



2021

WORLD DIRECT REDUCTION STATISTICS

MIDREX

THE WORLD LEADER
IN DIRECT REDUCTION
TECHNOLOGY



CONTENTS

- 2** World DRI Production
- 6** World DRI Production by Region/Year
- 7** World DRI Production Tables
- 9** Major Trade Routes for International Trade of DRI
- 10** World DRI Shipments
- 11** World Direct Reduction Plants

Audited by



WORLD
STEEL
DYNAMICS®

9.1.22



World DRI production reaches 119.2 Mt in 2021 Sets new annual production record

Annual global direct reduced iron (DRI) production in 2021 was 119.2 million tons (Mt). DRI output was up by 13.7% from the revised 104.8 Mt produced in 2020, and up 10.2% from the previous record of 108.1 Mt in 2019. Once again, the combination of India and Iran produced well over half of the global DRI.

From 2016, worldwide DRI output has grown by almost 46.4 Mt, or nearly 64%, primarily driven by the increase in coal-based DRI in India, new gas-based plants in Iran, and ramp-up of new gas-based capacity in Algeria, Egypt, USA, and Russia. The reduced effects of the global COVID-19 pandemic, an 18.8% jump in coal-based production in India, as well as the completion and start-up of new natural gas-

2021 Top 5 DRI Producing Nations

COUNTRY	PRODUCTION (Million Tons)
India	39.11
Iran	31.85
Russia	7.89
Saudi Arabia	6.13
Mexico	5.83

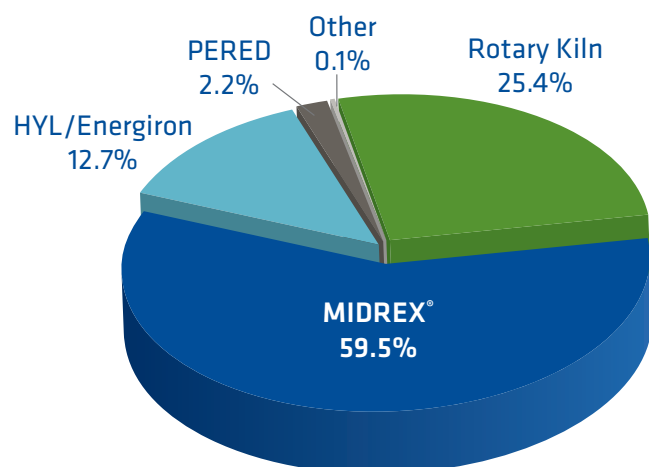
Source: World Steel Association, SIMA, and Midrex Technologies, Inc.

based facilities in Algeria and USA had a large effect on the DRI production increase in 2021 compared to 2020.

The production of hot DRI (HDRI), which is fed directly to a nearby melt shop for energy savings and to improve productivity, was 13.8 Mt, a 21.2% increase compared to 2020, and made up 11.6% of the total in 2021. The production of hot briquetted iron (HBI) – a compacted form of DRI ideally suited for shipping and for use in the blast furnace – is estimated to have been 10.4 Mt, a 9.3% increase over 2020 and a 7.4% increase over 2019.

(Continued on page 3)

2021 World DRI Production by Process



Total World Production: 119.2 Mt

	2019	2020	2021
MIDREX®	60.5%	60.2%(r)	59.5%
HYL/Energiron	13.2%	12.4%	12.7%
PERED	2.1%	2.9%(e)	2.2%(e)
Other	0.2%	0.2%	0.1%
Rotary Kiln	24.0%	24.3%(r)	25.4%

(e) estimated (r) revised

Source: Midrex Technologies, Inc.





MIDREX Plants produced 70.85 Mt in 2021, a 12.3% increase compared to 2020. The production in 2021 was calculated from 41.68 Mt confirmed by MIDREX Plants located outside of Iran (a 17.5% increase over 2020) and 29.17 Mt estimated for MIDREX Plants in Iran. Over 9.7 Mt of HDRI were produced by MIDREX Plants worldwide, which were consumed in nearby steel shops to assist them in reducing their energy consumption per ton of steel produced and increasing their productivity.

MIDREX Technology continued to account for ~80% of worldwide production of DRI by shaft furnaces. MIDREX Plants have produced a cumulative total of approximately 1,250 Mt of all forms of DRI (CDRI, HDRI, and HBI) through the end of 2021.



BEHIND THE NUMBERS

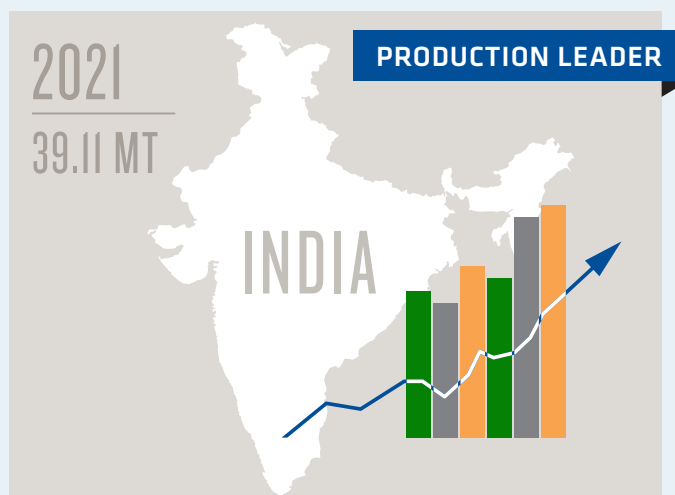
Crude Steel Production

World crude steel production for the 64 countries reporting to the World Steel Association (worldsteel) was 1,911.9 Mt in 2021, a 3.6% increase compared to 2020.

- Asia and Oceania produced 1,382 Mt, up 0.6% over 2020 production. Worldsteel includes Australia, China, India, Japan, New Zealand, Pakistan, South Korea, Taiwan, and Vietnam in Asia/Oceania.
- EU (27) produced 152.5 Mt in 2021, an increase of 15.4% compared to 2020.
- CIS production in 2021 was 105.6 Mt, up by 5.6% over 2020. Worldsteel includes Belarus, Kazakhstan, Moldova, Russia, Ukraine, and Uzbekistan in CIS.

- North America produced 117.8 Mt in 2021, a 16.6% increase compared to 2020. Worldsteel includes Canada, Cuba, El Salvador, Guatemala, Mexico, and United States in North America.
- Middle East produced 41.2 Mt in 2021, an increase of 1.2% over 2020. Worldsteel includes Iran, Qatar, Saudi Arabia, and United Arab Emirates in Middle East.
- South America production in 2021 was 45.6 Mt, a 17.8% increase compared to 2020. Worldsteel includes Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela in South America.
- Europe (Other) produced 51.2 Mt in 2021, an 11.6% improvement over 2020. Worldsteel includes Bosnia-Herzegovina, Macedonia, Norway, Serbia, Turkey, and United Kingdom in Europe (Other).
- Africa produced 16.0 Mt in 2021, an increase of 26.7% compared to 2020. Worldsteel includes Egypt, Libya, and South Africa in Africa.

Direct Reduced Iron Production



India continued its streak as the number one DRI producer worldwide, producing a record 39.11 Mt of DRI – 30.11 Mt in rotary kilns and 9.00 Mt by gas-based processes – a 18.6 % increase overall, one of the highest growth rates in the history of the Indian DRI industry. According to the Sponge Iron Manufacturers Association (SIMA) of India, rotary kilns saw a 18.8% increase from 2020, after a 27.9% increase from 2018 to 2019, following a 35% increase from 2017. Production





by gas-based DRI plants also posted an 18% increase last year.

