

## AN OUTLINE OF MAIN PROBLEMS IN RUSSIAN ENERGY SECURITY

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The concept "energy security" was introduced by the World Energy Council as "the assurance that energy will be available in the quantity and of the quality which are needed under these economic conditions". Combining this formulation with the concept "security" in the Russian federal law "On Security" ("Security is a state of protection of vitally important interests of person, society and state against the internal and external threats") the following definition can be suggested: energy security is a state of protection of a country (its citizens, society, state and the economy) against the threat of deficiency in meeting their substantiated energy demands on the base of economically available fuel and energy resources of the acceptable quality under normal conditions and in emergency situations, and against the threat of instability of fuel and energy supply.

Energy security of Russia is determined by the ability of its fuel and energy complex to perform the required functions, providing stable operation and progressive development of all branches of the national economy (as far as it depends on deliveries of fuel and energy resources) and the acceptable level of living and labour conditions for population. Within this framework the energy security concept is close to that of energy supply reliability in the face of threats to its supply. The other requirements of energy security to FEC consist in provision of national energy independence and ability to take effective measures together with the state and consumers on protection of the latter from the above mentioned threats. Moreover, energy security of Russia also depends on the ability of its economy (including the non-productive sphere) to set a limit on its demand for fuel and energy resources, pursuing the energy conservation policy, and to adapt to changes in the conditions of fuel and energy supply.

Sufficiently high survivability of existing energy systems, primarily the electric power and pipeline ones, is an important factor in energy security provision. Survivability is an internal property of such systems that is determined by various factors, for example their resistance to faults and other physical impacts.

The energy security concept is substantially wider than the aims of both the fuel and energy complex and the national economy (in its interrelations with the fuel and energy complex) and takes into account economic, socio-political and technogenic threat. The tried and tested methods applicable to the survivability of energy systems can, with the necessary details and reserves, constitute recommendations to problems of energy security.

### **Threats to energy security**

Analysis of the present-day state and trends in operation and development of the fuel and energy complex and its associated industries has revealed a broad spectrum of potential destabilising factors to energy security in Russia. These threats can be roughly divided into four classes: economic, which are more dangerous now; socio-political; technogenic; natural.

### **Economic threats**

The most important economic threat is represented by the lack of investment resources for new capacity commissioning (currently, removal of capacities exceeds their commissioning), reconstruction and technical requirement. The fuel and energy complex in turn stipulates that because of ageing of production facilities and the decrease in capacity reserves to unacceptable. Another consequence of this lack of investments is a sharp reduction in prospecting for combustibles and correspondingly qualitative deterioration and quantitative decrease of fuel resources for the complex industries (increase of new oil and gas reserves does not compensate their production).

Another most important economic threat to energy security is in the effect of financial destabilisation and the crisis of non-payments in the national economy of Russia. This results from low financial discipline related to the current assets of the fuel and energy complex enterprises and to the consumers of its product. This gives rise to the non-payment of wages and attendant social consequences, decrease in the storehouse fuel reserves and limitation of investment activity. It also leads to the termination of fuel and energy resources supplies to non-payers.

Additional consequences are:

- violations of established economic links with respect to supplies of fuel, materials and equipment including their import, to energy plants and related enterprises;
- extraordinary monopolisation at markets of fuel and energy resources in the face of weak state control;

- high energy intensity of the Russian economy as a result of long absence of real progress in energy conservation and the associated lack of sufficient fuel reserves;

- a lack of normative and regulatory base in the economy, including the energy sector and resource management.

**Principal socio-political threats:**

- regional, national (ethnic) and other sharp political conflicts, which can be followed sometimes by military or terrorist operations often close to enterprises of the complex;

- labour conflicts and strikes at enterprises of the complex and in related industries;

- some pressure groups, primarily of ecological nature, and their associated activities;

- illegal actions of regional authorities and monopolistic enterprises on restriction of free flows of goods and services, particularly energy, among regions and other forms of separatism;

- illegal intervention of the federal authorities in prerogatives of the regional authorities and competence of economic subjects;

- discrimination measures of foreign states with respect to FER supplies to some boundary regions of Russia.

