XV April International Academic Conference on Economic and Social Development

April 1–4, 2014
Moscow

HIGHER SCHOOL OF ECONOMICS
NATIONAL RESEARCH UNIVERSITY
WITH THE PARTICIPATION OF THE WORLD BANK AND INTERNATIONAL MONETARY FUND

POWER INDUSTRY IN RUSSIA — CHALLENGES OF DEVELOPMENT MODEL SELECTION

Analytic report

Moscow
HSE Publishing House
2014

УДК 338.45:621.31
ББК 65.304.14
Р89

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Р89 **Power Industry in Russia** — Challenges of Development Model Selection [Text] : analyt. rep. at XV Apr. Intern. Acad. Conf. on Economic and Social Development, Moscow, April 1–4, 2014 / O. G. Barkin, I. O. Volkova, I. S. Kozhukhovsky et al. ; Nat. Res. Univ. Higher School of Economics. — Moscow : Higher School of Economics Publ. House, 2014. — 38, [2] p. — 300 copies. — ISBN 978-5-7598-1164-0 (pbk.)

УДК 338.45:621.31
ББК 65.304.14

ISBN 978-5-7598-1164-0

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Introduction

Overall situation with Russian power industry, which has developed starting from the 1980s, necessitates changes that may stimulate higher performance of the businesses in the industry and the required fund-raising.

A series of industrial reforms in the 1990s and global restructuring of power industry in 2003–2006 resulted in the dissolution of the former monopoly vertical integrated structure. Hence, most of vertical integrated businesses withdrew from the market to be replaced by new businesses with target industrial structure, which specialize in natural monopoly or competitive activities. Long-term transformations have principally leaded to new competitive wholesale power market and fund-raising for the construction of power-generating capacities.

Power industry in other countries also had to face this challenge. Over the last years, the world has approbated various ways to switch over from conventional industry-regulated power industry to competitive industry model: from simplest competitive selection within the existing monopoly power supply structure to the markets with free access for the consumers to the power grids.

These reforms are primarily aimed at overcoming the existing restrictions for efficiency growth of power industry, which are created by conventional governmental control system, and achieving higher efficiency through developing a competitive power production and sales market and adequate control over the services provided by monopoly market infrastructure.

We must admit that *modern power markets are far too different from classic perfect competition markets, which is widely attributed to production process specifics of the industry at this stage of technical development rather than the structure of market drivers*. The markets do not have any sufficient modern measurement devices or controls that allow on-line data communication process, which is one of the critical conditions for free competition in the power markets. This environment prevents the consumer from being a fully-fledged market player who may quickly respond to price fluctuations on-line. These drawbacks of the existing market often lead to high power prices, which cause restrictions on the prices and create conditions for the suppliers to use market force (particularly, in the local markets due to low capacity of power lines).

However, best global practices have shown[1] that the existing power markets may be quite successful if they are designed to provide *maximum competition* and *transparent prices*. The challenges of market imperfection may be widely resolved using well-designed and applied controls both as self-regulation on the part of the market players and as governmental control, which are based on competitive trade priority, higher efficiency of natural monopolies and free access for the market payers to their services.

We should note that *no country that have switched over to competitive power industry makes any plans to return to vertical integrated power industry structure and former drivers for its state control*. The challenges, which are faced by modern power markets, are related to the problems unresolved during restructuring (for instance, that the modern market is unable to ensure correct price signals to develop the best structure for the capacities and ensure the best balance reliability). This gives rise to the challenges related to adjustment and further development of the industry in the competitive environment, rules for power market operation.

In the long-term future, we may reasonably believe that *technological development of power production and consumption will allow improving power market structure and making its characteristics closer to those of common commodity markets as well as solving the challenge of generating market price signals for the end consumers*. The achieved technological level in electronics, computer equipment and telecommunications have created pre-requisites for future development of the-so-called smart networks, which will allow flexible control over power consumption process and direct participation of the end consumers in service provision by the most centralized power supply system. This will make the role of state industry control less critical for maintaining industry efficiency and reliability and create conditions for its independent development in strict compliance with the consumers' interests.

We must anticipate that *further innovative development will change the entire model of organization and principles of control in the power industry, require reevaluation of the role and combination of development of big centralized and small distributed power-generating sources, change the way the consumers interact with centralized power system, set new requirements for the design of centralized power system and for the rules of power market functioning, which may make operation of these markets more efficient*. However, this will also require new approach to industry development policy and industry control methods based on comprehensive understanding of the end consumers' interests.

[1] Power market in PJM and New England (USA), power markets in Australia and Great Britain, Nord Pool market in Scandinavian countries, etc.

1. Challenges of power industry development in Russia

1.1. Key conditions, which affect the development of modern power industry

Challenges of power industry development both in Russia and overseas have widely similar routes proceeding from technological specifics of the industry and their material impact on economic and organizational basis for its functioning and development. One of the major factors, which determine modern state of the industry, is increasing sizes of power system to achieve economies of scale, reduce requirement in power reserve due to effect of emergency assistance between individual areas, optimize power plants operation modes, improve flexible use of power sources in various areas, including with awareness for passing of local max loads at different times, etc. It is these factors that determine the requirement to establish UES of USSR (UES of Russia) to promote consolidation of both generating sources and the system as a whole. For a long time, the alternative of a centralized system has been considered as a knowingly inefficient decision. But currently, we may state that the positive economies of scale have been achieved and largely exhausted. Moreover, overcentralization puts material restrictions on market development.

The second factor is a hidden economic degradation, which, in fact, has the opposite effect of the previous factor. Economies of scale, centralization, no alternatives for development scenarios, complex and non-transparent economic system promoted increasing market force thus eliminating possible control from outside, demotivated control aimed at improving or maintaining efficiency.

The third factor, which determines current situation in the power industry and also creates some restrictions for its further development is its "politization". When the power system has achieved the scale of the state as a result of territorial expansion, it has become a political tool having various forms: social, economic, regional development, security, integrity, etc. — as a matter of fact, it has such state now. However, if the "political" component used to be a tool of industrial development, now it is more and more restrictive factor. First and foremost, this is manifested in the practice of cross-subsidization, i.e. support provided to sectors, regions or consumers at the expense of other sectors, regions or consumers.

The forth critical factor, which has a material impact on the state of modern power industry, is the development of competition, i.e. transfer of free market principles to power supply process which began in the 1990s. The model of competitive market was developed based on the then existing technologies, which were driven by centralized power supply; no possible technological changes were discussed yet. Restructuring experience of many world countries have shown that strict control on the part of the state remained the key condition for successful functioning of such model, yet in other form adequate to the market: efficient control over natural monopolies (besides costs reduction, provision of free access to their services becomes critical), maintaining competitive environment among the suppliers, rights protection of end consumer. Also, long-term experience in using competitive models in power industry lead to understanding that long-term industry development processes are not fully provided with market signals and require particular support from regulators (power payment mechanisms, long-term contracts, state guarantees, RES support drivers, CO emission taxes, etc.).

The fifth factor, which considerably transformed power industry in the last decade, is the development of new technologies: distributed power generation, consumption management and smart grids. Besides environmental trend, new technologies develop other characteristics of power systems: changes in principles ensuring reliable functioning (not only due to whole system capacity reserves but also using local sources) as well as broader options for communication between entities (active role of consumers, participation of small power generation, etc.). No global integral successful smart-grid projects have been implemented at a scale of big power systems so far, yet some local projects are known; however, this area is rapidly developed. The impact of new technologies on Russian power industry is low.

