Can the U.S. Shale Gas and Tight Oil Boom Happen Elsewhere? The Case of Russia

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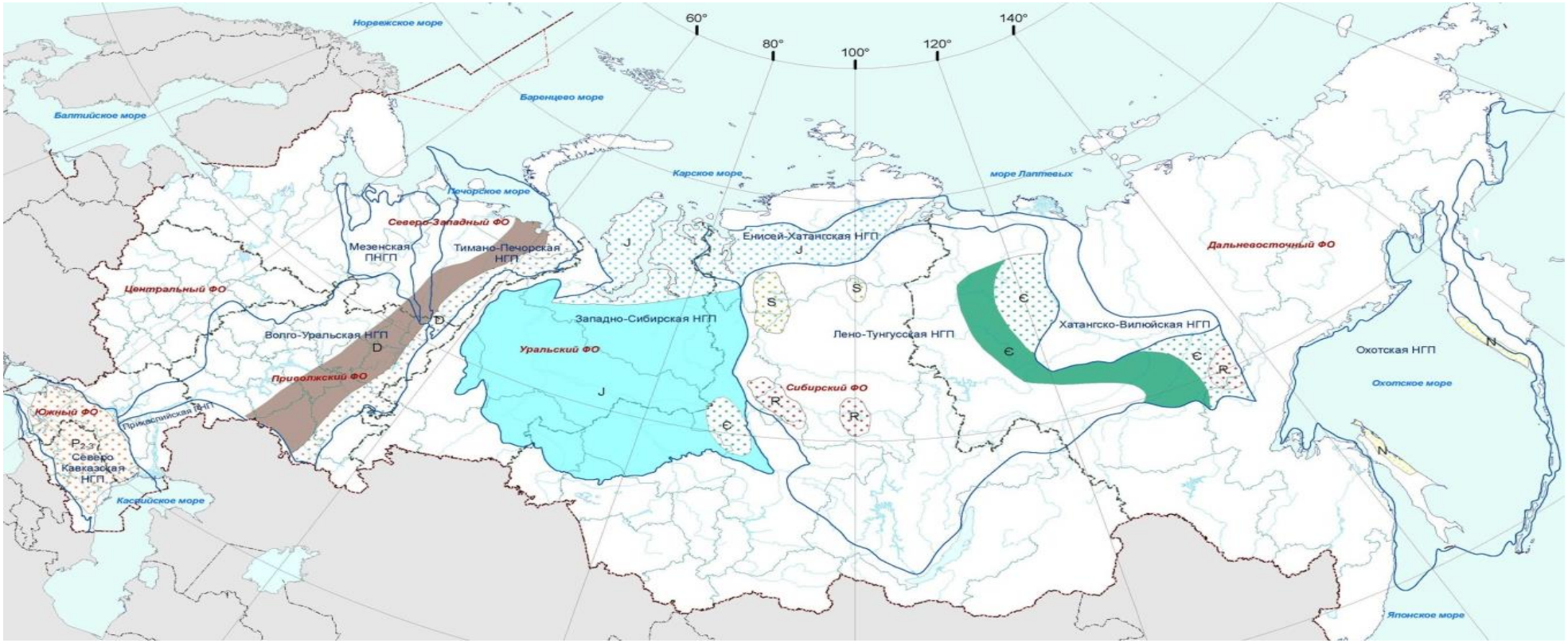
ИНЭИ РАН

New York
4-5 November, 2013

Russia has large unexplored potential of shale gas resources, but abundance of conventional gas makes them unattractive

