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Formation of Technological Sovereignty in the Implementation of Strategies for the Development of Hydrocarbon Fields in the Russian Arctic

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Abstract. The study examines the substantive components of the formation of technological sovereignty by key industries in Russia in the current geopolitical and economic conditions. The directions of state management on creation of institutional basis for implementation of innovative technological projects, production of domestic high-tech products within the framework of the concept of guaranteed independence of the Russian economy in critical infrastructure areas are defined. Promising directions for the implementation of projects aimed at large-scale development of carbon deposits in the Arctic zone of the Russian Federation in the medium- and long-term perspective from the perspective of achieving technological sovereignty are identified. The interconnection of strategic plans of government and business structures, training centers and manufacturing enterprises, scientific and industrial institutions for building procedures for further strengthening the technological development of the country is presented. Examples of testing individual domestic components to achieve technological sovereignty in the fuel and energy complex of the Arctic zone of the Russian Federation, in the construction of ice-class ships, industrial engineering, etc. are outlined. The implementation of natural gas liquefaction projects in the Russian Arctic is becoming a strategically important and relevant topic for the development of carbon deposits. The created and implemented domestic technologies for liquefying natural gas "Arctic Cascade", "Modified Arctic Cascade", as well as the new technology "Arctic Mix", which will be implemented in the future at the new Murmansk LNG terminal, are a good foundation for the innovative and technological development of Russia.
Keywords: *technological sovereignty, economics, Arctic, strategy, innovation, shipbuilding, fuel and energy complex*

Introduction

The Russian Federation owns about 74% of the Arctic shelf, which causes increased interest among Western, Eastern and Southern partners of our country in the natural resources located there. The global economy is and will continue to be oil and gas dependent for its development both in the medium and long term, therefore, the explored and potentially predicted hydrocarbon reserves of the Arctic shelf put pressure on the world market. When looking at the structure of Northern Sea Route (NSR) traffic in 2020 presented by the State Commission for Arctic Development [1], it can be seen that the percentage of cargo was distributed as follows:

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[1] Northern Sea Route: 2020 Results. URL: https://arctic.gov.ru/wp-content/uploads/2021/02/2020.pdf (accessed 25 October 2023).

- import-export and cabotage structure: liquefied natural gas (LNG) — 59%, oil — 24%, general cargo — 11%, as well as several percent of gas condensate, oil products and coal;
- transit traffic structure: iron ore — 78%, general cargo — 7%, cellulose — 5%, mineral fertilizers — 5%, bulk cargo — 2%, equipment — 2%, petroleum products — 1%, frozen fish — 0.5%.

Currently, the political and economic pressure exerted by unfriendly countries aimed at reducing the production, processing and shipment of hydrocarbons in the Arctic Zone of the Russian Federation (AZRF) has led to the implementation of technological projects to level out import dependence, create domestic high-tech products / goods within the framework of achieving the technological sovereignty of the country. The production and export of liquefied natural gas in the AZRF is one of the priority areas of the national energy industry.

Technological sovereignty and its elements

Technological sovereignty is a government program to ensure the independence of the Russian economy from external economic factors and global political trends — it is the most important condition for the prosperity of the country. The concept of technological sovereignty is being formed and gradually implemented [1; 2]. An important role is assigned to the state in creating the institutional basis for technological sovereignty [3], in particular, the state government launches key megaprojects [2].

The issues of technological sovereignty for the implementation of projects aimed at large-scale development of carbon deposits in the Arctic zone of the Russian Federation deserve special attention due to their heterogeneity, complexity, and extreme nature of the entire range of works [4; 5]. In the existing natural and climatic conditions, construction and development of the Far North infrastructure continues; federal infrastructure facilities are being commissioned according to the plans of the State Corporation Rosatom: in 2022, the construction of the Utrenny terminal was completed; in 2023, the Bukhta Sever terminal was built; in 2024 — the Severnaya Zvezda terminal; In 2026, the construction of the Mys Nagleynyn terminal and an energy port in the East Siberian Sea is planned to be completed to accommodate four modernized floating power units (MFPU) to provide energy to the Biamskaya ore zone [3]. JSC Nevskoe Design Bureau, by order of JSC Atomenergomash, developed the working design documentation for the MFPU of Project 20871. According to experts, the construction of domestic small NPPs is a good solution for northern regions, since their carbon-free nature creates conditions for environmental safety and ensures long-term predictability of electricity prices during the implementation of large-scale industrial facilities [6]. The commissioning of the terminals will contribute to the development of a year-round transportation route along the Northern Sea Route.

