



The Global Ore-based Metallics Market

6TH MENA BILLET & STEELMAKING RAW MATERIALS CONFERENCE-
SEPTEMBER 27TH 2018

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What is IIMA?



INTERNATIONAL PIG IRON ASSOCIATION

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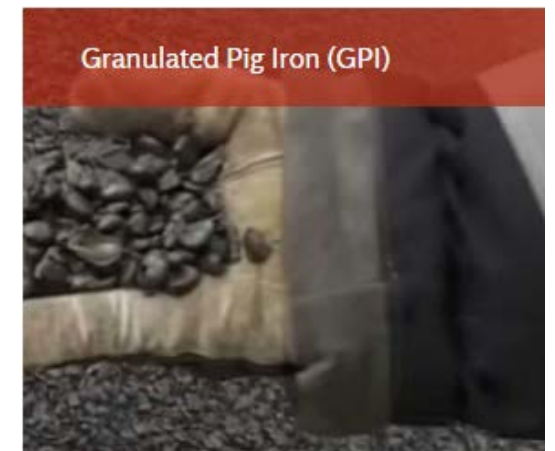
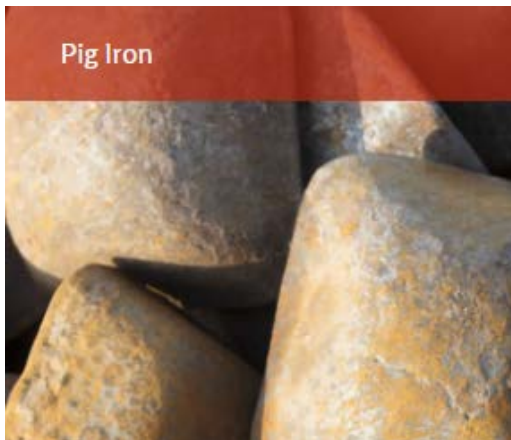


HOT BRIQUETTED IRON ASSOCIATION

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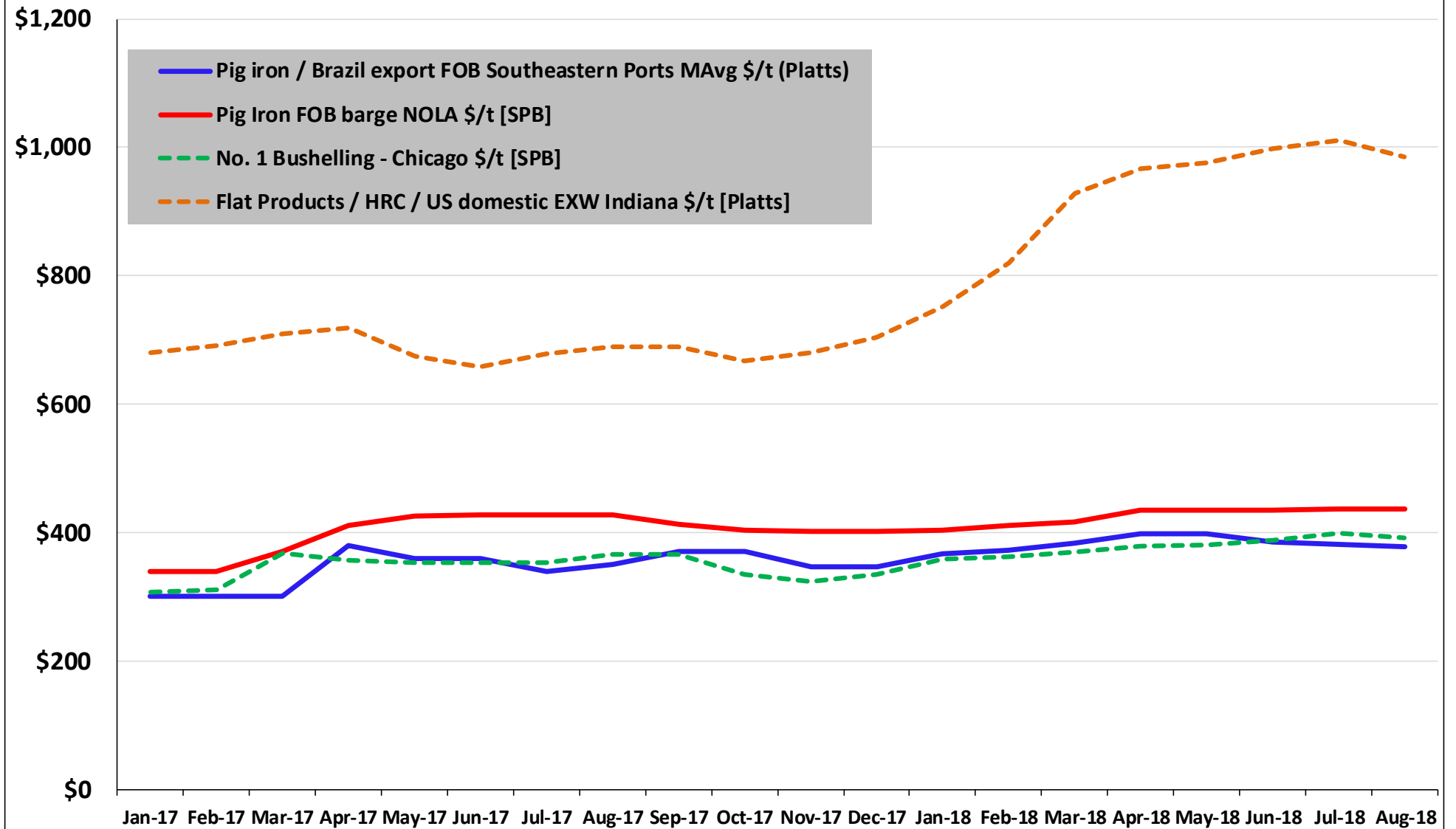
Created in 2011 as the unified voice of the ore-based metallurgy industry



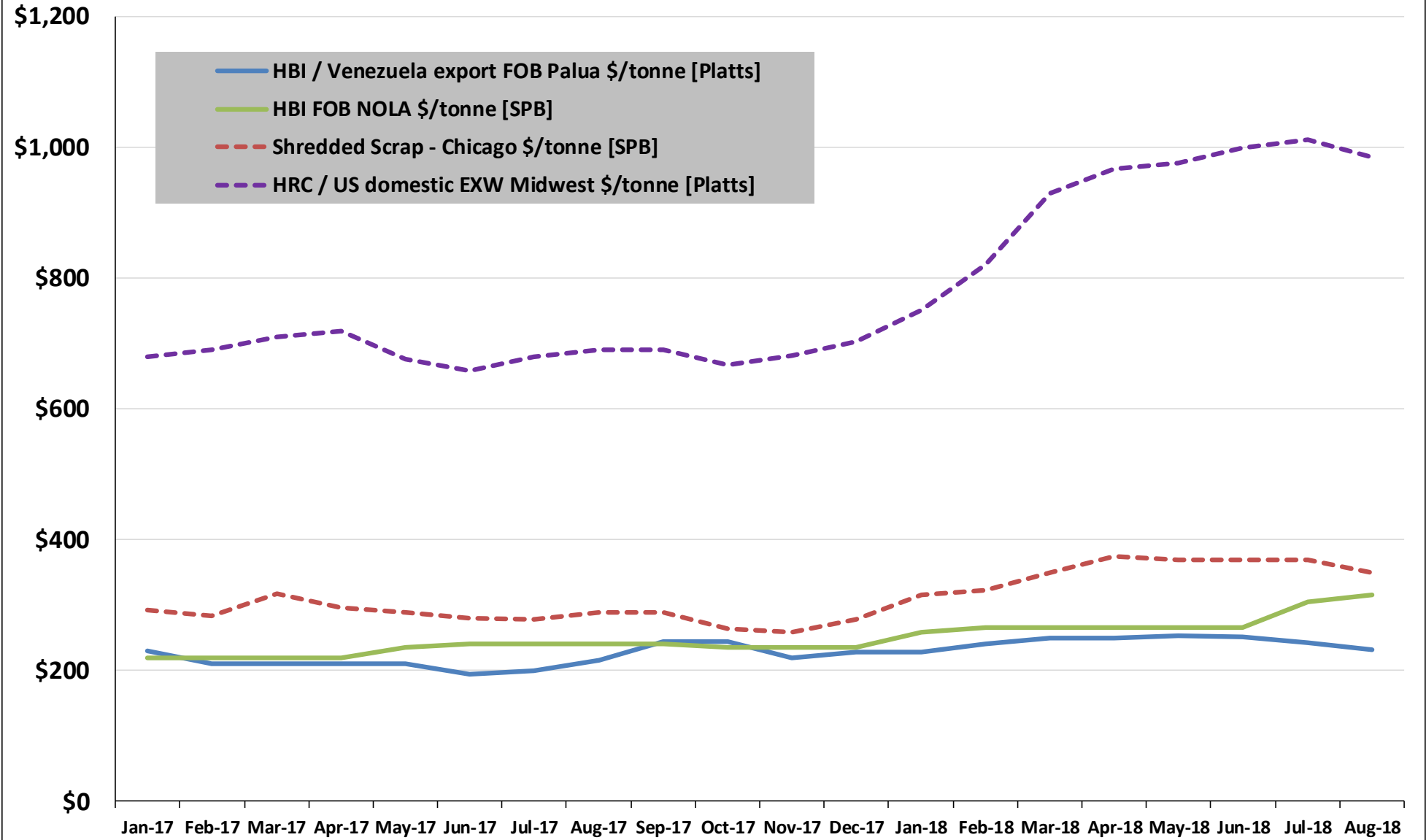
- **Overview of Ore-Based Metallics Market [OBMs]**
 - Price development snapshot
 - Cross border trade
 - Supply-side issues and new supply to the market

