

Markets of Electricity and Heat in the Russian Far East: 30 years of Transformation

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Abstract. The paper studies transformations in electricity and heat markets of the Russian Far East in 1980-2022. The timeline can be broken down into 4 periods of development in the region: pre-reform (1980-1991), economic reform (1992-1999), electricity market reform (2000-2011), and heat market and institutional reform (2012-2022). Development of electricity and heat markets happened during a period of demand and supply imbalance. High costs of energy supply, deficit of energy, and issues with fuel supply in the pre-reform period worsened in the next period. During economic reforms sharp drop in subsidies, rising costs of energy resources, non-payments for energy, lack of investments caused a massive energy crisis in the region despite sharp drop in demand. From the beginning of 2000s the economy started to recover, with demand of electricity growing. During electricity market reforms the Russian Far East was consolidating assets in electricity and heating industries, forming distinct market segments: non-price zone of wholesale market and retail markets of isolated energy systems. The 2000s continued to be plagued by issues of high depreciation of generators, lack of mass investments for modernization, and high energy prices for consumers. The latter required application of several measures after 2012: special decrees of the President and the Government of Russia to construct new electric power plants, modernize and construct CHP power plants; to provide ready infrastructure for residents of the advanced development territories, financed by the state; the state co-financing network infrastructure and connections for priority investment projects; bringing the tariffs for industrial consumers of certain territories of the region to the level of country average.

1 Introduction

The last 30 years have seen multiple transformations of electricity and heat markets in Russia as a whole and in the Russian Far East specifically. These primarily concerned institutional changes to the markets, price formation, and structural changes to demand.

The active phase of electricity market reforms happened in 1998-2008. The main goal was to mitigate the crisis of the entire industry: increase productivity, attract large investments, modernize technology, and switch from regulated to market electricity prices. From 2011 onward the entire wholesale electricity market switched to free prices in the

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country [1]. As a result, in the wholesale market of electricity, the economic indicators of combined heat and power stations (CHPs) are lagging behind condensation power plants (CPPs).

One of the specifics of the Russian market of heat is the scale, strong fragmentation (about 50 localized markets), lack of coordinated policies in regulation of electricity market. The foundations of state policy in the industry were created back in the Soviet period, when two largely independent sub-industries were created: “large” energy, which governed over large regional energy systems, and “public” energy, localized in residential areas and considered to be a part of public utilities. As a result, the focus was mainly on regulating centralized heat supply (especially collective production of electricity and heat in CHPs), while municipal systems of heat supply and decentralized systems are virtually unregulated.

Transformation of heat energy market began in 2017, when target-based market model was introduced. It included switching to pricing zones, where state regulation of tariffs was replaced by price-formation with price ceilings: the cost of heat supplied from an alternative source, which replaces centralized heat supply (the price of an “alternative heating plant”). The goal was to attract investments to modernize the unprofitable industry without increasing the prices for final consumers of heat. However, the calculations show that this mechanism would not work in all regions. As a result, the reform is slow to come: from 2018 to 2021 only 32 settlements switched to using an alternative heating plant model [2-5].

The markets of electricity are supplied by electric stations of different types, including CHPs, while the markets of heat – only by CHPs and heating plants. The high share of CHPs in both markets explains the strong ties between them. The current model of functioning of the electricity market lowers the competitiveness of CHPs, ignoring the specifics of heat generation. As a result, the current institutional conditions lead to CHPs lagging behind heating plants economically in the heat market or both heat and electricity markets.

2 Preconditions and factors of energy markets transformation: 1992-2023

Development of energy supply in the Russian Far East before the reforms happened through cooperation between the regions where energy supply was higher – West and East Siberia (these supplied about 46% of the primary energy demands); electricity and heat plants were built with local energy sources in mind (coal, primarily), prices on which were artificially lowered (thanks to subsidies on production and supply of fuel). The preconditions of market reforms in the Russian Far East in 1990s were defined by conditions of the industry and the results achieved during the economic boom of 1970-1985. Despite the positive economic dynamics and the expansion of the network the region systematically failed to deliver new plants on time and the existing plants struggled to supply the necessary fuel, which led to the crisis in the Far East. In 1990 the total deficit of power output was 600 thousand kW (5,5-6% of the demand). Despite almost doubling the coal supply, it still left 14% of demand unsatisfied [6, p.61].

