New Opportunities of the Oil and Gas Resources Development in the Barents Sea Region

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Presentation at

SPE Moscow Section

Moscow, May 15, 2012

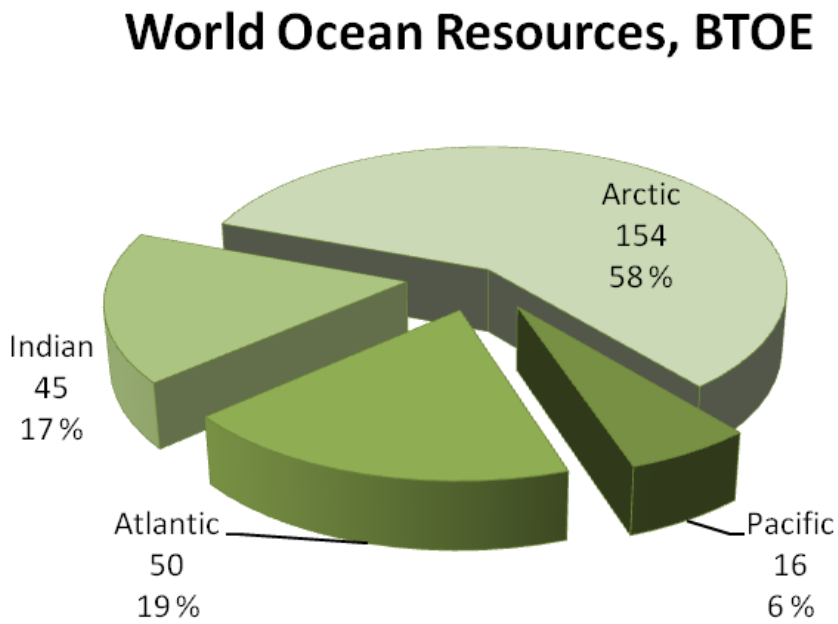
Новые возможности освоения нефтегазовых ресурсов Баренцевоморского региона

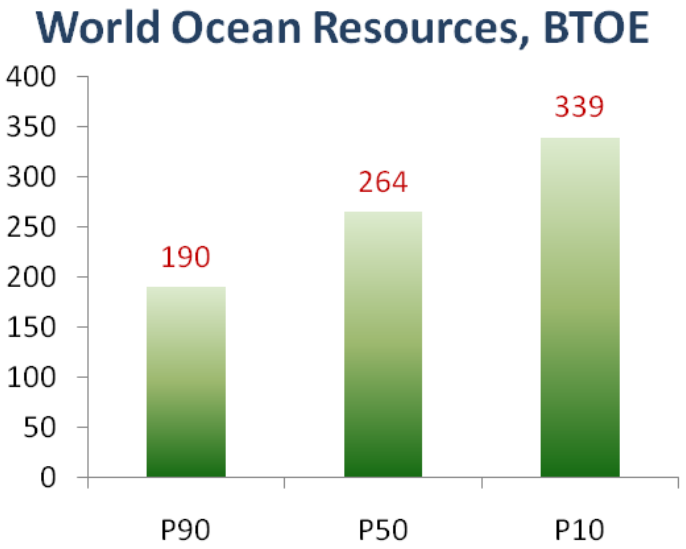
World Ocean Petroleum Resources

УВ запасы мирового океана

World Ocean HC Resources

УВ ресурсы мирового океана





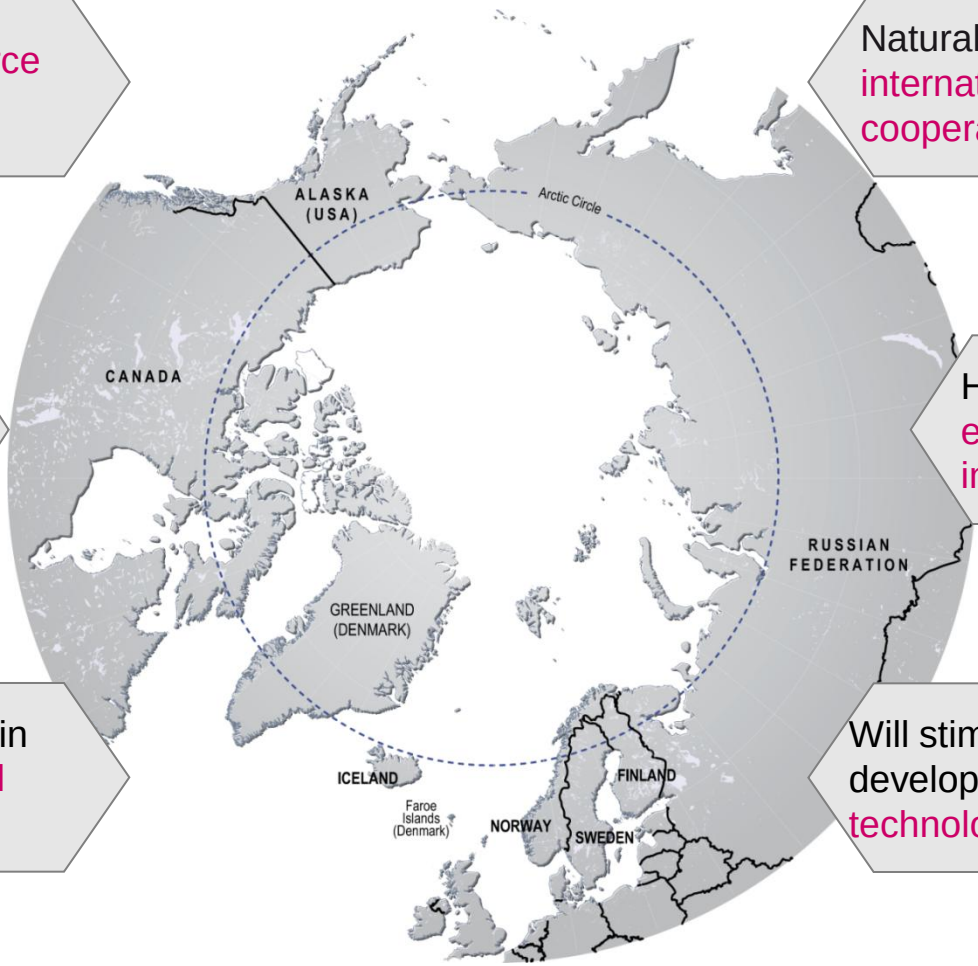
Ref.: A. Kontorovich, RAO-2009

The New Arctic Perspective

Новые перспективы в Арктике

Significant resource potential

Natural arena for international cooperation



Not distant from world markets

Highly vulnerable environment & indigenous population

Will play a key role in the long term global energy supply

Will stimulate development of new technology

Ref: T. Kydland, Rus-Norw Seminar, June 20, 2011

XXI century – active development of the world ocean HC resources

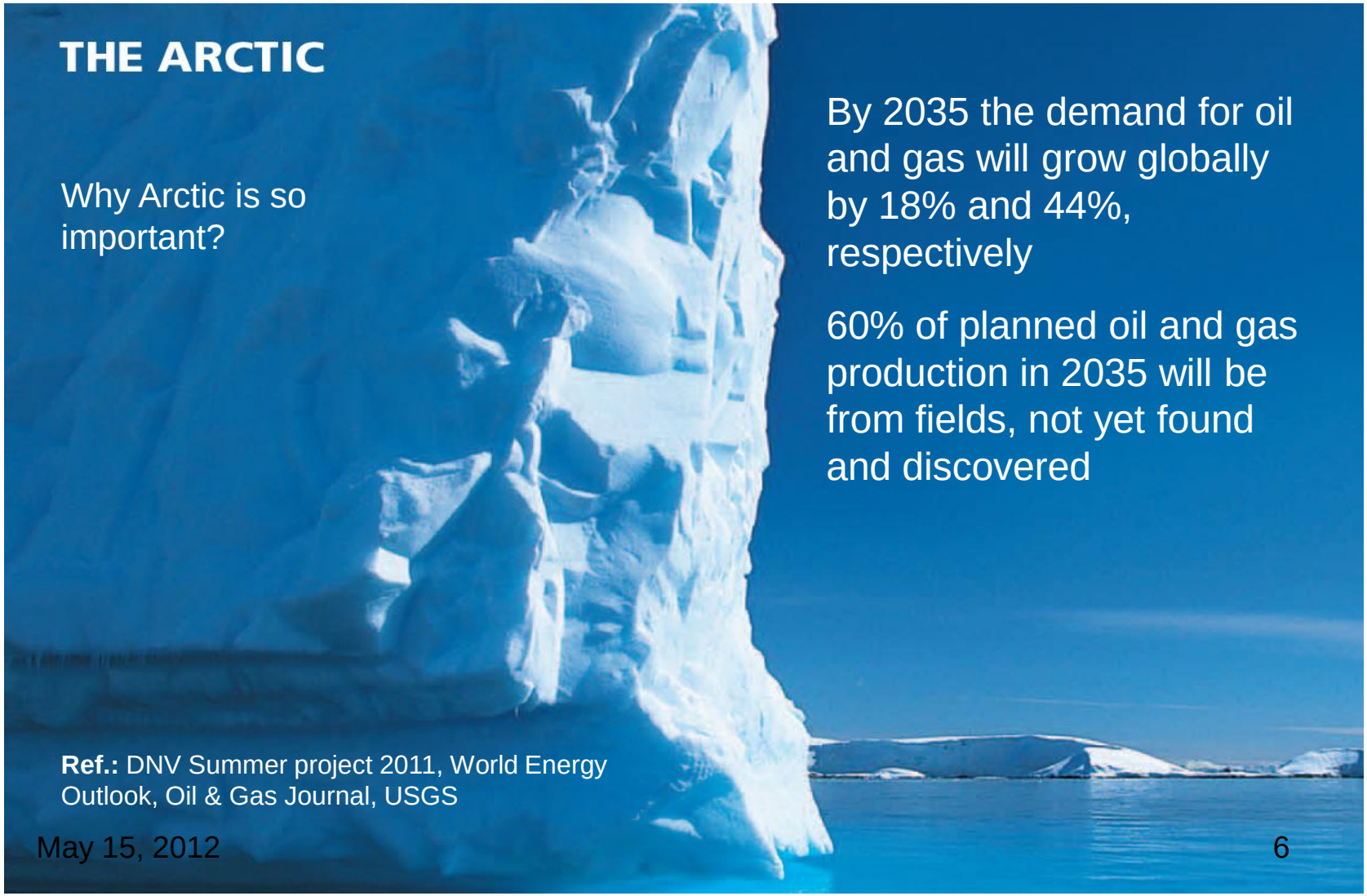
Активное освоение УВ ресурсов мирового океана в XXI веке

- Participating countries: 55
- Annual production:
  - Oil – 1 BT
  - Gas – 0.8 TCM
- Investments: 350-360 Bln USD annually
- Number of platforms: 7000
- Total length of pipelines: 120 000 km
- By 2015 the oil production from the ocean will reach 39% of the global oil production

