

Provisions of the Energy strategy of the Sakha Republic (Yakutia) till 2030

N. A. Petrov, B. G. Saneev, A.F. Safronov.

Abstract - The main provisions of the Energy Strategy of the Republic of Sakha (Yakutia), 2030. The problems of state and development of raw materials, priorities and main directions of development, the main risks and mechanisms for implementing the Energy Strategy of the Republic of Sakha (Yakutia), 2030.

Index Terms - fuel and energy complex, power generation, thermal farms is and communal energy, coal, oil and gas, fuel and energy balances, mechanisms for implementing the strategy.

INTRODUCTION

The energy strategy is a document forming and specifying the goals and aims of a long-term development of the country and region energy sector for the given period; the priorities, guiding lines, and mechanisms of the state energy policy at certain stages of its implementation securing achievement of stipulated aims. Yakutia's fuel and energy complex is created not "for the sake" of Yakutia, but for solution of major social and economic problems of the priority interest for the Russian Far East and Eastern Siberia. "The Energy Strategy of the Sakha Republic (Yakutia) for the Period till 2030" (ES-2030) [1], comprising a system of prospective measures and guiding lines, will make a tool for coordination of interested parties (federal and regional bodies of the executive energy, companies-users of natural resources, domestic and foreign partners, etc) for solution of the

Russian Far East fuel and energy complex problems for the long-term period.

Preparation of the draft of "The Energy Strategy of the Sakha Republic (Yakutia) for the Period till 2030" was performed by Institute of Oil and Gas Problems, the Siberian Division, the Russian Academy of Sciences (Yakutsk), the Larionov Institute of Physical and Technical Problems of the North, the Siberian Division, the Russian Academy of Sciences (Yakutsk), the Melentiev Institute of Energy Systems (Irkutsk), the joint stock company "Vostoenergoproekt" (Irkutsk), and executive bodies and energy production companies of the Sakha Republic by order of the Ministry of Economic Development of the Sakha Republic (Yakutia).

ES-2030 was elaborated on the basis of the strategic priorities of social and economic development of the Sakha Republic (Yakutia)[2], the Far East and Transbaikalia regions in regard to energy security and reliable supply with energy and fuel, the concepts of "The Energy Strategy of Russia for the Period till 2030" (ES-2030)[3] and the necessity to solve a broad range of issues of Russia, the Russian Federation subjects, the Sakha Republic, energy production companies, etc, programs and documents, elaborated and under elaboration, defining the development of the Sakha Republic, the Russian Far East and Transbaikalia economy [4] and fuel-energy complex.

The Sakha Republic (Yakutia) as the Russian Federation subject is part of the Far Eastern Federal Okrug and makes one of the largest Russian subjects by its territory. It occupies almost all of the North-Eastern part of the Asian continent.

The Sakha Republic (Yakutia) belongs to those regions which energy potential exceeds current and prospective needs of the region many times, and actively participates in formation of

N.A. Petrov - Larionov Institute of Physical and Technical Problems of the North SB RAS, Yakutsk, Russia (e-mail: n.a.petrov@iptpn.ysn.ru).

B.G.Saneev - Melentiev Institute of Energy Systems SB RAS, Irkutsk, Russia (e-mail: saneev@isem.sei.irk.ru).

A.F. Safronov - Institute of Oil and Gas Problems, SB RAS, Yakutsk, Russia (e-mail: a.f.safronov@prez.ysn.ru).

the fuel and energy balance (FPB) of the country and its large regions. The weight of major mineral supplies makes the following in the mineral and raw material potential of Russia and the Far Eastern Federal Okrug (in %): diamond- 82 (100); gold- 17,2 (30); coal-5 (46,6); iron ore- 6,2 (79); tin- 28 (36); antimony- 81,5 (96,1); zinc- 0,1 (2,9); lead- 0,4 (5,1); wolfram- 5 (22); silver- 3(8); mercury- 7,9 (12,5); uranium- 61 (100).

The Sakha Republic (Yakutia,) like the whole of the Far Eastern Federal Okrug, holds economic and geopolitical interrelations with the countries of the Asia-Pacific Rim, has trade ties with Japan, China, Korea, etc.