[2] Government launches mega-projects of technological sovereignty. URL: https://ac.gov.ru/news/page/pravitelstvo-zapuskaet-megaproekty-tehnologiceskogo-suvereniteta-27609 (accessed 25 October 2023).
[3] Construction of the cargo terminal "Mys Nagleinyn". URL: https://portnews.ru/news/342846/ (accessed 25 October 2023).

Strategic components of technological development

The current state of import substitution in the country’s industry structures is determined by timely actions by government agencies and business communities [7; 8]. Particular attention in matters of creating the technological sovereignty is paid to the regulatory framework, strategic plans of government and business structures, the implementation of which creates competitive advantages for domestic enterprises and is a solid foundation for the development of the country’s economy [9]. The creation of new and the development of existing institutions and centers, the main focus of which is the sphere of high technologies, is carried out taking into account the strategies of technological development of the Russian Federation, strategies of spatial development, territorial and industry planning schemes, plans in the areas of information technology and scientific and technical activities of companies, the general goal of which is to provide production with industrial products, the introduction of new products/services and technologies to the market that contribute to ensuring the technological sovereignty of the Russian Federation [10; 11].

Table 1 presents the level of equipment dependence on imports in the oil and gas sector of Russia, developed by specialists of the Institute of Economic Forecasting of the Russian Academy of Sciences [12].

Table 1

Level of equipment dependence on imports in the oil and gas sector of Russia

Indicators	Year							
	2014	2015	2016	2017	2018	2019	2020	2021
Import, bln rub.	*155*	*155*	*170*	*181*	*191*	*212*	*204*	*229*
Drilling rigs and platforms	8	15	26	8	13	10	7	8
Pipes and fittings	23	17	24	32	29	49	24	17
Pumping and compressor equipment	68	75	76	89	85	85	98	120
Separators for oil and gas purification	43	30	30	35	40	49	48	56
Storage tanks for oil, oil products and liquefied gas	8	6	6	7	10	9	15	16
Catalysts	5	12	8	9	15	10	12	13
Investments in machinery and equipment, bln rub.	*594*	*648*	*516*	*694*	*642*	*738*	*684*	*581*
Oil and gas production	265	317	240	308	264	303	285	244
Services in the field of oil and natural gas production	80	97	85	115	125	143	117	117
Production of petroleum products	186	146	113	171	148	164	187	150
Production and distribution of gaseous fuel	6	7	6	9	34	72	42	25
Pipeline transportation of oil and petroleum products	45	62	60	73	44	37	34	35
Pipeline transportation of of gas and its processed products	12	19	12	18	27	19	19	10
Level of dependence on imports, %	26	24	33	26	30	29	30	39

Prioritization of domestic products and technologies is a complex, expensive process with a large time lag [13]. The measures taken and the launched mechanism of state support for companies producing high-tech products that can replace foreign equipment/products/services allow speaking confidently about the implementation of the set goals and objectives [14; 15].

In particular, within the framework of implementation of the Strategy for scientific and technological development of the Russian Federation and the National Security Strategy, the Government of the Russian Federation approved the Program of activities of the National Research Center (NRC) "Kurchatov Institute" dated 06.02.2023 No. 263r [4] for 2023–2027, aimed at developing promising technologies, forming a technological base for Russia to achieve leadership in priority areas of scientific and technological development, for the implementation of which budget funding in the amount of more than 185 billion rubles was allocated. The Program's target indicators include: fundamental and applied research in the field of creating materials for marine equipment; new technologies for the production of materials and coatings with anti-icing and wear-resistant properties for anti-corrosion protection with reduced ice adhesion to the surface for underwater and surface marine equipment; innovative technologies for producing powder materials from titanium alloys for marine use and manufacturing products from them with specified properties. The Kurchatov Institute will conduct applied research to create the foundations of a new-generation full-electric propulsion system technology using direct thermoelectric energy conversion and superconductivity technologies, which will result in the creation of promising nuclear power plants for transport purposes, including for nuclear icebreakers [16; 17].