1.2. 1992–2008 power industry restructuring outcomes

At current stage of technological development, power is an integral part of any production process and sustenance. Hence, power industry, in fact, has universal cross industrial importance and may be related to basic sectors for the development of the country; the level and quality of power supply determine critical conditions for production and welfare of modern society.

In the end of the 20th century, most developed countries realized the urgent necessity of fundamental changes in power industry organization principles based on market transformations [Гительман, 2013]: switch over from vertical integrated structures and centralized control to industry liberalization, from monopoly market to open competitive power markets. Power industry restructuring was an integral part of liberalization (deregulation) of global economies as control over the companies with private ownership was considered as more efficient than control over the companies with public or state ownership [Окороков, 2007].

Restructuring of power industries in different countries, which has begun in the 1980s and is still going on, offers a myriad of conceptually new challenges and tasks, and this requires deep understanding, analysis and developments. Power industry specifics such as continuity and combination of production time and power consumption, impossible product output to the "warehouse" and impact of volume and use conditions on output and power generation indicators form special requirements for the operation of the industry as a whole and utilities in the market environment: combination of competitive and natural monopoly sectors in the market, need for state control and unified operational control over the market entities, optimization of their operation.

In the end of the 1980s — beginning of the 1990s, amid slowdown of the economy and further transformation of social and economic system from social planned system into market system, Russian power industry had growing stagnation signs: upgrading of production capacities was slower than the growth in demand for power. In the early 1990s, rapid deterioration of overall economic environment in the country lead to significant problems in the industry development [Электроэнергетика.., 2008]:

- Russian utilities were lagged behind their analogues in the developed countries in terms of production process indicators (specific fuel consumption, average KPI of the equipment, operating capacity of stations, etc.);
- there were no impetuses to enhance performance, for rational planning of production modes and power use, power saving;
- capital inflow had dropped and was low, wear and tear of fixed assets of the industry was steadily increasing;
- individual regions had blackouts, energy crisis, high risk of emergencies existed;

• there was no payment discipline, non-payments were widely practiced;

• the businesses were "non-transparent" in terms of information and finance;

• access to power market was actually unavailable for independent players.

At the turn of the 2000s, to change the existing situation, a decision was made to restructure the entire industry and its organizational and management system based on the best global practices in the power industry liberalization. The restructuring of the industry was aimed at creating a system to stimulate enhancing performance and fund-raising potential of the utilities as well as raise the required funds for the industry, reduce the level of governmental participation in the assets of competitive sectors (including generation) as well as raise the required funds for further development and modernization of the industry.

First and foremost, the reform was meant to restructure the industry: natural monopoly sectors (power transfer, operational dispatcher control) and potential competitive sectors (power production and sales, repairs and servicing) were separated, and individual companies were incorporated to replace the former vertical integrated business that used to perform all these functions.

Large-scale structural transformations in the power industry of Russia were quite long-term and finally lead to switch over to market drivers of the industry functioning in the end of the last decade; however, these transformations failed to attain the anticipated goals. The following important interim outcomes of these transformations may be noted:

• competitive wholesale power market was developed, which included day-ahead market (DAM) and balancing market (BM) that are close to target model and similar power markets in the countries having restructured power industry;

• the appropriate infrastructure companies ensuring functioning of power industry in the competitive environment were established such as Rossiyskie Seti OJSC, which provides centralized control over and development of power grid system in the country; System Operator (SO) is a single hierarchical company functioning as operational and dispatcher control within UES of Russia; commercial power industry market operator is a trade system administrator (TSA);

• Russian power market independent control system such as NP Market Council was established (though not yet bedded in and largely dependent on the Government);

• step-by-step switch over to market pricing for all categories of consumers (except household sector) in the European part of the country, in the Urals and Siberia (excluding isolated areas) was provided through use of controlled contracts (CC) tool;

• power supply controlled contracts (PSC) system was developed and implemented to provide investments in new generating capacities before commissioning and adjustment of efficient long-term mechanisms of power payment.

We should also note:

• successful privatization of the major part of cogeneration industry before world recession in 2008 and some successful IPO of power generating companies, which demonstrated that private investments may be attracted to Russian power industry through financial markets;

• beginning of the experiment (though not yet quite successful) with commissioning of grid companies control based on RAB methods, which is a globally acknowledged method of control over general-use monopolies enhancing fund-raising potential of these companies. However, the challenges of efficient control over the costs (including investment costs) of grid companies,[1] long-term planning of their development are still unresolved.

However, *the reform of power industry in Russia was not accomplished and did not bring any anticipated results for a number of areas*.

All in all, the existing situation may be described using the following key challenges in the power industry restructuring.

1. No public consensus with regard to the selected model of power industry restructuring

Power industry restructuring has not yet lead to the development of efficient competitive power market: market drivers in power generation and sales sectors are subject to strong regulatory interference that distorts their effect and has a negative impact on competitive forces thus finally demotivating all economic agents.

Despite the fact that regulatory base has been created for switch over to competitive power industry (laws, Executive Orders, rules and

[1] According to NP Energy Consumer Community, total investments in the grids exceeded 2 tln rubles over 10-year period with the cost of fixed assets of 760 bln rubles. Moreover, depreciation was reduced only by 1%. Such data speak for the burning need for establishment of the system for control over the way natural monopolies in the power grid system spend their investments <"The Market Falls Apart", "Rossiyskaya Gazeta", 19.12.2013>.

regulations) and that competitive wholesale power marker has been commissioned, efforts are still used to review the decisions made and go back to the old regulated power industry. In reality, non-harmonized decisions are made regularly, which worsen normal functioning of the power market and industry as a whole, that is direct interference with the market pricing process; many power-generating capacities are excluded from market pricing; competitive structure of power-generating capacities is still deteriorating due to the mergers resulting in increasing market force of some market players, etc.

Competition in the Russian power market may be evaluated through the structure of power value for the end consumer (Fig. 1): the black area shows the share of competitive drivers use while the major part of the pie is represented by controlled component prices for the end consumer. We can't but conclude that only a very small market segment speaks for the existence of a real competitive environment.

2. Drawbacks in the design and development of power market system

- Low competition in the wholesale power market:
  - competition in the power-generating sector does not exceed 15–20% of production;
  - increasing possibility to use market force due to significant consolidation of power-generating companies (including those with governmental equity, this results in higher share of governmental sector in the industry than it was anticipated for the target model during power industry restructuring).
- Regulatory pressure on free pricing in the power market (both through restricting submittal of bids and administrative drivers).
- The developed power market structure has the financial vehicles used between the market entities that contradict the economic viability of the combined power supply (cogeneration) for the consumers: The existing market regulations as well as out-of-date heat supply model have poorly competitive TPPs; these TPPs are vastly underloaded, which increases their max costs and reduces their compatibility in the power market. In general, total financial performance of thermal companies have been negative over the last years.
- All necessary economic drivers ensuring operational reliability have not yet been commissioned.
- Full composition of (additional) system services required to ensure reliable functioning of UES of Russia in the market environment is not determined; development of the markets (or other payment mecha-

