



# 2016

## WORLD DIRECT REDUCTION STATISTICS

# MIDREX

[www.midrex.com](http://www.midrex.com)

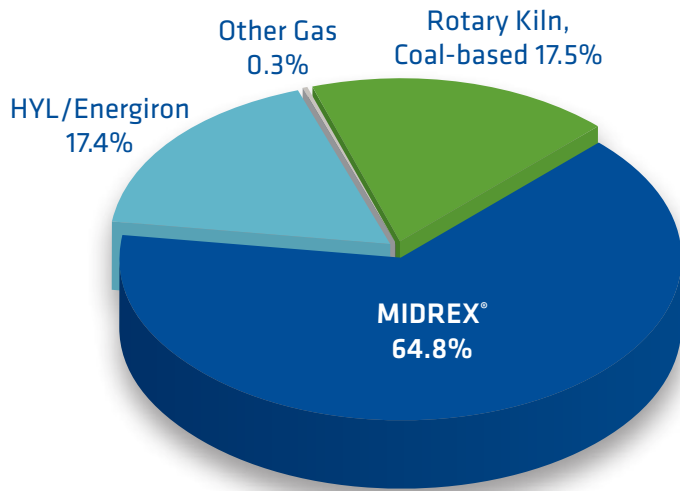


### CONTENTS

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



## 2016 World DRI Production by Process



### Total World Production: 72.8 Mt

	2014	2015	2016
MIDREX®	63.2%	63.1%	64.8%
HYL/Energiron	16.2%	16.0%	17.4%
Other Gas	0.0%	0.7%	0.3%
Rotary Kiln, Coal-based	20.6%	20.2%	17.5%

Source: Midrex Technologies, Inc.

## 2016 World DRI Production at 72.76 Million Tons:

US production was up by more than 700,000 tons over 2015

Five nations represent 71% of world DRI production

World steel industry steadies

**W**orldwide production of direct reduced iron (DRI) was 72.76 million tons in 2016, according to data collected by Midrex Technologies, Inc. and audited by World Steel Dynamics. This is slightly greater than the 2015 figure, which in light of recent revisions, was raised to 72.64 million tons. Considering the slowdown of the world steel industry in late 2015 and early 2016, the fact that the production of DRI held constant was positive for the DR industry.

Interestingly, it initially appeared that DRI output had declined by a few million tons until a detailed accounting was made of all producers. Many of those that reported early, primarily the ones which report to the World Steel Association,

made less than they had in 2015, by a substantial margin. But the others, DR plants that are either merchant suppliers not associated with any particular steel works, or those related to steel companies that do not report to WSA, produced more in 2016.

Prices for scrap steel and alternate iron (including DRI) fell to a nadir in January 2016. For instance, CRU reported that DRI delivered into southern Europe was purchased, CIF basis, for less than \$165 per ton. As would be expected, DRI production suffered a strong decline in response. But by May, pricing was up by 75% and so production returned to more normal levels.

The greatest increases in DRI production were seen in Iran, India and the United States, which combined produced three million tons more than in 2015. The United Arab Emirates, Russia and Libya also enjoyed substantial gains. Nations experiencing the biggest declines were Venezuela and Trinidad and Tobago, while Argentina, South Africa and Malaysia also fell noticeably.

The surge of DRI in Iran from 14.6 million tons to over 16 million tons was part of the longstanding growth trend of the national steel industry. Capitalizing on large iron ore resources and extraordinary reserves of natural gas, the country plans to continue expanding very rapidly over the ensuing decades, using direct reduced iron. By comparison, Iran made only 2.25 million tons of blast furnace hot metal during 2016.



The increase of Indian DRI by almost 800,000 tons can be attributed to a combination of causes. Gas-based DRI plants were aided by lower costs for imported liquefied natural gas and by the stabilization of the coal gasification plants that supply direct reduction furnaces. Gas-based DRI output in India rose remarkably, by over 70%, versus 2015. Meanwhile, production by the hundreds of rotary kiln coal-based plants dropped by about 5%. A number of the kilns were shuttered, but their market was taken by the surviving operations which upped their production.

Growth in the United States DR industry was due to the increase toward nameplate capacity by the Nucor Louisiana plant and the startup of the new voestalpine Texas LLC HBI plant late in the year. US production was up by more than 700,000 tons over 2015.

Increases in production of 200,000-300,000 tons occurred in the UAE, Russia and Libya. In the UAE, production climbed toward capacity due to plant expansions in the previous years; in Russia plants continued to ramp up; and in Libya production recovered from the political instability.

The largest decline was experienced by Venezuela, where production fell to only 1.6 million tons, the lowest level in 35 years. The drop was due to many reasons, all of which are the result of the dire economic situation. The next largest fall was by Trinidad and Tobago, which slipped by more than one million tons as the three ArcelorMittal plants were shuttered in late-2015 and did not operate in 2016. At the time of this writing they were in the process of liquidation, seeking a new owner. The MIDREX® Plant in Trinidad owned by Nucor continued in steady operation, supplying CDRI to Nucor steel works in the United States. Declines of 0.3-0.5 million tons occurred in Argentina, South Africa and Malaysia. In the case of Argentina the fall was largely due to lower oil prices, and the corresponding drop in demand for oil and gas tubular steels.

The same five nations from 2015 remained the top DRI producers in 2016. However, Russia and Mexico exchanged places as the increases in Russia moved it up to fourth position. Combined, these five nations represent 71% of world DRI production.

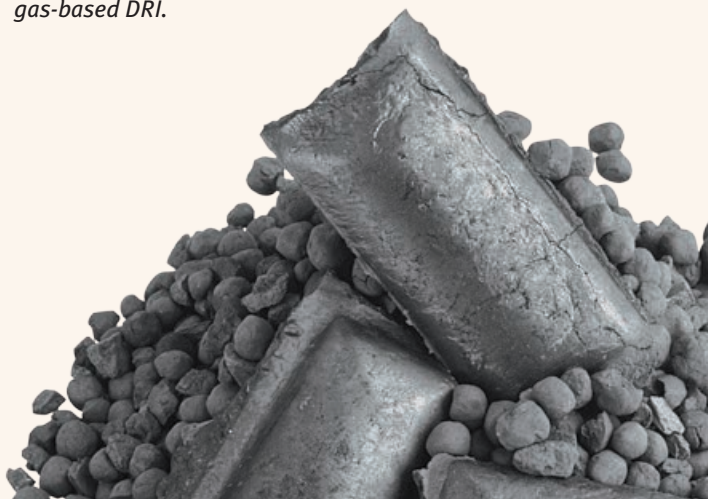


### 2016 Top Producing Nations

	Million Tons
India	18.47
Iran	16.01
Saudi Arabia	5.89
Russia	5.70
Mexico	5.31

Source: Midrex Technologies, Inc.

