



# Industry update: merchant DRI supply, pellets and regulation

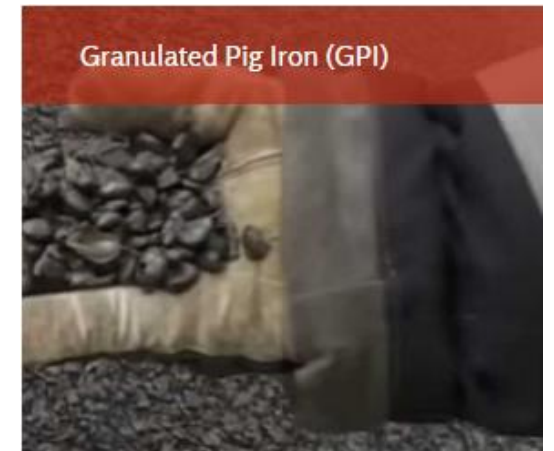
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METAL BULLETIN DRI & PELLETS CONFERENCE - APRIL 2018

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- **IIMA's credentials**
- **Supply of merchant DRI and HBI**
- **Supply of DR grade pellets**
- **Regulatory developments affecting DRI and pellets**

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



# What does IIMA do?

## Communication

Getting the right messages to  
our stakeholders

## Product & Market Support

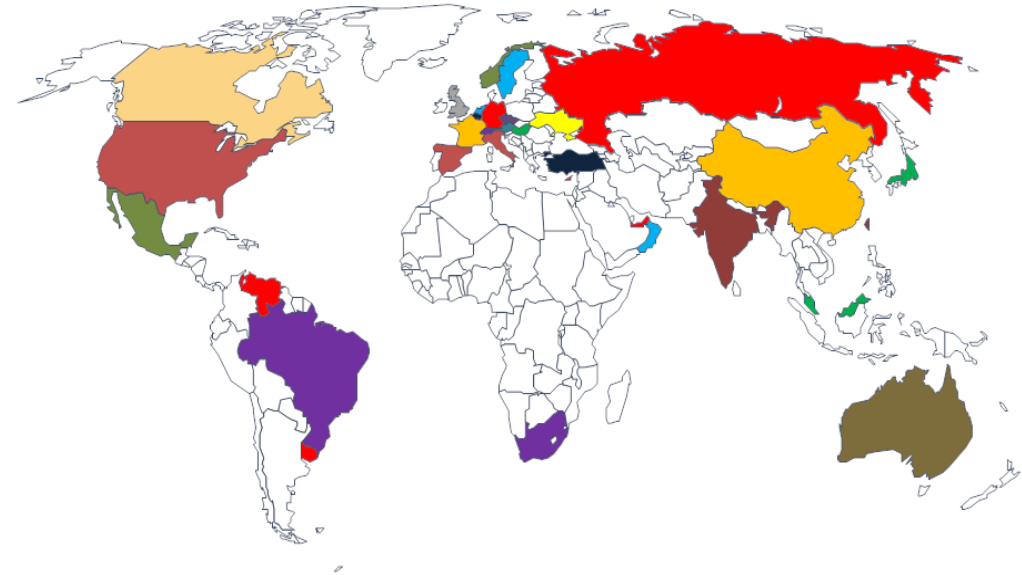
Product information & guides  
Value-in-use model  
Educational workshops &  
webinars

## Regulatory Support

Chemical industry regulation  
(e.g. REACH)  
Maritime regulation  
Product stewardship

# IIMA's membership

- iron ore producers
- pig iron, HBI and DRI producers
- traders and distributors
- OBM consumers
- technology suppliers
- plant and equipment suppliers
- shipping and logistics providers
- sampling and inspection providers
- project developers