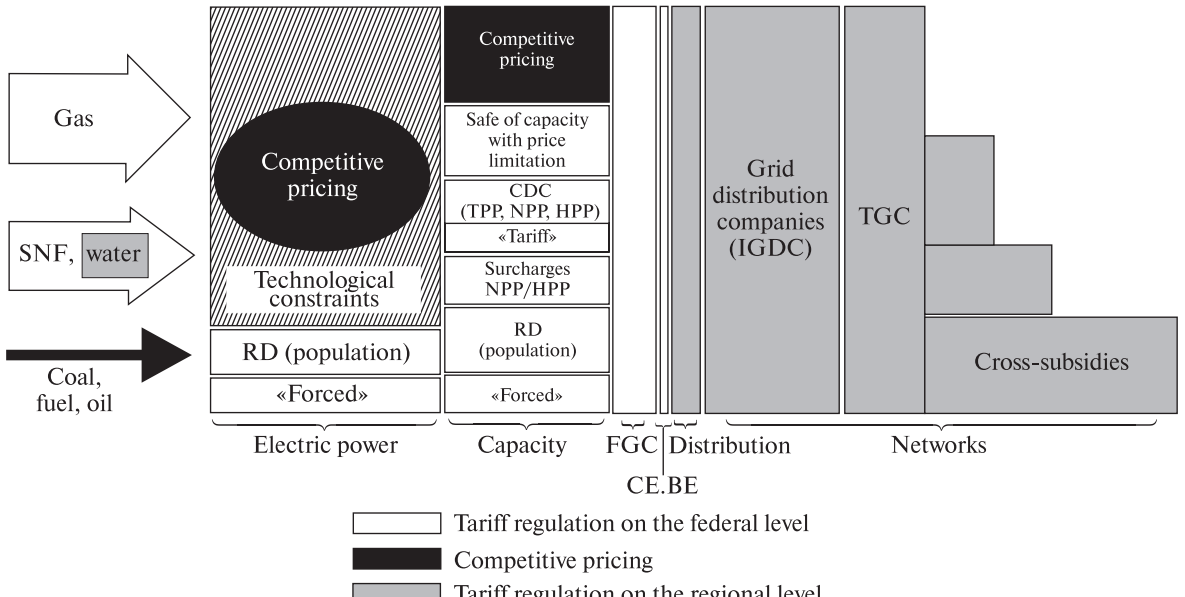

Fig.1. The Structure of Power Cost for the End Consumer

Source: Data from NP Market Council.

nisms) of these services is not accomplished. Many systems services provided by the market players on de facto basis, are delivered without any appropriate compensation thus discriminating players against their competitors.

• Power market is controlled, it is segmented (in 2007 — 31 free power transfer zones (FPTZ), in 2013 — 21 ones), and only some FPTZ have free pricing, while, in most cases, regulator (FAS) established a price-cap due to insufficient competition.

• No economic drivers ensuring balance (long-term) reliability of the power system as a whole are created.

• Poor communication between upper (state programs) and lower (utilities' investment programs) levels of power industry management system.

• Poor link between power industry management system and national innovative system to promote industry modernization; poor drivers stimulating modernization of power-generating and power grid equipment.

• Underfunding of investments and repairs lead to critical wear of the equipment.

• Lag behind and ill-advised decisions in restructuring retail power markets.

3. Poorly adjusted power industry governmental control system

Power industry governmental control system is not fully adapted to market environment, while its decisions are often dictated by short-term conditions requirement rather than economic control principles.

• Antimonopoly regulation: No efficient market monitoring and antimonopoly regulation system has been developed yet. Organizational and analytical capabilities of FAS of Russia (even together with Market Board) are not sufficient for this.

• Price (tariff) regulation: The system and functions of power industry tariff regulation bodies have varied only slightly during switch over to competitive model of power industry.

4. Power Industry Strategy Management

Over the last years, the old power industry future development management system (existing in the environment of the directive planned economy) has been lost, while no new one has been established.

The industry, apart from global analogues, lacks any efficient system for developing and approving investment programs of business entities (annual programs together with future ones) where the decisions for

separate entities would be linked to overall situation in the industry. This gives rise to material uncertainty for a number of key indicators such as:

• appropriate levels (indicators) of balance and grid reliability which have strong influence on the volumes of commissioning and reconstruction, in particular, in power generation by types, respectively, on the requirement in investment resources;

• providing inputs with gas resources;

• possible investments in the industry through all investment sources with a link to restrictions on price and tariff growth imposed by the Ministry of Economic Development of Russia.

With no governmental control bodies (regulators) having the appropriate competence, all decisions with regard to future development of power industry are made by the System Operator whose key competence historically includes operational and dispatcher control. SO ensures reliability of power supply based on the principle "the demand must be met at any price", while the demand forecast prepared by SO is often overpriced. The costs associated with such "super reliability", including creating and maintaining material capacity reserves in power generation and grids, are paid by all consumers, while their opinion is often neglected.

Lack of competitive drivers used by the consumers to influence the power suppliers is one of the main causes of low market performance and unreasonably outrunning growth of power prices (tariffs), with annual growth rate of 7–10%. In 2012, electricity price in Russia for average industrial consumers was EURO 0.122 per kWh,[1] which is a considerably higher price than that one overseas: by 2.5 compare to USA, by 41% compare to Germany and by 25% compare to EU average price.[2] Such price imbalances reduce compatibility of Russian industrial companies, and thus compatibility of the entire economy of the country.

In this case, the consumers may not select power tariffs, which meet the required reliability levels. This results in unreasonable growth of power-generating capacities and power grid facilities in some regions, and as a consequence — in the growth of costs incurred by power plants

[1] Calculated based on par value of EU purchasing power, excluding VAT.

[2] According to the outlook of the Ministry of Economic Development of the Russian Federation, 2013–2014 will see wholesale gas price growth of 15% per year for all categories of the consumers in the Russian Federation, with annual indexation on July 1. Hence, in 2015, power price in Russia for industrial consumers will be almost the highest price in Europe.

and grids (with relevant price growth), and at the same time — in impossible quick technological connection to consumer's grids in other regions. Moreover, reliability issues will always be of top priority for the System Operator, while the issues related to economy and power supply costs are paled into insignificance.

With the existing personnel and financial capabilities, the role of governmental control bodies in determining strategy issues for power industry still remains restricted. Power industry development is not quite harmonized with the development of other infrastructure sectors.

The reforms result in the lack of material effects in the dynamics of industry development.

1.3. Industry evaluation — current state and dynamics of development

Power industry in Russia is developed in the conditions of dissonant trends in the dynamics of basic technical and economic characteristics.

Analysis of dynamics of basic industrial technical and economic indicators in 2012 compare to the level of those in 1990[1] shows that the industry is described by:

• *Deteriorating state of power-generating and supplying capacities of the industry:*

- aggregate installed capacity of the power plants for the period in question has increased by 9.8 ths MW[2] (by 5%), while electricity demand has decreased by 8%.[3] This means that return of the demand to the pre-restructuring level (which will happen in the nearest future) will bring power-generating equipment fleet retrofitting to naught;
- growth of average life time of the equipment from 18.3 to 33.4 years, i.e. almost twice,[4] thus leading to increased breakdown rate of the equipment and increasing repair costs;
- lengths of all power grids 110 kV and above were increased by 30% (from 422 ths km in 1990 to 549 ths km in 2012), and the

[1] <http://federalbook.ru/files/FS/Soderjanie/FS-7/IV/Elektroenergetika.pdf>.

[2] <http://minenergo.gov.ru/activity/powerindustry/powersector/structure/manufacture_principal_views/index.php?sphrase_id=522599>.

[3] Max load of UES power plants is reduced by 155 ths MW <http://www.e-apbe.ru/analytical/>.

