

Potential development activities

Activity levels in the Arctic will depend in the nearest future on the price for oil and gas. Industry plans a pipeline 1,800 kilometers in length to move six trillion cubic feet of natural gas from the Beaufort/MacKenzie Delta to Alberta at a rate of 800 million cubic feet a day. It may take until 2006 for the regulatory process to be completed.

Natural Resources Canada
Indian and Northern Affairs Canada
National Energy Board Canada
Government of the Northwest Territories—Resources, Wildlife and Economic Development

RUSSIA

Russia currently has no offshore production of oil or gas from the Arctic Seas as defined in the Arctic Council.

Prirazlomnoye Oil Field.

Discovered in 1989, the field lies about 1,200 kilometers northeast of Arkhangelsk in the Pechora Sea approximately 60 kilometers from shore in water depths of 19-20 meters. It contains over 600 million barrels of conventionally recoverable oil. Production is set to begin in 2004-5 with a rate of 150,000bopd (22,000 tons/day). Production will be achieved through the use of a Floating Production Storage Offloading vessel with shuttle tankers transporting oil to market.

The plan is to drill 40 wells (19 — production, 16 — injection and 5 — reserve), to reach maximum annual production volume. The field life is estimated to be 22 years.

Shtokmanovskoye field

The gas condensate field on the Barents Sea shelf was opened in 1988. Six test wells were drilled revealing 4 geological structures. In 1993 a feasibility study for development of Stockmanskoye field was developed and a license for the right to use the resources was granted.

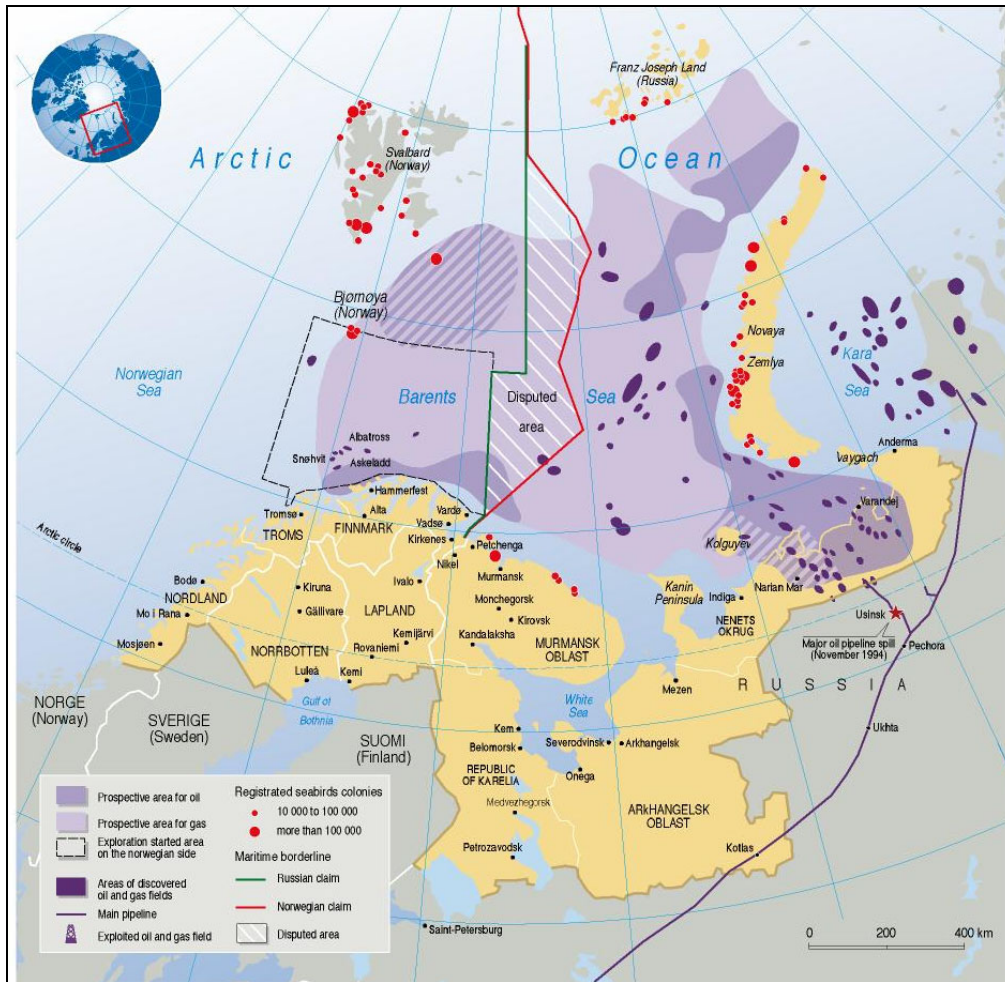
Geological gas reserves are estimated at 3.205 trillion cu m and gas condensate estimated at 30.98 million t. Annual volume gas production was estimated in the feasibility study at 60 billion cu m, with a full development cycle of 50 years. Production may start by 2010 to 2015. Gas may be liquefied in Murmansk and shipped by LNG tanker to Europe and North America.

Commercial production from these two fields will involve expansion of the Pechengi terminal on the Barents Sea coast -- which will receive oil production and used drilling mud and cuttings from the platform -- and support bases at Arkhangelsk and Naryan-Mar.