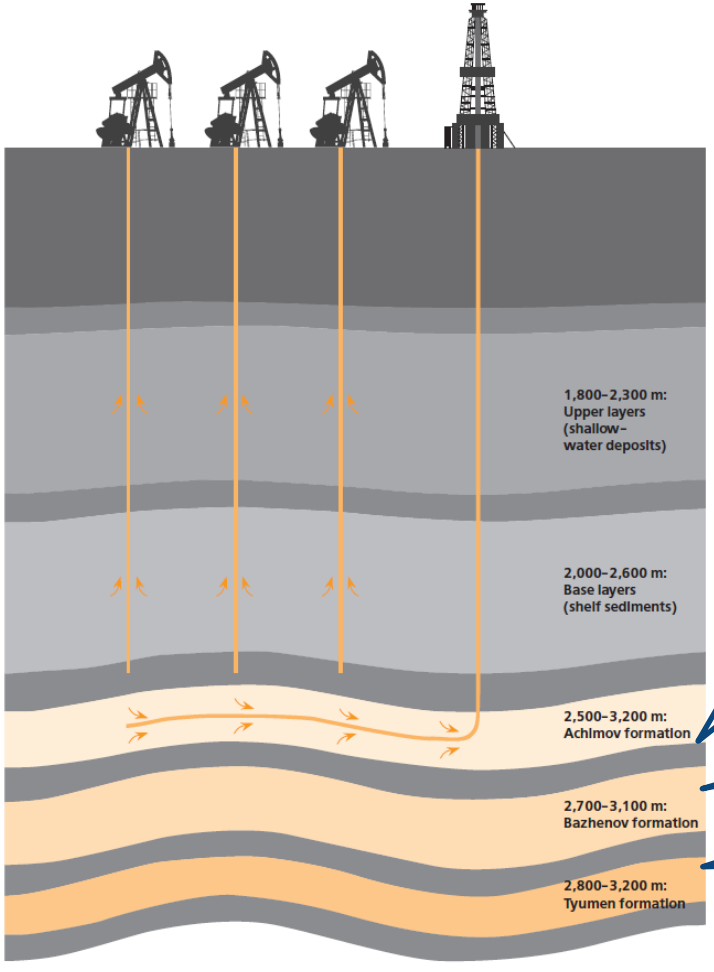


Source: VNIGRI.

VNIGRI ESTIMATES RUSSIAN SHALE GAS RESOURCES AT APPROXIMATELY 49 TCM, BUT THERE ARE NO STAKEHOLDERS INTERESTED IN SHALE GAS PRODUCTION IN THE COUNTRY SO FAR AS PROVEN RESERVES OF CONVENTIONAL GAS ARE 44,5 TCM

Total tight oil reserves in Russia have been put in the range of 15 billion to 1.05 trillion barrels and include three types of formations

Distribution of geological formations



Source: Rosneft. Sberbank Investment Research.

Achimov deposits are located above Bazhenov, making them easier to reach. Oil is locked in tight sandstones confined by shale. Achimov bedrocks feature average porosity but low permeability, but nevertheless have better flow rates and lifetime production than the Bazhenov layer. The cost of drilling at Achimov is slightly lower than at Bazhenov.

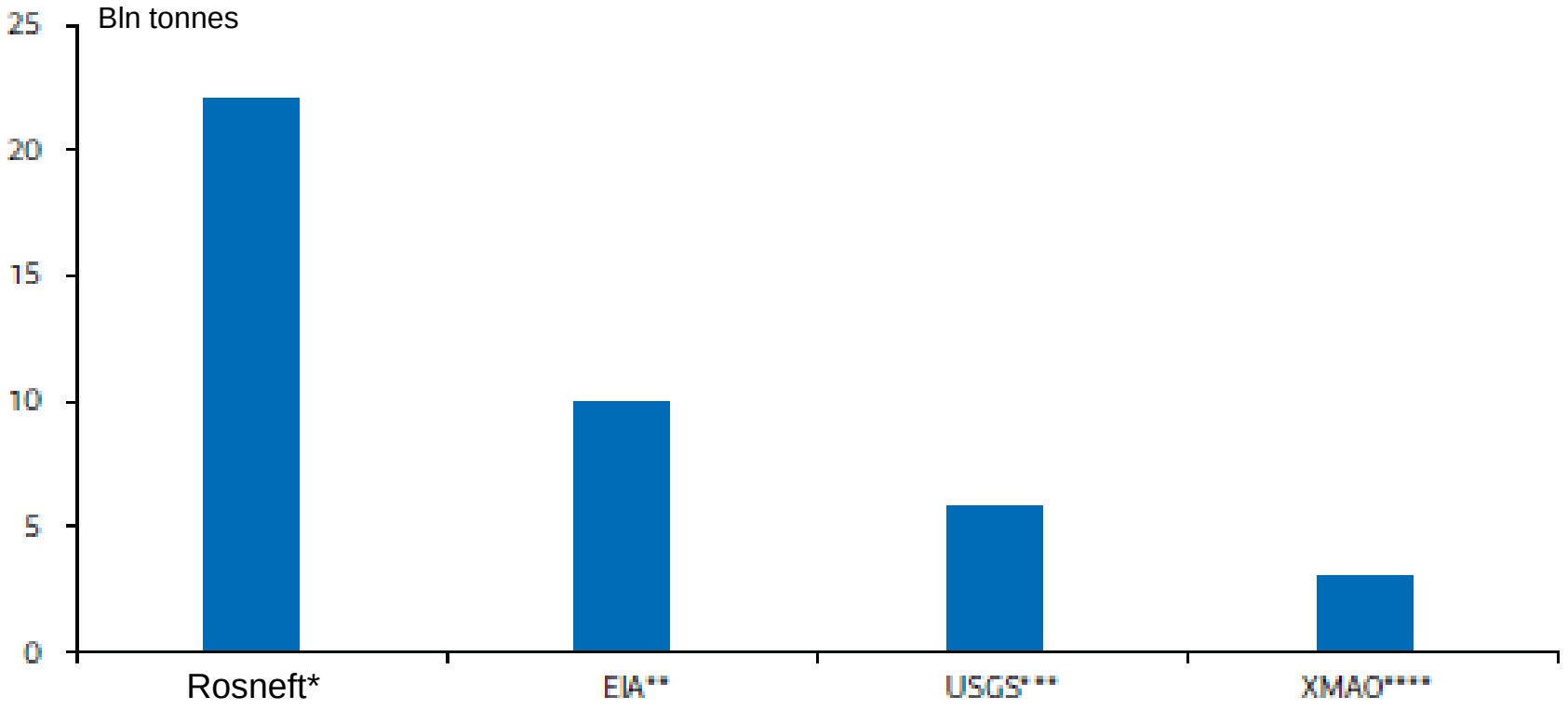
Bazhenov. This is the most often-cited source of unconventional oil in Russia. It has high-quality crude oil in reservoirs of low thickness (10-40 m) at a depth of up to 3,500 m, and covers an extensive area in Western Siberia

