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The Mineral Industry of Norway

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Norway is situated in the western portion of the Scandinavian Peninsula in northern Europe and Norway has land borders with Finland, Russia, and Sweden. The geology of Norway is dominated by the Caledonide orogen, which, in Norway, extends for more than 1,500 kilometers (km) from Bergen to the Arctic-bound sections of the country; it contains sections of Mesoproterozoic rocks, of which granitoids are predominant. Along the border with Russia and Finland, Archean and Paleoproterozoic rocks of the Fennoscandian shield are exposed, both in the north and southeast of the Caledonide orogen. Mesoproterozoic rocks dominate southeastern Norway, along with the Oslo graben, which contains volcanic and intrusive complexes dating from the Late Carboniferous to the Early Triassic periods and these are emplaced into Cambrian- to Silurian-age sediments (Mining Journal, 2015).

Norway was not a member of the European Union (EU) but was a member of the European Free Trade Association (EFTA) and participated in the euro area single market through the European Economic Area Agreement. In 2015, Norway's real gross domestic product (GDP) was $373 billion, which was an increase of 1.6% compared with that of 2014. A depreciation of the Norwegian kroner (NOK) with respect to the U.S. dollar during 2015 made Norway's products cheaper in terms of dollars and helped the country increase its net export revenues. Compared with that of 2014, Norway's employment rate increased by 0.3% and its net inflation rate decreased by 0.2% (to 2.2%) (Statistics Norway, 2016).

Mineral trade was important to the economy in 2015. Norway's exports increased by 3.7% and its imports decreased by 1.6%; petroleum and petroleum products were the most significant component of the country's exports. In 2015, Norway held the largest crude petroleum reserves, by volume, in Europe, and it was the third-ranked exporter of natural gas in the world after Russia and Qatar. Norway's production of ilmenite accounted for 4.4% of world production (U.S. Energy Information Administration, 2016a, b; Bedinger, 2017).

Minerals in the National Economy

In 2015, the natural gas and crude petroleum sector accounted for almost 40% of the country's export revenues and more than 15% of the country's GDP. Although crude petroleum production had been declining since 2001, natural gas production had, on average, increased steadily since 1993. Despite the abundance of natural gas, hydropower was the country's main source of electricity. The Government, in anticipation of the eventual decrease in natural gas and petroleum production in the country, was saving a significant amount of revenue from petroleum exports in a sovereign wealth fund (SWF) that, in 2015, was valued at more than $800 billion. Norway's SWF was the second largest of all the SWFs after Luxembourg. Several United States companies had invested in or were active participants in Norway's petroleum industry, and several Norwegian companies participated in the petroleum industry of the United States. Besides crude petroleum and natural gas, Norway produced principally coal, iron ore, nickel, sand and gravel, stone, and titanium. The country's mines and quarries were mostly of regional significance and were located mainly along the coast; the natural gas and petroleum fields were located mainly offshore in the Norwegian area of the North Sea (table 1; U.S. Energy Information Administration, 2016c).

The United States trade in goods with Norway in 2015 totaled $3.57 billion in exports and $4.76 billion in imports for a negative trade balance of about $1.2 billion. United States exports to Norway included petroleum products, drilling and oilfield equipment, coal and other fuel, fuel oil, and finished metal shapes. Norway's exports to the United States included petroleum products, crude petroleum, fuel oil, liquefied petroleum gases, and nickel (U.S. Census Bureau, 2016a, b).

Production

In 2015, Norway's production of titanium increased by 63.2% in terms of titanium dioxide (TiO_2) content of ilmenite concentrate and by 62% in terms of gross weight. Other production increases included that of ferrosilicon (increased by 22.8%), olivine sand (19.9%), graphite (11.1%), and cadmium metal (6.9%). For mineral fuels, the most notable production increases were for marketed natural gas, which increased by 34.6%, and kerosene, which increased by 2.9%. The most notable production decreases in 2015 were for clays (decreased by 55%); feldspar (50.6%); dolomite (33.9%); coal (29.3%); lime, including hydrated and quicklime (12%); Fe content of iron ore (8.7%); sand and gravel (7.9%); hydraulic cement (5.9%); and refined cobalt (5.7%) (table 1).