Production of DRI in Iran was 31.85 Mt in 2021, all from natural gas-based processes. This was a 5.4% increase compared to their 30.2 Mt record in 2020. The MIDREX Process accounts for ~90% of DRI production in Iran. Another five MIDREX Modules are either under construction or in engineering phase. PERED plants produced an estimated 2.67 Mt.

Russia maintained its 3rd place as a producing nation with 7.89 Mt, after establishing a record mark of 8.03 Mt in 2019. The Russian MIDREX HBI plants maintained high productivity in 2021, benefiting from captive iron ore, low natural gas prices, and sustained demand for HBI.

Saudi Arabia retained its 4th place with 6.13 Mt and Mexico placed 5th with 5.83 Mt in 2021. Both countries posted virtually the same production numbers, 5.2 Mt in 2020, compared to 5.8 and 6.0 Mt in 2019.

Other countries in the Middle East and North Africa region (MENA) saw improvements, notably Egypt sustaining their recovery with an 11.0% increase to 5.23 Mt; and Algeria, where production increased by 38% over 2020, from a record third full-year operation of Tosyali Algérie, as well as the start-up of the Algerian Qatari Steel (AQS) MIDREX HDRI/CDRI combo plant in March 2021.

The start-up of the Cleveland-Cliffs HBI plant in Toledo, Ohio also helped increase the DRI production in the U.S. to 5.01 Mt in 2021, a 49.6% increase over 2020.

In South America, Argentinian production of DRI recovered from poor local market conditions and COVID. Venezuela continued to produce well below rated capacity, due to limited availability of iron ore and spare parts. Venezuela is mainly making HBI for export.

Tosyali Holding's 2.5 Mt/year combination module (Tosyali Algérie), located in Bethioua, near Oran, Algeria, in only its third full year, set a new world record in 2021 for DRI production by a single module with 2.28 Mt, exceeding the record it set in 2020 of 2.23 Mt.

2021 saw iron ore prices climb ~\$50 per ton in the first half of the year and experience a big drop (~\$100 per ton) in the 3rd and 4th quarters, reaching a minimum halfway through the 4th quarter before initiating a small recovery toward the end of the year.

NEW CAPACITY AND PLANTS UNDER CONSTRUCTION

MIDREX

Mikhailovsky HBI, jointly established by USM and Mikhailovsky GOK (part of Metalloinvest), signed a contract with Midrex and its consortium partner Primetals Technologies Limited for a 2.08 Mt/year hot briquetted iron (HBI) plant in Zheleznogorsk, Kursk region, Russia. Start-up was expected in the first half of 2024, at contract signing.

Metalloinvest has contracted with Midrex and consortium partner Primetals to supply a third MIDREX HBI Plant (HBI-4) at Lebedinsky GOK (LGOK) in Gubkin, Russia. The plant will be designed to produce 2.08 Mt of HBI per year. Full production was expected to become operational in the first half of 2025, with first product in December 2024, at contract signing.

Tosyali Holding awarded Midrex and its partner Paul Wurth a contract to build a second DRI plant at the Tosyali Algeria steelworks in Bethioua (Oran), Algeria. The new DRI plant will produce 2.5 Mt of HDRI and CDRI, similar to the original plant, with the capability to operate with the addition of hydrogen in the future.

HYL/ENERGIRON

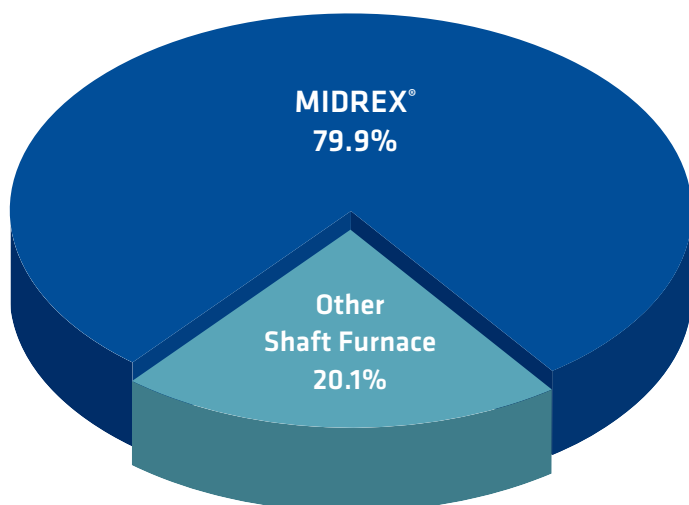
The production capacity of the LGOK HBI-1 plant, which was commissioned in 2001 for the Metalloinvest company in Gubkin, Russia, will be boosted by more than 10% to more than 1.0 Mt/year. At the same time, the metallization and carbon content will be increased. When the project was announced, completion was scheduled for early 2023.

Sinosteel Engineering & Technology Co., Ltd., located in Beijing, China, has contracted Tenova HYL for the design and supply of a hydrogen-based 1.0 Mt/year ENERGIRON® plant, which will be installed at Baosteel Zhanjiang Iron & Steel Co., Ltd, located in Guangdong Province, China. Tenova also has signed a contract with the HBIS Group for a 0.6 Mt/year ENERGIRON plant utilizing hydrogen-enriched gas.





2021 World Shaft Furnace Production by Process



Total World Production: 88.69 Mt

	2019	2020	2021
MIDREX®	79.8%	79.7% (r)	79.9%
Other Shaft Furnace	20.2%	20.3% (r)	20.1%

(r) revised

Source: Midrex Technologies, Inc.

Shaft Furnace DRI Production by Process and by Year

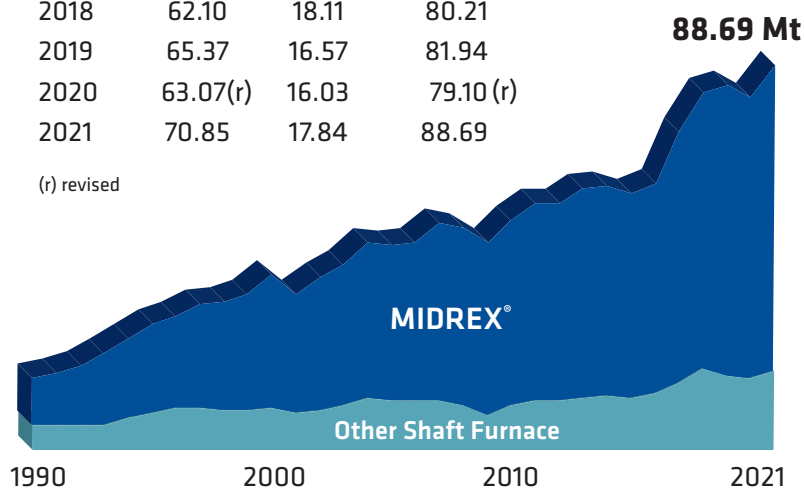
Year **MIDREX®** **Other Shaft Furnace** **Total**

1990	10.73	5.25	15.98
1991	11.96	5.40	17.36
1992	13.26	5.29	18.55
1993	15.91	5.73	21.64
1994	17.83	7.01	24.84
1995	19.86	8.15	28.01
1996	21.03	9.12	30.15
1997	23.08	9.55	32.63
1998	24.82	8.52	33.34
1999	26.12	8.81	34.93
2000	30.12	9.39	39.51
2001	26.99	8.04	35.03
2002	30.11	8.88	38.99
2003	32.06	9.72	41.78
2004	35.01	11.34	46.35
2005	34.96	11.00	45.96
2006	35.71	10.91	46.62
2007	39.72	11.20	50.92
2008	39.85	9.84	49.69