Tyumen. The Tyumen formation represents a mix of permeable and impermeable layers of continental origin, it covers the same geographic area as the Bazhenov but at a lower depth of 2,800 to 3,200 metres, tends to contain narrower reservoirs with mixed permeability, making it a more difficult target for drilling and generally more expensive to develop.

Bazhenov rock covers an extensive area in Western Siberia (22 times the size of the Bakken)

Source: SKOLKOVO Energy Center

Bazhenov rock resource estimates vary from 3 to 145 bln. tonnes (CERA) and 403 bln. tonnes (Ritek)



* Презентация к CERA week (2013)
** World Shale Gas and Shale Oil Resource Assessment
*** Ulmishek, G.F., Petroleum geology and resources of the West Siberian Basin, Russia: U.S. Geological Survey Bulletin 2201 (2003)
**** Центр рационального природопользования ХМАО им. В.А. Шпильмана (2010)

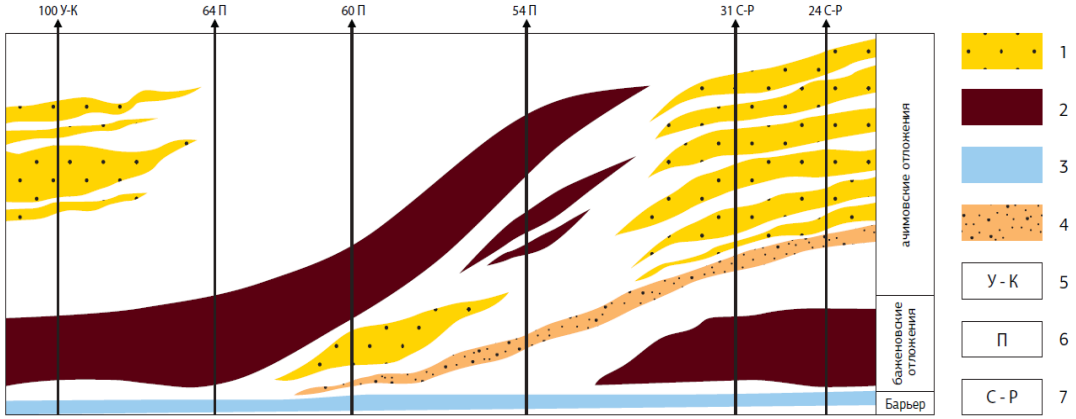
Source: SKOLKOVO Energy Center

Bazhenov rock has many similarities with Bakken, but it contains mainly kerogen (oil shale) and therefore demands different technologies for its development

Comparison of Bazhenov rock and Bakken formation

Index	Bazhenov rock	Bakken formation
Area, mln km²	2,3	0,52
Formation thickness, m	10-30	3-45
Porosity, %	3-8	3-12
Average occurrence depth, m	2 700-3 100	2 100-3 300

Currently all production is concentrated in the areas of so-called abnormal Bazhenov rock profiles