- **Iron ore market**
 - DR grade iron ore pellet supply
 - Pellet feed supply

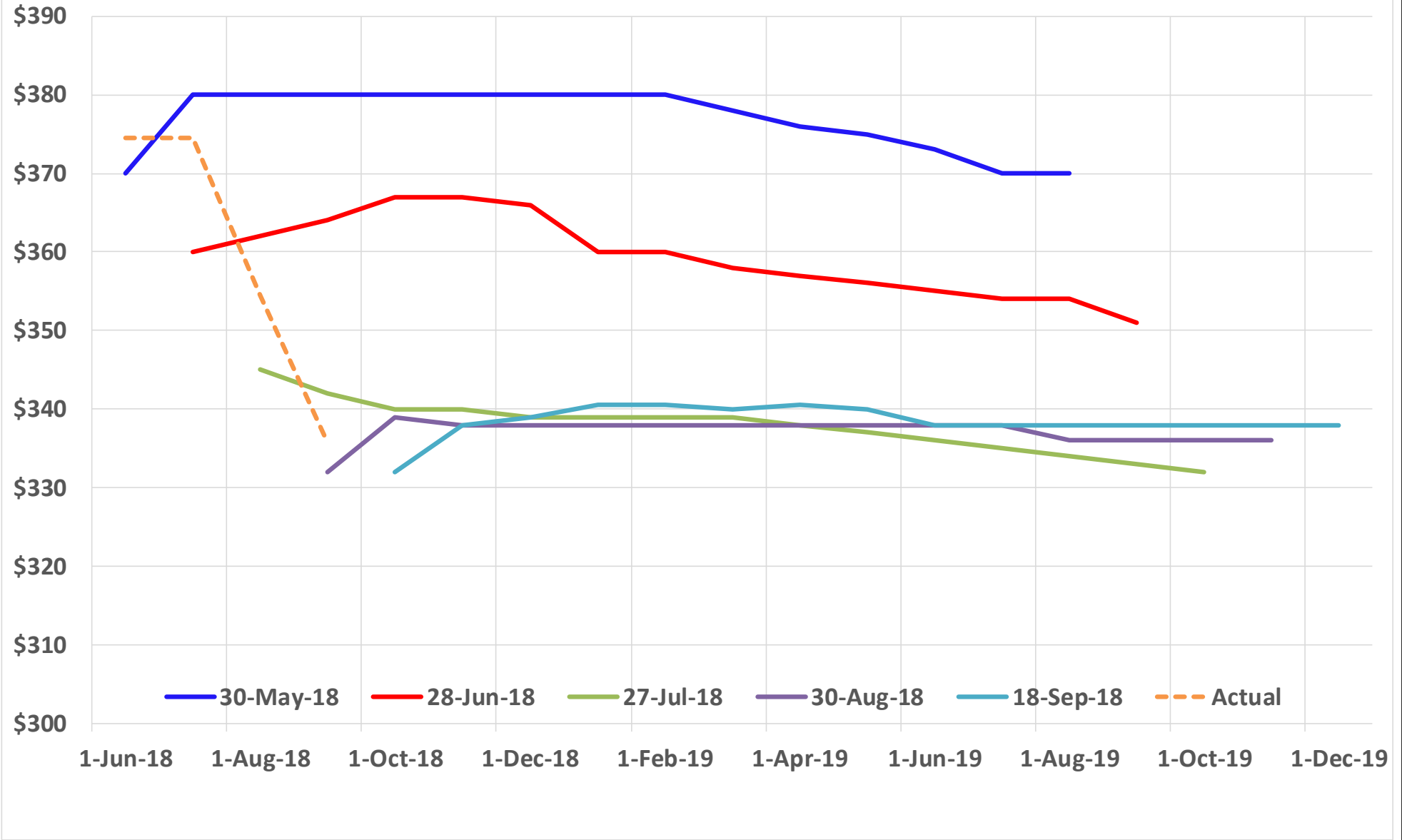
Brazilian merchant pig iron price development



Venezuelan HBI price development



NFX-AMM US Midwest Shredded Scrap Steel Futures Prices



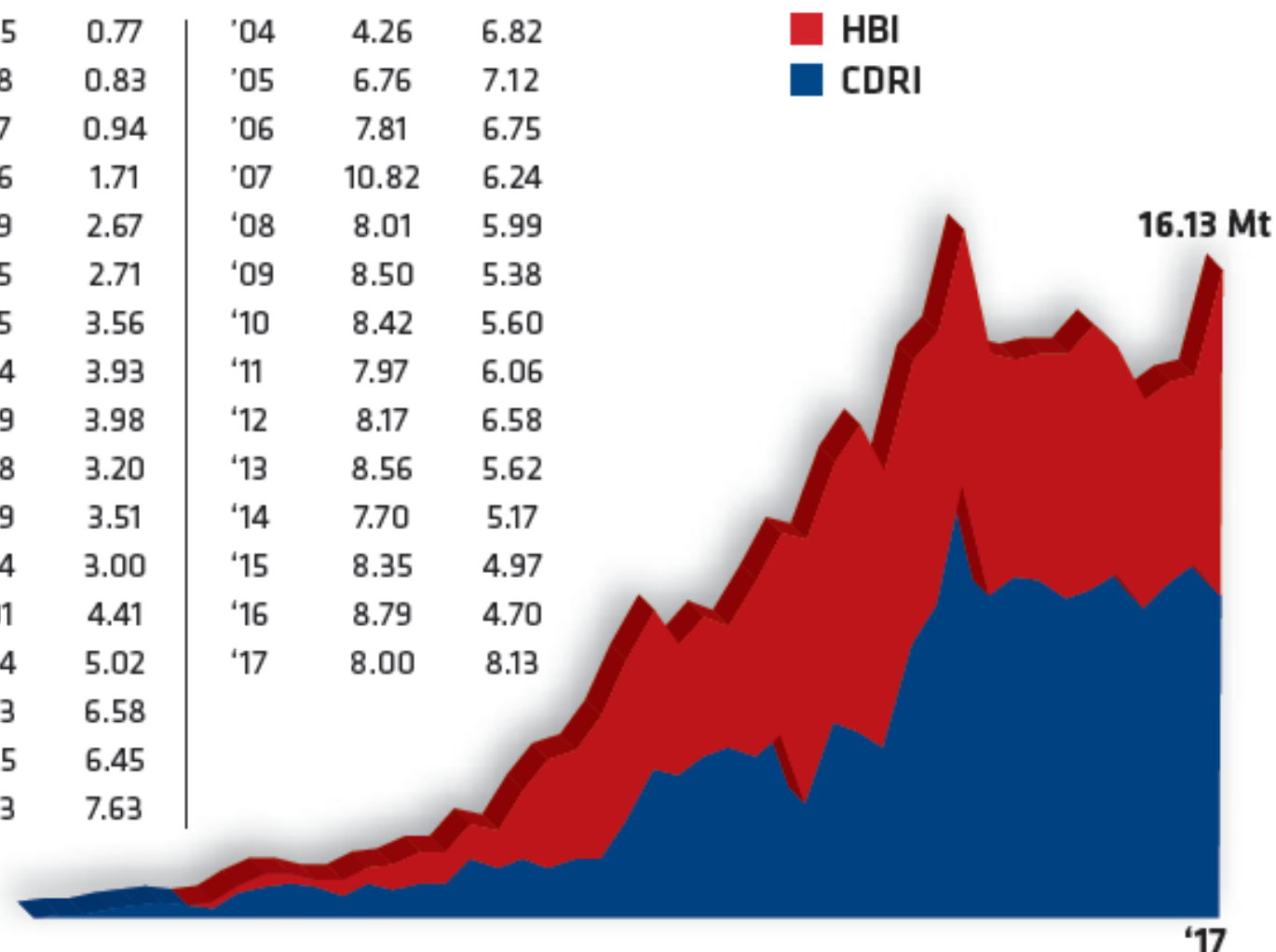
Data sources:
World Steel Dynamics
Scrap Price Bulletin

World DRI Shipments (Mt)