Ref.: Dmitrievsky, A.N. and Eremin, N.A. Smart field conf, Moscow, 2012

World Ocean HC Resources

УВ запасы мирового океана

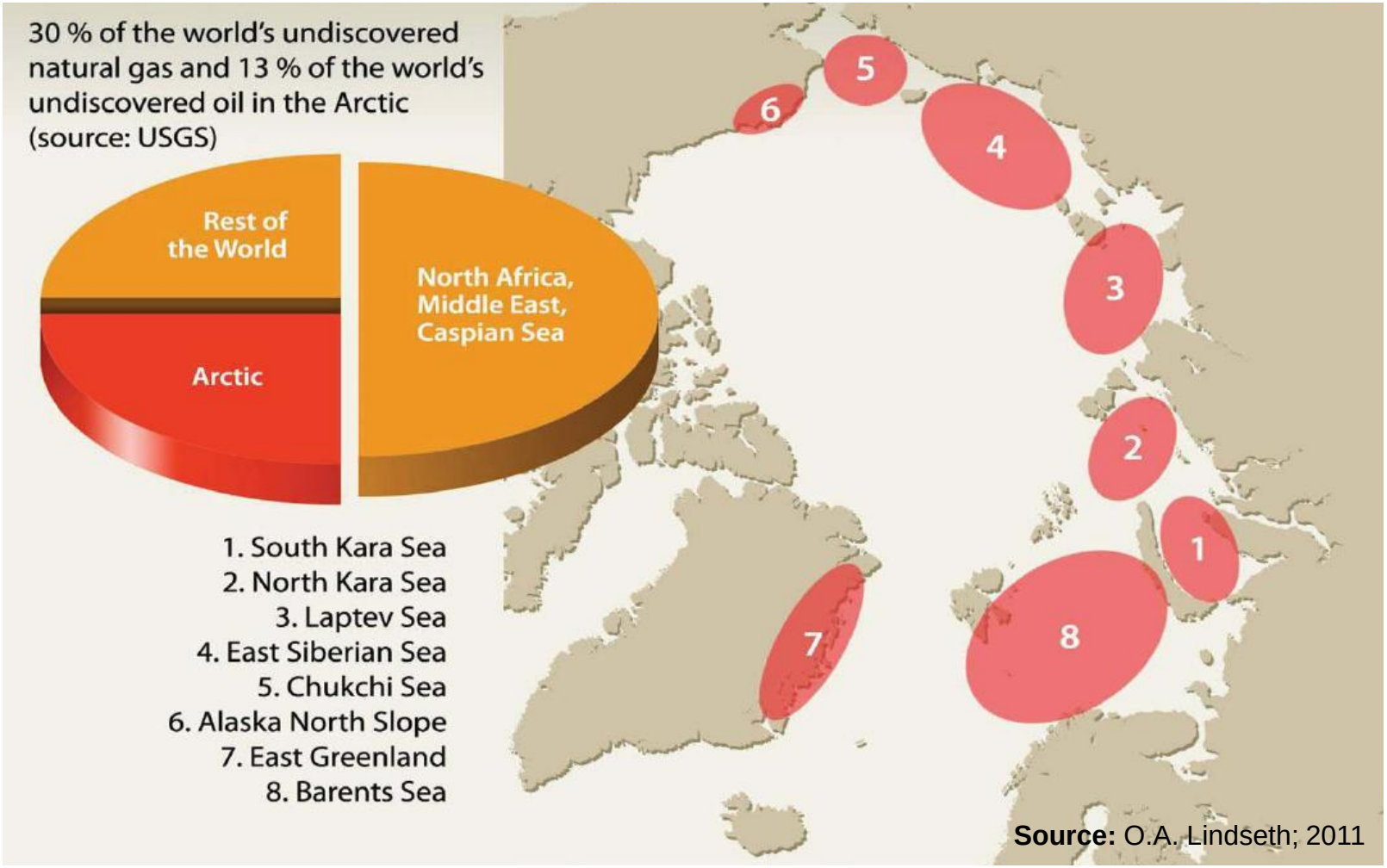


Arctic Petroleum Resources

УВ ресурсы Арктики

Energy Resources in the Arctic

Энергетические ресурсы Арктики



Undiscovered Oil

Неразведанная нефть

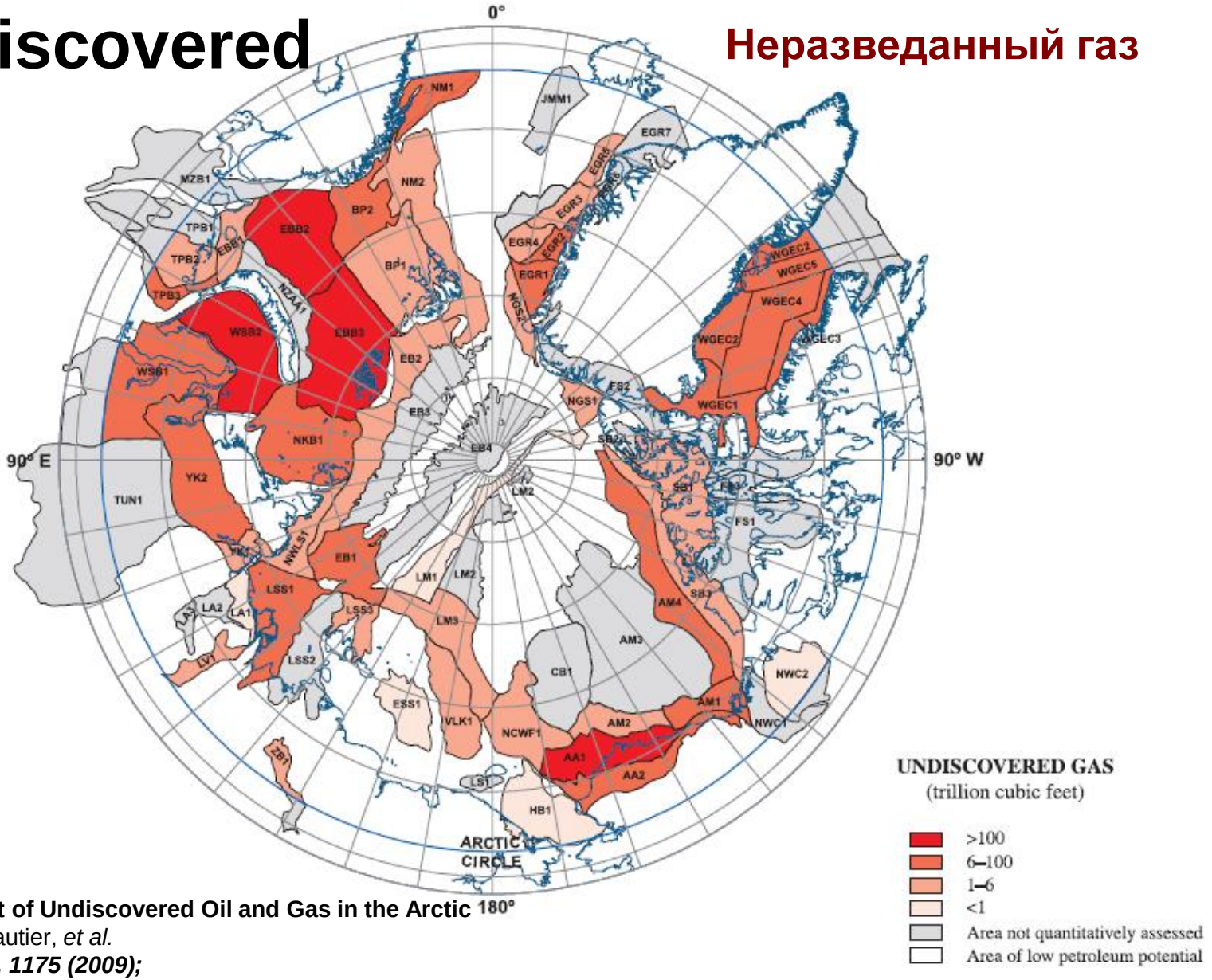
UNDISCOVERED OIL
(billion barrels)

- >10
- 1–10
- 0.1–1
- <0.1
- Area not quantitatively assessed
- Area of low petroleum potential

Assessment of Undiscovered Oil and Gas in the Arctic
Donald L. Gautier, *et al.*
Science ***324, 1175 (2009);***
DOI: 10.1126/science.1169467

Undiscovered Gas

Неразведанный газ



Assessment of Undiscovered Oil and Gas in the Arctic
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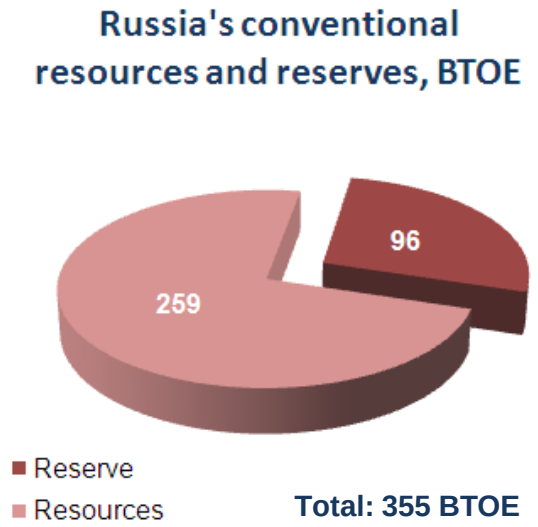
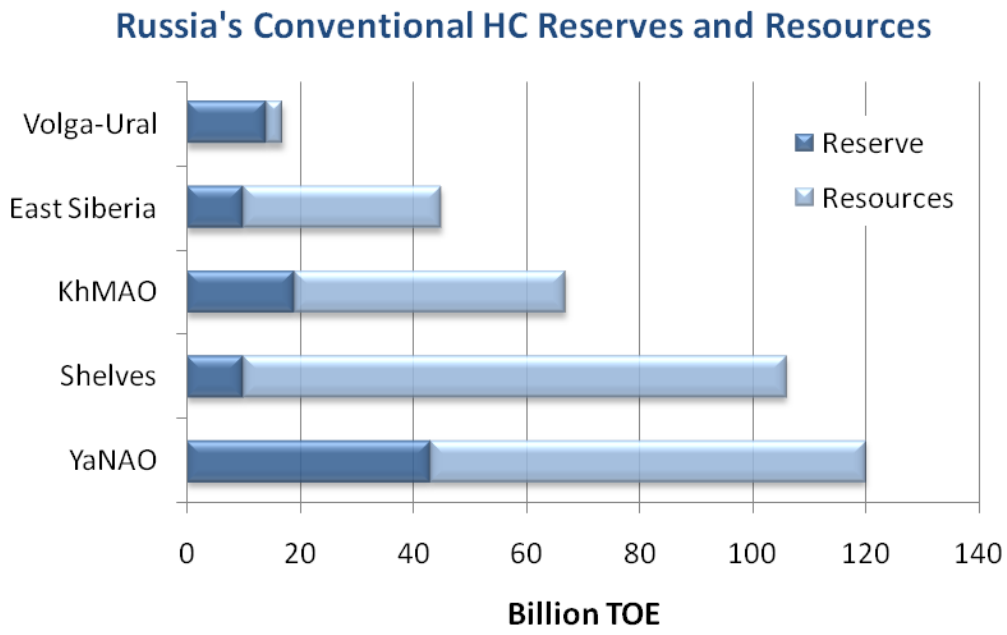
European Arctic Petroleum Resources

Углеводородные ресурсы европейской Арктики

Russia’s conventional HC reserves & resources

Традиционные углеводородные запасы и ресурсы России

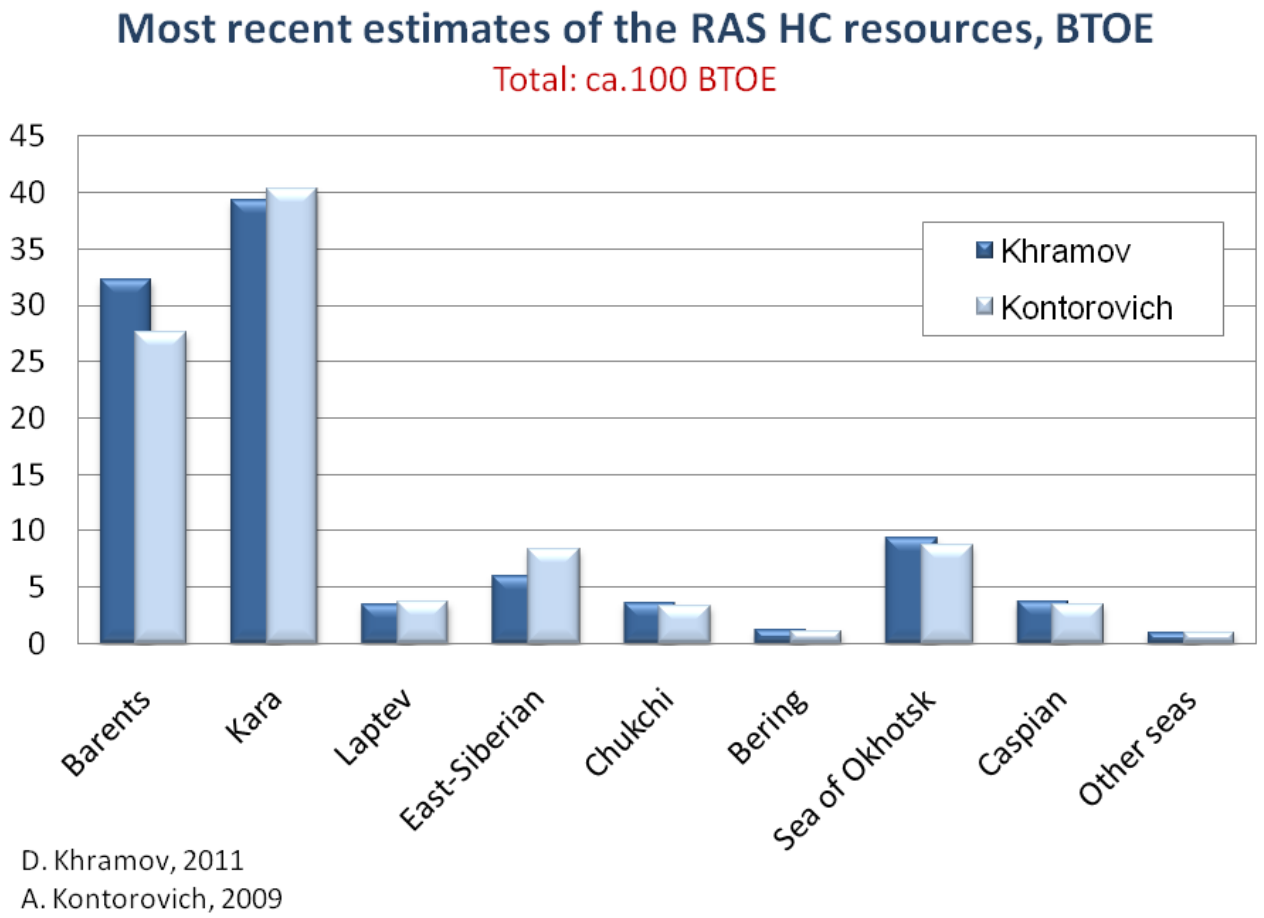




Ref.: D. Khramov, Rus-Norw Seminar, June 20, 2011

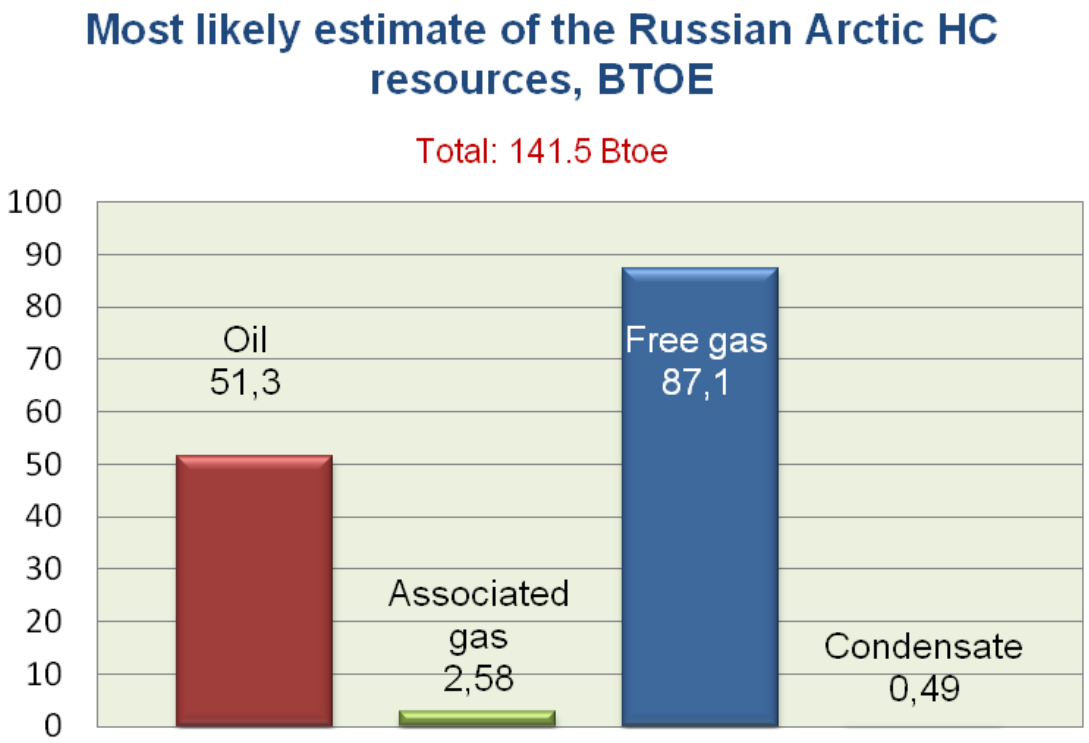
HC Resources of the Russian Arctic Shelf

Углеводородные ресурсы российского арктического шельфа



HC Resources of the Russian Arctic

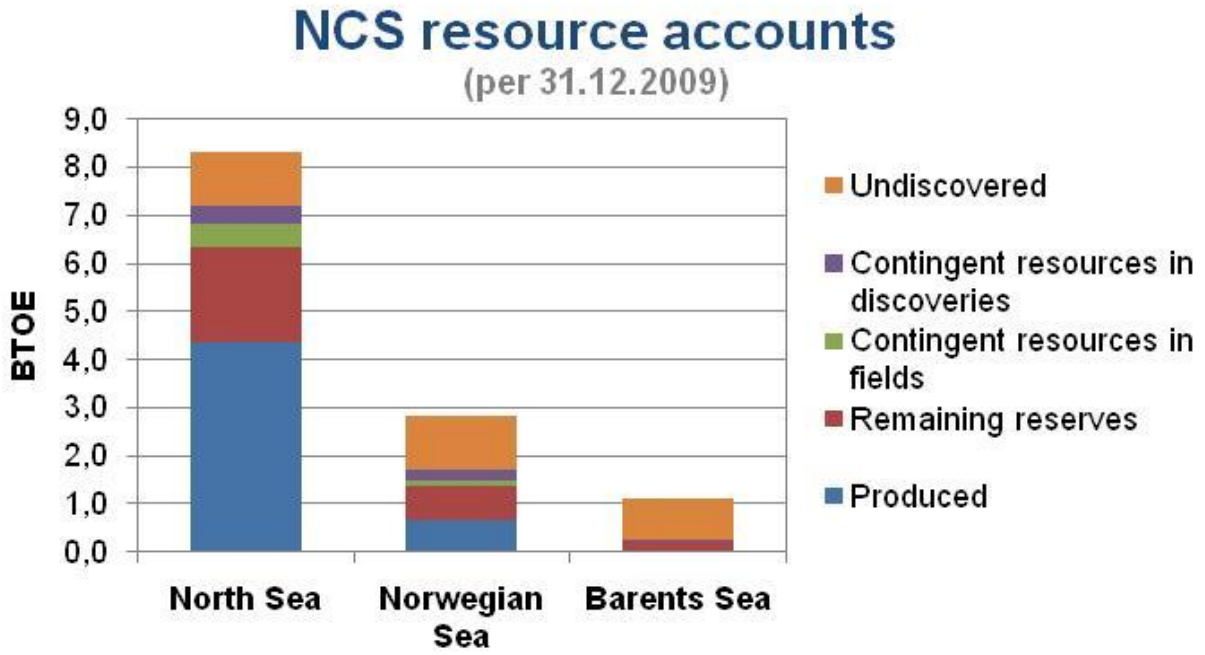
Углеводородный потенциал российской Арктики