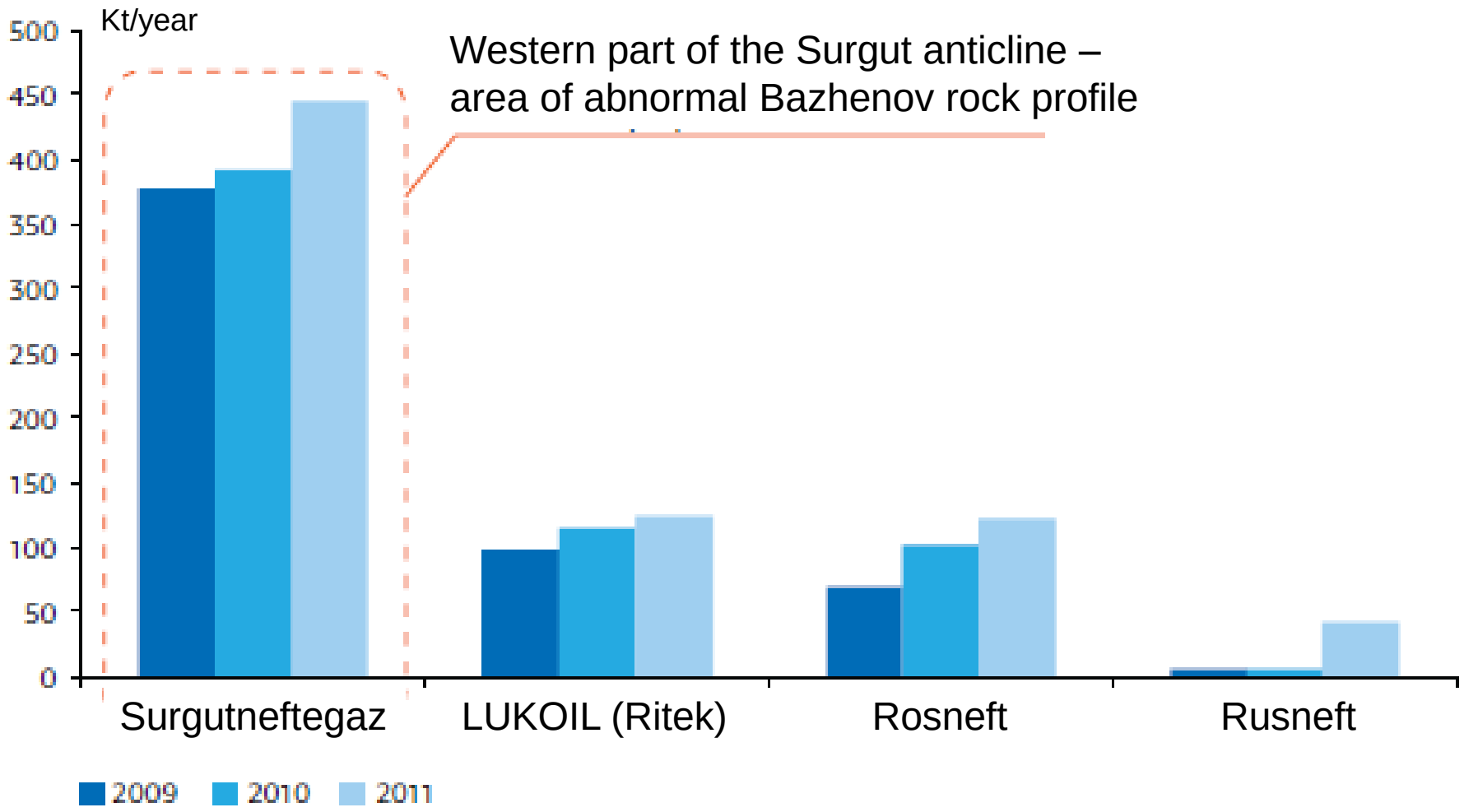


1. Песчаник;
2. Битуминозные породы;
3. Георгиевские отложения;
4. Песчано-алевритовые отложения;
5. Усть–Котухтинское месторождение;
6. Повховское месторождение;
7. Сардаковская площадь

MULTISTAGE FRACKING IS NOT VERY EFFICIENT IN BAZHENOV ROCKS DUE TO THINNER COLLECTORS AND HUGE VARIATIONS IN THE COMPOSITION OF ROCK EVEN IN ONE AREA AND UNEVEN PRESSURE. EFFICIENT TECHNOLOGIES TO TRANSFORM KEROGEN INTO OIL ARE LACKING SO FAR. NEW TECHNOLOGIES HAVE TO BE DEVELOPED IN ORDER TO INCREASE BAZHNOV PRODUCTION.

