



The Global HBI/DRI Market: outlook for seaborne DR Grade pellet supply

FASTMARKETS

MIDDLE EAST IRON & STEEL 2020



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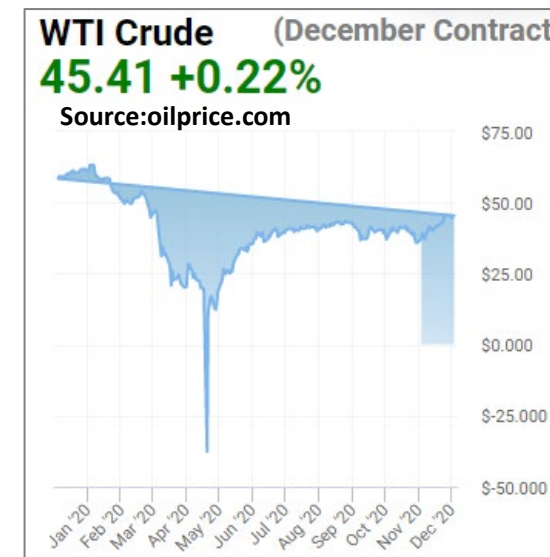


Presentation overview

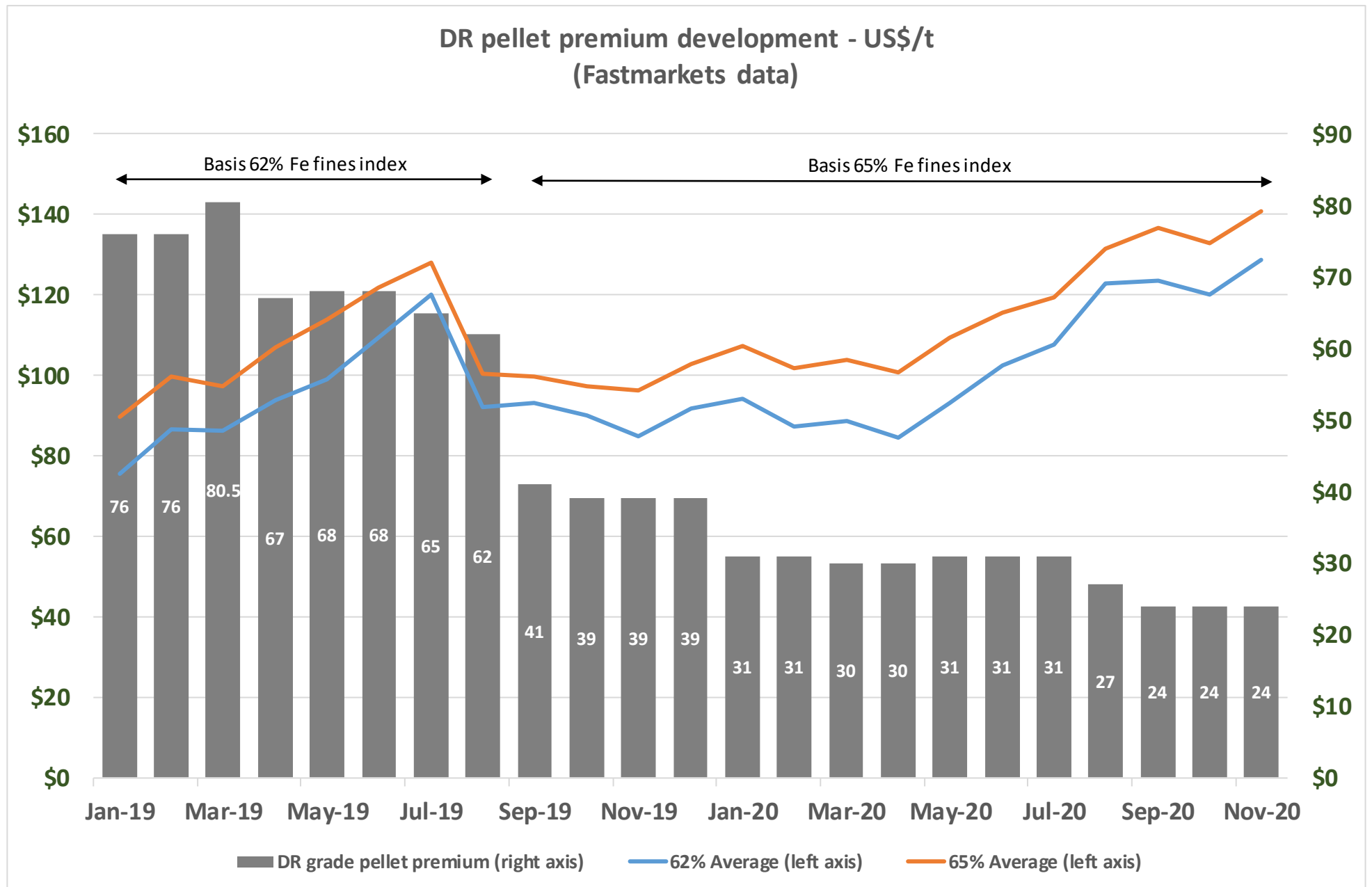
- **Setting the scene**
- **2019 analysis revisited**
- **Outlook for DR grade pellet supply out to 2030**
- **Pathway to carbon-neutral steelmaking**
 - **a head scratcher to finish with**

What's happened since June 2019?

- **Economic growth has slowed as a consequence of COVID-19: global growth is projected by the IMF at negative 4.4 percent in 2020.**
- **Oil prices have fallen dramatically, briefly into negative territory mid-year, and still below \$50.**
- **Based on China's strong demand, iron ore prices have firmed to the point that scrap or even billets are more competitive than DRI at some steel plants, leading to reduced DRI production.**
- **Pellet demand softened in some seaborne blast furnace markets, notably Europe, Japan, South Korea.**