[4] <http://www.e-apbe.ru/analytical/>.

total capacity of the transformers at substations was increased by 45% (from 510 mln kVA in 1990 to 744 mln kVA in 2012).[1] With actually decreasing power demand, such changes are one of the sources for material growth of the cost of tariff power grid component for the end consumer.

• *Unreasonably increasing cost of power facilities, which provokes rapid growth of operational costs in all sectors:*

- over the last decade, 19.911 ths MW of power-generating capacities have been commissioned for power generation with total cost of approximately 565 bln rubles.[2] Analysis of specific cost indicators (1 kW of the installed power plant capacities) against world analogues shows that Russian indicators exceed those of USA, Europe and Chine almost by two times: 3.85 ths $/kW in Russian against 2.0–2.5 ths $/kW in the world. This proves that the investment process is inefficient;
- in 2010–2011, ETLs and substations of different voltage class were constructed for the amount of 632 bln rubles,[3] which when calculated per 1 kW of the commissioned power generating capacity is approximately 2.7 ths $/kW. Price power grid component leads to increasing energy costs of approximately by 40% for end consumers. At the turn of the 1990s, similar characteristics in Russia were 1.3 ths $/kW respectively. Thus, the costs related to power construction have increased more than by two times over the 20 years of restructuring.

• *Growth of operational costs due to deteriorating basic technical and economic indicators of the utilities:*

- over these 20 years, specific fuel consumption for TPPs has increased from 312 goe/kWh to 332 goe/kWh,[4] i.e. by 6%, which speaks for slow rate of innovative upgrading of production assets, their growing ageing, accumulation of out-of-date technologies in the utilities' assets, natural deterioration of technical and economic characteristics. Development scheme and program of UES of Russia sets the goal to reach the mark of 310.3 goe/kWh

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[1] <http://www.e-apbe.ru/analytical/>.

[2] <http://www.e-apbe.ru/analytical/>.

[3] <http://www.e-apbe.ru/analytical/>.

[4] <http://www.minenergo.gov.ru/documents/fold13/index.php?ELEMENT_ID=15555>.

by 2019 and increase average KPI for TPPs to 43.4% (now it is 36–37 %);[1]

- currently, the share of power grid component in the power price pattern has reached almost 60%, which exceeds the relevant indicator of 1990 by 3 times and is almost twice higher the current level in the developed countries;
- the indicator of energy costs for transportation (grid power losses) has considerably deteriorated from 8.7% in 1990 to 11.2% in 2013[2] (for the developed countries, it is 5–9%). For your reference: each percent of power losses is approximately 10 bln kWh;
- the staffing levels of operational personnel involved in the power industry have increased from 545 ths men in 1990 to 717 ths men in 2011.[3] In 1990, the share of executive staff in operational personnel was 3.7%. With growth of the installed power plant capacities only by 4.7% for the period in question, the staffing levels of administrative and management personnel have increased by 40%. Staffing levels per unit of installed capacity in the power industry of Russia are still too high[4] and, unfortunately, have an increasing trend. This results in increasing unreasonable costs for personnel and hence in increasing power tariffs.

• *Material cross-subsidization* of all kinds which brings disbalance into motivation system of various power market players. Power prices (tariffs) have the most critical impact for the population: In our country, they are lower than the prices for industrial consumers, while their level is lower than that one in the developed countries. Moreover, the prices for industrial consumers exceed the prices of our competitors in the USA by over 40% and those of our European competitors by over 10%.[5]

• *Lack of independent regulation procedure and optimization of relationships between the entities in the wholesale and retail markets*. This leads to overestimating the volumes of investment programs of power suppliers and services providers who failed to pass expert and instrumental (on the

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[1] <http://www.minenergo.gov.ru/upload/iblock/9e7/9e788ddefb6a116b28760c5c1d4cb3c5.pdf>.

[2] <http://www.e-apbe.ru/analytical/>.

[3] <Rosstat http://cbsd.gks.ru/; http://www.e-apbe.ru/analytical/>.

[4] In 1990, it was 2.55 men/MW in Russia. Over the last years, it does not exceed 0.4 men/MW in the USA.

[5] <http://www.e-apbe.ru/analytical/>.

basis of grid model) expertise carried out by market entities or by regulatory bodies thus resulting in duplication of investment projects of power grid facilities and expenditures for them. The expenditures for maintaining surplus generation reserves (>25–30%)[1] and grids are unreasonably too high.

1.4. Challenges faced by current power market model

The key issue related to power market development is an actual competition and potential for its growth. As mentioned above, one of the critical tasks of restructuring was the development of a competitive market in the industry to enable most efficient functioning of the power industry and its entities. We should note that possible development of a fully competitive market is considerably restricted by technological and technical conditions.

We will view current basic aspects, which determine and affect competition in the current market model.

Competition in the power market may be admitted as low from the point of view of the consumer, due to the following:

- our market does not provide any competition for the consumer achieved by world power markets as the consumers have material restrictions when selecting/substituting the power supplier;
- entry to the wholesale market, which has more attractive price conditions for the consumer, is associated with immense financial and time costs for the consumer;
- the consumers who are not wholesale market players may not have a competitive influence on the power suppliers and service providers and power and service purchase at open trading platforms, etc.;
- extremely low competition in the retail markets where no expectations of efficient competition between power supply companies (hereinafter, PSC) for the consumer, their stimulation to introduce price reducing drivers and service quality improvement, were met. We should note that potential for price reduction due to competition in the retail market is rather limited as PSCs' costs are considerably lower than power generation and power supply costs.

Current market model envisages natural monopoly of technological infrastructure, first of all, power grids. Similar international market

[1] <http://www.e-apbe.ru/analytical/>.

models have the Government ensuring efficient sector functioning using stimulating regulation methods and steady reduction of power grid components of power tariff for end consumer as well as non-discriminatory access to the grid. Analysis of the development of this sector in Russian model shows that:

• tariff controls are imperfect, which results in uncontrollably increasing tariffs for power transfer and distribution;

• procedure for connecting to the grids is complicated and its costs are high. The applicants still need much time to access power grids (162 days) despite material improvement of this time indicator in 2013;

• cross-subsidization system (cross between the groups of consumers is currently "packed" in transfer tariff, but its liquidation mechanism is not indicated), this considerably distorts signals and stimuli both in current state and when developing industry strategy.

All these factors create a system of negative signals for the consumer, whose reaction may be expressed as reduction of consumption, increasing energy efficiency and development of own power generation. In the last 2–3 years, industrial and other consumers actively exited the market and focused on the development of local power supply systems (besides high price, this is also driven by a number of other factors: impossible operational technological connection to the grids, insufficient power supply, environmental regulations, which require by-gas disposal, etc.). This, in its turn, causes additional reduction of the efficiency of the existing market due to relevant reduction of supply and increasing specific costs of power generation and UES of Russia grids.

This results in a kind of institutional trap: the more actively the consumers restrain from power supply by centralized power industry the higher is the price load for the other consumers, the stronger are negative signals, which make the consumers reduce consumption or establish their own power supply system. In this case, distributed power systems have new reserve capacities with low efficiency of use, while the better alternative will be a joint work with centralized power system so that the costs could be minimized by exports and imports.