**Technogenic threats are:**

- faults at energy enterprises, especially in the case of their high concentration;

- faults in other branches connected with them technologically and spatially.

As a rule, either the single large-scale faults especially with their cascading development or the less severe faults with their overlapping or overlapping on other effects represent a threat to energy security.

The increasing threat related to faults is caused by:

- rapidly increasing stock of physically worn equipment;

- failure to meet requirements of plans and programs on equipment repair and modernisation;

- in a number of cases, insufficient level of skill, personnel training, labour and technological discipline;

- weak development of the system of energy economy monitoring, equipment diagnostics, sometimes technological protection devices.

Apart from such mentioned economic threats as high energy intensity of the Russian economy and, in some cases, insufficient capacity reserves, there are two factors, leading to energy security violations. They are:

- insufficient capacity for storage of fuel of different types and fuel reserves;
- weakness of energy and transport (interregional, intersystem, internodal) links together with the existing deep energy imbalances of regions, energy consumption centres etc.

**Natural threats** to energy security include two subgroups:

- natural calamities, i.e. earthquakes, floods, hurricanes, icings, torrents, tsunamis which result in destruction or heavy damage (emergencies) of energy enterprises and, especially, communications;
- intensive manifestation of normal natural processes, e.g. severe winters, long periods of low water in rivers, which lead to the general or local problems in the fuel balances. The latter can cause interruptions in fuel and energy supply.

Currently for the fuel and energy complex to maintain stable operation, the economic and socio-political threats are of dominating significance. In the course of economic and political stabilisation in Russia significance of these threats will decrease and the relative importance of technogenic and natural threats will increase.

#### **Indicators of energy security**

Analysis of the current state of the fuel and energy complex shows that many recommended indicators of energy security have reached a dangerous level and some of them exceeded it. For example, the threshold values are the following: the factual wear of fixed production assets in different industries of the fuel and energy complex amounts to 60- 85%, the factual gas fraction in the fuel balance of the European part of Russia constitutes 60%, the energy-GDP ratio in 1991-1994 increased with a rate of more than 10% per year. On the average in the fuel and energy complex only about 20% of energy equipment patterns correspond to the level of developed countries. These data are indicative of the critical state in the fuel and energy complex in the context of the energy security of the country.

A complex of concrete measures on protection against these threats aimed at provision of the national energy security and the required stable operation of the fuel and energy complex are organised as follows.

**Preventive measures** to provide energy security should be implemented at different hierarchical levels of the economic system of the country.

Measures at a macroeconomic level common to all branches of the economy should be taken at the higher level of hierarchy to decrease the possibility of threats. Among these are measures that are intended for:

- solution to the problem of mutual non-payments, including the supplied energy resources;
- increase of investment activity and restoration of investment process;
- improvement of the efficiency of tax system and the privatisation and pricing policy;
- decrease in differentiation in the incomes of different groups of population, non-admission of wage debts etc.

**Immediate practical measures** required include:

- intensification of the activity of created emergency-restoration services;
- operative redistribution of energy resources, limitation and disconnection of consumers based on the social priorities and necessity to maintain the systems of life support for population and the regional economy at least at the minimum level;
- restoration of storehouse reserves of fuel and other material resources, depleted during the emergency situation.

These immediate measures are only applicable during the current emergency situation to achieve optimal operation of the fuel and energy complex..

#### **Problems of energy security support**

Energy security in Russia consists in the overcoming and prevention of the violations of stable fuel and energy supply as a result of different internal and external threats. At the same time these activities on the energy security support are associated with solution to some other problems.

A preliminary analysis identifies four groups of such problems:

1. problems of the contradictory nature of measures on the energy security control;
2. problems of a methodology for substantiation of actions (measures) on the energy security support;
3. problems of implementation of these measures; and
4. contradictions in the statement of the energy security support problem itself.

An attempt has been made to classify such problems applied to energy security. Therefore, a range of identified problems is not complete and their description and grouping are insufficiently worked out as yet. Further studies in this area and particularly practical activity on

creation of a system of the energy security support and performance of its functions will undoubtedly improve and modify an insight into the mix of problems and their understanding and structure will be specified.