In 1992-1993 with the advance of liberalization of energy markets (primarily, coal, oil, and oil products), the markets of electricity and heat, of natural gas, remained monopolies under state control. The management of large electricity and heating power plants was led by regional associations and a special department of “Vostokenergo” of the Russian joint stock company “Unified Energy System of Russia” (RAO UES).

The timeline of market transformations in energy and heat industries that began in 1992 and continues to this day can be divided into 3 periods. The first period (1992-1999) saw a

radical reform of the economic system of the country, liberalization of coal market and prices of all energy resources. The second period (2000-2011) saw mass transformation of the market of electricity. The third period (2012-2023) began with the reform of heat markets. From 2012 the priorities in national policy towards the Russian Far East changed: preferential regimes to stimulate economic activity in the region were introduced (for example, active subsidies to producers and consumers of electricity); thanks to the expansion of the Far Eastern Federal District the geographical segmentation of the electricity markets changed.

During the first period of reforms (1992-1999) the technological foundation in electricity and heat industries remained at the level of the beginning of 1980s. New construction of electrical power plants was virtually non-existent, which led to the lack of necessary and timely update to the power output. To modernize energy industry, significant investments were required – investments, the volume of which dropped 10 times compared to the second half of 1980s [7, p.142-143]. Despite the lack of new power capacities, a significant drop in demand from regional economy stabilized the situation. The existing capacities provided the volume of energy needed for new economic conditions; however, the lack of funding causes the deficit in fuel (local coal deposits provided only half of the demand). Due to inability to guarantee sustained supply of fuel needed for uninterrupted energy supply, the limits on energy consumption for not only industrial consumers but population were required [8].

Changes to price setting led to lack of regulation of normal profit levels for power plants. Receiving investments was possible thanks to including them in tariffs and amortization. However, transferring the authority on tariff setting to the local energy commissions meant most regions of the Far East turned their energy production into donors for their economies. On the one hand, the producers had no resources to modernize and to pay for current production costs. On the other, the consumers were saddled with one of the highest level of prices in the country. The average tariff on electricity in the Far East in September 1999 was 1.6 times higher than country average [9, p.101]. The sudden jump in prices forced industrial consumers to cut down on heat consumption and buying heat from the suppliers. To mitigate the issue and support Far Eastern industries from 1995 the Government of Russia has decreed the federal budget to compensate the intraregional difference in tariffs [9, p. 102].

As such, in the first period (1992-1999) the development of energy supply in the Russian Far East was influenced by the following factors:

- sharp drop in state subsidies;
- dominating concept of “energy independence”, meaning orienting on local production of energy (both fuel and electricity) [7, p.142-143];
- payment crisis, caused by growth of non-payments for energy supplies (in 1996 the share of non-payments for electricity and heat was 27%, of mutual payments – 51.5%) [10, p.19];
- investments crisis (lack of own funds and of access to cheap loans) [9, p.93-105];
- liberalization of energy prices;
- regulation of tariffs on energy shifted to the regional level (to regional energy commissions) [6, p.125-126].

During the next period (2000-2011) development of energy industry happened in conjunction with improvements of country-wide economy and restorative growth. Thanks to the active transformation of Russian energy the system of state regulation changed; the focus shifted from vertically integrated companies to organizations with narrow focus; potential competitive spheres (production, supply, repair, and service) and natural monopolies (transport, operational dispatch management) were outlined; wholesale and

retail markets of energy were organized. Structural transformation in the industry changed the approaches to price formation, which affected dynamics and price levels of electricity.

The Russian Far East in that period was consolidating the assets. The most developed southern part of the region (Khabarovsk Krai, Primorsky Krai, Amur Oblast, Jewish Autonomous Oblast, the southern part of Yakutia), following the general logic of the reform, has consolidated network assets into one company – the Far Eastern Distribution Network (FEDN), generating assets – into the Far Eastern Generating Company (FEGC), and client interaction assets – into the Far Eastern Energy Company (FEEC). In the isolated energy systems of the region all functions remained in the hands of regional vertically-integrated energy companies.