Hydrocarbon Resources of the Russian Continental Shelf

The peripheral marine area of Russia equals 6.2 million km², of which the shelf (200-300 m water depth) accounts for 4.2 mln km². Ninety percent of the offshore (3.9 mln km²) is prospective for oil and gas, about 2/3 of that for onshore. Two million square

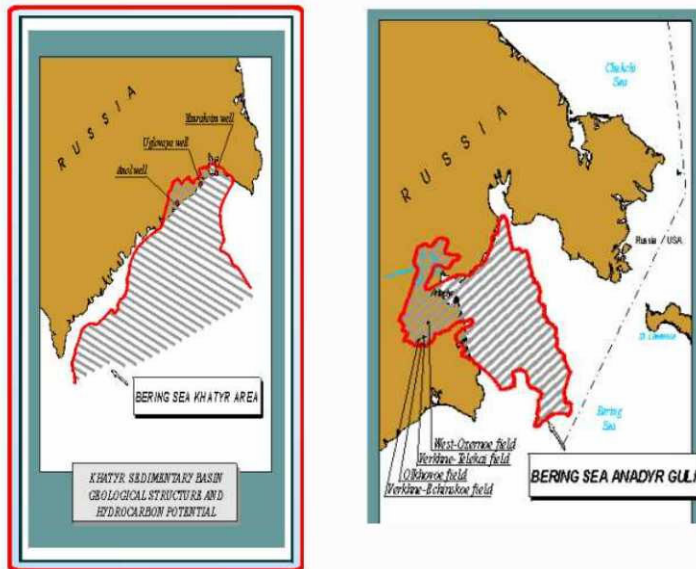
kilometers of this area is in the Western Arctic (Barents and Kara seas); 1 mln km² is in the Eastern Arctic (Laptev, East Siberian and Chukotsk seas), 800,000 km² are in the Far East seas (Bering, Okhotsk, and Japan), and the remainder in the southern seas (Caspian, Azov-Black seas, and a small area in the Baltic Sea near Kalingrad). Total estimates of offshore oil equivalent resources as of 1993 is 133 bln t (BTU estimated in oil equivalents), of which the recoverable resource equals 100 bln t. Seventy percent of these recoverable resources are in the Western Arctic (Barents and Kara seas) and 10% in total recoverable reserves (half in Sakhalin Island) in the Far East seas. The most plentiful



Oil and Gas Areas in the Barents Sea

resource is gas, estimated at 85 trln m³ (free and dissolved), whereas oil and condensate reserves are only 15.5 bln t. Oil reserve estimates by region are: Barents and Pechora=3.8 bln t; Kara=4.7 bln t; Far Eastern Siberian=2.1 bln t; and Okhotsk=2.1 bln t.

Analysis of available information has shown that in some offshore areas the estimate of hydrocarbon resource potential can be increased considerably. This is especially true for the East-Siberian and Chukotka seas, where the predicted increase of oil resources can be as much as 2-3 times.



Prospective Areas in the Far East Offshore

The degree of exploration of the initial recoverable hydrocarbon reserves for the Barents and Pechora seas amounts to only 10.5 % of the predicted total, including 11.9 % of free gas, and 0.4 % of oil. This index is considerably higher for the northeastern shelf of the Sakhalin where 76.7 % of the estimated reserves for oil and 28.3 % for free gas, and 57.6 % for condensate have been explored. The main super giant fields in the Russian offshore are: the Southern Barents Sea (Shtokman gas condensate field with 3 trln m3 gas in Jurassic reservoirs), Southern Kara Sea (Leningrad and Rusakov gas condensate fields with 4-6 trln m3 each in Cretaceous reservoirs), Pechora Sea industrial area (large Prirazlomnoye oil, gas and condensate field in Carbonates of Permian-Carboniferous), and Sakhalin (oil, gas, and condensate fields of NE offshore, Piltun-Astakhskoye, Arkutun-Dagin, Odopta and others).

Potential development activities

Besides Shtokman and Prirazlomnoye, the Barents Sea also offers other substantial prospects. Russia's Natural Resources Ministry hopes to tender 13 areas in the province, reportedly containing 14.3 billion boe, in the period by 2006. The Ministry has set an October 2003 deadline for the auction of exploration and development licences for three offshore blocks in the Barents Sea. The three blocks -- North Dolginsky, South Dolginsky and West Matveyevsky -- are estimated to contain recoverable reserves of 6 billion barrels of oil equivalent. They are located near the Prirazlomnoye oilfield.

The ministry estimates that North Dolginsky holds recoverable reserves of 360 million tonnes of oil equivalent, South Dolginsky 260 million tonnes of oil equivalent and West Matveyevsky 180 million tonnes of oil equivalent.

If the ministry succeeds in its push for the first tender, then it hopes the second tender for blocks 4, 5 and 6 -- Russky, North Pomorsky 1 and North Pomorsky 2, which have combined estimated recoverable reserves of 177 million tonnes of oil equivalent -- will be held during 2004.

The ministry's programme calls for at least four more tenders for 10 blocks to be held between 2005 and 2006.

All blocks on offer lie hundreds of kilometres from the "grey zone" -- the area disputed by Russia and Norway -- to avoid political complications.

Freshfields Bruckhaus Deringer Energy case studies: Europe
 Prirazlomnoye PSA Project description and logistics
 Rosneft 2003 webpage
 Upstream 13.03.2003
 Ministry of Natural Resources Feasibility Study "RUNARC" 1998
 Upstream "Barents Sea" 10.07.2003
 Upstream "October date for Barents sale" 16.04.2003
 Upstream "Russians eye three-block tender round" 13.03.2003
 AMAP Arctic Assessment
 Dalmorneftegeofysika

NORWAY

There are several offshore Arctic fields (as defined by Norway in the Arctic Council) in the Norwegian and Barents seas that are producing.

Net production per field per year of saleable products (Norwegian share)

Field	Period	Oil [mill Sm ³]	Gas [bill Sm ³]	Cond. [mill Sm ³]	NGL [mill Sm ³]	Sm ³ o.e. [mill]
Heidrun	2003	5.860594	1.127443	0.013078	0.050486	7.051601
Norne	2003	5.014645	0.470756	0.020856	0.072430	5.578687
Åsgard	2003	4.377720	5.842051	2.795546	1.787728	14.803045

The **Heidrun Field** was discovered in 1985 and was producing in 1995 after 11 exploration wells and 83 production wells we drilled. The field covers 130 km² and as of 12/31/2002 has the following reserves.

