



2008 Minerals Yearbook

DENMARK, THE FAROE ISLANDS, AND GREENLAND

THE MINERAL INDUSTRIES OF DENMARK, THE FAROE ISLANDS, AND GREENLAND

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DENMARK

Denmark's mineral resources were limited and consisted mainly of industrial minerals, fuels, and peat. Private ownership and exploitation of minerals were allowed under Danish law. The permitting procedures for mineral production were developed and administered at the county level. Regulations concerning the mineral industry were comparable with those of the other European Union (EU) member countries (Ministry of Foreign Affairs, 2008).

Denmark has an industrialized market economy, and the country's economic growth depended on imported raw materials and foreign trade. Denmark followed a liberal trade policy consistent with EU trade policy. Geography was a factor in Denmark's trading partners, and in 2008, the other 26 EU countries accounted for 71% of the total Danish external trade and Norway accounted for another 5%. In 2008, Germany was Denmark's leading trading partner and accounted for 22% of Denmark's imports and 16% of Denmark's exports. China was the fourth ranked supplier of goods to Denmark and accounted for 6% of all Danish imports. Two percent of Danish exports went to China (Statistics Denmark, 2009).

Production

Denmark has no known economically exploitable reserves of metallic ores but it does have reserves of such nonmetallic materials as chalk, clays (including bentonite and kaolin), lime, peat, salt, and stone (including dimension stone and limestone). The country had reserves of limonite (bog ore); however, they were not exploited. Limonite is used in the production of pig iron, and when the country's steel plant closed in 2004, there was no longer a demand for limonite or pig iron. Denmark was the only commercial producer of moler, which consists of a natural mixture of diatomite and 20% to 25% smectite clay and is an important ingredient of insulation bricks. The production of natural gas and petroleum from the Danish area of the North Sea was continuing. These mineral fuels were the most important mineral commodities produced within the country, although petroleum production was declining as reserves were being depleted. In 2008, petroleum production fell for the fourth year in a row, dropping to 105,430 thousand barrels in 2008 from a record level of 144,465 thousand barrels in 2004 (table 1).

Structure of the Mineral Industry

The Danish mineral industry was mostly privately owned. Table 2 is a list of the country's major mineral industry facilities and their capacities.

Commodity Review

Industrial Minerals

Cement.—Aalborg Portland A/S, which was a subsidiary of Cementir Holdings S.p.A. of Italy, was the sole producer of gray and white cement in Denmark. Aalborg operated seven kilns at its plant in Rordal, which had a capacity of 2.7 million metric tons of gray cement and 850,000 metric tons of white cement. Aalborg was an international player in the production of white cement and grey cement (Aalborg Portland A/S, 2008, p. 96).

Stone, Crushed.—A/S Faxe Kalkbrud, which was owned by the Lhoist Group of Belgium, was a major producer of calcium carbonate from its deposits on the island of Zealand. Faxe was a market leader in the production and marketing of stone products (A/S Faxe Kalkbrud, 2008).

Mineral Fuels and Other Sources of Energy

Petroleum.—All of Denmark's producing natural gas and petroleum fields are located in the North Sea. In 2008, the country had 19 producing fields of various sizes. Although most Danish fields had passed the period of peak production using known technology, oil companies showed continued interest in investing in natural gas and petroleum recovery in 2008. Production in 2008 was derived from 283 production wells consisting of 204 petroleum wells and 79 natural gas wells. In 2008, about 20% of the known mineral fuel resources had been recovered. An additional 6% was expected to be recoverable, leaving more than 70% of the country's oil resources still unproduced. These resources were considered to be difficult or impossible to recover with today's production technology (Danish Energy Agency, 2008).

Hess Denmark APS, which was the operator of license 7/89, announced that petroleum in the form of oil-bearing chalks was discovered in the South Tor Pod exploration well. The purpose of the well was to explore for hydrocarbons in the Upper Cretaceous chalks within a structural closure. The area south of and down dip from the South Tor Pod well could constitute a potential stratigraphic oil accumulation trap. The well was drilled to a vertical depth of 2,968 meters (m) below sea level and was concluded in the Cretaceous Hod formation. Water depth at the site is 55 m. The well was drilled by International Energy Co.'s Enco-70 jack up rig (Oil and Gas Journal, 2008).

DONG Energy A/S was planning to develop the Nini East field in the Siri fairway, which is located close to the border with Norwegian waters. The firm planned to use an unmanned platform, from which the crude would be piped through Nini to the Siri field's tanker-loading facilities. The field's estimated reserves of 17 million barrels of oil were expected to result in

the production of about 11,000 barrels per day, with the first oil expected by yearend 2009. The development costs were estimated to be \$440 million. The production was expected to keep the Siri field in operation until 2020 (Petroleum Economist, 2008).

