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NICKEL

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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12 Nickel

Nickel is a lustrous, silvery-white metal. It is the fifth most common element of earth's crust. It has a melting point of 1,453 °C, relatively low thermal & electrical conductivities, high resistance to corrosion & oxidation, excellent strength & toughness at high temperatures and capable of getting magnetised. It is attractive and very durable as a pure metal and alloys readily with other metals.

Nickel is not produced from primary sources in the country and the entire demand is met through imports. However, HCL is planning to recover nickel as a by-product in the form of nickel sulphate during refining of copper at Ghatsila copper smelter of Hindustan Copper Ltd (HCL) in Jharkhand.

OCCURRENCES AND RESERVES & RESOURCES

Nickel occurs principally as oxides, sulphides and silicates in India. Important occurrence is nickeliferous limonite in the overburden of chromite in Sukinda Valley, Jajpur district, Odisha. In addition, nickel is found associated with uranium deposits at Jaduguda, Jharkhand and a process is being developed for its recovery. Resources are spread over in Singhbhum East district of Jharkhand and Jajpur, Keonjhar & Mayurbhanj districts of Odisha.

As per NMI database as on 1.4.2015, based on UNFC, Resources of nickel are estimated at 189 million tonnes. The entire resources fall under Remaining Resources category. The State of Odisha is endowed with the largest share of resources of nickel ore in the country at 175 million tonnes (93%) followed by Jharkhand & Nagaland. These resources are mainly found to occur in three districts, namely, Jajpur (140 million tonnes), Mayurbhanj (27 million tonnes) and Keonjhar (8 million tonnes). Jharkhand has 9 million tonnes (5%) resources most of which are in Singhbhum (East) district. Nagaland has 5 million tonnes (3%) resources which predominantly are in Kiphire district (Table- 1).

EXPLORATION & DEVELOPMENT

The exploration and development details, if any, are covered in the Review on "Exploration & Development" under "General Reviews".

Table –1: Reserves/Resources of Nickel Ore as on 1.4.2015
(By Grades/States)

(In million tonnes)

Grades/States	Total Reserves (A)	Remaining Resources						Total Resources (A+B)
		Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
		STD221	STD222					
All India : Total	**–**	**21**	**21**	**31**	**53**	**63**	**189**	**189**
By Grades								
+ 0.9% Ni	–	13	8	–	18	3	42	42
0.5 to 0.9% Ni	–	8	13	31	21	21	94	94
(+) 0.5% Ni, unclassified	–	–	–	–	14	39	53	53
Not-known	–	–	–	–	–	–	–	+
By States								
Jharkhand	–	–	–	–	2	7	9	9
Karnataka	–	–	–	–	–	+	-	+
Nagaland	–	–	–	–	–	5	5	5
Odisha	–	21	21	31	51	51	175	175

Figures rounded off

INDUSTRY

HCL produced nickel sulphate as a by-product at its Ghatsila Copper Smelter in Jharkhand. The sulphide copper ore from Ghatsila area contains nickel in small quantity along with other important metals like gold and cobalt. HCL by means of imported EMEW technology from Canada, developed capabilities to recover LME-Nickel grade cathode from lower concentration of copper in spent electrolyte, which otherwise was not possible by conventional means. Besides this, the technology also enabled HCL to recover nickel from the spent electrolyte at ICC refinery. Another technology of Acid purification Unit (APU) again imported from Canada, and that which is an eco-friendly technology allowed reduction of liquid effluent and facilitates recovery of nickel in the downstream process. HCL have installed capacity of 390 MT to recover nickel sulphate. However, production of nickel sulphate has not been reported since 2004-05. The Nicomet Industries Ltd located at Goa is presently engaged in production of nickel metal and their derivatives and its annual production capacity from its Goa plant is about 5,400 MTPA.

RESEARCH & DEVELOPMENT

India's first facility to produce nickel, a metal for which India is completely dependent on imports, has been launched by the Hindustan Copper Limited (HCL) at its Indian Copper Complex (ICC) at Ghatsila in Jharkhand. The new facility "Nickel, Copper and Acid Recovery Plant" is the first facility in India to produce nickel metal of London Metal Exchange (LME) grade from primary resource.

