such direct social and political pressure. Therefore, the power sector reform became a priority for the political leadership. Needless to say, policy processes that receive strong backing from the President tend to be resolved relatively efficiently (see Fortesque, 2009).

Yet the part played by one formidable man, RAO UES CEO Anatoly Chubais, should not be underestimated. Mr Chubais was appointed CEO of RAO UES in April 1998 and he led the state-controlled electricity company until it was dissolved in the summer of 2008. Whereas in many developing countries it is national governments and international donors that have often been the most vocal proponents of power reform, in Russia it was the leadership of the old monopoly. As the former deputy prime minister and one of the main architects of the liberal reforms in the 1990s, Mr Chubais had the connections and personal capabilities to push the reform forward. In the minds of many ordinary Russians, the power reform was the Chubais reform – a fact that gave rise to numerous satirical cartoons in the Russian press.[5]

With hindsight, the timing of the reform was perfect. The extremely politically sensitive task of unbundling and splitting both the holding company RAO UES and the regional *oblenergos* was done during 2003-2007 when the Russian economy was growing at an unprecedented rate. It was possible to persuade the minority shareholders to support the reform as the future incomes of the reformed companies looked attractive. Domestic and international investors were keen to see new shares listed on the Russian stock exchange push up the share prices. After the financial crisis of 2008-2009, this advantage disappeared. Further, the large privatization auctions for the new generation companies were all concluded by summer 2008, just before the collapse of Lehman Brothers froze the international financial markets in September 2008. Had the process been delayed by just one year, privatization would have been extremely difficult to achieve.

All of these factors helped in drafting a reform aimed at attracting massive private investments. But, given Russia's generally dismal investment climate, the careful design of the reform process was indispensable to success. A firm political commitment to liberalizing wholesale electricity prices was necessary to attract private investments. But, in all probability, implementing the plan of heavily regulated capacity supply agreements may have been the best possible way to safeguard a stable operating environment for a sector dependent on long-term investments. The smooth functioning of a fully liberalized, Scandinavian-type energy-only market would require sophisticated financial markets and state-of-the-art supervision and regulation, neither of which is readily achievable in just a couple of years. And finally, allowing foreign investors a level playing field in entering the market has probably been a useful way to provide all the domestic actors with a reasonable benchmark.

Given its magnitude and its relative success in attracting the necessary new investments, the reform has attracted surprisingly little attention both in domestic political discussions and in the international community. One reason is, that the reform is bound to be unpopular as it will eventually lead to increased consumer prices for electricity. Many Russian enterprises accustomed to relatively low energy prices are now faced with increasing electricity bills eroding their price competitiveness. Also the current political climate in Moscow is not very favorable for blowing one's own trumpet about a very liberal economic reform. As stressed above, the reform in Russia was done out of necessity to avert a looming electricity crisis, not for ideological reasons. Still another reason naturally is that many Russian actors are still uncertain as to whether the reform will be a success in the medium to long term. These questions, however essential in increasing our understanding of the Russian political scene, will require further study and therefore a deeper analysis is left for the future.

[5] See www.chubais.ru/humor. Accessed on 15.12.2010.

7 Conclusions

The power sector reform in Russia has not commanded much attention outside the power industry. This is surprising since, all things being considered, Russia has the largest power sector ever privatized and liberalized. Large reforms are always the result of political bargaining, but the Russian reform is nevertheless a fairly successful example of a liberal, "state-of-the-art" reform. If the main goal was to attract new investments, one must conclude that the reform clearly is a success thus far. New capacities are being built both in generation and in distribution.

However, the reservation is that the investments will not be market-driven. The new forthcoming investments are defined by the government and the former management of RAO UES in the plan for the power sector (GenShema). If demand forecasts or transmission and distribution networks do not develop as planned, some new generation capacities may turn out to be at the wrong time and in the wrong place. This observation leads to two major concerns over the future development of the Russian market. These concern the emergence of competition in generation and the quality of regulation.

Lessons from other countries highlight that a fair amount of competition in generation, coupled with good regulation in the transmission and distribution sectors, is needed to prevent the abuse of market power and to guarantee socially (and therefore politically) acceptable price levels. Whether the new market structure in Russia will be able to support competition in the wholesale electricity markets is not entirely clear. Naturally, increasing generation capacity is a necessary condition for competition to emerge; when all capacities are in full use in a liberalized market, no competition will emerge. But the existence of spare capacity will not suffice as a condition by any means. Two major issues will shape the nature of competition in the Russian market in the coming years.