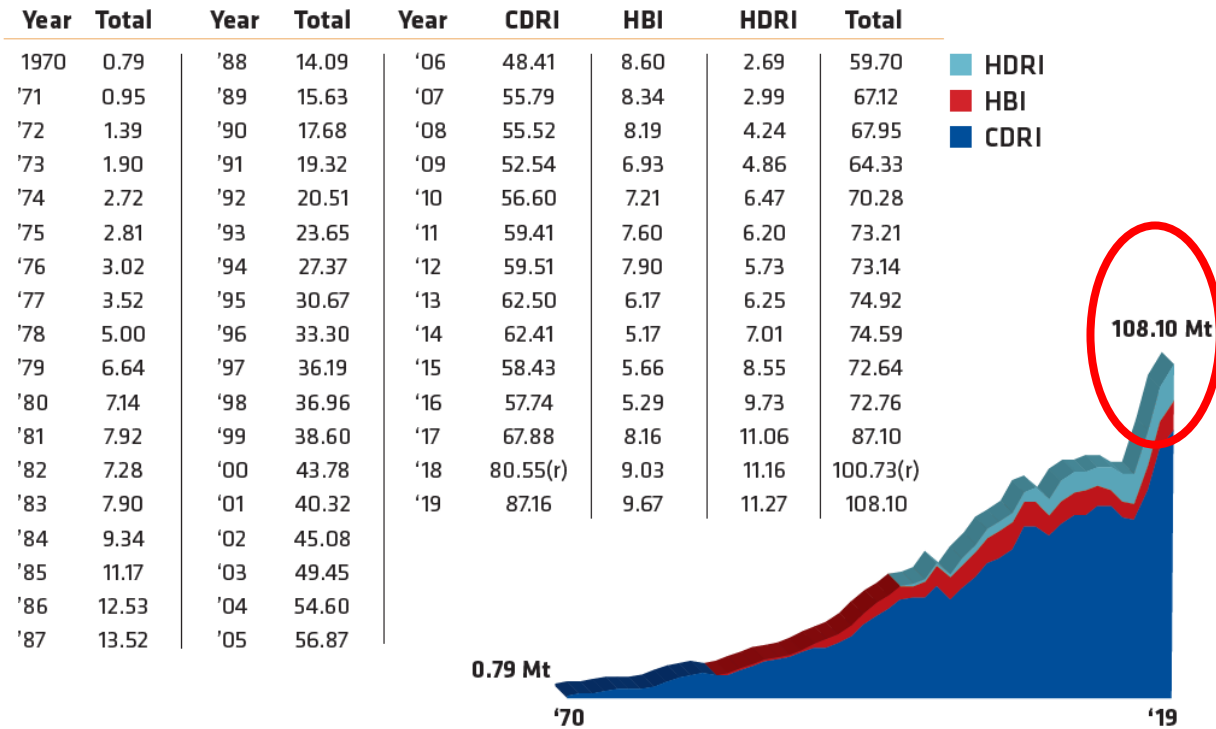
Setting the scene





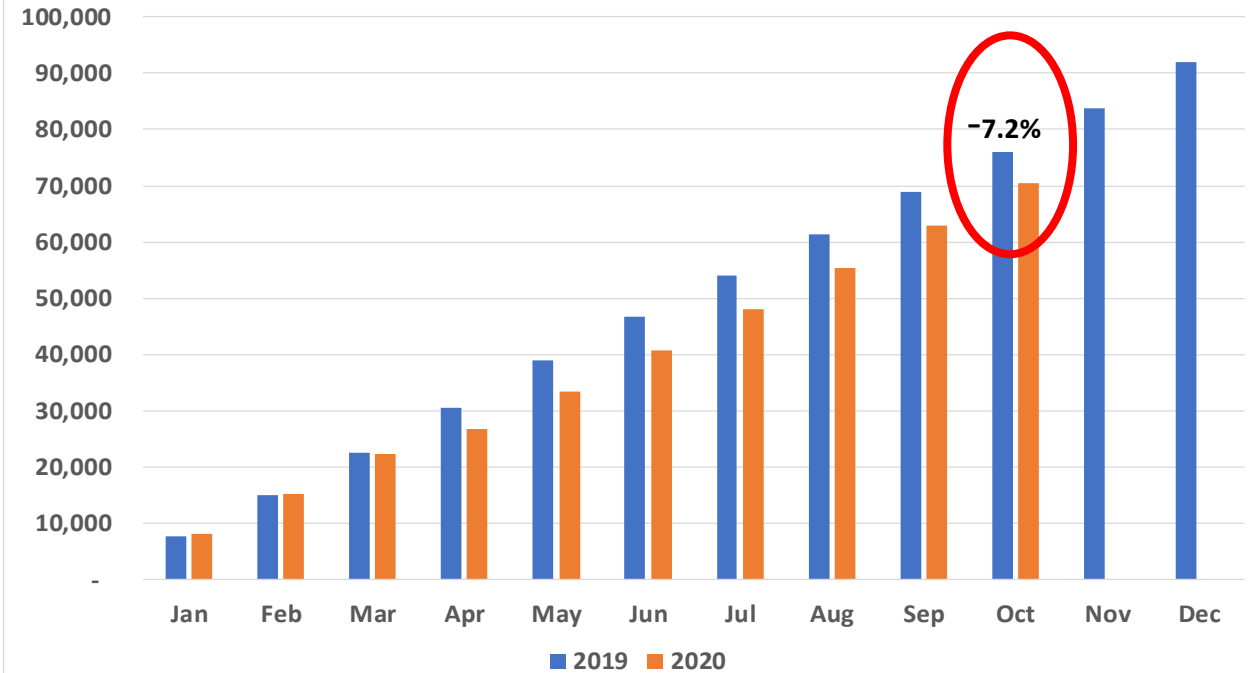
World DRI Production by Year (Mt)

Source: Midrex Technologies, Inc.



worldsteel DRI production data '000 tonnes

Canada, Mexico, Argentina, Venezuela, Egypt, Libya, South Africa, Iran, Qatar, Saudi Arabia, UAE, India
(= approximately 85% of global production)