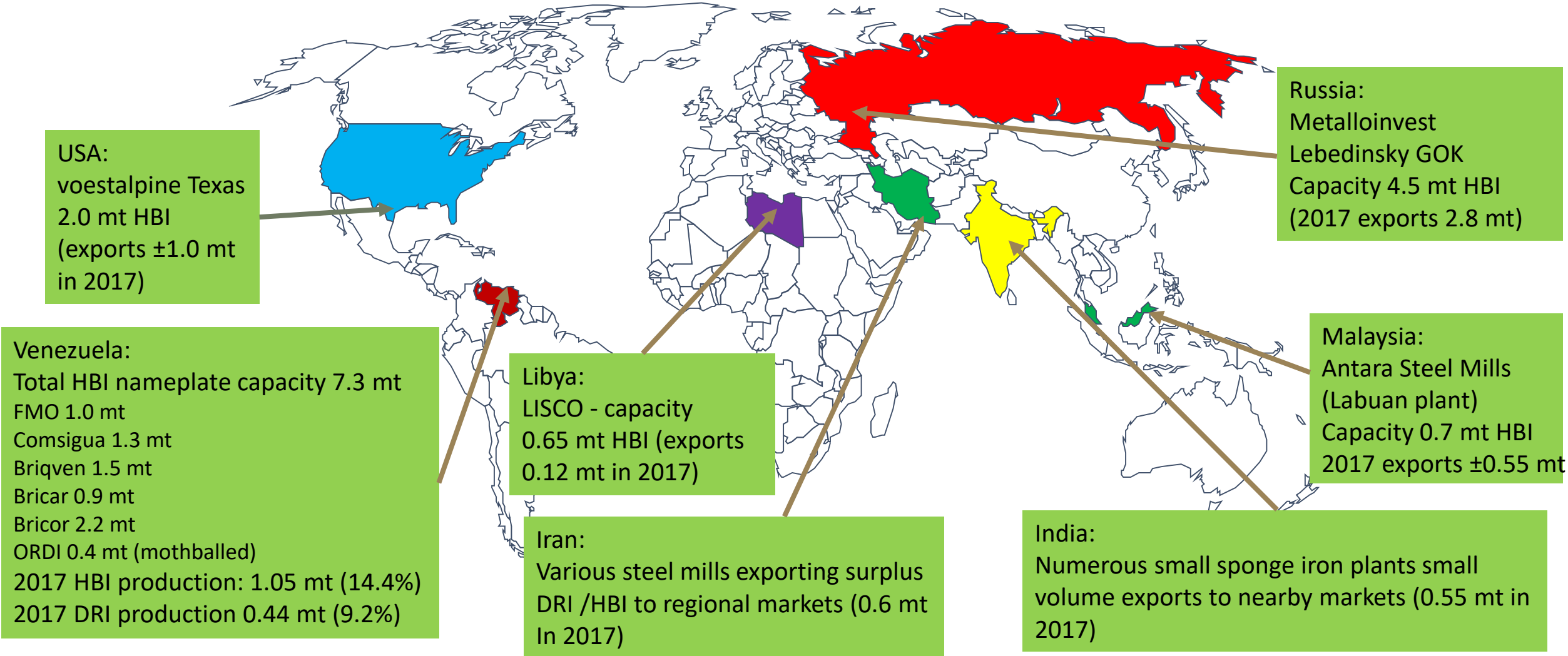


*... spanning the global supply chain ...*

# 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 growing: 0.7 mt exports in 2017/18, reported to reach about 1 mt in 2018/19**
- **Indian sponge iron production grew significantly in 2017 with exports to nearby markets, notably Bangladesh**

# Global merchant DRI/HBI supply





# DR Grade pellets

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



000' metric tons	4Q17	3Q17	4Q16	2017	2016	% change		
						4Q17/3Q17	4Q17/4Q16	2017/2016
<b>Southeastern System</b>	<b>7,890</b>	<b>7,678</b>	<b>7,616</b>	<b>30,830</b>	<b>28,495</b>	<b>2.8%</b>	<b>3.6%</b>	<b>8.2%</b>
Itabrasco (Tubarão 3)	1,157	1,095	1,133	4,552	4,502	5.7%	2.1%	1.1%
Hispanobras (Tubarão 4)	1,160	1,192	1,104	4,606	4,403	-2.7%	5.1%	4.6%
Nibrasco (Tubarão 5 and 6)	2,372	2,464	2,378	9,615	8,535	-3.7%	-0.2%	12.6%
Kobrasco (Tubarão 7)	1,311	1,134	1,150	4,817	3,902	15.6%	14.0%	23.4%
Tubarão 8	1,890	1,793	1,851	7,239	7,153	5.4%	2.1%	1.2%
<b>Southern System</b>	<b>2,605</b>	<b>2,600</b>	<b>2,551</b>	<b>10,268</b>	<b>9,173</b>	<b>0.2%</b>	<b>2.1%</b>	<b>11.9%</b>
Fábrica	989	998	981	3,825	2,798	-0.9%	0.8%	36.7%
Vargem Grande	1,616	1,602	1,570	6,443	6,374	0.9%	2.9%	1.1%
Oman	2,403	2,488	2,453	9,203	8,552	-3.4%	-2.0%	7.6%
<b>PELLETS PRODUCTION</b>	<b>12,898</b>	<b>12,766</b>	<b>12,620</b>	<b>50,300</b>	<b>46,220</b>	<b>1.0%</b>	<b>2.2%</b>	<b>8.8%</b>
<b>PELLETS SALES</b>	<b>13,579</b>	<b>13,135</b>	<b>13,190</b>	<b>51,775</b>	<b>47,709</b>	<b>3.4%</b>	<b>2.9%</b>	<b>8.5%</b>