In 2008 after the restructuring of RAO UES another stock company was created: RAO “Energy Systems of the East” (RAO ESV), the largest supplier of heat and electricity in the Far East, which included all the “large energy” enterprises of the region. As a result, the Far East saw the birth of two independent segments of electricity market:

- non-price zone of wholesale electricity market and
- retail markets in locally isolated energy systems.

The non-price zone of the wholesale electricity market has one buyer and the tariffs are regulated by the state. Retail electricity markets in isolated energy systems get their prices set and regulated by the executive authorities of the respective sub-regions [11].

Electricity consumption grew during that period, fueled by reinvigoration of the economy; current payments for electricity and heat were made in full; new plants were actively constructed. At the same time the average tariffs on energy stabilized throughout the Far East.

Although payment discipline was no longer an issue, there was still a lack of funds to implement investment programs. As such, due to the excess of reserve capacities, they were highly worn out. Taking into account different directions of demand on heat and electricity, the technical parameters of CHPs were getting worse. Similar problems plagued the network: lack of technological advancement and high depreciation.

The development of energy supply in the Russian Far East during the second period (2000-2011) was characterized by the following:

- stabilization of energy supply, switch from current issues to long-term goals [12, p.13];
- segmentation of electricity market;
- consolidation of assets in heat and electricity industries;
- gasification of heat and electricity facilities in the Russian Far East.

From 2012 onwards the energy industry has transformed further: institutional changes (special decisions of the President and the Government of Russia on constructing power plants in the Far East, on modernization and construction of CHP, government-funded infrastructure for residents of the advanced development territories; state co-financing the network infrastructure and paying for technological connection of priority investment projects; equalizing tariffs for industrial consumers of certain sub-regions; reform of heat market) and geographical changes (two sub-regions joined the Far Eastern Federal District, which increased the area of preferential regimes and the market of electricity in the Far East had price zone 2 of wholesale market; expansion of the Unified Energy System of the East (“UES Vostok”) service territory thanks to inclusion of West and Center energy regions of Yakutia, increasing also non-price zone of wholesale market).

As a result, electricity consumption increased rapidly in the region, thanks to in part new large consumers. The growth of new capacities is lagging behind consumption significantly, essentially using up the excesses of power generated back in 1990s.

Development of energy supply in the Far East during the third period (2012-2023) was characterized by the following:

- increase in state support of electricity and heat energy systems;
- continuation of gasification of electrical and heat facilities;
- changes to price signals for electricity consumers;
- reforms in heat market;
- depletion of power reserves in the non-price zone of the wholesale market of electricity.

3 Demand and supply of electricity and heat in the Russian Far East

Before the reforms when the economy of the Far East developed primarily thanks to extensive factors, the industry saw a rise in electrical capacities. In 1985-1990 for 1% increase in gross industrial product 1.02% increase of energy consumption was required [9, p.88]. The main consumer of energy was industry (40%), public sector and population consumed about 30%. In 1990 the installed power output of power plants in the Russian Far East was 11.2 GW, 75.5% of which was heat. The volume of generation of electricity was 47.5 billion kWh, generation of heat – 110.6 million Gcal. The main fuel for electric power stations and heating plants was coal [6, p.125]. After the crisis the coal industry of the region that decreased production after 1988 has seen the increase in coal deliveries from afar to satisfy the demand for fuel in electric and heating facilities. In 1990 about 15% of coal demand was satisfied thanks to import (5.9 million metric tons) [7, p.144-147]. The exiting way of fuel supply explained its high costs. For example, 1 metric ton of equivalent fuel for Far Eastern electric plants was 1.6 higher than country average [9, p.101]. However, prices for energy for final consumer was relatively low thanks to large-scale state subsidies in the Far East. The share of electricity and heat in the structure of industrial production was 4.5%.