Besides the above, we should note basic unresolved organizational and legal challenges faced by the power market:

• the consumers are artificially (through the rules) restricted in their right to direct power supplies from power generation sources located in the close vicinity, including from independent, distributed grid; the consumers are still made to sign the contracts;

• lack of technological base and infrastructure for direct contracts between power generation and consumers;

• self-regulating market drivers do not work at local level;

• the system operator makes decisions (not always transparent for the market entities), which have a material impact on the economies of the market entities but does not bear any adequate responsibility;

• the power purchase scheme established by the market rules to reimburse grid losses through GP PSC creates for the latter the conditions for making profit thus stimulating them to loss growth.

The suppliers' tariffs are overpriced (according to expert opinion by 20–40%) due to lack of competitive environment, impossibility for the consumers to refuse expensive energy (market elasticity coefficient is null).

Thus, the structure of trade relations developed in the power industry, which centralized the pricing system for all power plants in the country at a single trade platform, inadequately reflects physical, technical and economic specifics of power supply systems functioning, artificially depriving TPP generation of its compatibility and promoting expensive "boilerization" in the country. The Government can't but see these results and has given multiple instructions to its Ministries and Departments since 2012. The decision to freeze the tariffs for several years and analyze all prices heaps in our power industry is evidently dictated also by the arising necessity to analyze the market model and introduce actual competitive pricing mechanisms pushing the prices downwards.

In the existing environment, the Ministry of Energy of Russia and other state regulators declare urgent necessity to improve the market model. Over the last two years, they have actively discussed 3–4 alternatives, which envisage changes in separate mechanisms rather than the market model as a whole. No decision has been made to change the existing market model so far as finally none of the proposed alternatives can ensure switch over to real competition. When selecting the ways to adjust the existing wholesale power market or developing a new model we may suggest that market pricing mechanisms should be arranged, first of all, based on the consumer's interests.

1.5. Challenges of investment and regulatory measures under the current model

One of the key tasks of market transition in the energy sector was to create conditions to attract investments. It is notable that there are a number of contradictory results in this area.

Generating companies with predominance of private capital created in the course of the reform in 2003–2008 were imposed obligations for the construction of new capacities in accordance with the capacity delivery contracts (CDC), under which the investors were guaranteed a refund of investment in the capacity market within 10 years. State-controlled RusHydro OJSC, Inter RAO OJSC, and Rosatom Concern were also assigned plan targets for the construction of new capacities, which are guaranteed to be paid by the capacity market consumers. Thus, in 2010–2013 the industry has seen an investment boom, which has largely been implemented using non-market mechanisms ensuring acceptable returns to investors.

There are no long-term market signals and tools for the development of power industry. Besides the non-market mechanism of capacity delivery contracts (hereinafter — CDC), it is extremely difficult for the large generating companies to attract investments through other mechanisms. The consequence of CDC introduction was deterrence of investment attractiveness of the current generation (outside CDC). This mechanism guarantees the result, but only at a high cost and upon condition that all risks (financial risks and risks of errors in facilities allocation and redundancy) shall be borne by the consumers. With energy costs for Russian thermal power plants much lower than in the EU (in particular, the price of natural gas[1] in Russia is still 34.7% lower than the average for Europe), the cost of electricity for average industrial consumers in Russia is yet higher by 25%. This is the result of long-lasting underinvestment of the industry and the inflated growth forecasts for the demand for electricity. The attempts to solve these challenges by introducing CDCs, in fact, shifted the returns on investments to consumers.

Unfortunately, it should be stated that the results of the investment boom did not significantly change the state of generation: as mentioned above, the level of power generation capacity has generally not reached the pre-reform level against the background of increase of major production assets almost two-fold. This entails the need for new investment to replace a significant amount of retired capacities. The delay in commissioning new capacities may increase the risks for stability of a single national power system.

The sources of investment are currently less significant than in the mid-2000's. In the previous decade, the conditions in the financial mar-

[1] Calculated based on par value of EU purchasing power.

kets, both Russian and foreign, attracted (equity or debt) capital into the Russian economy, macroeconomic indicators and investment climate assessments were at a higher level than after 2009. Today capital attracting in the Russian economy has become more difficult. Besides, in the next decade Russia needs to provide a high level of investment in other sectors of economy to ensure modernization of the social and economic system. Otherwise, if the development follows the inertial way, the possibilities of attracting investment in the industry both at the expense of budget and private investments shall be severely limited.

There are no prerequisites to repeat the investment boom of the second half of 2000's: rapid demand growth, available funding sources, certainty in the industry development plan. Investors are pessimistically noting the regulatory system and market model shortcomings, the instability and inconsistency of the "rules of the game" as the major obstacles for the industry development.

It should be reminded, however, that Russia possesses a considerable broad range of energy reserves, an impressive system (albeit in need of considerable modernization and improvement) of power industry development, including engineering and scientific background.

The domestic economy falls behind in terms of per capita consumption of electricity and power industry availability compared to many developed countries, which provides an additional potential demand for electric power. This predetermines the investment attractiveness of the generation sector and Russian power industry as a whole in the long-term perspective; however, the industry remains paradoxically unattractive for capital investments due to the unfavorable investment climate and the accumulated problems in management and strategic planning.

One of the reasons for this situation is ineffective industry management. Regulation of the Russian power industry is largely based upon public institutions, while functions are distributed between different structures of executive power.

According to the Law "On Power Industry", "public policy in the power sector aims to ensure compliance with the general principles of economic relations management in the power industry stipulated by this Federal Law" [Федеральный закон, 2003]. The investment sector has a complex task involving several elements: creation of investment climate in the industry, energy efficiency, and control over investment in originally monopolistic sectors. In addition, the Law "On Power Industry" provides for an economically justified rate of return on invested capital.

In the power industry, as well as in many other industries of FEC and economy as a whole, there are many inconsistencies in regulating policies, "manual" control, the rules change often, the solutions are short-term and to a large extent related to macroeconomic and social objectives instead of being used as development tools of industry as such. In particular, in 2011 preceding the elections retail rates were fixed, and in 2014 public investment programs in the industry were trimmed (including RusHydro OJSC), and the level of payments under CDCs was decreased (violating the terms of these contracts). This was a disincentive for investors and increased the risk for further investment activities in the sector.

At the same time, tariff pricing in the power industry still plays a subordinate role and is regulated by the state largely as a factor of influence on inflation in the economy, which depends on the political situation in many respects. Meanwhile the state, being the owner and the regulator, allowed for the rapid growth of the network component in the consumers tariff (under the already mentioned low load of certain new facilities of the power network infrastructure), which, as already noted, increased the motivation of consumers to build their own capacities and transit to a distributed energy.

The decisions of regulators at the regional level are often influenced by local authorities, motivated by the development of their regions, while the effectiveness of such solutions to the industry (especially for individual investors) is not taken into account. Presently the activities of the System Operator raise questions both among investors and consumers. Including the following questions:

- forecasts of aggregate demand (and at the regional level), which are currently often inflated, providing inaccurate data for the formation of development plans, decisions in electricity markets (of the required level of reliability of the system) and capacity (the levels of payments), and increases the risks for investors;
- formation of capacity reserves in the system under the slow withdrawal (and significant administrative costs) of old capacities, which creates additional costs to consumers in the capacity market and reduces the incentive for new investments in the generation sector.

Another important area where uncertainty, inconsistency, and inefficient regulation play an important role is the presence of contradictions in the industry and interferences in the development of any market-type model in the power industry, the solution or elimination

of which is directly dependent on the actions of regulators. Besides the above challenges, another key issue is cross-subsidies between different groups of consumers. So far all of these issues remain unresolved, and each of them has a negative impact on investment decisions in the power generation sector.