*It should be noted that almost two-thirds of the DRI made in India is produced in rotary kilns which employ coal as the reductant and fuel. For this reason, Iran is the number one producer of gas-based DRI.*





## NEW CAPACITY AND PLANTS UNDER CONSTRUCTION

### MIDREX®

#### New modules begin operations

Two new MIDREX® Plants began operation in 2016 and one additional plant was commissioned in 2017 by the time of this writing (June 2017).

Rated at 2.0 million ton per year (tpy) of Hot Briquetted Iron (HBI), the voestalpine Texas plant began operation in September 2016. It is the largest HBI module yet commissioned. Reserving 40% of its production for internal voestalpine use, it immediately began dispatching HBI to the voestalpine home steelworks in Austria. By applying iron reduced via natural gas as the fuel/reductant, this HBI is making the Austrian blast furnaces more productive while simultaneously decreasing their fuel use and lowering their carbon footprint.

A new 800,000 tpy MIDREX® Plant for the Sepiddasht Steel Complex started up in the Char Mahal and Bakhtiari province of Iran, to the southwest of Esfahan. Mobarakeh Steel, headquartered in Esfahan, is the majority owner of Sepiddasht. The new plant produces Cold DRI for use in Sepiddasht's EAF melt shop.

In early-2017 the 1.8 million tpy LGOK HBI-3 MIDREX® Plant began operating, bringing LGOK's total HBI capacity up to 4.1 million tpy This makes LGOK the world's largest manufacturer of Hot Briquetted Iron and underscores their position as the number one merchant supplier of HBI, worldwide.

#### Under Construction

14.75 million tpy of MIDREX® Plant capacity are under construction. Of this total, over 11 million tpy will be capable of Hot Discharge, including 3.1 million tpy that will produce HBI.

The next two plants to begin operation are the 1.5 million tpy Persian Gulf Saba MIDREX® HBI Plant at Bandar Abbas in the Hormozgan Province of Iran and the 2.5 million tpy Tosyali Algeria MIDREX® HDRI Plant at Bethioua near Oran, Algeria. The latter, when commissioned, will be the world's largest multiple product direct reduced iron plant. It is designed to produce HDRI and/or CDRI simultaneously without stoppage of production. This will provide Tosyali Algeria with greater production flexibility.

A second 2.5 million tpy MIDREX® Combo Plant is also under construction in Algeria, for Algerian Qatari Steel at the Bellara Steel Complex in Jijel, east of Algiers.

Throughout 2018-19, an additional eight MIDREX® Plants are

scheduled to begin operation in Algeria and in Iran. A listing providing details of the individual facilities is given in the section of this Statistics Booklet titled World Direct Reduction Plants beginning on page 11.



voestalpine Texas MIDREX® HBI Plant located near Corpus Christi, Texas, is the world's largest HBI plant.

### HYL/ENERGIRON

#### New module begins operation

No new HYL/Energiron modules began operation in 2016.

#### Under Construction

The only HYL/Energiron module under construction is the 800,000 tpy CDRI plant for Sidor in Matanzas, Venezuela. Construction began nearly a decade ago but has been much delayed following the change in ownership to the national government.

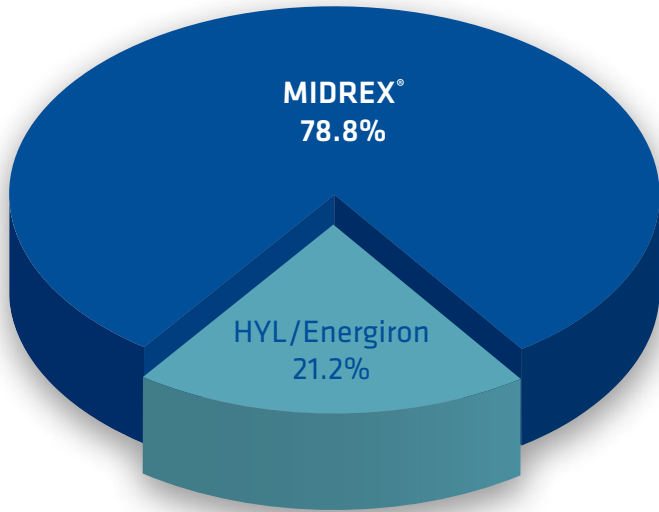
#### Rotary Kiln Coal-based

Environmental and supply pressures continued to restrict the rotary kiln DR industry in 2016. Production declined by over 13%, falling from 14.7 million tons to 12.7 million tons. Suitable new coal supplies continued to be difficult to source and the costs of adding required pollution control equipment caused many of the smaller, less well positioned plants to close. There continue to be over 200 kilns operating, almost all of them in India.

In that total world output by the rotary kilns was nearly 50% greater only six years prior, and that during this same period Indian steelmaking has burgeoned, growing nearly 40%, the trend is clear.



## 2016 World Shaft Furnace Production by Process



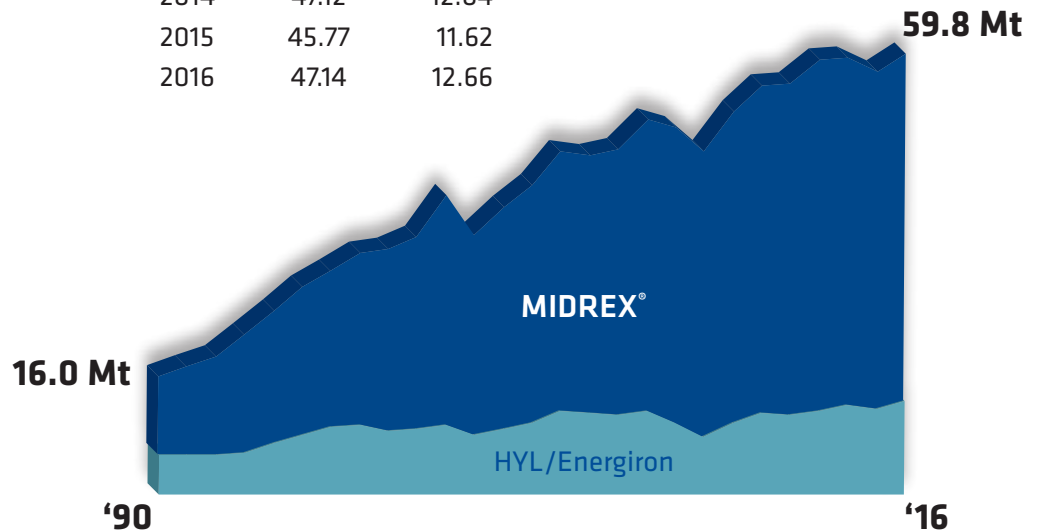
### Total World Production: 59.8 Mt

	2014	2015	2016
MIDREX®	79.6%	79.7%	78.8%
HYL/Energiron	20.4%	20.3%	21.2%

Source: Midrex Technologies, Inc.