Structure of the Mineral Industry

The Norwegian mineral industry was composed of a mixture of Government and privately owned operations. The largest mineral-producing company in Norway, in terms of revenue and share of the GDP, was Statoil ASA, which was created in 2007 by the merger of Statoil (a mostly Government-owned company) and the petroleum operations of Norsk Hydro ASA. The new company was majority owned by the Government, which owned 67% of the shares of the company, and had interests in more than 30 countries (U.S. Energy Information Administration, 2016c, p. 3).

Norsk Hydro was another important Norwegian company. It was one of the largest aluminum and renewable energy companies in the world, in terms of production and revenue. Norsk Hydro had aluminum smelters in Ardal, Hoyanger, Husnes, Kamoy, and Sundal and a combined production capacity of more than 1 million metric tons (Mt). Table 2 lists the major mineral companies and facilities that were operating

in Norway in 2015 and their respective mine and (or) plant locations and capacities.

Commodity Review

Metals

Iron Ore.—On November 18, Sydvaranger Gruve AS, which was a subsidiary of Northern Iron Ltd. of Australia, filed for bankruptcy. The company, which had 400 employees and had begun operations in 2009, produced iron ore concentrate, but was no longer able to continue operations. At the time of the announcement, no buyer had been found; therefore, the company was forced to shut down the facility. On November 12, Northern Iron requested a trading halt for its shares pending the outcome of talks with banks regarding the future of the Sydvaranger Mine. The mine, which is located in Bjørnevatn, had an annual capacity of 6 Mt of iron ore (table 2; Thomson Reuters, 2015).

Titanium.—Kronos Norge AS (the parent company of Titania AS, which operated the Tellnes Mine) reported an increase in production at the Tellnes facility owing to unspecified improvements in efficiency and increased demand from some of its European customers. The company did not provide further specific information regarding the increase in production. The company stated that its plants worldwide had increased production to close to capacity, with an average production increase of 3% across all its facilitates, despite lower than average sale prices for TiO_2 (Kronos Norge AS, 2016).

Nordic Mining ASA announced that, in April, the Ministry of Local Government and Modernization had approved its industrial area plan for development of the Engebø rutile project. The company also reported that a discharge permit for the project had been granted separately by the Ministry of Climate and Environment. The company considered the granting of these permits to be important milestones for the Engebø project. Nordic Mining, which estimated the mineral deposit at Engebø to be one of the largest resources of rutile in the world, proposed to develop the mine operation in two stages. The first stage would be an open pit operation that would operate for a period of 10 to 15 years, and the next stage would be an underground operation with a mine life of about 35 years. The Engebø deposit forms a 2.5-km-long lenticular eclogite body across Engebø Mountain, and the company estimated the average content of rutile in the deposit to be approximately 4% (Kronos Norge AS, 2016; Nordic Mining ASA, 2016).

Industrial Minerals

Norway was a significant regional producer of industrial minerals. Production of aggregate, gravel, and sand for domestic use and export was significant to the national economy.

Graphite.—Skaland Graphite AS stated that the company had increased its production of graphite as a result of improvements in efficiency in the production process, including increased worker productivity, despite the fact that graphite prices had remained low. The company indicated that it had increased the quality of its product in response to consumer demand for more highly refined products than in the past, and that, in 2015, the company had sold about 800 metric tons more graphite than in the previous year. The vast majority of the production at the facility was exported to Europe, although the company also sold to customers outside the region, including in Japan (Folkebladet, 2015).

Mineral Fuels and Other Sources of Energy

Norway had an abundance of energy from two types of sources: hydroelectric power and mineral fuel resources. The bulk of domestic demand for energy was fulfilled with hydroelectric power; mineral fuels were produced mainly for export. Norway had a highly developed natural gas and petroleum sector and was the leading petroleum producer and exporter in Western Europe.