Testing of certain components in ensuring technological independence

The construction of the Russian icebreaker fleet for the development of the Northern Sea Route (NSR) is one of the main priorities for domestic shipbuilders. In particular, two (out of five planned) universal nuclear icebreakers of Project 22220, Arktika and Sibir, are already operating on the NSR lines, Yakutia is undergoing ship trials in the Gulf of Finland, and Ural and Chukotka are in the active stage of construction. These 60-megawatt icebreakers of the Baltic Shipyard will increase the existing transportation potential in the Arctic zone of the Russian Federation (AZRF).

The Zvezda shipbuilding complex is constructing 35 vessels to ensure large-scale year-round work along the NSR. The contracts include the construction of the lead nuclear icebreaker of Project 10510 Lider, four multifunctional ice-class supply vessels, more than 10 Afromax tankers, 10 Arc7 ice class Arctic shuttle tankers, one Arctic shuttle tanker with a deadweight of 69 thousand tons, product tankers with a deadweight of 51 thousand tons, equipped to operate on gas fuel, etc. [5] The order portfolio of Zvezda SC is quite large, and in order to reduce the deadlines for commissioning the Russian ice-class fleet for work in the AZRF, FSUE Rosmorport has implemented the option of transferring the contract for the construction of two Project 22740 shallow-draft icebreakers of the consortium of JSC Rosneftegaz, PJSC Rosneft and JSC Gazprombank from

[4] The program of activities of the Federal State Budgetary Institution "National Research Center "Kurchatov Institute"" for 2023-2027, approved by the Order of the Government of the Russian Federation dated 06.02.2023 No. 263r. URL: http://publication.pravo.gov.ru/Document/View/0001202302090033 (accessed 25 October 2023).

[5] Zvezda shipbuilding complex. URL: https://sskzvezda.ru/ (accessed 25 October 2023).

Zvezda SC to JSC Onezhskiy Shipbuilding Plant (OSP) [6]. In May 2023, the construction of the lead shallow-draft icebreaker of Project 22740M began at the OSP, the general designer is the St. Petersburg branch of JSC Central Design Bureau Lazurit, the second icebreaker of Project 22740M is planned to be started in 2023.

The Iceberg Central Design Bureau, together with the Krylov State Research Center, has developed a project of a nuclear multifunctional offshore icebreaker 10570, designed to operate in shallow areas of the Arctic shelf — its propulsion is based on the RITM-200B reactor plant (modernized version). The project is equipped with two full-turning steerable propellers, a central propeller and bow thrusters; the thickness of the ice to be overcome is up to 2.4 m. It is noteworthy that the adopted domestic concept suggests the possibility of creating various types of multifunctional offshore icebreakers with specialized equipment.

In November 2023, the Vyborg Shipyard laid down the first diesel-electric icebreaker of Project 21900M2, in which everything is made in Russia. Project 21900M2 is a 120-meter Arc7 ice class vessel with a propulsion system with a total capacity of 18 MW — the engines were developed and manufactured at the Kolomenskiy Shipyard. This project assumes a high degree of automation and a modern electronic integrated control system, a helipad and the ability to place 33 containers on the deck (12 of which can be refrigerated with the ability to connect to the on-board electrical network), and is capable of breaking through ice up to 1.5 m thick. The experience of building the Project 21900M2 icebreaker without the participation of foreign suppliers will be important for the entire shipbuilding industry of our country.

According to Rosatom's forecasts, to ensure full-scale year-round navigation along the Northern Sea Route, it is necessary to have at least 7, and optimally 14 icebreakers (including conventional ones) in service by 2030. The icebreaker fleet is a real driver for increasing cargo traffic along the NSR, as stated in the Strategy for developing the Russian Arctic Zone and ensuring national security until 2035 [7]. The cargo turnover of the Arctic basin ports is presented in Table 2 for 2021 [8], 2022 [9] and January — June 2023 [10].

