



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

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FASTMARKETS AMM STEEL SCRAP, DRI & MINI-MILLS CONFERENCE
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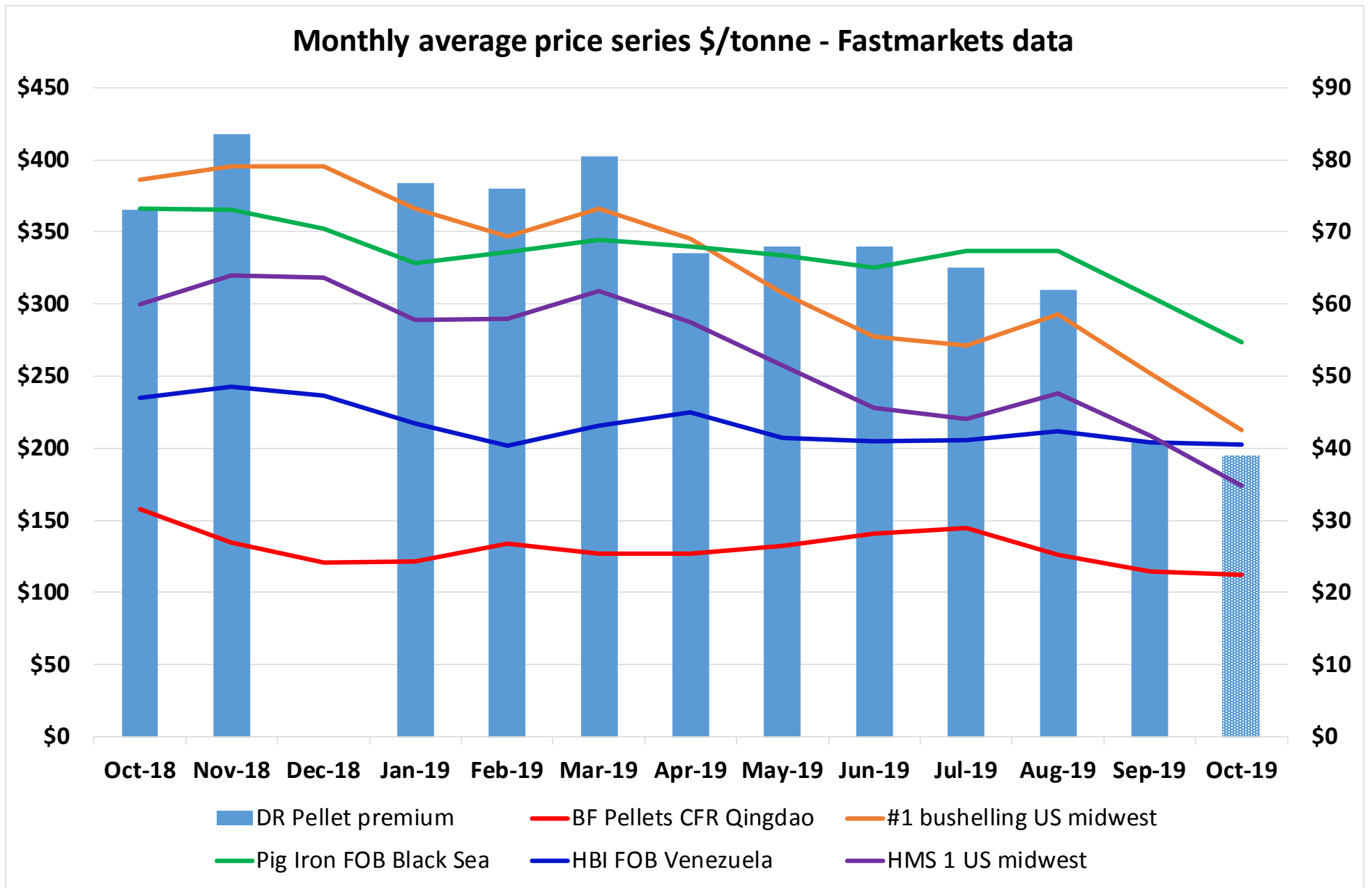
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- **Setting the scene**
- **June 2019 analysis revisited**
- **Outlook for DR grade pellet supply**

Fastmarkets AMM DRI and mini-mills conference - June 2019

[The Global HBI/DRI Market: outlook for DR Grade pellet supply](#)