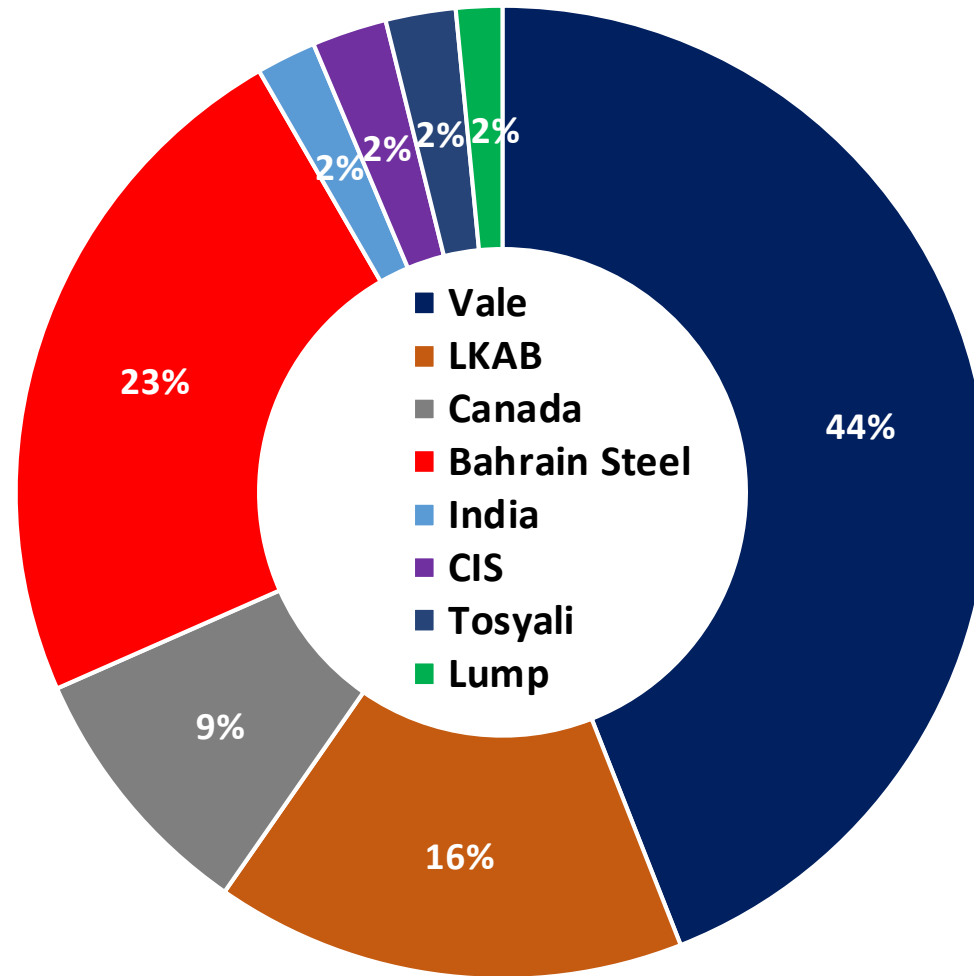




Seaborne Ore Supply to DR plants 2019 (mt) - total 43 mt

source: trade statistics, private communications

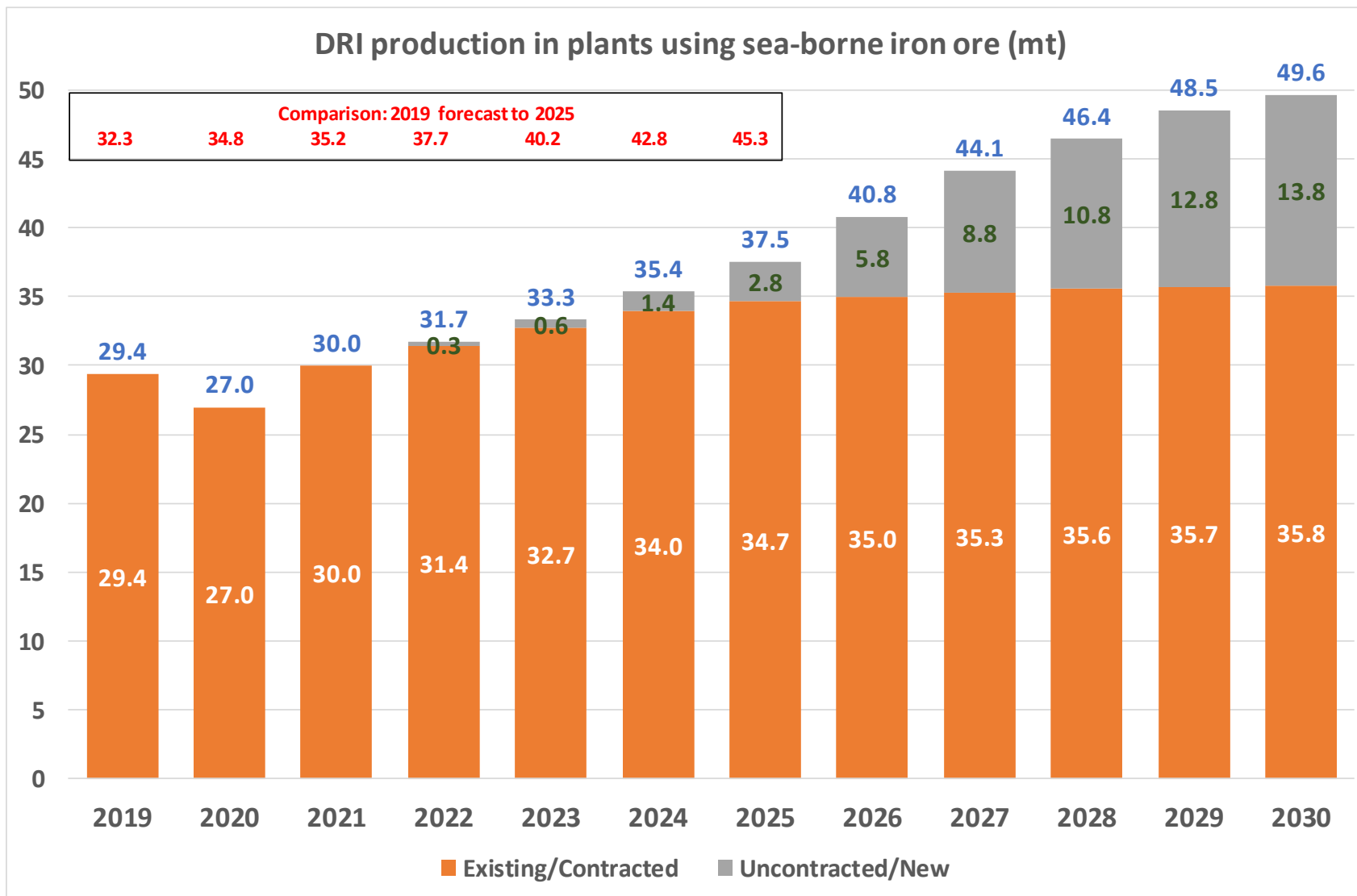
(compares with 42.6 mt derived from DRI production data)





November 2020 analysis: DRI

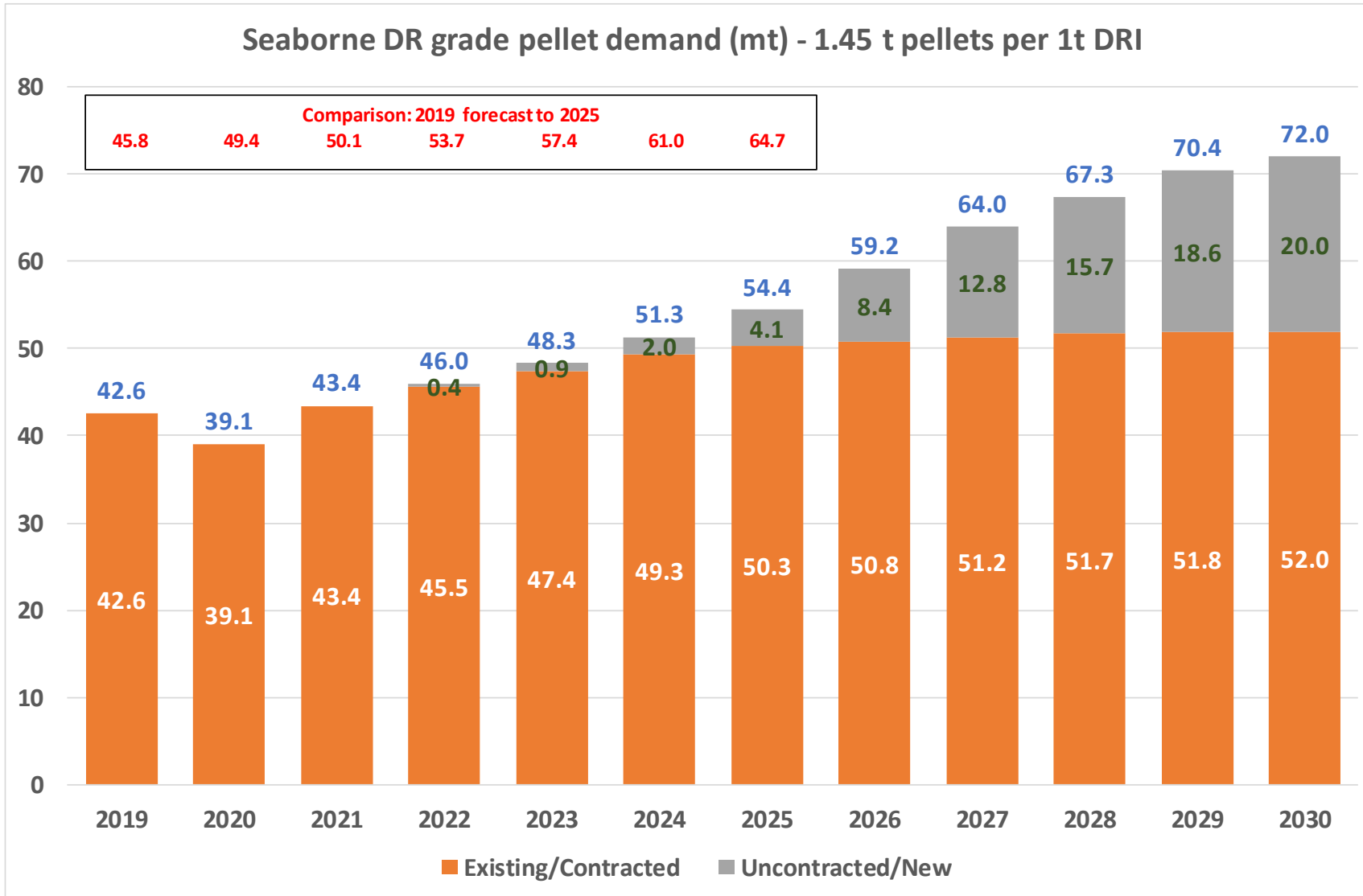
DRI production in plants using sea-borne iron ore (mt)



Argentina
Trinidad
USA
Germany
South Africa
Algeria
Libya
Egypt
Saudi Arabia
Qatar
Bahrain
UAE
Oman
Malaysia

November 2020 analysis: iron ore

Seaborne DR grade pellet demand (mt) - 1.45 t pellets per 1t DRI



Comparison: 2019 forecast to 2025
 45.8 49.4 50.1 53.7 57.4 61.0 64.7

Argentina
Trinidad
USA
Germany
South Africa
Algeria
Libya
Egypt
Saudi Arabia
Qatar
Bahrain
UAE
Oman
Malaysia