Table 2

Cargo turnover of Arctic ports, million tons

No.	Arctic ports	2021	2022	January–June 2023
1	Murmansk	54.5	65.3	30.5
2	Sabetta	27.9	28.4	13.9
3	Varandey	4.6	5.9	2.7

[6] JSC Onezhskiy Shipbuilding Plant. URL: http://onegoshipyard.ru/ (accessed 25 October 2023).
[7] Decree of the President of the Russian Federation of October 26, 2020 No. 645 "On the Strategy for developing the Russian Arctic Zone and ensuring national security until 2035". URL: https://www.garant.ru/products/ipo/prime/doc/74710556/ (accessed 25 October 2023).
[8] Cargo turnover of Russian seaports for 12 months of 2021. URL: https://www.morport.com/rus/news/gruzooborot-morskih-portov-rossii-za-12-mesyacev-2021-g (accessed 25 October 2023).
[9] Cargo turnover of Russian seaports for 12 months of 2022. URL: https://www.morport.com/rus/news/gruzooborot-morskih-portov-rossii-za-12-mesyacev-2022-g (accessed 25 October 2023).
[10] Cargo turnover of Russian seaports for January–June 2023. URL: https://www.morport.com/rus/news/gruzooborot-morskih-portov-rossii-za-yanvar-iyun-2023-g (accessed 25 October 2023).

4	Arkhangelsk	3.2	2.3	0.85

The infrastructural development of the AZRF in general and of the NSR in particular implies quite a large number of facilities; today, more than 70 transshipment bases and ports are located along this transport crossing.

The creation of oil and gas industry facilities, which are strategically important for the country, is of particular interest in the AZRF [18]. Within the framework of the Energy Strategy of the Russian Federation until 2035 [11], the Long-term Program for the development of liquefied natural gas production in the Russian Federation dated 16.03.2021 No. 640 [12], an increase in the production of liquefied natural gas to 140 million tons is projected. At the current stage, there is a noticeable increase in the share of LNG in the total volume of "blue fuel": at the beginning of 2020, the share was 27%, in 2010 — 47%, in 2021 — 50%, in 2022, natural gas became a kind of "safety cushion" in the face of European sanctions; about 17 million tons of LNG were supplied to the EU, which is almost 20% more than in 2021.

The projects of PJSC Rosneft, PJSC Gazprom Neft, PJSC Novatek, PJSC Gazprom, Rosatom State Corporation and other companies, the implementation of which will make it possible to realize the planned activities, are considered promising in the AZRF.

Following the events of February 2022, the EU adopted the fifth package of sanctions — critical equipment for the LNG industry was banned. According to the Union of Oil and Gas Producers of Russia, before these events, about 80% of the equipment used in the Russian Federation was exported by foreign suppliers. For example, the Prirazlomnaya offshore ice-resistant stationary platform operating on the Arctic shelf consists of 90% imported equipment.

The oil and gas sector and, in particular, PJSC Novatek have experienced an impressive number of restrictions from their recent "partners" [19]. The USA and EU have limited the supply of equipment and technologies for the Russian oil and gas sector, and Baker Hughes, Weatherford, SLB (Schlumberger) and Halliburton have announced the suspension of work. The French authorities and banks have refused to participate in the Arctic LNG 2 project. South Korean shipyard Daewoo Shipbuilding & Marine Engineering (DSME) has terminated a contract for the construction of three Arc7 LNG tankers, while Japanese and French companies are freezing investments for the project.

However, PJSC Novatek is implementing new projects using its own technology. Novatek's LNG technology portfolio includes: medium-tonnage "Arctic Cascade" [13]; "Polar Star" [14], which op-

[11] Energy Strategy of the Russian Federation for the period until 2035. URL: http://static.government.ru/media/files/w4sigFOiDjGVDYT4IgsApssm6mZRb7wx.pdf (accessed 25 October 2023).
[12] Long-term program for the development of liquefied natural gas production in the Russian Federation dated 16.03.2021 No. 640. URL: http://static.government.ru/media/files/l6DePkb3cDKTgzxbb6sdFc2npEPAd7SE.pdf (accessed 25 October 2023).
[13] A method for liquefying natural gas using a high-pressure cycle with pre-cooling with ethane and supercooling with nitrogen "Arctic Cascade" and the installation for its implementation. URL: https://patents.google.com/patent/RU2645185C1/ru (accessed 26 November 2023).
[14] The Polar Star natural gas liquefaction method and the installation for its implementation. URL: https://patents.google.com/patent/RU2740112C1/ru (accessed 26 November 2023).

timizes the “Arctic Cascade”; large-tonnage “Arctic Cascade Modified” [15]; large-tonnage “Arctic Mix” [16].