Recoverable reserves				Remaining reserves			
Oil [mill Sm ³]	Gas [bill Sm ³]	NGL [mill tonn]	Cond. [mill Sm ³]	Oil [mill Sm ³]	Gas [bill Sm ³]	NGL [mill tonn]	Cond. [mill Sm ³]
180.20	29.90	1.80	0.00	98.30	25.40	1.70	0.00

The **Norne Field** was discovered in 1992 and began producing in 1997 after 4 exploration and 27 development wells were drilled. The field covers 52.5 km² and as of 12/31/2002 has the following reserves.

Recoverable reserves				Remaining reserves			
Oil [mill Sm ³]	Gas [bill Sm ³]	NGL [mill tonn]	Cond. [mill Sm ³]	Oil [mill Sm ³]	Gas [bill Sm ³]	NGL [mill tonn]	Cond. [mill Sm ³]
87.40	13.70	1.40	0.00	40.40	11.80	1.30	0.00

The **Åsgard Field** was discovered in 1981 and began production in 1999 after drilling 18 exploration and 55 development wells. The filed covers 466.23 km² and as of 31.12.2002 contains the following reserves.

Recoverable reserves				Remaining reserves			
Oil [mill Sm ³]	Gas [bill Sm ³]	NGL [mill tonn]	Cond. [mill Sm ³]	Oil [mill Sm ³]	Gas [bill Sm ³]	NGL [mill tonn]	Cond. [mill Sm ³]

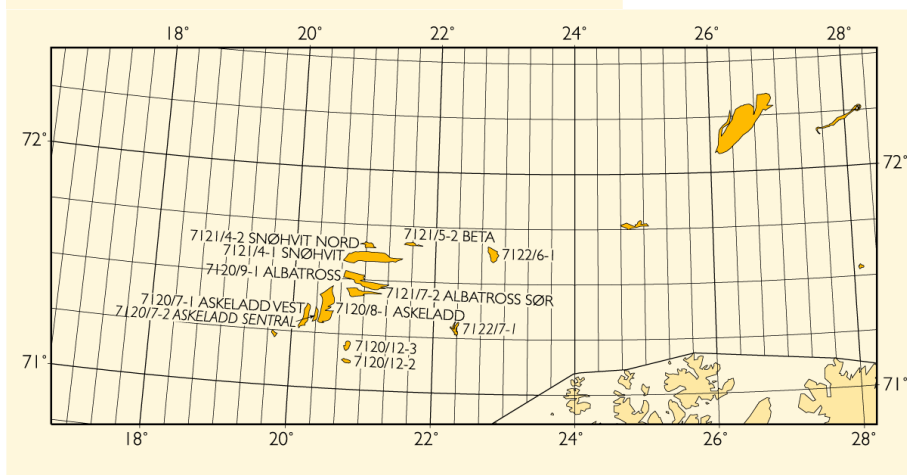
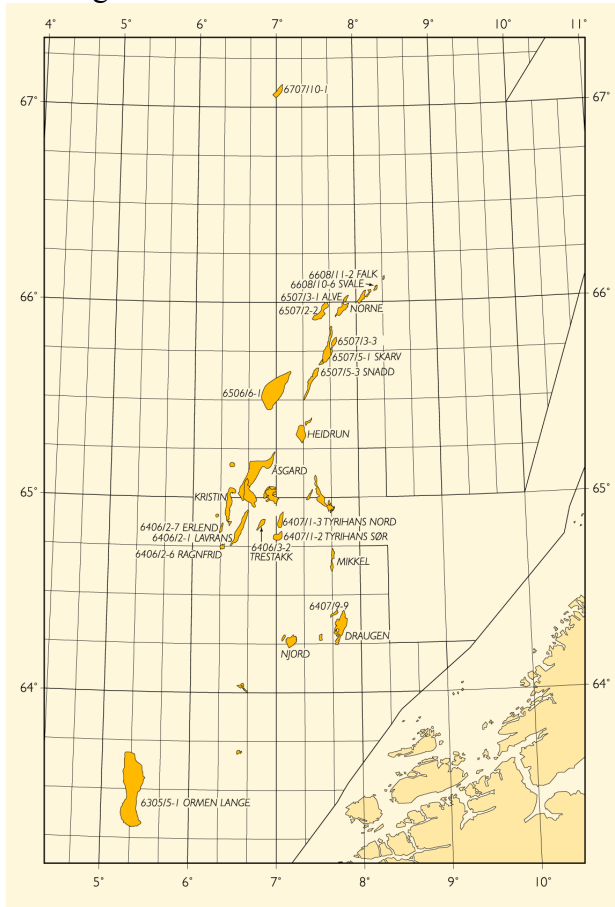
67.90	191.90	32.90	47.10	39.60	180.20	31.40	43.30
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NGL = butane + ethane + isobutane + propane + LPG.

Condensate = condensate + gasoline.

Sm³o.e. = oil + gas + NGL + condensate.

