

## MISSION OF TYUMEN STATE UNIVERSITY IN THE PERIOD OF INTENSIVE ECONOMIC DEVELOPMENT OF THE ARCTIC TERRITORIES IN THE YAMAL REGION

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**Abstract.** *The mission of Tyumen State University is to contribute to sustainable development of the Arctic through the pursuit of education and research. The basic national interests of the Russian Federation in the Arctic are to use the territories as a strategic resource base which provides social and economic development of the country along with the preservation of unique ecological systems of the Arctic. The strategic Arctic resources are mostly located in the territories of Yamalo-Nenets Autonomous Region. To achieve the national interests the unified network of industrial and transport facilities is arising in the region: development of hydrocarbon deposits in the Yamal Peninsula and adjacent continental shelf, centers for production of liquefied natural gas, construction of a new Arctic sea port and railway access to the Northern Sea, tankers and icebreaking vessels, new oil and gas pipelines. These large-scale projects in the near future will have a geopolitical importance and a significant impact on the economy of the country. At the same time, the Arctic environment is extremely fragile, and scientists have repeatedly stated that irresponsible industrial development can create global environmental problems. Therefore, industrial projects in the Yamal region should be implemented with a research support to ensure environmental safety and sustainable development. To protect the Arctic environment in the period of intensive economic development is the primary objective of the region authorities and industrial companies and the objective is achieved in close cooperation with Tyumen State University. Several environmental projects have been carried out by the University in collaboration with the leading research centers (Institute of the Earth Cryosphere of the Siberian Branch of Russian Academy of Science), Research Center of the Arctic studies, technical departments of Rosneft, Tyumen Oil Research Center.*

**Keywords:** *investment projects, Yamal Arctic territories, environmental protection, university research and training.*

Tyumen State University — a leading educational and research institution in Western Siberia — formulates its mission with respect to the objectives of developing Russian society. According to the University Strategy its mission is to contribute to economic development of Russia and of the Tyumen Region through the pursuit of effective research and applied studies, high technologies and innovations [1].

The high priority of Russia today is to develop its Arctic zone. The Foundations of the Russian Federation Policy in the Arctic Until 2020 and Beyond set the basic national interests of the Russian Federation in the Arctic:

1) to use the Arctic zone as a strategic resource base which provides for social and economic development of the country;

2) to safeguard the Arctic as a zone of peace and cooperation;

3) to preserve unique ecological systems of the Arctic;

4) to use the Northern Sea Route as a national integrated transport-communication system of the Russian Federation in the Arctic [2].

The strategic Arctic resources are mostly located in the territories of the Yamalo-Nenets Autonomous Okrug [3]. The large-scale investment and research projects of the region are aimed at expanding the resource base of the Arctic zone of the Russian Federation and providing the country with hydrocarbon, aquatic biological and other strategic resources. Several ongoing projects can be described:

1) **The Program for the Comprehensive Development of Oil and Gas Fields in the Yamal Peninsula and adjacent offshore areas.** The Program was commissioned by the Russian President and the Government, and worked out jointly by Gazprom company and the Yamalo-Nenets Autonomous Okrug Administration in 2002. According to the Program, the field development process will include the creation of three industrial

zones: Bovanenkovo, Tambey, and Yuzhnaya [4]. The estimated investments will be approximately 300 bn rubles.

2) **Next generation gas pipeline system** which will be a part of the renovated United Gas Pipeline System of the Russian Federation. This unique system will be launched by 2030, and it will include 2500 km of pipelines; 27 booster stations with total power capacity 8,600 to 11,600 MW. The system will be able to carry over 300 bn m<sup>3</sup> of natural gas from Yamal [5]. The investments are amounted over 424.4 bn rubles.

3) **The Messoykha Project** is extremely important for both the Yamal region and Russia since it provides a framework for the development of the Russian most northern oil and gas onshore fields — the Western Messoyakha and Eastern Messoyakha [6]. Full-scale development of the fields is to be started in 2016, with the expected aggregate investment of 17 to 20 billion USD.