Setting the scene

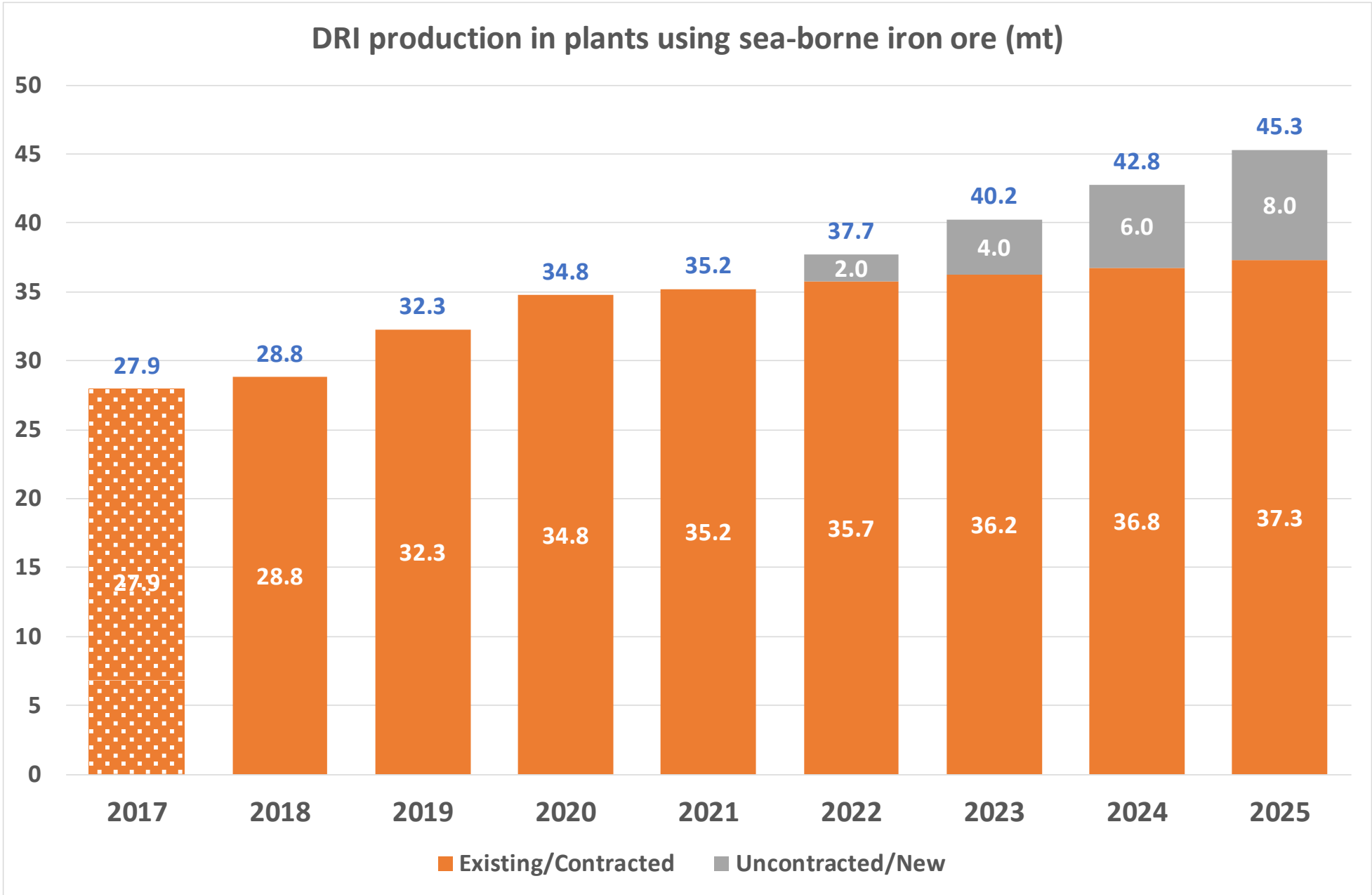


History: DR grade pellet supply issues

- **Samarco remains shut down (pellet capacity 30.5 mt)**
 - no definitive date for restart - H2 2020 at the earliest
- **IOC strike cost ± 3 mt pellet production in 2018**
 - 2018 pellet production: 8.5 mt (capacity about 12.5 mt)
- **LKAB's Svappavaara plant was out of operation through February 2019 - 4 months lost production**
- **Anglo American's Minas Rio operation shut down in March 2018 for pipeline repairs, re-started Q4 2018**
- **Bahrain Steel 2018 production constrained by pellet feed supply**
- **January 2019: Vale's dam collapse at Córrego do Feijão Mine in Brumadinho (MG)**