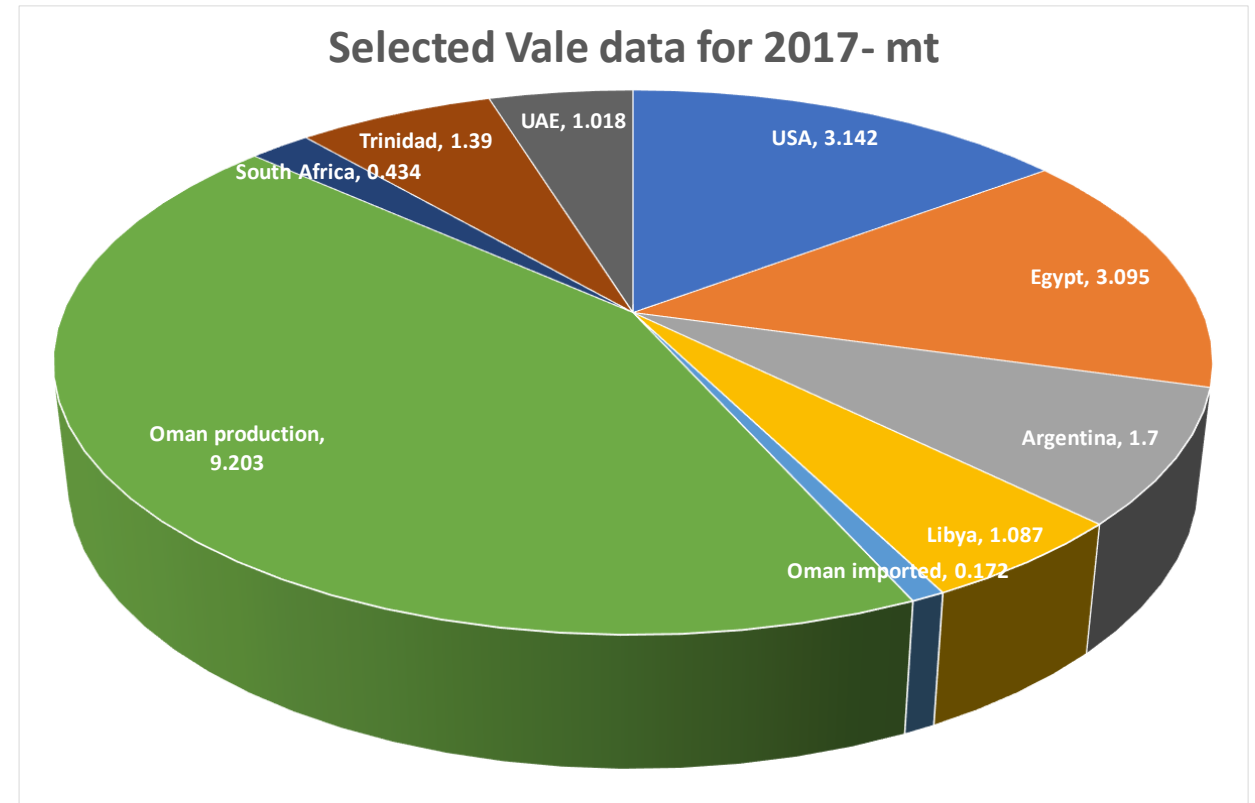
Source: Vale 2017 Q4 production report

- **Vale's 2017 operational pellet capacity in Brazil was 41.1 mt + 9.2 mt in Oman, 50.3 mt in total.**
- **Vale plans to increase pellet production by about 5 mt in 2018.**
  - **Tubarão #2 line was restarted in January 2018**
  - **Tubarão #1 line scheduled to start in April 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**