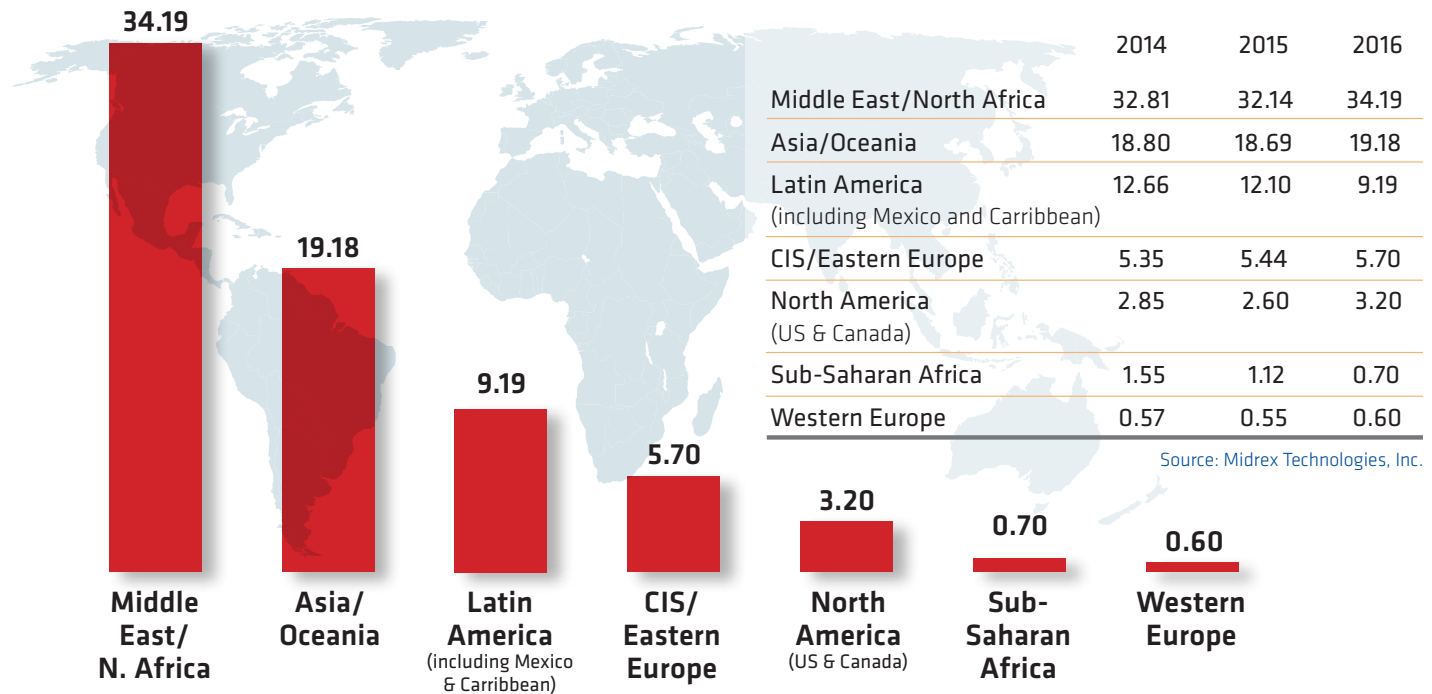
## Shaft Furnace DRI Production by Process and by Year

Year	MIDREX®	HYL/Energiron	Year	MIDREX®	HYL/Energiron
1990	10.73	5.25	2007	39.72	11.20
1991	11.96	5.40	2008	39.85	9.84
1992	13.26	5.29	2009	38.62	7.88
1993	15.91	5.73	2010	42.01	9.81
1994	17.83	7.01	2011	44.38	11.03
1995	19.86	8.15	2012	44.76	10.79
1996	21.03	9.12	2013	47.56	11.29
1997	23.08	9.55	2014	47.12	12.04
1998	24.82	8.52	2015	45.77	11.62
1999	26.12	8.81	2016	47.14	12.66
2000	30.12	9.39			
2001	26.99	8.04			
2002	30.11	8.88			
2003	32.06	9.72			
2004	35.01	11.34			
2005	34.96	11.00			
2006	35.71	10.91			



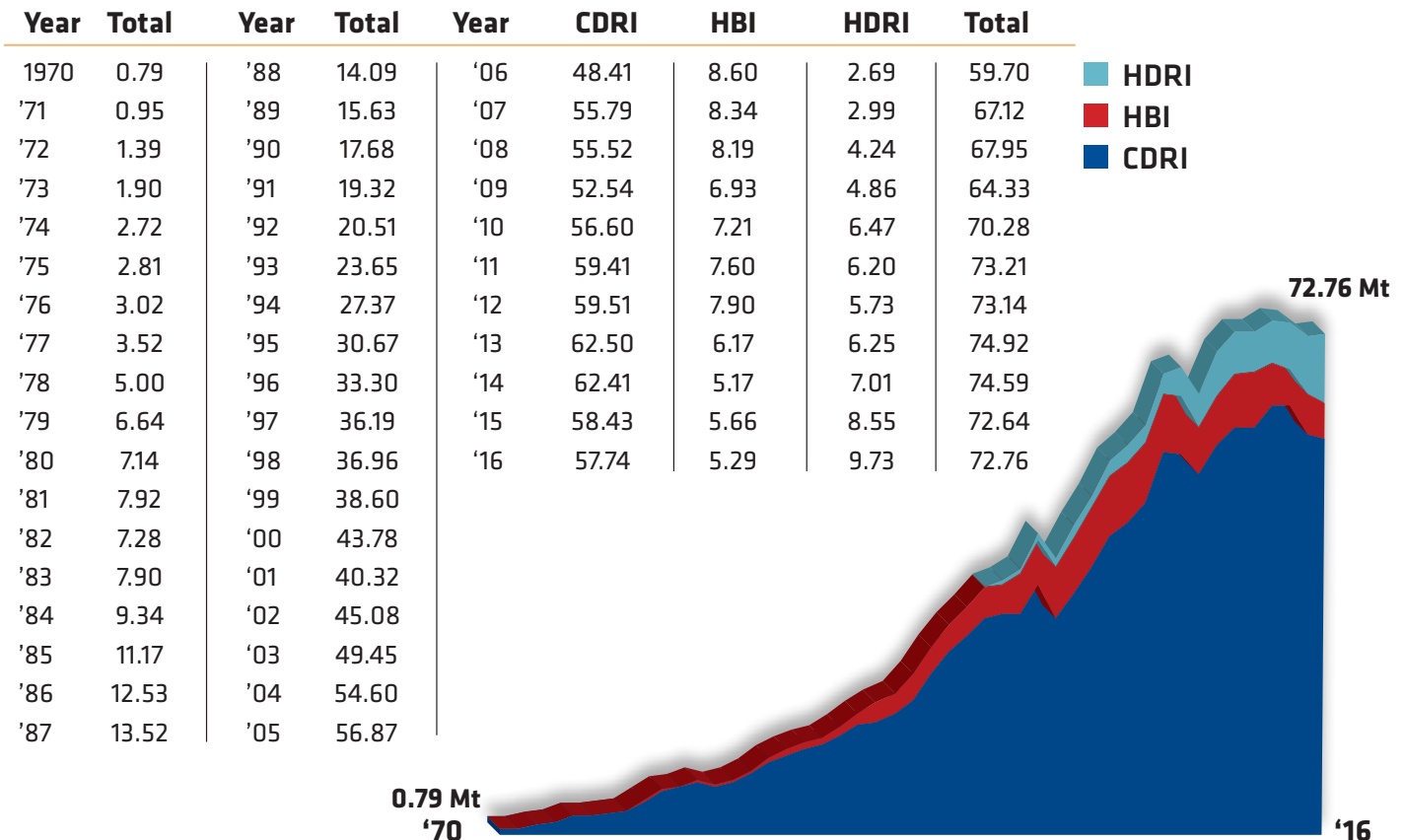


## 2016 World DRI Production by Region (Mt)



## World DRI Production by Year (Mt)

Source: Midrex Technologies, Inc.