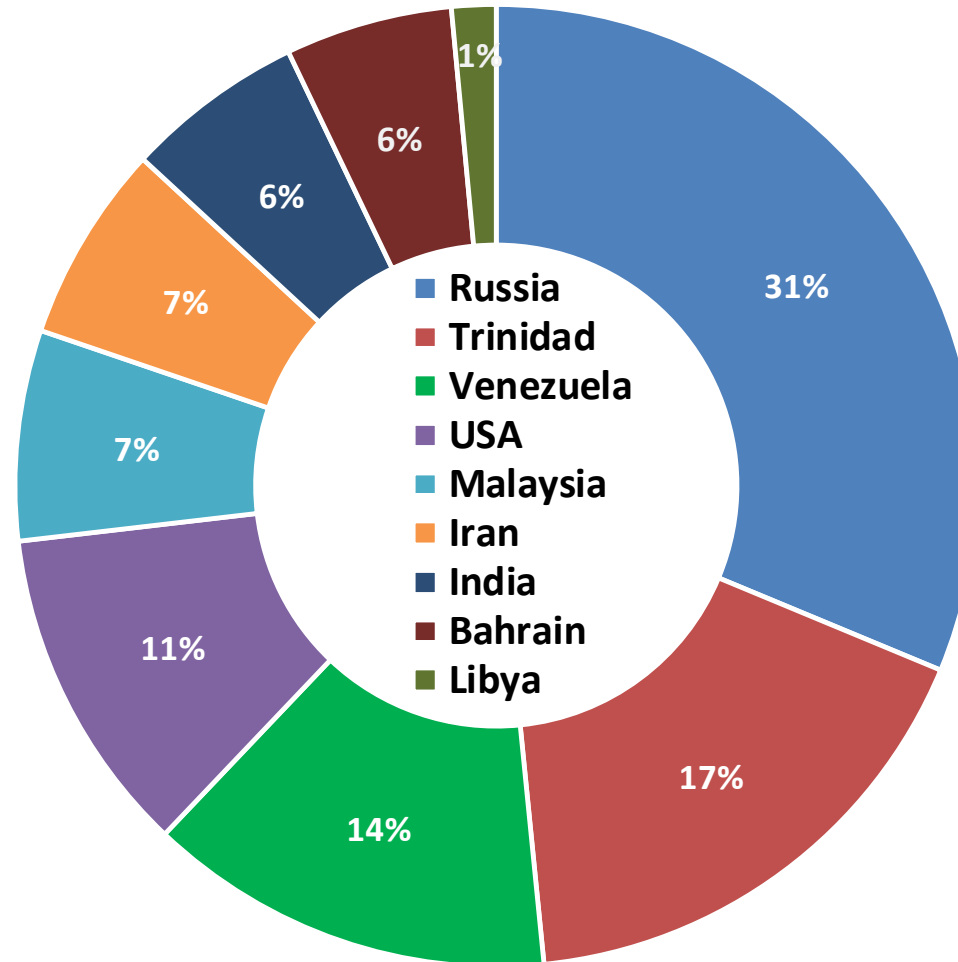
Source: Midrex Technologies, Inc.

Year	CDRI	HBI	Year	CDRI	HBI	Year	CDRI	HBI
1970	0.00	-	'87	0.85	0.77	'04	4.26	6.82
'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			
'85	0.71	0.61	'02	4.85	6.45			
'86	0.89	0.73	'03	4.63	7.63			

0.00 Mt
'70

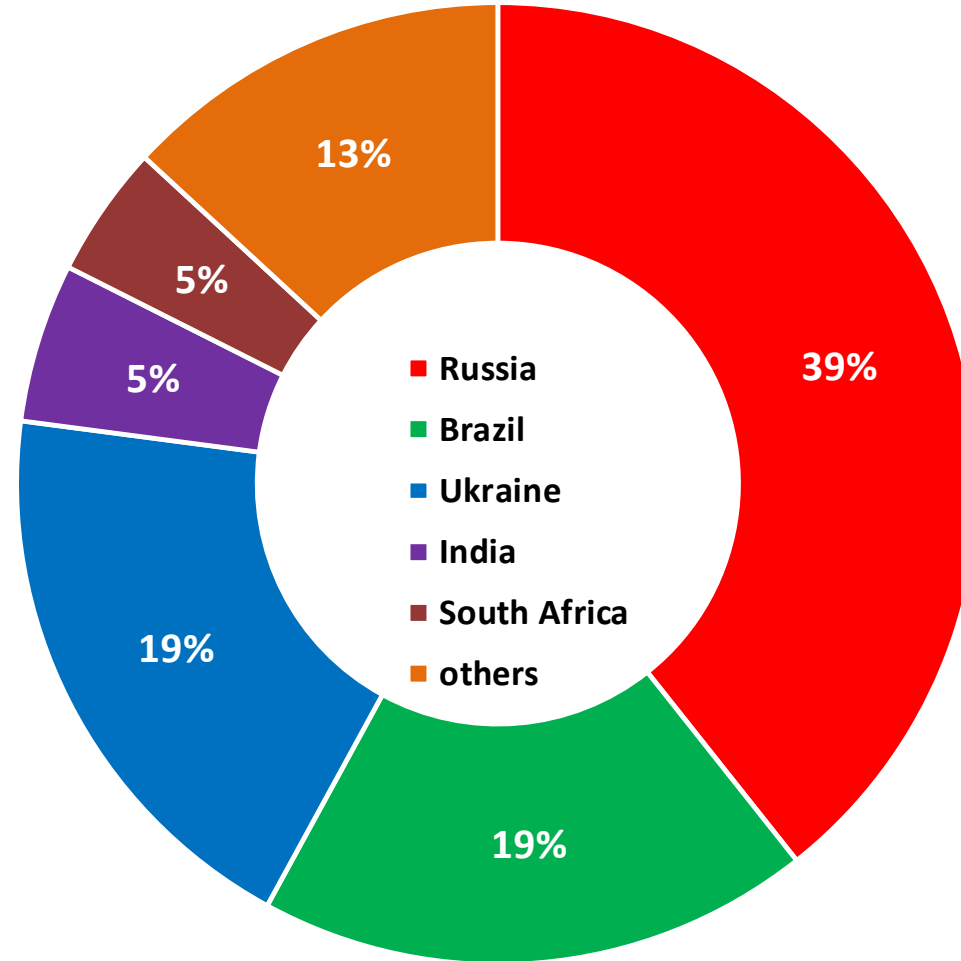


DRI/HBI exports 2017 - mt



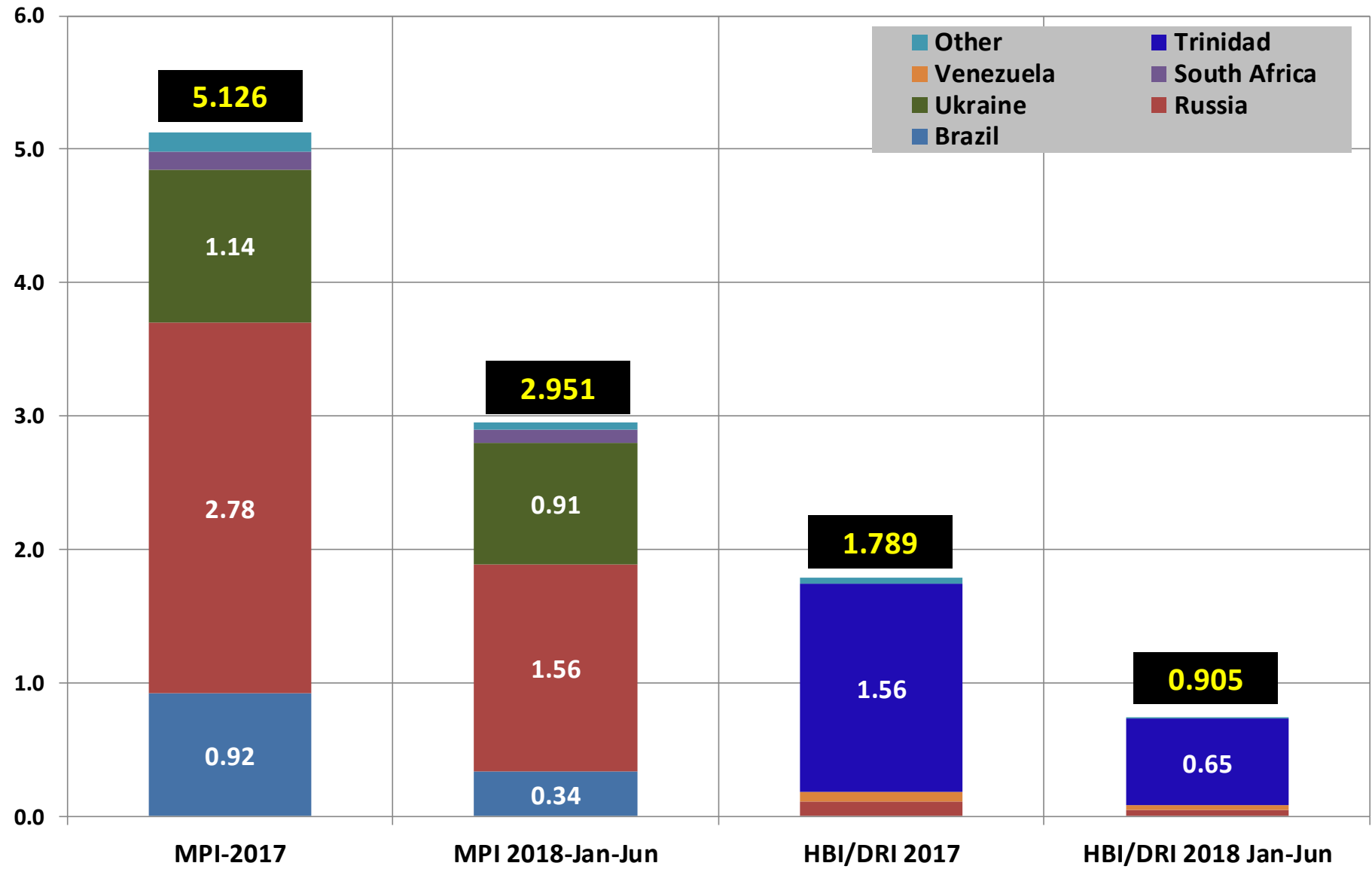
Total 9.113 mt (by deduction)

