

Climate Changes in the Arctic with the Emphasis on Future Industrial Development

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ABSTRACT

Discoveries of oil and gas in the Arctic increased industrial activities and development of natural resources. Russian Federation covers around two thirds of the Arctic, covering Barents Sea, Pechora Sea, Kara Sea, Laptev Sea, and East Siberian Sea. Arctic is populated with more than 4 million citizens. Russian citizens present a dominant population in the Arctic with around 2 million of Arctic habitants with the decreasing trend in last 20 years. The world has a strong demand for oil and gas with an increasing trend in the future. Energy demand requires more exploration activities in northern latitudes. Arctic rich petroleum resources can contribute in future energy needs and attracted world attention for research as well as investments in this region. Arctic showed perspective petroleum potential for new investments in infrastructure and technology. The cost of oil and gas production in the Arctic is almost double than in other areas. Discovered oil and gas resources has attracted many companies and that trend will continue in the future. Oil and gas deposits are under exploration and development, but the capital and operational costs are much higher than other worldwide petroleum provinces.

Beside a large oil and gas resources, Arctic contain an enormous amount of natural gas hydrates, but currently there are no available technologies for secure hydrate extraction. If gas hydrates can be commercially developed, it could be one of the major world gas resources. Global resources of gas hydrates are much higher than conventional gas from the fields. Gas hydrates occur locally over the Arctic Ocean and North Sea. By analogy with current discoveries, gas hydrates can be expected within 1.5 km of the sediment surface within thick Arctic sediments. The harsh and fragile environment creates additional problems for accessibility of petroleum resources. The presence of the ice cover affects on all activities in the Arctic.

Currently, the Arctic is a region under rapid transformation due to climate changes. The most observed effects of climate changes were in the North Pole. The Arctic is changing; ambient temperature becomes higher from year to year, ice is melting creating more ice-free water during summer months increasing transportation period. The ice-free period of most of the Arctic shipping routes were only for about 30 days. Arctic region is under constant heating and there is no exact explanation. According to the latest observations, North Pole is warming twice as fast as the rest of the planet. In the North Pole, sunrays are falling under sharp angle and ice reflects sunrays from the surface. When the ice melts down, the ocean can absorb more sun exposure and raise the temperature of the water. Ice extent in the Arctic is decreasing; the current trend is 2 million of square kilometres per 20 years. With the current trend, the Arctic could become ice-free during summer months in 2040.

The phenomenon of climate changes has recognized as a main concern of the 21st century. The increased concentration of greenhouse gases in the Earth's atmosphere contributes to increasing of temperature. All



theories of climate changes can be classified as anthropological and astronomical. Anthropological theory of climate changes implies that human activities and industry contribute to increasing concentration of greenhouse gases and global warming effect. Most of the scientist addressed the climate changes to the anthropological effect due to high quantities of CO₂ released into the atmosphere from fuel combustion and transportation. According to astronomical theory, climate changes are result of astronomical events including Earth orbital eccentricity, axial tilt of the rotation, and precession. Those events are known as Milankovitch cycles and explain long-term climate changes caused by changes in the position of the Earth in Solar system. His calculations were matched with ice age periods from the past of the Earth. According to the astronomical theory of climate changes, the Earth goes through the cycling climate changes, creating ice ages at the large scales (several thousands of years) that is confirmed by ice core analysis. However, climate changes at smaller scale (several hundreds of years) need to be investigated.

In this study, the influence of the climate changes on future industrial development in the Arctic were analyzed. Based on analysis, recommendations for future research and projects were presented.