June 2019 analysis

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

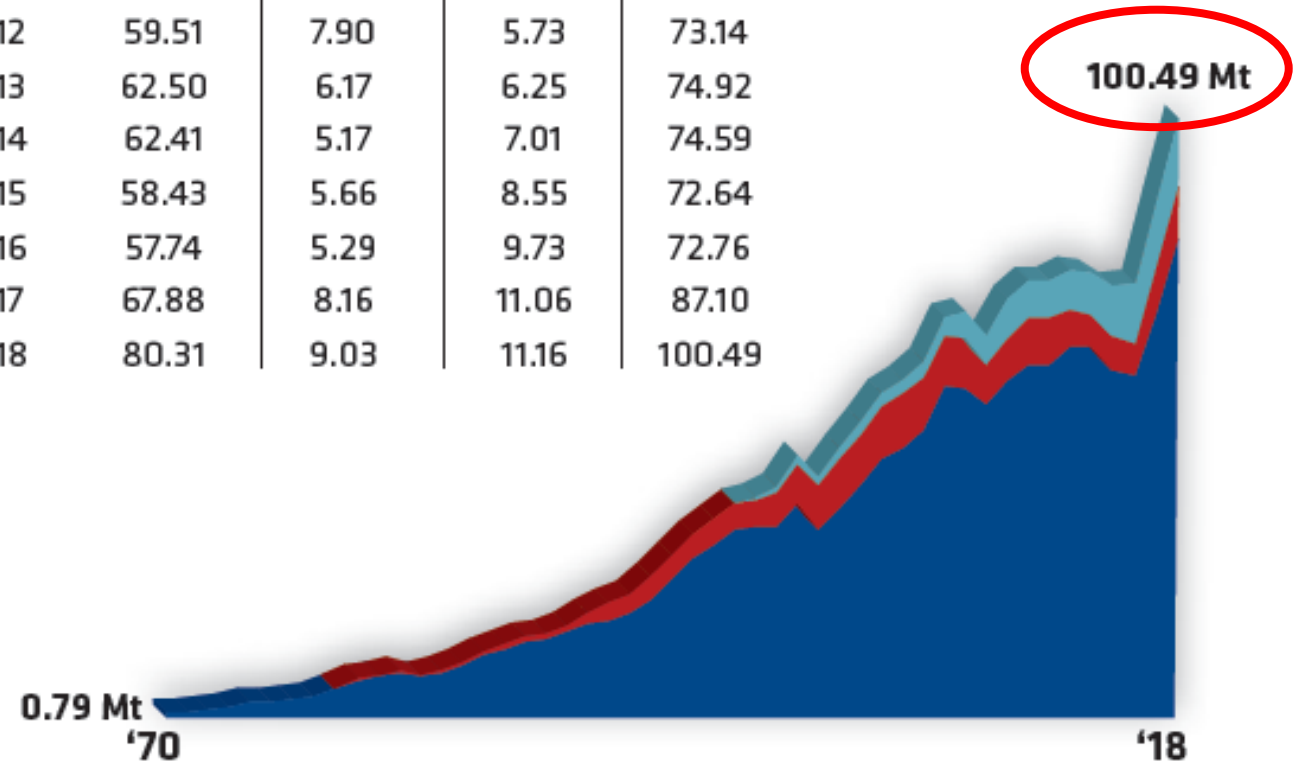


World DRI Production by Year (Mt)

Source: Midrex Technologies, Inc.

