

BAZHEN TECHNOLOGICAL CENTRE

NEW INDUSTRIALIZATION OF WESTERN SIBERIA

ESTABLISHING TECHNOLOGICAL LEADERSHIP

The Bazhenov formation consists of a bed of rocks that is 30-80 m thick in Western Siberia at depths of 2,000-3,000 metres over an area of more than 1 million km². According to optimistic estimates, the oil resources in the Bazhenov formation could reach as much as 18-60 billion tonnes¹ and are classified as non-conventional. The rocks in the Bazhenov formation are regarded as similar to North American shale from which shale oil is extracted in the U.S.

One of the largest scientific consortiums in Russia was established to study the Bazhenov formation. It consists of an alliance between Moscow State University, Moscow Institute of Physics and Technology, Gubkin Russian State University of Oil and Gas, and the Skolkovo Technical Centre, where Gazprom Neft is a production partner. The alliance studied 617 m of the core of the Bazhenov formation from nine prospective areas and conducted more than 20,000 experiments.

Now, Gazprom Neft and its partners are setting up the Bazhen Technological Centre at the Palyanovskaya area of the Krasnoleninskoye field in KMAD-Yugra. It will provide an open platform for the development of technologies that can be used not only by oil and gas companies, but also by engineering, oilfield services, machine-building companies and software developers. The project has already been granted national status, and the Centre is scheduled to open in 2018. Approximately

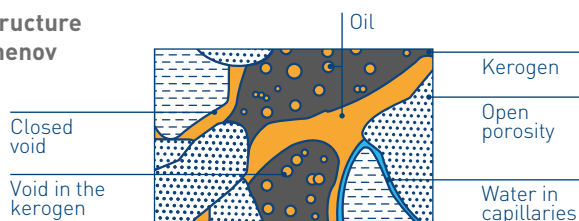
RUB 8.5 billion will be invested in the site by 2021, including investments of RUB 7.5 billion by Gazprom Neft and RUB 685 million in state financing. The Company plans to drill more than 50 wells at the Palyanovskaya area by 2021 followed by another

50 plus wells with hydraulic fracturing by 2027. As the required technologies are developed, oil production from the Bazhenov formation will reach 10 million tonnes per year by 2025, with Gazprom Neft's share making up 2.5 million tonnes of that amount.

Multi-stage hydraulic fracturing (MSHF)

Technology B.3

Internal structure of the Bazhenov formation²



Hydraulic fracturing is a technology in which fluid is pumped into a well, creating cracks in the rock, along which oil enters into the borehole bottom.

Multi-stage hydraulic fracturing is widely used nowadays. The main task of MSHF is to combine small disconnected pores filled with oil into a single hydro-dynamically connected system by creating a sufficiently dense system of artificial cracks using fracturing methods.

Gazprom Neft drilled two horizontal wells with MSHF at the Palyanovskaya area in 2016 and obtained a commercial inflow of 45 tonnes of oil per day. This demonstrated the effectiveness of the basic technology that had been adapted for the Bazhenov formation.

The MSHF Growth software developed by the research consortium jointly with Gazprom Neft was tested at the wells of the Bazhenov formation in 2017. This solution allows for simulating the formation of cracks in the reservoir, calculate the flow of oil, and select the optimal parameters for hydraulic fracturing.

MSHF is used at 80% of the Company's wells.

1 — Potentially recoverable resources that will only be available if the necessary technological solutions are developed.

2 — Author of the image – Doctor of Geological Mineralogical Sciences A.G. Kalmykov.