## 2016 World DRI Production by Region (Mt)

Source: Midrex Technologies, Inc.

NAME	'70-'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
<b>Latin America</b>										
ARGENTINA	19.25	1.50	1.54	0.99	1.42	1.28	1.46	1.74	1.74	1.83
BRAZIL	6.02	0.32	0.34	0.40	0.42	0.43	0.36	0.41	0.44	0.43
MEXICO	49.77	4.54	5.68	6.24	5.83	3.67	4.90	5.62	6.54	5.98
PERU	0.63	0.12	0.11	0.05	0.08	0.07	0.03	0.08	0.08	0.09
TRINIDAD & TOBAGO	9.22	1.24	1.14	1.30	1.53	2.31	2.32	2.28	2.36	2.25
VENEZUELA	54.41	5.36	5.06	5.05	6.69	6.38	6.89	6.90	7.83	8.95
<b>Middle East/N. Africa</b>										
BAHRAIN	-	-	-	-	-	-	-	-	-	-
EGYPT	7.56	1.19	1.61	1.67	2.11	2.37	2.53	2.87	3.02	2.90
IRAN	13.44	4.38	3.69	4.12	4.74	5.00	5.28	5.62	6.41	6.85
LIBYA	5.81	0.99	1.01	1.33	1.50	1.09	1.17	1.34	1.58	1.65
OMAN	-	-	-	-	-	-	-	-	-	-
QATAR	9.28	0.57	0.71	0.67	0.62	0.73	0.75	0.78	0.83	0.82
SAUDI ARABIA	19.14	2.11	2.27	2.36	3.09	2.88	3.29	3.29	3.41	3.63
UAE	-	-	-	-	-	-	-	-	-	-
<b>Asia/Oceania</b>										
AUSTRALIA	-	-	-	0.32	0.56	1.37	1.02	1.95	0.69	-
CHINA	-	-	-	0.11	0.05	0.11	0.22	0.31	0.43	0.41
INDIA	18.78	5.26	5.26	5.22	5.44	5.59	6.59	7.67	9.37	12.04
INDONESIA	19.58	1.60	1.64	1.74	1.82	1.48	1.50	1.23	1.47	1.27
MALAYSIA	8.93	1.72	0.91	0.96	1.26	1.12	1.08	1.60	1.68	1.38
MYANMAR	0.28	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	-
PAKISTAN	-	-	-	-	-	-	-	-	-	-
<b>North America</b>										
CANADA	16.06	1.39	1.24	0.92	1.13	-	0.18	0.50	1.09	0.59
US	10.17	0.51	1.60	1.67	1.56	0.12	0.47	0.21	0.18	0.22
<b>CIS/Eastern Europe</b>										
RUSSIA	17.52	1.73	1.55	1.88	1.92	2.51	2.91	2.91	3.14	3.34
<b>Sub-Saharan Africa</b>										
NIGERIA	1.53	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	11.18	1.09	1.05	1.16	1.53	1.56	1.55	1.54	1.63	1.78
<b>Western Europe</b>										
GERMANY	7.21	0.47	0.45	0.40	0.46	0.21	0.54	0.59	0.61	0.44
<b>Other Nations</b>										
	0.47	-	-	-	-	-	-	0.47	-	-
<b>WORLD TOTAL</b>	<b>306.20</b>	<b>36.19</b>	<b>36.90</b>	<b>38.59</b>	<b>43.78</b>	<b>40.32</b>	<b>45.08</b>	<b>49.45</b>	<b>54.60</b>	<b>56.87</b>

## 2016 World DRI Production by Process (Mt)

NAME	'70-'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
MIDREX®	181.89	23.08	24.82	26.12	30.12	26.99	30.11	32.06	35.01	34.96
HYL/Energiron	94.64	9.55	8.52	8.81	9.39	8.04	8.88	9.72	11.34	11.00
Fluidized Bed Processes	6.27	0.48	0.40	0.66	0.96	1.93	1.63	2.57	1.62	1.52
Rotary Kiln, Coal-based	22.41	3.01	2.94	2.94	3.14	3.18	4.43	5.04	6.41	9.17
Other Processes*	0.99	0.1	0.09	0.07	0.15	0.14	0.04	0.04	0.04	0.18
<b>WORLD TOTAL</b>	<b>306.20</b>	<b>36.19</b>	<b>36.90</b>	<b>38.59</b>	<b>43.78</b>	<b>40.32</b>	<b>45.08</b>	<b>49.45</b>	<b>54.60</b>	<b>56.87</b>

\* Other Processes: A variety of processes using retorts, shaft furnaces and hearths that have had limited commercial success.





## 2016 World DRI Production by Region (Mt)

Source: Midrex Technologies, Inc.