**Information sources: Vale, author's estimates**

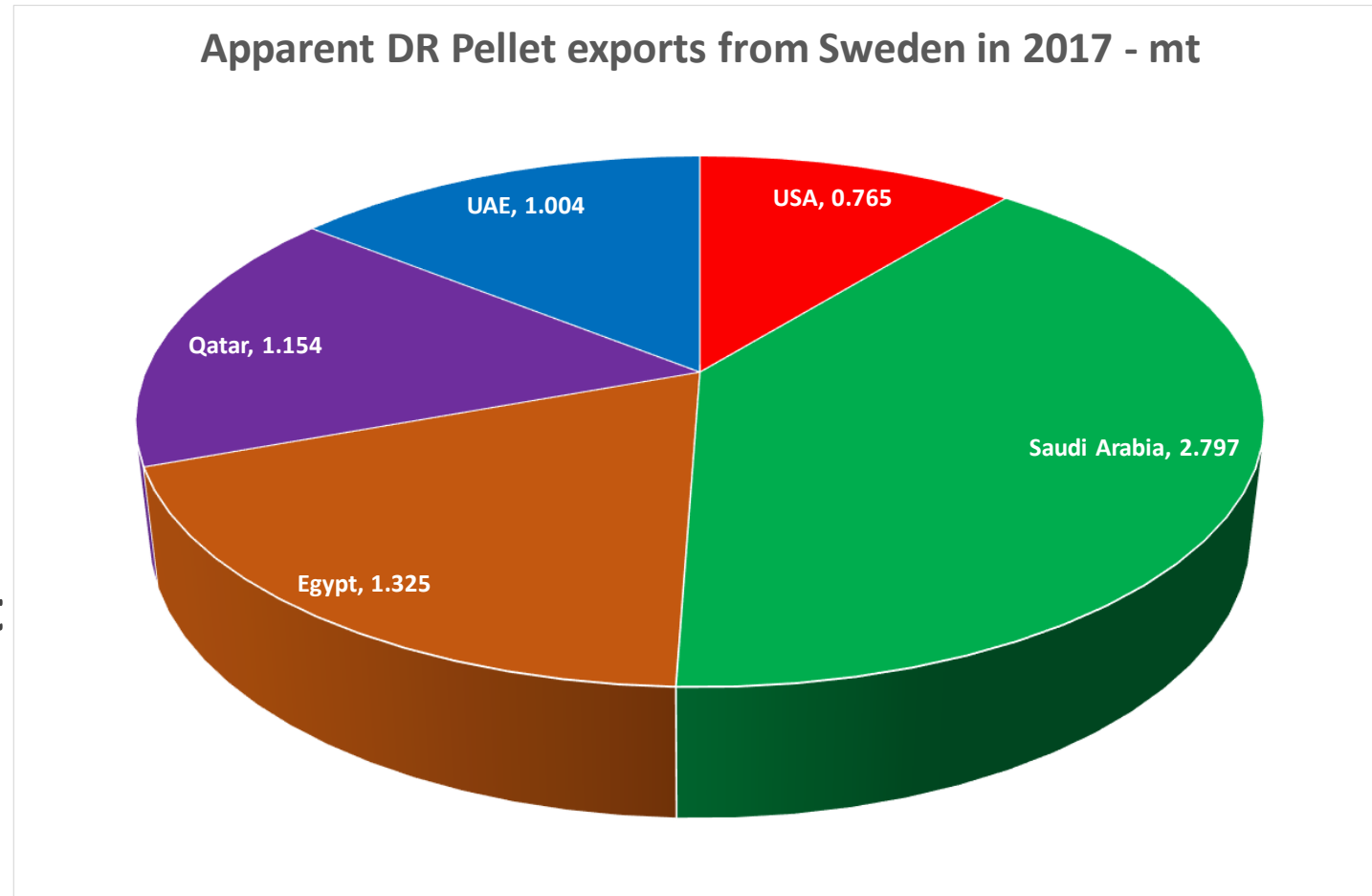
# Brazil pellet exports

- **Oman produces DR grade pellets (9.2 mt in 2017, 2.2 mt in Q1 2018)**
- **Selected Brazil data for 2017 shown in chart**
  - 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

- **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/Svappavaara
  - 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

# LKAB capacity

- **LKAB's installed pellet capacity is about 28 mtpy**
  - three lines at Kiruna (DR and BF pellets) - effective capacity limited by environmental permits
  - two lines at Malmberget and one at Svappavaara (BF pellets only)
  - effective capacity is about 26 mt in total
- **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