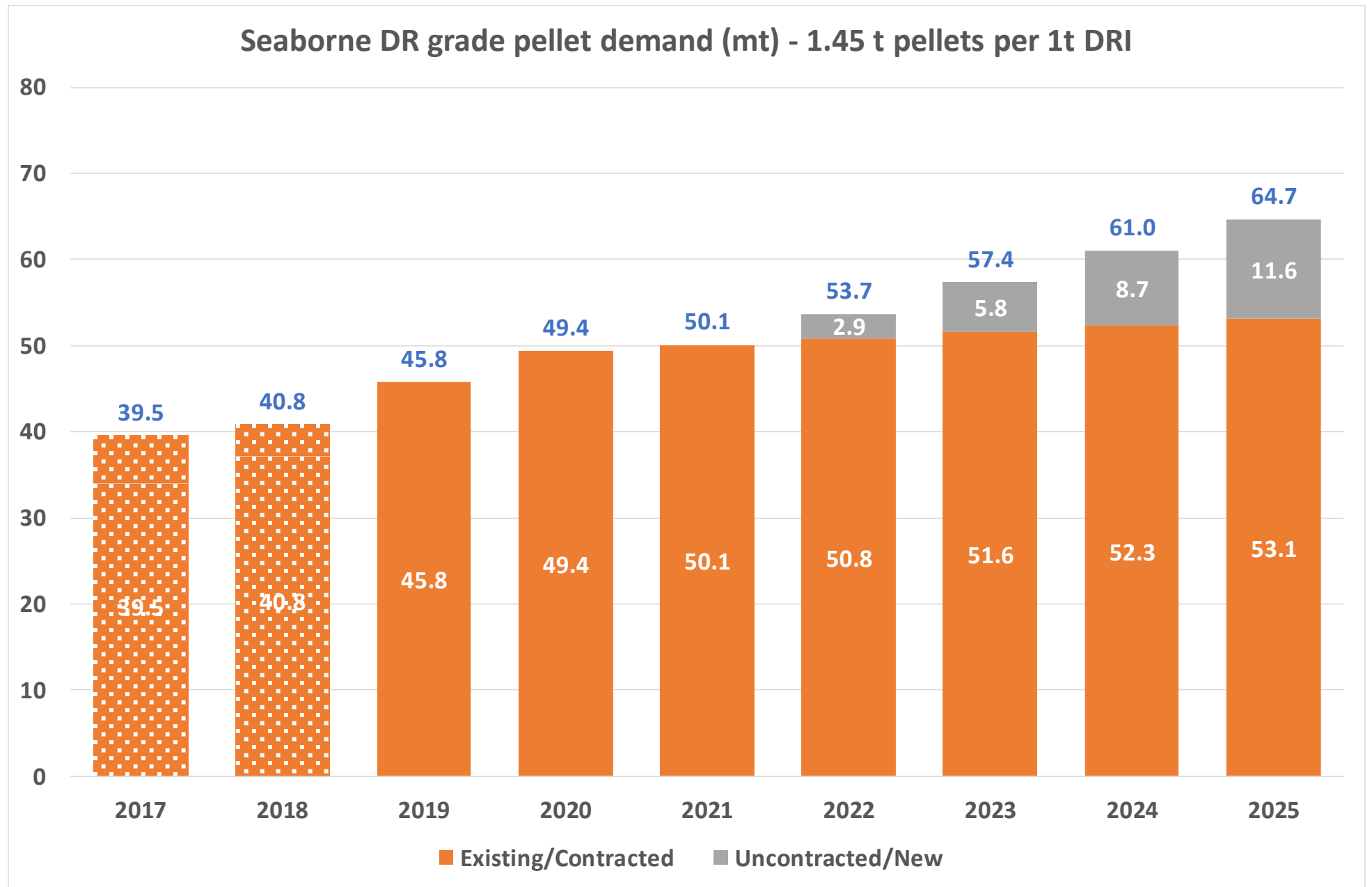
Year	Total	Year	Total	Year	CDRI	HBI	HDRI	Total
'70	0.79	'88	14.09	'06	48.41	8.60	2.69	59.70
'71	0.95	'89	15.63	'07	55.79	8.34	2.99	67.12
'72	1.39	'90	17.68	'08	55.52	8.19	4.24	67.95
'73	1.90	'91	19.32	'09	52.54	6.93	4.86	64.33
'74	2.72	'92	20.51	'10	56.60	7.21	6.47	70.28
'75	2.81	'93	23.65	'11	59.41	7.60	6.20	73.21
'76	3.02	'94	27.37	'12	59.51	7.90	5.73	73.14
'77	3.52	'95	30.67	'13	62.50	6.17	6.25	74.92
'78	5.00	'96	33.30	'14	62.41	5.17	7.01	74.59
'79	6.64	'97	36.19	'15	58.43	5.66	8.55	72.64
'80	7.14	'98	36.96	'16	57.74	5.29	9.73	72.76
'81	7.92	'99	38.60	'17	67.88	8.16	11.06	87.10
'82	7.28	'00	43.78	'18	80.31	9.03	11.16	100.49
'83	7.90	'01	40.32					
'84	9.34	'02	45.08					
'85	11.17	'03	49.45					
'86	12.53	'04	54.60					
'87	13.52	'05	56.87					

■ HDRI
■ HBI
■ CDRI



June 2019 analysis

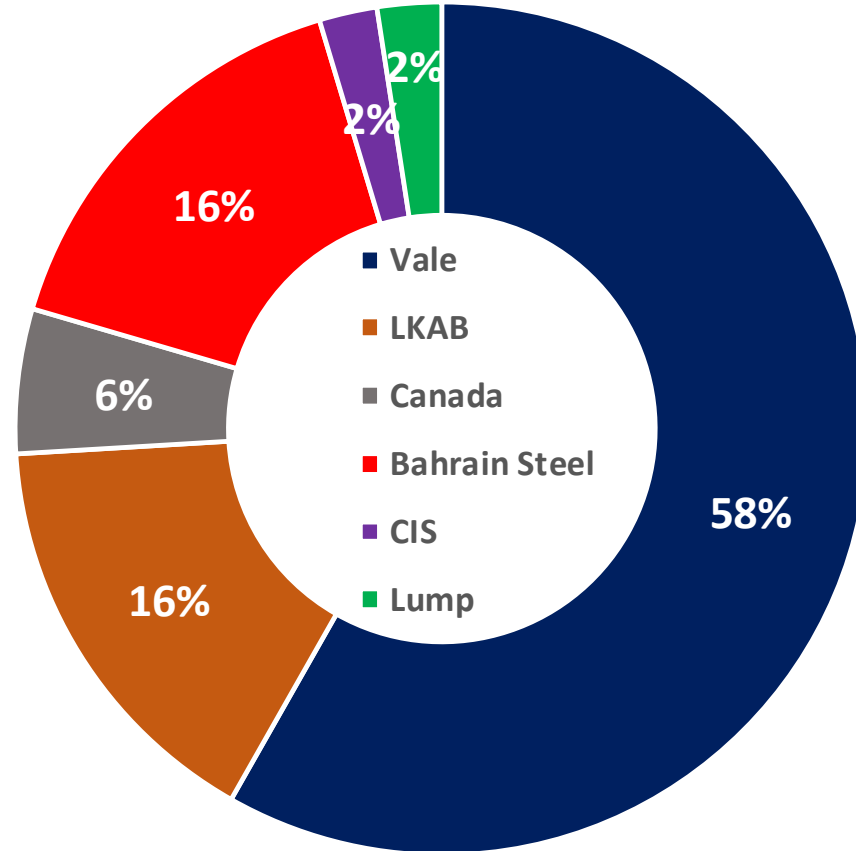
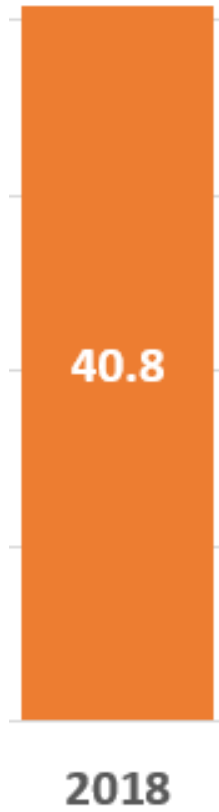
Argentina
Trinidad
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Malaysia