The following problems are the most obvious candidates for the first group.

1. Ratio between centralisation and decentralisation of energy supply. From the standpoint of energy security an advantage of centralisation lies in the possible mutual assistance of energy consumption centres, manoeuvrability of reserves and stores; dependence of consumers on the outside energy sources and on reliability of the extended and vulnerable communications as well as low reliability and controllability of the system of energy (power, heat, gas) supply are its disadvantages. Evidently, there is some compromise, rational (in terms of different criteria and requirements) extent of centralisation, which differs from system to system. For example, in heat supply, where a great number of consumers are supplied with heat from one or sometimes two sources, a high extent of centralisation provokes the greatest objections in the context of energy security. In electric utility industry, on the contrary, due to availability of numerous sources in the centralised system the optimal level of centralisation is higher than in heat supply. In the systems of gas supply the potentialities for decentralisation can be reduced to creation of independent systems on the base of small local fields. In practice each specific project for development of such systems should be analysed and redetermined in terms of the rational level of centralisation, taking into account the energy security criterion.

2. There are contradictions in such measures on the energy security support as creation of own energy sources, improvement of the self-provision extent of territories or individual consumers which have some other character. If the own fuel and energy resources are more expensive than energy carriers supplied from outside (and it takes place rather frequently though not always), it should be taken into account that higher certainty of sufficient supplies and their practical guarantee will inevitably lead to additional expenses. In each particular case, it is necessary to specially substantiate the decision, made in the context of readiness and ability of consumer (and profitability for him) to pay one or other price to decrease the risk of unstable supplies of fuel and energy resources (i.e for the higher energy security).

The same considerations have to be taken into account when substantiating and realising measures on diversification of energy supply, deconcentration of energy production, creation of additional fuel reserves etc.

3. To overcome the investment lack results in the unacceptably low scales of production capacity commissioning (reconstruction) in the industries of the complex and, simultaneously, the desirability to retain control in such vitally important sphere as the energy sector, make it necessary to maintain a rational balance between provision of favourable conditions to foreign investors and a protectionist policy with respect to domestic producers and investors.

Typical problems of the second group (methodology for substantiation of measures) are as follows.

1. Problem of identification of threats to energy security and establishment of the cause-effect relationships of phenomena creating, in the long run, a danger for energy security. The key group of contradictions to be resolved in this case is between apparent (or impressed by lobbyists) relations of causes and effects and their factual relations.

2. Problem of the energy security level standardisation. The tendency to such standardisation, more precisely to standardisation of a definite set of indicators of the energy security level that is determined by the requirement of maximum validity of recommendations. This comes into conflict with the problematical character of such standardisation due to both the high diversity of the threats to energy security and a multiaspect nature of indicators themselves, especially as such indicators are often evaluable only in the qualitative values.

3. Energy conservation and some measures entering into the complex of anti-crisis procedures (such as overcoming the current economic, social and political crisis) are the most important directions in the energy security support. The activity in these directions has a multipurpose character. However, the aim of the energy security support, as a rule, does not dominate. Nevertheless, the "fair" sharing of costs on realisation of the corresponding measures between different aims, in particular for the valid comparison of measures belonging to these groups, with other measures on the energy security support, is of certain interest. It is important that it should be determined how much the energy security support program (regional, branch, national) "must pay" for the measure realisation (what part of the total costs on this measure).

4. A variety of measures which lead to the energy security improvement (see above) together with the substantial difference in the composition of factors causing the efficiency of the measures that refer to different groups, result in the impossibility of using a single technique (or more precisely the technique based on the single system of mathematical models) to

study, compare and substantiate these measures. One of the developed techniques allows the study and comparison of the energy security support measures which foresee radical changes in the structure of the fuel and energy complex and energy systems, increase in redundancy levels etc.