Other Sources of Energy.—In 2008, E.ON Group placed an order with the Siemens Renewable Energy Division for the supply of 90 wind turbines for the Rodsand II offshore wind farm, which is located south of the Danish island of Lolland in the Baltic Sea. With an installed capacity of 207 megawatts (MW), the new project would be one of the largest offshore wind farms in the world. The 90 turbines, which would each have a rotor diameter of 39 m and a capacity of 2.3 MW were to be installed in 2010. The project is located 3 kilometers (km) to the west of the existing Rodsand I offshore wind farm, which was connected to the power grid in 2003. Once completed, the Rodsand II offshore farm would reduce the emission of carbon dioxide (CO₂) by an estimated 700,000 metric tons per year (t/yr) (Alexander's Gas & Oil Connections, 2008).

Outlook

Considerable natural gas and petroleum reserves were thought still to exist in Denmark, and discoveries that may turn out to be substantial have been made at several locations. Further exploration that would contribute to a better understanding of the area, continued research in new production and recovery technology, and the testing of new exploration methods will continue to play a major role in Denmark's future natural gas and petroleum production.

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FAROE ISLANDS

The Faroe Islands, which is a self-governing overseas administrative division of Denmark, has no identified mineral

resources. The Faroese economy depended on fishing and salmon farming and was aided by a substantial annual subsidy from Denmark. The principal involvement of the Faroe Islands in the international mineral industry was as a market for imported materials, principally cement, fertilizer materials, and fuels. Possible future discoveries of oil in the Faroese area could give hope for eventual oil production and diversification of its economy.

StatoilHydro ASA was awarded the operatorship of a large exploration area in the third Faroese licensing round. The partners were DONG Energy A/S (30%) of Denmark, and local companies Atlantic Petroleum P/F (10%) and Faroe Petroleum plc (10%) each. The area covers 5,312 square kilometers (km²) and is the largest license ever to be awarded in Faroese waters. StatoilHydro announced that it would gather seismic data on the area and make a decision within 3 to 6 years about whether to drill an exploration well. Statoil already had four operatorships on the Faroese Continental Shelf and was a partner in one, which was operated by Chevron Corp. of the United States (Mbendi Information Services (Pty) Ltd., 2008).

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GREENLAND

Greenland is a self-governing overseas administrative division of Denmark (it was granted self rule in 1997). About one-half of Greenland's revenues came from grants from the Danish Government. This was expected to change in June 2010 when greater independence would pass over to the Greenlanders on their national day. Greenland will take 100% control of its mineral and oil acreage after the handover, with Danish subsidies to be progressively reduced. Greenland has shown a willingness to move toward a mining-based economy, which would enable the country to use royalties to fund greater independence and fuel growth of an economy that was currently reliant on fishing and other small internal industries. The private and public sectors contributed to Greenland's economy. Hydrocarbon and mineral exploration activities were the focuses of foreign investment. Exploration was most active for base metals, diamond, gemstones, gold, nickel, and platinum-group metals (Ellis, 2009).

Commodity Review

Metals

Gold.—The joint venture of Crew Gold Corp. of the United Kingdom and NunaMinerals A/S discovered the Nalunaq gold deposit in southern Greenland in 2004. The Nalunaq deposit is a high-grade gold-only mineralization associated with quartz veins in a major shear zone. The deposit is a mesothermal vein-type gold mineralization hosted in Proterozoic amphibolite-facies metavolcanic rocks.

The mine began operating in 2005, and the first gold was poured in March 2007. NunaMinerals sold its shares in Nalunaq to its partner, Crew Gold, in 2007. In late 2008, Crew Gold decided to suspend operations at Nalunaq to stockpile ore in preparation for shipping the material to Crew Gold's Nugget Pond processing facilities in Newfoundland and to move towards putting the mine on care-and-maintenance status. Although the resources at Nalunaq appeared to be substantial, the continued high costs of mining, shipping, and processing were the primary factors on which the planned suspension of operations was based. Nalunaq produced 1,518 kilograms (kg) of gold in 2008 compared with 1,639 kg of gold in 2007 (Crew Gold Corp., 2008, p. 2).

Molybdenum.—Quadra Mining Ltd.'s Malmbjerg project is located on the east coast of Greenland and was considered by the company to be one of the country's highest grade molybdenum projects that were amenable to open pit mining. Quadra Mining's subsidiary, International Molybdenum plc, was to be the operator, and Quadra planned that the project would be developed as a conventional open pit mine. The mine would operate year round and have a mining rate of 25,000 to 30,000 t/yr of ore, an estimated mine life of 15 to 20 years, production of 7,500 t/yr to 10,400 t/yr concentrate, and a recovery rate of 86% at a grade of 55% molybdenum by flotation processing (Quadra Mining Ltd., 2008).