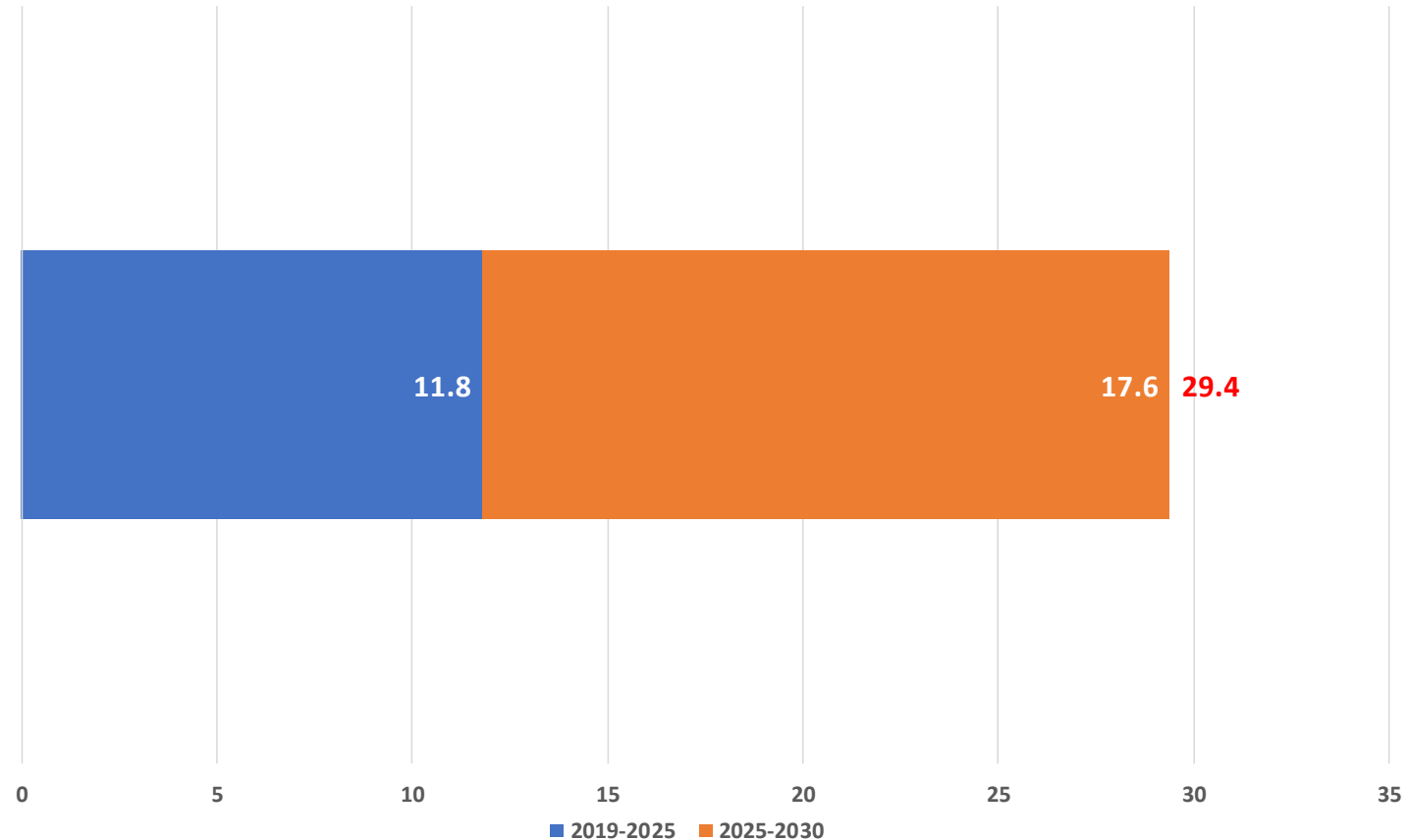


2025 DRI production

Δ from June 2019 analysis:

- 2.6 mt less production from existing plants, including:
 - shut down of AM Saldanha Bay
 - USA plants maxed out at lower level
- 5.2 mt less production from new plants
 - projects delayed due to COVID-19, lower oil prices, economic slow down, etc.
 - slower ramp-up

Iron ore pellets gap to fill - million tonnes



DRI production from new projects

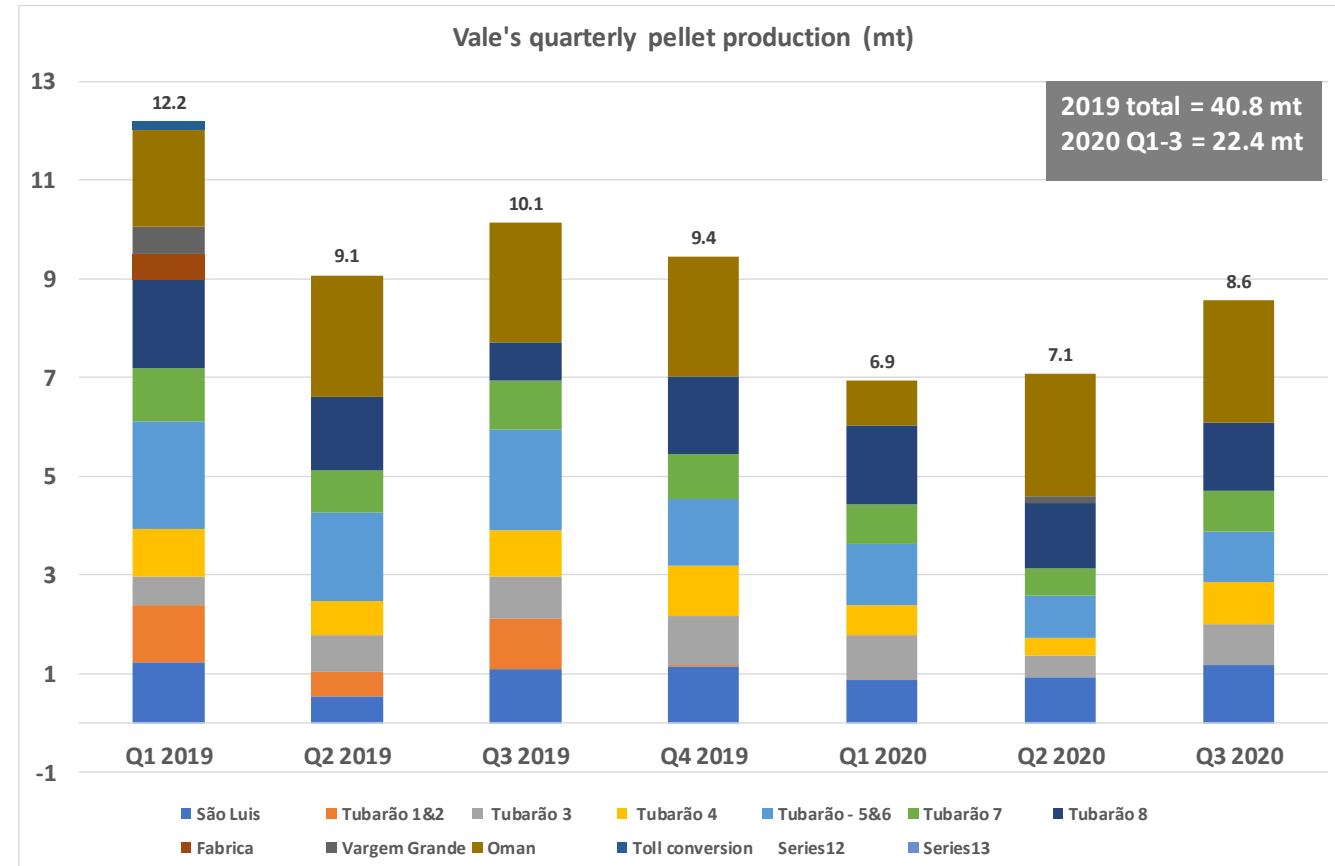
(based on seaborne iron ore)