In 2011–2013 it became apparent that the market model and the accumulated challenges need to be elaborated and resolved, but the preparation of decisions has been rather slow, which increased uncertainty and led investors to postpone the launch of new projects in the power generation sector, and also gives them a reason to talk about the need for new CDCs (which are non-market tools and in case of inaccurate demand forecasts lead to the construction of capacities that are not popular enough in the future).

Important aspect is the regulation of prices not only in the power sector itself, but also prices for fuel, in housing and utility sector, in thermal energy sector, where the decisions are also often short-term and contradictory. For example, the "Energy Strategy — 2030" provided for high dynamics of gas prices, which increased the competitiveness of coal as fuel (this was also taken into account in the development of the General Scheme of power facilities allocation up to 2020), but later in the development of medium-term forecast for social economic development (worked out by the Ministry of Economic Development) a forecast providing for a reasonable price for gas was taken as a basis. This changes the priorities for future investment decisions in the power generation sector and affects the returns on the already constructed capacities.

Another important point is the implementation of the state energy efficiency program, which commenced in 2009 and should continue till 2020, according to which energy consumption per GDP should decline by 40%. Further growth in demand for electricity depends on the success of the program. Thus far the results achieved are low compared to the potential energy savings. The incentives and mechanisms selected by the regulator determine the efficiency, which is low.

There is no single monitoring system of perspective prices and tariffs for electricity and heating used by the regulatory authorities and the Ministry of Energy, based upon the prospects of growth of energy consumption, the dynamics of generating capacities and projected conditions for the functioning of the wholesale energy (capacity) market.

2. Challenges of industry development model selection

2.1. The basic international trends in the development of industry models

The issue of the required capacity level (and the required capacity reserve) and reliability of power supply is a complicated question under any model of power industry. In a liberalized environment this issue becomes even more complicated, as most of the actual decisions on construction are adopted by decentralized (private) investors in the power generation sector and excluding system solutions.

In the 1990s, a number of countries followed the path of liberalization of power industry without creating any incentive mechanisms for investment in the generation sector. But experience proved that the signals of the electricity market are not enough, even if it operates smoothly, without limitations and problems.

• First, market prices for electricity are generated by the System Operator, balancing supply and demand in real time and setting parameters for operating and reserve capacities (and the schedule of their load), as well as making decisions on consumers curtailment under the conditions of limiting regimes of electricity production. This reflects both the lack of organic production and consumption of electricity (in the existing technical conditions). Thus, the System Operator affects the formation of market signals that determine the subsequent investment decisions in the power generation sector.

• Second, the signals arising in the electricity market are not sufficiently informative to investors, especially in regard to long-term strategic plans.

• Third, the active policy of many countries to support renewable energy sources (RES) has led to the discrimination against other (traditional) types of generation and increased complexity for the evaluation and return period of investment projects.[1]

[1] This area (RES) is actively developing in the world in the last decade, and, as noted, the environmental requirements in the world are developing, which sets the trend in the demand for "green" electricity in the future. But after the 2008 crisis many countries faced the question of budget cuts to support RES (RES construction subsidies and payments for the electricity produced) both in the public sphere and consumer sector. This

There is one more challenge for investing activities proved by the EU experience. EU Directives have set conditions for the development of national power industries in the future. In particular, based upon the evaluation of the total capacity of all countries being the members (or intending) to join the EU stringent requirements were set for generators (creating advantages for the development of RES and requiring substantial modernization (or shutdown) of operating thermal and nuclear power generating facilities aimed at implementation of laws on environmental protection).

Herewith, power generation in the EU is decentralized and despite the EU Directives, most of countries slowly (and often reluctantly) change legislation and energy policy in accordance with the general requirements.

These conflicting circumstances created considerable uncertainty for investors and investment activity in the EU power generation sector (excluding RES) for the past two decades remains low (insufficient). Yet decades of experience of liberalization and rapid development of RES has led to the fact that many countries create incentives for investment in the generation sector. In the coming years this path shall be followed in those EU countries where the idea of possibility of generation sector development without additional incentives has dominated for a long time [Eurelectric, 2012].

In the context of globalization and development trends the level of strategic uncertainty in the global energy sector, in the global economy and geopolitics in general increased, making it even more difficult to manage long-term risks of capital investments in the construction of large facilities (including the generation sector).

Finally, it should be noted that poor investment climate, which in modern terms is largely shaped by the actions of the state, may become a deterrent to investment in the generation sector, where projects due to their capital intensity and long payback periods are sensitive to the conditions of business environment.

According to the survey "Energy transformation: The impact on the power sector business model", conducted by PwC in 2013 among the experts in power industry (top managers of 53 utilities from 35 countries), 67% of experts expect that in the next one and a half decade (by 2030) their countries shall develop a combined model of centralized and

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caused uncertainty for future RES investment projects, and complicated the conditions of return for the implemented projects, and generally heightened uncertainty for all investors in generation capacity.

decentralized distributed power industry, and 9% of respondents expect that decentralized power industry shall replace centralized power industry. However, only 24% of survey participants (mainly from the Middle East, Africa, South America) hold an opinion that centralized generation and networks will maintain a leading role in the development of power industry in the upcoming decades [13th PwC.., 2013].

Table 1. In your opinion, which model is the most suitable for the power industry in your country? (% respondents)

	Centralized system (generation and transmission networks)	**Combination of centralized and distributed power generation**	**Distributed generation will replace centralized generation**
North America	9	82	9
South America	50	50	0
Europe	20	67	13
Asia	8	77	15
Middle East & Africa	50	50	0
Total	24	67	9

Source: [13th PwC.., 2013].

Investment activity in the generation sector in many countries in the context of liberalization had conflicting results,[1] the dynamics of investment in the past two decades was unstable. The idea of the organic nature of the market boom and investment recession in generating capacities has become popular [Ford, 1999; US Energy.., 2013]. The challenge of compliance with the "rules of the game" (especially in the long term) has become the key issue in liberalized power industries.

[1] In many developed countries power industry reform began with a surplus of generating capacities, alleviating the investment challenge for a certain period. The main attention was focused on the design model of wholesale (and retail) market, its testing and improvement. In developing countries with shortage of generating capacity at the very beginning of reforms non-market methods of investment incentives were widely used, which initially allowed to engage (mostly in the rapidly developing major industrial economies) significant resources to build new plants. However, after the rise of the 1990s, in the period of 1997–2007 there was a decrease in investment activity, both in developing and in many developed countries.

According to the survey of PwC mentioned above, due to the rapid development of distributed power generation 94% of the respondents expect that the business model of utilities shall undergo major changes (41% of respondents expect complete transformation, 53% of respondents predict serious changes).

It should be noted that the process of reforming and further development of the power industry unfolds against the backdrop of globalization of world economy and the rapidly changing context for the development of the power industry, FEC and global world as a whole. In particular, the last decade saw the tendency to increase the environmental and energy security in the world, and the reduction of energy intensity of economy; there are new technologies in the production and processing of energy (including renewable energy sources) and communication and management; a variety of new communication networks are developing at all levels in the global economy, etc.[1]

2.2. Challenges of technological mode selection

In recent years, due to the breakthroughs in the development of intelligent technologies significant changes have taken place in the trends of development of the industry, primarily it affected the transition to the new technological mode. The traditional way of energy development first of all provided for the expansion of new capacities and facilities, and the upgrading of capacities of certain equipment with improved performance on the basis of existing production background, allowing the industry to meet the growing demands of the society and the economy during the last hundred years. Major industrialized countries analyzed possible solutions to the above challenges; the results of such analysis showed that there are serious capacity constraints of energy development in the traditional approaches [Кобец, Волкова, 2010].

