European Arctic Oil and Gas Resources: 

Basis for petroleum activities in the 21st century

Prof. Anatoly Zolotukhin

Gubkin Russian State University of Oil and Gas
National Research University

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Agenda

- Definition of the Arctic
- Petroleum/energy resources of the Arctic
- Challenges and opportunities associated with the development of the Arctic HC resources
- Exploration status and development cost
- Future of the Arctic
Definition of the Arctic

The Arctic is defined by:

- Arctic marine boundary
- The Arctic circle
- Temperature (10°C July isotherm)

Source: Arctic Monitoring and Assessment Program (AMAP)
Why Arctic is so important?

Arctic is believed to be an area with the highest unexplored HC potential in the world.

By 2035 the demand for oil and gas will grow globally by 18% and 44%, respectively.

60% of planned oil and gas production in 2035 will be from fields, not yet found and discovered.

Ref.: DNV Summer project 2011, World Energy Outlook, Oil & Gas Journal, USGS
Arctic Petroleum Resources
World Ocean HC Resources

Ref.: A. Kontorovich, RAO-2009

World Ocean Resources, BTOE

World Ocean Resources, BTOE

Ref.: A. Kontorovich, RAO-2009
Energy Resources in the Arctic

30% of the world’s undiscovered natural gas and 13% of the world’s undiscovered oil in the Arctic (source: USGS)

- North Africa, Middle East, Caspian Sea
- Rest of the World

1. South Kara Sea
2. North Kara Sea
3. Laptev Sea
4. East Siberian Sea
5. Chukchi Sea
6. Alaska North Slope
7. East Greenland
8. Barents Sea

Source: O.A. Lindseth; 2011
Assessment of Undiscovered Oil and Gas in the Arctic
Donald L. Gautier, et al. Science 324, 1175 (2009); DOI: 10.1126/science.1169467
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Undiscovered Gas
Arctic Offshore – HC Potential

Arctic resources and technically recoverable reserves, BTOE

Legend:
First letters: R – resources; TRR– technically recoverable resources (reserves);
Second letters: A – the whole Arctic; RA – Russian Arctic; RAO – Russian Arctic Offshore

Ministry of Natural Resources
Russian Academy of Sciences
VNIGRI
USGS
Zapivalov
Petrologica
Summary on Russian and European Arctic conventional petroleum resources
Russia’s conventional HC reserves & resources

Ref.: D. Khramov, Rus-Norw Seminar, June 20, 2011
HC Resources of the Russian Arctic Shelf

Most recent estimates of the RAS HC resources, BTOE

Total: ca. 100 BTOE

D. Khramov, 2011
A. Kontorovich, 2009
HC Resources of the Norwegian Arctic

NCS resource accounts
(per 31.12.2009)

- Undiscovered
- Contingent resources in discoveries
- Contingent resources in fields
- Remaining reserves
- Produced

Source: NPD, Facts book, 2010
HC Resources of the Norwegian Arctic

Reserves Distribution on NCS
(as of 31.12.2009)

Source: NPD, Facts book, 2010
Europe Arctic Offshore – HC Potential

Arctic HC resources, BTOE
Available: 82 BTOE

Oil and gas production forecast from the Northern seas

41.7 BTOE – Europe Arctic resources

26.10.2012
3-nd NRBF, Oslo
Metocean conditions and technology 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
New regions – challenges in project development
New regions – challenges in project development

Figure 5 Mobile Drilling unit with subsea completion (ref.: Zolotukhin, et al., 1999)
New regions – challenges in project development

Figure 6 Subsea complex: Templates, X-mas tree, manifold system (Nergaard, 2010)
Technology Tunnel concept

Illustrative, wet tunnel as example, for production phase only

Develop oil/gas fields from a shoreline base

Technology Tunnel
- Build dry. Wet or dry drilling/production
- L < 30 km, D 6+ m, Cavern 35 m high
- Max depth 350 m below sea level

Authors: Prof. O.T. Gudmestad, Prof. A.B. Zolotukhin and Russian MSc and PhD students A. Khruleenko, O. Bychkova, T. Mokshaev, F. Domanuyk, 2009
Development opportunities
Europe Arctic Offshore – HC Potential

Arctic Europe Petroleum Resources and Infrastructure
Kirkenes
in pole position

The Municipality of Sør-Varanger

Available at: www.sherpakonsult.com
Europe Arctic Offshore – HC Potential

Former ”Grey Zone” development opportunities

Russian estimates show that HC potential of the area of ca. 170,000 km² amounts to 6.8 BTOE, mainly gas

USGS estimates are somewhat 4 times lower – ca. 1.7 BTOE

To successfully develop this zone a “Unitization principle” is required

Source: Sherpa Konsult, 2010. Available at: www.sherpakonsult.com
Barents and Pechora seas with their almost 31 billion TOE* of oil and gas resources represent one of the most attractive areas of the petroleum resources development.

Discovered in the Barents Sea:

- 2 gas-condensate fields – Shtokman and Ledovoye
- 3 gas fields – Ludlovskoye, Murmanskoye and North-Kildinskoye

Potentially interesting structures – in the Fersman-Demidov shoulder, Shatsky, Vernadsky, Medvezhy and Admiralteisky swells.

Source: Sherpa Konsult, 2010. Available at: www.sherpakonsult.com

* Russian part of the former Grey Zone HC resources is included in this evaluation
Yamal gas resources are estimated at ca. 15 TCM

Total resources of the Kara Sea and Yamal exceed 50 BTOE (75% – gas)

This is more than 50% of the total resources of the Russian shelves

Available at: www.sherpakonsult.com
Future development opportunities
The Barents Sea: An area of international energy cooperation
Exploration status and development cost
Russian Arctic Offshore – Exploration Status

Number of exploration wells drilled offshore is unacceptably low:
- Pechora Sea: 1 well per 9,000 km²
- Barents Sea: 1 well per 27,000 km²
- Kara Sea: 1 well per 80,000 km²
Keeping the energy balance: RRR

Exploration expenditures, all Russian shelves

Total reserves to be prepared, million TOE

> 1 trillion $
Concluding remarks

Challenges associated with the development of Arctic resources:

- Environmental & Reputation
- Geological
  - Low exploration status
- Political
  - Territorial disputes
  - Security of Supply
- Economics/Costs
  - High CAPEX / OPEX and transportation cost
- Competing resources
  - Shale gas & CBM, lower cost OPEC oil
- Harsh environment

Source: K. Mørk, DnV, 2012
We can have a safe, secure and reliable development of arctic resources… only through cooperation, not competition, among arctic nations.

Any other way of doing this… will not benefit any nation in the long run.

Assistant Secretary of State Daniel S. Sullivan,
Oct. 15, 2007
In the second part of XXI century production of HC in the Arctic petroleum mega basin will be as important in energy supply as Persian Gulf and West Siberia basins today

A. Kontorovich, RAO-2009
Thank you!

Prof. Anatoly Zolotukhin
E-mail: anatoly.zolotukhin@gmail.com
Phone/Fax: +7 499 135 75 16