Norwegian Sea Fields

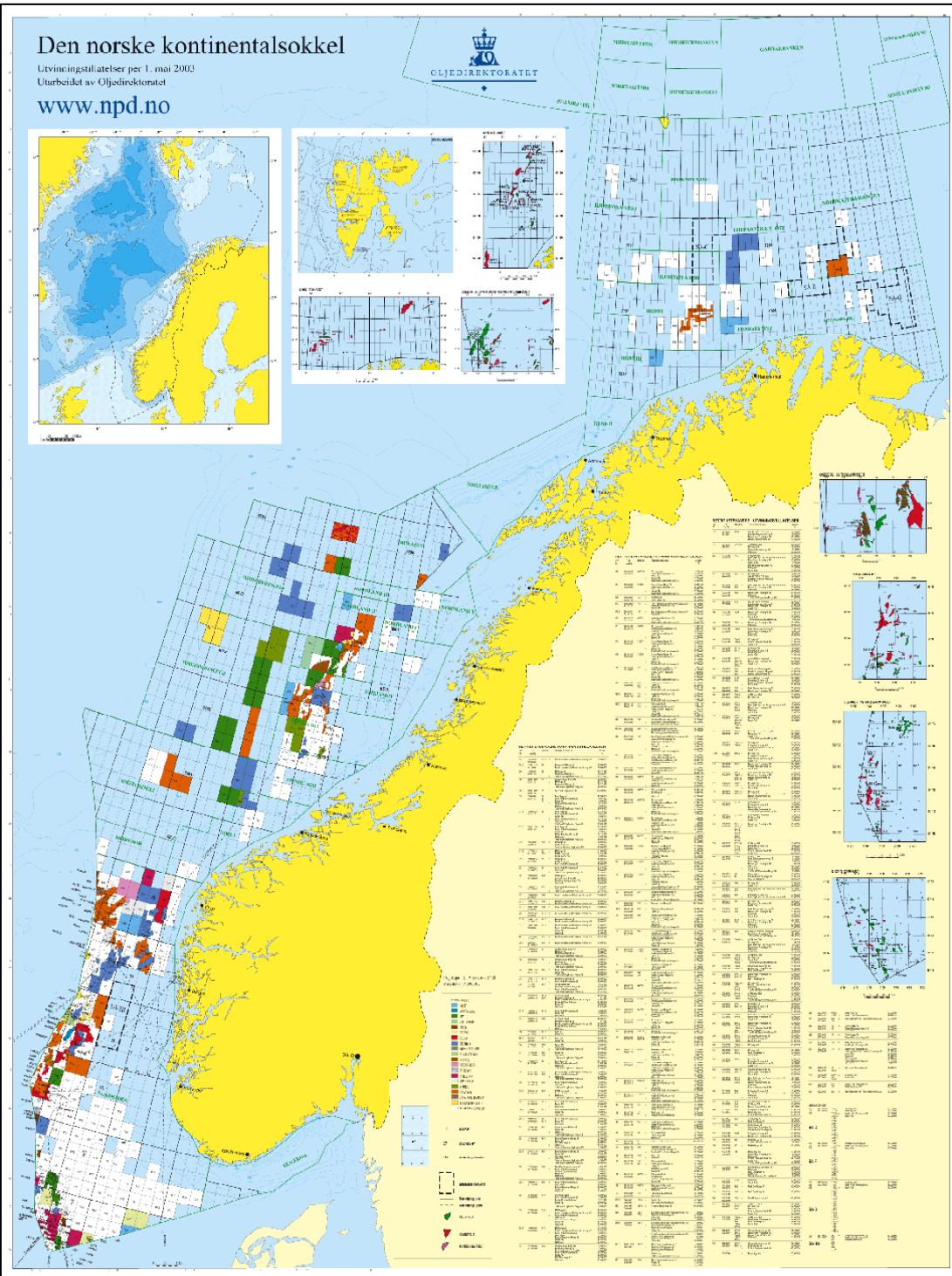


Barents Sea Fields

Den norske kontinentalsokkel

Utvinningsstillatelser per 1. mai 2003
Utbetalt av Oljedirektoratet

www.npd.no

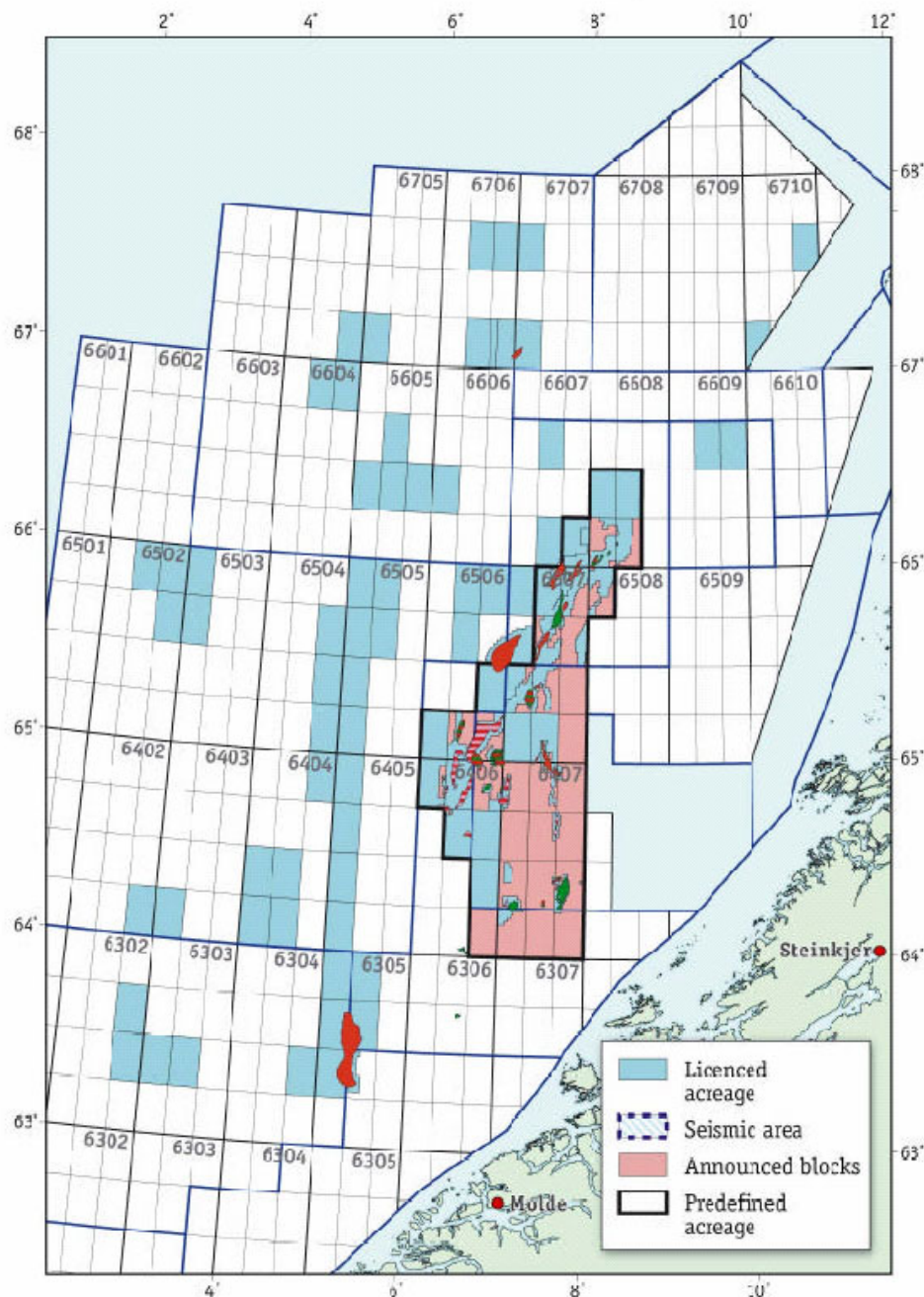


License Areas off Norway

Awards in Predefined Areas



Announced blocks in the Norwegian Sea



RG

20.5.03

OD 0305003

The 2003 License Area in the Norwegian Sea

Nominations for the 18th Licensing Round

The Ministry of Petroleum and Energy has received nominations from 14 companies regarding blocks to be included in the 18th licensing round on the Norwegian Continental Shelf (NCS). Two or more companies nominated 43 blocks. The Ministry of Petroleum and Energy will base the announcement of the 18th licensing round on the nominations. The 18th licensing round will give the companies access to frontier acreage, which is important to increase the exploration activity and to achieve the long-term scenario. Awards could then take place before summer 2004.

The long-term development scenario

In Storting White Paper No. 38 - On oil and gas activities, two potential scenarios were outlined for Norwegian petroleum production: the gradual decline scenario and the long-term development scenario. Up to 2050, the difference in added value between the two scenarios amounts to NOK 2000 - 4000 billion at today's oil price.

The Norwegian-Russian Disputed Lands

Some massive exploration targets have been mapped including the Fedinsky High structure, which allegedly could hold volumes two to three times as large as the giant Shtokman field on the Russian side. Shtokman, in turn, is more than double the size of the Troll gas field, which is Norway's largest.