Merchant pig iron exports 2017 - total 12.2 mt

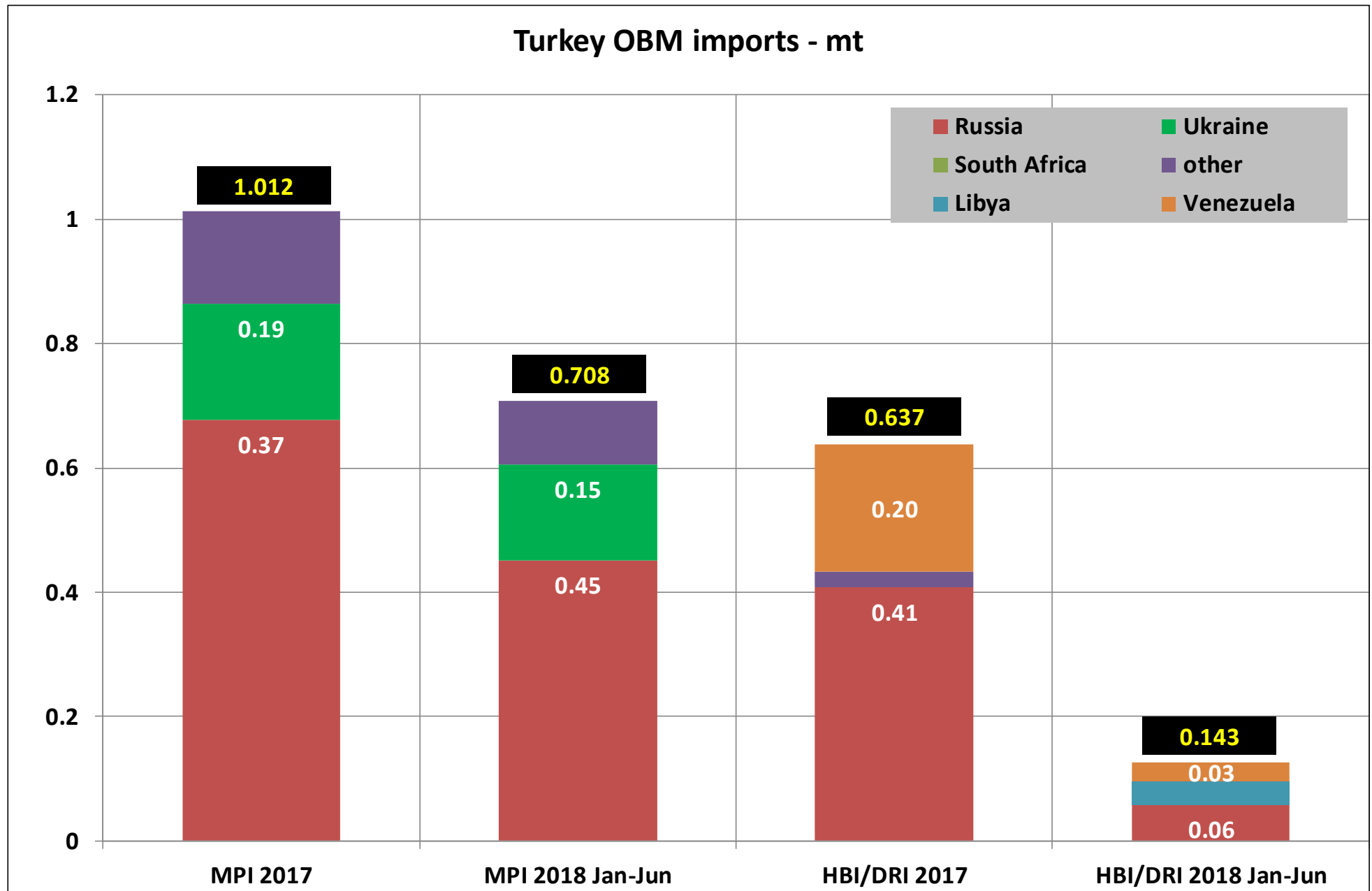


Total 12.25 mt

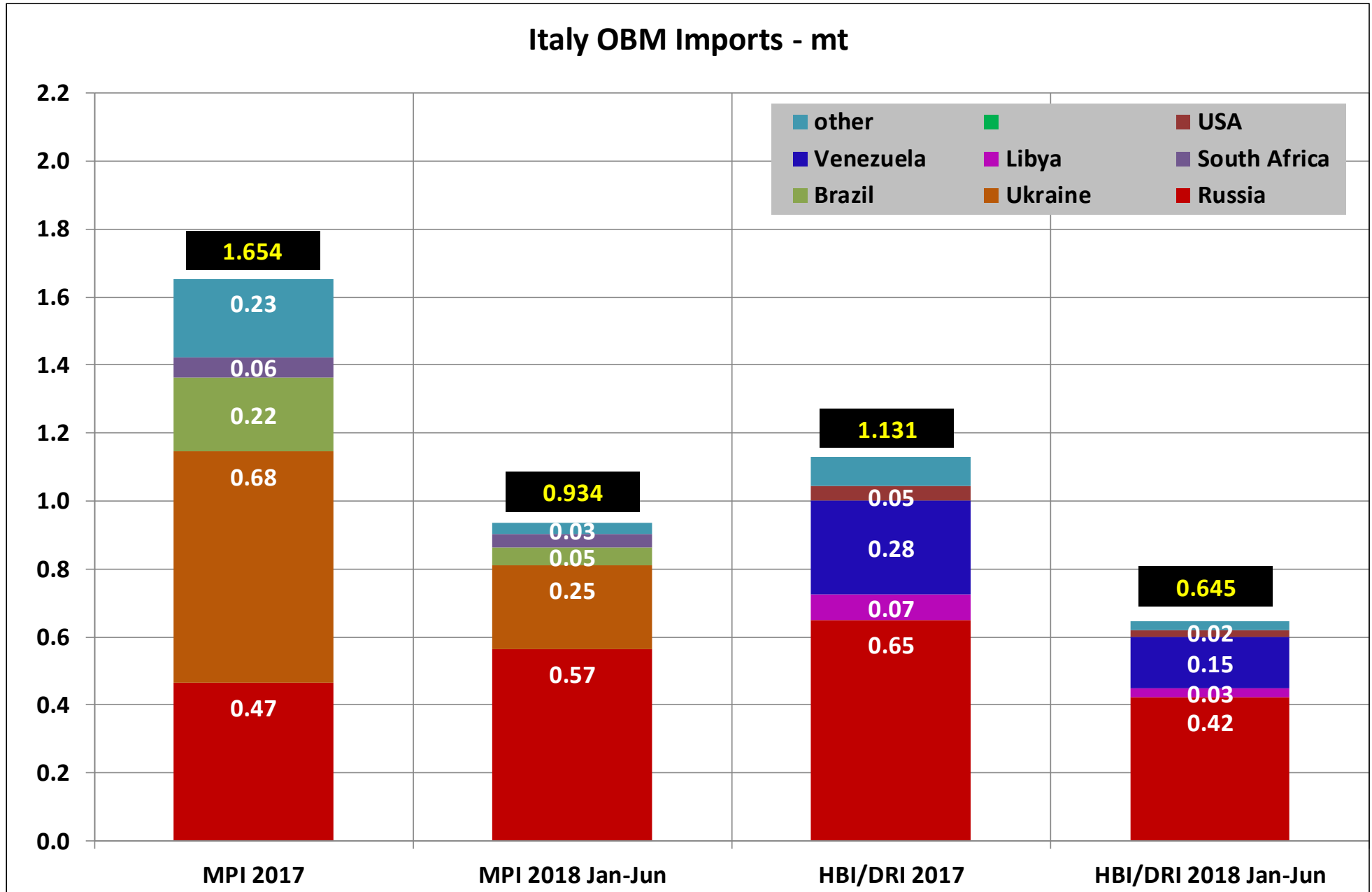
USA OBM imports [mt]