Ref.: A. Kontorovich, RAO-2009

HC Resources of the Norwegian Arctic

Углеводородный потенциал норвежской Арктики

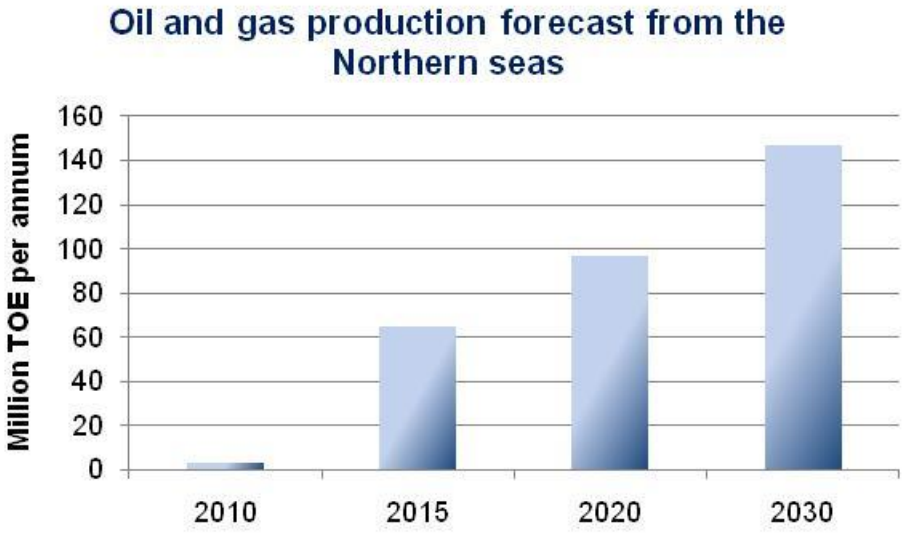


Source: NPD, Facts book, 2010

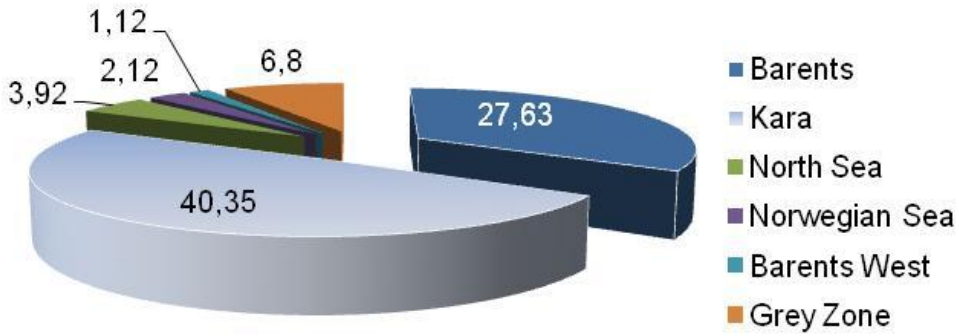
Europe Arctic Offshore – HC Potential

Углеводородный потенциал европейской Арктики

41,7 BTOE – Europe Arctic resources

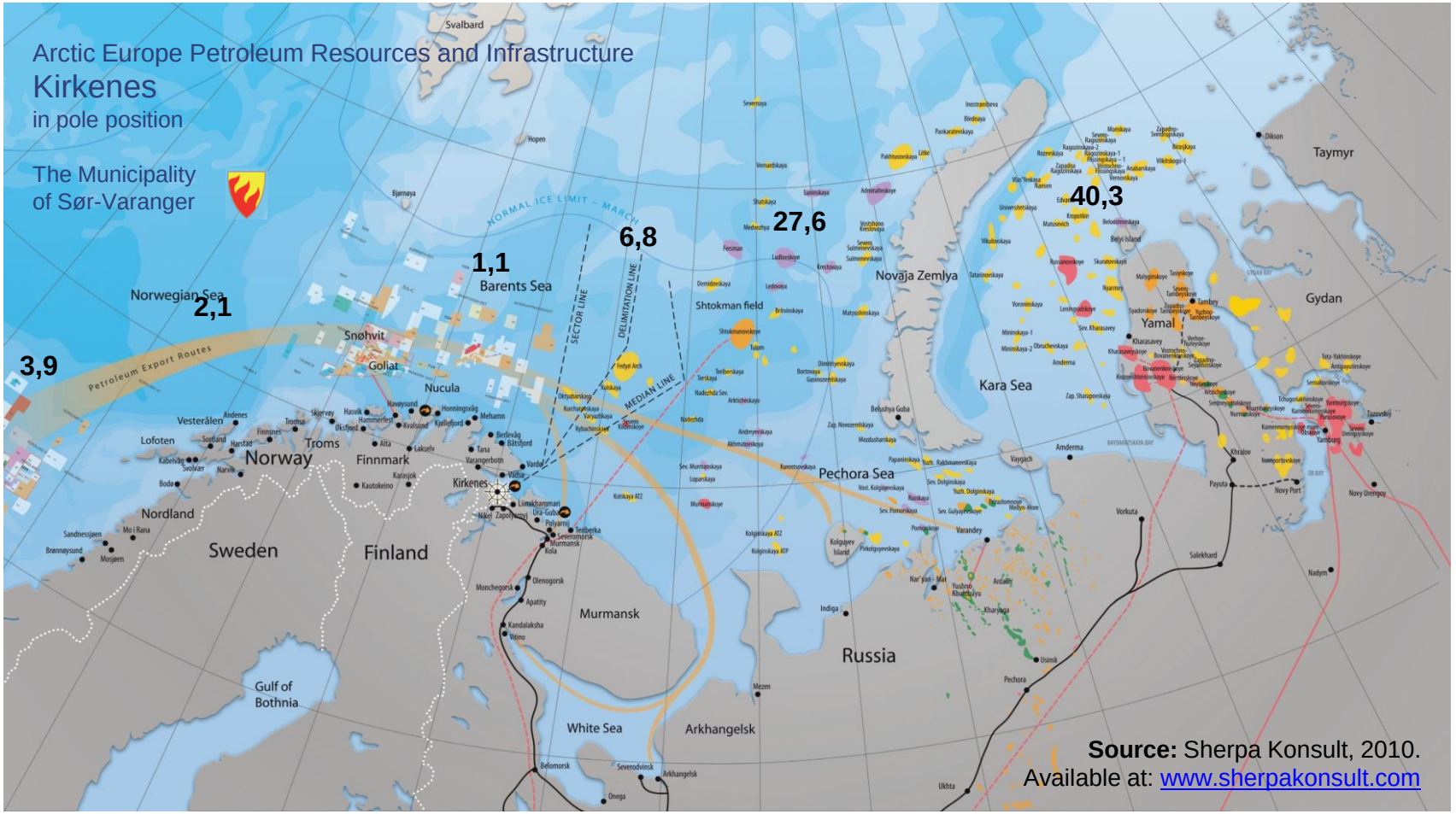


Ref.: A.N. Dmitrievsky, RAO-2009



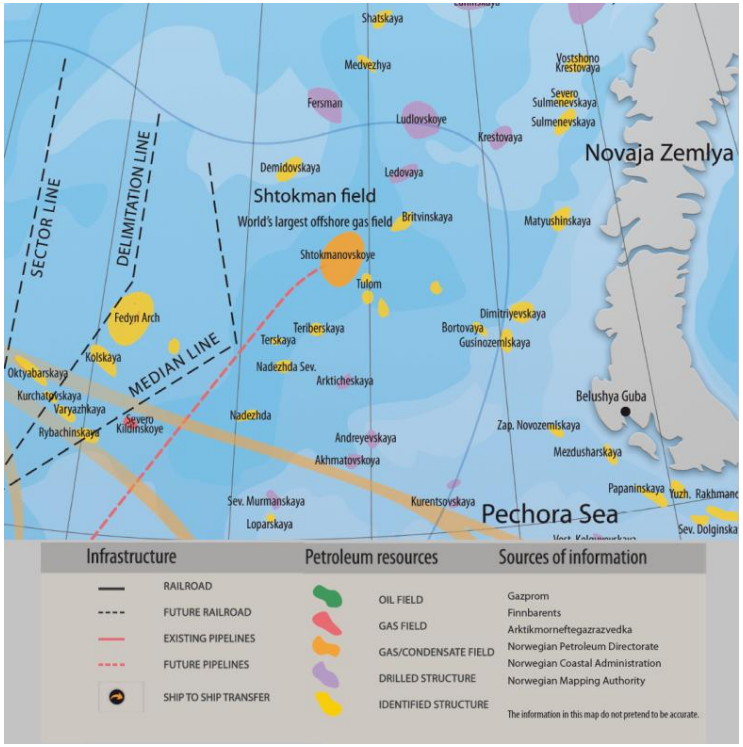
Europe Arctic Offshore – HC Potential

Углеводородный потенциал европейской Арктики



Barents Sea

Баренцево море



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.

* Russian part of the former Grey Zone HC resources is included in this evaluation

Pechora Sea

Печорское море

Total resources of Medyn-Varandey and Kolokomorsky locations – up to 410 million tons of oil

Recoverable volumes – 80 million tons.

Prirazlomnoye – start of production in the Pechora Sea

Main fields:

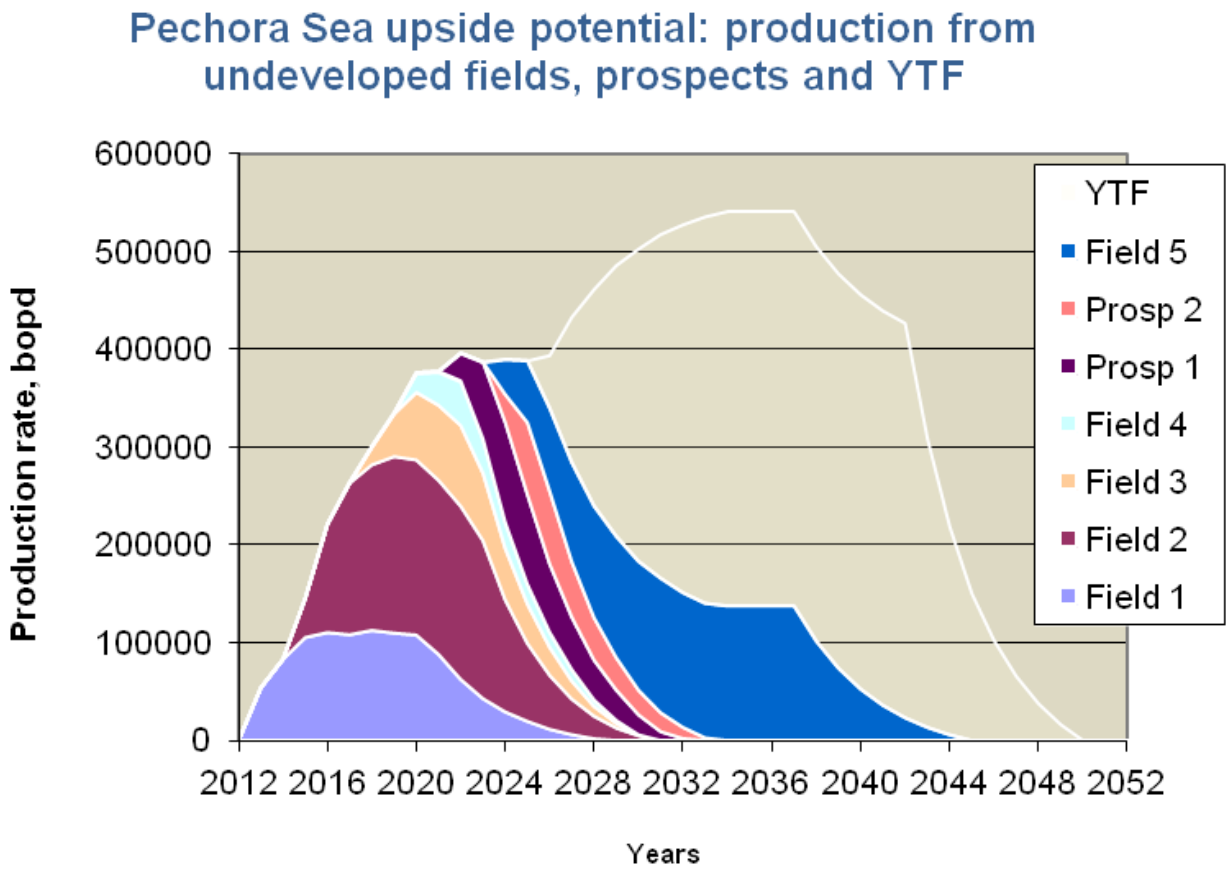
- Prirazlomnoye, Dolginskoye, Medyn-more, Varandey-more and Kolokomorskoye oil fields
- Severo-Gulyaevskoye oil-gas-condensate field and Pomorskoye gas-condensate field.

Prospective structures (SE part of Pechora Sea):

- Yuzhno-Russkaya, Pakhanchevskaya, Sakhaninskaya and Papaninskaya

Pechora Sea upside potential

УВ потенциал Печорского моря



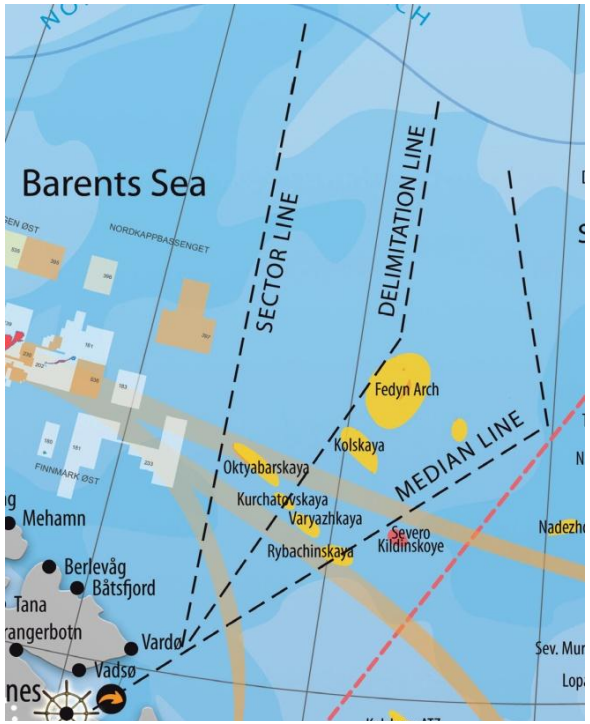
AZ – **2000-2007**

Europe Arctic Offshore – HC Potential

Европейские арктические ресурсы – УВ потенциал

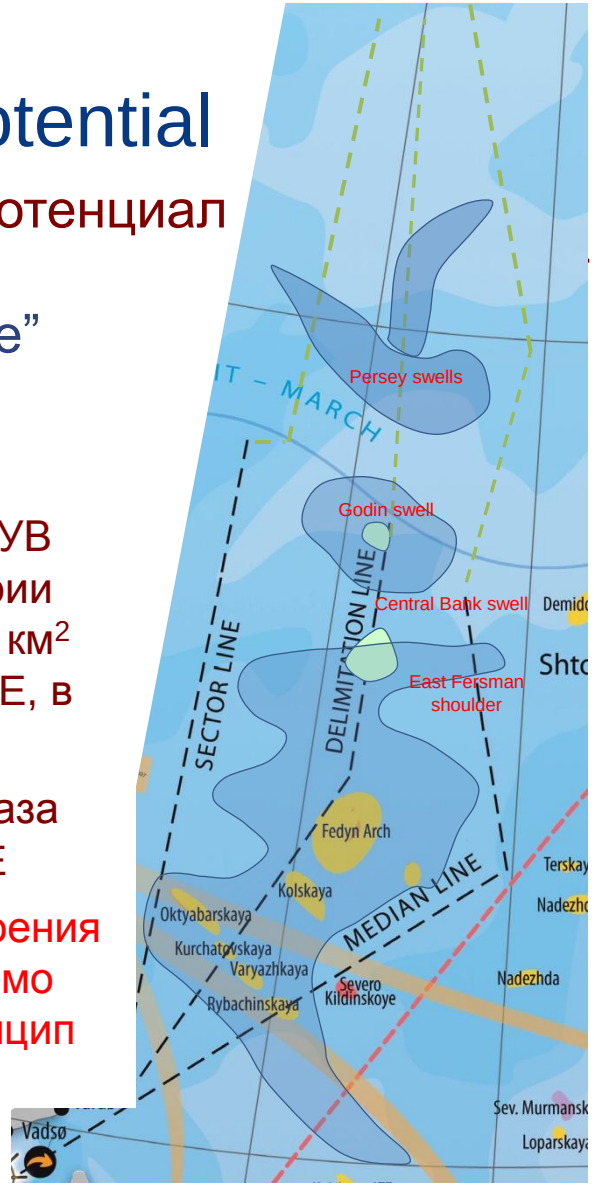
Resource estimate of the former ”Grey Zone”