NAME	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16
<b>Latin America</b>											
ARGENTINA	1.95	1.81	1.86	0.81	1.57	1.68	1.61	1.54	1.67	1.26	0.78
BRAZIL	0.38	0.36	0.30	0.01	-	-	-	-	-	-	-
MEXICO	6.17	6.26	6.01	4.15	5.37	5.85	5.59	6.13	5.98	5.50	5.31
PERU	0.14	0.09	0.07	0.10	0.10	0.09	0.10	0.10	0.09	0.07	0.01
TRINIDAD & TOBAGO	2.08	3.47	2.78	1.99	3.08	3.03	3.25	3.29	3.24	2.52	1.50
VENEZUELA	8.61	7.71	6.87	5.61	3.79	4.47	4.61	2.77	1.68	2.75	1.59
<b>Middle East/N. Africa</b>											
BAHRAIN	-	-	-	-	-	-	-	0.78	1.44	1.23	1.26
EGYPT	3.10	2.79	2.64	2.91	2.86	2.97	2.84	3.43	2.88	2.73	2.82
IRAN	6.85	7.44	7.46	8.20	9.35	10.37	11.58	14.46	14.55	14.55	16.01
LIBYA	1.63	1.64	1.57	1.11	1.27	0.30	0.51	0.95	1.00	0.45	0.69
OMAN	-	-	-	-	-	1.11	1.46	1.47	1.45	1.48	1.46
QATAR	0.88	1.30	1.68	2.10	2.16	2.23	2.42	2.39	2.64	2.71	2.58
SAUDI ARABIA	3.58	4.34	4.97	5.03	5.51	5.81	5.66	6.07	6.46	5.80	5.89
UAE	-	-	-	-	1.18	2.25	2.72	3.07	2.41	3.19	3.48
<b>Asia/Oceania</b>											
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-
CHINA	0.41	0.60	0.18	0.08	-	-	-	-	-	-	-
INDIA	14.74	19.06	21.20	22.03	23.42	21.97	20.05	17.77	17.31	17.68	18.47
INDONESIA	1.20	1.32	1.21	1.12	1.27	1.23	0.52	0.76	0.16r	0.05r	0.05
MALAYSIA	1.54	1.84	1.94	2.30	2.39	2.16	2.01	1.40	1.33	0.96r	0.66
MYANMAR	-	-	-	-	-	-	-	-	-	-	-
PAKISTAN	-	-	-	-	-	-	-	0.06	-	-	-
<b>North America</b>											
CANADA	0.45	0.91	0.69	0.34	0.60	0.70	0.84	1.25	1.55	1.50	1.40
US	0.24	0.25	0.26	-	-	-	-	-	1.30	1.10	1.81
<b>CIS/Eastern Europe</b>											
RUSSIA	3.28	3.41	4.56	4.67	4.79	5.20	5.24	5.33	5.35	5.44	5.70
<b>Sub-Saharan Africa</b>											
NIGERIA	-	0.15	0.20	-	-	-	-	-	-	-	-
SOUTH AFRICA	1.75	1.74	1.18	1.39	1.12	1.41	1.57	1.41	1.55	1.12	0.70
<b>Western Europe</b>											
GERMANY	0.58	0.59	0.52	0.38	0.45	0.38	.56	0.50	0.57	0.55	0.60
<b>Other Nations</b>											
	-	-	-	-	-	-	-	-	-	-	-
<b>WORLD TOTAL</b>	<b>59.70</b>	<b>67.12</b>	<b>67.95</b>	<b>64.33</b>	<b>70.28</b>	<b>73.21</b>	<b>73.14</b>	<b>74.92</b>	<b>74.59r</b>	<b>72.64r</b>	<b>72.76</b>

## 2016 World DRI Production by Process (Mt)

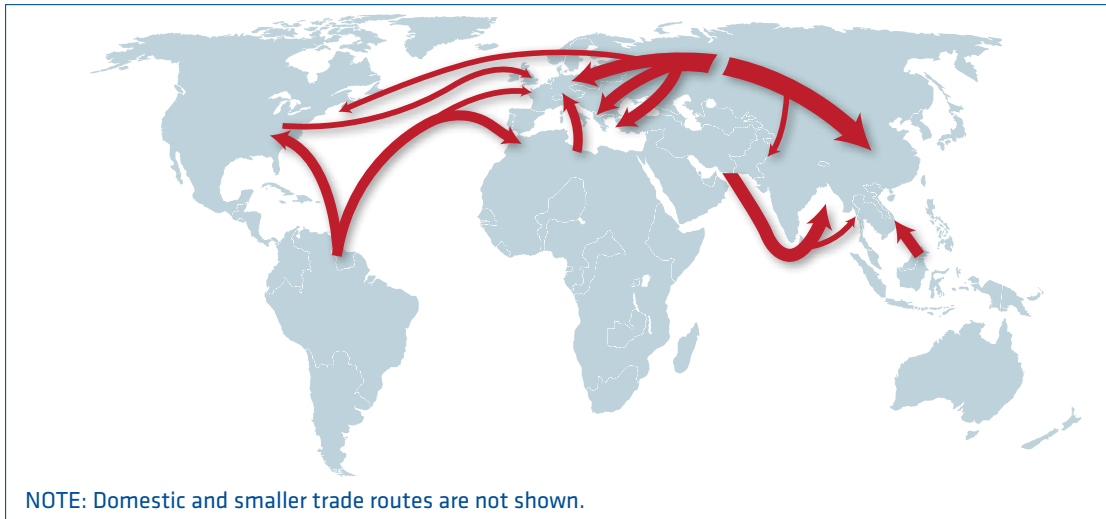
NAME	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16
MIDREX®	35.71	39.72	39.85	38.62	42.01	44.38	44.76	47.56	47.12	45.77r	47.14
HYL/Energiron	10.91	11.20	9.84	7.88	9.81	11.03	10.79	11.29	12.08r	11.62	12.66
Fluidized Bed Processes	1.31	1.05	1.08	0.50	0.34	0.48	0.53	0.14	-	0.51	0.24
Rotary Kiln, Coal-based	11.53	14.90	16.92	17.33	18.12	17.32	17.06	15.93	15.39	14.74r	12.72
Other Processes*	0.22	0.24	0.25	0.26	-	-	-	-	-	-	-
<b>WORLD TOTAL</b>	<b>59.70</b>	<b>67.12</b>	<b>67.95</b>	<b>64.33</b>	<b>70.28</b>	<b>73.21</b>	<b>73.14</b>	<b>74.92</b>	<b>74.59r</b>	<b>72.64r</b>	<b>72.76</b>

\* Other Processes: A variety of processes using retorts, shaft furnaces and hearths that have had limited commercial success.  
r - revised





## Major Trade Routes For International Trade of DRI (HBI and CDRI)



The map shows the major routes of international transport of DRI in 2016. The width of the lines indicates the amount of DRI that traveled over the individual routes.

Data for the map was taken from three sources: the International Steel Statistics Bureau (ISSB), The 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 (Canada, the United States and Mexico). The regions for the purpose of these statistics are: North America, Caribbean, South America, NW Europe (UK, Scandinavia, Benelux, France, and Germany), Mediterranean Europe (mostly Spain and Italy) and Turkey, Eastern Europe, North Africa, the CIS nations, Arabian Gulf plus Oman, South Asia, SE Asia, East Asia and Oceania (Indonesia and Malaysia).

Although total flow of international trade in DRI/HBI was only slightly greater in 2016 than in 2015, the suppliers and receivers altered somewhat.

### SUPPLIERS

Russia continued to be the dominant source of supply sending well over 2 million tons of HBI to buyers worldwide. But, the next largest shipper, Trinidad, dropped significantly due to the late-2015 closure of a site there. Large growth in export was seen coming from Malaysia where one HBI plant returned to being a noteworthy international source as it added over 300 thousand tons to its annual dispatches. Venezuela, too, grew its exports by nearly 100 thousand tons. Even so, its total shipments were far lower than its historic highs. With the startup of the new HBI plant in Texas, the United States became a source of supply. Shipment from the plant was split between domestic and international customers.

### DESTINATIONS

The United States and Italy continued to be the largest customers for DRI. Combined, they imported almost half of the total international trade. The list of countries bringing in over 100 thousand tons lengthened. In 2016 it included Germany, Mexico, Portugal, Saudi Arabia, South Korea, Spain and Turkey. Trade among Middle Eastern nations grew rapidly and is approaching one million tons annually. Mexico's imports increased to over one half million tons, despite the large tonnage of DRI produced within the country.