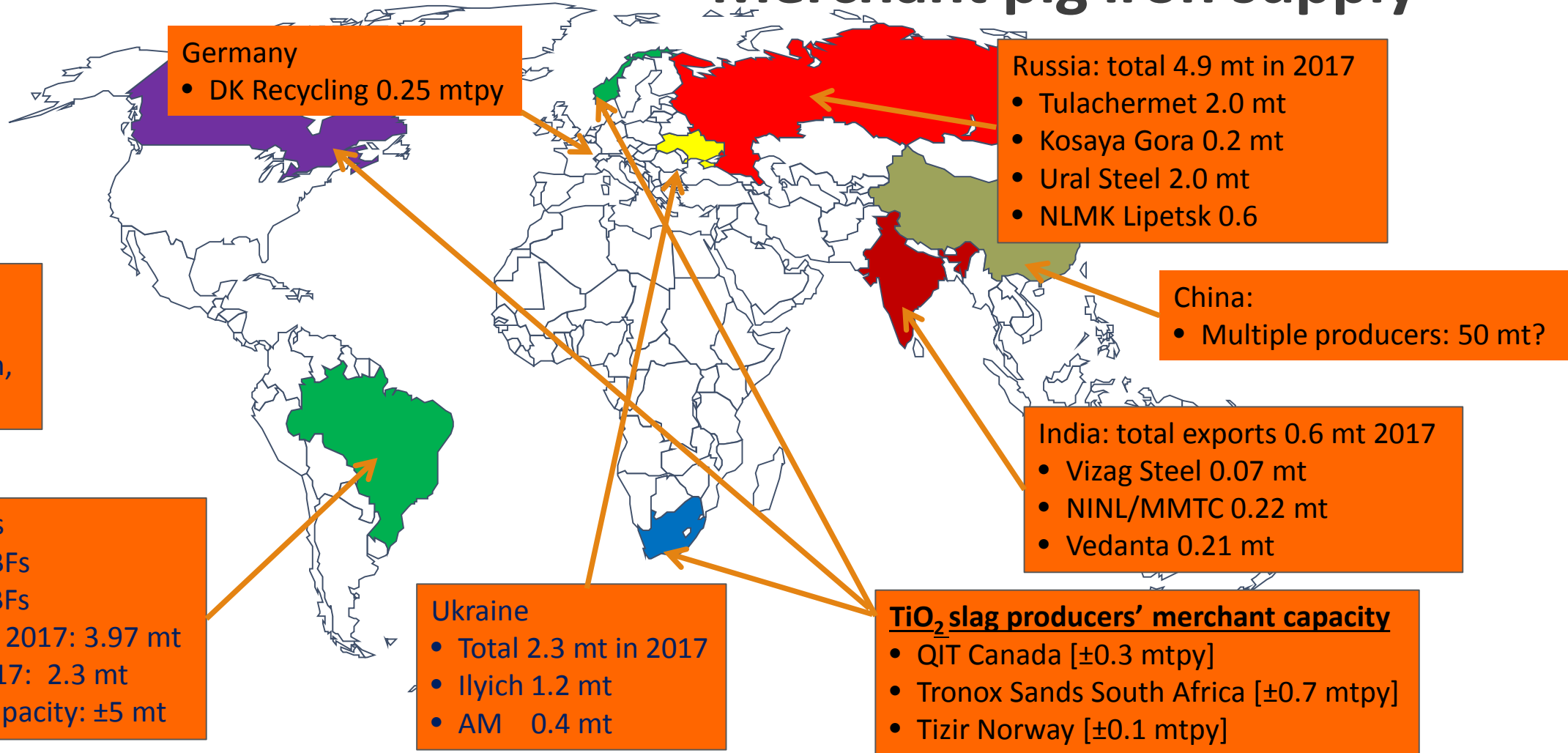
Turkey OBM imports - mt



Italy OBM Imports - mt



Merchant pig iron supply



MERCHANT PIG IRON PRODUCING COUNTRIES

MPI supply-side issues: Brazil

- **Although Brazil's nominal MPI capacity is about 10 mt, it is unlikely that this level will be reached again:**
 - charcoal supply could be a constraint
 - many of the smaller furnaces are not competitive cost-wise
 - some pig iron producers now also have the option to produce steel
- **A more realistic estimate would be that production of 5-6 mt is achievable in the foreseeable future**

MPI supply-side issues: CIS

- CIS integrated steel mills have the choice to sell pig iron or make steel, so relative margin is an important driver
- IMH will commission its steel mill early in 2019 which will consume 1.3 mt Tulachermet pig iron by 2020
 - BF #1 will be blown in in 2020 and BF #2 will be taken out of service in 2021, BF#3 refurbished in 2018 (BF#2 could be rebuilt in the future)
 - MPI availability will fall from the current 2.3 mtpy to 1.7-1.8 mtpy from 2020

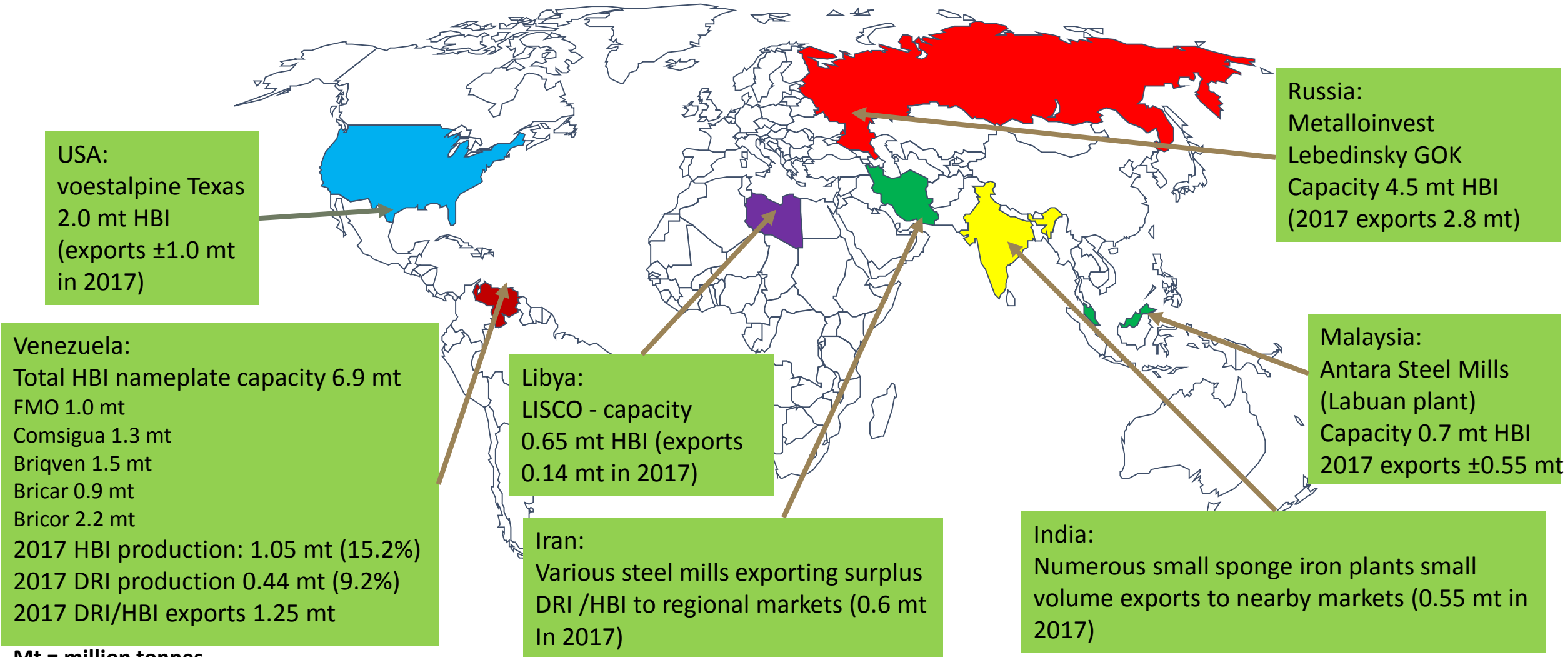


- **Ukrainian supply influenced by political situation in Luhansk and Donetsk**

MPI supply-side: new projects in US/Canada

- **Petmin: planning 0.425 mt merchant pig iron plant in Ohio.**
- **Republic Steel / ERP Iron Ore joint venture: plan is to restart the blast furnace at Lorain, OH and sell 1 mt pig iron, based on pellets from ERP's Reynolds, IN pellet plant.**
- **Black Rock Metals: plans to exploit V- and Ti- bearing magnetite and ilmenite deposits in Chibougamau, Quebec to produce ferro-vanadium, TiO_2 feedstock and potentially 0.525 mt high purity pig iron**

Global merchant DRI/HBI supply



Mt = million tonnes

DRI and HBI supply-side developments

- **LebGOK HBI #3 module started up in March 2017, adding at least 1.8 mt to global HBI capacity**
- **voestalpine Texas HBI plant started up in October 2016, adding 2.0 mt to global HBI supply (about 50% to be consumed in own blast furnaces in Austria)**
- **DRI/HBI production in Venezuela is severely constrained by lack of pellet supply, maintenance and spare parts, etc.**
- **Nucor Louisiana DRI production has been constrained by plant/equipment issues (captive supply to own mini-mills)**
- **Iranian exports are/were growing: 0.7 mt exports in 2017/18, reported to reach about 1 mt in 2018/19 - but government requires priority for domestic market**
- **Indian sponge iron production grew significantly in 2017 with exports to nearby markets, notably Bangladesh**