Оценка ресурсов «Серой Зоны»



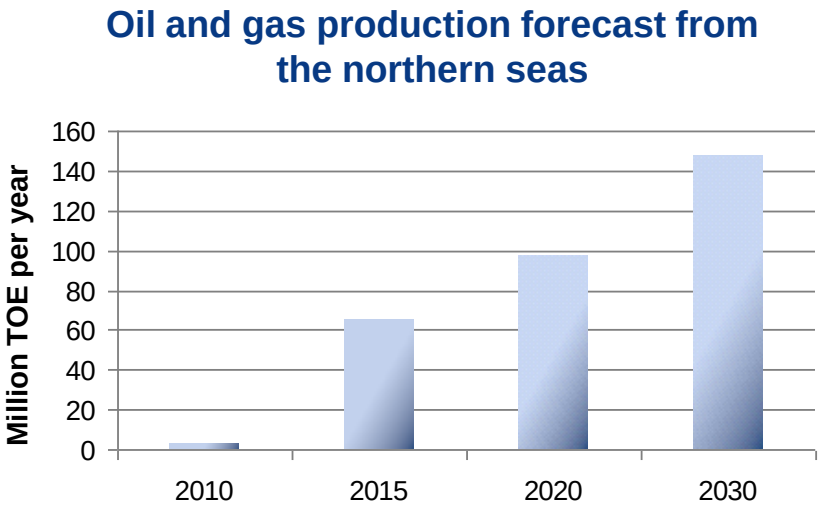
Source: Sherpa Konsult, 2010.
Available at: www.sherpakonsult.com

- Российская оценка УВ потенциала акватории площадью 170 000 км^2 составляет 6.8 BTOE, в основном, газ
- Оценки USGS в 4 раза ниже – ок. 1.7 BTOE
- Для успешного освоения этой зоны необходимо использовать «принцип юнитизации»

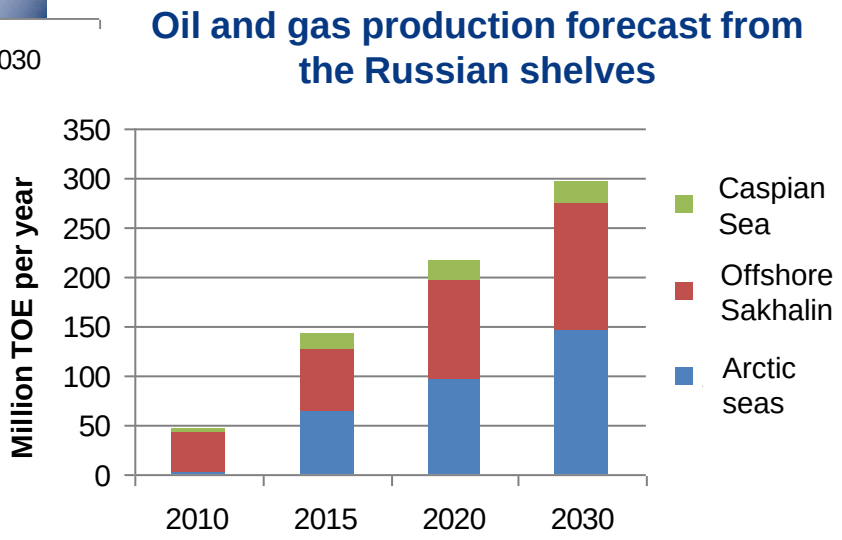


Ref: «Oil and Gas of the Arctic», Moscow, 2007

Forecasted petroleum production from the Russian shelves, 2010-2030



Прогноз добычи нефти и газа из шельфовых месторождений

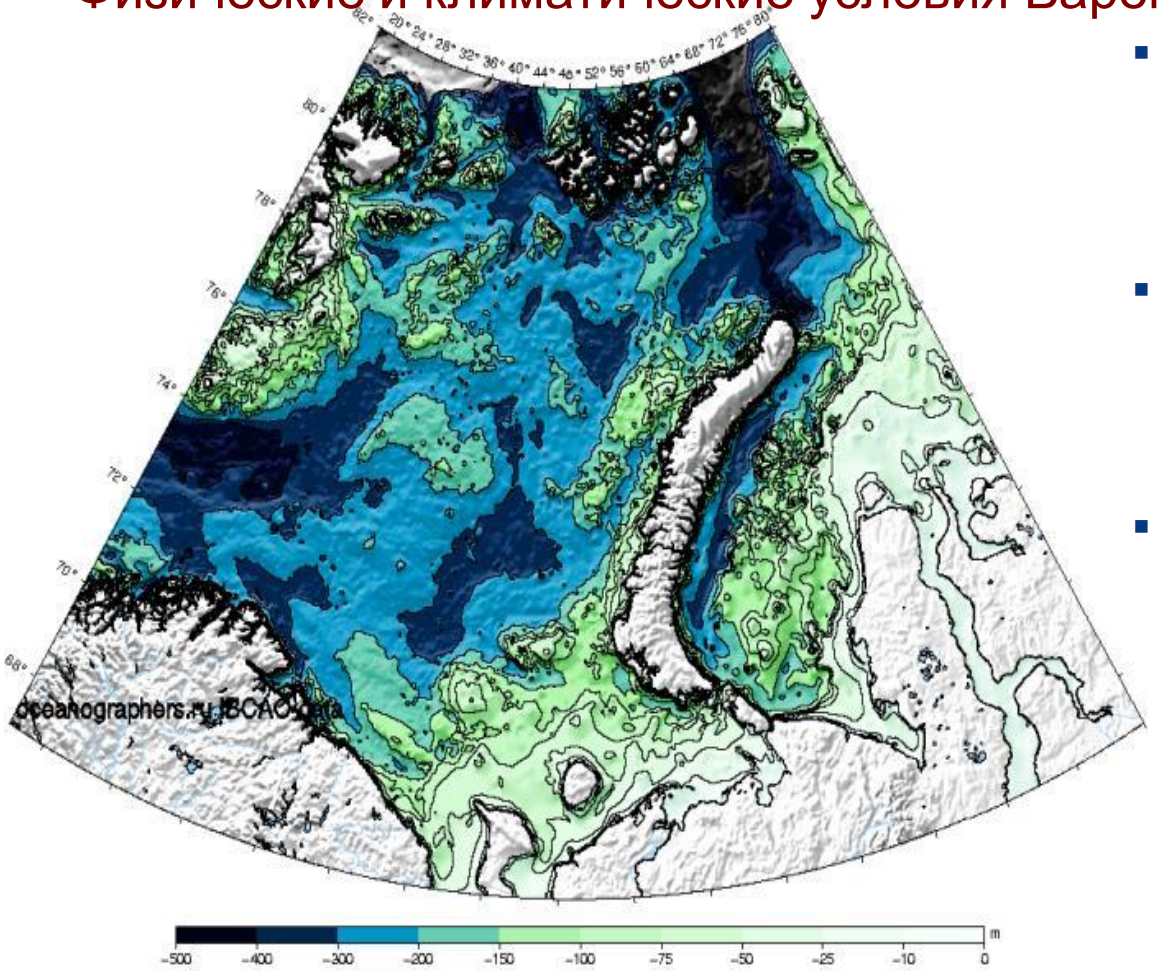


Metocean conditions and technology challenges

Метеорологические условия и технологические сложности

Physical and climate conditions of the Barents Sea

Физические и климатические условия Баренцева моря

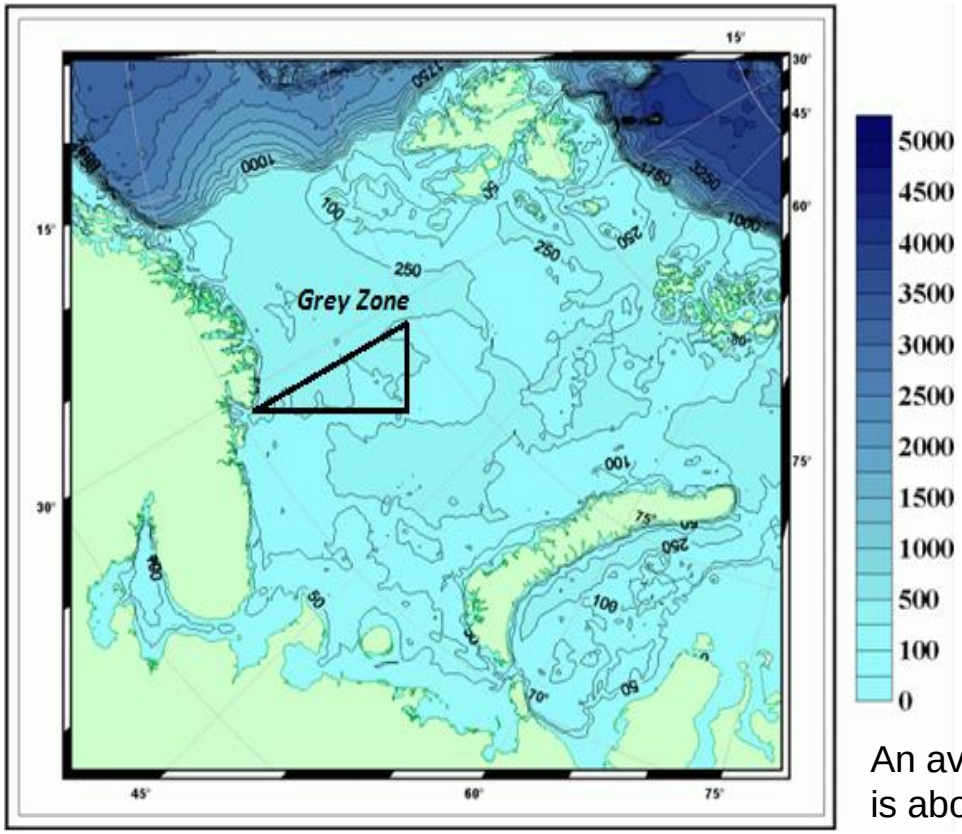


- The Barents Sea area is about 1.4 million km^2 with water volume of 322 000 km^3
- The sea climate is polar, but it is the warmest among the Arctic seas
- Almost 3/4 of its surface is covered by ice and never freezes completely

Source: SPE 149654

Depth contour & hydrological regime

Батиметрия и гидрологический режим



Source: SPE 149654

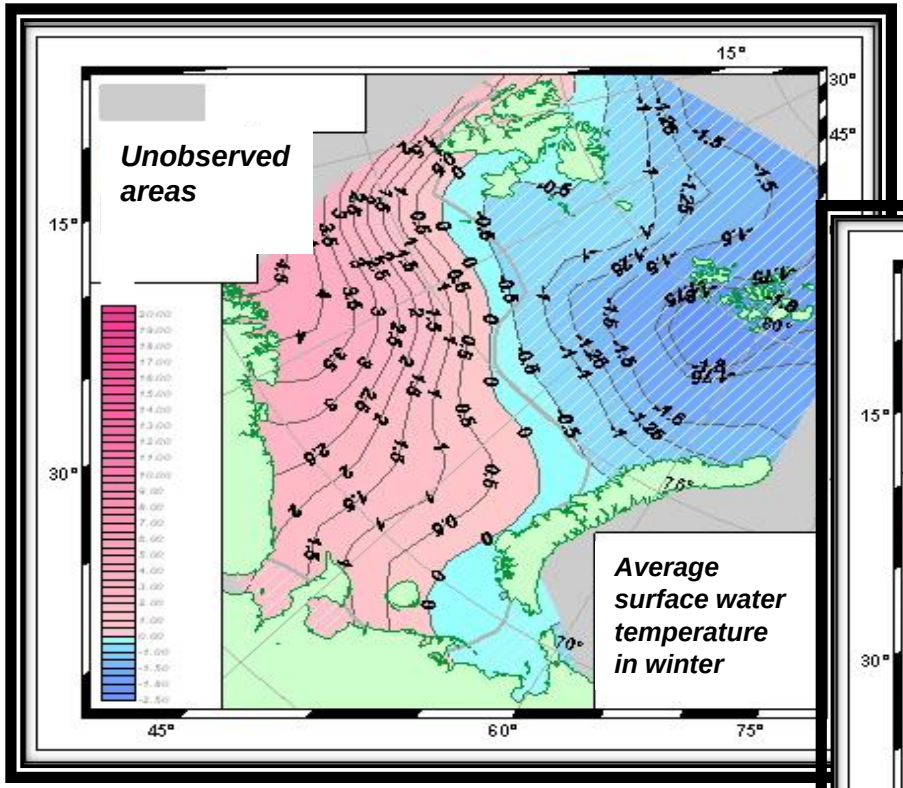
Great diversity of waters with different origins and different properties:

- Warm water coming from the North Atlantic Ocean
- Warm waters of the rivers
- Relatively cold local waters
- Cold polar waters

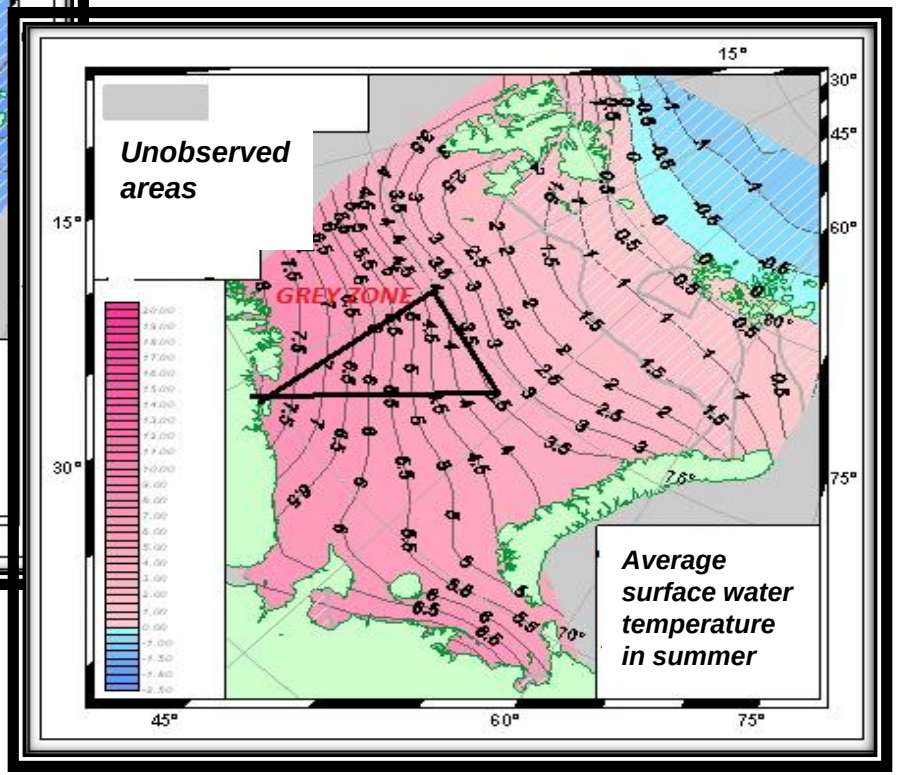
An average water depth at Fedynsky High is about 200 m