Platinum-Group Metals.—NunaMinerals announced that it had entered into an option and joint-venture agreement with Impala Platinum Holdings Ltd. (Implats) of South Africa with respect to the 124-km² Amikoq platinum property in the northern part of the Nuuk fjord area. The Amikoq layered intrusion, which was discovered by NunaMinerals in 2005, is up to 3 km wide and outcrops across a strike extent of about 40 km. Implats would be able to earn a 60% interest in the property's platinum-group metals production by funding \$5 million of exploration expenditures on the property during 4 years. Implats would pay NunaMinerals a lump sum of \$1 million for historical expenditures incurred by NunaMinerals before the agreement date.

Zinc.—Angus & Ross plc was continuing with its exploration program at the Black Angel Mine area in 2008; the company expected to receive a mining license for the mine by midyear and to commence production by yearend. Angus and Ross expected the mine to cost \$50 million, plus a peak working capital requirement of about \$33 million, as mined ore would have to be stockpiled for 6 months during the winter when the fjord is frozen over and not accessible to shipping (Hill, 2008).

Zirconium.—The Government announced that Rimbal Pty Holdings Ltd./Westrip Holdings (Rimbal) was proceeding with a feasibility study and a mining plan for an eudialyte deposit near Kringlerne in southern Greenland. The zirconium-rich eudialyte ore reserve was estimated to be 2.9 billion metric tons with a cutoff grade of 1% zinc. The average grades of the ore were 2.79% zinc oxide, 0.7% rhenium trioxide, 0.25% niobium pentoxide, 0.2% yttrium trioxide, and 0.03% tantalum pentoxide. Rimbal was planning to mine 1 million metric tons per year from an open pit operation. The mine operations would be carried out by Rimbal's subsidiary Tanbreez Mine A/S (Greenland Mineral Exploration Newsletter, 2008).

Industrial Minerals

Gemstones.—True North Gems Inc. announced that the drilling was completed at the Fiskenaasset Ruby project as part of the 2008 exploration and prefeasibility program. The drilling was successful in extending the known pink and ruby sapphire mineralization and intersected new intervals of high-grade concentrations from the two Aappaluttog zones at the company's 823-km² Fiskenaasset Ruby project, which is located on the southwest coast of Greenland. Pink and ruby sapphire was identified in 45 of the 65 holes drilled. The Aappaluttog Deep Zone had been traced across a strike length of 85 m and to vertical depths of 70 to 143 m below the surface. True North continued with plans to upgrade the Fiskenaasset processing plant for the preparation of sized gravity concentrates. True North planned to optimize the value of the project by processing the mined ruby ore into polished ruby gemstones (True North Gems Inc., 2008).

Mineral Fuels

Petroleum.—Capricorn Group, which was a subsidiary of Cairn Energy plc, was to be operator for four licenses covering large offshore areas west of Greenland. Two areas offered in the Disko West round, Eggua and Sigguk, would be held by Capricorn (87.5%) and by Nunaoli A/S, which was the national oil company of Greenland, (12.5%), and the two open-door areas of Kingittog and Saggaaamiut would be held by Capricorn (92%) and by Nunaoli (8%) (Petroleum Economist, 2008).

Capricorn secured interests in two exploration licenses offshore southern Greenland. Capricorn was awarded a 92% interest in the Cape Farewell 1 and 2 Blocks. The remaining interest in each of the blocks was held by Nunaoli. The combined area of the two blocks is 20,072 km², and water depths range from 50 to 2,200 m. Very little data are available for offshore Greenland and the two blocks form part of Capricorn's exploration strategy for this area. Capricorn was planning to acquire about 1,780 km of two-dimensional seismic data for the Cape Farewell 1 and 2 Blocks (Rigzone.com, 2008).