4) **The Novoportovskoye Field Development Project** is one of the top priority Yamal projects of Gazprom Neft company for the next several years. A huge oil and gas condensate field will be developed, and the inlet oil terminal near Cape Kamenny, at 2.5 km from the coast, will be constructed. The investment amount in 2013 was 12 to 15 billion rubles, and total capital investment in the development of the field and the construction of oil transportation system will be 320 billion rubles by 2020. By this date the Novoportovskoye oil and gas condensate field will be producing 5 million to 8 million tons of oil per year, with a total output of 13 million tons of oil equivalent [7]. Oil and gas condensate will be transported by tankers with icebreaking support by the Northern Sea Route.

5) **Yamal Liquid Natural Gas Project (Yamal LNG)** is the most ambitious project ever in the Russian gas industry, which includes the development of the Yuzhno-Tambeyskoye natural gas condensate field, and the construction of the natural gas liquefaction plant together with the Arctic port Sabetta. For

processing and liquefaction process onshore facilities will be built — LNG plants with capacity of one million tons per year for three process lines; four LNG terminals with capacity of 160 thousand m<sup>3</sup>; oil pier with two berths. The first phase launch is planned in 2016, the total amount of investments is estimated at 18 bn USD. For transporting of LNG from the port Sabetta 16 new gas tankers of ice class with 140-160 tons carrying capacity will be used.[8]

The future projects are based on the natural resource potential of the Yamal territories and new opportunities of maritime infrastructure, hence they will make a significant contribution to the Russian economy. Moreover, the investment projects of the Yamalo-Nenets Autonomous Okrug are of great geopolitical importance as they are able to make our country the leader of the Arctic development.

The Governor of the Yamalo-Nenets Autonomous Okrug, Dmitry Kobylkin, believes that the unique geographical position of the region is a big advantage for the implementation of the Yamal projects. The transportation facilities of “Yamal LNG”, for example, gives the opportunity to supply liquefied natural gas to the European, North American and Asian Pacific markets through the Northern Sea Route, which significantly reduces the time of supply and transportation costs. This is a basically new export route for the Yamal gas. He said that “the Northern Sea Route from Yamal through the Arctic would be the Russian window to Asia” [9].

At the same time, the Arctic environment is extremely fragile, and scientists have repeatedly stated that irresponsible industrial development can create global environmental problems [10]. Having in mind the strategic importance of these projects for the whole nation, the country must prioritize health and well-being of its citizens, their sustainable future, and safe environment [11].

Therefore, industrial projects in the Yamal region should be implemented with a research support to ensure environmental safety and sustainable development of the Arctic. According to the Foundations [12] the objectives of Russia in the sphere of science and technology are the provision of a sufficient level of fundamental and applied scientific research involving the accumulation of knowledge and the creation of modern scientific and geoinformational facilities for the effective management of the Arctic territories and the creation of well-functioning systems of life support and industrial activities in the specific Arctic environment and climate.

One of the peculiarities of the economic development of Yamal is that all stages of oil and gas industry have a wide range of impacts on practically all components of natural ecosystems — air, landscapes, soil, surface and ground water, flora and fauna. And even deep studies of ecosystems’ transformation cannot give a holistic understanding of resource loss, long-term effects of nature disturbances. In this regard, comprehensive environmental studies of ecosystem functioning in the period of intense oil and gas development is of particular importance, and new theoretical foundations for environmental sustainability of the Arctic territories, for monitoring and remediation of disturbed areas are highly demanded.[13]

Environmental research has been the key point of cooperation between Tyumen University, scientific organizations, public authorities of the Yamalo-Nenets Autonomous Okrug and operating companies. In accordance with the Strategic Program of Innovative Development of Tyumen State University for 2010-2020 the main activities of the University include basic and applied research in priority areas of science and technology [14]. For better results the University integrates its research and educational programs as well as works jointly with industrial companies, West-Siberian

Oil and Gas Innovation Center. Also the University actively participates in the international research cooperation.