NMDC has submitted application to the DMG, Govt. of Odisha for proposal to reserve 8 Sq. Km area in Jajpur district, Odisha under Section 17 A (2A) of MM(D&R) Amendment Act, 2015 for prospecting and mining operation of Nickel.

An Indian delegation led by Dr. V. K. Saraswat, Member, NITI Aayog visited Chile, Argentina and Bolivia to explore opportunities for sourcing lithium for manufacture of advanced chemistry batteries in India. Discussions were held with Western Australian Premier and the delegation on strategic partnerships for sourcing raw materials, such as, lithium, cobalt and nickel to support battery manufacturing. The mobility mission held consultations with industry to develop battery recycling as a sustainable method for ensuring up to 95% recovery of critical minerals, such as, lithium, nickel, cobalt etc.

USES

Sectoral uses of nickel metal are in the areas of stainless steel making; catalysis chemical industries, as an electroplating material; heat resistant alloys; alloying element for non-ferrous metals; space, defence & rocket industries; and nickel cadmium batteries. Nickel is used in many specific and recognisable industrial and consumer products including stainless steel, alnico magnets, coinage, for filters & binders, rechargeable batteries, foundry, electric guitar strings, microphone capsules and special alloys. It is also used for plating and as green tint in glass. Nickel is predominantly an alloy metal & its chief use is in the nickel steel & nickel cast iron of which there are many varieties. It is also widely used in many other alloys, such as, nickel bronze & brasses and alloys with copper, chromium, aluminium, lead, cobalt, silver & gold. It is used as catalyst which is key to several important reactions including the hydrogenation of vegetable oils, reforming of hydrocarbons and in the production of fertilizers, pesticides and fungicides.

Nickel sulphate is an important compound used commercially in the country in nickel plating, in dip baths for enamelling, in preparation of nickel compounds and as a catalytic nickel. Nickel based alloys, like stainless steel with higher nickel content are used for more demanding applications, such as, in gas turbines and some chemical plants.

CONSUMPTION

World over about 65% of nickel is used in the manufacturing of stainless steel and 20% in other steel and non-ferrous (including super alloys) components often used for highly specialised industrial, aerospace and military applications. About 9% is used in plating and 6% in other uses, including coins and a variety of nickel chemicals.

SUBSTITUTES

Aluminium, coated steels, plain chromium steels and plastics are the common substitutes that could replace stainless steel to a limited extent in many construction and transportation applications. Low-nickel, duplex, or ultra-chromium stainless steels are being substituted for austenitic grades in construction. Nickel-free speciality steels are sometimes used in place of stainless steel within the power-generating, petrochemical and petroleum industries. Titanium alloys or speciality plastics are in use as materials that could substitute nickel metal or nickel-based alloys in applications to resist corrosion in highly corrosive chemical environments. Lithium ion batteries are replacing nickel-metal hydride batteries in many applications.

TRADE POLICY

As per Foreign Trade Policy, 2015-2020, imports of nickel ores & concentrates (ITC-HS Code No. 26040000) and nickel scrap (ITC-HS code No.75030010) are allowed, free. However, nickel waste & scrap (other) (ITC-HS Code No. 7503 0090) are restricted.

WORLD REVIEW

The world reserves of nickel are estimated at 89 million tonnes of metal content. Indonesia (24%), Australia (22%), Brazil (12%), Russia (8%), Cuba (6%) and Philippines (5%) are the major countries having reserves of Nickel. The identified land-based resources with an average of 1% nickel or more are about 130 million tonnes. About 60% of nickel reserves is in laterites and 40% in sulphide deposits. Extensive nickel resources are also found in manganese crusts and as nodules in the ocean floor (Table-2).

In 2018, world mine production of nickel increased considerably to 2.23 million tonnes as compared to 1.98 million tonnes of metal content in the previous year (Table-3). The chief producers of Nickel in the world in 2018 were Indonesia (23%), Philippines (15%), Russia & New Caledonia (10% each), Canada (8%), Australia (7%), China (4%), etc.