Year **MIDREX®** **Other Shaft Furnace** **Total**

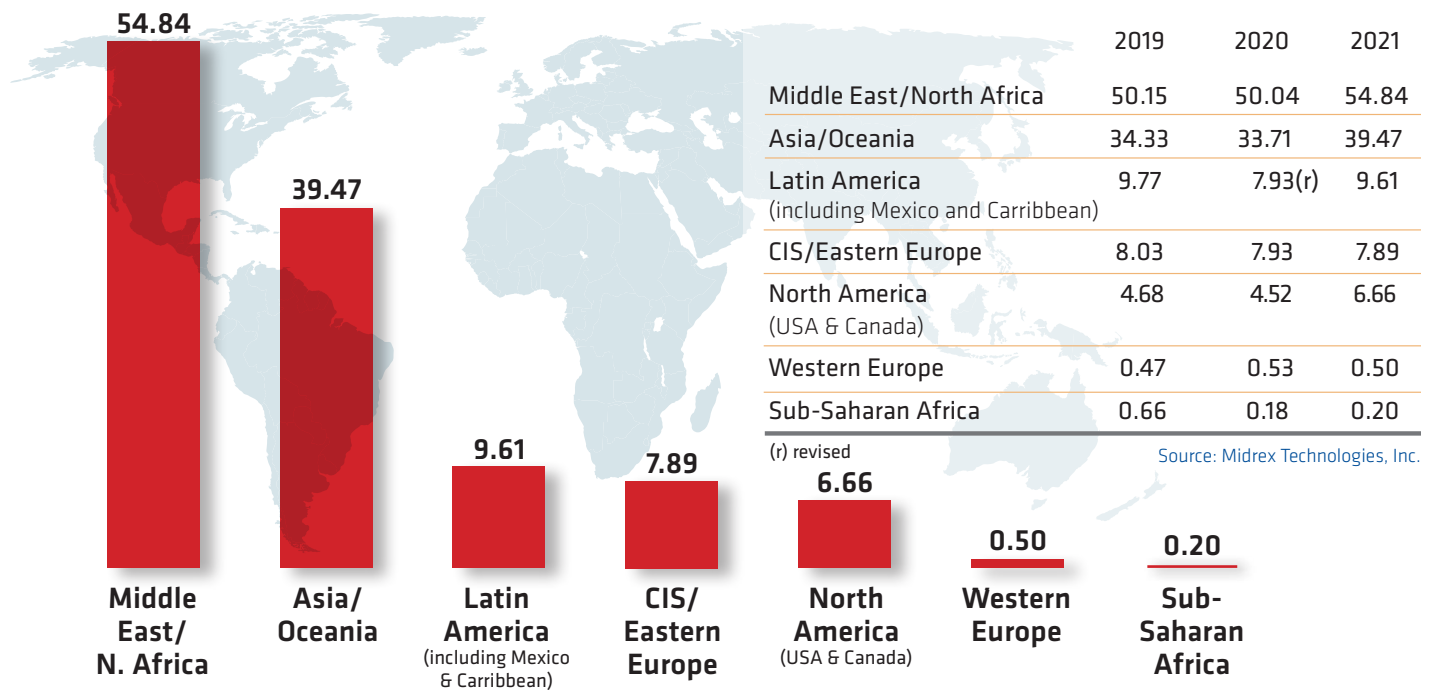
2009	38.62	7.88	46.50
2010	42.01	9.81	51.82
2011	44.38	11.03	55.41
2012	44.76	10.79	55.55
2013	47.56	11.29	58.85
2014	47.12	12.04	59.16
2015	45.77	11.62	57.39
2016	47.14	12.66	59.80
2017	56.65	14.68	71.33
2018	62.10	18.11	80.21
2019	65.37	16.57	81.94
2020	63.07(r)	16.03	79.10 (r)
2021	70.85	17.84	88.69

(r) revised



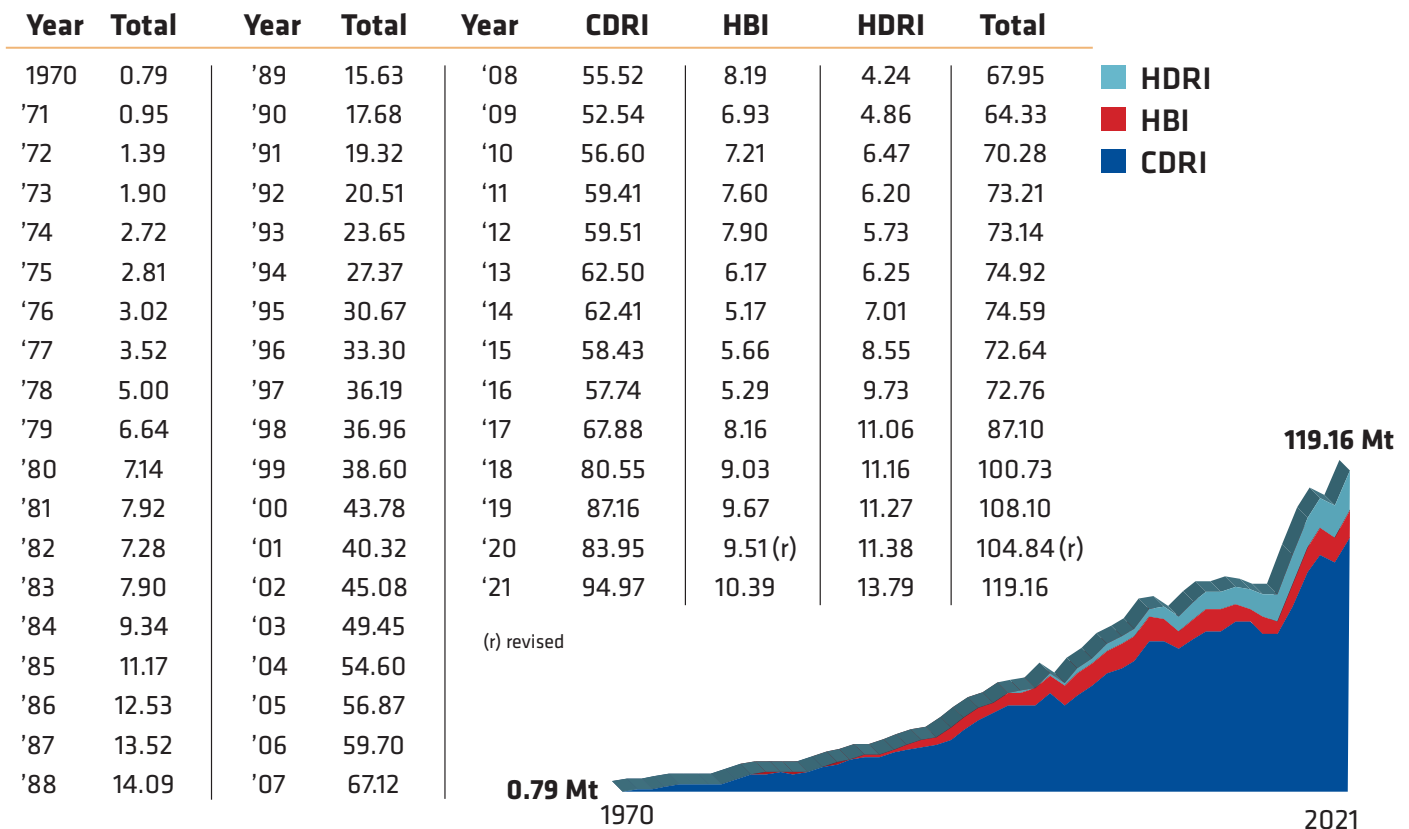


2021 World DRI Production by Region (Mt)



World DRI Production by Year (Mt)

Source: Midrex Technologies, Inc.