Project	2022	2023	2024	2025	2026	2027	2028	2029	2030	Location
HBIS Group	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	China
Salzgitter			0.8	1.6	2	2.0	2.0	2.0	2.0	Germany
TKS				0.6	1.2	1.2	1.2	1.2	1.2	Germany
EU1					1.0	2.0	2.0	2.0	2.0	Italy, Romania, France
MENA 1					1.0	2.0	2.0	2.0	2.0	North Africa
MENA 2						1.0	2.0	2.0	2.0	North Africa
EU2							1.0	2.0	2.0	Italy, Romania, Germany, France
Asia								1.0	2.0	ASEAN, China
Total	0.3	0.6	1.4	2.8	5.8	8.8	10.8	12.8	13.8	

Author's assumptions

update **Vale**

- Since the Brumadinho dam rupture, Vale has idled the Fabrica, Vargem Grande and Tubarão I and II pellet plants.
- Estimated pellet supply to the DR sector in 2019 = 19 mt (23.9 mt in 2018), 44% of total 43.2 mt pellet sales (2018: 23.9 mt, 42%).
- Vale's updated production guidance for 2020 is 300-305 mt fines and 30-35 mt pellets
- Q1-3 production/sales:
 - Iron ore: 215.9 mt / 172.0 mt (incl. pellet feed)
 - Pellets: 22.6 mt / 22.7 mt
 - Pellet sales to DR markets: est. 9 mt



outlook **Vale**

400 Mtpy run-rate capacity to be achieved at the end of 2022


	Capacity (Mtpy)			
	Today ¹	End of 2021	End of 2022	Long-term
Northern System	206	206	230	260
Southeastern System	61	77	101	106
Southern System	51	65	67	82
Midwestern System	2	2	2	2
 VALE	320	350	400	450
2020 production	300-305 Mt			
2021 production	315-335 Mt			

Chart source: Vale Day presentation, December 2nd 2020

- Prior to the Brumadinho dam rupture, we estimated Vale's pellet supply to DR sector in 2019 and 2020 at ~27 mt (total pellet capacity 60 mt).**

 - Estimate for 2020 is ~12 mt
- No guidance yet for 2021 pellet production – guesstimate: 35 mt of which DR grade 15-16 mt**

 - Vargem Grande and Fabrica pellet plants scheduled for restart in 2021 Q2 and Q3 respectively (domestic market focus).
 - 2021 Tubarão pellet production will be driven market demand and in the case of DR grade pellets by high grade pellet feed availability.
 - Oman pellet production will likely be maximised.

outlook - **LKAB**

- **LKAB has 10 mt capacity at pellet plants with coating capacity (Kiruna KK3 and KK4)**
 - **KK3 produces only DR grade, KK4 can switch between BF and DR grades**
- **LKAB's pellet deliveries in 2019: 20.4 mt (22.2 mt in 2018)**
 - **4 months outage at Svappavaara to February 2019**
 - **disruption at pelletising plants and logistics problems at Narvik Q4**
- **Estimated DR grade pellet supply (basis trade data):**
 - **6.7 mt (32.8% of total pellet deliveries by volume) in 2019**
 - **4.5 mt (33.0% of total pellet deliveries by volume) in 2020 to July**
 - **Kiruna affected by earthquake in May 2020 (4.9 on Richter's scale)**
- **Based on its contract portfolio, it seems that about 7 mtpy is a maximum level of seaborne DR grade pellet supply for the foreseeable future**
- **From ~2025 HYBRIT project will utilise ~1.5 mt “fossil-free” pellets from Malmberget**



WE TAKE A NEW POSITION ON THE MARKET
A successive change from supplier of iron ore pellets to supplier of sponge iron

THE PACE OF TRANSFORMATION



Source: LKAB presentation 23/11/2020



overview - **Canada**

- **Canada has two pellet producers, Iron Ore Company of Canada (IOC) and ArcelorMittal Canada (AM)**
 - **AM supplies DR grade pellets to captive DR plants in Canada and Germany**
 - **IOC supplies the wider DR market, with estimated shipments of ~ 3.5 mt in 2019 (1.7 mt 2018, with strike at IOC costing ~3 mt lost production)**
- **AM is considered unlikely to supply DR grade pellets to external DRI producers**

outlook: **Iron Ore Company of Canada (IOC)**

- **2019 pellet production was 10.5 mt (2018: 8.5 mt), 2019 pellet sales were 9.5 mt of which 3.3 mt was to DR markets (2018: 8.4 mt of which 1.7 mt to DR markets).**
- **Q3 2020 production of pellets + concentrate was 21% lower than the same period of 2019 due to an annual maintenance shutdown deferred from June to September as a result of COVID-19 travel restrictions. A weather-related power failure and mechanical issues also impacted production in Q3. 2020 guidance: 16.9 - 21.2 mt.**
- **Based on trade data 2020 Q1-3 supply to the DR market was 2.75 mt - estimated supply for all 2020 is ~3.6 mt.**
- **Expectation for 2021 is about ~4 mt and by the middle of the decade annual supply potential of ~5 mt DR grade pellets.**

outlook - **Bahrain Steel**

- **Bahrain Steel is in effect partly captive to adjacent DR plant SULB which produced 1.5 mt DRI in 2019 (est. 2019 pellet offtake from BS ~2.2 mt).**
- **Nameplate capacity of the two pellet lines is 11 mt and production at above this level has been achieved, although production is now market-constrained.**
- **Ore imports in 2019 per trade data: ~10 mt (main suppliers Brazil, Canada, Sweden) - production in 2019 estimated at ~10 mt and pellet supply to external DR markets in 2019 at ~8 mt (thought to include some toll conversion).**
- **Ore imports Q1-3 2020 per trade data: 5.7 mt, suggesting 2020 production of ~7.5 mt (pellet exports Q1-3 2020 were 4 mt, suggesting 5-6 mt for the year).**
- **20 year contract ($\geq 67\%$ Fe / $\leq 2\%$ gangue) with Anglo American/Minas Rio (annual DR grade pellet feed capacity of which is ~8 mt).**

outlook - **Tosyali Algeria**

- **Tosyali Algeria (2.5 mt DR plant) has adjacent 4 mt pellet plant, but no captive supply of pellet feed.**
- **Supply of suitable pellet feed has been a major constraint, initially due to lack of grinding capacity (now remedied), but also to difficulty in sourcing DR grade pellet feed and port constraints. Latest developments are port improvements and addition of a 4.5 mt ore beneficiation plant, due to commission in 2021.**
- **Pellet imports in 2019 per trade data were 1.1 mt (other sources suggest somewhat higher) and Q1-3 trade data (0.8 mt) suggest a somewhat higher level of pellet imports in 2020.**
- **Once the ore beneficiation plant is fully operational, dependence on imported pellets should be significantly reduced or eliminated by 2022.**
- **In-house pellet production in 2019 was ~1mt and is estimated at 1.8 mt in 2020. Based on a DRI production estimate of 2.2 mt in 2020, there is an apparent need for about 1.4 mt externally-sourced pellets.**

outlook - **Samarco**

- **Licensing process is complete.**
- **On track for restart in December 2020 – all equipment is operational.**
- **Ramp up will be progressive in three “step-by-step” phases (nominal capacity 7-8 mt pellets each phase):**
 - **Phase 1: starting with concentrator #3/pellet plant #4 with ramp-up Q1 2021**
 - **Phase 2: “official” position is to restart concentrator #2/pellet plant #3 in 2026, but could be sooner, say in 2023 - timing will depend on Phase 1 performance, etc.**
 - **Phase 3: timing is unclear at this point as a tailing solution has still to be determined, but will hopefully be by 2030 - based on 2015 performance, total pellet production of ~28 mt could be achieved**
- **Initial ramp-up will be on BF pellets - best estimate today is that product split in 2021 will be 50-60% BF pellets, 40-50% DR pellets (3.0-3.75 mt DR grade pellets) - ultimately product split will be market driven.**

(author's estimates)



“Samarco resumes its operation with a filtration technology whereby 80% of tailings (the coarsest sandy part) will be filtered and dry stacked. The finer slurry part, representing 20% of tailings, will be disposed of in the "Germano pit" (a totally confined environment).”