Coal.—In 2015, only one company—Store Norske Spitsbergen Grubekompani AS (SNSG)—produced coal in Norway, and coal production was concentrated in Svalbard. SNSG had two mines with a production capacity of about 2 million metric tons per year (combined); they were Mine 7 in Longyearbyen and the Svea Nord Mine at Svea. In 2015, the company sold about 1.2 Mt of coal valued at $69.4 million. SNSG suspended operations at both its mines in September owing to declining sales and the decreasing prices of coal (Geological Survey of Norway, 2016, p. 30).

Petroleum.—Norway, which has the largest petroleum reserves in Europe, was reported to have 5.14 billion barrels of proven reserves in 2015. All the reserves were located offshore on the Norwegian Continental Shelf (NCS), which is divided into three sections: the Barents Sea, the North Sea, and the Norwegian Sea. The bulk of production had taken place in the North Sea, and smaller amounts had been produced in the Barents Sea and the Norwegian Sea. The NCS measures about 2,040,000 square kilometers (km^2) and is roughly six times larger than Norway itself. The Norwegian Petroleum Directorate (NPD) estimated that two-thirds of this area contains sedimentary rocks with the potential for petroleum content. The areas that were open for exploration amounted to 570,000 km^2, and about 130,000 km^2 had been awarded production licenses. According to the NPD, 53 companies in total were active in exploration and drilling on the NCS. BP p.l.c. of the United Kingdom, ConocoPhillips Co. of the United States, Eni S.p.A. of Italy, Exxon Mobil Corp. of the United States, Royal Dutch Shell plc of the Netherlands, and Total S.A. of France were the major foreign oil companies involved in exploration of and extraction from the NCS. The Norwegian companies Statoil ASA and Petoro AS also had a major role in the exploration and development of the NCS, as well as European gas and power companies and medium and small companies (Norwegian Petroleum Directorate, 2016, p. 3, 13, 42; U.S. Energy Information Administration, 2016b).

Renewable Energy.—In 2014, Energi Norge [Energy Norway], a nonprofit industry organization composed of 270 companies that produce, distribute, and trade electricity in Norway, produced nearly 130 terrawatthours of electricity, which was 99% of all power production in Norway. The majority of the electricity was generated using hydropower and renewable energy sources, such as wind power and biomass. Energi Norge stated that Norway had only 1% of Europe's

population but 20% of the hydropower resources, 40% of the gas resources, and 60% of the petroleum resources of the continent. According to Energi Norge, the organization's member companies had approximately 2.5 million grid customers, or about 91% of Norway`s total grid customers. Also, the members of Energi Norge had approximately 15,000 employees (Energi Norge, 2014).

Outlook

Norway will continue to rely heavily on its petroleum exports to keep its economy growing. The increase in demand for titanium products will likely increase the incentive for Norway's titanium-producing companies to increase production, but that will be limited by the price of titanium in the world market. It is likely that Norway will increase its investment and development of the natural gas industry to increase production and exports and compensate for decreased revenues resulting from decreased crude petroleum production. The NPD is expected to continue with efforts to open up new offshore areas, particularly in the Arctic region. Coal production will likely continue to decrease owing to the decrease in the global price for coal and, therefore, Norway's coal mines will likely continue to suspend operations until the market becomes more favorable and production is more economically feasible.

