Russia’s Arctic Resources: Opportunities and Challenges

Anatoly Zolotukhin

RUSSIAN GUBKIN STATE UNIVERSITY OF OIL AND GAS

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Oil and gas in a modern world
Global energy consumption

Source: Korzhubaev, presentation at RAEN, April 2008

Russia's Arctic Resources: Opportunities and Challenges
Growth of the global energy demand

Global demand (mill tonn o.e.)

- Gas
- Oil

<table>
<thead>
<tr>
<th>Year</th>
<th>Global Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>3,341</td>
</tr>
<tr>
<td>2003</td>
<td>6,029</td>
</tr>
<tr>
<td>2030</td>
<td>9,488</td>
</tr>
</tbody>
</table>

Source: IEA WEO 2005, base scenario

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World Primary Energy Substitution

Energy security challenge: Global Consumption

- Governments face the challenge of making long-term decisions and investments in a time of great uncertainty that is only exacerbated by the financial crisis.
- For businesses, any disruption to the power supply can be hugely damaging—one need only look at the blackout of 2003 that brought chaos to several states of the US for a very real example of the potential risks.
- Consumers are also increasingly aware of what energy security means to them, in terms of what they spend on their fuel bills and how much it costs them to fill up at the gas station.
- Physical security: how vulnerable are local supplies to interruptions? Do we have adequate diversity, back-up, storage and emergency planning?

Global Oil and Gas Reserve Base
Global Oil Reserves

Global oil reserves

Potential resources of the Russian Arctic shelf – 30 Billion tones
Global Gas Reserves

Global gas reserves

Russia

Trillion CM

Potential resources of the Russian Arctic shelf – 70 Trillion CM

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Potential resources of the Russian Arctic shelf – 100 Billion TOE

Russia

Iran

Saudi Arabia

Qatar

UAE

Iraq

Turkmenistan

Venezuela

Kuwait

Nigeria

USA

Kazakhstan

Algeria

Billion TOE

Global Petroleum Reserves

Russia's Arctic Resources:
Opportunities and Challenges
Russian Arctic Offshore – HC Potential

Distribution of the world HC resources

- 25% Russian Arctic shelf
- 50% North Africa, Middle East, Caspian
- 25% Rest of the world

100 x 10^{12} m^3
(100 TCM)

Source: RF Ministry of Natural Resources, 2007
Oil  Billion-Barrel AUs (>50% chance)

Source: B. Pierce, Seward Conf, May 2009
South Kara ~651 TCF
South Barents ~318 TCF
North Barents ~221 TCF
AK Platform ~122 TCF

Source: B. Pierce, Seward Conf, May 2009
Russian Petroleum Industry
Russia: petroleum Industry – a leading sector of the economics

Russia's GDP

- 80% Other
- 20% Petroleum Industry

Petroleum Industry:
- Biggest part of GDP
- Highest return on investment

Budget revenue

- 57% Other
- 43% Petroleum Industry

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Russia's oil production until 2030 by regions

Russia's oil production forecast

Russia's Arctic Resources: Opportunities and Challenges
Russia's gas production forecast

Annual production, billion cub m

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Stagnation of the industry due to lack of investment potential

Two possible developments during the next 5-years (2009-2013):

- No solutions to the investment challenges: oil production falls down to 450 million ton by 2013 (5-year plan)
- With solutions: oil production growth up to 511 million ton by 2013

Source: Ministry of Energy, Rosneft
Rational use of associated gas – need for a state policy in increasing energy efficiency

Utilized and flared associated gas, billion m³

- Utilized 70%
- Flared 30%

Explanations

- Limited access to gas transport system
- Undeveloped infrastructure for utilization of associated gas

Annual economic loss due to associated gas flaring amount to $ 750 million (gas price $50/1000 m³)

Russia's Arctic Resources: Opportunities and Challenges
New regions – challenges in project development

Arctic offshore fields

- Severe climate conditions
- Presence of ice
- High cost
- Long distance export of oil and gas – additional heavy cost
- Lack of technology, competence and experience in offshore field development
- Deficit of qualified personnel
- Environmental risks, not yet fully understood
- Emergency response time
Russian Arctic Offshore – Exploration status

Ref.: Varlamov, Stavanger, 2007

Total number of geophysical traverses - 112 ths km

- Offshore acreage release areas to January 1, 2005
- Russia Federation’s relative maritime boundaries and “gray zone”
- The continental shelf limits of Eurasia
- The complex geophysical traverses of regional survey net
Russian Arctic Offshore – Exploration status

Number of exploration wells

Exploration coverage, km/km²

Russia's Arctic Resources: Opportunities and Challenges
Keeping the energy balance: RRR

Why exploration program is so important?

Two important indicators:

1. Annual production
2. Reserves base

Production is always constrained: \( p = k \cdot R \)

However, we are interested in production growth: \( p_n = (1+a) \cdot p_{n-1} \)

Then *Reserves Replacement Ratio* (RRR) is:

\[
RRR = \frac{S}{P} = \frac{1+a}{k(1+a)} \approx 1 + \frac{a}{k}
\]
Keeping the energy balance: RRR

Reserves Replacement Ratio for oil and gas (Russia)

RRR for oil

RRR for gas

Russia's Arctic Resources: Opportunities and Challenges
Arctic shelf development – a long term strategic task

Source: Rosneft

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[Kommersant, April 21, 2008]. Rosneft … is to develop Russian shelf together with Gazprom, has estimated the required investments: they will run to $2.64 trillion until 2050.

This is 2.5 times Russia’s 2007 GDP.

Bogdanchikov (Rosneft CEO) says $680 billion will have to be invested in geological prospecting, and $1.96 trillion in development.
International cooperation – powerful resource for the development of offshore fields

How to attract foreign companies

- Stable and predictable laws and regulations
- Standards and norms for Arctic shelf development
- Organization of joint projects financing
- Management of large projects
- Establishment of service infrastructure in Russia
- Transfer of competence and experience to Russian subcontractors
- Stable access to market outlets

<table>
<thead>
<tr>
<th>Western seas</th>
<th>Far East</th>
</tr>
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<tbody>
<tr>
<td>Oil reserve</td>
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<tr>
<td>Oil resources</td>
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<tr>
<td>Gas reserve</td>
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Eastern seas

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Future development of RACS will depend on

- State program for exploration of the Arctic shelf
- Conditions for attracting international experience and competence and foreign capital
- Rapid transfer to a stimulating tax system based on profit taxation
- Tax holidays on production of oil, natural gas and gas condensate from continental shelf
- Modernization of Russia’s Arctic sea ports
- Introduction of economic stimuli for the development of petrochemical industry and export of oil products
- Law enforcement and state program for efficient use of associated gas and development of gas chemistry
- Internationalization of education
Development of oil and gas field in the arctic seas located few hundreds miles from shoreline is according to experts opinion the most challenging project in the world.

Without international cooperation, coordination of all activities and use of modern and proven technologies for production of hydrocarbons, their transport, efficient safety and environmental protection tools realization of such project would be questionable.
Thank you!

Prof. Anatoly Zolotukhin
E-mail: zolotukhin.a@gubkin.ru
Phone/Fax: +7 499 135 75 16