During the reform period (1992-1999) economic activity went down rapidly, followed by decrease in consumption of electricity and heat. As a result, demand for electricity dropped down 17.5% in comparison to 1990. Changes to consumption of heat were even more dramatic. The price of central heating was so high that industrial consumer switched to creating their own heating plants. By the end of the first period consumption of heat was only 60% of the volume in 1990. Due to lack of demand, a reserve of capacities was created. Lack of funding stimulated optimization of costs. Structural changes happened in breakdown of fuel: coal was pushing out expensive oil. Lack of local reserves, however, caused 1.1-1.2 times increase in deliveries of coal from afar [9, p.99]. In 1996-1997 6.5-7 million metric tons of coal were of non-local origin (about 17% of consumption). By 1997 the average price of 1 metric ton of equivalent fuel for electric power plants in the Far East and on average in Russia increased up to 1.8 times [9, p.101]. The unequal decrease in production in industries and changes to prices led to sharp increase in the share of electric and heating industries in the structure of production – 13.7% (three times higher than compared to 1990). By the end of the period average tariffs on electricity for Far Eastern consumers were 1.6 times higher than country average [9, p.135]. During this period the share of public utilities and population in consumption of electricity and heat. The crisis caused commercial losses of electricity, since consumers were trying to lower the costs without refusing electric services outright. The state attempted to support consumer by setting prices below actual costs and implementing cross-subsidies (between consumer groups, between energy types, between sub-regions). Further patronage of the state was justified. From 1995 the state renewed subsidies, which came up to 13.5% of gross costs of energy in the region, of which 67.5% were given to the population [9, p.139].

From 2000s, during the second period, markets of electricity and heat saw improvements: the demand on electricity volume was increasing, decrease in heat

consumption was slowing down, financial situation of producers was increasing, new capacities were introduced. The growth of consumption of electricity was 18.6%, increase in power output – 33.4%. The share of industry in consumption of electricity stabilized at 43-45%, the share of population – at 17%. Reserves of output in 2011 were 67% of maximum output, which was 3 times higher than the established norm for UES Vostok. However, 40% of the existing capacities was from facilities beyond their expected life cycle (double for at least half of the facilities). The depreciation of equipment, excess power, disruptions in heat and electricity loads caused increase in costs. The gap between Far Eastern tariffs and country averages went down to 1.2 times only thanks to the state keeping the prices down in the Far East and the country average prices growing. Far Eastern industries were represented mainly by extractive businesses, which meant that the demand of industrial consumers in 2000s was non-elastic. The structural transformation in these industries reduced the burden of electricity payments: the share of energy in the cost breakdown went down from 11.9% in 2005 to 8.8% in 2011. The share of electricity and heating in industrial production was 11-14%. The volume of heat generation in the period was down to 7%. Main consumers of heat in the period were population and state-funded organizations (about 70-80% of heat generation).

2012 marked the beginning of the new developments in the Russian Far East. Industrial production, gross regional product, and energy consumption continued to grow. In between 2012-2022 the increase of electricity consumption was 25.6%, of heat – 7%. Population increased its share of electricity consumption, especially during COVID-19 pandemic, after which it was fixed at about 18%. Population and public utility companies continue to dominate the consumption of heat (82% at the end of 2022). Extractive industries were increasing their share in the total production of the region, which meant consumption of electricity and heat was decreasing (9.7% in 2022). Growth of installed capacity in the third period was 3.1 GW (15% of installed capacities). Seven large energy facilities were constructed: Sakhalin State District Power Plant (GRES-2), Yakutia GRES-2, Sovetskaya-Gavan CHP, Vostochnaya CHP, Nizhne-Bureyskaya hydroelectric power station, Ust-Srednekanskaya hydroelectric power station, and the first Russian floating nuclear power station, and Blagoveschensk CHP was expanded. Construction of CHP was made possible due to state support. From 2017 onwards wholesale market experienced increased prices on power output, the funds from which were used to decrease tariffs for industrial consumers in the Far East to country average levels. In 2022 the list of territories where this mechanism was implemented was expanded to add Buryatia, Primorsky Krai, and Khabarovsk Krai. However, it turned out to be ineffective: it wouldn't stimulate businesses to decrease energy costs and maintained technological backwardness. The share of energy costs increased from 11.8% in 2017 to 13.8% in 2022. In 2019, when the West and Center energy regions of Yakutia were added to the service territory of UES Vostok, the tariffs for consumers in the North energy region increased from 8.8 rubles per kWh in 2020 to 45.8 rubles per kWh in 2021 (almost 5 times). Despite all the existing support measures undertaken by the state, the average tariff in the Far East is 3.5 times higher than country average. Both the producers and the consumers experience significant issues: low efficiency of facilities and need for state support to attract investments and modernize the industry for the former; costly energy and connections, local energy deficit for the latter. This makes the issue of reliable and affordable energy supply of the region especially acute.