1970-2010 World DRI Production by Region (Mt)

Source: Midrex Technologies, Inc.

NAME	'70-'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10
Latin America											
ARGENTINA	24.70	1.28	1.46	1.74	1.74	1.83	1.95	1.81	1.86	0.81	1.57
BRAZIL	7.50	0.43	0.36	0.41	0.44	0.43	0.38	0.36	0.30	0.01	-
MEXICO	72.06	3.67	4.90	5.62	6.54	5.98	6.17	6.26	6.01	4.15	5.37
PERU	0.99	0.07	0.03	0.08	0.08	0.09	0.14	0.09	0.07	0.10	0.10
TRINIDAD AND TOBAGO	14.43	2.31	2.32	2.28	2.36	2.25	2.08	3.47	2.78	1.99	3.08
VENEZUELA	76.57	6.38	6.89	6.90	7.83	8.95	8.61	7.71	6.87	5.61	3.79
Middle East/N. Africa											
ALGERIA	-	-	-	-	-	-	-	-	-	-	-
BAHRAIN	-	-	-	-	-	-	-	-	-	-	-
EGYPT	14.14	2.37	2.53	2.87	3.02	2.90	3.10	2.79	2.64	2.91	2.86
IRAN	30.37	5.00	5.28	5.62	6.41	6.85	6.85	7.44	7.46	8.20	9.35
LIBYA	10.64	1.09	1.17	1.34	1.58	1.65	1.63	1.64	1.57	1.11	1.27
OMAN	-	-	-	-	-	-	-	-	-	-	-
QATAR	11.85	0.73	0.75	0.78	0.83	0.82	0.88	1.30	1.68	2.10	2.16
SAUDI ARABIA	28.97	2.88	3.29	3.29	3.41	3.63	3.58	4.34	4.97	5.03	5.51
UAE	-	-	-	-	-	-	-	-	-	-	1.18
Asia/Oceania											
AUSTRALIA	0.88	1.37	1.02	1.95	0.69	-	-	-	-	-	-
CHINA	0.16	0.11	0.22	0.31	0.43	0.41	0.41	0.60	0.18	0.08	-
INDIA	39.92	5.59	6.59	7.67	9.37	12.04	14.74	19.06	21.20	22.03	23.42
INDONESIA	26.38	1.48	1.50	1.23	1.47	1.27	1.20	1.32	1.21	1.12	1.27
MALAYSIA	13.78	1.12	1.08	1.60	1.68	1.38	1.54	1.84	1.94	2.30	2.39
MYANMAR	0.43	0.04	0.04	0.04	0.04	-	-	-	-	-	-
PAKISTAN	-	-	-	-	-	-	-	-	-	-	-
North America											
CANADA	20.74	-	0.18	0.50	1.09	0.59	0.45	0.91	0.69	0.34	0.60
USA	15.51	0.12	0.47	0.21	0.18	0.22	0.24	0.25	0.26	-	-
CIS/Eastern Europe											
RUSSIA	24.60	2.51	2.91	2.91	3.14	3.34	3.28	3.41	4.56	4.67	4.79
Sub-Saharan Africa											
NIGERIA	1.53	-	-	-	-	-	-	-	0.20	-	-
SOUTH AFRICA	16.01	1.56	1.55	1.54	1.63	1.78	1.75	1.74	1.18	1.39	1.12
Western Europe											
GERMANY	8.99	0.21	0.54	0.59	0.61	0.44	0.58	0.59	0.52	0.38	0.45
Other Nations											
	0.47	-	-	-	-	-	-	-	-	-	-
WORLD TOTAL	461.62	40.32	45.08	49.48	54.60	56.87	59.70	67.12	67.95	64.33	70.28

1970-2010 World DRI Production by Process (Mt)

NAME	'70-'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10
MIDREX®	286.20	27.03	30.10	32.11	35.01	34.96	35.71	39.72	39.85	38.62	42.01
HYL/Energiron	130.91	8.04	8.88	9.72	11.34	11.00	10.91	11.20	9.84	7.88	9.81
PERED	-	-	-	-	-	-	-	-	-	-	-
Rotary Kiln	34.44	3.18	4.43	5.04	6.41	9.17	11.53	14.90	16.92	17.33	18.12
Other *	10.08	2.07	1.67	2.61	1.66	1.70	1.53	1.29	1.33	0.76	0.34
WORLD TOTAL	461.62	40.32	45.08	49.48	54.60	56.87	59.70	67.12	67.95	64.33	70.28

* Other: A variety of processes using retorts, shaft furnaces, fluidized bed furnaces and hearths.
e - estimated





2011-2021 World DRI Production by Region (Mt)

Source: Midrex Technologies, Inc.

NAME	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21
Latin America											
ARGENTINA	1.68	1.61	1.54	1.67	1.26	0.78	1.23	1.61	1.09	0.53	1.41
BRAZIL	-	-	-	-	-	-	-	-	-	-	-
MEXICO	5.85	5.59	6.13	5.98	5.50	5.31	6.01	5.97e	5.97	5.17	5.83
PERU	0.09	0.10	0.10	0.09	0.07	0.01	-	-	-	-	-
TRINIDAD AND TOBAGO	3.03	3.25	3.29	3.24	2.52	1.50	1.59	1.54	1.70	1.34	1.62
VENEZUELA	4.47	4.61	2.77	1.68	2.75	1.59	1.68	0.99	1.01	0.89r	0.76
Middle East/N. Africa											
ALGERIA	-	-	-	-	-	-	-	0.11	1.54	2.23	3.08
BAHRAIN	-	-	0.78	1.44	1.23	1.26	1.26	1.60	1.45	1.38	1.51
EGYPT	2.97	2.84	3.43	2.88	2.73	2.82	4.67	5.22e	4.05	4.71	5.23
IRAN	10.37	11.58	14.46	14.55	14.55	16.01	20.55	25.75	28.52	30.21	31.85
LIBYA	0.30	0.51	0.95	1.00	0.45	0.69	0.56	0.61	0.87	0.83	0.88
OMAN	1.11	1.46	1.47	1.45	1.48	1.46	1.51	1.50	1.75	1.73	1.70
QATAR	2.23	2.42	2.39	2.64	2.71	2.58	2.63	2.63	2.49	0.78	0.79
SAUDI ARABIA	5.81	5.66	6.07	6.46	5.80	5.89	5.74	6.00	5.79	5.19	6.13
UAE	2.25	2.72	3.07	2.41	3.19	3.48	3.61	3.78	3.67	2.96	3.66
Asia/Oceania											
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-
CHINA	-	-	-	-	-	-	-	-	-	-	-
INDIA	21.97	20.05	17.77	17.31	17.68	18.47	22.34	28.11	33.74	32.98	39.11
INDONESIA	1.23	0.52	0.76	0.16	0.05	-	-	0.24	-e	-e	-e
MALAYSIA	2.16	2.01	1.40	1.33	0.96	0.66	0.57	0.75	0.59	0.73	0.36
MYANMAR	-	-	-	-	-	-	-	-	-	-	-
PAKISTAN	-	-	0.06	-	-	-	-	-	-	-	-
North America											
CANADA	0.70	0.84	1.25	1.55	1.50	1.40	1.61	1.67	1.44	1.17	1.65
USA	-	-	-	1.30	1.10	1.81	2.99	3.35	3.24	3.35	5.01
CIS/Eastern Europe											
RUSSIA	5.20	5.24	5.33	5.35	5.44	5.70	6.99	7.90e	8.03	7.93	7.89
Sub-Saharan Africa											
NIGERIA	-	-	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	1.41	1.57	1.41	1.55	1.12	0.70	0.93	0.83	0.66	0.18	0.20
Western Europe											
GERMANY	0.38	.56	0.50	0.57	0.55	0.60	0.63	0.56	0.47	0.53	0.50
Other Nations											
-	-	-	-	-	-	-	-	-	-	-	-
WORLD TOTAL	73.21	73.14	74.92	74.59	72.64	72.71	87.10	100.73	108.10	104.84r	119.16