A number of the University units are involved in environmental research and practice. The main two are University Techno-park and Research Institute for Ecology and Rational Use of Natural Resources. Also there are specialized laboratories and centers — International Research Laboratory for the comprehensive study of climate change, land use and biodiversity; Center for Industrial Engineering and Geoinformatics; Center for Chemical Analysis and Identification of Substances, Nanotechnology Center for Oilfield Applications; Center for Biotechnology and Gene Diagnostics, Center for Environmental Education; Research and Technology Center “Ecology”; Environmental Research Laboratory, Laboratory of Water Quality [15].

These units have been successfully working on environmental projects for many years. Their areas of excellence include:

- environmental monitoring,
- engineering and environmental survey,
- biodiversity studies and protected areas planning,
- environmental impact assessment (EIA),
- measuring and valuing of environmental impacts,
- GIS and remote sensing data decryption materials,
- disposal of drilling and hydraulic fracking waste,
- remediation of oil-contaminated and disturbed lands,
- surface waters cleaning-up,
- hydrocarbon-oxidizing microorganisms,
- environmental design,
- energy saving technologies and environmental audits.

One of the priority areas for the University is training specialists and experts for maintaining environmental protection and sustainable resource use in the Arctic. Recently a big contribution has been made by joint projects of Tyumen University and leading research centers of the Russian Academy of Science. Research and technical centers of the Russian oil and gas companies (Rosneft Research and Technical Center, Tyumen Oil Research Center) also carry on researches jointly with the University.

For example, Tyumen University and the Institute of Earth Cryology are establishing a modern scientific and educational station for permafrost studies, studies of technological transformation of landscapes and biodiversity of the Arctic ecosystems. The station will be located near the town of Nadym (approximate coordinates (65 ° 21'39.29» north latitude, 72 ° 57'12.99» east longitude) in the area of continuous permafrost. In the immediate vicinity there are some natural areas (the river Nadym, natural sand bulges, different plant associations and faunal complexes of forest-tundra zone). The year-round research will be focused on the analysis of permafrost thermal dynamics and response to climate change and technogenesis, fauna and flora observations; development of land reclamation technologies for the Arctic.

In 2010-2012, the University implemented the project “Water quality in the changing environment and climate of Western Siberia”. In the framework of the project the Federal Government supported a water quality laboratory for the research conducted under the supervision of leading Russian scientists. In 2011, a survey was conducted with a sampling of 55 lakes in the Yamalo-Nenets Autonomous Okrug outside the existing oil and gas fields. As a result some unique data about aquatic ecosystems of the North were obtained. Hydrochemical, hydrobiological and ecotoxicological studies of the northern water objects will be continued in the nearest future.

Much work was done to rehabilitate disturbed and contaminated lands at Bovanenkovo Gas Field in 2010 and

2011. Bio remediation of sludge pits has been doing at the Novoportovskoye field since 2012.

In the conclusion we would like to outline the basic directions of Tyumen University activities which will be aiming for environmental security during the economic development of the Arctic territories in Yamal.

**1. Further research in two main areas — (1) promotion and adoption of new technologies for land reclamation and for cleaning-up oil and gas condensate spills, (2) biodiversity studies.**

In particular, at the Bovanenkovo field anti-erosion measures will be used including phytoremediation technologies. The experimental work at the old exploration wells will be based on mulching and cutting the upper horizon of peat-sand mixture enriched with mineral fertilizers.

A series of studies on the permafrost, on geochemical evaluation of natural environment (air, soil, surface water) will be managed jointly by the University and the Institute of the Earth Cryosphere. Geobotanic and dendrochronological observations on experimental sites in pre-tundra forests are scheduled for the group of scientists from the University and the Institute of the Northern Development (Siberian Department of the Russian Academy of Science). The University will continue to identify and explore the unique natural objects, such as pinery Mangazeya — the northernmost point of growth of Siberian pine and *Pinus sylvestris*. The researchers' team will include students, post-docs, scientists and members of the faculty. Researchers from foreign universities will also be involved in the project.