Russian geologists have previously hinted at reserves in the order of 40 billion barrels of oil equivalent in the disputed area -- 4.5 times the Norwegian Petroleum Directorate's official estimates for the undisputed Norwegian part of the Barents.

Potential development activities

Snohvit Field: Barents Sea: Discovered 1988. Drilling of production wells will start in the autumn of 2004 and go on continuously until the end of 2005. Nine production wells - six at Snohvit and three at Albatross -- plus one injector well.

Goliath Field: Barents Sea: Discovered in 2000, appraisal well will be drilled at the end of 2004, with production of between 40,000 and 80,000 barrels per day around of the end of 2007.

Staer Field: Discovered 2001 contains 25million to 30 million-barrels of oil

Svale Field: Discovered in 2000 contains 50 million-barrels of oil.

Norwegian Petroleum Directorate

Upstream "Breaking up the forbidden zone" 13.03.2003

Upstream "Agip's Goliath oilfield development in the Barents Sea is likely to be delayed by a year" 13.03.2003

Upstream Snohvit 30.01.2003

Ministry of Petroleum and Energy Press release No.: 78E 04.08.2003

Upstream "Norwegians set to probe Norne promise" 30.01.2003

Denmark GREENLAND

Exploration History

Petroleum exploration in offshore West Greenland began in the early 1970s. In 1975, licenses were granted and in 1976 and 1977, 5 exploratory wells were drilled (Hellefisk-1, Ikermiut-1, Kângamiut-1, Nukik-1, and Nukik-2). A hydrocarbon discovery was made in the Kângamiut-1 well. Exploration was discontinued in late 1978.