In the Sakha Republic (Yakutia), a large fuel and energy basis comprising all the branches of the fuel and energy complex (except for nuclear industry): coal, oil and gas industry, electric and thermal energy industry. The Sakha Republic fuel and energy complex completely satisfies domestic needs in coal, natural gas, electric and thermal energy, while the products of oil refinery continue to be transported to the republic from other regions. Currently, Sakha mines 3,9% of coal mined in the country (39,2% in the Russian Far East) and produces 0,7% (18,4%) of electric energy and 1,1% (22,1%) of thermal energy.

The main goal of the republic's fuel and energy complex for the long-term perspective is the efficient use of its fuel and energy potential for stable development of its economy and improvement of the population's quality of life. Achievement of this aim implies solution of the following issues:

- to meet economically and socially substantiated needs of the republic's economy in fuel and energy supply and expansion of their export area;
- to secure the republic energy security;
- to integrate the republic's fuel and energy complex into energy markets of the Asia-Pacific countries exporting high value added products;
- to form stable institutional medium in the fuel and energy complex branches;

Solution of these problems alongside with development of the republic's traditional fuel and energy industry branches (coal, oil and gas

industries, electric and thermal energy production) will require formation of oil chemistry and gas chemistry industries, development of transportation and energy infrastructure (main energy lines, gas and oil pipe systems), and increase of renewable energy supply consumption.

The priorities of the Sakha Republic's fuel and energy complex development are as follows:

- Increase of efficiency of energy consumption on the basis of advanced technology and re-equipment of production, introduction of energy saving technologies, use of new type energy supply, etc.

- Large-scale development of hydrocarbon supplies in reference to formation of a new federal oil and gas centre in Eastern Siberia and Sakha, new oil refinery, gas processing, and gas chemistry industries, as well as elimination of the republican dependence on oil refinery product import.

- Short-term implementation of the republic gasification program as one of the factors of stable production, social and economic development aiming at efficient fuel supply of the consumers and reduction of ecological stress on the developed regions of Sakha.

- Implementation of the development plan of the unique Elginsky deposit which is of global value to meet the needs of domestic metallurgy and domestic and international markets of energy and coking coal.

- Development of coal and hydrocarbon deposits of regional and local value aiming at greater adaptation of the fuel and energy complex to changing international and domestic conditions which in combination with a certain share of imported fuel will ensure the necessary level of energy security of the consumers.

- Improvement of energy and fuel supply of decentralized (isolated) consumers adjusting to "The Program of Local Energy Optimization in the Sakha Republic (Yakutia) for 2005-2015". In the short-term perspective, the priority in northern region "small energy" is given to two main sources: liquid (hydrocarbon) fuel and energy saving as a new energy source. The latter source, besides

organization and technological measures of energy saving, implies the use of non-traditional energy sources: nuclear power stations of medium capacity, wind and solar energy, etc. resulting from energy saving measures if the rate of their aggregate efficiency will be preferable as compared with use of imported liquid fuels.

- Increase of fuel and energy supplies export, primarily of hydrocarbons, coal and electric energy, to the countries of North-Eastern Asia (Japan, Korea, and China). In the future, development of deep processing of hydrocarbon resources (oil and gas refinery and gas chemistry products), and of complex coal processing in the republic will facilitate the growth of high added-value product export.

The corresponding economic, legal and institutional mechanisms of management should facilitate implementation of the prospective development of the republic's fuel and energy complex. The most important and demanding for the republic are the economic mechanisms of management linked with investment, price, tax and credit policy in reference to energy industry which are formed at the federal level.

In the nearest future up to 2030, the proportions and dimensions of the republic's fuel and energy complex are as given below.

In ES 2030, two scenarios (strategic and moderate) of Sakha fuel and energy complex development up to 2030 have been elaborated on the basis of prediction of domestic and international conditions (rates of social and economic development, supply of Russian and foreign markets with fuel and energy).

The strategic scenario is oriented towards high rates of production force development in the republic, the most favorable combination of economic factors and international energy market opportunities, as well as high investment opportunities. The moderate scenario in comparison with the strategic one is characterized with lower rates of social and economic development (considering the current financial and economic crisis), levels of energy consumption and volumes of fuel and energy export.

For the scenarios under consideration, fuel and energy consumption in 2007-2030 will increase:

- in electric energy – 3,4-5 times: from 67 billion kWt to 233-282 bill kWt per hour

- in thermal energy- 13-14 times; 15,3 mil. Gcal up to 207-216 mil. Gcal.