The “Arctic Cascade” and “Arctic Cascade Modified” natural gas liquefaction technologies can only be used in the Arctic at low average annual air temperatures. The new development of the company “Arctic Mix” with a capacity of about 6.5 million tons of LNG per year will be implemented at Murmansk LNG and is intended for operation not only in the Arctic zone, but also in the European part of Russia. Using the gas liquefaction technology “Arctic Cascade”, the fourth line of Novatek’s Yamal LNG is operating, and according to experts’ forecasts, it can produce 1 million tons of LNG instead of 950 thousand tons [17].

The technology “Arctic Cascade Modified” with a capacity of 3 million tons per year is planned for implementation at Obskoe LNG.

Novatek’s Arctic LNG 2 project is being actively implemented in the AZRF, where three lines will produce up to 19.8 million tons of LNG per year using both foreign and domestic equipment. In July 2023, LLC Novatek–Murmansk — the Center for the construction of large-tonnage offshore structures (CCLOS, Belokamenka settlement, Murmansk Oblast) sent the first liquefaction line of the Arctic LNG 2 plant on a gravity platform. V.V. Putin took part in the ceremony of the plant’s shipment by sea to the Utrennee field. In August, the LNG complex was delivered to the project’s resource base on the Gydan Peninsula, and specialists started connecting it to the coastal infrastructure. The second stage is planned for delivery in 2024, the third — in 2026.

The complexity of the project is in the fact that the most promising projects in oil and gas production in previous times were created according to Western standards in order to include their equipment in the production process [20; 21]. In the new geopolitical situation, many projects are at risk of failure due to the suspension of critical equipment supplies from the US and EU, in particular, the German Linde. One of the problems is the lack of technology for the production of medium and high-power gas turbines. Harbin Guanghan Gas Turbine Co of the People’s Republic of China helped resolve the issue, PJSC Novatek signed an agreement to purchase medium-power turbines to meet the needs of the Arctic LNG 2 under construction; an alternative option for solving the issue of power supply was also found, in particular, the Turkish Karpowership gas piston power plant was considered. The above-mentioned points indicate the existence of international co-operation with friendly countries [22].

During the implementation of Arctic LNG 2, many decisions had to be changed in process, which resulted in a 17% increase in the cost of the project: the initial cost of the project was 21 billion US dollars, at the current stage — 25 billion US dollars. According to Leonid Mikhelson, the

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[15] The method of liquefying natural gas "modified Arctic cascade" and the installation for its implementation. URL: https://patenton.ru/patent/RU2792387C1 (accessed 26 November 2023).
[16] Natural gas liquefaction method "Arctic Mix". URL: https://patents.google.com/patent/RU2797608C1/ru (accessed 26 November 2023).
[17] Fuel and energy complex of Russia. URL: https://www.cdu.ru/tek_russia/issue /2023/1/1107/ (accessed 25 October 2023).

head of Novatek, the cost of the project will be more expensive at the first stage, but this always happens when introducing new technological solutions; once serial production of domestic equipment for liquefying natural gas begins, it will be cheaper than foreign analogues [18].

The topic of technological sovereignty in the oil and gas and industrial complexes of the country to create completely domestic units, machines, ship component equipment (SCE) and other products in 2022 has come to the forefront. The Russian Government has formed a list of projects that include critical areas of import substitution until 2030. According to forecasts, 5.2 trillion rubles are planned for the implementation of 162 projects: 2.3 trillion rubles in the form of preferential loans, and 2.9 trillion rubles as investor contributions. The list includes the following projects in the largest number: 54 in the chemical industry; 27 in the ferrous metallurgy industry; 18 in the forestry complex; 16 in railway engineering; 12 in the pharmaceutical industry; 8 in the automotive industry; 6 in agricultural engineering; 5 in non-ferrous metallurgy; 5 in construction and road engineering; 3 in the machine tool industry and 3 in heavy engineering; 2 in the aviation industry; 3 in other industries.