Water temperature

Температура воды



The water temperature is a key indicator of the distribution of warm Atlantic waters, which determine the ice conditions



Source: SPE 149654

Waves

Волны

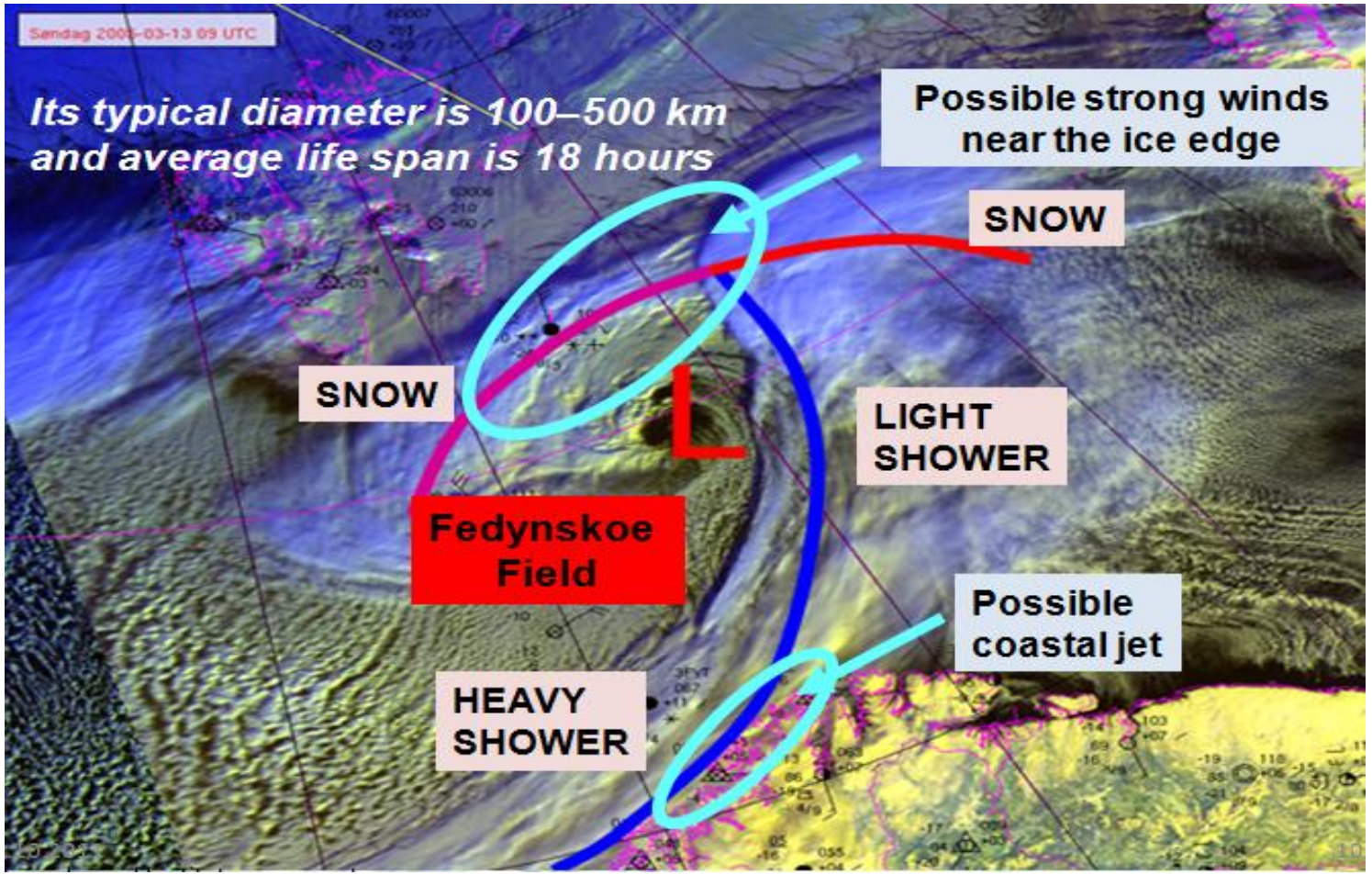
Typical Hs/Tp Scatter Table for the eastern Barents Sea (based on World Waves data. **Source:** *www.barentssea.no*)

Occurence	***Peak period (s)***								
Significant wave height (m)	0–2.9	3–5.9	6–8.9	9–11.9	12–14.9	15–17.9	18–20.9	21–23.9	Total
0.0 – 2.9				0.01	0.05				0.06
3.0 – 5.9			0.02	0.97	0.45	0.03			1.5
6.0 – 8.9		0.01	8.0	6.8	1.9	0.08	0.01		16.7
9.0 – 11.9		15.2	48.5	13.5	8.4	0.94	0.12	0.09	91.7
Total	0.0	15.3	51.5	21.3	10.7	1.1	0.13	0.09	100.0

Mainly waves with height in significant rate 9.0-11.9 m. The highest significant waves observed in this middle area have 12.7 m high during south westerly wind caused by a rapid developing low pressure

Polar lows pressure effect

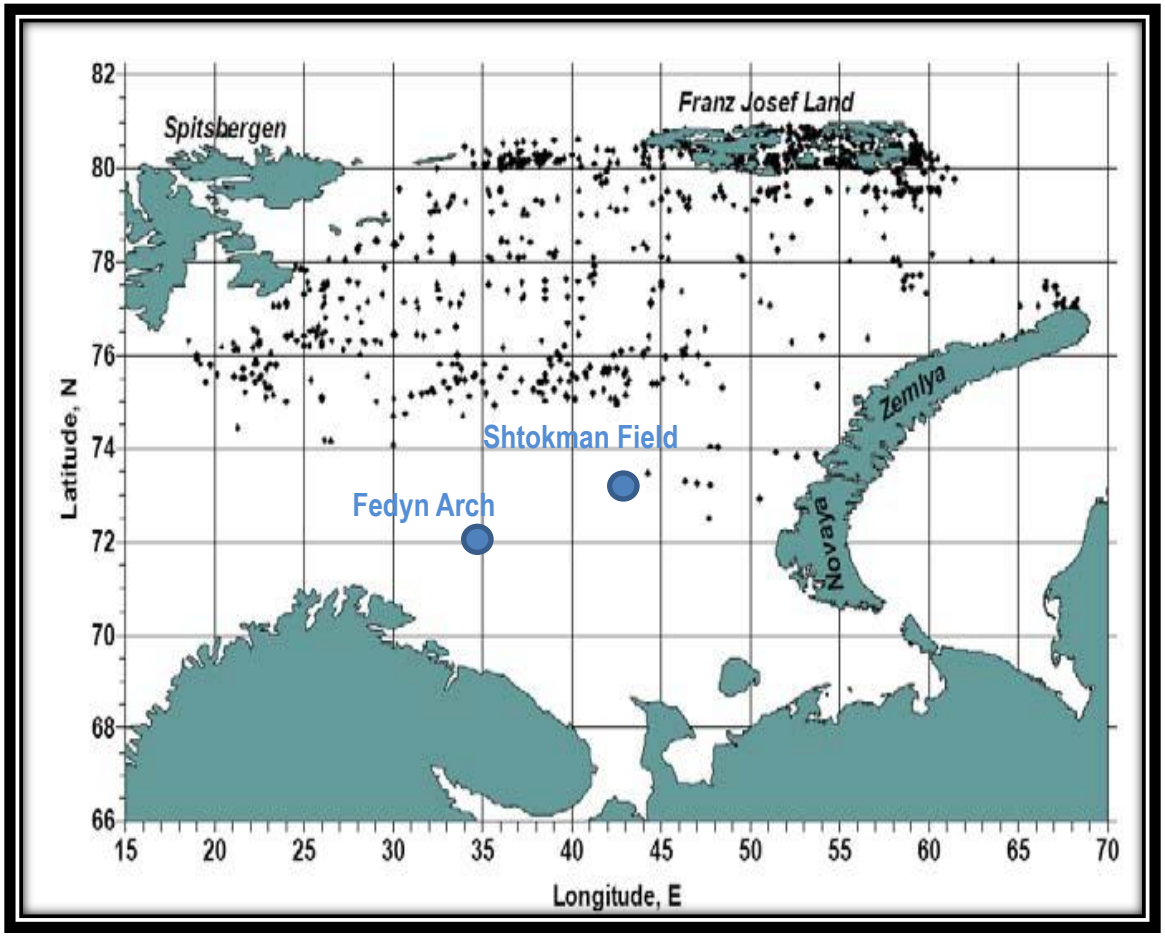
Эффект низкого (полярного) давления



Source: SPE 149654

Ice conditions

Ледовая обстановка



- The ice thickness over the winter reaches 70-75 cm
- Icebergs are usually rather smooth, less than 100 m thick and with a horizontal extension of maximum 300-400 m
- Polar lows pressure influences

Locations of icebergs observed in April 1928-2005. IDAP was focused on the circled area east of Spitsbergen.

Source: AARI, St. Petersburg, Russia

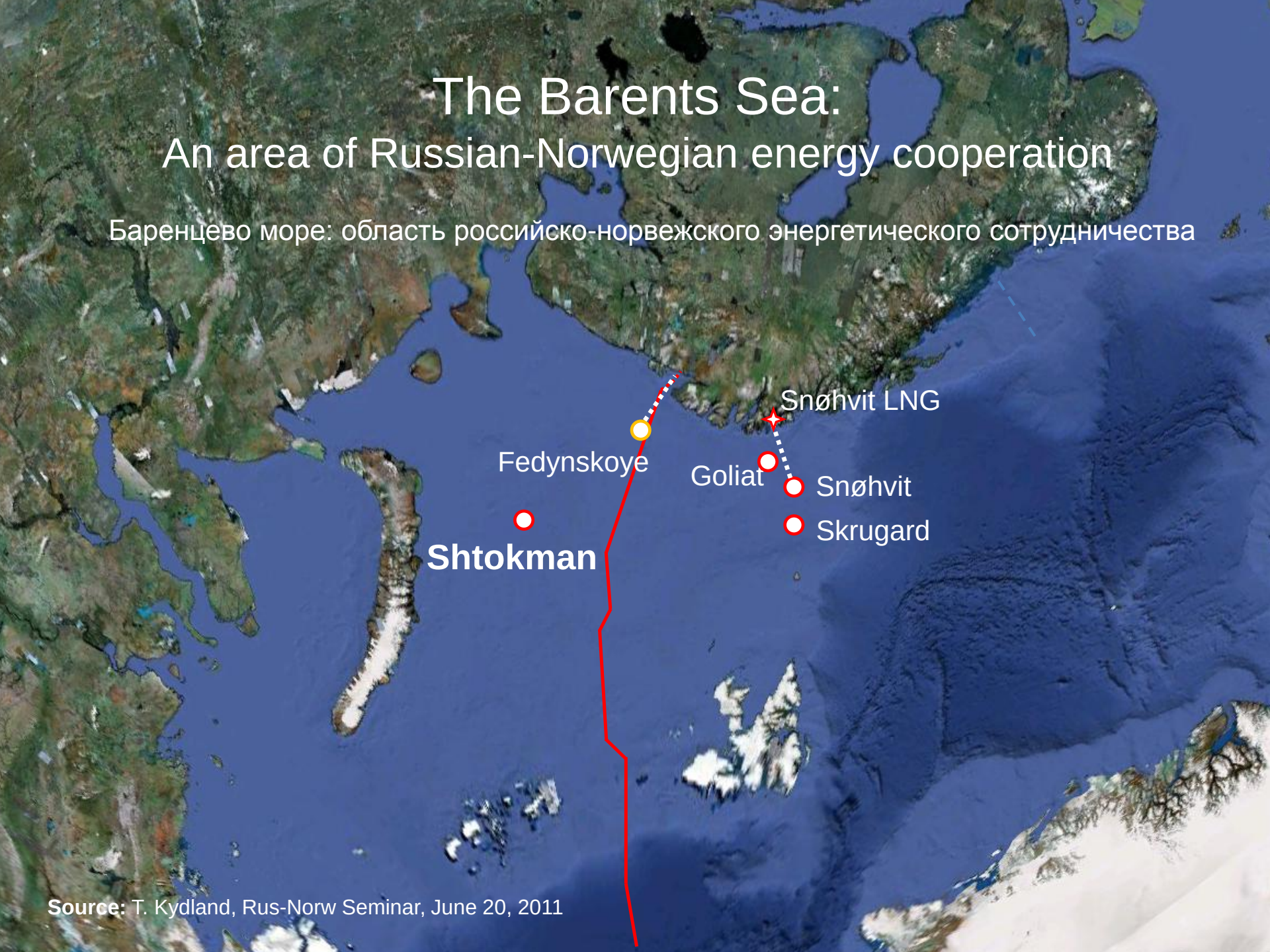
Ref.: DNV, Report No: 2008-006642008-0664, rev. 01

Development opportunities

Возможности освоения

The Barents Sea:
An area of Russian-Norwegian energy cooperation

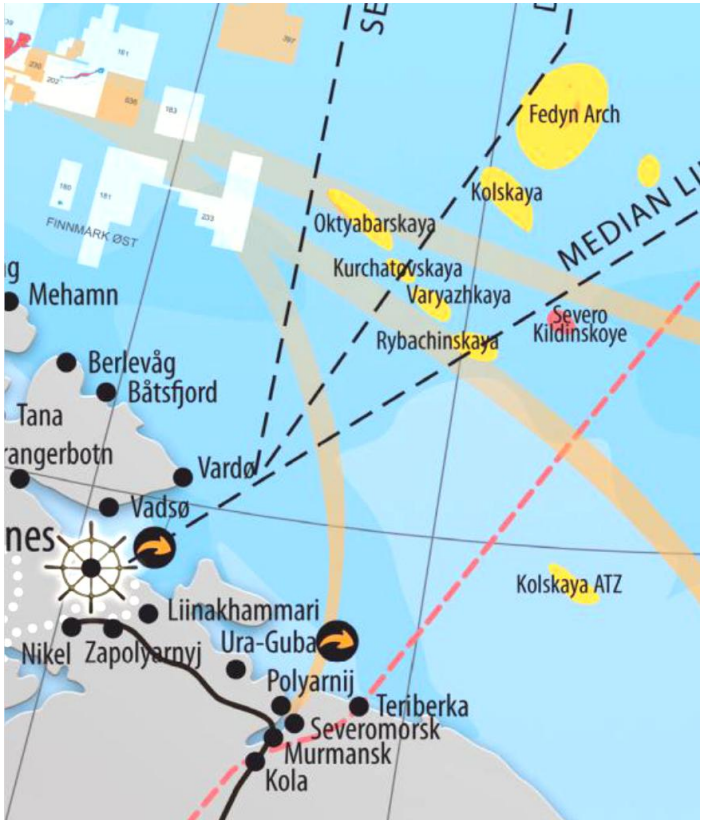
Баренцево море: область российско-норвежского энергетического сотрудничества



Source: T. Kydland, Rus-Norw Seminar, June 20, 2011

Former disputed zone: development opportunities

Бывшая спорная зона: новые возможности освоения



- Short distance to shore – below 300 km
- Being year-round ice-free sea
- Relatively shallow waters – 200-250 meters
- Flow assurance opportunities with potential for multiphase flow to shore
- Multiple export opportunities for oil and gas and their products