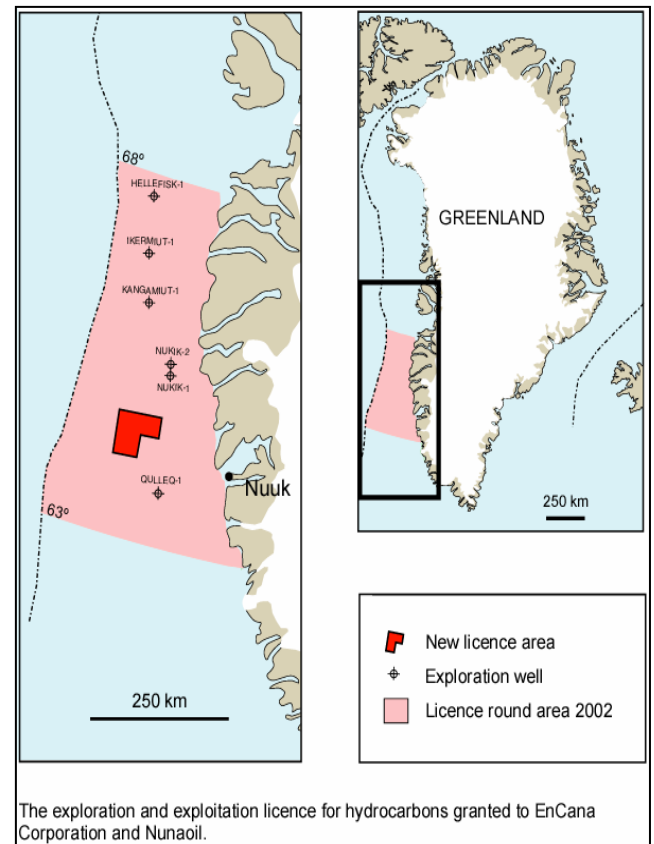
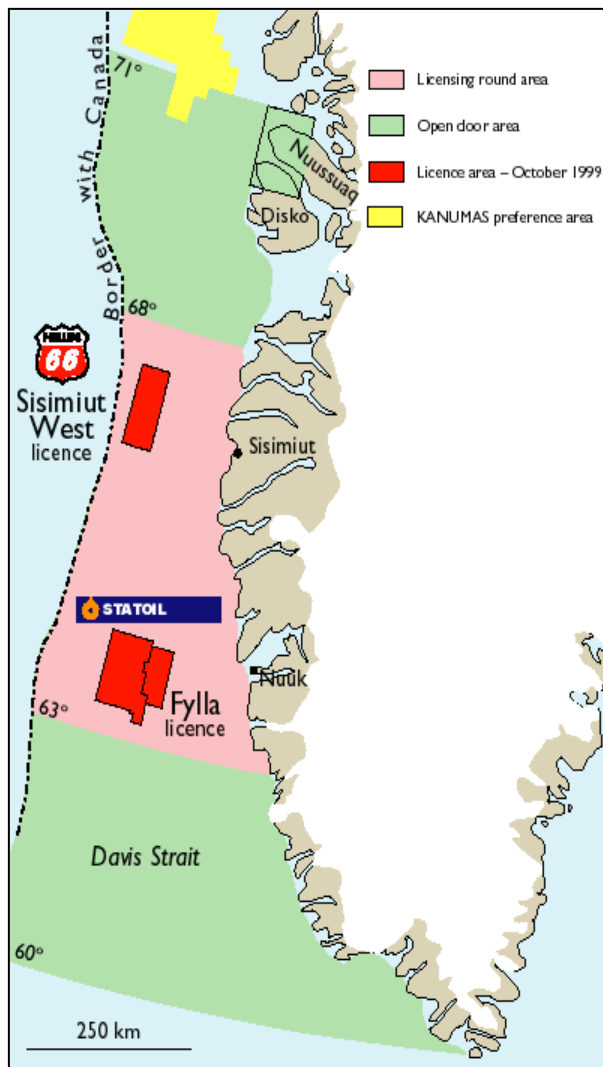
The Kalaallit Nunaat Marine Seismic (KANUMAS) seismic reconnaissance survey project in the extreme northern frontier areas offshore eastern and western Greenland collected seismic data offshore North-West Greenland, North-East Greenland, and central East Greenland. The KANUMAS group holds a preferential exploration position in the areas covered by the seismic surveys.

A licensing round for areas offshore West Greenland south of 66°N was held in 1992-93. However, no applications were submitted and, as a consequence, an open-door policy for both onshore and offshore areas south of 70°30'N in West Greenland was introduced in 1994. In 1996 a license covering 9,487 km² was awarded.

In 1998, a new license off Sisimiut in West Greenland was signed. The Sisimiut West license covers an area of 4,744 km².

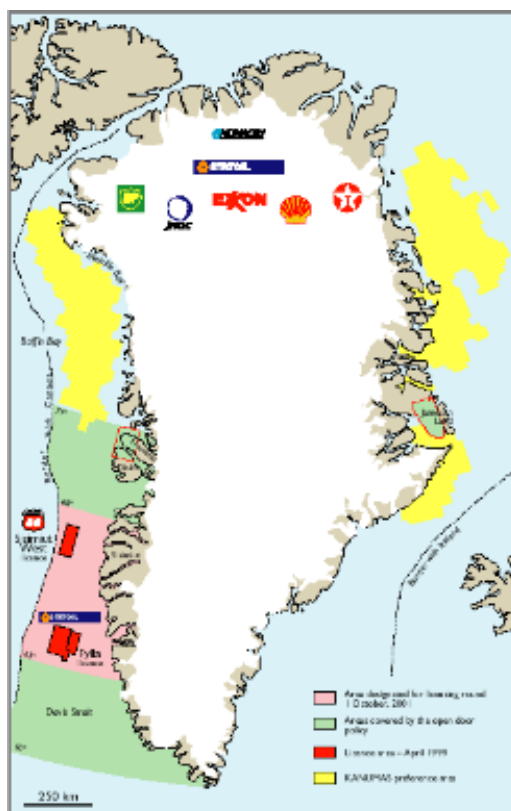
The Fylla License covers 3985 square kilometres and is located approximately 200 kilometres west of Nuuk. Most of the licence is within the southern part of the Nuuk Basin, but the easternmost part also encompasses parts of the Atammik Structural Complex. Water depths range from 200 to 1000 metres and no wells have previously been drilled in the area.

Licence No.	Licensee	General Location	Name of licence area	Type of Licence	Status
<u>08/99</u>	<u>Norsk Hydro AS</u>	<u>East Greenland</u>	<u>East Greenland</u>	<u>Prospecting licence (non-exclusive)</u>	<u>In force</u>
<u>2002/15</u>	<u>Nunaoil A/S</u> <u>EnCana Corporation</u>	<u>West Greenland</u>	<u>Offshore West Greenland</u>	<u>Exploration and exploitation licence (exclusive)</u>	<u>In force</u>



The exploration and exploitation licence for hydrocarbons granted to EnCana Corporation and Nunaoil.

KANUMAS project 1990-96



Resource Estimates

Greenland Assessment Results Summary - Allocated Resources

(MMBO, million barrels of oil; BCFG, billion cubic feet of gas; MMENGL, million barrels of natural gas liquids; MFS, minimum field size assessed (MMBO or BCFG); Prob., probability (including both geologic and accessibility probabilities) of at least one field equal to or greater than the MFS. Results shown are fully risked estimates. For gas fields, all liquids are included under the NGL (natural gas liquids) category. F95 represents a 95 percent chance of at least the amount tabulated. Other practices are defined similarly. Practices are additive under the assumption of perfect positive correlation. Shading indicates not applicable.)