2011-2021 World DRI Production by Process (Mt)

NAME	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21
MIDREX®	44.38	44.76	47.56	47.12	45.77	47.14	56.65	61.96	65.37	63.07r	70.85
HYL/Energiron	11.03	10.79	11.29	12.08	11.62	12.66	14.68	15.85	14.26	12.98	15.16
PERED	-	-	-	-	-	-	**	2.40	2.31	3.05e	2.67e
Rotary Kiln	17.32	17.06	15.93	15.39	14.74	12.67	15.34	20.31	25.98	25.50	30.30
Other *	0.48	0.53	0.14	-	0.51	0.24	0.44	0.22	0.18	0.24	0.16
WORLD TOTAL	73.21	73.14	74.92	74.59	72.64	72.71	87.10	100.73	108.10	104.84r	119.16

* Other: A variety of processes using retorts, shaft furnaces, fluidized bed furnaces and hearths.

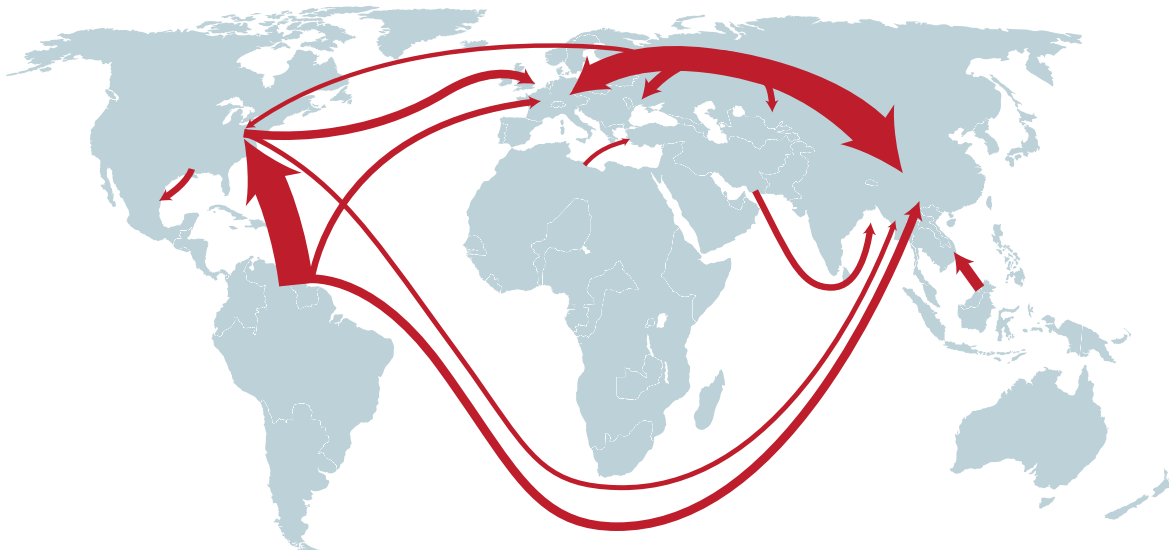
** Included in Other

e - estimated r - revised





Major Trade Routes for International Trade of DRI



The map shows the major routes of international transport of DRI in 2021. The width of the lines indicates the amount of DRI products that traveled over the individual routes. **NOTE: Domestic and smaller trade routes are not shown.**

MAJOR TRADE ROUTES FOR INTERNATIONAL TRADE OF DRI:

Shipments of DRI increased to a record 22.8 M tons in 2021, a 5.9 % increase from the previous record of 21.5 Mt in 2018. Land shipments in 2021 totaled over 14.8 Mt, a 4.4% increase compared to 2020.

SUPPLIERS

Russia led all exporters with approximately 3.5 M tons of DRI products, most coming from the three HBI plants at Lebedinsky GOK. Trinidad and Tobago exported almost 1.6 Mt of CDRI, all going to the USA. Iran exported approximately 1.0 Mt, and India and USA rounded out the top five exporting countries according to data from the ISSB.

DESTINATIONS

According to data from ISSB, 38 countries imported significant quantities of DRI/HBI. The top three importers were USA, China, and Italy, with 1.7 Mt, 1.5 Mt, and 0.9 Mt, respectively.

OUTLOOK

The trade of DRI products in 2022 is expected to be flat or decrease somewhat compared to 2021, due to the continuing

effects of COVID-19, the invasion of Ukraine, and the governmental efforts to reduce inflation globally.

The relationship between scrap and HBI prices will remain somewhat volatile, with freight as another variable. HBI suppliers know what products they compete against and will have to adjust their prices to stay competitive with other ferrous feedstocks on a regional CIF basis.

Data Source

Data for the map was taken from three sources: International Steel Statistics Bureau (ISSB), International Iron Metallurgy Association (IIMA), and reports from individual operating DR plants. Data from the ISSB originates with national export and import records; for instance, from the US Customs Bureau. IIMA information derives from a variety of sources. It should be stressed that a significant portion of the export data does not match the import data. Also, reports from individual plants show large tonnages for which the destination is unknown.

The arrows do not originate and terminate at specific countries. Rather, sums for dispatch and arrival were totaled by region and the arrows flow from region to region. For instance, the wide arrow originating from the north coast of South America shows DRI and HBI coming from the Caribbean (Venezuela plus Trinidad and Tobago) and being transported to North America, Asia and Europe.

Notes:

- All references to tons are metric unless otherwise stated
- A MIDREX Plant can include one or more modules





World DRI Shipments (Mt)

Source: Midrex Technologies, Inc.

Year	CDRI	HBI	Year	CDRI	HBI	Year	CDRI	HBI
'71	0.04	–	'88	1.48	0.83	'05	6.76	7.12
'72	0.08	–	'89	1.27	0.94	'06	7.81	6.75
'73	0.13	–	'90	1.46	1.71	'07	10.82	6.24
'74	0.26	–	'91	1.29	2.67	'08	8.01	5.99
'75	0.34	–	'92	1.45	2.71	'09	8.50	5.38
'76	0.37	–	'93	1.45	3.56	'10	8.42	5.60
'77	0.32	–	'94	2.44	3.93	'11	7.97	6.06
'78	0.28	0.11	'95	3.69	3.98	'12	8.17	6.58
'79	0.66	0.12	'96	3.58	3.20	'13	8.56	5.62
'80	0.81	0.25	'97	3.99	3.51	'14	7.70	5.17
'81	0.83	0.25	'98	4.24	3.00	'15	8.35	4.97
'82	0.80	0.18	'99	4.01	4.41	'16	8.79	4.70
'83	0.59	0.36	'00	4.54	5.02	'17	8.00	8.13
'84	0.83	0.39	'01	2.83	6.58	'18	12.49	9.03
'85	0.71	0.61	'02	4.85	6.45	'19	11.27	8.33
'86	0.89	0.73	'03	4.63	7.63	'20	12.39	9.11(r)
'87	0.85	0.77	'04	4.26	6.82	'21	12.92	9.86