4 Reform of the public sector of economy in the Russian Far East

Together with the market reforms, public sector was undergoing its own reforms from 1992. They were aimed at cutting down state funding, gradual switch of producers of public

utilities to 100% population-funded public utilities (state funding of socially vulnerable groups remained). The prolonged crisis of 1990s caused rapid growth of tariffs on public utilities and consumer prices, sudden drop in solvent demand, loss of income, decrease in state subsidies of businesses, and the loss of quality of life. The latter fact was also contributed to by high growth rate of energy tariffs (electricity, heating, hot water supply), which is explained by the scale and technology of public utilities and geographical conditions of the country where a significant portion of the population lives in harsher climates.

Despite almost 30 years of reforms necessary means of reliable and sustainable operation of public utility industry are still missing. Among negative factors preventing this from happening are the following:

- macroeconomic disproportions in the Russian and Far Eastern economies, where growth of prices on energy and public utilities outpaces growth of population income;
- high depreciation of networks, especially in the north and remote settlements, which increases losses and high energy costs, which in turn increases the burden on household budgets;
- state leaving the burdens on local and municipal authorities that are often ill-equipped to modernize and expand the infrastructure;
- objective limitations and lack of private investments into public utilities in the Far East;
- lack of complex approach to reforms in public utility sphere, which depends on other changes in national and regional economies.

Despite all this. The state beyond controlling the tariffs by establishing ceilings also maintain the level of cost compensation for producers. For the Far East it is about 61%. Compensation of difference between prices for population and actual costs for producers is entrusted to the sub-regions of the Far East, making it an additional burden for them. Among the regions for which the state set lower levels of compensation are isolated energy system (who have the highest expenses on production of electricity and heat due to high fuel and delivery costs). These territories also have low population density and uneven distribution of economic activity, which decreases the power output and increases the expenses on maintaining the network. As such, despite keeping the tariffs down among the subjects of the Far Eastern Federal District there is a significant variation of public utility prices, especially in remote locations, which in turn also places excessive burden on the households.

Through programs of social support of the population of the Russian Far East the state continues to patronize the region, through subsidies for certain population groups and low-income households. But even with low tariffs and extra subsidies the burden on household budgets is larger than country average. The main share of these expenses is heating and electricity. For northern territories it can be as high as 75-80% among all utilities. High spatial heterogeneity causes differences in purchasing power in the Far East, both between and inside sub-regions, which complicates measures of state support. Implementing country-wide measures in the Far East would give controversial results. Even if all costs on heating and electricity are compensated in full but the share of population expenses is capped at 22%, the volume of subsidies from regional budgets would virtually remain unchanged in the Far East, which is the exact opposite of the reform.

5 Conclusion

Transformation of electricity and heat markets in Russia were meant to create competition and to liberalize the prices. The results of these in the Far East do not match the logic,

however. There is no way to actually decrease the level of subsidies, the only thing that changes is the form that these subsidies take (including using Soviet mechanism of intra-territorial cross-subsidies).

The reform of the market of electricity caused the segmentation of the market in the Far East, the increased differentiation of energy prices, high burden on the consumers. Institutional transformation in the Far Eastern economy shifted the burden of creating infrastructure and facilities to local and municipal budgets. Equalizing tariffs for industrial producers led to a distortion of price signal, lack of stimulus to decrease costs and technological modernization.

If the objective factors of increasing costs of energy supply in the Far East remain, further reforms of electricity market in the Far East, including switching non-price zones to price zones of wholesale market, would only lead to increased burden on final consumers. Depending on the formation of price zones, the growth of prices would affect either consumers from the south of the Far East (creation of price zone 3) or the consumers in Siberia (joining price zone 2).

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