18-60

BNT OF OIL
GEOLOGICAL RESOURCES

760

MNT
CONSERVATIVE FORECAST
FOR RECOVERABLE
RESOURCES AVAILABLE
WITH THE CURRENT
LEVEL OF TECHNOLOGY

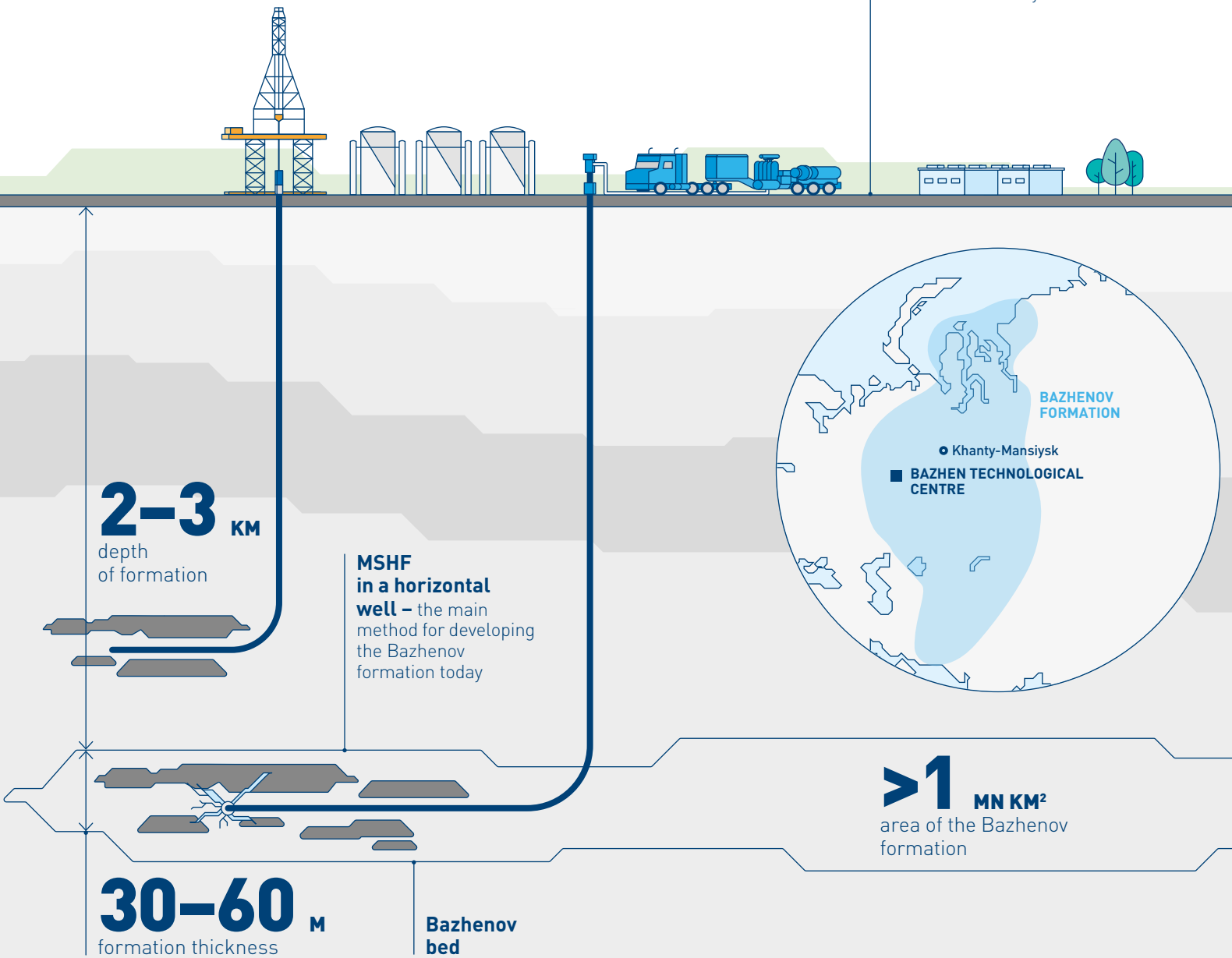
1,000

TIMES
HIGHER PERMEABILITY
OF THE CONVENTIONAL
RESERVOIR THAN THAT
OF THE BAZHENOV
FORMATION DEPOSITS

UP TO 1,000

WELLS PER YEAR BY 2025
PLANNING DRILLING
AT THE BAZHENOV FORMATION

The Palyanovskaya area of the Krasnoleninskoye field in KMAD-Yugra will be the pilot site for the industry



2-3 KM
depth of formation

MSHF
in a horizontal well – the main method for developing the Bazhenov formation today



>1 MN KM²
area of the Bazhenov formation

30-60 M
formation thickness

Bazhenov bed