-in boiler house and oven heating- 3 -3,4 times; from 49 mil. t coal up to 147-170 mil. t.

For the coming years in the Asia Pacific region countries, notably in East –Northern Asia, significant increase of fuel and energy consumption is predicted which will result in increase of supply of these countries with energy from Russia. Export of Yakutian fuel and energy by 2030 is estimated in the following volumes: natural gas- 6,8-13,2 billion cubic meters, oil- 6,2-8,6 mil. t, coal- 15,9-16,2 mil. t, electric energy- 10,8 bill kWt ph. The republic's fuel and energy complex will develop through increase in extraction of all the types of fuel and energy resources, Within 2007-2030, coal mining will increase 3,3,-3,6 times: from 12,2, mil. t up to 40,6 - 44,1 mil. t. Natural gas production will increase 10,7-19 times from 1,6 bln cubic meters in 2007 up to 171-307 bln cubic meters in 2030. Oil production (including gas condensate) will increase from 0,4 mil. t in 2007 to 11,7-157 mil. t in 2030. Electric energy production in 2007-2030 will increase 5,4-6 times from 7,3 bln kWt to 19,7-44 bln kWt ph.

The major directions of the fuel and energy complex branch development are as follows:

Electric power. To secure the predicted levels of electric consumption in the republic, operation of the following large electric energy source systems is stipulated:

- In the South-Yakutian energy region- by 2020, the Kankunsky hydro-electric power station (1300 MWt), by 2025 the Nizhne-Timptonsky hydro-electric power station (800 MWt), new blocks of the Neryingrinsky electric power plant (555 MWt), and by 2020 the Elginsky electric power plant (1800 MWt) for utilization of industrial products from the Elginsky deposit processing plant and participation in large-scale export of electro-energy to China.

-In the Central energy region: by 2015, the Yakutsk State Regional Electric Power station 2 (in both the scenarios the capacity makes 304 MWt). This project is stipulated by the Strategy of social and economic development of the Far East, the Republic of Buryatiya, the Thranbaikalia Krai and the Irkutsky Oblast for the period up to 2025. They are not the basic system forming generating sources, rather they only replace morally and physically antiquated equipment of the Yakutsk State Regional Electric Power station 1 by foreign equipment at a new site. To solve the problem of energy security and stable supply with energy of the Central, Western and South-Yakutian regions, the decision to elaborate “The Scheme of the Yakutia Energy System Development in Regard to the Thermal Electric Energy Center of the Dzhebariki-Khaya Coal Mine, the Yakut State Regional Electric Power plant 2, a New Energy Source in the Western Energy System and Unified Energy Regions” till December 1, 2010 according to Yakutia’s President V. Shtyrov’s proposal.

In the Western energy region: by 2030 in the moderate scenario and by 2020 in the strategic scenario, the thermal power station in Lensk (the total capacity being 1200 MWt) on gas to secure stresses of oil refineries, gas processing and gas chemical plans. Thermal power stations working on natural and associated gas to provide for needs in electric energy at oil deposits will be put into operation.

The defined total capacity of the republic’s electric power stations during 2007-2030 will increase 3,8-4,1 times – from 2100 MWt to 7900-8800 MWt. Thermal power stations -60-65% and the Kankunsky and Nizhne-Timtonsky hydro electric power stations- 24-27% will make the considerable share of the defined capacity.

The main routes of the energy lines run along pipes and railroads under construction or due to be constructed and they provide the republic’s integrated energy regions. The major routes of energy line construction are: Lensk-Olekminsk-Aldan, Maya- Tommot-Aldan-the Neryungrinsky power plant-Tynda-Skvorodino, Tabaga-Maya-Khandyga-Nezhdaninskoe, the Elginsky power station-

the Eastern unified electric energy station (export energy line). The total length of the energy lines make 6000 km, 1000km of them making 500 kV and the total capacity of substations being about 5500MVA.