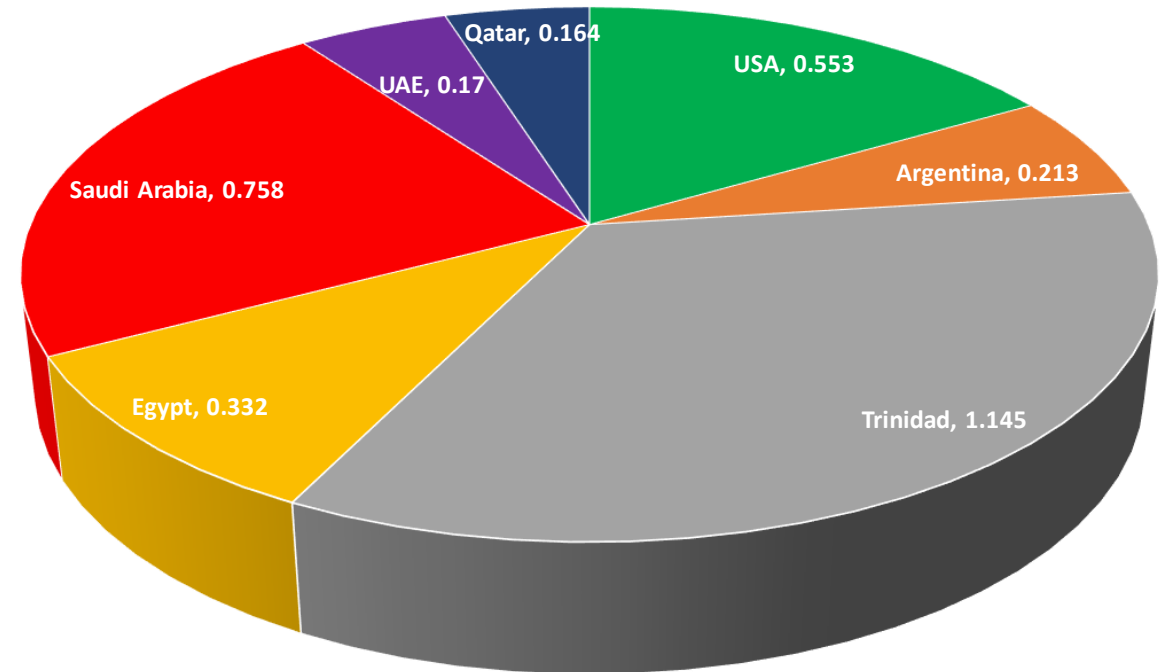


- **Two producers of DR pellets in Canada**
  - **Rio Tinto Iron Ore (IOC)**
    - pellet capacity ±12.5 mtpy
    - 2017 production 10.5 mt (9.8 mt in 2016)
    - Pellet capacity will increase with furnace relines, etc.
    - DR market share of pellet sales in 2017 ± 31% - future production increase will be focused on DR market
    - IOC workers went on strike on March 26<sup>th</sup> - 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**
  - **Tagora Mines** 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 - tailings dam rupture 05/11/2015

- **Samarco's pelletising capacity at Ponta do Ubu: 30.5 mtpy (four lines)**
- **Pellet production**
  - 24.0 mt in 2014
  - 24.6 mt in 2015
  - No production in 2016, but some PF sales from stock
- **The big question: if/when Samarco will resume pellet production – there are many issues.....**
  - there have been many predictions, so far mostly too optimistic



# 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**

# Summary: issues for the DR pellet market

- **Samarco not likely to resume production in 2018 and extent of future supply to DR market**
- **Iran continues to ramp up DRI and pellet production**
- **Growth in Indian DRI / sponge iron production**
- **Unused DRI production capacity in Egypt**
- **Higher capacity utilisation by Nucor**
- **5 mt new DRI capacity scheduled to come on stream in Algeria with no domestic pellet supply**
- **Short term supply-side issues: Rio Tinto/IOC strike and suspension of production at Anglo American's Minas Rio project**

# Other new/potential sources of DR pellets

- **Russia: Metalloinvest (66.0-66.5% Fe)**
- **Russia: Severstal Resources**
- **FMO Venezuela**
  - second line under construction - for domestic HBI producers
- **Cliffs Natural Resources – Northshore Mining**
  - for captive HBI plant at Toledo, OH
- **India**
  - unlikely to export DR grade pellets
  - India's steel development plan foresees 80 mt DRI/sponge iron capacity
- **New projects:**
  - Chippewa Capital Partners (MN, USA) – ex Essar Minnesota
  - New Millennium Iron (Canada) , El Aouj Mining (Mauritania), Wadi Sawawin [Saudi Arabia)