June 2018 analysis: the gap to bridge

- **Between 2018 and 2025, DRI production at plants using seaborne pellets increases by 16.5 mt, requiring an additional 23.9 mt iron ore, ideally DR grade pellets:**
 - **short/medium term (between 2018 and 2020): +6 mt DRI production, requiring +8.6 mt iron ore**
 - **longer term (between 2020 and 2025): +10.5 mt DRI production, requiring +15.3 mt iron ore**

Seaborne Ore Supply to DR plants 2018 (mt) - total 41.1 mt source: trade statistics, private communications



- **In 2018 Vale restarted idled pellet plants with aggregate capacity of 13 mt, adding ± 5 mt production in 2018, bringing total capacity in Brazil and Oman to ± 60 mt.**
- **Estimated pellet supply to the DR sector in 2018 = 23.9 mt, $\pm 42\%$ of total 56.6 mt pellet deliveries (2017: 21.7 mt, $\pm 43\%$). 2018 DR pellet production was 24.5 mt (9.5 mt in Oman).**
- **Prior to the Brumadinho dam rupture, we estimated Vale's supply of DR grade pellets in 2019 and 2020 at ± 27 mt ($\pm 45\%$ of pellet sales by volume).**

- **Vale's Vargem Grande and Fabrica pellet plants (with aggregate capacity about 11 mt) expected to resume in 2019 and H2 2020 respectively - these plants were focused on the domestic market.**
- **Vale hoped to increase production at São Luis to 7 mt in 2019 (0.95 mt in 2018) - a challenging goal. Q1-3 2019 production 2.85 mt (abnormal rains in Q2).**
- **DR grade pellet production at the Tubarão plants constrained by reduced supply of high grade pellet feed from the Brucutu and Timbopeba mines. Total production Q1-3 2019 21.47 mt (12.3% below Q1-3 2018).**
- **Oman was expected to produce at full capacity ± 9.5 mt in 2019 - using some feed from Carajas, perhaps 25-30%. Q1-3 2019 production 6.84 mt (scheduled maintenance on both lines in Q1). Some BF pellets being produced in Oman in 2019.**
- **Vale's updated guidance for 2019 pellet production reduced from 45 mt to 43 mt - estimated 19 mt DR grade (44.2%).**

- **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 production / sales in 2018: 23.9 mt / 22.1 mt.**
- **Estimated DR grade pellet supply (basis trade data):**
 - **6.5 mt (36.4% of total exports by volume) in 2018**
 - **2.9 mt (33.7% of total exports by volume) in 2019 H1**
- **Based on its contract portfolio, it seems that about 7 mtpy is a maximum level of DR grade pellet supply for the foreseeable future.**

- **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 1.7 mt in 2018 (3.3 mt in 2017).**

- **AM is considered unlikely to supply DR grade pellets to external DRI producers.**