Source: www.arctic-europe.com, SPE 149654

Brief comparison of two Barents Giants

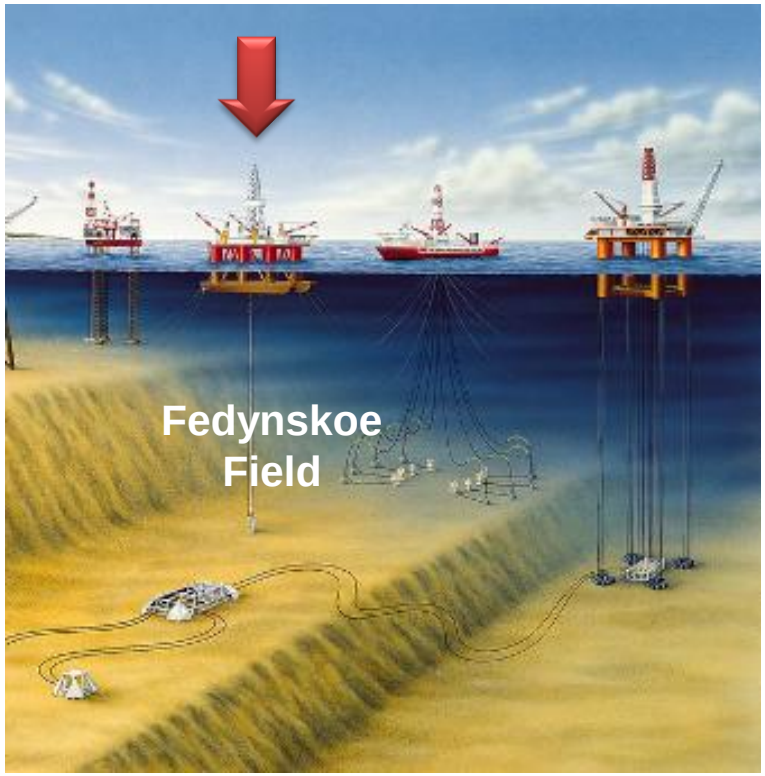
Сравнение двух гигантов Баренцева моря

Features	*Fedynskoye field*	*- /+*	*Shtokman field*	*- /+*
HC accumulations	> 6 trillion m3 of natural gas	+	3.7 trillion m3 of natural gas	+
Water depth	200-250 m	+	320-350 m	(-)
Distance to shore	About 300 km	(+)	About 600 km	-
Ice conditions	Icebergs are not excluded but extremely rare	(-)	Icebergs are not excluded	-
Existing facilities	Yes	+	Not at all	-

Source: SPE 149654

Facilities-1: Mobile Drilling Unit (MDU)

Мобильный буровые установки

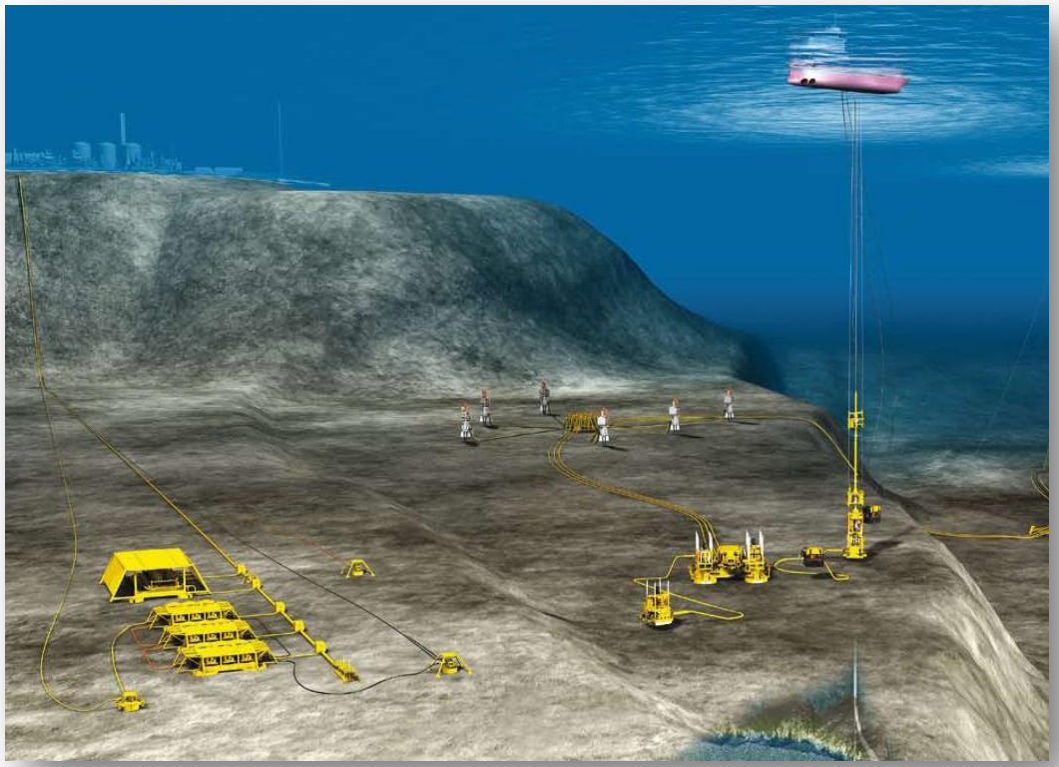


Four Types of Mobile Drilling Units (MODU). Left to Right: Jack-Up, Semi-Submersible, Drill Ship & Submersible

The *Henry Goodrich* is a four-column, twin-pontoon semi-submersible

Facilities-2: Subsea system with multiphase flow to shore

Подводные системы с многофазным потоком на берег



www.fmctechnologies.com

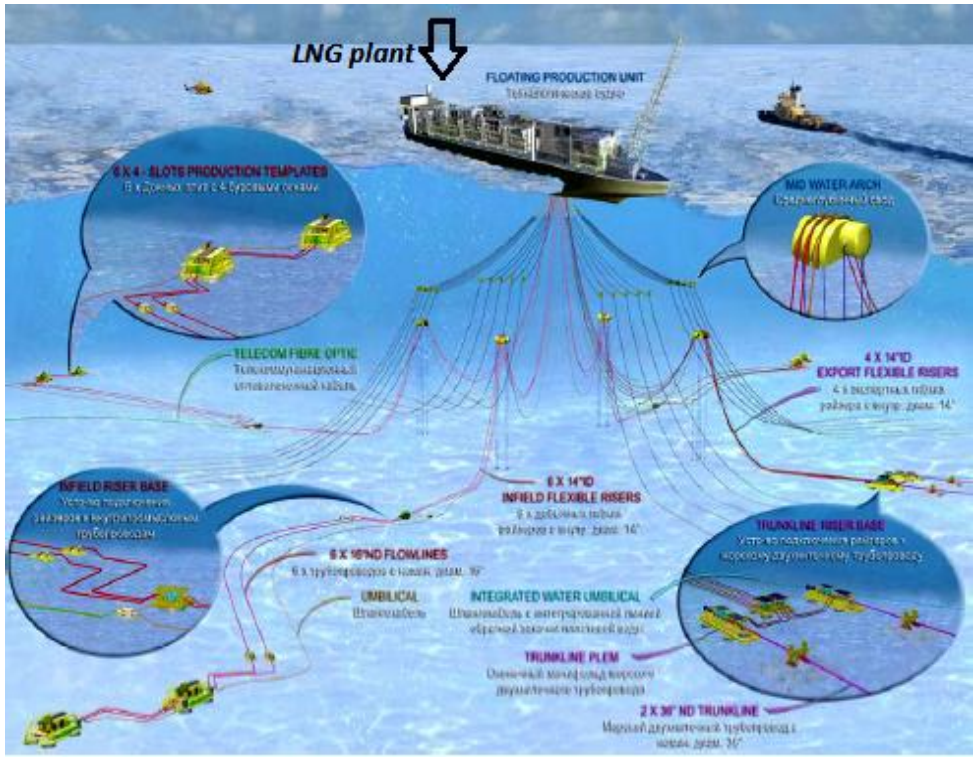
X-mas tree

Manifold complex

Offshore Gas Megacentre in the Barents

Морской газовый мега-центр в Баренцевом море

- Scheme of development by special ship ***(LNG FPU)*** with processing and liquefaction units on board
- Subsea well completion ***(wet trees)*** and connection through the ***riser and turret system***
- Such a concept could be considered for ***Fedyn Arch region*** and ***Shtokmanovskoe gas field***

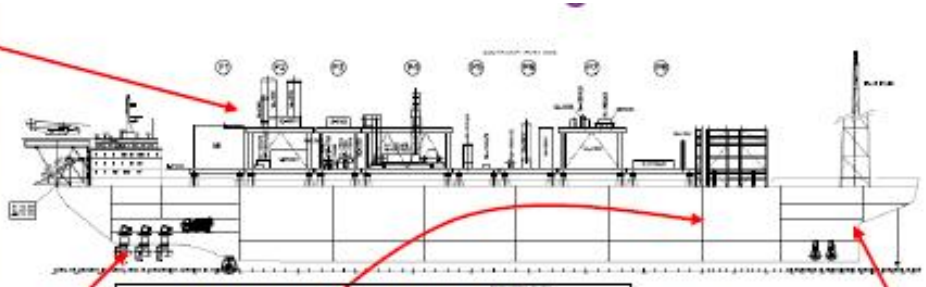


Source: www.frecom.ru

FPU for Shtokman field development

FPU для освоения Штокмановского месторождения

Topsides Winterization)



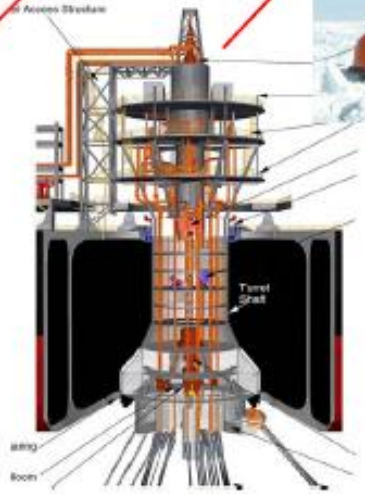
Daily production (70MSm3/d)

Technological Development

EER

Ice-resistant hull design for sea ice and iceberg

First FPU development of its kind …paving the way for future Arctic development

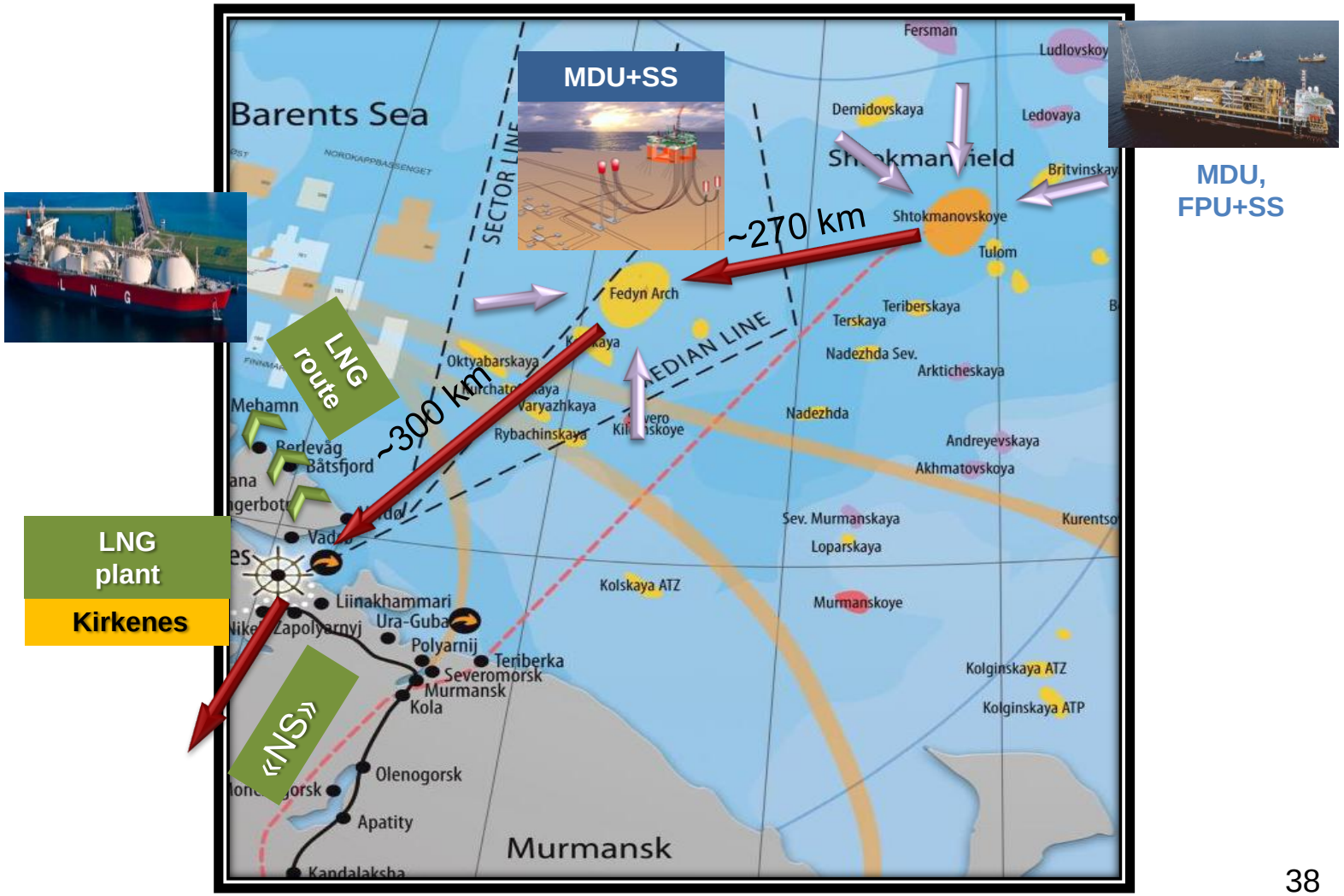


Disconnectable through MRB/Turret/swivel

Source: http://www.shtokman.ru

One of the development concepts…

Одна из возможных концепций освоения



Another possible development concept

Другие возможные концепции освоения

Goliat oil field

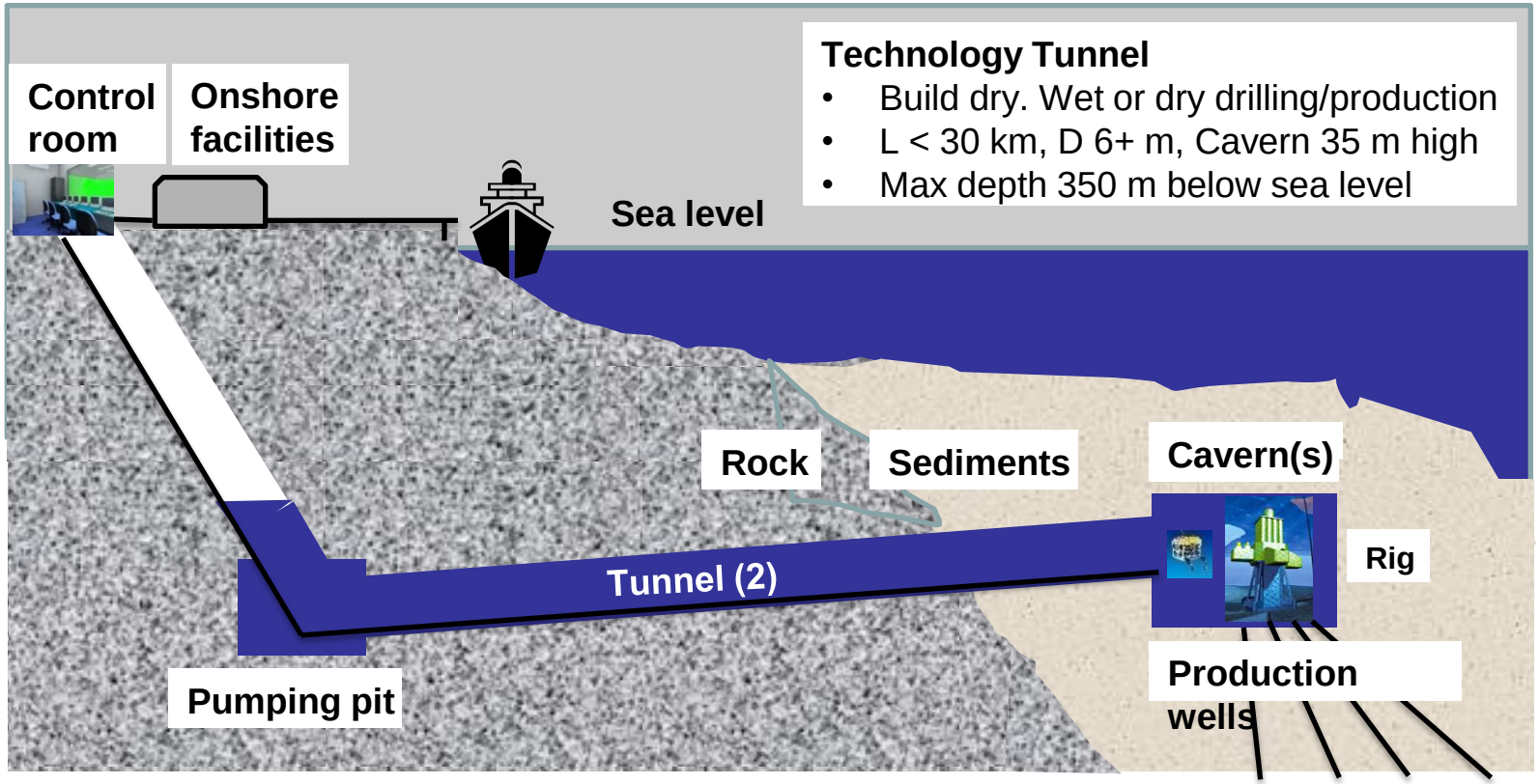
Source: O.A. Lindseth; 2011

- Production start planned in 2013
- Development based on the basis of impact assessment carried out be licensees
- One of the largest industrial projects ever undertaken in Northern Norway
- Goliat will have to meet strict environmental standards stipulated in the integrated Management Plan: zero discharges to sea of drilling mud and other substances