# Regulatory issues affecting DRI & Pellets

- **International Maritime Organisation**
  - IMSBC Code schedule for DRI Fines with moisture >0.3% IMSBC still not finalised
  - Planning for the future: DRI/HBI product diversity - example lower density HBI
  - IMSBC Code test for assessing corrosivity is not fit for purpose
  - Outcome of MEPC meeting on GHG strategy
  
- **Chemical industry regulation**

- A very sensitive issue at the IMO due to incidents involving loss of life and vessels in the 2000s.
- Existing IMSBC Code schedule for DRI (C) requires moisture content 0.3% maximum (an impractical requirement) and inerting of the cargo with nitrogen (not the best solution).
- Current practice is to operate with exemptions.
- IIMA has been pushing for a new schedule for DRI (D) (DRI Fines with moisture >0.3%) using continuous mechanical ventilation to control hydrogen:
  - a mandatory instrument to regulate ocean shipment of DRI Fines is needed to minimise the risk of future accidents and the risk of reputational damage to the direct reduction industry, e.g. due to mis-declaration of the cargo
- IMO stance vis-à-vis DRI (D) is tougher than for any other commodity with similar hazards.

# Ocean shipment of HBI with density $< 5 \text{ t.m}^{-3}$

- **Future new HBI products may have lower density than required by the IMSBC Code schedule for DRI (A) (at least  $5 \text{ t.m}^{-3}$ ) due to**
  - use of lower Fe content BF pellets as feedstock
  - higher carbon content of the HBI
- **The options:**
  - modify the existing DRI (A) schedule - strongly opposed by the industry
  - a new schedule (DRI (E)?) - currently the preferred solution
- **To gain IMO acceptance, any proposal will need to be backed up with clear, scientific, peer-reviewed evidence that it ensures safety for mariners and vessels.**
- **The IMO process is lengthy, but careful preparation will shorten it.**
- **IIMA and the direct reduction industry are starting to work on this.**

# IMSBC Code: MHB corrosivity solids hazard

**9.2.3.7.3** A material shall be classified as MHB when **the corrosion rate on either steel or aluminium surfaces is between 4 mm and 6.25 mm a year** at a test temperature of 55°C when tested on both materials. For the purposes of testing steel, type S235JR+CR (1.0037 resp. St 37 2), S275J2G3+CR (1.0144 resp. St 44 3), ISO 3574:1999, Unified Numbering Systems (UNS) G10200 or SAE 1020, and for testing aluminium, non-clad, types 7075-T6 or AZ5GU T6 shall be used. **An acceptable test is prescribed in the United Nations Manual of Tests and Criteria, part III, section 37. When this test is performed the sample shall contain at least 10% moisture by mass. If the representative sample of the cargo to be shipped does not contain more than 10% moisture by mass, water shall be added to the sample.**



# IMSBC Code: MHB corrosivity solids hazard

- **Bulk carriers are not made of aluminium, so testing on aluminium is not appropriate**
- **The “acceptable” test has no guidance for laboratories and produces results that are neither repeatable, not reproducible, sometime resulting in false positives for cargoes which are known not to be corrosive**
- **The mining and metals industry has formed an alliance to address these issues vis-à-vis the IMO**