First, what will happen to transmission capacities? Will transmission bottlenecks be overcome in the future or will Russia, in fact, be a collection of several regional markets prone to creating local monopolies? Particularly during the heating season, most thermal generation turns into baseload generation. If inter-regional transmission lines have no spare capacities, the heating season is likely to bestow considerable market power on the few remaining plants able to adjust their production according to market signals. Second, despite significant privatization, the state is still a major owner of power generation. RusHydro, RosAtom and InterRAO jointly control over one-third of the power generation capacities. If one assumes that the state can influence the pricing and production decisions of the state-controlled Gazprom assets, over half of the electricity generation in Russia will remain state-controlled. Only time will tell how competition-oriented the state-controlled generators will be.

In addition to sufficient competition, another crucial issue in the future development is the quality of regulation in the sector. Transparent and credible regulation is of utmost importance in a sector dependent on very long-term investments. The Federal Tariff Service and the Federal Antimonopoly Service, together with the System Operator, Market Council and Ministry of Energy, face an enormous task in creating the right incentives for the transmission and distribution companies and in safeguarding the efficient functioning of the state-of-the art electricity markets that have been created. There is no *a priori* reason why this would be unattainable, but unfortunately the Russian economy has not been renowned for high quality regulation in any other sector. Nevertheless, even if imperfect, the reformed power sector is far superior to the pre-reform structure in Russia.

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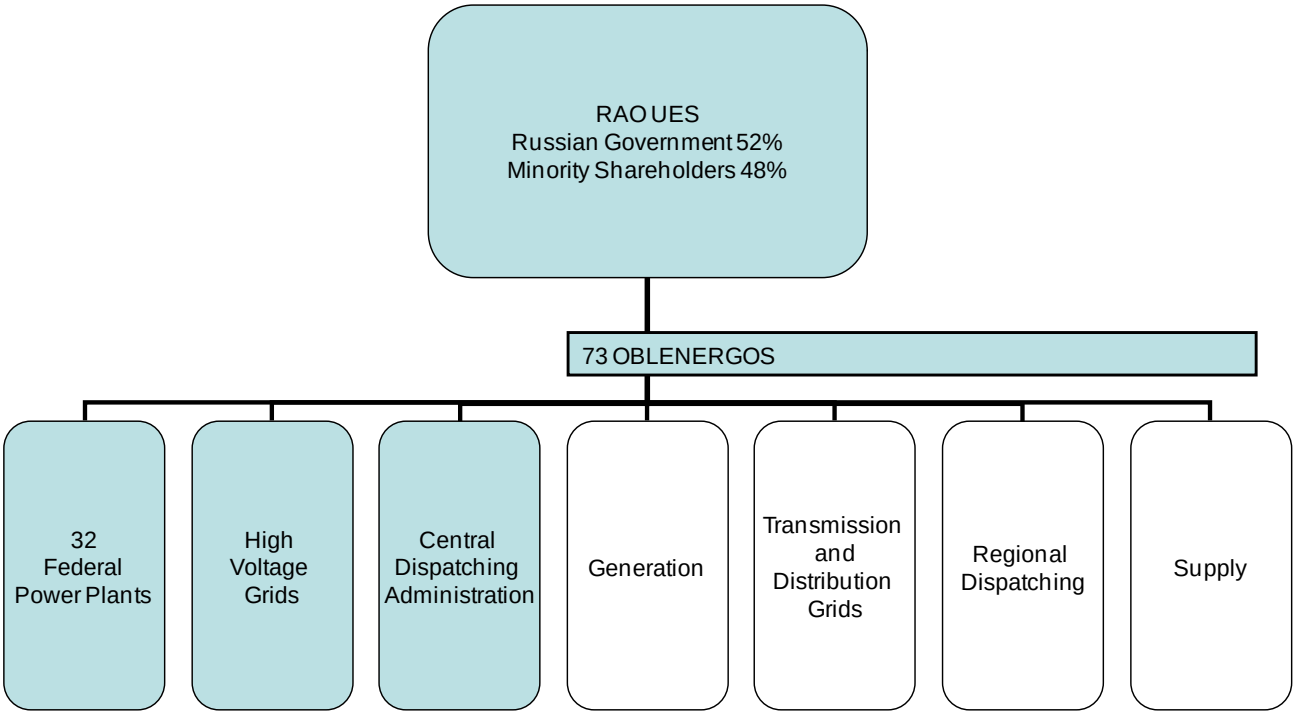
Appendix.

Figure A1. Pre-reform RAO UES structure. Source: RAO UES.



Source: RAO UES.

Figure A2. Post-reform power sector structure.

Monopolistic sector (majority owned by the state)		**Competitive sectors** (mostly privately owned)
System Operator	Federal Grid Company	Generation companies (OGKs, TGKs, RosHydro, RosAtom, independents)
MRSK-Holding (11 interregional distribution companies)		Sales companies

Source: RAO UES and own calculations.

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