The following activities have been stipulated to decrease isolated customer energy supply funding:

1. Construction of a lower-power coal plant with the total capacity of 53 MWt according to the moderate scenario and 69 MWt according to the strategic scenario;
2. Construction of floating nuclear power stations in the villages of Yuryung –Khaya (36 MWt), Ust-Kuiga (30MWt) and Tixi (12 MWt);
3. Construction of the electricity supply network to expand the area of centralized electric supply;
4. Transfer of wind power stations along gas pipes to natural gas;
5. Construction of diesel power stations with the capacity of 1MWt;

Thermal energy and thermal energy economy
Development of thermal energy supply in the republic will require implementation of the major strategic projects:

- updating and reconstruction of boiler-houses and thermal energy networks, implementation of energy saving activities for reliable operation and further development of the existing thermal energy supply networks;
- introduction of thermal capacity into lower-power coal plants will make: in the moderate scenario- 240 Gcal ph (8 lower-power coal plants), in the strategic scenario- 320 Gcal ph (11 lower-power coal plants), and construction of nuclear substations of small capacity in the villages of Ust-Kuiga, Ust-Kuiga and Tixi with the total capacity of 64 Gcal ph;
- construction of the Dzhebariki-Khaya thermal power station with the capacity of 30 Gcal/h and the Elginsky heat plant (320 Gcal/h for energy supply of new and developing coal deposit;
- construction of 11 new boiler-houses (total capacity- 240 Gcal/h) for supply of large industrial projects under construction and of 6 industrial boiler-houses (50 Gcal/h);

- in 2009-2030, 386 boiler-houses (total capacity- 920 Gcal/h) will be transferred to gas, while gas consumption by boiler-houses will make 266,000 t of equivalent fuel by the end of the year. The total demand of boilers for gas by 2030 will be 881,000 t of equivalent fuel;

- a step-by-step decrease and exclusion of fuelwood and crude oil from fuel burnt at central heating boilers by converting them to coal. The total amount of fuel being replaced by 2030 will comprise 50,000 t of equivalent fuel. By the end of the period under consideration the total heating capacity input will comprise 1714 Gcal/h in the moderate scenario and 1794 Gcal/h in the strategic one. The heating capacity input of large energy plants in Yakutia will reach 1120 Gcal/h by 2030. In the moderate scenario the main heating capacity input is planned for 2011-2020, in the strategic scenario by 2015.

Coal industry. In perspective considered Sakha Republic is provided with its own coal reserves according to both scenarios of the economic development. To ensure the demand of the domestic market and to supply coal outside Sakha Republic the coal production will increase up to 40.6 mil.t in 2030 in the moderate scenario and 44.1 mil.t in the strategic scenario.

The coal production in Sakha Republic is developed through modernization of the facilities in operation and construction of new plants in South Yakutia: the Elginskiy opencast colliery (designed capacity 30 mil. t), the Denisovskiye mines (3 mil. t in the moderate scenario and 4.5 mil.t in the strategic scenario), the Inaglinskaya mine (2 and 3 mil.t), the Kholodnikanskaya mine (1 and 1.5 mil.t in the moderate and strategic scenario respectively), the Lokuchakitskaya mine (1 mil.t). The scenarios of the coal industry development in Sakha Republic differ basically in the terms of starting-up new plants. The realization of the Elginskiy project is planned in the moderate scenario commencing in 2015, in the strategic scenario by 2015.

Coal is planned to be processed at coal-preparation plants of the Nerungrinskiy opencast colliery and new mines in South Yakutia. Coal preparation output will increase

by 2030 more than 6 times up to 38.2 mln t in the moderate scenario and up to 40.9 mln t in the strategic scenario. More than 90% of the coal mined in Sakha Republic will be processed. Processing output will comprise 30.8 mil. t in 2030 in the moderate scenario and up to 33.3 mil. t in the strategic scenario.

Supply of energy-generating coal to the Far East federal district will increase from 2.6 mil. t in 2007 to 4 mil.t in 2030 in the strategic scenario, 3 and 5 mil.t respectively in the moderate scenario.

The potential production of coking coal of the export quality in Sakha Republic will comprise 14.5 – 15 mil.t per year by 2020.

Oil and gas industry. Oil and gas industry development depends above all on exploration surveys. To provide the increase of oil recovery up to 11.5 mil.t by 2030 in the moderate scenario and up to 15.3 mil.t in the strategic scenario it is necessary to provide addition of reserves no less than 260 mil.t.

The main oil recovery output is provided both in the moderate and strategic scenario at the three deposits and the perspective adjacent areas: Talakanskoye (6.4 mil.t in 2030 in the moderate scenario and 8.5 mil.t in the strategic scenario), Srednebotuobinskoye (2.8 mil.t in 2030 in the moderate scenario and 4.5 mil.t in the strategic scenario), Chayandinskoye (2 mil.t in 2030 in both scenarios).