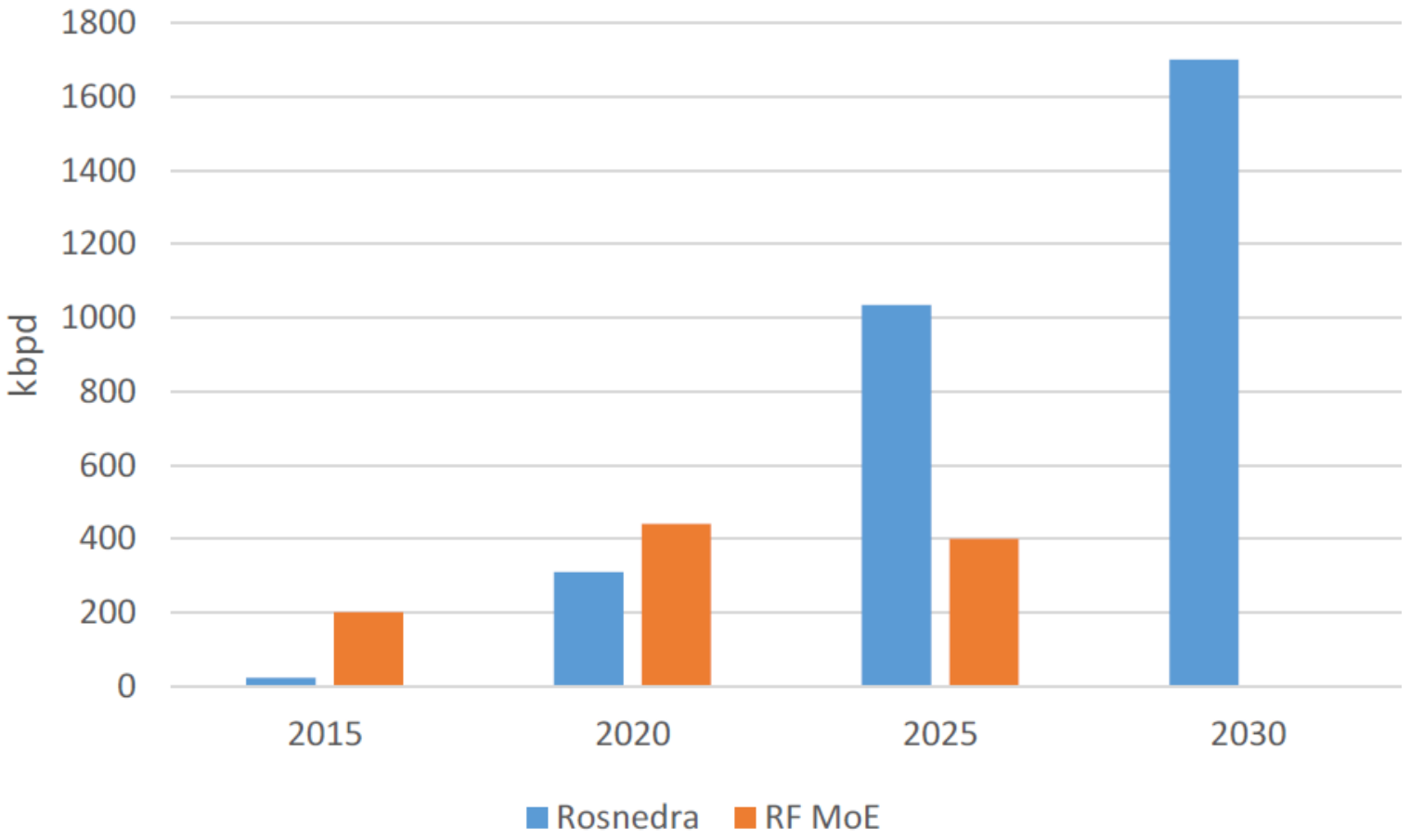
Sources: Sberbank Investment Research, Oil & Gas Journal, CERA, LUKOIL, SKOLKOVO Energy Center

Current Bazhenov rock production in Russia



Sources: Natural Resource Department of Khanti-Mansiysk Region

Even Government forecasts for tight oil production in Russia differ considerably – from 10-20 to 76 mln. tonnes per annum



Sources: Ministry of Natural Resources of Russian Federation; Ministry of Energy of Russian Federation

1 SHALE GAS IN RUSSIA

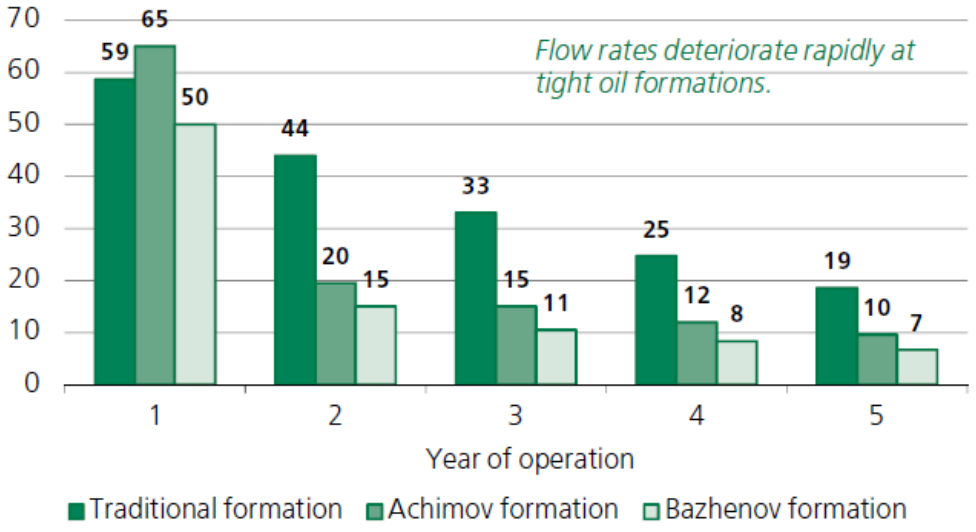
2 TIGHT OIL, SHALE OIL AND OIL SHALE RESERVES