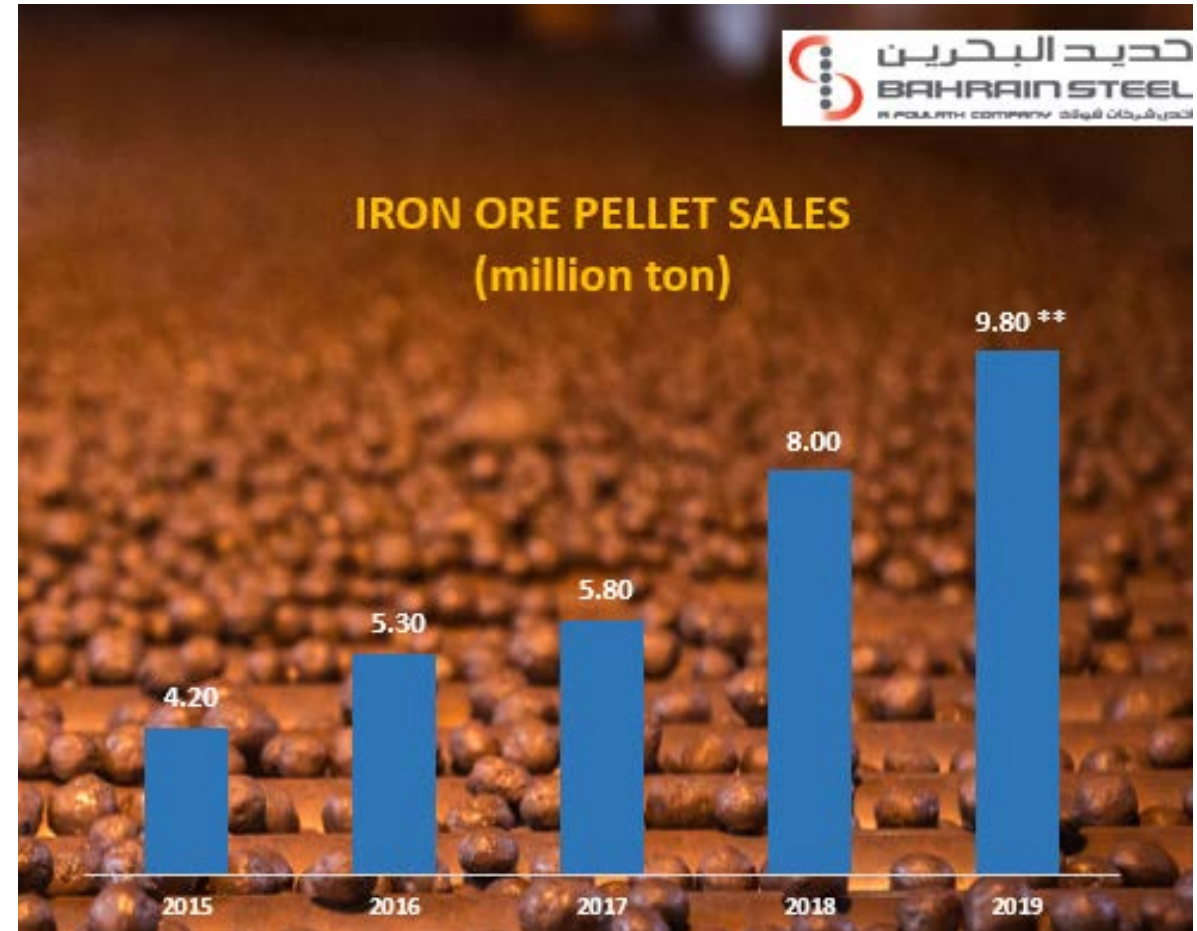
outlook: Iron Ore Company of Canada (IOC)

- **IOC's original ambition for 2019 was to increase supply to the DR markets to close to 4 Mt ($\frac{1}{3}$ of estimated production of about 12 mt)**
- **2019 Q1-3 pellet production 7.646 mt (2018 Q1-3: 6.156 mt)**
- **2019 1-7 supply to the DR market estimated at 2.08 mt - estimated supply to DR markets in 2019 is about 3.5 mt**
- **Ramp up towards nameplate capacity is likely to be achieved by/in 2021 when all six lines will have been repaired/upgraded**
- **Split between DR and BF markets is market and margin dependent, but DR share could in theory be 50%**

- **Bahrain Steel is in effect partly captive to adjacent DR plant SULB which produced 1.6 mt DRI in 2018 (est. 2018 pellet offtake from BS 2.2 mt).**
- **Production in 2018 was 8.2 mt and estimate for 2019 is 9.5-10 mt - nameplate capacity of the two pellet lines is 11 mt and production at above this level has been achieved, but production is now market-constrained.**
- **Ore imports in 2018 per export data: 8.8 mt (mainly Brazil, Chile and Canada). Pellet supply to external markets in 2018 was about 6.5 mt (thought to include some toll conversion).**
- **New 20 year contract ($\geq 67\%$ Fe / $\leq 2\%$ gangue) signed with Anglo American (Minas Rio production guidance for 2019 is 20-22 mt [wet basis] - Q1-3 2019 production 17 mt). Minas Rio DR grade pellet feed capacity is 8 mt.**

Bahrain Steel in 2019

- Ore imports 2019 1-7 per export data: 6.5 mt (Brazil, Canada, Sweden).
- Pellet exports same period 5.6 mt (incl. 0.3 mt to China, balance to DR market).
- Sales estimate for 2019: **9.5 mt** - reduced since September (includes offtake by SULB)