### OUTLOOK

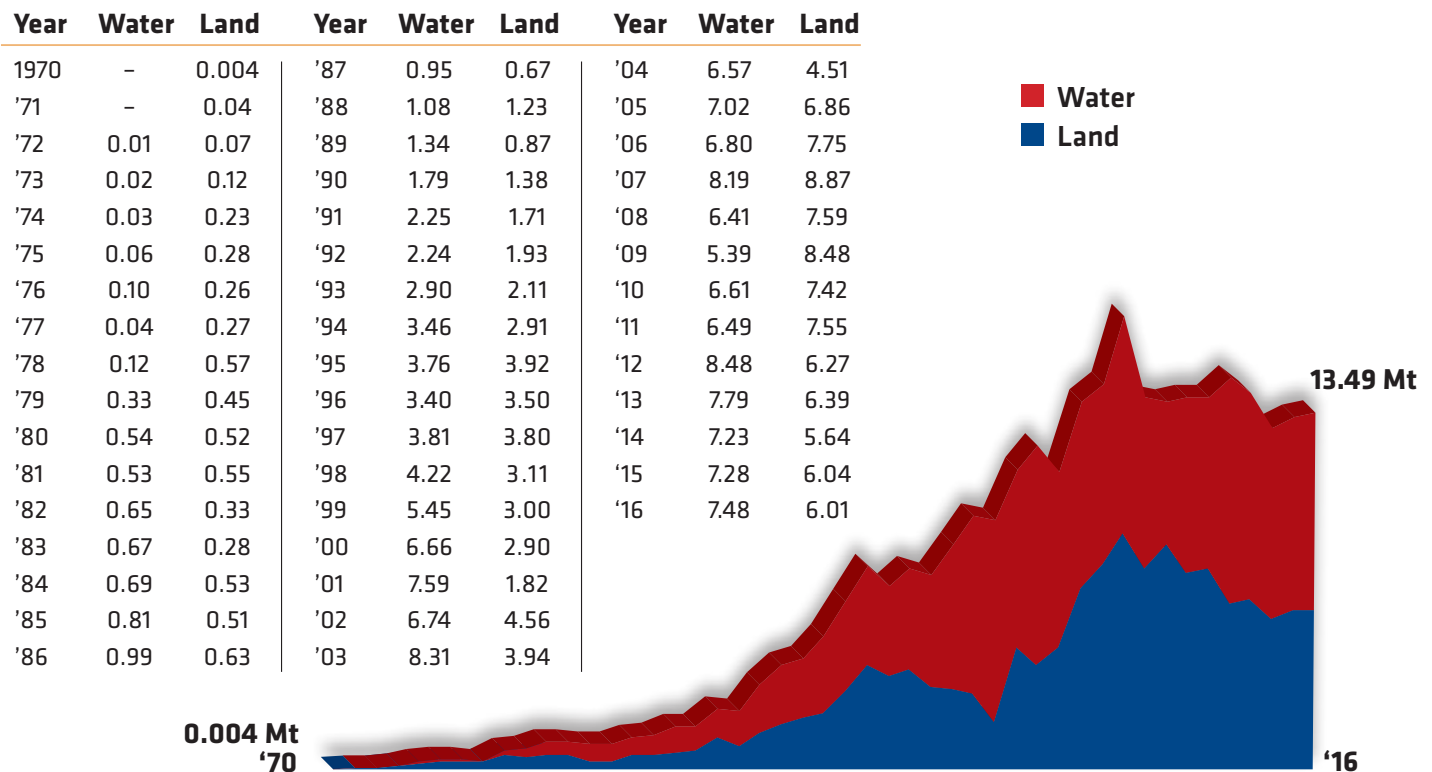
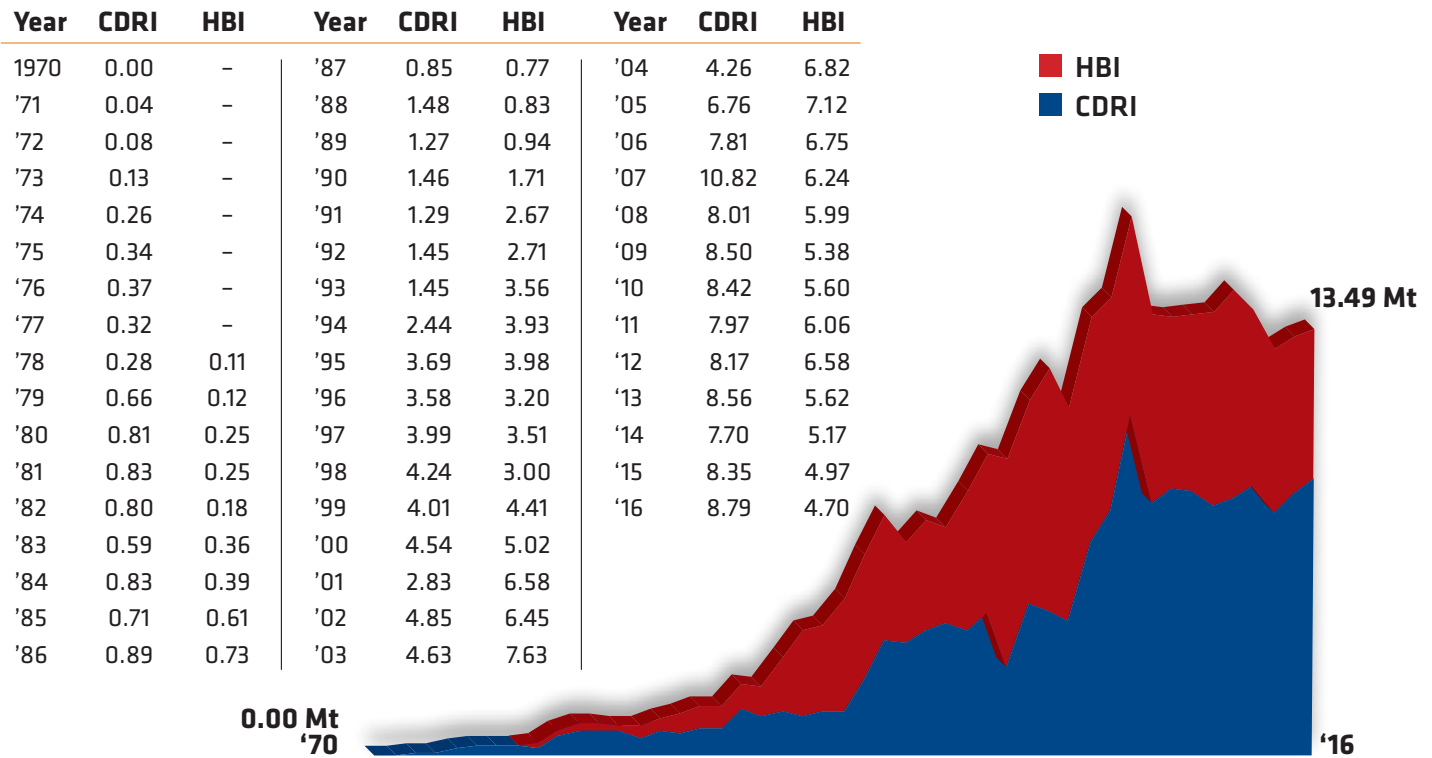
With the recent startup of two new HBI plants, one in the United States in late-2016 and the other in Russia in early 2017, trade is very likely to grow swiftly in 2017.