# Global Industry Alliance



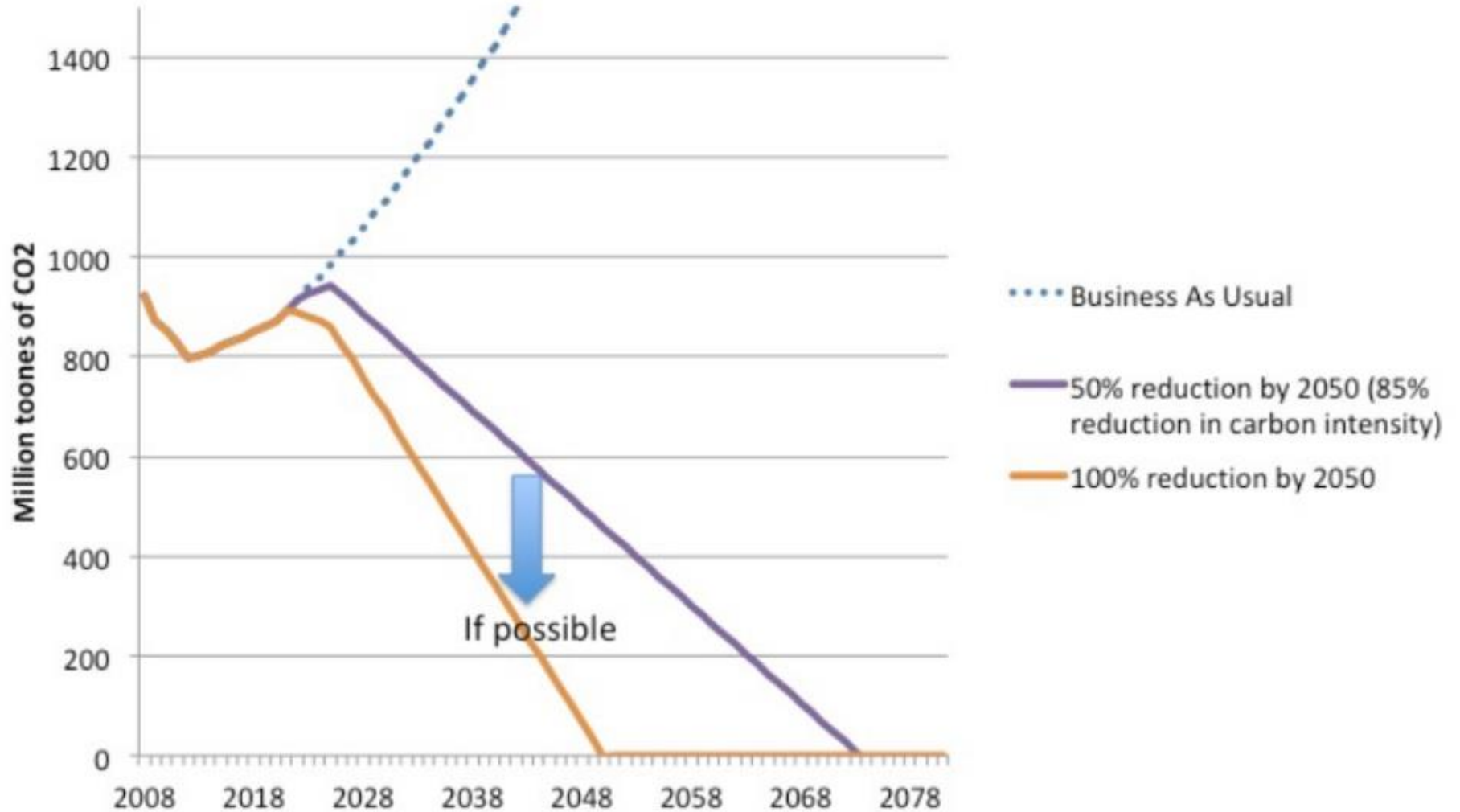
# The GIA's approach

- **remove the requirement to test corrosivity on aluminium coupons**
- **refinement of the existing IMSBC Code test**
  - test samples should represent “as shipped” conditions with respect to moisture content, particle size distribution, bulk density and atmospheric conditions
  - qualification and quantification of corrosion to be assessed/measured in accordance with national and international standards
- **guidance on test set-up, sample preparation, test procedures, etc. to be provided**
- **NB: sooner or later DRI, HBI, DRI Fines and Iron Oxide Pellets will have to be tested**