Source: Bahrain Steel presentation at Saudi Intl Iron & Steel Conference. September 2019

- **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 was a major constraint due to lack of grinding capacity which is now being remedied - the grinding plant will be completed in late 2019/early 2020.**
- **Pellet production is understood to have been about 0.15 mt in 2018 and is expected to be about 2.5 mt in 2019, now running at full capacity rate - 2020 production target not yet finalised.**
- **Currently pellet plant feedstock sources are understood to be Ukraine, Chile, Brazil (2019 1-7 imports per export data: 0.8 mt)**

- **Licensing process almost completed - now expected by end October 2019. LOC (corrective operational licensing) for Germano complex is last step. This will enable work to start on filtration plants. Alegria Sul pit is licensed and ready.**
- **Restart now planned for 2020 Q3/Q4, most likely Q4.**
- **Ramp up will progressive - starting with one concentrator/pellet plant (7-8 mt pellets); the second (7-8 mt pellets) could be 1-2 years later; timing of the third (8 mt pellets) is still unclear at this point.**
- **Best estimate today is that product split will be similar to the pre-dam collapse - $\pm 50\%$ BF pellets, $\pm 50\%$ DR pellets (3.5-4 mt DR grade pellets) in first phase.**
- **Samarco is starting re-establish contact with key customers.**

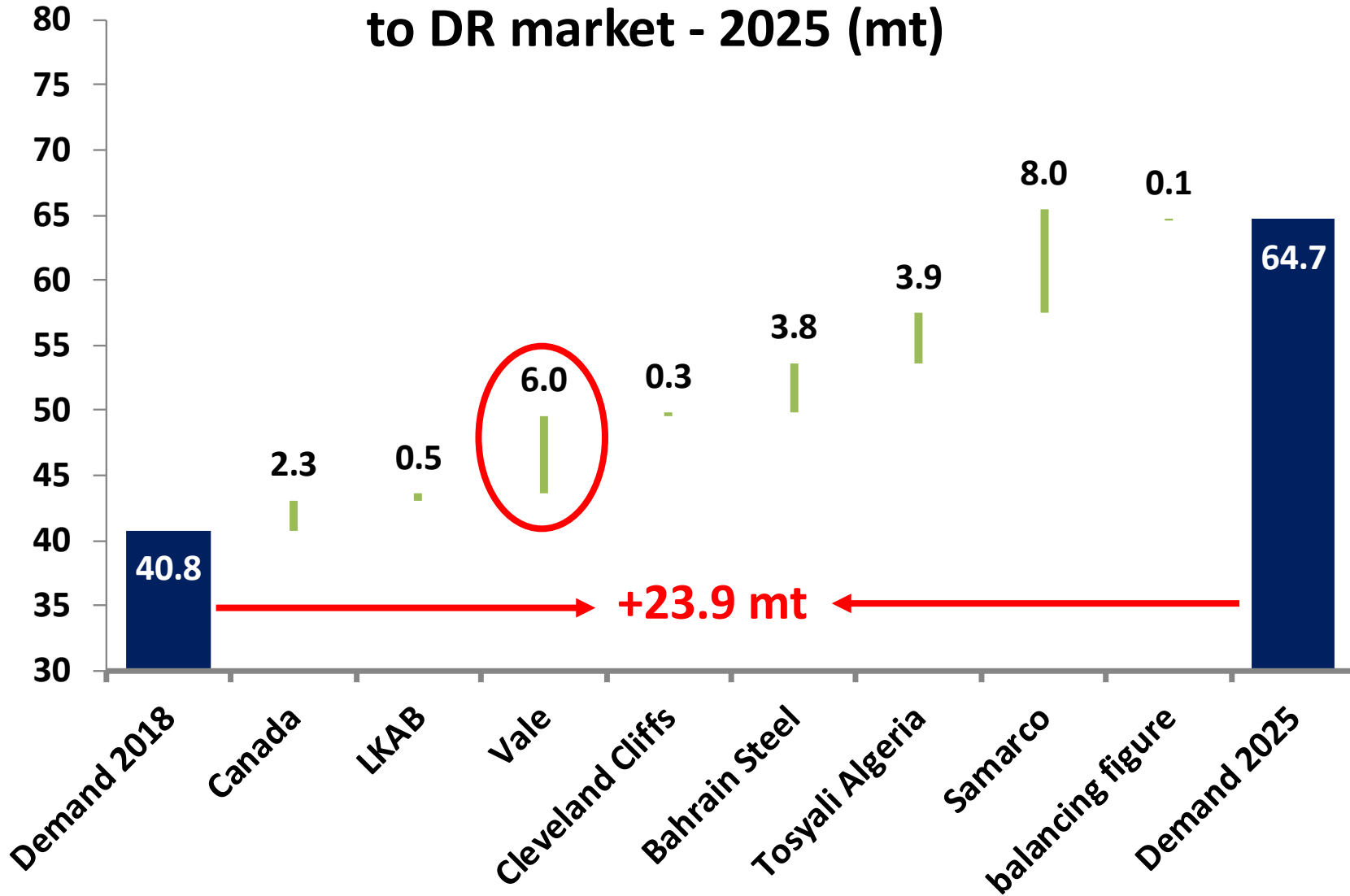
(author's estimates)