Awareness of the need of fundamental changes in the mode of industry functioning has led foreign countries to search for new approaches to address the challenging issues: the new approach was based on the classical theory of strategic management, the basic element of which is

[1] "The energy map of the world is changing... Oil and gas production in the United States is regenerated, some countries may refuse using atomic energy, wind and solar energy are rapidly developing, the rates of unconventional gas recovery are increasing... International efforts to improve energy efficiency of the economy may also dramatically change the world energy" [World Energy.., p. 4].

strategic vision being a frame of references to the image of the object of research in the future. Thus, a clear vision of energy system meeting the requirements of the future society and all stakeholders (government, science, economy, business, consumers, and other institutions) has become the starting point of development of the concept of intellectual energy.

Development of strategic vision was based upon the following: "Making a breakthrough in the energy system (power industry) through the integration of 21st century technology to achieve a smooth transition to new technologies in generation, transmission and consumption of electricity, providing benefits for the state and the society as a whole" [European Commission.., 2006].

The strategic vision for the future of energy represents an accumulation of the following elements.

1. Energy is the infrastructural basis for the development of any economy, the development of which is the target of all institutions: government, business, science, population, etc. Goods and services produced in the industry have a high level of public concern and have virtually no substitutes.

2. Optimizing the quality and efficiency of all types of resources (fuel, technical, management, information, etc.) and energy assets.

3. In society today and future energy is seen as the source (tool or means) providing individuals and society with certain consumer values: life essentials, comfort level, etc.

4. Determining this level, an individual should not get restricted by energy supply choosing where to live, what devices and services to use, etc.

5. Satisfaction of the need for electric energy of the society of the 21st century along with significant reduction of pressure on the planet's ecology.

The diversity and differentiation of requirements or values occurring in this connection radically alter traditional views on the role, place and purpose of energy development: the concept of intellectual energy comes from the need to meet the requirements of all stakeholders at any time and in any place.

Thus, under the new concept the task is not to get a certain amount of energy with certain (set by someone) parameters and characteristics, but to provide the consumer with an option to choose how, where and energy of what characteristics they want to receive (and/or produce), giving them the opportunity to obtain the required benefits and level of comfort and to effectively implement their activities both at present time and in the long run.

The concept of intellectual energy is based upon a deep enough analysis of trends in the development of society, assessment of current and projected threats and challenges emerging and queries expected, motivation and behavior of both consumers and other stakeholders, including those caused by common technical and technological development, influencing energy requirements. Its implementation shall allow to change the energy sector drastically and to ensure its efficient and reliable operation for the benefit of society in the next 15–20 years. One of the key solutions to achieve the objectives of the concept is gradual shift in the trend toward distributed generation on the basis of intelligent technologies that enable functioning and management of such systems in real time.

Traditionally, national power facilities include large generating capacities and distribution networks owned by grid distribution companies (GDC). However, currently the facility structure of power industry undergoes major changes. Distributed energy sector is rapidly developing — consumer's generation; modernized utility boilers, converted to cogeneration plants; grid distribution companies not owned by GDC (called territorial grid companies or TGC). Under these conditions, analysis and planning of power industry development within the former framework becomes inadequate to the new realities.

The emergence and active development of increasingly important sector of distributed power requires changes in the paradigm of power and a corresponding adjustment of the legal framework.

Ideologically, it is necessary to overcome negative attitudes towards small distributed energy capacities by the representatives of large power capacities and authorities. It is necessary to determine the rational proportion of combination of large and small capacities on the basis of balance between economic interests of consumers and producers of electricity, consider these proportions in the development of strategic documents on power industry development, as well as to introduce the necessary changes to market rules to ensure fair payment of small generation capacities.

As part of the development of legal framework it is necessary to: clarify the concept of municipal energy infrastructure, including municipal electricity infrastructure; introduce the concept of small distributed energy capacity into the Federal Law "On Power Industry" and create conditions for its non-discriminative development (in particular, to determine the rules of pricing the excess electricity produced by con-

sumers on their own generating plants and sold in the retail market, so that these rules could stimulate the development of economically feasible own generating plants of consumers instead of holding back their construction).

Besides, to develop public policy with respect to distributed energy sector and promote its development it is necessary to:

• ensure on a priority basis observation of this sector, which requires the design and launch of collection of relevant accounting information;

• change the pricing rules for network services that provide for: a) transition from the blanket rate scheme for network services when the "blanket" is formed at the level of the Russian Federation to the municipal blanket rates for network services for networks of 35 kV and below; and b) avoiding compulsory distribution of electricity sold under the blanket rate and paying only the redundancy required within the network capacity for low power generating plants operating for a specific group of consumers;

• introduce and regulate the development of municipal power development schemes to align management processes of the distribution grid infrastructure and small cogeneration capacities;

• organize cooperation between the Ministry of Energy and the Ministry of Regional Development of Russia on coordination of municipal power industry and national power industry at the federal level and at the level of federal subjects of the Russian Federation.

For today the result of these tasks for Russia should be attraction of investment in the generation sector (to replace worn-out equipment and expand capacities in line with the projected growth in demand) against the decelerated rate of economic growth, deteriorating investment climate, unsolved challenges within the reformation of power industry and unrealized housing reform, weak inefficient institutions (including state power) and rapid development of distributed energy.

2.3. Organization of strategic management of industry

Restructuring RAO UES of Russia into many (more than three hundred thousand) economic entities in the power industry, in fact, eliminated the center of industry competence and unified strategic management. The reform assumed that the Ministry of Energy of Russia should become such center, but this has not happened until present moment:

• Ministry of Energy of Russia is one of the initiators of development of Energy Strategy of Russia; however, the requirements for the implementation of its main provisions were not put across to each utility;

• technological platforms were one of the potential tools for the consolidation of strategies for the development of various utilities — the Russian Ministry of Energy supported the creation of four of them — "Intelligent Energy System of Russia", "Small and distributed energy capacities", "Advanced technologies of renewable energy" and "Organic thermal power of high efficiency". But to date technological platforms have not received real organizational and methodological support from the Russian Ministry of Energy and do not fulfill the tasks set.

The reform assumed that NP Market Council shall be the center of regulatory and methodological support of market development, which had to balance the economic interests of producers and consumers of energy with the participation of commercial and technological infrastructure (FGC and system operator UES), as well as with the representatives of the state from all authorities related to the power industry. However, the target of the organization in the new structure of industry in fact has not been implemented. Key decisions affecting the industry are still made outside of this site and to overcome differences on important issues its participants address the state regulator. Furthermore, in this organization since its very creation mainly the largest companies in the industry (large generating holdings and power supply companies) represent the interests of participants, which significantly distorts the signals and the requirements of end-users and small generation capacities.

At the regional level administrations of the subjects of the Russian Federation (except for some national republics) have virtually excluded themselves from the responsibility for energy supply in the regions. It should be recognized that the responsibility of regions was also "falling to pieces" due to the mechanisms of privatization, and as of today regional authorities have almost no responsibilities as to energy supply for consumers and proper functioning of regional life support systems. The elimination of consequences of emergencies in regions is mostly the responsibility of units of the Ministry of Emergency Situations, rather than of companies of power industry. As for the role of regions in price regulation of the transport component of the price for electricity, this role proved insufficient for effective liability and adversely affects the entire organization of works aimed at the development of regional power industry.

