Russia’s Polar Oil and Gas Activities

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Oil and gas in a modern world
Global energy consumption

Source: Korzhubaev, presentation at RAEN, April 2008

Russia's Polar Oil and Gas Activities
Growth of the global energy demand

Source: IEA WEO 2005, base scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>Global Demand (mill tonn o.e.)</th>
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<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>
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Source: IEA WEO 2005, base scenario
International character of the oil and gas supply

- More than 75% of oil and 40% gas cross international borders
- Russia: more than 70% of oil production and 30% of gas production are delivered to the world market
- European market: 26% of crude and almost 40% of oil and its products are supplied from Russia
Structure of the energy consumption

Source: IEA

Russia's Polar Oil and Gas Activities
Global Oil and Gas Reserve Base
Global Oil Reserves

Global oil reserves

Russia's Polar Oil and Gas Activities

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

Global gas reserves

Potential resources of the Russian Arctic shelf – 70 Trillion CM

Russia's Polar Oil and Gas Activities
Global Petroleum Reserves

Global Oil and Gas reserves

- Russia: 56.7 Billion TOE
- Iran: 47 Billion TOE
- Saudi Arabia: 43.4 Billion TOE
- Qatar: 27.4 Billion TOE
- UAE: 19.1 Billion TOE
- Iraq: 18.7 Billion TOE
- Turkmenistan: 18 Billion TOE
- Venezuela: 15.8 Billion TOE
- Kuwait: 15.8 Billion TOE
- Nigeria: 10.1 Billion TOE
- USA: 9.6 Billion TOE
- Kazakhstan: 8.5 Billion TOE
- Algeria: 6 Billion TOE

Potential resources of the Russian Arctic shelf – 100 Billion TOE
Russian Arctic Offshore – HC Potential

Distribution of the world HC resources

- 50%
- 25%
- 25%

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

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

Source: RF Ministry of Natural Resources, 2007
Russian Petroleum Industry
Petroleum Industry – a leading sector of Russian economics

- Biggest part of GDP
- Highest return on investment

Russia's GDP

- 80% Other
- 20% Petroleum Industry

Budget revenue

- 57% Other
- 43% Petroleum Industry

Russia's Polar Oil and Gas Activities
Petroleum’s Share in GDP and Budget Revenue

PI Investments (in billion USD):

- Construction – 6.0
- Metallurgy – 0.7
- Pipes – 1.8
- Machine building – 4.4
- Cargo transport – 1.7
- Petroleum service – 9.4
- Other – 6.0
- Total – 30.0 billion USD

GDP cumulative gain: 46.6 billion USD

Source: Ministry of Energy RF, 2009
*converted in USD by AZ
Factors of the Russian oil industry sustainable development in 2000-2008

2000-2008:

- Production from fields discovered and developed in FSU
- Stabilization of politics and tax regime
- Oil price growth from $27 to $95 for barrel
- As a result, growth of income from the oil industry, establishment of stabilization fund

Source: Ministry of Finances, 2008
Russia's oil production until 2030 by regions

Russia's oil production forecast

Annual production, million tones:

- Far East
- East Siberia
- West Siberia
- European part

Russia's Polar Oil and Gas Activities
Russia's gas production until 2030 by regions
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
Present fiscal policy and tariff setting rules — too high impact on the industry

- At current macroeconomic conditions almost 70% of the revenue of oil companies is paid back as taxes and transport tariffs
- Present fiscal policy and tariff setting rules have too high impact on the oil industry

Source: S. Bogdanchikov, April 2009
Change of taxation system – conditions for sustainable development of oil industry

Investment deficit

- 93% of field development projects unprofitable due to high taxes and tariffs
- Deficit in 2009: $ 9.1 billion
- Deficit in 2009-2013: $ 85 billion
- Requirements for sustainable development in 2009-2015:
  - Profit taxation
  - Development of petrochemistry
  - Gas chemistry development and gas monetization

Source: Ministry of Energy

Russia's Polar Oil and Gas Activities
Rational use of associated gas – state policy in increasing energy efficiency

Utilized and flared associated gas, billion m$^3$

- Flared 14.30%
- Utilized 47.70%

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 $50/1000 m$^3$)
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
Shtokman development – challenges and opportunities

Challenges

- Long distance to shore – construction of multiphase pipeline which doesn’t have analogs
- Harsh climatic conditions (limited access to the field, ca. 4 months a year)
- Very complex sea floor in combination with a high sea depth – very challenging technical solutions
- High cost, need for external financing
- No analogs in the world’s practice – need for nonconventional technology solutions and their integration
Shtokman development – challenges and opportunities

Opportunities

- Huge gas reserves secure stable and long-term contracts
- Possibility to diversify gas deliveries to Europe and to USA depending on market conditions
- High gas quality minimizes expenditures on gas processing
- Low temperatures favorable for minimizing energy consumption for gas liquifaction
- Gas from Shtokman directly to Germany increases projects economic efficiency
- Relatively short distances to market (US East coast, Canada, Mexico) secure competitiveness of the Shtokman gas
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

- Russia total
- North Sea

Exploration coverage, km/km²

- Russia total
- North Sea
Russian Arctic Offshore – 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:

\[
RRR = \frac{S}{P} = \frac{1 + a}{k(1 + a)} \approx 1 + \frac{a}{k}
\]
Russian Arctic Offshore – RRR

Reserves Replacement Ratio for oil and gas (Russia)

RRR for oil

RRR for gas
Russian Arctic Offshore – investment requirements

- [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.
Arctic shelf development – a long term strategic task

![Graph showing unit cost for different regions]

- Developed regions: 30-50
- Eastern Siberia: 60-80
- Far East shelf: 200-300
- Arctic shelf: 500-700

Source: Rosneft

Russia's Polar Oil and Gas Activities
Foreign companies – 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

Russia's Polar Oil and Gas Activities
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!

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What do we have for building technology for the future?

- Substantial base of technology
- Gained experience and competence
- Work processes and methodology
- Training of specialists
Technology for the Future

- Integrated subsea solutions (processing and separation, re-injection, boosting)
- Selection of efficient transport solutions
  - *Multiphase transport*
  - *Shipping of oil, gas and their products*
- Gas power plants with CO₂ capture and its re-injection into subsurface strata:
  - *Aquifers – for storage*
  - *Oil reservoirs – for enhanced oil recovery*
- Integrated project management systems
- Global eco-monitoring system with international “quick reaction forces”
Resource management and the need in coordination

… Our aim is to create conditions for co-existence of different industry sectors, especially, fisheries, oil and gas and marine transport.

Activity extension and growth of the number of participants using natural resources [in this region] requires well established coordination to enable the ecosystem be the basis for value creation for many years to come
Our Common Task

To conduct a sustainable development that "meets the needs of the present generation without compromising the ability of the future generations to meet their own needs"

(Brundtland Commission report, 1987)