## World DRI Shipments (Mt)

Source: Midrex Technologies, Inc.



**Note regarding land shipments:** It is estimated that about 30% 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

Status as of 5/31/17 Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
<b>SHAFT FURNACE TECHNOLOGY</b>						
<b>MIDREX® PROCESS</b>						
ArcelorMittal Hamburg	Hamburg, Germany	0.40	1	CDRI	'71	0
ArcelorMittal Montreal 1	Contrecoeur, Quebec, Canada	0.40	1	CDRI	'73	0
TenarisSiderca	Campana, Argentina	0.40	1	CDRI	'76	0
ArcelorMittal Montreal 2	Contrecoeur, Quebec, Canada	0.60	1	CDRI	'77	0
SIDOR I	Matanzas, Venezuela	0.35	1	CDRI	'77	0
Acindar	Villa Constitucion, Argentina	0.60	1	CDRI	'78	0
Qatar Steel I	Mesaieed, Qatar	0.40	1	CDRI	'78	0
SIDOR II	Matanzas, Venezuela	1.29	3	CDRI	'79	0 0 I
ArcelorMittal Point Lisas I & II	Point Lisas, Trinidad & Tobago	0.84	2	CDRI	'80/'82	I
Global Steel Holdings	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
Khouzestan Steel Co. I - IV	Ahwaz, Iran	1.84	4	CDRI	'89/'90/'92/'01	0
EZDK I	El Dikheila, Egypt	0.72	1	CDRI	'86	0
LISCO 1 & 2	Misurata, Libya	1.10	2	CDRI	'89/'90	0
Essar Steel I & II	Hazira, India	0.88	2	HBI/HDRI	'90	I 0
FMO	Puerto Ordaz, Venezuela	1.00	1	HBI	'90	0
Briqcar	Matanzas, Venezuela	0.82	1	HBI	'90	0
Essar Steel 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	3.20	5	CDRI	'92/'93/'94	0
JSW Dolvi Works	Raigad, 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	0
EZDK III	El Dikheila, Egypt	0.80	1	CDRI	'00	0
Essar Steel IV	Hazira, India	1.00	1	HBI/HDRI	'04	0
Nu-Iron	Point Lisas, Trinidad & Tobago	1.60	1	CDRI	'06	0
Essar Steel V	Hazira, India	1.50	1	HBI/HDRI	'06	0
Mobarakeh Steel F	Mobarakeh, Iran	0.80	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 II	Mesaieed, Qatar	1.50	1	CDRI/HBI	'07	0
Khouzestan Steel V	Ahwaz, Iran	0.80	1	CDRI	'08	0
Lion DRI	Banting, Malaysia	1.54	1	HDRI/HBI	'08	I
HOSCO I & II	Bandar Abbas, Iran	1.65	2	CDRI	'09/'10	0
Essar Steel VI	Hazira, India	1.50	1	CDRI	'10	0
Khorasan Steel I	Khorasan (Mashad), Iran	0.80	1	CDRI	'10	0
Jindal Shadeed	Sohar, Oman	1.50	1	HDRI/HBI	'11	0

(Continued next page)

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 over 200 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list. The total capacity of all rotary kilns in India is estimated to be 19.5 Mt/y.

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

Status as of 5/31/17 Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
<b>SHAFT FURNACE TECHNOLOGY</b>						
<b>MIDREX® PROCESS (Continued)</b>						
IGISCO	Ardakan (Yazd), Iran	0.80	1	CDRI	'12	O
Khorasan Steel II	Khorasan, Iran	0.80	1	CDRI	'12	O
South Kaveh Steel	Bandar Abbas, Iran	1.86	2	CDRI	'12/'13	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	Ardakan (Yazd), Iran	0.80	1	CDRI	'13	O
Mobarakeh Steel (Saba)	Esfahan, Iran	1.50	1	CDRI	'14	O
JSW Projects Ltd.	Toranagallu, Karnataka, India	1.20	1	HDRI/CDRI	'14	O
Mobarakeh Steel (Kharazi A & B)	Esfahan, Iran	3.0	2	CDRI	'14	O
Sirjan Iranian Co.	Kerman, Iran	0.8	1	CDRI	'14	O
ESISCO	Sadat City, Egypt	1.76	1	HDRI/CDRI	'15	I
Jindal Steel & Power	Angul, India	1.80	1	HDRI/CDRI	'15	O
Sirjan Jahan Steel	Kerman, Iran	0.96	1	CDRI	'15	O
Gol-e-Gohar	Kerman, Iran	1.70	1	CDRI	'15	O
voestalpine Texas	Corpus Christi, Texas, USA	2.00	1	HBI	'16	O
Sepiddasht	Char Mahal and Bakhtiari, Iran	0.80	1	CDRI	'16	O
LGOK HBI-3	Gubkin, Russia	1.80	1	HBI	'17	O
Persian Gulf Saba	Bandar Abbas, Iran	1.50	1	HBI	'17	C
Tosyali Algeria	Oran, Algeria	2.50	1	HDRI/CDRI	'17	C
Qaenat	South Khorasan, Iran	0.80	1	CDRI	'18	C
Sabzevar	Khorasan Razavi, Iran	0.80	1	CDRI	'18	C
Chador Malu	Ardakan (Yazd), Iran	1.55	1	HDRI	'18	C
Ardakan Steel	Ardakan (Yazd), Iran	0.80	1	CDRI	'18	C
Algerian Qatari Steel	Bellara, Algeria	2.50	1	HDRI/CDRI	'18	C
Gol-e-Gohar II	Kerman, Iran	1.80	1	CDRI	'18	C
Sirjan Iranian Co. 2	Kerman, Iran	0.90	1	CDRI	'18	C
Makran	Chabahar, Sistan-Baluchestan, Iran	1.60	1	HBI	'19	C
		85.14	92			
<b>HYL/ENERGIRON PROCESS</b>						
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
Khouzestan Steel (ASCO)	Ahwaz, Iran	1.03	3	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
Ternium 4M	Monterrey, Mexico	0.68	1	HDRI	'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	'09	O
Gulf Sponge Iron	Abu Dhabi, UAE	0.20	1	CDRI	'10	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 over 200 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list. The total capacity of all rotary kilns in India is estimated to be 19.5 Mt/y.