3 POTENTIAL TIGHT OIL PRODUCTION

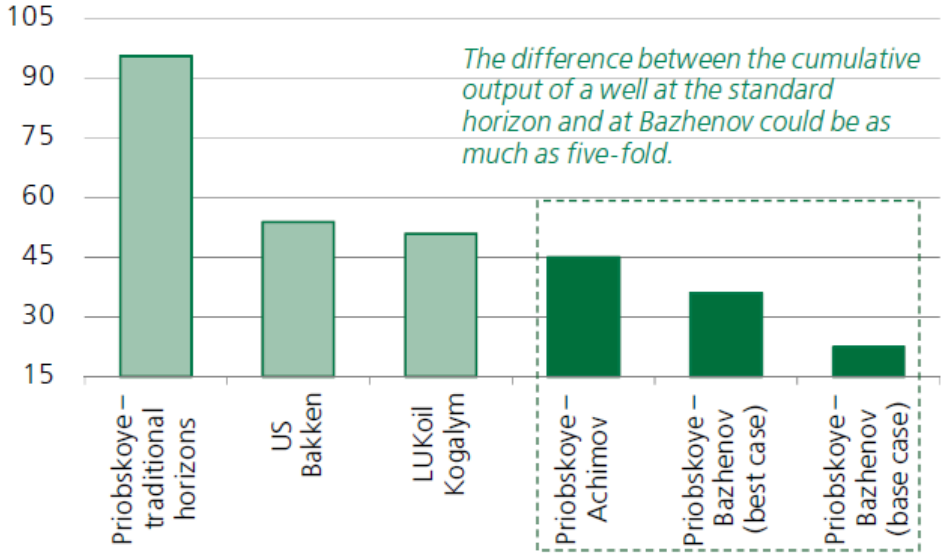
4 **MAIN LIMITING FACTORS**

Tight oil has much lower flow rates and lifetime output per well

Flow rates comparisons for horizontal wells at Yuganskneftegas, tpd