Natural gas production will comprise 17.1 billion t by 2030 in the moderate and 30.7 billion m³ in the strategic scenario (incl. associated gas of oil deposits) through development of the Sredneviluiskoye gas-condensate field (3.5 billion m³ by 2030) and the Chayandinskoye oil-gas condensate field (12.2 billion m³ by 2030 in the moderate scenario and 25.2 billion m³ in the strategic scenario).

Gas condensate recovery at fields of Sakha Republic will increase up to 363 thousand t in the moderate scenario and up to 564 thousand t in the strategic scenario by 2030.

Oil and gas-processing industry of Sakha Republic is based on the three petroleum product complexes: a refinery in Lensk, a gas condensate processing plant in Kysyl-Sir, a synthetic petrol plant in Aldan, a gas

processing plant in Yakutsk (upgrading of the existing facilities), and a gas chemical complex in Lensk.

The refinery in Lensk with capacity 1 m t/y is provided by oil from the Srednebotuobinskoye oil-gas condensate field starting from 2016. By 2020 the Lensk refinery will meet the demand of the West energy region in petroleum products.

The capacity of the gas condensate processing plant of the Vilui fields in Kysyl-Sir is estimated to be 150 thousand t/y in 2015. The capacity of the synthetic petrol plant in Aldan to process 1320 mil. m³/y of natural gas is planned starting from 2030 in the moderate scenario and from 202 in the strategic scenario.

The moderate scenario suggests the start-up of natural gas processing plants with capacity 12.6 billion m³ in 2030, the strategic scenario with capacity 25.7 billion m³ starting from 2016. It is planned to derive ethane, propane, butane resulting from gas separation to produce different chemicals. Some gas processing and gas chemistry products can be produced in the adjacent regions, e.g. in Primorskiy Krai and Amurskaya Oblast. Special calculations will show the proper production volume and location of facilities. In this connection gas chemical complexes are designed either in Lensk or Aldan. Chemical products will be consumed in Sakha Republic and will be supplied to the neighbouring regions and external markets.

In 2030 the light-end product volume will comprise about 1405-1411 thousand t, incl. 395-400 thousand t of petrol, 130 thousand t of kerosene, and 880-881 thousand t of diesel fuel.

Great oil supplies outside Sakha Republic are planned after the oil pipeline East Siberia – the Pacific is put into operation with capacity in 2030: 10.4 m t in the moderate scenario and 14.4 m t in the strategic scenario.

Natural gas supplies outside Sakha Republic are planned after realization of the gas pipeline system in the Far East (2016 to 2020). Thus, the construction of the gas pipeline Chayanda – Khabarovsk – Vladivostok passing through South Yakutia will start in 2012. The total production share of natural gas supply outside Sakha Republic in 2030 will comprise 61% in

the moderate scenario and 72% in the strategic scenario.

INVESTMENT, RISKS, AND REALIZATION MECHANISMS OF SAKHA REPUBLIC ENERGY STRATEGY 2030

The development of the fuel-energy complex of Sakha Republic 2009 to 2030 will require large-scale investment of 1.4 – 1.7 trillion RUB. The main sources of financing are: own funds of organizations (incl. loans of domestic and foreign banks, insurance companies, venture capital trusts, leasing companies, etc.) and budgetary funds of different levels.

The development of the fuel-energy complex will ensure the investment of 278 – 466 billion RUB in the Gross Regional Product of Sakha Republic (30 – 45 % of the assessed Gross Regional Product). The tax proceeds of the fuel-energy complex in budgetary funds of different levels are estimated to be 123.4 – 180.7 billion RUB by 2030.

The realization of the Sakha Republic Energy Strategy 2030 is associated with both internal and external risks. The main internal risks are: the rates of the social and economic development of Sakha Republic and neighboring regions determining the internal demand for fuel and energy resources as well as the possibility to supply them to the domestic market; investment risks affecting terms and scale of coal deposit and oil field development, construction of new energy facilities and transport energy infrastructure, etc.; the government control on the fuel-energy complex; demographic situation in Sakha Republic.

The main external risks are: the energy market conditions in the Asia-Pacific countries affecting the potential export opportunities of fuel-energy resources from Russia incl. those from Sakha Republic; negotiating the export volumes of energy resources enabling to arrange the particular sequences and stages of supplies; attraction of foreign investments, etc.