Year	Water	Land	Year	Water	Land	Year	Water	Land
'71	–	0.04	'88	1.08	1.23	'05	7.02	6.86
'72	0.01	0.07	'89	1.34	0.87	'06	6.80	7.75
'73	0.02	0.12	'90	1.79	1.38	'07	8.19	8.87
'74	0.03	0.23	'91	2.25	1.71	'08	6.41	7.59
'75	0.06	0.28	'92	2.24	1.93	'09	5.39	8.48
'76	0.10	0.26	'93	2.90	2.11	'10	6.61	7.42
'77	0.04	0.27	'94	3.46	2.91	'11	6.49	7.55
'78	0.12	0.57	'95	3.76	3.92	'12	8.48	6.27
'79	0.33	0.45	'96	3.40	3.50	'13	7.79	6.39
'80	0.54	0.52	'97	3.81	3.80	'14	7.23	5.64
'81	0.53	0.55	'98	4.22	3.11	'15	7.28	6.04
'82	0.65	0.33	'99	5.45	3.00	'16	7.48	6.01
'83	0.67	0.28	'00	6.66	2.90	'17	10.30	5.83
'84	0.69	0.53	'01	7.59	1.82	'18	10.22	11.30
'85	0.81	0.51	'02	6.74	4.56	'19	8.61	11.00
'86	0.99	0.63	'03	8.31	3.94	'20	7.30(r)	14.20
'87	0.95	0.67	'04	6.57	4.51	'21	7.96	14.82



Note regarding land shipments: It is estimated that about 25% of the DRI produced in India is transported domestically to nearby melting furnaces. This tonnage is included in the figures given above.





World Direct Reduction Plants (as of 12/31/21)

Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
MIDREX®						
ArcelorMittal Hamburg	Hamburg, Germany	0.40	1	CDRI	'71	0
ArcelorMittal Canada 1	Contrecoeur, Quebec, Canada	0.40	1	CDRI	'73	0
Tenaris Siderca	Campana, Argentina	0.40	1	CDRI	'76	0
ArcelorMittal Canada 2	Contrecoeur, Quebec, Canada	0.60	1	CDRI	'77	0
SIDOR I	Matanzas, Venezuela	0.35	1	CDRI	'77	I
Acindar	Villa Constitucion, Argentina	0.60	1	CDRI	'78	0
Qatar Steel 1	Mesaieed, Qatar	0.40	1	CDRI	'78	0
SIDOR IIA, IIB, IIC	Matanzas, Venezuela	1.29	3	CDRI	'79	0
ArcelorMittal Point Lisas I & II	Point Lisas, Trinidad & Tobago	0.84	2	CDRI	'80/'82	I
Delta Steel I & II	Warri, Nigeria	1.02	2	CDRI	'82	I
Hadeed A & B	Al-Jubail, Saudi Arabia	0.80	2	CDRI	'82/'83	0
OEMK I - IV	Stary Oskol, Russia	1.67	4	CDRI	'83/'85/'85/'87	0
Antara Steel Mills	Labuan Island, Malaysia	0.65	1	HBI	'84	0
EZDK I	El Dikheila, Egypt	0.72	1	CDRI	'86	0
Khouzestan Steel Co. I - III	Ahvaz, Iran	2.05	3	CDRI	'89/'90/'92	0
LISCO 1 & 2	Misurata, Libya	1.10	2	CDRI	'89/'90	0
AM/NS India I & II	Hazira, India	0.88	2	CDRI/HDRI	'90	0
FMO	Puerto Ordaz, Venezuela	1.00	1	HBI	'90	0
VENPRECAR	Matanzas, Venezuela	0.82	1	HBI	'90	0
AM/NS India III	Hazira, India	0.44	1	HBI/HDRI	'92	0
Hadeed C	Al-Jubail, Saudi Arabia	0.65	1	CDRI	'92	0
Mobarakeh Steel A - E	Mobarakeh, Iran	4.00	5	CDRI	'92/'93/'94	0
JSW Steel Ltd.	Dolvi, Maharashtra, India	1.00	1	CDRI	'94	0
EZDK II	El Dikheila, Egypt	0.80	1	CDRI	'97	0
LISCO 3	Misurata, Libya	0.65	1	HBI	'97	0
ArcelorMittal Lázaro Cárdenas	Lázaro Cárdenas, Mexico	1.20	1	CDRI	'97	0
COMSIGUA	Matanzas, Venezuela	1.00	1	HBI	'98	0
ArcelorMittal Point Lisas III	Point Lisas, Trinidad & Tobago	1.36	1	CDRI	'99	I
ArcelorMittal South Africa	Saldanha Bay, South Africa	0.80	1	CDRI	'99	I
EZDK III	El Dikheila, Egypt	0.80	1	CDRI	'00	0
Khouzestan Steel IV	Ahvaz, Iran	0.85	1	CDRI	'01	0
AM/NS India IV	Hazira, India	1.00	1	HBI/HDRI	'04	0
Nu-Iron	Point Lisas, Trinidad & Tobago	1.60	1	CDRI	'06	0
AM/NS India V	Hazira, India	1.50	1	HBI/HDRI	'06	0
Mobarakeh Steel F	Mobarakeh, Iran	0.85	1	CDRI	'06	0
DRIC I & II	Dammam, Saudi Arabia	1.00	2	CDRI	'07	0
Hadeed E	Al-Jubail, Saudi Arabia	1.76	1	HDRI/CDRI	'07	0
LGOK HBI-2	Gubkin, Russia	1.40	1	HBI	'07	0
Qatar Steel 2	Mesaieed, Qatar	1.50	1	CDRI/HBI	'07	I
Khouzestan Steel V	Ahvaz, Iran	0.92	1	CDRI	'08	0
Lion DRI	Banting, Malaysia	1.54	1	HDRI/HBI	'08	I
Hormozgan A & B	Bandar Abbas, Iran	1.66	2	CDRI	'09/'10	0
AM/NS India VI	Hazira, India	1.50	1	CDRI	'10	0
Khorasan Steel I	Neyshabur, Khorasan Razavi, Iran	0.80	1	CDRI	'10	0
JindalShadeed	Sohar, Oman	1.50	1	HDRI/HBI	'10	0

Note 1: This list does not include plants that are inoperable or that have been dismantled.

Note 2: This list only includes plants processing feed materials with total iron content of 60% or higher and producing DRI with metallization of 85% or higher.

Note 3: There are nearly 300 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list.

Note 4: Only a representative sample of rotary kiln facilities larger than 50,000 tons per year are shown.