outlook - **Cleveland Cliffs**

- **Cleveland Cliffs produces DR grade pellets at its Northshore operation - capacity ~3.0 mt.**
- **Cliffs' Toledo HBI plant scheduled to start up in late 2020 and consume 2.7-2.8 mt pellets at full production.**
- **Thus, ~0.25 mt DR grade pellets is available for sale to third parties (understood to be contracted to Nucor).**



Metinvest – Central GOK

- **Upgrading plan approved in 2018 and now completed:**
 - **beneficiation plant: concentrate quality upgraded to 70.5% Fe**
 - **pellet plant: addition of double deck screening, new mixer and pelletising disc**
 - **pilot operation started in March 2020 with full scale operation from Q3/4 2020**
- **Nominal capacity is now 5.5 mt concentrate and 2.2 mt pellets (basis DR grade).**
- **Plan is to produce 2.0-2.2 mt DR grade pellets with target specification of min. 67.6% Fe and max. 2.6% SiO₂. DR plants In MENA region are the key target market.**
- **Production of pellets with Fe >67.5% in 2020 Q1-3 was 0.892 mt, delivered to traditional BF customers as DR pellet quality is being fine-tuned.**

Ferrexpo

- **According to its H1 2020 report, Ferrexpo produced and sold 0.185 mt DR grade pellets in the period and plans to increase production of DR grade pellets in the medium term.**

- **Mikhailovsky started pilot scale shipments of DR grade pellets (~68% Fe, 1.4% SiO₂) made from Lebedinsky concentrate to OEMK and Lebedinsky in mid-2020. Ore beneficiation is being upgraded to enable production of 16.4 mt high grade concentrate from 2022, including 8.8 mt flotation concentrate grading 70% Fe.**
- **Metalloinvest plans to produce ~0.5 mt DR grade pellets (68% Fe) at Mikhailovsky for trial shipments to the market in 2021 and could supply ~2 mt to the market from 2022 - the decision to produce DR or BF pellets will be market-/margin-driven.**
- **It is understood that Metalloinvest's 4th HBI plant (capacity 2.5 mt) will be built at Mikhailovsky – construction to start in H2 2021 and merchant HBI production to start in 2024. DR pellet production will be increased to supply this plant.**
- ***OMK is studying a project to build a 2.5 mt Energiron DR plant at Vyksa Metallurgical Plant (VMP), to be commissioned H2 2024. So far there is no final decision. Company has no iron ore assets.***

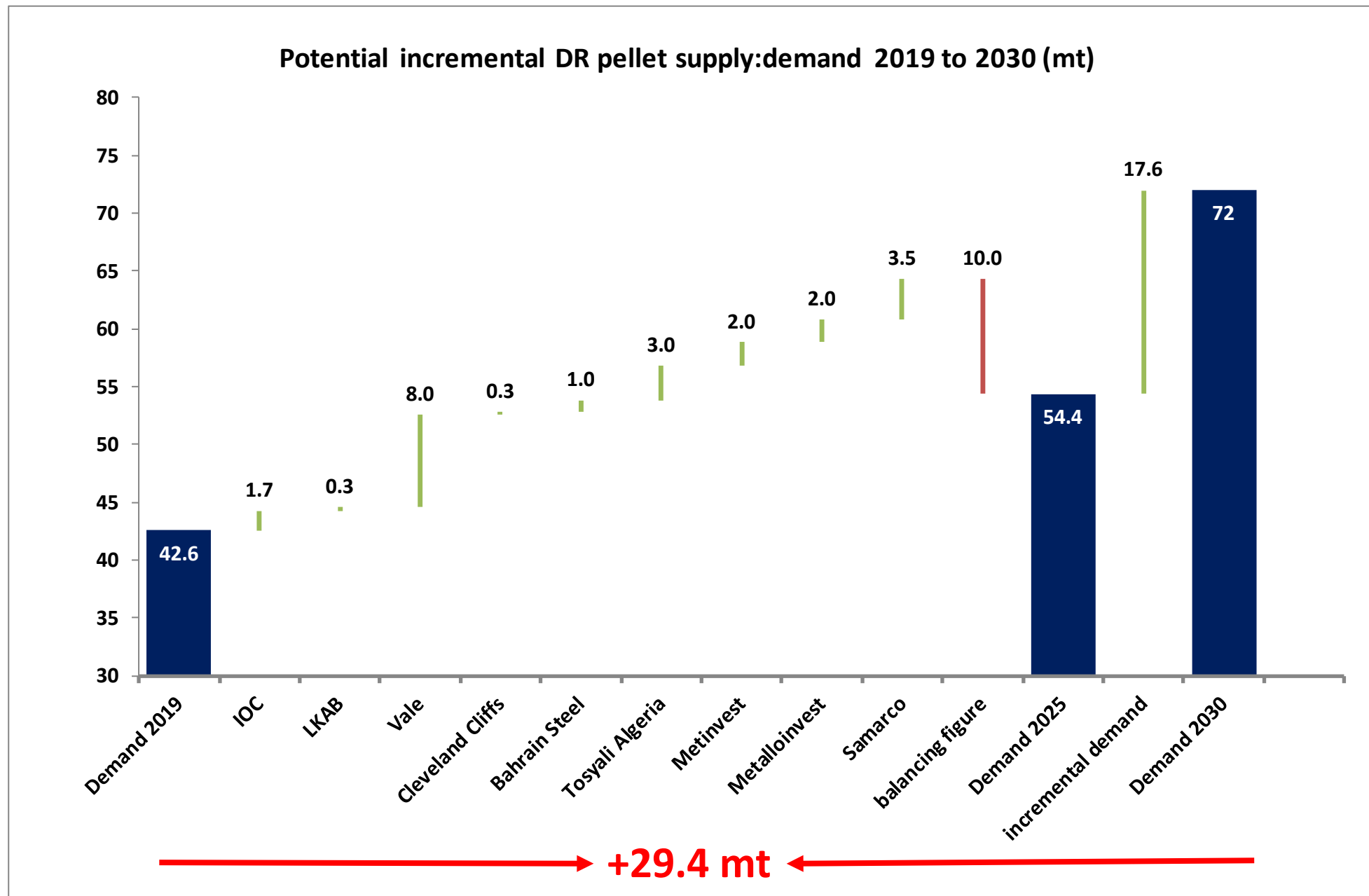


Image from Metalloinvest website

Lump ore

- **Main current supplier is Kumba (Anglo American) from Sishen mine:**
 - Only 0.16 mt DR grade was exported in 2019 + estimated supply to Saldanha Steel of about 0.6 mt.
 - Premium grade lump ore (typically 65.2% Fe) is understood to involve selective mining and as the pit gets deeper, scope for increased production is limited.
- **Potential new supplier is Baffinland Iron Mines' Mary River mine (jointly owned by ArcelorMittal and Nunavut Iron Ore):**
 - current production 6 mt of which 70% lump with >67% Fe, 1.6% SiO₂, 0.9% Al₂O₃ - could be enriched by selective mining
 - proposed Phase 2 Expansion Project would involve constructing a railway from the Mary River Mine Site to the Port Site, adding a second ore dock at the Port and increasing production to 12 Mt per year

- Assumes Vale reaches 60 mt pellet production of which 45% is DR grade
- Assumes Tosyali Algeria is self-sufficient in pellets by 2025
- Assumes 2026 start date for Samarco Phase 2
- According to this scenario, potential DR pellet supply exceeds demand by 18%
- To meet the 2030 level of demand, Samarco Phases 2 and 3 and much more will be needed....