Code and Field Type	MFS	Prob. (0-1)	Undiscovered Resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMENGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Total: Assessed onshore portions of Greenland														
Oil Fields			0	994	2,236	948	0	932	2,372	943	0	53	150	57
Gas Fields	0.70						0	689	1,624	671	0	26	69	27
Total	0.70		0	994	2,236	948	0	1,621	3,996	1,614	0	79	219	83
Total: Assessed offshore portions of Greenland														
Oil Fields			0	48,630	109,579	46,205	0	45,675	116,225	46,205	0	2,593	7,343	2,770
Gas Fields	0.70						0	33,742	79,555	32,890	0	1,271	3,383	1,315
Total	0.70		0	48,630	109,579	46,205	0	79,416	195,780	79,095	0	3,861	10,738	4,085
Grand Total: Assessed portions of Greenland														
Oil Fields			0	49,624	111,815	47,148	0	46,607	118,597	47,148	0	2,642	7,439	2,827
Gas Fields	0.70						0	34,430	81,179	33,551	0	1,297	3,468	1,343
Total	0.70		0	49,624	111,815	47,148	0	81,037	199,776	80,709	0	3,940	10,957	4,170

Values are not necessarily those for the entire country, but only for that part assessed in World Petroleum Assessment 2000.

Possible Future Activities

The new petroleum licensing policy for Greenland was announced in April 1999 that re-establishment of the open-door policy for areas both onshore and offshore.

A new Licence Round in 2004 for selected areas offshore West Greenland between 62°N and 69°N it is anticipated that licences will be granted at the New Year of 2004/2005.

- (1) Parts of Lady Franklin Basin between approx. 63°N and 65°N covering approx. 10,500 km²
- (2) Kangaamiut Basin and Ridge around 66°N covering approx. 4900 km²
- (3) Parts of Ikermiut Fault Zone/Sisimiut between approximately 67°N and 68°N covering approx. 5600 km²
- (4) Parts of the Atammik and Fylla Structural Complexes between approx. 63°N and 64°N covering approx. 11,200 km²

Bureau of Mines and Petroleum, Greenland
U.S. Geological Survey World Petroleum Assessment: Resource Assessment Summaries of the Countries of the World

FAROE ISLANDS

Exploration History

In August 2000 the Minister of Petroleum granted 7 exploration licenses in the first licensing round on the Faroese Continental Shelf. The work programmes of the licenses cover 8 well commitments in addition to comprehensive seismic and other surveys. Three wells were drilled in 2001 and one well was drilled in 2003. The first well established that the Faroe Shelf holds a working petroleum system, the second well confirmed the result. The third well discovered light oil and gas over an interval of approx 170 metres, the fourth well did not contain any traces of hydrocarbons.

In late 2001 both oil and gas were discovered on Licence 001 in the Faroe Islands—the first discovery in the Faroes offshore. Light oil and gas were discovered over a gross interval of approximately 170m. The well was not subjected to a flow test, due to weather conditions, and following the completion of logging operations, it will be plugged and abandoned. Located close to the boundary with the United Kingdom, in 950m of water, the well was drilled to a total depth (TD) of 4275 metres in a deepening operation, after reaching the commitment depth of 3830 metres. Another test is scheduled for 2005 before a decision is made by the company on whether to initiate production or not.

In August 2003 ENI Denmark BV and Faroe Petroleum plugged and abandon the Marimas exploration well on Faroes License 002 in the Atlantic. The well was drilled to 3,847 m in 1,048 m of water. It drilled through all of the stratigraphic objectives the operator identified and encountered good reservoir-quality sandstones but only traces of hydrocarbons.

Possible Future Activities

Faroe Petroleum noted that Faroes exploration is still in an early stage and said it remains confident of the presence of significant oil-bearing structures. Large oil companies have scheduled four more wildcats in the next three years.

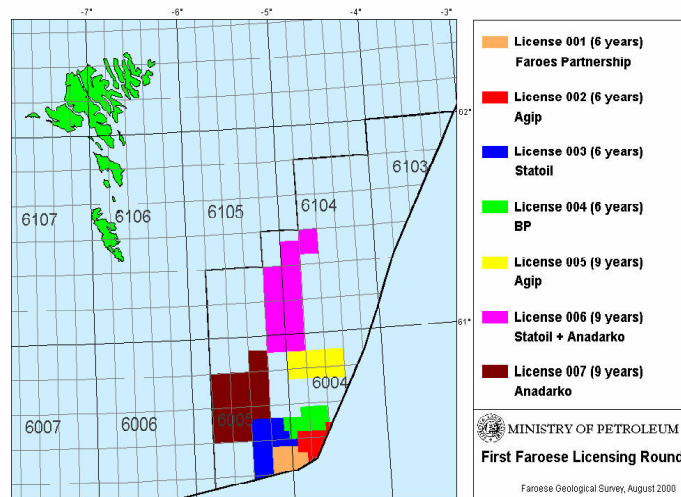
The Faores authorities are committed to oil exploration, and new work programs for the nine-year licenses are being negotiated by the Ministry of Petroleum and the licensees.

The Ministry of Petroleum is preparing for a second licensing round on the Faroese Continental Shelf. Invitations have been sent to international industry to nominate blocks they would like to see included in the second licensing round.

The nominations, which apply to the Faroese continental shelf within 200 nautical miles, will be submitted to the Faroese Geological Survey by 15 December 2003. Companies have been asked to rank the nominated blocks into two categories 1) interesting and 2) very interesting. The nominations will be part of the decision making process when the Ministry decides which areas to include in the second licensing round.

The Minister of Petroleum is expected to open the new licensing round in the first half of

2004 and award the licenses towards the end of 2004, if sufficient interest is demonstrated.