Table – 2: World Reserves of Nickel
(By Principal Countries)

(In '000 tonnes of nickel content)

Country	Reserves
World: Total (rounded off)	**89000**
Australia	20000(8)
Brazil	11000
Canada	2600
China	2800
Cuba	5500
Indonesia	21000
New Caledonia(9)	NA
Philippines	4800
Russia	6900
USA	110
Other countries	14000

***Source**: USGS, Mineral Commodity Summaries,2020*
(8) for Australia, Joint Ore Reserve Committee - compliant reserves were 5.4 million tonnes.
(9) Overseas territory of France.

Table – 3: World Mine Production of Nickel
(By Principal Countries)

(In '000 tonnes of metal content)

Country	2016	2017	2018
World: Total	**1863**	**1980**	**2233**
Indonesia	126	217	509
Philippines	300	339	345
Russia	223	221	218
New Caledonia	204	215	216
Canada	235	214	180
Australia	203	185	148
China	100	94	99
Brazil	79	69	74
Guatemala	37	54	66
Cuba	52	53	53
Finland[k]	21	35	44
South Africa[a]	49	48	43
Colombia	37	41	43
Papua New Guinea	22	35	35
Madagascar	42	35	33
Other countries	133	123	126

***Source**: BGS,World Mineral Production, 2014-18.*
a: Includes metal and metal content of sulphate and concentrates
k: In addition some nickel is produced as by-product in talc operation. The amount is negligible.

FOREIGN TRADE

Exports

Exports of nickel ores and concentrates were at 50 tonnes in the year 2018-19. However, there were negligible exports of nickel ores & concentrates in the preceding year. Exports were only to two countries, Singapore (78%) and Germany (22%). On the other hand exports of nickel and alloys including scrap increased by 34% to 3,764 tonnes in 2018-19 from 2,806 tonnes in the previous year. Out of the total alloys and scrap exported in 2018-19, nickel & alloys were 2,480 tonnes, while nickel waste & scrap were 1,284 tonnes. Exports of nickel and alloys including scrap were mainly to UK (16%), USA (13%), Netherlands (8%), Republic of Korea & China (7% each), Mexico (6%), Saudi Arabia & Thailand (4% each), etc. (Tables- 4 to 7).

Imports

Imports of nickel ores & concentrates were negligible in the year 2018-19. Imports of nickel & alloys including scrap were 47,229 tonnes in 2018-19 which decreased by 24% from that of 62,254 tonnes in the previous year. Out of the total alloys and scrap imported in 2018-19, nickel & alloys were 45,133 tonnes as compared to 58,520 tonnes in the previous year, while nickel waste & scrap were 2,096 tonnes as compared to 3,738 tonnes in the previous year. Imports of nickel and alloys including scrap in 2018-19 were mainly from Norway (12%), South Africa (11%), Netherlands (9%), UK, Japan, Taiwan & Australia (6% each) and China & Malaysia (5% each) (Tables-8 to 11).

Table – 4: Exports of Nickel Ores and Conc. (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**++**	**19**	**50**	**1618**
Singapore	-	-	39	948
Germany	-	-	11	667
UK	++	1	++	4
USA	++	18	-	-

Figures rounded off.

Table – 5: Exports of Nickel and Alloys Including Scrap (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**2806**	**2730933**	**3764**	**4648661**
USA	266	341088	492	636069
Korea, Rep. of	55	59721	281	500226
Saudi Arabia	71	205297	153	488780
UK	371	239607	595	455337
China	479	355963	280	298048
Mexico	80	81662	228	290214
Netherlands	95	75367	318	229487
Thailand	68	75739	165	196144
UAE	96	128284	96	139437
Taiwan	8	8602	103	120931
Other countries	1216	1159602	1054	1293988

Figures rounded off.