Longer term considerations: carbon-neutral steelmaking

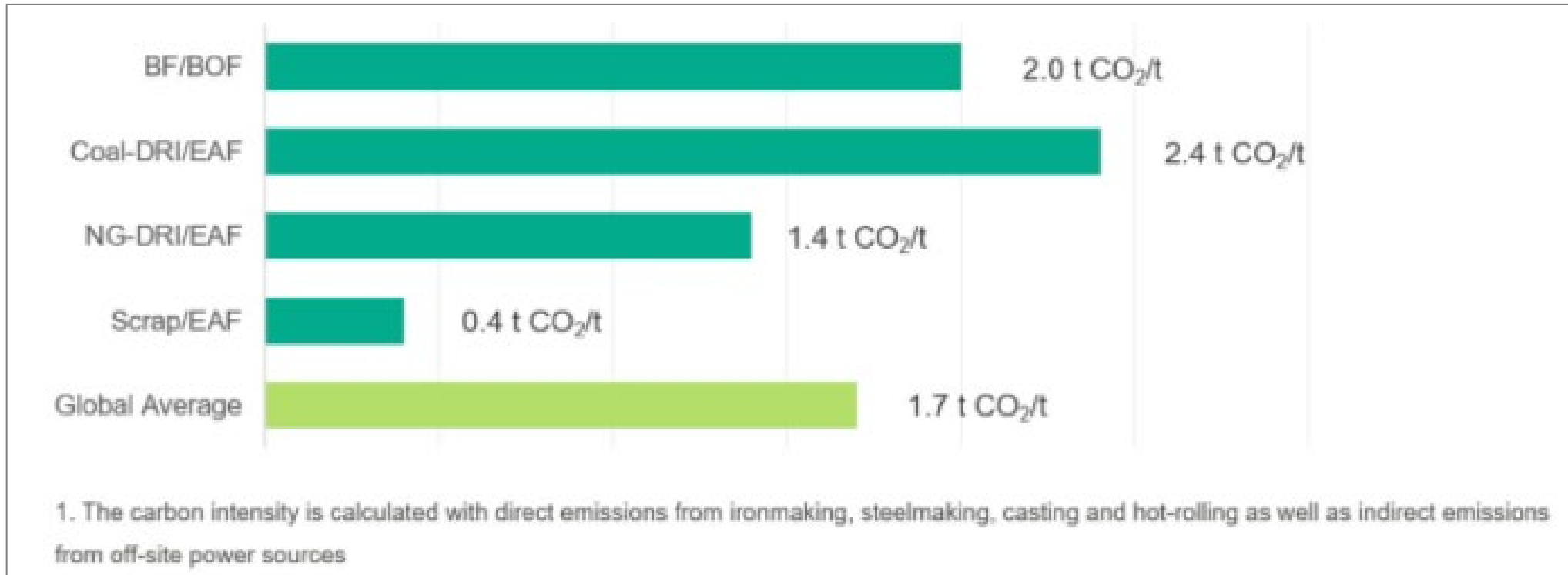
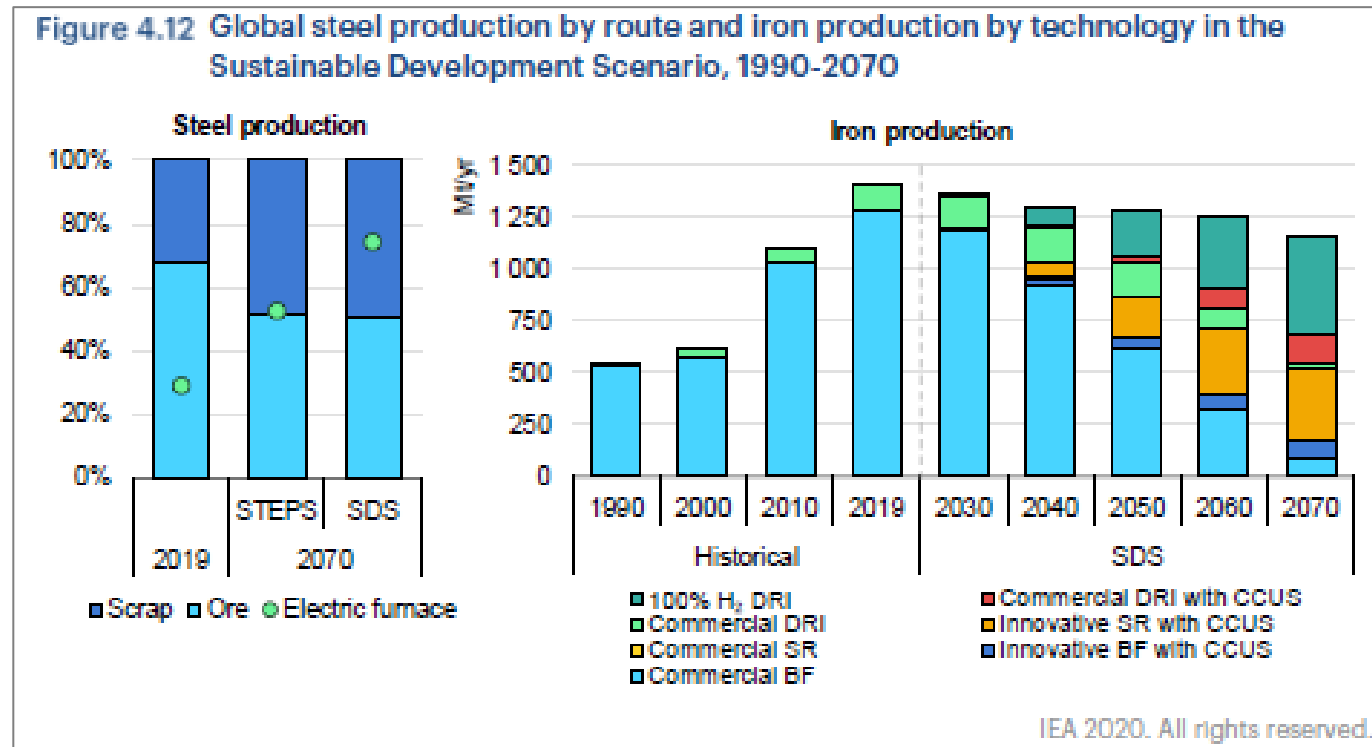


Chart from BHP's Pathways to decarbonisation episode two: steelmaking technology

International Energy Agency’s “Energy Technology Perspectives 2020” and “Iron & Steel Technology Roadmap”