* Status Codes: 0 – Operating I – Idle C – Under Contract or Construction





World Direct Reduction Plants (as of 12/31/21)

Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
MIDREX® (Continued)						
Ghadir Iron and Steel Company	Ardakan (Yazd), Iran	0.80	1	CDRI	'11	O
Khorasan Steel II	Neyshabur, Khorasan Razavi, Iran	0.80	1	CDRI	'11	O
South Kaveh Steel A & B	Bandar Abbas, Iran	1.86	2	CDRI	'12	O
Mobarakeh Steel (Kharazi A & B)	Mobarakeh, Iran	2.76	2	CDRI	'12/'14	O
Tuwairqi Steel Mills	Karachi, Pakistan	1.28	1	HDRI/CDRI	'13	I
SULB	Hidd, Bahrain	1.50	1	HDRI/CDRI	'13	O
Arfa Steel Company	Ardakan (Yazd), Iran	0.80	1	CDRI	'13	O
Mobarakeh Steel (Saba)	Chamgordan, Isfahan, Iran	1.38	1	CDRI	'13	O
JSW Steel Ltd.	Toranagallu, Karnataka, India	1.20	1	HDRI/CDRI	'14	O
Sirjan Iranian Co.	Bardsir, Kerman, Iran	0.80	1	CDRI	'14	O
Jindal Steel & Power	Angul, Odisha, India	1.80	1	HDRI/CDRI	'14	O
ESISCO	Sadat City, Egypt	1.76	1	HDRI/CDRI	'15	I
Sirjan Jahan Co. 1	Sirjan, Kerman, Iran	0.96	1	CDRI	'15	O
Golgohar Iron & Steel Development 1	Sirjan, Kerman, Iran	1.56	1	CDRI	'15	O
voestalpine Texas	Corpus Christi, Texas, USA	2.00	1	HBI	'16	O
Sefid Dasht Steel	Sefiddasht, Iran	0.80	1	CDRI	'16	O
LGOK HBI-3	Gubkin, Russia	1.80	1	HBI	'17	O
Persian Gulf Saba Steel	Bandar Abbas, Iran	1.50	1	HBI	'17	O
Sabzevar Steel Company	Khorasan Razavi, Iran	0.80	1	CDRI	'18	O
Golgohar Iron & Steel Development 2	Sirjan, Kerman, Iran	1.70	1	CDRI	'18	O
Tosyali Algérie 1	Oran, Algeria	2.50	1	HDRI/CDRI	'18	O
Chadormalu M & I Co.	Ardakan (Yazd), Iran	1.55	1	HDRI/CDRI	'18	O
Pasargad Steel	Shiraz, Fars, Iran	1.50	1	HDRI/CDRI	'19	O
Ardakan Steel	Ardakan (Yazd), Iran	0.96	1	CDRI	'20	O
Cleveland-Cliffs HBI Plant	Toledo, Ohio, USA	1.60	1	HBI	'20	O
Algerian Qatari Steel (AQS)	Bellara, Algeria	2.50	1	HDRI/CDRI	'21	O
Qaenat	Nimbolook, South Khorasan, Iran	0.80	1	CDRI		C
Makran	Chabahar, Sistan Baluchestan, Iran	1.60	1	HBI		C
Sirjan Jahan Co. 2	Sirjan, Kerman, Iran	0.90	1	CDRI		C
Torbat	Shirabad, Razavi Khorasan, Iran	1.85	1	CDRI		C
Saqquez	Saqquez, Kurdistan, Iran	1.00	1	HBI		C
Mikhailovsky HBI	Zheleznogorsk, Kursk, Russia	2.08	1	HBI		C
LGOK HBI-4	Gubkin, Russia	2.08	1	HBI		C
Tosyali Algerie 2	Oran, Algeria	2.50	1	HDRI/CDRI		C
		99.35	99			

HYL/ENERGIRON

Ternium 3M5	Monterrey, Mexico	0.50	1	CDRI	'83	O
ArcelorMittal Lázaro Cárdenas I	Lázaro Cárdenas, Mexico	1.00	2	CDRI	'88	O
ArcelorMittal Lázaro Cárdenas II	Lázaro Cárdenas, Mexico	1.00	2	CDRI	'91	O
JSW Salav**	Raigad, India	0.90	1	HBI/CDRI	'93	O
PT Krakatau Steel	Cilegon, Indonesia	1.35	2	CDRI	'93	I
Perwaja Steel	Kemaman, Malaysia	1.20	2	CDRI	'93	I
Usiba	Salvador Bahia, Brazil	0.31	1	CDRI	'94	I
Ternium 2P5	Puebla, Mexico	0.61	1	CDRI	'95	O

** JSW Salav has two reduction furnaces but only one reformer. The reformer can supply either reduction furnace, but not simultaneously.

Note 1: This list does not include plants that are inoperable or that have been dismantled.

Note 2: This list only includes plants processing feed materials with total iron content of 60% or higher and producing DRI with metallization of 85% or higher.

Note 3: There are nearly 300 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list.

Note 4: Only a representative sample of rotary kiln facilities larger than 50,000 tons per year are shown.

* Status Codes: O – Operating I – Idle C – Under Contract or Construction





World Direct Reduction Plants (as of 12/31/21)

Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
HYL/ENERGIRON (Continued)						
Ternium 4M	Monterrey, Mexico	0.68	1	HDRI/CDRI	'98	O
LGOK HBI-1	Gubkin, Russia	0.90	1	HBI	'99	O
Hadeed D	Al-Jubail, Saudi Arabia	1.10	1	CDRI	'99	O
Briqven	Matanzas, Venezuela	1.50	2	HBI	'00	I
Emirates Steel I (GHC)	Abu Dhabi, UAE	2.00	1	HDRI/CDRI	'09	O
Gulf Sponge Iron	Abu Dhabi, UAE	0.20	1	CDRI	'10	O
Emirates Steel II (GHC)	Abu Dhabi, UAE	2.00	1	HDRI/CDRI	'11	O
Suez Steel	Adabia, Egypt	1.95	1	HDRI/CDRI	'13	O
Nucor Steel Louisiana	Convent, Louisiana, USA	2.50	1	CDRI	'13	O
Ezz Rolling Mills	Ain Sukhna, Egypt	1.90	1	CDRI	'15	O
Mutún Steel	Puerto Suarez, SC, Bolivia	0.25	1	CDRI		C
OMK	Vyksa, Russia	2.50	1	HDRI		C
Myingyan Steel	Myingyan, Myanmar	0.50	1	CDRI		C
Hebei Iron and Steel	Hebei, China	0.55	1	CDRI		C
		25.40	27			
PERED						
Shadegan Steel	Shadegan, Khouzestan, Iran	0.80	1	CDRI	'17	O
Mianeh Steel	Mianeh, East Azerbaijan, Iran	0.80	1	CDRI	'17	O
Neyriz Steel	Neyriz, Fars, Iran	0.80	1	CDRI	'18	O
Baft Steel	Baft, Kerman, Iran	0.80	1	CDRI	'19	O
Shanxi Taihang Mining	Jinzhong City, Shanxi Province, China	0.30	1	CDRI	'21	C
		3.50	5			
OTHERS						
FINMET						
BriqOri	Matanzas, Venezuela	2.20	4	HBI	'00	O
CIRCORED						
Arcelor Mittal Trinidad	Point Lisas, Trinidad & Tobago	0.50	1	HBI	'99	I
FIOR						
Operaciones RDI	Matanzas, Venezuela	0.40	1	HBI	'76	I
ROTARY KILN						
SL/RN						
Piratini	Charquedas, Brazil	0.06	1	CDRI	'73	I
SIIL	Paloncha, India	0.06	2	CDRI	'80/'85	O
Siderperu	Chimbote, Peru	0.10	3	CDRI	'80	I
ISCOR	Vanderbijlpark, South Africa	0.72	4	CDRI	'84	O
Prakash Industries	Champa, India	0.40	2	CDRI	'93/'96	O
Nova Iron & Steel	Bilaspur, India	0.15	1	CDRI	'94	O
Ashirwad	Jamshedpur, India	0.05	2	CDRI	'00	O
Vandana Global	Siltara, Raigarh, India	0.05	1	CDRI		O
Prakash Industry	Champa, India	0.60		CDRI		O

Note 1: This list does not include plants that are inoperable or that have been dismantled.