Assessing the real opportunities, it should be understood that it will not be possible to achieve rapid and complete import substitution, in particular, due to the fact that in some areas of activity it will be necessary to start from scratch. Consequently, it is possible to use one of the design processes — reverse engineering [19], when, based on a ready-made set of design documentation, it is necessary to master the production of analogues of imported units and components for emergency and/or planned replacement in the shortest possible time; it is possible to create centralized structures to solve these problems, especially with the state funding.

In order to establish production of domestic high-tech equipment for the oil and gas industry, the issues of creating a unified technology bank, national oilfield service co-operation, the possibility of creating a consortium of Russian enterprises, etc., are being addressed. Nevertheless, domestic manufacturers are already offering their developments.

Rosatom creates cryogenic heat exchangers for large-scale production (to replace German Linde and American Air Products). Rosatom's mechanical engineering division — JSC Atommash (AEM) is a leading manufacturer of cryogenic pumps for medium- and large-scale LNG production. The first in the history of the Russian petrochemical industry large-capacity pump for liquefied natural gas, developed and manufactured by OKBM Afrikantov, a part of AEM, was put into commercial operation in 2020. It is used to load LNG onto gas tankers. AEM is currently working on developing and manufacturing a pilot model of the first Russian liquid turboexpander with maximum use of domestic components, and is also developing the first LNG shipment stands. The delivery of the pilot sample of the stand for the Russian LNG project is scheduled for 2024. In the fu-

[18] Arctic LNG-2 is getting more expensive. URL: https://www.kommersant.ru/doc/6068141/ (accessed 26 November 2023).

[19] Reverse engineering (or reverse design) is the process of developing design documentation (DD) and/or a 3D model of a product based on a finished product sample, i.e. the DD and/or 3D model are not developed from scratch, but are restored based on a finished product.

ture, there will be an expansion of the assortment and localization of a wide range of equipment for large-capacity LNG production projects, LNG icebreakers and gas tankers carrying out LNG shipments [20].

JSC United Engine Corporation (UEC, part of Rostec State Corporation) [21] developed and manufactured a GTA-8 unit with a capacity of 8 MW at the Rybinsk enterprise UEC-Gas Turbines, which will be used in the PJSC Gazprom project on an ice-resistant platform in the Kara Sea to develop the Kamennomysskoe More field. Four GTA-8 units will be part of the GTES-32 power plant. The GTA-8 is driven by a GTD-8RM gas turbine engine manufactured by UEC-Saturn, the automated control system (ACS) was supplied by Elna (Moscow), and information equipment of the research and production company Sistema Service (St. Petersburg) is used.

In 2023, UEC-Saturn (part of Rostec State Corporation) manufactured the first serial gas turbine GTD-110M in the Russian Federation. This high-tech unit has surpassed its foreign counterparts in many parameters and brought Russia into the world league of manufacturers of such equipment.

The Leningrad Metal Plant (part of Power Machines Corporation) has created a 155-megawatt GTE-170 system (gas turbine + generator) for electrical installations. Power Machines Corporation is implementing the gas turbine production project with the support of the Russian Ministry of industry and trade. The total investment volume is over 15 billion rubles, of which 4.6 billion rubles are government subsidies. The planned production volume is 8 turbines per year by 2025 with subsequent increase in output.

JSC RUMO (Nizhny Novgorod Machine-Building Plant) is ready for serial production of 1 MW gas piston power plants running on natural gas. These engines from JSC RUMO are used for operation of compressors, as a ship unit, propeller shaft drive and other areas; the production volume is 40–50 engines per year, at the current stage an investment project is being launched to expand capacity to 100 units per year. Customers include the United Shipbuilding Corporation (USC), PJSC Gazprom, and others.

JSC Ural Steel [22] presented innovative steels with improved characteristics and capable of replacing foreign models. One of the areas of application is the creation of LNG storage tanks.