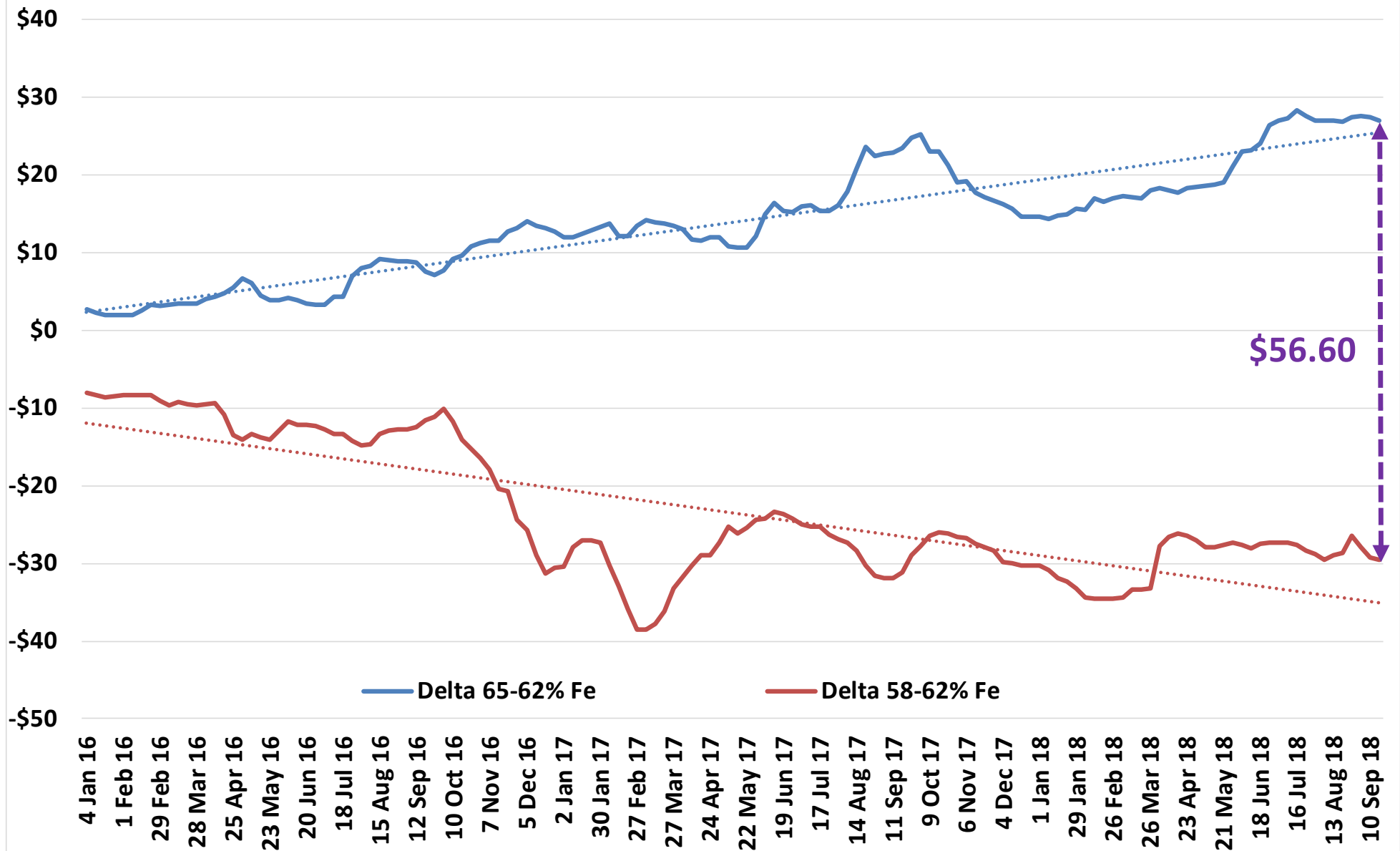
New sources of DRI/HBI, actual and potential

- **Cleveland Cliffs' 1.6 mt Midrex HBI plant at Toledo, OH, scheduled for start of commercial production in mid-2020, to be supplied with DR grade iron oxide pellets from captive North Shore operation.**
- **Chippewa Capital Partners plans 1.8-2.0 mt Energiron DRI/HBI plant as part of plan to revive the Essar Minnesota/Mesabi Metallics project at Nashwauk, MN. Under the bankruptcy agreement, construction of the DR plant must be completed by end 2021. Captive pellet supply.**
- **IMC (International Metallics Corp (Canada), Ltd.) plans 2 mt Midrex HBI plant at Bécancour, Quebec (project is at study stage) - based on purchased pellets.**
- **Ex ArcelorMittal Point Lisas DR plant (Trinidad) could be partially restarted under new management - would be based on purchased pellets.**

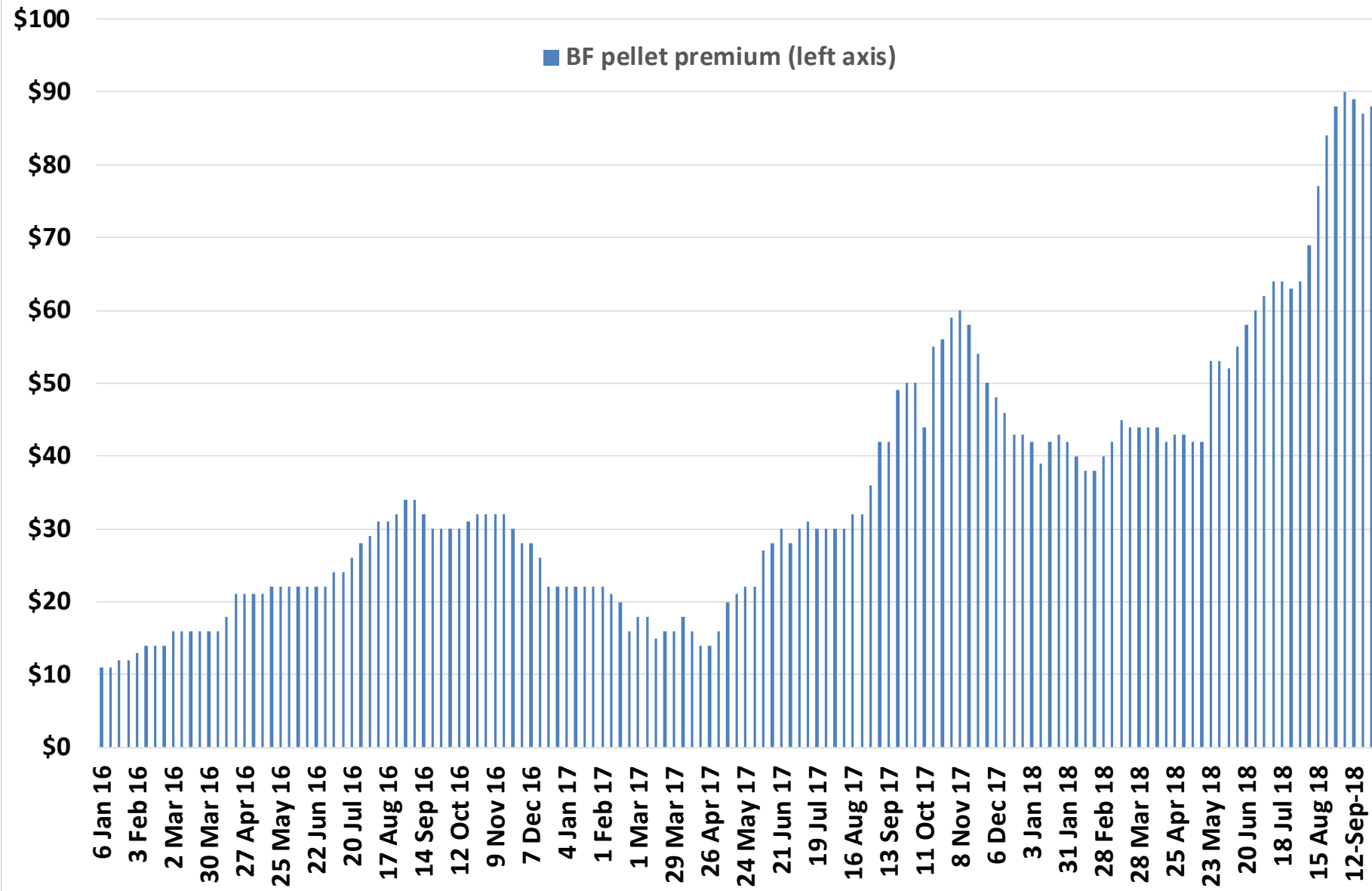
- **The over-arching issue is the flight to quality in China:**
 - improvement of the environment and lower CO₂ emissions
 - **production curtailments**
 - **sinter and pelletising plants shut down**
 - improvement in blast furnace productivity



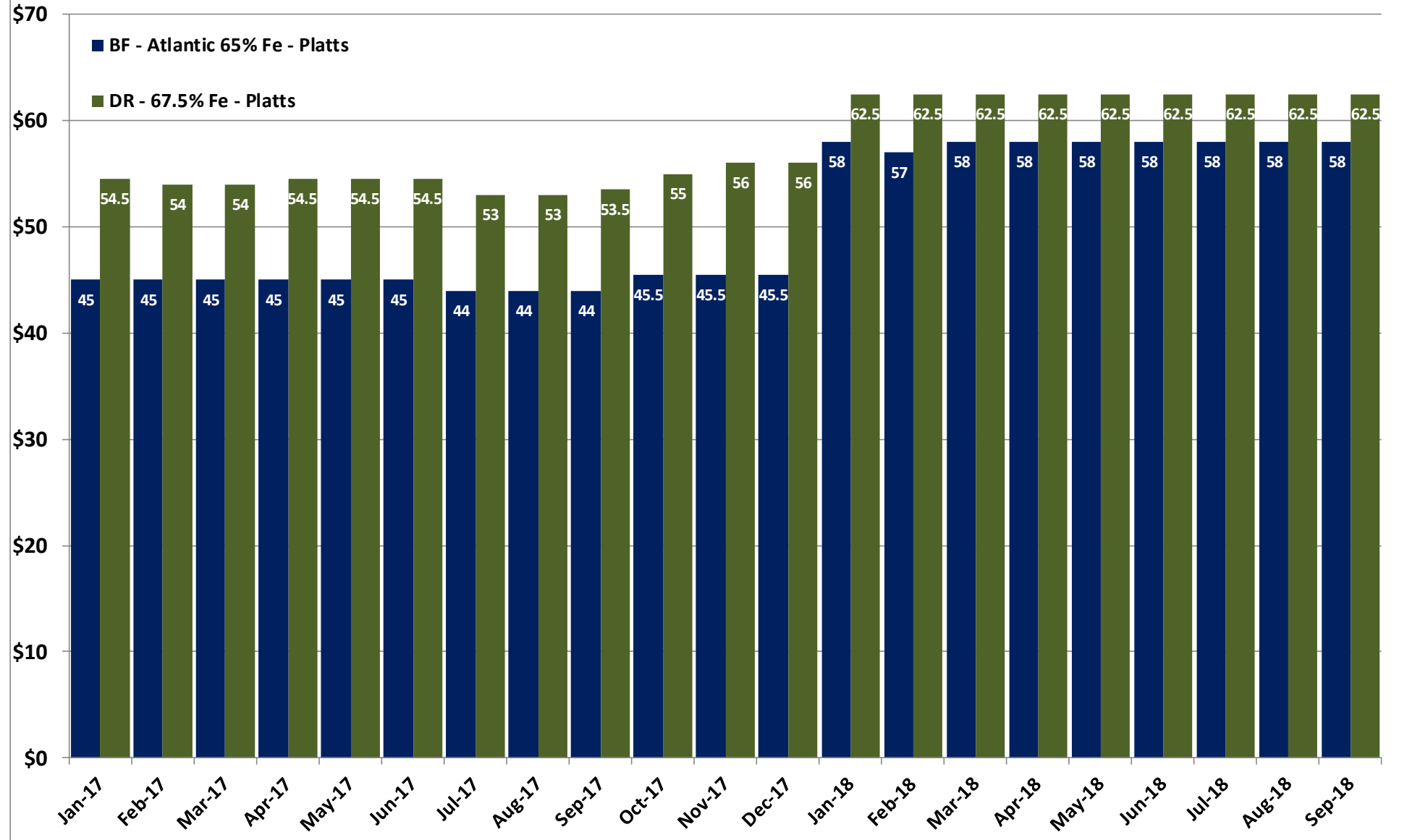
Iron ore price premium/discount to IODEX \$/t CFR North China [Platts]