Technology Tunnel concept

Концепция технологического тоннеля

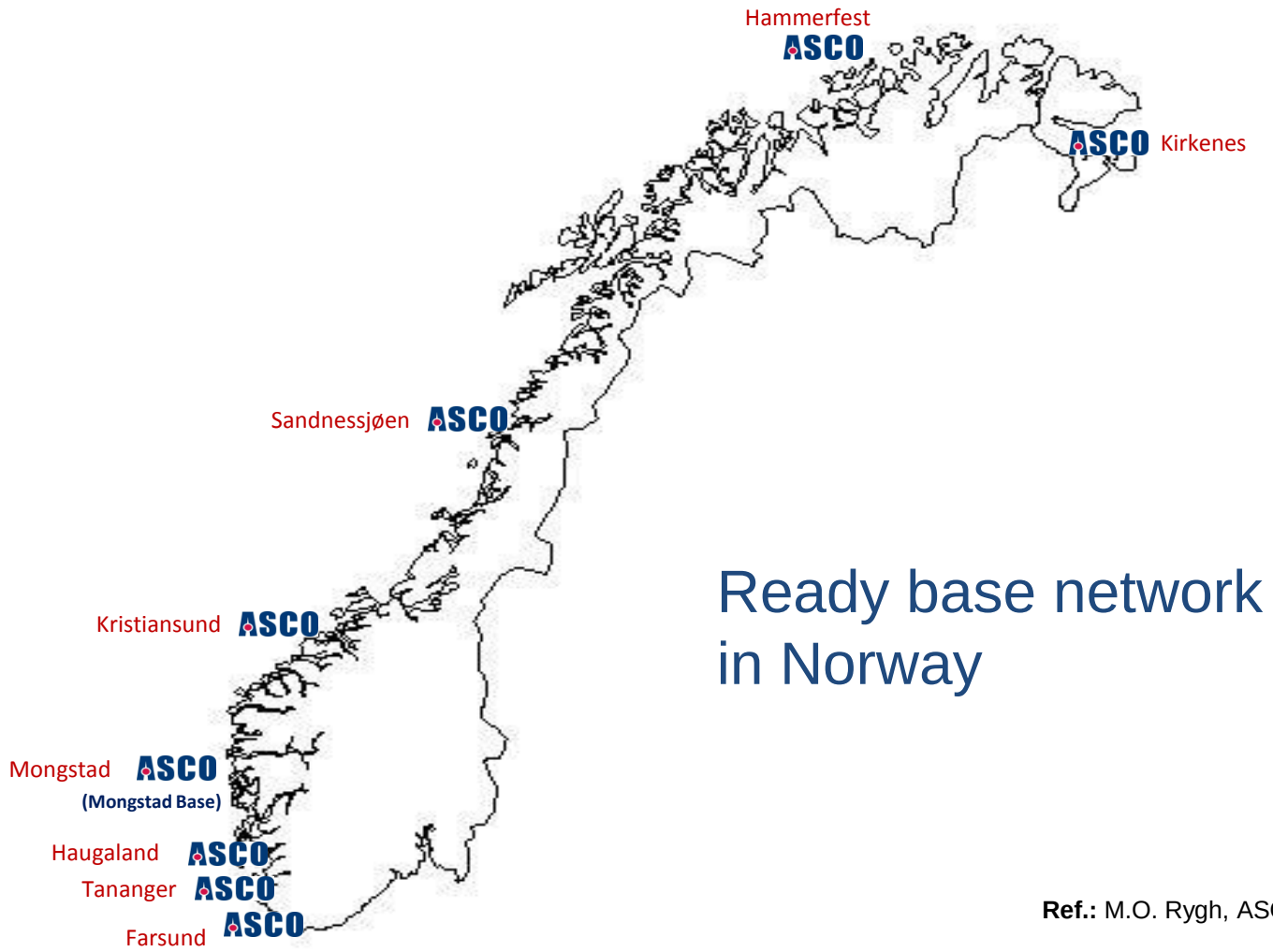
Develop oil/gas fields from a shoreline base



Authors: Prof. O.T. Gudmestad, Prof. A.B. Zolotukhin and Russian MSc and PhD students A. Khrulenko. O. Bychkova, T. Mokshaev, F. Domanuyk, 2009

Opportunities for a joint development

Возможности совместного освоения



Ready base network in Norway

Ref.: M.O. Rygh, ASCO, Sep. 20, 2011

ASCO Base - Sandnessjøen

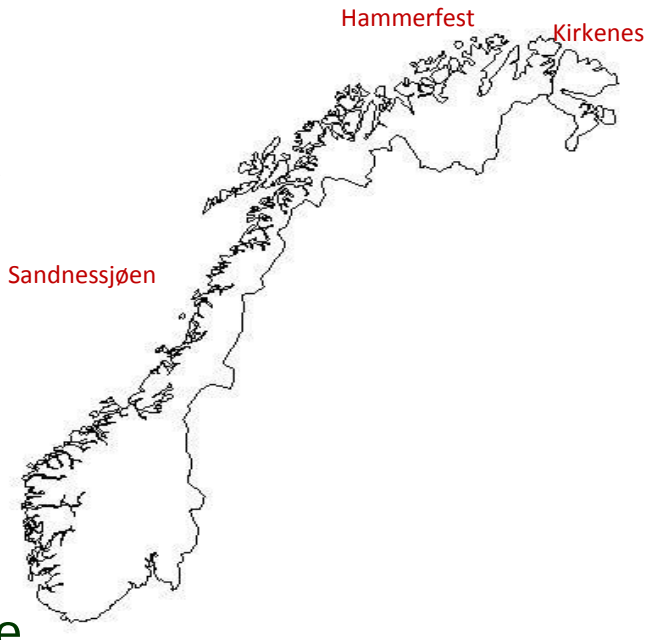
База ASCO в Санднесшёене

Ref.: M.O. Rygh, ASCO, Sep. 20, 2011

Why Supply Base in Sandnessjøen / Nordland ?

Причины для строительства базы снабжения в Санднесшёене

- Oil activity in Norway is moving North
- Sandnessjøen is chosen as the main logistic hub in the Northern parts of the Norwegian Sea – by Statoil and BP
- ASCO opened Supply Base in 2010 to support the BP Skarv development
- High level of exploration drilling – very promising area
- Well positioned to support activity in the Lofoten / Vesteraalen area, expected to be opened after 2013



Ref.: M.O. Rygh, ASCO, Sep. 20, 2011

Hammerfest

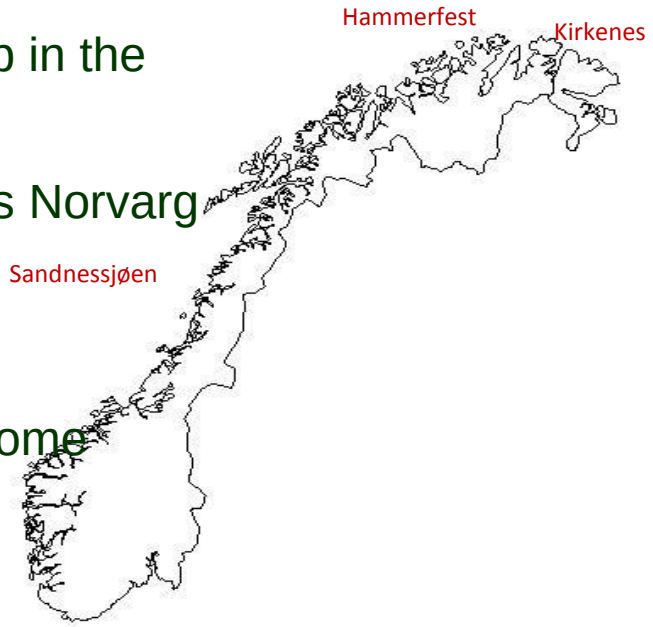
Хаммерсфест

Ref.: M.O. Rygh, ASCO, Sep. 20, 2011

Why Supply Base in Hammerfest?

Причины для строительства базы снабжения в Хаммерфесте

- Statoil operates the Snøhvit Gas Field (LNG plant at Melkøya)
- ENI develops the Goliat Field (production start in 2013)
- Well established at the main Oil Logistic Hub in the western parts of the Barents Sea
- Increasing activity due to the last discoveries Norvarg and Skrugard
- High interest for new licences
- High level of drilling activity in the years to come



Ref.: M.O. Rygh, ASCO, Sep. 20, 2011

ASCO Arctic Base – Kirkenes

Арктическая база ASCO в Киркенесе

Ref.: M.O. Rygh, ASCO, Sep. 20, 2011

Why Supply Base in Kirkenes?

Причины для строительства базы снабжения в Киркенесе

- Located in one of the most interesting and promising areas in the Barents region
  - Norwegian side of the Barents, Russian side of the Barents (incl Shtokman)
  - Close to the Russian border, familiar with customs regulations
  - Ice free harbour 365 d/y
- Well developed infrastructure
  - Hotels, airport, hospital, industry etc
- Great potential
  - Develop feeder service between Kirkenes and the Murmansk region
  - Easy access to Russian labour (approx 650 Russians are already working in Kirkenes)
  - Training and development of people across the border
  - Opportunities for the industry in Norway, UK and Russia to build network and alliances

Ref.: M.O. Rygh, ASCO, Sep. 20, 2011

Где находится рынок и каковы возможности его использования?

Where is the market and what are the market opportunities?

The market for Barents Sea natural gas

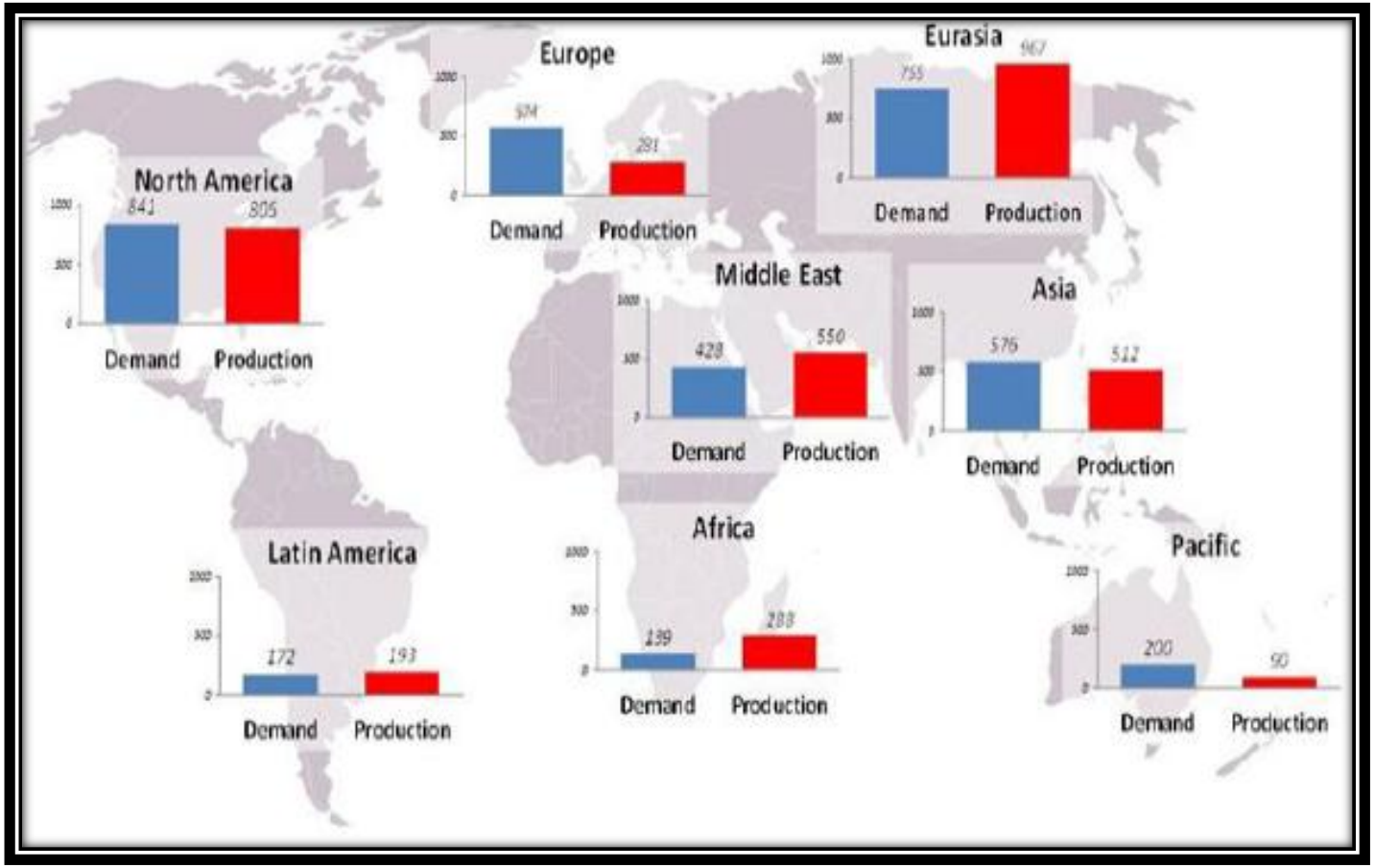
Рынок для баренцевоморского природного газа

- “Assuming that North America for the foreseeable future will be at least self-sufficient in natural gas, the market for Barents Sea natural gas will essentially be confined to Europe (EU)
- For the past decade, EU natural gas demand has been rising and production shrinking, with rising import dependency
- Apparently, this trend should point to a growing market for Barents Sea natural gas, supplementing and substituting for Norwegian North Sea output which is expected to decline
- The obstacle is, however, EU reluctance to use and import more natural gas”

Ref: O. Noreng, Norway and Russia – from cold war to a warm peace, OGEL special issue on the Arctic region. Sep 2011.