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TABLE 1
NORWAY: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity		2011	2012	2013	2014	2015
METALS						
Aluminum:						
Primary	metric tons	1,389,000	1,145,000	1,154,900	1,250,000	1,225,000
Secondary[e]	do.	300,000	250,000	250,000	250,000	250,000
Cadmium, metal	do.	309	310	310	290	310 [e]
Cobalt, metal, refined	do.	3,067	2,969	3,348	3,500	3,300 [e]
Copper, metal, refined, primary and secondary	do.	32,000	36,000	37,461	35,800 [r]	35,500
Iron and steel:						
Metal, ferroalloys:						
Ferromanganese		338	326	306 [e, r]	295 [e, r]	309 [e]
Ferrosilicomanganese		266	271	301 [e, r]	314 [e, r]	310 [e]
Ferrosilicon, 75% basis[e]		230	250	285	285	350
Steel, crude		620	600	605	600 [r]	590
Iron ore and concentrate:						
Gross weight		3,724	5,031	5,013	5,668	5,175
Fe content		2,532	3,421	3,409	3,854	3,519
Mercury[e]	metric tons	25	25	25	25	20
Nickel:						
Mine output, concentrate, Ni content	do.	339	351	350	290 [r]	300
Metal, primary	do.	92,427	91,687	91,017	92,000	92,000 [e]
Silicon metal[e]		175	175 [r]	150 [r]	150 [r]	150 [e]
Titanium, ilmenite concentrate:						
Gross weight		870	831	826	864	1,400 [e]
TiO_2 content[e]		400	400	369	386 [r]	630
Zinc, metal, primary	metric tons	153,200	152,647	143,000	165,600 [r]	162,878
INDUSTRIAL MINERALS						
Cement, hydraulic		1,387	1,500	1,700	1,700	1,600 [e]
Clay[e]		230	225	225	225	101
Feldspar		25	--	--	154	76
Graphite, flake	metric tons	7,789	6,992	6,207	8,266 [r]	9,185
Lime, hydrated, quicklime[e]		100	125	125	125	110
Nepheline syenite		330	320	320	331	324
Olivine sand		2,237	1,650	1,702	1,394	1,672
Sand and gravel		13,215	14,260	13,984	14,110	13,000
Stone, crushed:						
Dolomite		682	643	661	714	472
Limestone		5,956	5,856	5,703	5,839	5,865
Quartz and quartzite		1,162	1,083	1,451	1,095	1,112
Sulfur, byproduct:[e]						
Metallurgical		90	90	90	90	90
Petroleum		19	20	20	20	20
Total		109	110	110	110	110
Talc, soapstone, steatite	metric tons	8,191	7,983	--	--	--
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades		1,640	1,583	1,855	1,701	1,203
Gas, natural, marketed	million cubic meters	101,376	106,710	113,116	112,796	151,800
Peat, for agricultural use		68 [e, r]	68 [e, r]	68	99	100
Petroleum:						
Crude	thousand 42-gallon barrels	732,555	694,230	558,450	570,130 [r]	587,100 [e]
Refinery products:						
Gasoline	do.	32,303	30,920	32,850	28,105 [r]	28,000 [e]
Jet fuel	do.	4,380	4,636	3,650	4,380 [r]	4,400 [e]
Kerosene	do.	511	1,351	2,555	875 [r]	900 [e]
Distillate fuel oil	do.	49,567	46,866	51,100	47,815 [r]	48,000 [e]
Residual fuel oil	do.	11,425	10,366	10,950	11,315 [r]	11,500 [e]
Other products	do.	17,447	20,805	21,170	18,615 [r]	18,600 [e]
Total	do.	115,633 [r]	114,944 [r]	122,275	111,105 [r]	111,400 [e]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.
[1]Table includes data available through January 10, 2017.