To study and substantiate measures envisaging, for example, deconcentration of capacities, increase in an extent of self-provision of territories and individual consumers etc., it is expedient to use analytical models, algorithms for computation and estimation and similar tools, instead of the models of the development and operation of energy systems. In contrast, substantiation of measures on overcoming the social and economic threats to energy security necessitates the application of largely financial, behavioural and national-economic models. The methods and models for substantiation of energy conservation measures form a completely separate class. The contradiction under consideration between the uniqueness of the goal in each class and the variety of ways to it can be resolved on the base of uniqueness of the methodology of system approach with application of different methods and models.

5. The multicriterion problem is one of the most serious problems of this group. It has a series of aspects. One of them consists in the necessity to estimate any decision by the economic and environmental criteria, in addition to the energy security criterion. The second aspect is connected with distinctions, sometimes contradictions, in interests of different economic and legal groups making decisions on the energy security support: central state authority; regional authorities; various economic groups. The third aspect is associated with a variety of indicators of energy security.

The corresponding contradictions in their first and third aspects can be resolved either by reducing many criteria to one or by using subjectively assigned weight coefficients. The problem in its second aspect can be solved by identification of the accepted compromises.

The third group of problems (problems of implementation) includes two complex problems.

1. Relation between the state and economic group, federal, regional authorities and local government have responsibility for the energy security provision and the development of programs, organisational efforts, financing of measures, implementation of the state control measures and administrative interference. This problem reflects a contradiction between the objectively existing interest of each party's legal obligations in the energy security support and



that of the pressure of their administrative authority to minimise its contribution and to maximise rights in this sphere.

2. Realisation of energy-conservation policy as an important direction in the energy security support faces three mutually counteracting factors of the present-day crisis of the Russian economy. Firstly, the aggravation of threats to energy security under crisis conditions requires the quickest possible implementation of energy-conservation measures. Secondly, recession in the material production branches objectively leads to a decrease in the intensity of using the fixed assets and the corresponding growth of a specific energy intensity of product at the expense of assigning fixed energy expenditures (for example, for heating of production areas) to the lower output. Thirdly, the acute deficiency of investment resources results in closure of energy-conservation projects. Thus, two last factors mutually enhance each other and come into conflict with the first factor.

At the same time the second and third points above include the problem which can be formulated as: "Is it worthwhile to cover the costs of realisation of energy security support measures, if the consequence the occurrence of such events, the probability of which is not objectively determined but seems to be very low?" The problem can be solved by the subjective (expert) estimation of probabilities that a set of threats to energy security will be realised, and by the normative determination of the probability level, from which the threats can be neglected.

Problems of the fourth group (contradictions in the energy security statement) have, as distinct from the previous ones, a subjective rather than an objective character. In particular, it concerns partial identification of energy security and security in the energy sector. The latter, i.e. technical (productive) and environmental security of objects and energy systems, is one of the most important aspects in the FEC study and management. Moreover, support of the technical security at a certain level is a necessary condition for the ES support. But nevertheless, security of the energy sector is an internal feature of FEC and energy security is a property or an attribute of the society, its economic basis. The danger of identification of these notions lies in particular in the fact that security of the energy sector is a sufficiently traditional sphere of activity and studies which has its own methods and standards and it is undesirable that they would prevail over development of special tools for the ES study and management or substitute them.

## Conclusions.

1. When considering the problems of development and operation of the fuel and energy complex and the energy economy as a whole in new economic and socio-political conditions of Russia, one can not be limited by the analysis of reliability and survivability of existing energy supply systems but should study the complex problem of energy security support of the country.

2. Energy security of the country necessitates the accountability of both internal and external productive links of the fuel and energy complex and other branches of the economy. It is achieved by: development of energy systems that meet the substantiated demand for fuel and energy resources; energy conservation development in all branches of the economy to provide a reasonable decrease of demand for fuel and energy resources; special measures within the framework of the fuel and energy complex to prevent threats to energy security from being realised; decrease in the susceptibility of the fuel and energy complex to such threats and provision of the quick restoration of fuel and energy supply systems; formation of the favourable socio-economic climate in the country and its regions to assure the national security including energy security within the anti-crisis program.

3. The availability of a predetermined hierarchical structure and measures to deal with different levels of threat to energy security.

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