As a result of system failures in the power supply of Moscow, St. Petersburg, Sayano-Shushenskaya HPP, ice rain in some central areas of the country, and the last accident in the Kaliningrad region in August 2013, which caused outages of electricity consumers, the economy suffered multibillion losses, but the need to compensate for the economic damage to specific customers was not brought to notice of the energy sector. The state centrally financed all major costs related to the liquidation of the consequences in the power industry from the budget using the resources and instruments of the EMERCOM.

Such dilution of responsibility of regional administrations is equivalent to their suspension from addressing regional energy development — municipal and industrial, issues of access of new and developing industries to the electricity infrastructure in the region.

The prerequisite for the successful modernization at the regional level is decentralization, redistribution of power in favor of regions and municipalities, which corresponds to global trends.

Effectively addressing of regional economic development is impossible without the ability to solve the issues of regional energy at the local level on competitive terms with a large energy system. Regional energy and the availability of engineering infrastructure largely determine regional competitiveness and attractiveness to new business. However, along with liberalization of power industry itself, centralization and nationalization of market relations in the power industry occurred under the idea of strengthening the single economic space across the country, thus blocking local initiatives for efficient energy business in municipal and industrial engineering.[1] Combined production of electricity and heating in the climatic conditions of Russia provides up to 40% savings of fuel consumption compared to their separate production. It is necessary to return TPP to their regional markets for the supply of electricity and heating to local consumers through direct contracts at competitive pricing conditions, with possible supply of electricity to the region through the wholesale electric power and capacity market (WEPCM).

Consistent and predictable government policy to promote the industry is highly important for power development: interrelated strategies

[1] For example: mandatory requirement of regulatory (virtual) supply through WEPCM of all electricity generated by power plants with capacity 25 MW and above, regardless of their form of ownership, and counter (virtual) supply of electricity in the region only at the price of WEPCM is slowly but surely destroying the existing TPPs, stimulating the construction of local boiler plants and preventing the construction of medium power (100–150 MW) cogeneration power plants in the municipal and industrial energy.

of the country need to be developed on issues such as the development of fuel and energy complex, regional development, environmental protection. The solution to this task is one of the challenging macroeconomic issues related to forecasting economic development in the long run, which in the context of globalization and increasing instability of economic processes becomes more difficult.

It is important to emphasize that the development of such complex program is not the exclusive prerogative of the state, but it may not occur as the result of integration of development plans of economy agents. Long-term multi-level and multi-lateral negotiations, during which compromise positions should be found and agreed upon on the broad information base represented by the interests of the participant parties, are required to prepare the optimal alternative of development. Creating such a program is a form of social contract.

The report by World energy council "World Energy Trilemma: Time to Get Real — The Case for Sustainable Energy Investment" published in the 2013 concluded that the development of energy (in general) at the present stage requires the government to find balance in the energy policy in three major areas:

- energy security (*note* efficient and sustainable energy supply of the country at the moment and in the future);
- environmental viability (*note* development of renewable energy and energy efficiency);
- energy equality (*note* ensuring equal rights of access to energy for all citizens) [World Energy.., 2013, p. 4].

The analysis shows that the model of industry development should be focused on the consumer. Currently, the Russian power industry is still at the global crossroads: either to remain within the established technology of centralized power supply and take drastic measures to change the system of regulation with a view to focus on the formation of the market, or to focus on the changes in the technological plane, and to ensure that the consumer could respond to the market and choose between different options of power supply.

3. Conclusions and recommendations

The large-scale transformations in the power industry of Russia are not yet completed and a solid piece of work for the development of market mechanisms and infrastructure, creating a modern regulatory system, adequate to power industry issues in the 21st century is still ahead. It is difficult to disagree with many critical evaluations of the power industry reform. However, is it possible to judge the effectiveness of the reform which was not implemented in full?

Appeals to return to the traditional regulated power industry "before it falls apart" do not appear to be constructive either. One can argue about whether the reform of the power industry was timely and what are its results. But it has already taken place and there are new objects in the industry, new rules and relationships. Attempts to go back instead of finding new creative technological and organizational solutions, moving us toward the modern market of power industry, shall be a waste of time and shall doom power industry (and economy) to an even greater retardation and "freezing" of the technological structure of the last century. At the same time, the international experience of competitive power industry led to the understanding that the processes of long-term development of industry are not fully satisfied by market signals and require special support from the regulators (capacity payment mechanisms, long-term contracts, state guarantees, support mechanisms for RES, carbon taxes, etc.).

Extraordinary effective solutions are required to allow the modernization of power industry based upon new technological background. And this must be done with the greatest possible involvement of non-state capital and best management expertise that shall allow reduce significantly the cost of these changes on consumers due to the significant growth of economic efficiency in power industry.

So far Russian power industry is not fully focused on the consumers' requirements, while they increase the demand on the quality and availability of goods and services, pricing transparency and accessibility of information. In general, regulation of the industry remains unstable, and the variability of the "rules of the game" discourages investors and encourages consumers to actively develop their own power generation. Herewith, the development of distributed power industry is carried out without the incentives from the state and is barely taken into account in the development of centralized power and heat supply systems. This increases uncertainty and payback periods for investors in the sector of

centralized power system and can lead to negative consequences for its consumers, which shall be obliged to bear production costs.

Transition to the intellectual and distributed energy challenges industry development with new tasks that require an integrated solution in a dynamically unstable environment and contradictory interests of the major existing players.[1] The state needs to establish a mechanism to balance the interests of investors (in distributed power generation sector, electricity and heating supply systems), and incentives for investment in centralized systems of power and heat supply, creating a favorable investment climate in the distributed energy and providing high quality goods and services in the centralized power industry (and heat supply).

The key task of resource and innovative development is the interaction of energy companies with related industries (mechanical engineering, service structures, IT technology, science in the framework of innovation cycle), designed to ensure the safety of energy development process due to import substitution, creating new tools and comprehensive utilization of resources and non-waste production, personnel training for the new energy sector. The share of imported equipment for FEC in 2035 may be decreased to 3–5%.

The major direction of national energy policy is the creation of institutional system, including the formation of public-private partnership, creation of market environment, the development of competition, law regulation of subsoil use and other types of energy activities important from the point of view of the state, including the development of the Arctic shelf, the new East Siberia and Far East regions, stimulation of investment activity in Russia and in the world market in the area of interests of Russian companies. Energy diplomacy should be aimed at preserving Russia's leading role in the global market, not only in terms of exports, but also in the creation of the necessary global infrastructure, new principles of international energy relations, stipulated, in particular, in the draft of the Eurasian Energy Doctrine and within the EU-Russia energy dialog, as well as the priority development of fundamentally new energy technologies of the future and sustainable development.

[1] It means: centralized power (and heat supply) systems, consumers, investors in generation capacities of centralized power industry, investors in centralized networks (power industry and heat supply), investors in heating capacities, investors in distributed energy, society as a whole.

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Scientific publication

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**Power Industry in Russia —
Challenges of Development Model Selection**

Analytic report

Passed for print 24.03.2014. Format 60×88/16
Font NewtonC. Print. sheet 2.5. Publ. sheet 2.2
Pressrun 300 copies. Publ. No. 1755

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