Blast furnace pellet premium CFR China \$/dmt [Platts]



Iron Ore Pellet Premium \$/tonne



DR Grade pellets

- **Merchant DR grade pellet suppliers:**
 - Vale
 - LKAB
 - Rio Tinto Iron Ore (IOC)
 - ArcelorMittal Mines Canada
 - Bahrain Steel
 - CMP Chile
 - Samarco
 - Iran





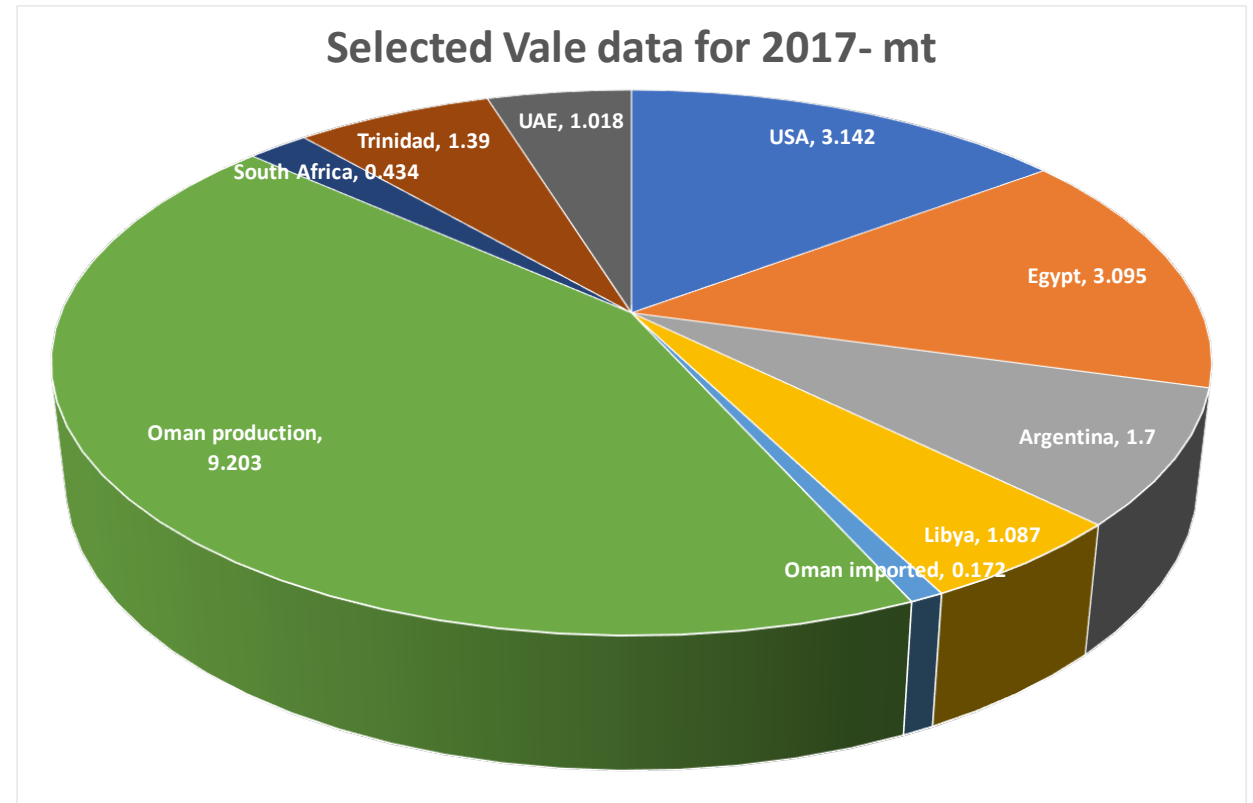
- **Samarco remains shut down**
 - no definitive date for restart - 2020 at the earliest
- **IOC strike cost about 1 mt pellet production in 2018**
 - 2018 guidance 9-10 mt pellets + concentrates
- **Anglo American's Minas Rio operation shut down in March 2018 for pipeline repairs, expected to be completed in Q4 2018**
 - 2018 guidance 3.0 mt concentrate (based on production prior to shutdown)
- **Bahrain Steel production constrained by pellet feed supply**
 - suspension of contract with Anglo American (Minas Rio)
 - Jan-Aug 2018 exports at 4.34 mt down 13% y-o-y



- **Vale's 2017 pellet production was 50.3 mt**
 - **41.1 mt in Brazil**
 - **9.2 mt in Oman**
- **Vale will increase pellet production by about 5 mt in 2018.**
 - **Tubarão #2 line was restarted in January 2018**
 - **Tubarão #1 line was restarted in May 2018**
 - **São Luis plant scheduled for re-start in Q3 2018, adding 7 mt capacity of BF pellets**
 - **Operational capacity addition in 2018 will be about 13 mt**
 - **2018 production guidance about 55 mt**
 - **Scope for ≥ 60 mt production post 2018**

Brazil pellet exports

- **Oman produces DR grade pellets (9.2 mt in 2017, 2.2 mt in Q1 2018)**
- **Selected Brazil data for 2017 shown in chart (12 mt)**
 - exports to USA might include some BF pellets
 - exports to Argentina exclude est. 0.7 mt BF pellets
- **Estimated ± 41% of total pellet sales in 2017 was DR pellets - expected to increase in 2018**

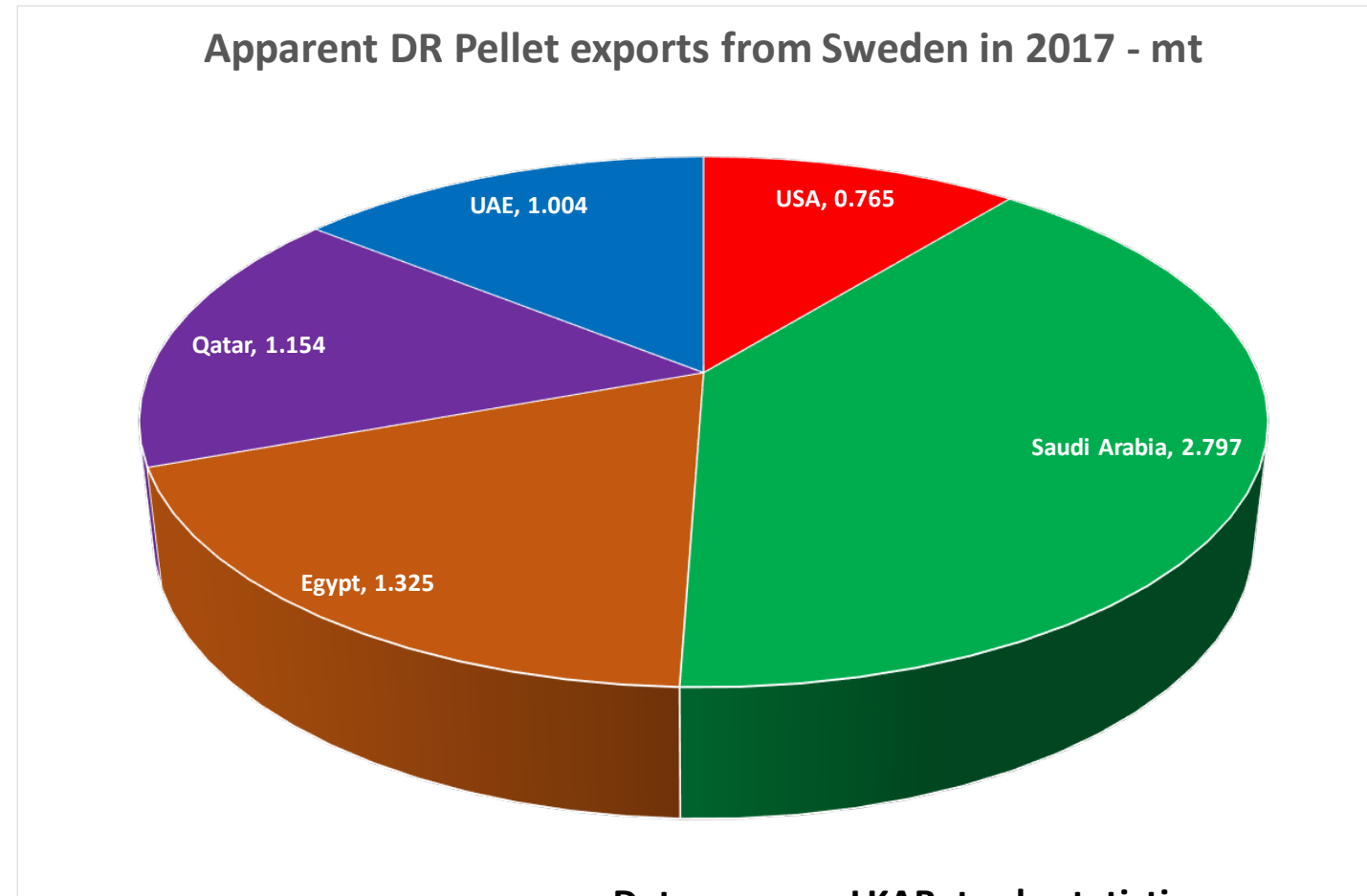


Data sources: Vale, trade statistics

- **LKAB's pellet capacity is about 28 mtpy**
 - Three lines at Kiruna (DR and BF pellets)
 - Two lines at Malmberget and one at Svappavaara (BF pellets only)
- **DR pellets are produced in the KK3 and KK4 plants in Kiruna**
 - combined capacity >10 mtpy
 - equipped with coating capability and using organic binders
- **LKAB has flexibility between production of BF and DR grade pellets within this >10 mt capacity**
 - product split driven by market factors – demand, margin, etc.
 - DR pellet capacity could be increased by adding coating capability at KK2 line