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

Status as of 5/31/17 Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
<b>SHAFT FURNACE TECHNOLOGY</b>						
<b>HYL/ENERGIRON PROCESS (Continued)</b>						
Emirates Steel II (GHC)	Abu Dhabi, UAE	2.00	1	HDRI	'11	O
Suez Steel	Adabia, Egypt	2.00	1	HDRI/CDRI	'13	O
Nucor Steel Louisiana	Convent, Louisiana, USA	2.50	1	CDRI	'13	O
Ezz Rolling Mills	Ain Sukhna, Egypt	2.00	1	CDRI	'15	O
Sidor	Matanzas, Venezuela	0.80	1	CDRI	'17	C
		<u>23.58</u>	<u>27</u>			
<b>FLUIDIZED BED TECHNOLOGY</b>						
BriqOri	Matanzas, Venezuela	2.20	4	HBI	'00	O
<b>CIRCORED PROCESS</b>						
Arcelor Mittal Trinidad	Point Lisas, Trinidad & Tobago	0.50	1	HBI	'99	I
<b>FIOR PROCESS</b>						
Operaciones RDI	Matanzas, Venezuela	0.40	1	HBI	'76	I
<b>ROTARY KILN TECHNOLOGY</b>						
<b>SL/RN PROCESS</b>						
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
<b>JINDAL PROCESS</b>						
Jindal Steel & Power	Raigarh, India	0.90	6	CDRI	'93/'94/'95/'96/'00	O
Monnet Ispat	Raipur, India	0.30	2	CDRI	'93/'98	O
Rexon Strips Ltd.	Via Lathikata, India	0.06	2	CDRI	'93/'00	O
<b>DRC PROCESS</b>						
Scaw Metals I	Germiston, South Africa	0.18	2	CDRI	'83/'89	O
Scaw Metals II	Germiston, South Africa	0.15	1	CDRI	'97	O
Tianjin Iron & Steel	Tianjin, China	0.30	2	CDRI	'97	I
<b>CODIR PROCESS</b>						
Dunswart	Benoni, South Africa	0.15	1	CDRI	'73	O
Sunflag	Bhandara, India	0.15	1	CDRI	'89	O

(Continued next page)

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 over 200 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list. The total capacity of all rotary kilns in India is estimated to be 19.5 Mt/y.

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

Status as of 5/31/17 Source: Midrex Technologies, Inc.

Plant	Location	Capacity (Mt/y)	Modules	Product	Start-up	Status*
<b>ROTARY KILN TECHNOLOGY</b>						
<b>SHENWU RHF PROCESS</b>						
Tianjin Rockcheck	Tianjin, China	0.50	1	CDRI	'14	I
<b>TISCO PROCESS</b>						
Tata Sponge Iron, Ltd.	Keonjhar, Orissa, India	0.40	2	CDRI	'86/'98	O
Vallabh Steels	Ludhiana, Punjab, India	0.12	1	CDRI		O
<b>SIIL PROCESS</b>						
Bellary Steel & Alloys	Bellary, Karnataka, India	0.06	2	CDRI	'92/'93	O
HEG	Borai, India	0.09	2	CDRI	'92	O
Kumar Met.	Nalgonda, India	0.06	2	CDRI	'93	O
Aceros Arequipa	Pisco, Peru	0.08	2	CDRI	'96	O
Rungta Mines	Barbil, India					
<b>OSIL PROCESS</b>						
OSIL	Keonjhar, Orissa, India	0.10	1	CDRI	'83	O
Lloyd's Metals & Eng.	Ghugus, India	0.27		CDRI	'95	O
<b>DAV PROCESS</b>						
Davsteel	Cullinan, South Africa	0.04	1	CDRI	'85	O
<b>BGRIMM PROCESS</b>						
ArcelorMittal South Africa	Vanderbijlpark, South Africa	0.30	2	CDRI	'09	O
<b>OTHER</b>						
Mahalaxmi TMT Bars	Wardha, Maharashtra India	0.24	1	CDRI	'11	O
BMM Ispat Ltd	Danapura, Hospet, Karnataka, India	0.73		CDRI		O
Sarda Energy and Minerals, Ltd.	Siltara, Raipur, India	0.36		CDRI		O
Godawari Power and Ispat	Siltara, Raipur, India	0.5		CDRI		O
Nalwa Steel and Power Ltd.	Raigarh, Chhattisgarh, India	0.18		CDRI		O
Janki Corp., Ltd.	Sidiginamola, Bellary, Karnataka	0.18		CDRI		O
Andhunik Metaliks, Ltd.	Chadrihariharpur, Orissa, India	0.3		CDRI		O
Shyam SEL Ltd.	West Bengal and Odisha, India	0.8		CDRI		O
Shri Bajrang Power and Ispat	Raipur, India	0.36		CDRI		O
Gallantt Metal, Ltd.	Kutch, Gujarat, India	0.2		CDRI		O
SKS Ispat, Ltd.	Raipur, Chhattisgarh, India	0.27		CDRI		O
Bhushan Power and Steel Ltd.	Sambalpur, Odisha, India	1.5		CDRI	11-'12	O
Bhushan Steel Ltd.	Angul, Odisha, India	1.5		CDRI		O
Electrotherm (India) Ltd.	Kutch, Gujarat, India	0.15		CDRI		O
Jayaswal Neco Industries Ltd.	Raipur, Chhattisgarh	0.25		CDRI		O
SMC Power Generation Ltd.	Jharsuguda, Odisha, India	0.2		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 over 200 small rotary kilns in India with annual capacities of 10,000-30,000 tons per year that are not included on this list. The total capacity of all rotary kilns in India is estimated to be 19.5 Mt/y.

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





2016 WORLD DIRECT REDUCTION STATISTICS is compiled by Midrex Technologies, Inc., Charlotte, North Carolina, USA. The publication is posted annually on the Midrex web site.

Midrex Technologies, Inc. compiles world DRI production data on an annual basis as a service to 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 an international process engineering and technology company that provides global process technology solutions to various industries and is principally known for the MIDREX® Direct Reduction Process that converts iron ore into a high-purity DRI or HBI for use in steelmaking, ironmaking, and foundry applications. Midrex continues to develop new technologies relating to its traditional iron and steel roots.

The following organizations supplied or assisted in collecting data for this issue of 2016 WORLD DIRECT REDUCTION STATISTICS:

*Sponge Iron Manufacturers Association – India*  
*World Steel Association – Belgium*  
*International Iron Metallurgy 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*

*MIDREX® is a registered trademark of Kobe Steel Ltd.*  
*MXCOL® is a registered trademark of Kobe Steel Ltd.*

For updates check [www.midrex.com](http://www.midrex.com)  
 For more information or general comments,  
 please e-mail: [info@midrex.com](mailto:info@midrex.com)

***World Steel Dynamics (WSD) has audited Midrex's collection and preparation process of the "2016 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 2016.***

Audited by



Englewood Cliffs,  
 New Jersey, U.S.A.  
 June, 2017

© 2017 Midrex Technologies, Inc.

**MIDREX**  
 Designed for Today,  
 Engineered for Tomorrow™