# IMO - green house gas (GHG) strategy

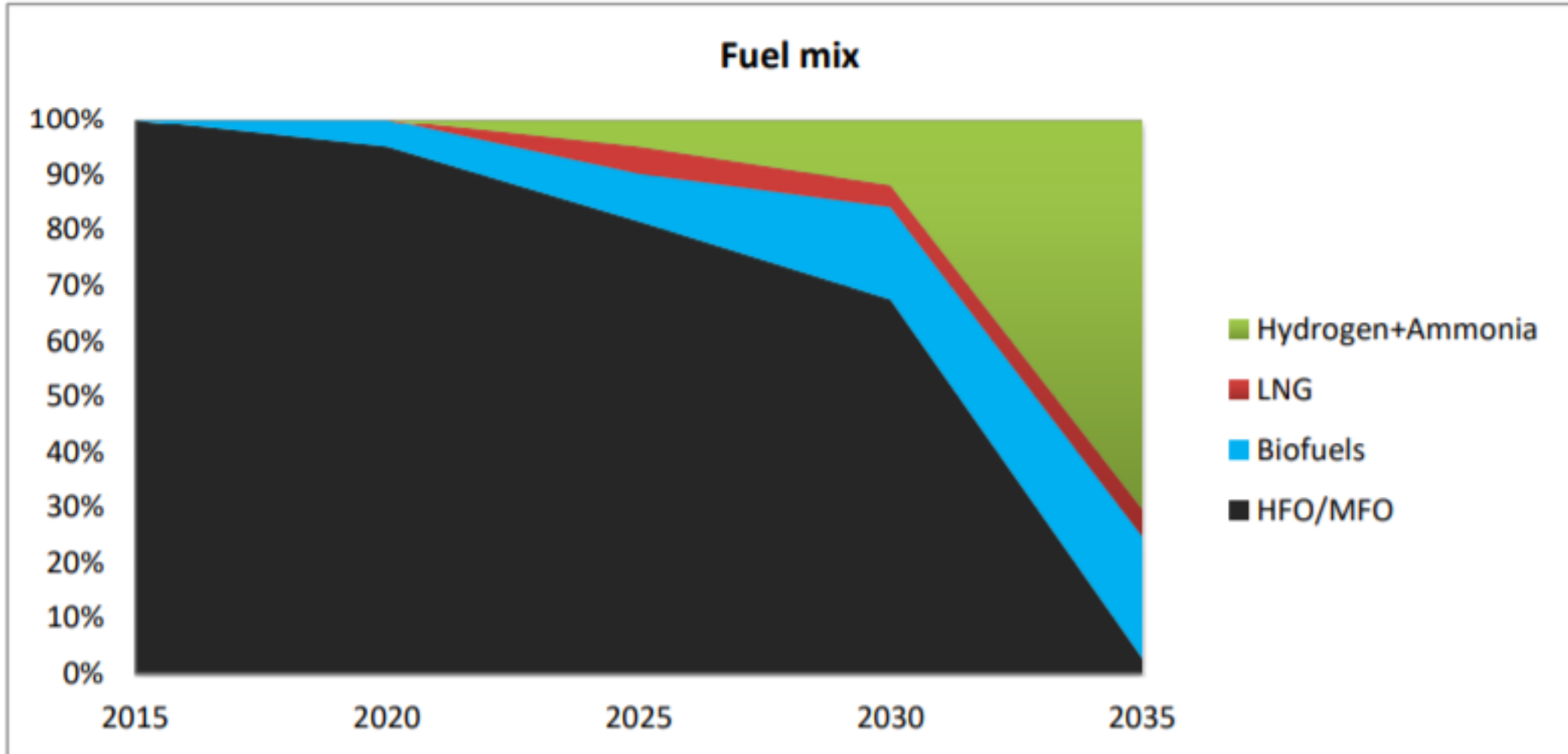
- **At April 2018 meeting of Marine Environment Protection Committee (MEPC), member states adopted the so-called GHG initial strategy, envisaging a reduction in total GHG emissions from global shipping by at least 50% by 2050 relative to 2008. Equates to 85% reduction in carbon intensity.**
- **Aligned with Paris agreement goals (limiting global warming to 1.5°C).**
- **Shipping currently accounts for 2-3% of global GHG emissions.**
- **Long term aim is to eliminate use of fossil fuels - full decarbonisation by 2050.**

### Pathways for international shipping's CO2 emissions



Source: Lloyds Register - IMO GHG Strategy – What does it mean?

## Fuel mix evolution between 2015-2035 for 80% carbon factor reduction



Source: OECD Decarbonising Maritime Transport - pathways to zero-carbon shipping by 2035 (March 2018)

# Sulphur limit of 0.5% in marine fuels

- In 2008 IMO set deadline of January 2020 for this limit which will require development of new fuel products to meet the standard.
- Current fuels contain up to 3.5% sulphur - a limit since 2012.
- **How will ships comply?**
  - use of low sulphur fuels
  - use of gas as fuel
  - use of exhaust gas scrubbers
- **These measures will not cause freight rates to decrease.**

# Threats from chemical regulation

- **2017 presentation: proposed classification of TiO<sub>2</sub> as category 1B carcinogen in EU**
  - Possible impact on iron ore containing  $\geq 0.1\%$  TiO<sub>2</sub>
  - Iron oxide (and aluminium oxide) quoted in CLH proposal to have same effect as TiO<sub>2</sub>
- **2018 update: ECHA's Risk Assessment Committee recommends TiO<sub>2</sub> be classified as Category 2 carcinogen - EU decision on recommendation awaited**
- **Recognised that carcinogenicity is function of PSLT particle effect rather than intrinsic toxicity of TiO<sub>2</sub>**
  - PSLT = poorly soluble low toxicity
- **Other PSLT's include iron oxide.....**





**DRI & Pellets!**

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