TABLE 2
NORWAY: STRUCTURE OF THE MINERAL INDUSTRY IN 2015

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Hydro Aluminium ANS (Norsk Hydro ASA, 70%)	Smelters at Ardal, Hoyanger, Karmoy, and Sunndal and Husnes	1,020
Do.		do.	Rolling mill at Holmestrand	90
Do.		Alcoa Inc.	Smelters at Lista and Mosjoen	282
Cadmium	metric tons	Boliden Odda A/S (Boliden AB, 100%)	Smelter at Eitrheimsneset	300
Cement		Norcem A/S (Heidelberg Cement Group)	Plants at Brevik and Kjopsvik	1,700
Coal		Store Norske Spitsbergen Grubekompani A/S	Mines at Longyearbyen and Svea	2,000
Cobalt		Nikkelverk A/S (Glencore plc, 100%)	Refinery at Kristiansand	3
Copper, metal		do.	do.	40
Dolomite		Franzefoss MiljokalkA/S	Mine at Ballangen	350
Do.		Omya Hustadmarmor A/S	Mines at Hammerfall and Seljeli	900
Ferroalloys		Elkem Bjolvefossen (China Bluestar)	Ferrosilicon plant at Alvik	NA
Do.		Elkem Bremanger (China Bluestar)	Ferrosilicon plant at Svelgen	NA
Do.		Finnfjord Smelteverk A/S	Ferrosilicon plant at Finnsnes	100
Do.		FESIL Rana Metall ASA (MFC Group)	Ferrosilicon plant at Mo I Rana	90
Do.		Hafsil AS	Ferrosilicon powder plant at Sarpsborg	5
Do.		Eramet Norway	Ferromanganese plant at Porsgrunn	115
Do.		do.	Ferromanganese plant at Sauda	170
Do.		Glencore Manganese (Glencore plc., 100%)	Ferromanganese plant at Mo i Rana	120
Graphite, flake		Skaland Graphite AS (LNS Group)	Traelen Mine and plant at Skaland	9
Iron ore		Rana Gruber A/S (LNS Group)	Mine at Mo i Rana	4,600
Do.		Northern Iron Ltd.	Mine at Bjørnevatn	6,000
Lime		Hylla Kalkverk (Francefoss Minerals, 100%)	Verdal plant	200
Limestone		Norcem A/S (HeidelbergCement Group)	Dalen, Bjorntvedt, and Kjopsvik Mines	1,600
Do.		Bronnoy Kalk	Akselberg Mine	2,200
Do.		Vardelskalk A/S (Franzefoss Burk A/S, 100%)	Sandvika Mine	800
Do.		Visnes Kalk AS	Lyngstad quarry	600
Do.		Franzefoss Minerals	Hamar and Hole quarries	50
Manganese, alloys		Eramet Norway AS	Silicomanganese plant at Kvinesdal	160
Do.		do.	Silicomanganese plant at Porsgrunn	65
Natural gas	million cubic meters	Statoil ASA	Grane, Gullfaks, Sleipner Ost, and Statfjord fields	12,270
Do.	do.	ConocoPhillips Skandinavia A/S (operator)	Ekofisk field	9,900
Do.	do.	Elf Petroleum Norge A/S	Frigg, Heimdal, and Ost-Frigg fields	5,750
Do.	do.	Statoil ASA	Mikkel field	2,100
Do.	do.	Total S.A., 40%; Petoro AS, 30%; Marathon Petroleum Norge AS, 20%	Skirne field	1,550
Do.	do.	Esso Norge A/S	Odin field	1,000
Do.	do.	Amoco Norway A/S	Hod and Valhall fields	910
Nepheline syenite		Sybelco Nordic AS	Mine at Stjernoy	350
Nickel:				
Ore, concentrate, Ni content	metric tons	Titania A/S (Kronos Norge A/S, 100%)	Mine at Tellnes	350
Metal		Nikkelverk A/S (Glencore plc., 100%)	Refinery at Kristiansand	85
Olivine		Sibelco Nordic AS	Mines and plant at Aheim	2,000
Petroleum	42 gallon barrels per day			
Do.	do.	BP Petroleum Development of Norway	Ulaf fields	155,000
Do.	do.	A/S Norske Shell	Draugen field	90,000
Do.	do.	Esso Norge A/S (Exxon Mobil Corp., 100%)	Slagen Refinery at Slagentangen	11,000
Do.	do.	Statoil Mongstad A/S (Statoil ASA, 100%)	Mongstad Refinery	84,000
Pig iron		Ulstein Jernstoperi A/S (Bergen Engines A/S)	Hordvikneset	10
Do.		TiZir (Eramet 50%)	Pig iron plant at Tyssedal	110
Quartzite		Elkem Tana (China Bluestar)	Mine at Tana	1200
Do.		Elkem Marnes (China Bluestar)	Mine at Marnes	200
Do.		Georg Tveit A/S Eramet Norway 75%)	Mine at Kragero	110
Silicon metal		Elkem Salten (China Bluestar)	Silicon plant at Straumen	70
Do.		Elkem Thamshavn (China Bluestar)	Silicon plant at Orkanger	45
Do.		Holla Metall (Wacker Chemicals Norway A/S)	Plant at Holla	50
Steel		Celsa Armeringsstal	Plant at Mo i Rana	600
Titanium, concentrate		Titania A/S (Kronos Norge A/S, 100%)	Mine at Tellnes	915
Zinc, metal		Boliden Odda A/S (Boliden AB, 100%)	Smelter at Odda	200

Do., do. Ditto. NA Not available.