**2. Scientific and educational stations, designed for long-term research and practical work.**

This project will be implemented jointly by the University, the Russian Academy of Sciences, and operating companies — Rosneft and Gazprom, in cooperation with the leading universities of the Arctic region.

For example, the Nadym experimental station can be used to examine the effectiveness of technologies and the selection of mixtures for phytomelioration. Its advantage is that it is situated in the area of natural sand dunes, as well as man-made wasteland closely to the technological objects (pipeline, compressor station).

Monitoring stations for long-term observations over the landscapes in the permafrost zone will be settled as well.

**3. The development of the “northern-oriented” educational programs aiming at promotion of specific knowledge about the Arctic.**

A challenge of all Arctic projects is a shortage of “arctic-qualified” engineers, managers and other personnel. The potential of many universities to prepare highly-qualified employees for the difficult Arctic development projects is insufficient. To meet this challenge, Tyumen University has taken several steps. It has become the only university in the Tyumen region involved in the Federal Program “Cooperation of universities and industrial enterprises” sponsored by the Russian Government. In 2014, the University launched a basically new project — the Polytechnic School aimed at preparing engineering leaders for the Arctic development. The work of the School is based on three principles.

First, CDIO approach is employed. CDIO is an innovative educational framework for producing the next generation of engineers. The framework provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating (CDIO) real-world systems and products [16]. Second, an interdisciplinary approach is used. The faculty of Tyumen University is capable to give deep fundamental knowledge of

chemistry, physics, mathematics, biology, geography; and their professional expertise helps to training specialists for further broad specialization. The theoretical training is supplemented with specialized “arctic knowledge” courses. Third, a distinctive feature of the Polytechnic School is the interaction of students with their potential employers who work closely with the University — setting their requirements for the competencies and skills, reading courses, offering internship opportunities for students [17]. Geographical location of Tyumen University is a big advantage here. Some distinguished engineering schools are located thousands of miles away, and the opportunities of the Yamal oil and gas companies to attract professionals for new projects are limited. Some big industrial companies have shown their interest in cooperation with the Polytechnic School — Tyumen Electric Steel Company, Gazprom Neft, SIBUR, and Schlumberger. “Fortum” company offers cooperation with its partner universities in Scandinavia and Israel to train experts on alternative energy and heat engineering.

In future the Polytechnic School will also use the University networking opportunities — it will be cooperating with the University foreign partners (California University, Oslo University, etc.) through joint syllabi and internships programs. It is proposed to establish partner relations with world top 200 universities. Their graduate diplomas are recognized without additional procedures on the territory of Russia.

The University is making efforts to develop new programs in English. For example, a new educational program “Sustainable Management of the Russian Energy Sector” has recently be added to the Curriculum. The Russian and foreign students can get professional interdisciplinary competence and knowledge of the history and development of the northern territories; of economic and resource potential of the Tyumen region; of legal framework for oil and gas development in Russia.

**4. Training and retraining program for the personnel jointly with the Arctic universities.**

In 2016 a new program of training highly qualified personnel to work in the conditions of intensive industrial development of the Arctic is developed jointly by Tyumen University, the Department of Science and Innovation of the Yamalo-Nenets Autonomous Okrug and the Russian Academy of Civil Service. The need to develop and implement of such a program is obvious — now the region faces shortage of personnel for its projects and it is becoming a serious obstacle to the realization of the strategic objectives of the Arctic zone development. Experts say there is a lack of regional geologists, hydrologists, oceanographers, specialists in permafrost, cryology. The lack of specialists enhances the environmental problems. The demand of the Yamalo-Nenets Autonomous Okrug is to organize new joint educational and internship programs with the Arctic Universities which have better expertise on the Arctic science and knowledge.

Thus, Tyumen University's mission to advance sustainable development of the Arctic and to serve its region can be realized through research, training, knowledge transfer and international cooperation.

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