Global supply and balance in 2015

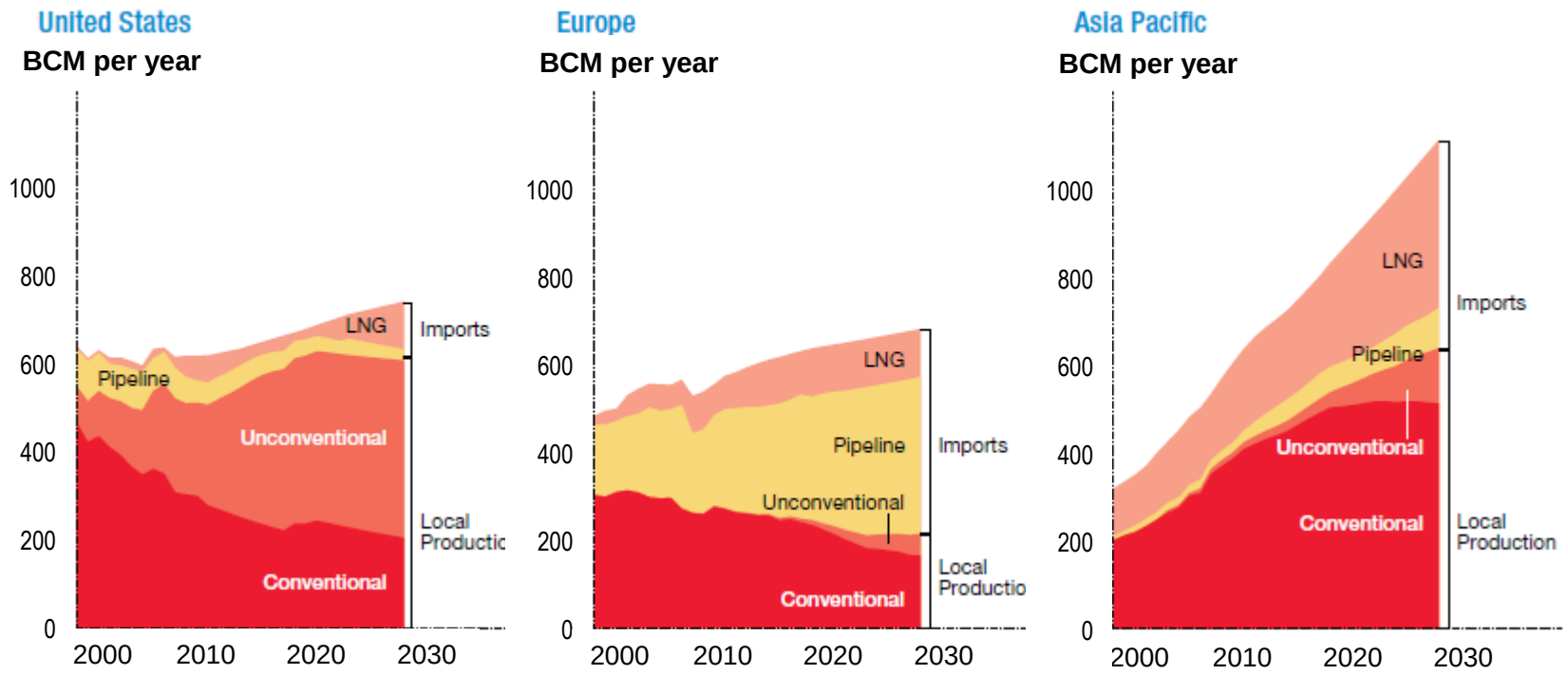
Глобальные поставки и энергобаланс в 2015 г.



Source: Timera Energy graphic based on IEA data

Global industrial demand

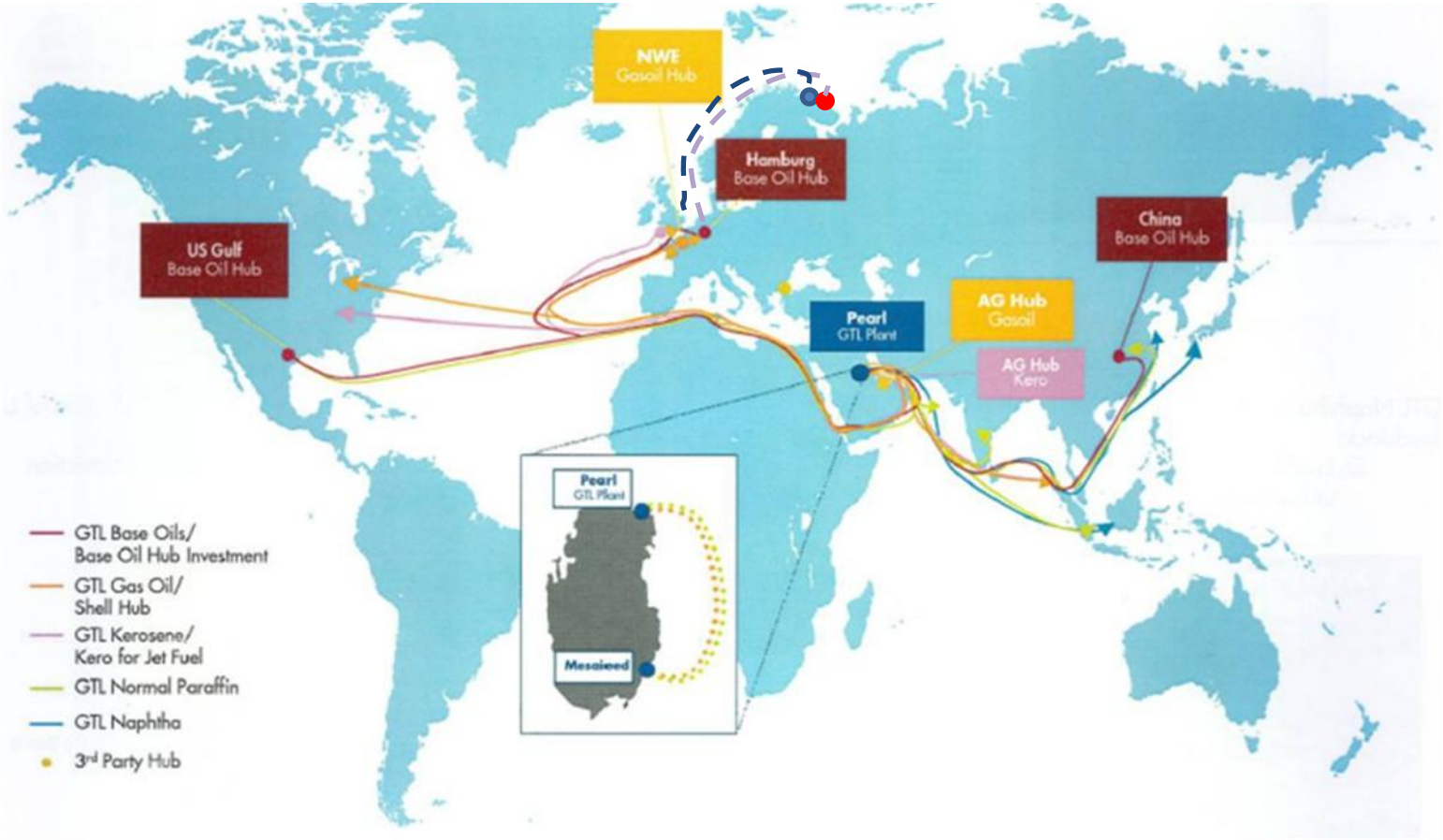
Глобальный спрос на углеводороды



Ref.: ExxonMobil Outlook for Energy, A view to 2030

Pearl GTL export and existing export opportunities

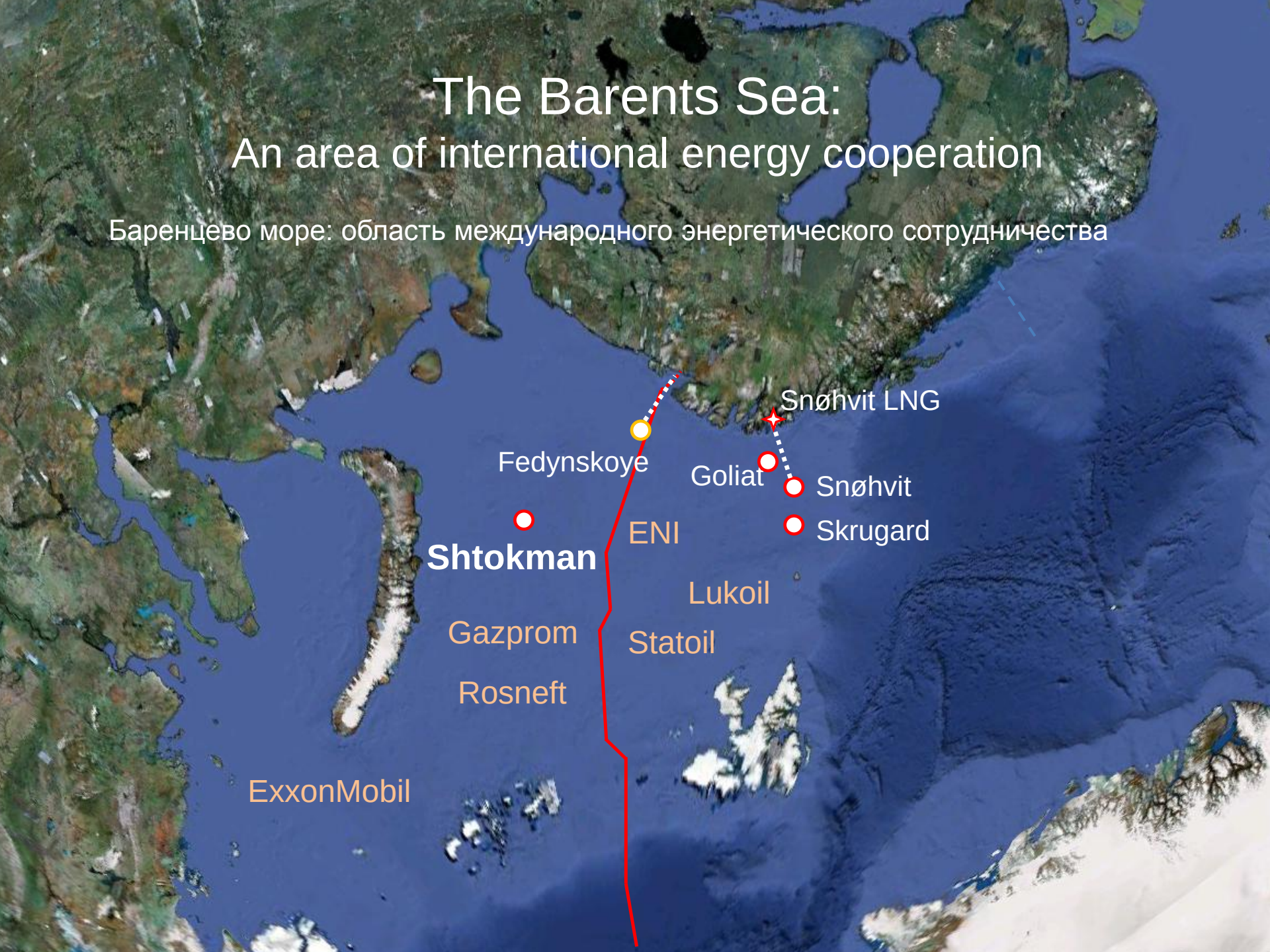
Экспортные пути с завода Pearl GTL и существующие возможности



Ref.: M. Levinbuk, Presentation at Gubkin University, Feb 15, 2012

The Barents Sea:
An area of international energy cooperation

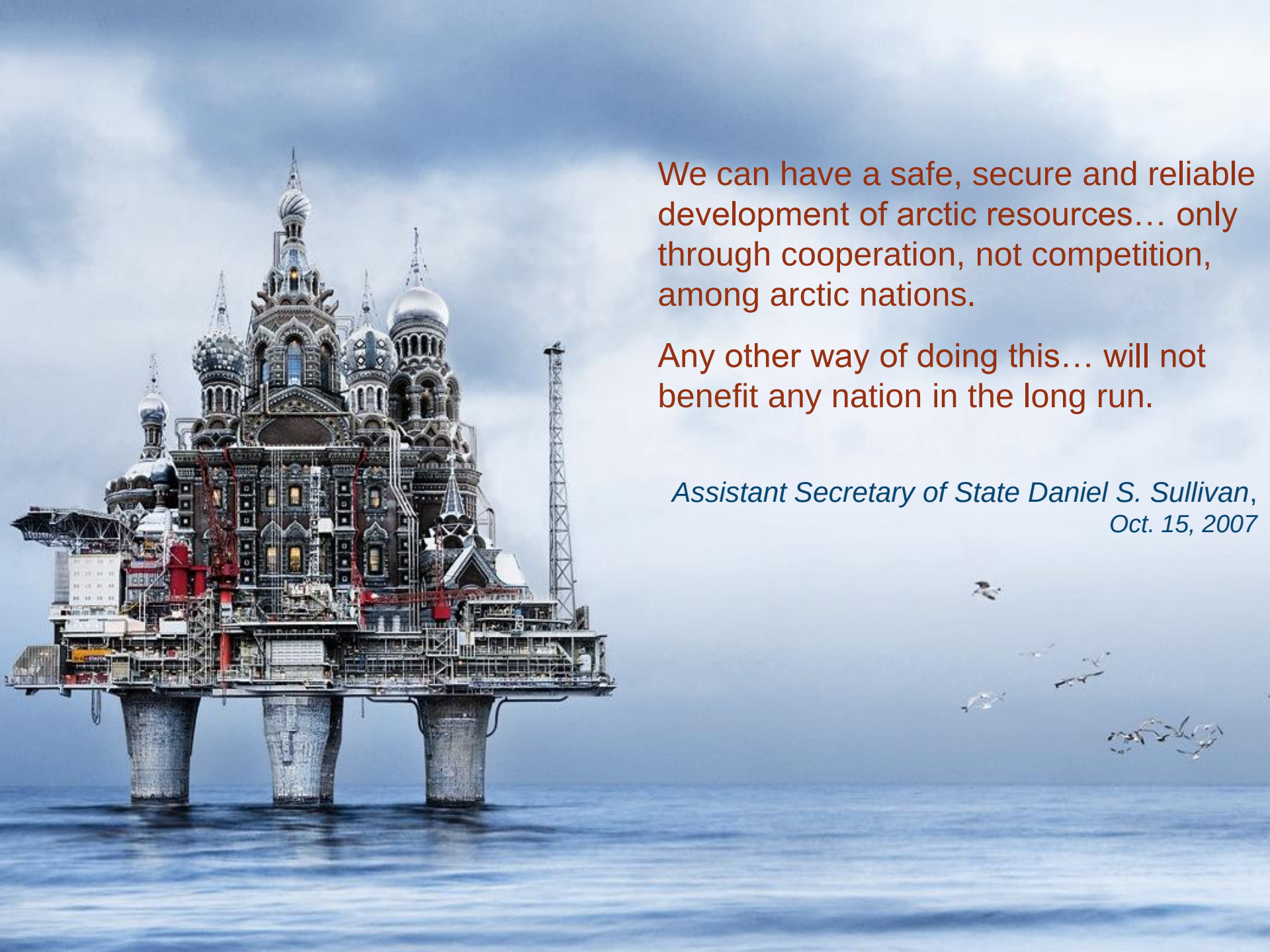
Баренцево море: область международного энергетического сотрудничества



What should be done?

Что необходимо сделать?

- State program for exploration of the Arctic shelf
- Conditions for attracting international experience, competence and capital
- Rapid transfer to a stimulating tax system based on profit taxation, including tax holidays on production of oil, natural gas and gas condensate from continental shelf, if and when required
- Modernization of Russia's Arctic sea ports
- Law enforcement and state program for efficient use of associated gas and development of gas chemistry
- International cooperation
- Internationalization of education



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

Thank you!

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