FIRST LICENSE AWARDS ON THE FAROESE CONTINENTAL SHELF

License no.	Blocks/part blocks	Companies	Share	Area	Period
001	6005/20, og 25, og 6004/16	Amerada Hess British Gas DONG Atlantic Petroleum	42,957% 39,960% 16,983% 0.1%	246 km ²	6 years
002	6004/11, 12, 13, 16, og 17	ENI Føroya Kolvetni	75% 25%	214 km ²	6 years
003	6005/14, 15, 19, 20, og 24, og 6004/16	Statoil Phillips Enterprise Petro-Canada	35% 30% 20% 15%	490 km ²	6 years
004	6004/11, og 12, og 6005/15	BP Amoco Shell	66 2/3% 33 1/3%	284 km ²	6 years
005	6004/1, 2, 3, 6, 7, og 8	ENI Føroya Kolvetni	75% 25%	485 km ²	9 years
006	6105/25, og 30, 6005/ 5, 6104/16, 17, 21, og 26, og 6004/1	Statoil Anadarko DONG Enterprise Petro-Canada	27,5% 27,5% 20% 15% 10%	1.278 km ²	9 years
007	6005/4, 7, 8, 9, 12, 13, og 14	Anadarko	100%	1.217 km ²	9 years

Atlantic Petroleum <http://www.petroleum.fo/>

Oil and Gas Journal, Aug. 4, 2003

Upstream "Faroes plan new round" 25/08/03

Ministry of Petroleum Faroe Islands http://www.oms.fo/uk/petrol_history.htm

GLOBAL CLIMATE CHANGE

In the most accepted scenario of global climate change in which the Arctic climate continues to warm, several effects on possible petroleum exploration might be seen. In the near term, shorter cold weather winter seasons may hamper winter-only operations

such as the construction of ice roads and ice islands, the Alaska Department of Natural Resources estimate that the time for winter operations has halved since 1970's. Also, melting and thinning of the coastal ice pack may result in less protection of the shoreline from storm surge, which could damage existing shoreline facilities as larger waves impinge on the unprotected coast. In the longer term, an ice-free outer continental shelf may open areas previously closed to exploration and development because of technological and economical barriers. In addition, trans-Arctic shipping and transport may become available that will allow access to wider areas in the Arctic seas. The development of the Northern Sea Route, the shortest navigable route between the Atlantic and Pacific Oceans, may further favour economic activity in the Arctic.

Upstream 15.08.2003 "Alaska drill window hit by warming"
Alaska Department of Natural Resources

PIPELINES

Pipelines may provide infrastructure for development of proximal resources

1. The Trans-Alaska Pipeline System may provide additional oil transportation for production from satellite fields or new discoveries in the Beaufort Sea (i.e. Liberty, Sandpiper, Kuvlum)
2. A new Alaska gas pipeline through Canada would allow production of gas from existing North Slope and possibly new offshore fields.
3. New Canadian gas pipelines will allow both discovered and potential MacKenzie Delta/Beaufort Sea gas to be transported to markets. And will allow Alaska North Slope gas access to markets by one or two possible tie-ins.
4. The Irkutsk-Murmansk pipeline and Murmansk port may attract proximal E&P activities as well as transport of Siberian oil to the northern coast for export overseas. The pipeline is proposed to carry 1.2 million barrels a day.

LAW OF THE SEA ARTICLE 76: NATIONAL SUBMERGED LAND CLAIMS

Article 76 of the United Nations Convention on the Law of the Sea (UNCLOS) provides that coastal states may claim sovereignty over "submerged extensions of their continental margin" beyond the recognized 200 nautical mile limit of their Exclusive Economic Zone. National land claims are being developed by Arctic coastal countries that will influence the location and speed of exploration and development in the offshore Arctic Ocean in the decades to come.

METHANE HYDRATES

On Alaska's North Slope alone, the hydrate resource has been estimated at 590 trillion cubic feet, according to the US Geological Survey. Conventional natural gas reserves in the Prudhoe Bay area are estimated at about 125 Tcf.



Location of sedimentary basins in the Northern Hemisphere that may contain gas hydrate.
Source: Collett and Dallimore, 2000.

Near-Term (by 2005)

- Conduct focused laboratory and field studies of methane hydrates to provide more complete data on the physical and chemical properties of hydrates and hydrate-bearing sediments.
- Provide these and other databases on a variety of methane hydrate topics on a world-wide-web site for use by the entire methane hydrate R&D community.
- Conduct initial investigations into the relationship between natural methane hydrates, the global carbon cycle and climate, and report results to Congress.
- Provide improved assessments of the distribution and volume of methane hydrates.
- Provide practical means to avoid or mitigate the potential hazards of overlying hydrate deposits to conventional oil and gas production in the Gulf of Mexico.
- Develop improved seismic and other geophysical tools for hydrate identification and characterization.
- Develop pressure/temperature-controlled devices for the sampling and preservation of samples in low-temperature, high-pressure environments.

Mid-Term (by 2010)

- Further refine analytical tools for the identification and characterization of natural methane hydrates.
- Produce estimates of the recovery potential from methane hydrates.
- Develop and test engineering concepts for production of gas from natural gas hydrate deposits.

Long-Term (by 2015)

- Enable the commercial production of methane from hydrates, providing a secure, long-term supply of domestic natural gas.
- Allow the continued safe production oil and gas from deep-water deposits overlain by hydrates.
- Provide a comprehensive knowledge base and suite of analytical tools to support ongoing research into natural methane hydrates and their role in the global environment.
- Secure the U.S. as a global leader in the science of natural gas hydrates and the technology of hydrate production.

Upstream Journal "Alaska soft shoe shuffle for hydrates 24.04.2003"
U.S. Department of Energy

Conversion Factors

1 mile (nautical international) = 1.852 kilometers; 1.151 statute miles; 0.999 U.S. nautical miles

1 foot = 0.3048 meter

1 acre = 43,560 square feet; 4,840 square yards; 0.405 hectare

1 hectare = 2.471 acres

1 square kilometer = 0.386 square mile; 247.105 acres; 100 hectares

1 square mile = 2.59 square kilometers

1 metric ton of Urals Crude = 7.31 barrels