Table – 6: Exports of Nickel & Alloys
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**2270**	**2481828**	**2480**	**3935406**
USA	197	298580	306	513334
Korea, Rep. of	43	52734	281	500226
Saudi Arabia	71	205297	152	488732
China	479	355963	280	298048
Mexico	80	81662	228	290214
Thailand	68	75739	156	193024
Netherlands	41	57178	121	157310
UAE	96	128284	93	136778
Taiwan	8	8602	103	120931
UK	147	132107	65	114249
Other countries	1040	1085681	694	1122560

Figures rounded off

Table – 7: Exports of Nickel Waste & Scrap
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**536**	**249105**	**1284**	**713255**
UK	224	107499	530	341088
USA	69	42508	186	122735
Japan	85	33903	133	74426
Netherlands	55	18190	197	72177
Sweden	-	-	80	39848
Germany	47	16128	114	39379
Singapore	34	18351	9	8307
Malaysia	10	5218	13	6874
Thailand	-	-	8	3120
UAE	-	-	3	2659
Other countries	13	7308	11	2643

Figures rounded off

Table –8: Imports of Nickel Ores & Conc.
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	-	-	++	**169**
Austria	-	-	++	99
Netherlands	-	-	++	70

Figures rounded off

Table – 9: Imports of Nickel and Alloys Including Scrap
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**62254**	**40778026**	**47229**	**51678358**
Norway	7745	5767029	5768	5531216
South Africa	4305	3042651	5081	4711066
Netherlands	58	104878	4419	4343380
UK	2041	2277454	2952	3934218
USA	1712	2433547	1765	3441760
Japan	2682	2315139	2634	3346610
Taiwan	69	73428	2968	3045737
China	1225	1335982	2305	2903182
Australia	10500	7528423	2931	2818516
Malaysia	265	179525	2377	2128375
Other countries	31652	15719970	14029	15474298

Figures rounded off

Table – 10: Imports of Nickel & Alloys
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**58520**	**39217138**	**45133**	**50672254**
Norway	7745	5767029	5768	5531216
South Africa	4305	3042651	5081	4711066
Netherlands	58	104878	4334	4304008
UK	1880	2202239	2844	3874065
Japan	2682	2315139	2611	3329447
USA	1067	2175518	1518	3325543
Taiwan	69	73428	2968	3045737
China	1225	1335982	2305	2903182
Australia	10499	7528063	2928	2816184
Malaysia	186	132375	2277	2079511
Other countries	28804	14539836	12499	14752295

Figures rounded off

Table – 11: Imports of Nickel Waste & Scrap
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**3738**	**1560889**	**2096**	**1006102**
UAE	684	286169	619	261591
Bangladesh	443	200015	236	134037
Qatar	39	14093	270	117513
USA	645	258030	248	116217
Saudi Arabia	991	392339	132	63137
UK	161	75215	108	60153
Malaysia	79	47150	100	48864
Netherlands	-	-	85	39371
Singapore	84	34215	43	36673
Bahrain	45	14910	77	34300
Other countries	567	238753	178	94246

Figures rounded off

FUTURE OUTLOOK

Primarily World nickel demand is for the production of stainless steel where about 65% nickel is consumed. Nickel accounts for 10 to 20% input cost in stainless steel production depending on the nickel content. The future outlook for nickel depends mainly on the production of stainless steel which is one of the main drivers for nickel produced. Batteries and the ongoing Electric Vehicle revolution could prove to be a transformational event as NCA and NCM, one still predominantly used. However, Li-ion technology is increasing by getting established as the battery of choice.

India will have no option but to depend on imports for this metal till a technology to recover nickel from the overburden of chromite ore in Odisha is established on a commercial scale.

The process developed by HCL for the production of primary nickel from waste generated during copper refining will be a breakthrough in the area of nickel production in the country.

India imports as well as exports nickel scrap covered by ISRI code, Aroma, Barly, Dandy, Daunt, Delta, Decov, Depth, Hitch, House, Ideal, Indian, Junto, Lemon, Lemur are covered under HS code 75030010. But there is hardly any data available is reported for recycling and recovery of nickel from scrap. The recycling of nickel-bearing scrap in Organised Sector will be another source for meeting the demand.