The C3D Labs Company [23] (a subsidiary of ASCON) has developed a domestic design program “Compass-3D” — a computer-aided design (CAD) system. The program is mainly used by engineers and designers in those industries that require schematic visualization of various objects — in instrument making, metallurgy, construction, mining, agriculture, etc. [23; 24]. The development required 17 years of painstaking work from Russian specialists, but the result is worth it. Thanks to it, there is no need to do a lot of work on adapting complex software complexes for new

[20] JSC Atommash. URL: https://www.aemtech.ru/ (accessed 25 October 2023).
[21] JSC United Engine Corporation. URL: https://www.uecrus.com/ (accessed 25 October 2023).
[22] JSC Ural Steel. URL: https://uralsteel.com/ (accessed 25 October 2023).
[23] C3D Labs. URL: https://c3dlabs.com/ru/company/about/ (accessed 25 October 2023).

operating systems — it is enough to go through the WINE@Etersoft, which ensures this compatibility.

According to the Union of Oil and Gas Producers of Russia, there are a number of domestic enterprises capable of producing high-tech products in the direction of creating technological sovereignty: SDO Obukhov Plant, Generatsiya Group, GMS Group, Uralmash-Izhora Group, ZAO NPF CKBA, NPO Vint, OJSC Barrikady, OJSC Katayskiy Pump Plant, OJSC Mashprom, OJSC NIITFA, OJSC NIKIMT-Atomstroy, OJSC Novaya Era, OJSC Proletarskiy Plant, OJSC Silovye Mashiny, OJSC Tekhnoros, OJSC Uralvagonzavod, OOO Uralmash NGO Holding, OOO Elektrotyazhmash-privod, FSUE SPO Analitpribor.

Conclusion

The Arctic is for the most part a Russian territory, an area of cooperation, ready for interaction with other countries. State support measures are being successfully implemented in the Arctic territories, new enterprises are being commissioned — 56 enterprises were commissioned in 2022, 47 have already been commissioned in the first half of 2023; more than 700 new investment projects are being implemented; infrastructure is being developed; living conditions for people are being created.

Speaking about the strategic development plans for the oil and gas industry, in particular, the Long-term program for the development of liquefied natural gas production in the Russian Federation, designed until 2035, we can confidently say that the foundation for subsequent development has been laid, and the solution of the tasks set is a matter of time.

Leading energy companies — Rosatom State Corporation, PJSC Novatek, PJSC Gazprom, PJSC Rosneft Oil Company, PJSC Gazprom Neft, etc. — as well as related enterprises are working on developing and localizing special equipment, creating domestic technologies for large-scale LNG production, programs for the exploration and production segment, carrying out research and development, and much more. In particular, PJSC Novatek has begun implementing the Murmansk LNG project, which provides for a significant increase in LNG production in the Arctic zone. Novatek's strategy includes the construction of the Volkhov–Murmansk gas pipeline with a capacity of 40 billion cubic meters, which will supply the Murmansk LNG. The measures for power supply of this project from the Kola NPP have been agreed upon and are being implemented, which is a distinctive feature in the use of electric drives of process compressors instead of gas turbines.

PJSC Novatek plans to use its own liquefaction technology "Arctic Mix", the capacity of one line will be about 7 million tons per year, the localization of the project is 70-75% of domestic equipment and components.

As a result, it should be noted that Russia is launching mega-projects that will further lead the country to technological sovereignty: today, 10 mega-projects have already started to create high-tech products, in particular, the production of medicines and medical devices, chemical, electronic and radio-electronic products, unmanned aircraft systems, machine tools, diesel engines, the production of liquefied and natural gas, the production of ships and aircraft. The total investment in each project will be at least 10 billion rubles. As a result, long-term demand for domestic products in these areas will be formed, not only by industrial enterprises, but also by socially significant sectors of the economy: healthcare, fuel and energy and transport complexes. Nevertheless, technical isolation, an attempt to do everything by own forces is a way to nowhere. Russia is part of the global world, where development is impossible without international partnerships.

The technological sovereignty of the country created on the basis of the domestic scientific instrument park will form a stable “immunity” to geopolitical factors.

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