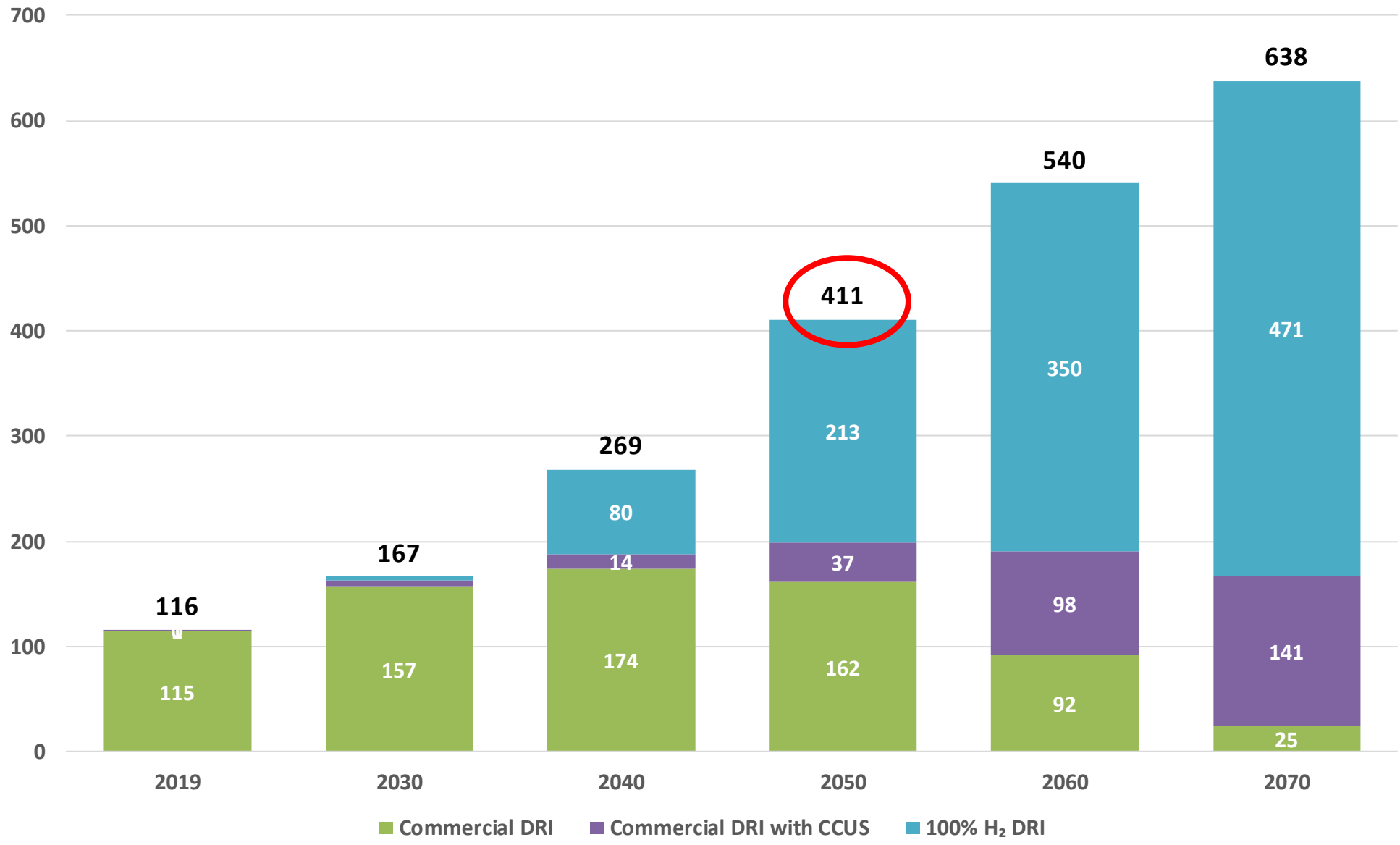
The IEA considers two scenarios:

- The **Stated Policies Scenario (STEPS)** takes into account countries’ energy- and climate-related policy commitments, including nationally determined contributions under the Paris Agreement, to provide a baseline against which to assess the additional policy actions and measures needed to achieve the Sustainable Development Scenario.
- The **Sustainable Development Scenario (SDS)** sets out the major changes that would be required to reach the main energy-related goals of the United Nations Sustainable Development Agenda, including an early peak and subsequent rapid reduction in emissions, in line with the Paris Agreement, universal access to modern energy by 2030 and a dramatic reduction in energy-related air pollution. The trajectory for emissions in the Sustainable Development Scenario is consistent with reaching global “net-zero” CO₂ emissions for the energy system as a whole by around 2070.





DRI production according to IEA's sustainable development scenario - mt



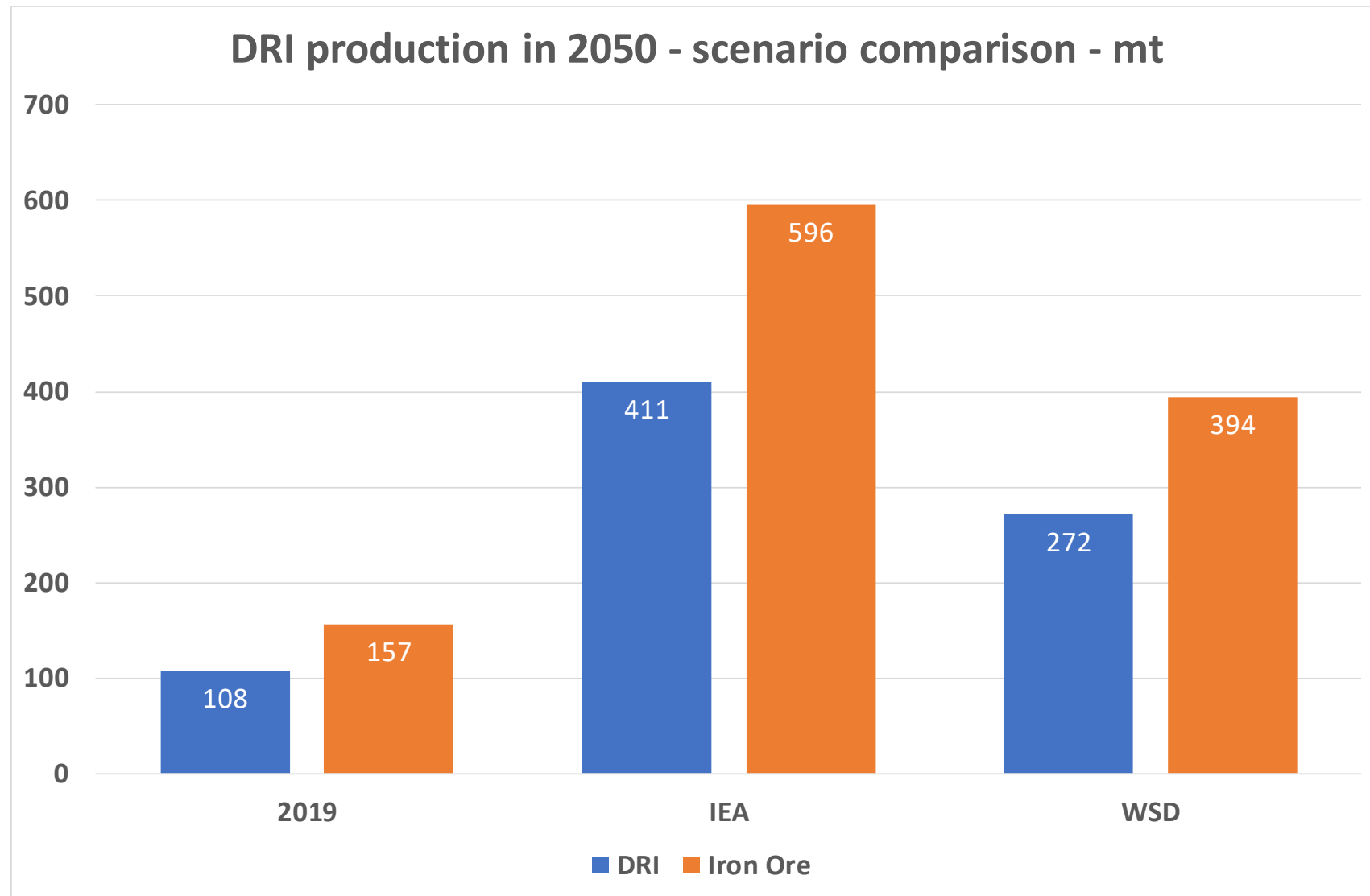


IIMA is preparing a White Paper on the role of and opportunities for ore-based metallics in the world of carbon neutral steelmaking - will be ready in 2021.

Thought starters:

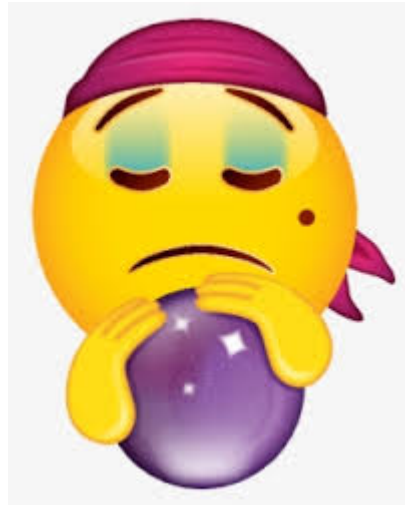
- **Iron ore quality in general is not improving – more beneficiation will be needed**
- **Should future DR plants be somehow integrated with iron ore mines and/or pellet plants?**
- **Is there scope for fines-based DR processes?**

A head scratcher to conclude....





IIMA contact information



Health warning: a forecast (or even a scenario) is not a prophecy!

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