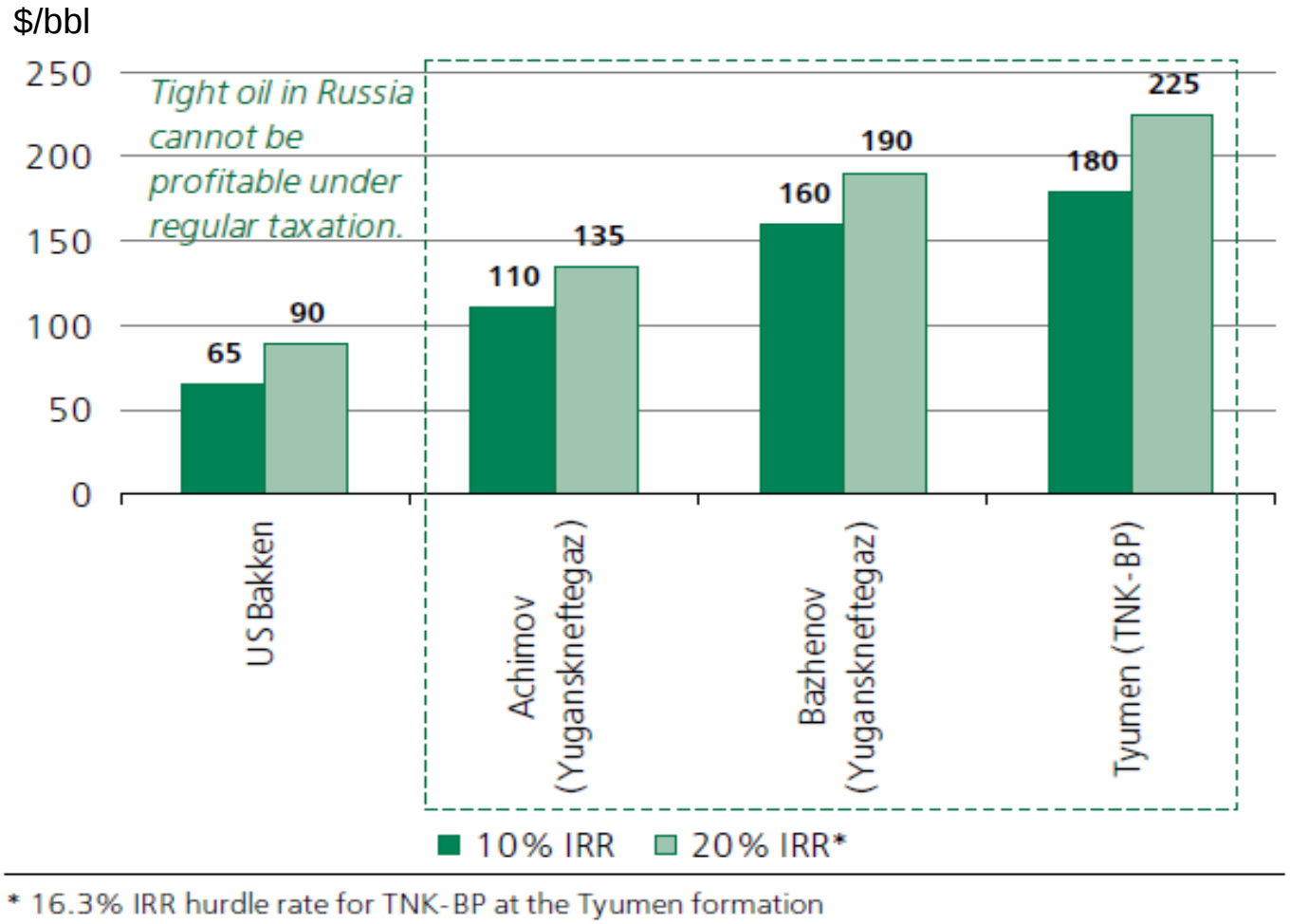


Estimates lifetime output per well, kt



Source: CDU TEK, Rosneft, Sberbank Investment Research.

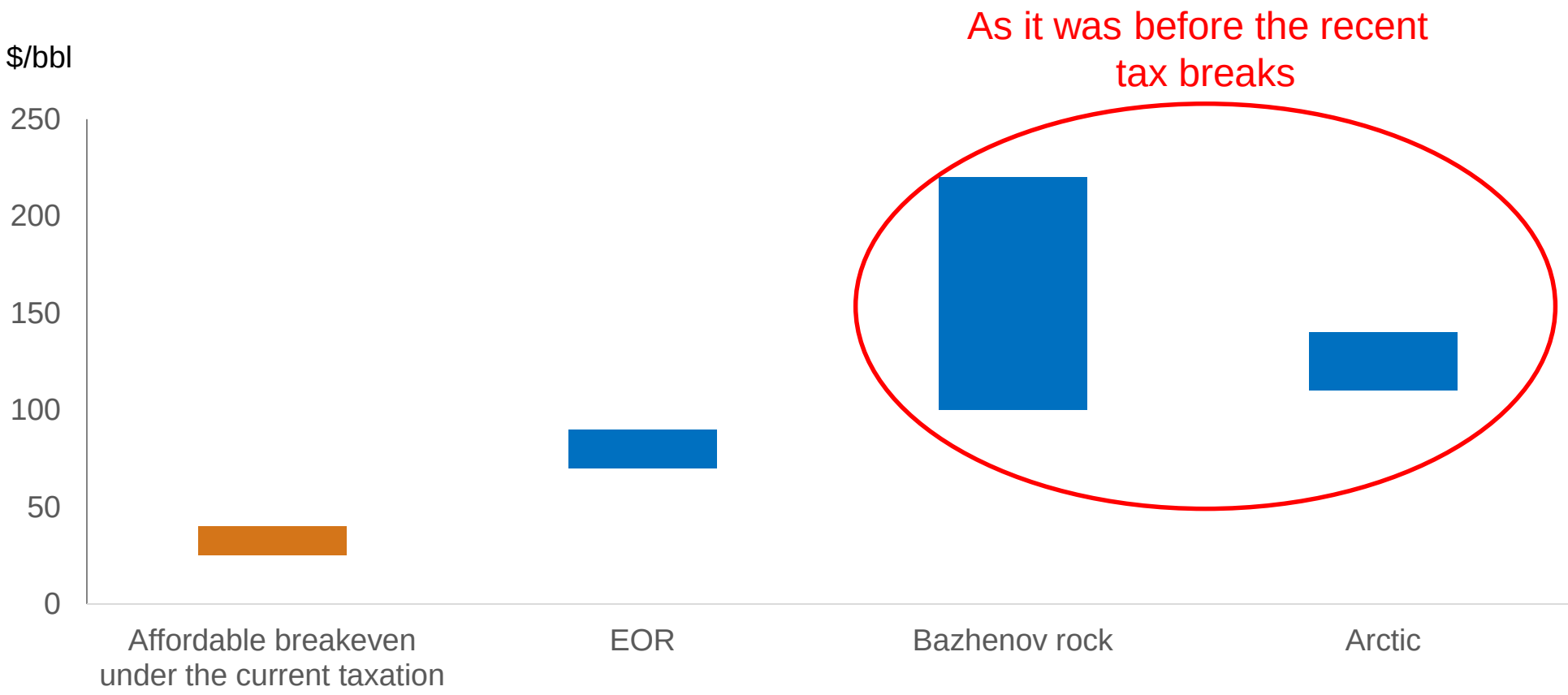
Russian tight oil economics: oil price necessary to reach a rate of return