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TABLE 1
DENMARK: ESTIMATED PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity	2004	2005	2006	2007	2008	
Aluminum metal, secondary	20,000	20,000	25,000	30,000	25,000	
Cement, hydraulic	2,050,000	2,120,000 ^r	2,937,132 ^{r,3,4}	2,871,402 ^{r,4}	2,800,000	
Chalk, calcium carbonate	1,950,000	1,950,000	1,900,000	1,950,000	1,900,000	
Clays:						
Bentonite	18,352 ⁴	18,515 ⁴	19,211 ^{r,4}	20,093 ^{r,4}	20,000	
Fire clay	25	25	25	25	25	
Kaolin	2,500	2,500	2,500	2,500	2,500	
Other	6,000	5,500	5,000	5,000	5,000	
Moler, extracted	thousand cubic meters	233	234	227 ^r	241 ^r	250
Gas:						
Manufactured	million cubic meters	1,500	1,500	1,500	1,500	1,500
Natural:						
Gross	do.	9,000	10,540 ⁴	10,304 ^{r,4}	9,128 ^{r,4}	8,860
Marketable	do.	8,200	9,500	9,500	8,752 ⁴	8,600
Gold ³	kilograms	--	1,000	1,500	1,639 ⁴	1,518 ⁴
Iron and steel, semimanufactures	thousand metric tons	516	--	--	--	--
Lime, hydrated and quicklime		116,000	120,000	115,000	115,000	115,000
Natural gas plant liquids	thousand 42-gallon barrels	47,000	48,000	48,000	48,000	48,000
Nitrogen, N content of ammonia		1,600	1,600	1,600	1,600	1,600
Olivine	thousand metric tons	--	450	1,000	1,100	1,100
Peat	do.	296 ⁴	259 ⁴	247 ⁴	242 ⁴	250
Petroleum:						
Crude	thousand 42-gallon barrels	144,465 ⁴	137,605 ⁴	125,830 ⁴	114,511 ⁴	105,430 ⁴
Refinery products:						
Liquefied petroleum gas	do.	1,902 ⁴	1,708 ^{r,4}	1,800	1,800	1,800
Gasoline	do.	16,881 ⁴	16,300 ^{r,4}	16,000	15,000	15,000
Naphtha	do.	51 ⁴	49 ^{r,4}	50	50	50
Jet fuel	do.	4,848 ⁴	3,979 ^{r,4}	4,800	4,800	4,800
Distillate fuel oil	do.	24,834 ⁴	24,050 ^{r,4}	26,000	25,000	25,000
Refinery gas	do.	2,100 ⁴	1,795 ^{r,4}	2,200	2,000	2,000
Residual fuel oil	do.	10,370 ⁴	9,059 ^{r,4}	11,300	11,000	11,000
Total	do.	60,986 ⁴	56,940 ^{r,4}	62,200	59,700	59,700
Phosphates, crude, gross weight		1,400	1,400	1,400	1,400	1,400
Salt, all forms		610,000	610,000	600,000	600,000	600,000
Sand and gravel:						
From onshore deposits	thousand cubic meters	28,000	28,400	28,000	28,000	28,000
From offshore deposits	do.	600	600	600	600	600
Total	do.	28,600	29,000	28,600	28,600	28,600
Of which sand, industrial (sales)	do.	500	500	500	500	500
Stone:						
Dimension (mostly granite)		26,000	27,000	26,000	25,000	25,000
Limestone:						
Agricultural		700,000	700,000	700,000	700,000	700,000
Industrial		250,000	250,000	250,000	250,000	250,000
Sulfur, recovered		4,660 ⁴	4,223 ⁴	4,142 ^{r,4}	3,896 ^{r,4}	3,800

^rRevised. do. Ditto. -- Zero.

¹Estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through September 31, 2009.

³Production from Greenland Island.

⁴Reported figure.

TABLE 2
DENMARK: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Aalborg Portland A/S (Cementir Holding S.p.A.)	Plant at Rordal	2,700
Chalk, (calcium carbonate)		A/S Faxe Kalkbrud	Quarries at Stevns and Sigerslev	2,500
Diatomite (moler)	thousand cubic meters	Dansk Moler Industri A/S (Damolin)	Quarries on Mors and Fur Islands	145
Kaolin		Aalborg Portland A/S (Cementir Holding S.p.A.)	Mine and plant on Bornholm Island	25
Lime		A/S Faxe Kalkbrud (Aalborg Portland Holding A/S)	Plant at Stubberup, near Fakse, on Zealand Island	200
Natural gas	million cubic meters	Maersk Olie og Gas A/S	Roar and Tyra gasfields, Danish North Sea	2,550
Olivine		Minelco A/S	Seqi Mine, Fiskefjord, west Greenland	1,100
Petroleum:				
Crude	barrels per day	Dansk Undergrounds Consortium	Dan, Gorm, Rolf, and Tyra, Danish North Sea	127,000
Refined	do.	A/S Dansk Shell	Fredericia	55,000
Do.	do.	Kuwait Petroleum Refining A/S	Gulfhavn and Skaelskor	56,500
Do.	do.	Statoil A/S	Kalundborg	65,000
Salt		Dansk Salt I/S	Mine (brine) at Hvornum, plant at Mariager	600
Do., do Ditto.				