Note 2: This list only includes plants processing feed materials with total iron content of 60% or higher and producing DRI with metallization of 85% or higher.

Note 3: There are nearly 300 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list.

Note 4: Only a representative sample of rotary kiln facilities larger than 50,000 tons per year are shown.

* Status Codes: O – Operating I – Idle C – Under Contract or Construction





World Direct Reduction Plants (as of 12/31/21)

Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
ROTARY KILN (Continued)						
JINDAL						
Jindal Steel & Power	Raigarh, India	0.90	6	CDRI	'93/'94/'95/'96/'00	0
Monnet Ispat	Ispat Raipur, India	0.30	2	CDRI	'93/'98	0
Rexon Strips Ltd.	Via Lathikata, India	0.06	2	CDRI	'93/'00	0
DRC						
Scaw Metals I	Germiston, South Africa	0.18	2	CDRI	'83/'89	0
Scaw Metals II	Germiston, South Africa	0.15	1	CDRI	'97	0
Tianjin Iron & Steel	Tianjin, China	0.30	2	CDRI	'97	I
CODIR						
Dunswart	Benoni, South Africa	0.15	1	CDRI	'73	0
Sunflag	Bhandara, India	0.15	1	CDRI	'89	0
TISCO						
Tata Sponge Iron, Ltd.	Keonjhar, Orissa, India	0.40	2	CDRI	'86/'98	0
Vallabh Steels	Ludhiana, Punjab, India	0.12	1	CDRI		0
SIIL						
Bellary Steel & Alloys	Bellary, Karnataka, India	0.06	2	CDRI	'92/'93	0
HEG	Borai, India	0.09	2	CDRI	'92	0
Kumar Met.	Nalgonda, India	0.06	2	CDRI	'93	0
Aceros Arequipa	Pisco, Peru	0.08	2	CDRI	'96	0
Rungta Mines	Barbil, India					
OSIL						
OSIL	Keonjhar, Orissa, India	0.10	1	CDRI	'83	0
Lloyd's Metals & Eng.	Ghugus, India	0.27		CDRI	'95	0
DAV						
Davsteel	Cullinan, South Africa	0.04	1	CDRI	'85	0
BGRIMM						
ArcelorMittal South Africa	Vanderbijlpark, South Africa	0.30	2	CDRI	'09	0
OTHER						
Mahalaxmi TMT Bars	Wardha, Maharashtra India	0.24	1	CDRI	'11	0
BMM Ispat Ltd	Danapura, Hospet, Karnataka, India	0.73		CDRI		0
Sarda Energy and Minerals, Ltd.	Siltara, Raipur, India	0.36		CDRI		0
Godawari Power and Ispat	Siltara, Raipur, India	0.50		CDRI		0
Nalwa Steel and Power Ltd.	Raigarh, Chhattisgarh, India	0.18		CDRI		0
Janki Corp., Ltd.	Sidiginamola, Bellary, Karnataka	0.18		CDRI		0
Andhunik Metaliks, Ltd.	Chadrihariharpur, Orissa, India	0.30		CDRI		0
Shyam SEL Ltd.	West Bengal and Odisha, India	0.80		CDRI		0
Shri Bajrang Power and Ispat	Raipur, India	0.36		CDRI		0
Gallantt Metal, Ltd.	Kutch, Gujarat, India	0.20		CDRI		0
SKS Ispat, Ltd.	Raipur, Chhattisgarh, India	0.27		CDRI		0

Note 1: This list does not include plants that are inoperable or that have been dismantled.

Note 2: This list only includes plants processing feed materials with total iron content of 60% or higher and producing DRI with metallization of 85% or higher.

Note 3: There are nearly 300 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list.

Note 4: Only a representative sample of rotary kiln facilities larger than 50,000 tons per year are shown.

* Status Codes: 0 – Operating I – Idle C – Under Contract or Construction





World Direct Reduction Plants (as of 12/31/21)

Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
ROTARY KILN (Continued)						
OTHER (Continued)						
Bhushan Power and Steel Ltd.	Sambalpur, Odisha, India	1.50		CDRI	11-'12	O
Tata Steel Ltd.	Angul, Odisha, India	1.50		CDRI		O
Electrotherm (India) Ltd.	Kutch, Gujarat, India	0.15		CDRI		O
Jayaswal Neco Industries Ltd.	Raipur, Chhattisgarh, India	0.25		CDRI		O
SMC Power Generation Ltd.	Jharsuguda, Odisha, India	0.20		CDRI		O
Electrotherm	Kutch, India	0.18		CDRI		O
PT Meratus Jaya	Kalimantan Selatan, Indonesia	0.32		CDRI		O

Note 1: This list does not include plants that are inoperable or that have been dismantled.

Note 2: This list only includes plants processing feed materials with total iron content of 60% or higher and producing DRI with metallization of 85% or higher.

Note 3: There are nearly 300 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list.

Note 4: Only a representative sample of rotary kiln facilities larger than 50,000 tons per year are shown.

* Status Codes: O – Operating I – Idle C – Under Contract or Construction





2021 WORLD DIRECT REDUCTION STATISTICS is compiled by Midrex Technologies, Inc. annually as a resource for the global iron and steel industry.

Direct reduced iron (DRI) is a high quality metallic product produced from iron ore that is used as a feedstock in electric arc furnaces, blast furnaces, and other iron and steelmaking applications. Hot briquetted iron (HBI) is a compacted form of DRI designed for ease of shipping, handling, and storage.

Midrex Technologies, Inc. is the world leader for direct reduction ironmaking technology and aftermarket solutions for the steel industry. As the technology provider of the MIDREX Process for 50+ years, Midrex designs Direct Reduced Iron (DRI) plants, providing engineering, proprietary equipment, and project development services. The MIDREX Process is unsurpassed in the industry in terms of production, reliability, and process flexibility to meet the constantly evolving nature of steelmakers and ore-based metallics providers.

The following organizations supplied or assisted in collecting data for this issue of 2021 WORLD DIRECT REDUCTION STATISTICS:

Sponge Iron Manufacturers Association – India
World Steel Association – Belgium
International Iron Metallics Association – UK
South East Asia Iron and Steel Institute – Malaysia
International Steel Statistics Bureau – UK
Kobe Steel Ltd. – Japan
All Individual MIDREX® Direct Reduction Plants
Other Direct Reduction Plants
Various company correspondence

MIDREX® is a registered trademark of Kobe Steel, Ltd in the USA and China. MxCol® is a registered trademark of Kobe Steel Ltd.

For updates check **www.midrex.com**

For more information or general comments, please e-mail: **info@midrex.com**

USA / CORPORATE HEADQUARTERS:

Midrex Technologies, Inc.
 3735 Glen Lake Drive, Suite 400
 Charlotte, NC 28208 USA
 Tel: +1 (704) 373 1600

World Steel Dynamics (WSD) has audited Midrex's collection and preparation process of the "2021 World Direct Reduction Statistics", i.e. "The Booklet". It is our observation that at the present, Midrex receives inputs from all over the world from practically every known direct reduction producer either directly or indirectly through partner organizations. Midrex invites all producers to participate directly. In instances where plant information is not available directly from producers, Midrex deduces that information from publicly available data. WSD has reviewed the data collection and preparation procedures and can confirm the documentation substantiates the methodology and accuracy of the data to be published in The Booklet for the world direct reduction industry in 2021.

Audited by



Englewood Cliffs,
 New Jersey, U.S.A.
 Sept, 2022

© 2022 Midrex Technologies, Inc.

MIDREX