* 16.3% IRR hurdle rate for TNK-BP at the Tyumen formation

Source: Sberbank Investment Research.

Taxation: the Government is not ready to change the system for profit-based taxation, therefore all the exemptions are currently adjusted in the manual regime



Source: ERI RAS.

Other limiting factors

- ***Law on Strategic Reserves*** – introduced in May 2008, limits foreign involvement in fields with reserves above 70 mln.t for oil and 50 bcm for gas. Any fields larger than this, or located offshore, must have a Russian company as a majority shareholder.

- ***Licensing*** - the licensing regime tends to favour larger companies. Much of the Bazhenov shale reservoir lies below existing licenses and fields in West Siberia and is the main source rock for oil in the region. In some instances the licenses for shallower reservoirs also extend down to the deeper shale layers, and so the large companies which dominate Russian production have extensive Bazhenov exposure by default. Even if the current licenses do not currently extend down to the Bazhenov, however, it is expected that companies owning the shallower licenses will be able to extend their exploration to the deeper horizons as a matter of course. As far as new licenses are concerned, GazpromNeft has identified acreage containing a potential 8−10 billion tons (60–75 billion barrels) of resources that has yet to be allocated in the Khanty-Mansiisk region alone, so the possibility of new entrants arriving still remains. Given the current government preference towards state-controlled institutions, however and the implications of the Law on Strategic Reserves discussed above, it would seem likely that the majority of this new acreage will go to the same group of companies that currently dominate the industry.

- ***Corporate landscape****.* The Unconventional Gas Centre in North Dakota lists 89 companies that operate in the Bakken shale area of the US alone, and it is this diversity of corporate involvement as well as the small and adaptive nature of many of the companies that has been at the heart of the success of the unconventional oil and gas industry in that country. The corporate landscape in Russia is in sharp contrast to the dynamic smaller company model in the US, with a few large companies leading the way, dominated by the country's NOC Rosneft. In Russia only four large and vertically integrated companies (now that Rosneft owns TNK-BP) are heading the drive to develop the Bazhenov reservoirs in co-operation with their new international partners.

Other limiting factors

- ***Environment and water issues*** - Russia has some strict environmental laws that can impose severe fines on companies that cause damage through leaks or harmful waste disposal, and it is currently unclear whether these might need to be adapted further to account for the increased activity that would result from significant horizontal drilling and well fracking involved in the development of tight and shale resources. The fact that temperatures remain below zero for a significant part of the year may require state approval for a broader network of heated pipelines to manage winter water supply, the expansion of road transport fleets and storage facilities to cater for water provision at different times of the year and an adaptation of the rules for water extraction and injection that are currently managed by the Ministry of Natural Resources.
- ***Manpower requirements*** - much of the country's skilled oil industry workforce is already heavily engaged in stemming the decline of the country's existing assets, if a dramatic increase in drilling is required to accelerate unconventional output, then it is likely that significant additional manpower will be required that cannot just be shifted from existing fields.
- ***Service industry*** - the number of heavy oil rigs, which are capable of drilling the deep horizontal wells in Bazhenov, will need to triple if the Ministry of Resources target is to be met, raising a question about the ability of the oil service industry to meet the possible $15 billion expenditure requirement. Furthermore, the industry will also have to expand its ownership of fracking equipment and other operational items.

TAKING INTO ACCOUNT ALL THE LIMITING FACTORS, IT SEEMS THAT RUSSIAN TIGHT OIL PRODUCTION WILL GRADUALLY MATERIALIZE AS THE STATE WILL FURTHER EXTEND TAX GRANTS, BUT IT WILL BE YEARS BEFORE IT WILL MATERIALIZE IN THE TOTAL RUSSIAN OIL OUTPUT. THE GOVERNMENT'S PROJECTIONS OF OVER 400 KBPD OF TIGHT OIL MAY BE ACHIEVABLE. BUT A SHALE REVOLUTION THIS WILL NOT BE.

Contacts

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"Global and Russian Energy Outlook up to 2040"
http://www.eriras.ru/files/Global_and_Russian_energy_outlook_up_to_2040.pdf

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