- **2017 pellet production/deliveries 24.6/22.9 mt (2016: 24.0/22.7 mt)**
 - 14.4 mt pellet deliveries from Kiruna
 - 8.4 mt pellet deliveries from Malmberget/Svapavaara
 - 55% of total sales value BF pellets, 26% DR pellets
- **Per iron ore trade statistics, Sweden apparently exported about 7 mt DR pellets in 2017 (6.5 mt in 2016)**



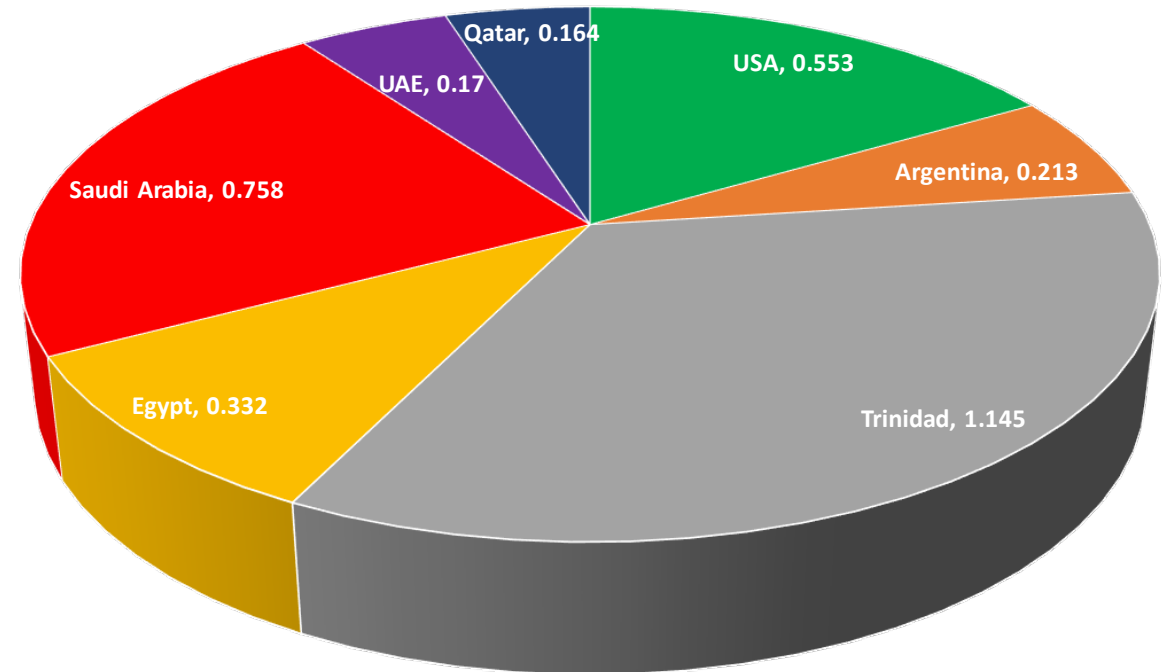
Data sources: LKAB, trade statistics

- **Two producers of DR pellets in Canada**
 - **Rio Tinto Iron Ore (IOC)**
 - pellet capacity ± 12.5 mtpy
 - 2017 production 10.5 mt (9.8 mt in 2016)
 - Pellet capacity will increase with furnace relines, etc.
 - DR market share of pellet sales in 2017 $\pm 31\%$ - future production increase will be focused on DR market
 - IOC workers went on strike on March 26th - each month without production equates to about 1 mt lost pellet supply (pre-strike 12-12.5 mt production was planned for 2018)
 - **ArcelorMittal Mines Canada**
 - pellet capacity 10.2 mt
 - 2017 production 10.1 mt
- **Former Wabush Mines Scully mine and Pointe Noire pellet plant**
 - **Tacora Resources** has acquired assets and plans restart, but unlikely to produce DR grade

Information sources: Rio Tinto, Mazurak Resource Consulting, author's estimates

- **Selected export data opposite:**
 - total 3.3 mt = author's estimate of supplies to DR market
 - excludes Germany, perhaps 0.9 mt ex AMMC to Hamburg DR plant

Selected Canadian Pellet Exports in 2017 - mt



Data source: trade statistics

Samarco restart issues

- **Government approvals and granting of licences by state authorities:**
 - environmental permits, water supply
 - licence applications subject to much scrutiny and politicians may be slow to take decisions
- **Germano pit is now licensed only for dry waste.**
 - Samarco's "in house" solution is thought to be to dump tailings into the Alegria South pit which is permitted, but Alegria Sul deposit has lowest P ore and is best suited for production of DR pellets, so with this solution scope for DR pellet production may be limited. Permit for preparatory operations granted, but Corrective Operational Licensing of the Germano Complex still awaited.
 - Use of Vale's adjacent, mined out Timbopeba pit, already licenced for wet tailings is an alternative that would allow access to the low P ore in Alegria Sul - non-binding term sheet agreed among Samarco, Vale and BHP.
- **Ongoing negotiations between Vale and BHP over future ownership structure, etc.**
- **Legal issues and claims to be settled**
- **Samarco's debt to be restructured**

Information sources: Samarco, author's understanding

DR pellets - short term outlook - **demand**

- **5 mt DRI capacity to come on stream in Algeria**
 - Tosyali has 4 mt pelletising plant (pellet feed to be purchased from the market)
 - AQS will purchase pellets from the market
- **Ex ArcelorMittal Point Lisas DR plant may be restarted under new management (module III, 1.36 mt capacity?)**
- **ESISCO, Sadat City, Egypt plant idle (1.76 mt capacity)**
- **Cleveland Cliffs to start production at Toledo in 2020 using captive pellet supply**

DR pellets - short term outlook - **supply**

- Increased pellet supply from **Vale** - 2018 guidance \approx 55 mt (of which \approx 24 mt DR grade, 2019 & 2020 estimate \approx 60 mt (of which \approx 27 mt DR grade)
- Prospect of increased supply from **Bahrain Steel** as supply from Minas Rio resumes
 - ore imports Jan-Aug 2018 @ 4.9 mt (5.6 mt in CY 2017)
- Cannot count on supply from **Samarco** in 2019 & 2020
- Hopefully supply from **IOC/Canada** will increase by \approx 1 mt

Pellet feed - short term outlook - **supply**

- **Minas Rio** to resume Q4-2018 / Q1 2019 - aims to obtain permit in 2019 for ramp up to full capacity of 26.5 mt
- **Kaunis Iron** started production at the Pajala mine in northern Sweden in July 2018 to produce 2 mtpy 69% Fe concentrate by Q1 2019
- **Vale** accelerating ramp up of S11D to reach 90 mt sinter feed capacity in 2019 instead of 2020 (will replace lower grade fines from the south)
- **Champion Iron's Bloom Lake mine** in Quebec producing 7.4 mtpy 66.2% Fe concentrate

Pellet feed - longer term potential - **supply**

- **Various development projects:**
 - **Eurasian Resources' Bamin project** in Brazil - 16-18 mt 67-68.5% Fe concentrate, start-up potentially 2021
 - **Metalloinvest** upgrading concentrate quality at **Mikhailovsky GOK** from 65% to 67% Fe by 2022
 - **Nordic Iron Ore** plans to produce 4.3 mtpy high grade magnetite concentrate at the Ludvika mines in central Sweden
 - **Carpentaria Resources' Hawsons Iron project** in NSW, Australia aims to produce 70% Fe magnetite concentrate at initial rate of 10 mtpy from early 2020s - now undertaking bankable feasibility study, part funded by Mitsui & Co.

- **Continuing to communicate the message that OBM's are value-adding feedstock materials for the iron and steel industries**
 - EAF value-in-use model - request download via our website
- **Promotion of HBI as BF feedstock material**
 - Increased productivity, lower coke rate, reduced CO₂ emissions
- **Optimised and safe handling, transportation and storage**
 - Guides - HBI and DRI Fines Guides to be added soon
- **Sensible and practical regulation**
 - Maritime regulations - IIMA has NGO consultative status at IMO
 - Chemical industry regulation - supporting the iron ore industry by monitoring potential regulatory threats
 - Support with REACH and its international derivatives



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