To decrease the realization risks of the Sakha Republic Energy Strategy 2030 it is necessary to:

- 1) pass the long-term 'Program of Social and Economic Development of the Far East, the

Republic of Buryatia, Zabaikalskiy Krai, and Irkutskaya Oblast up to 2025' in the government;

2) develop the development programs of the fuel-energy complex of East Siberia and the Far East with the finalized transport schemes of fuel-energy resources as well as the location of new oil and gas processing plants;

3) enhance the negotiations of long-term contracts for the fuel-energy supply to the Asia-Pacific countries and the countries of the North East of Asia and the foreign investment in the fuel-energy complex development of the Russian East;

4) develop the mechanisms of government control on the Sakha Republic's fuel-energy complex development;

5) develop a government program to attract and consolidate population in the Far East, incl. Sakha Republic, etc.

The main *realization mechanisms* of the Sakha Republic Energy Strategy 2030 are the economic, investment, organizational, and institutional measures:

tax regulations - exemption from the mining operations tax of the coal mining enterprises with worst mining conditions; tax remissions at the initial period of the hydrocarbon deposit development; abandonment of the water bodies use tax for the emerging hydroelectric facilities.

budget policy – increase of federal spending for geological surveys on oil and gas; financing of the municipal energy development from budgetary funds of all levels and private investors.

price and tariff policy – banning of inflation development due to fuel and energy price overgrowth; setting of rational price relations for different kinds of energy resources based on fuel capacity and consumer effect; promotion of energy saving; social leveling of energy supply expenses.

investment mechanisms – attraction of private investment and energy company assets; development of partnership between the state and private sector.

organizational mechanisms - establishment of a united fuel-energy complex control body in the Sakha Republic government; establishment

of separate departments of heat supply, energy saving, government energy control; monitoring the realization of the fuel-energy complex development strategy.

the regional legislation – adaptation of federal laws to the region's conditions; ensuring of the normative legal basis to realize the fuel-energy complex development strategy.

environment policy – economic promotion of environment protection activities; introduction of waste treatment and recycling technologies in the production and use of energy resources.

CONCLUSIONS

The realization of the Sakha Republic Energy Strategy 2030 will enable to:

- guarantee the reliable and safe operation of the fuel-energy complex, productive potential development in the oil and gas complex, coal industry, heat and energy engineering;
- increase the depth of fuel and energy resources processing and production output with high value added;
- form a rational fuel and energy balance;
- guarantee a reliable energy supply of the remote regions using renewable and local energy resources;
- increase the energy efficiency of fuel and energy resources;
- guarantee the environmental efficiency and social responsibility of the fuel-energy complex.

The annual realization control of the strategic development directions of the Sakha Republic's fuel-energy complex with the Report to the President of Sakha Republic (Yakutia) during the first quarter of the next year provided for by the Decree of the Government of Sakha Republic (Yakutia) from 29 October 2009 No. 441 will also include suggestions for prior economic, investment, organizational, and institutional measures necessary to realize the Sakha Republic Energy Strategy 2030.

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gas areas, the geochemistry of organic matter, generation and migration of hydrocarbons, lithology.

BIOGRAPHIES



Nikolai A. Petrov – head of department of Energy, Larionov Institute of Physical and Technical Problems of the North SB RAS, Yakutsk. Doctor of Technical Sciences, Professor, Honoured power engineering specialist. His major research interests: development of a methodological approaches and tools for investigating the

relationship of energy, economy and social sphere; research directions for the fuel and energy bases interregional and interstate, development of requirements for design and manufacture of equipment and management tools for small-scale power.

Boris G. Saneev is Deputy Director of Melentiev Energy Systems Institute, Professor. In 1967 he graduated from Novosibirsk State University and began to work at Siberian Energy Institute of SB RAS (at present Melentiev Energy Systems Institute). His main direction of research is scientific fundamentals of the regional energy policy, methodological approaches, systems of models and databases to forecast regional energy demand, principles, methods and models for studying and choosing rational options of FEC development in the country and regions, energy impact on the environment.



Alexandr F. Safronov - Director of the Institute of Oil and Gas Problems SB RAS, Yakutsk, Acting President of the Presidium of the YSC SB RAS. Corresponding Member of RAS, Doctor of Geological and Mineralogical Sciences, Professor. His major research interests: structure and history of the development of oil and