outlook - **Cleveland Cliffs**

- **Cleveland Cliffs has started DR grade pellet production at its Northshore operation - capacity 3.0 mt.**
- **Cliffs' Toledo HBI plant scheduled to start up in mid-2020 and consume 2.7-2.8 mt pellets.**
- **Thus, 0.25 mt DR grade pellets is potentially available for sale to third parties.**

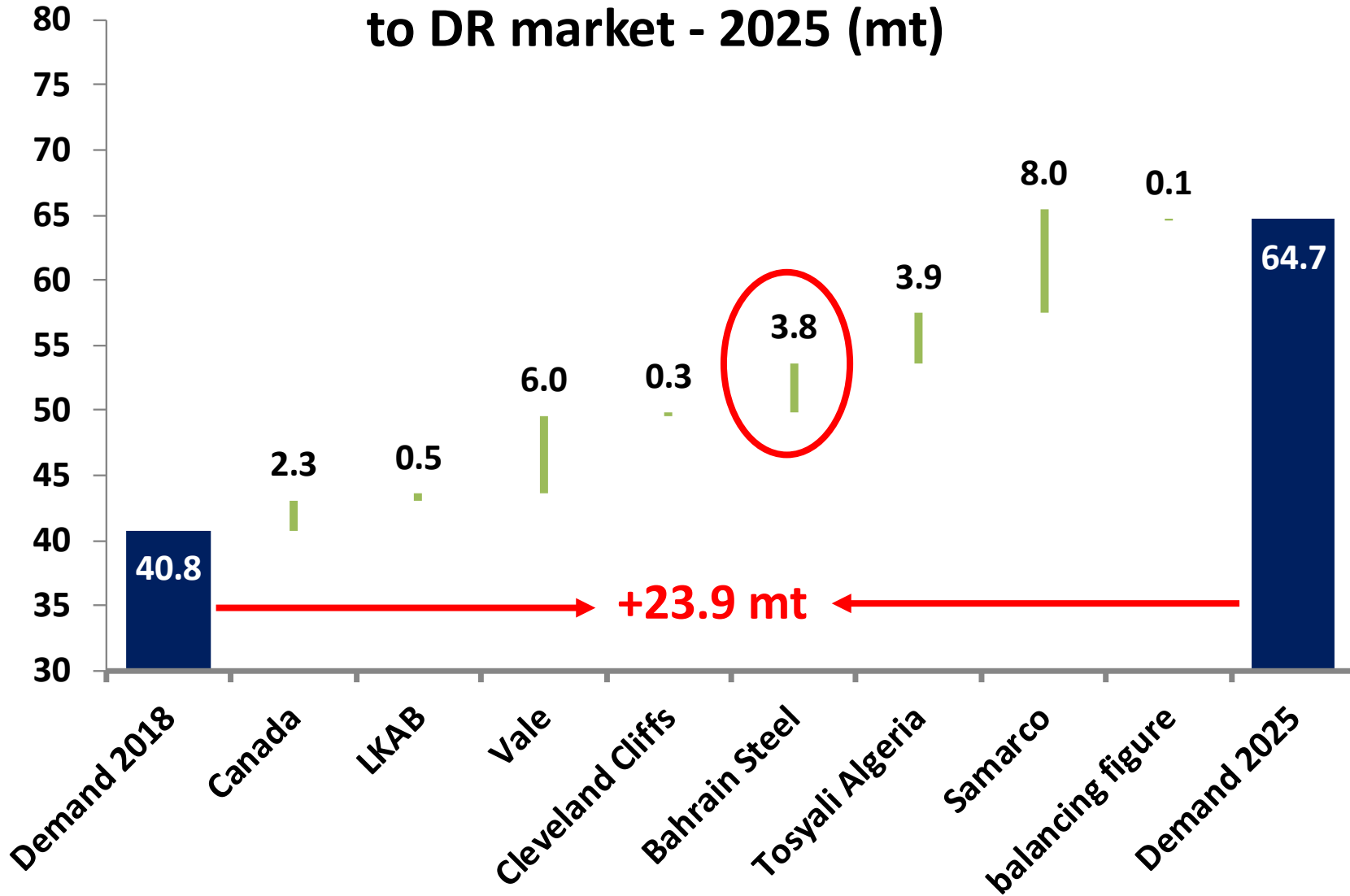


Potential incremental pellet supply to DR market - 2025 (mt)



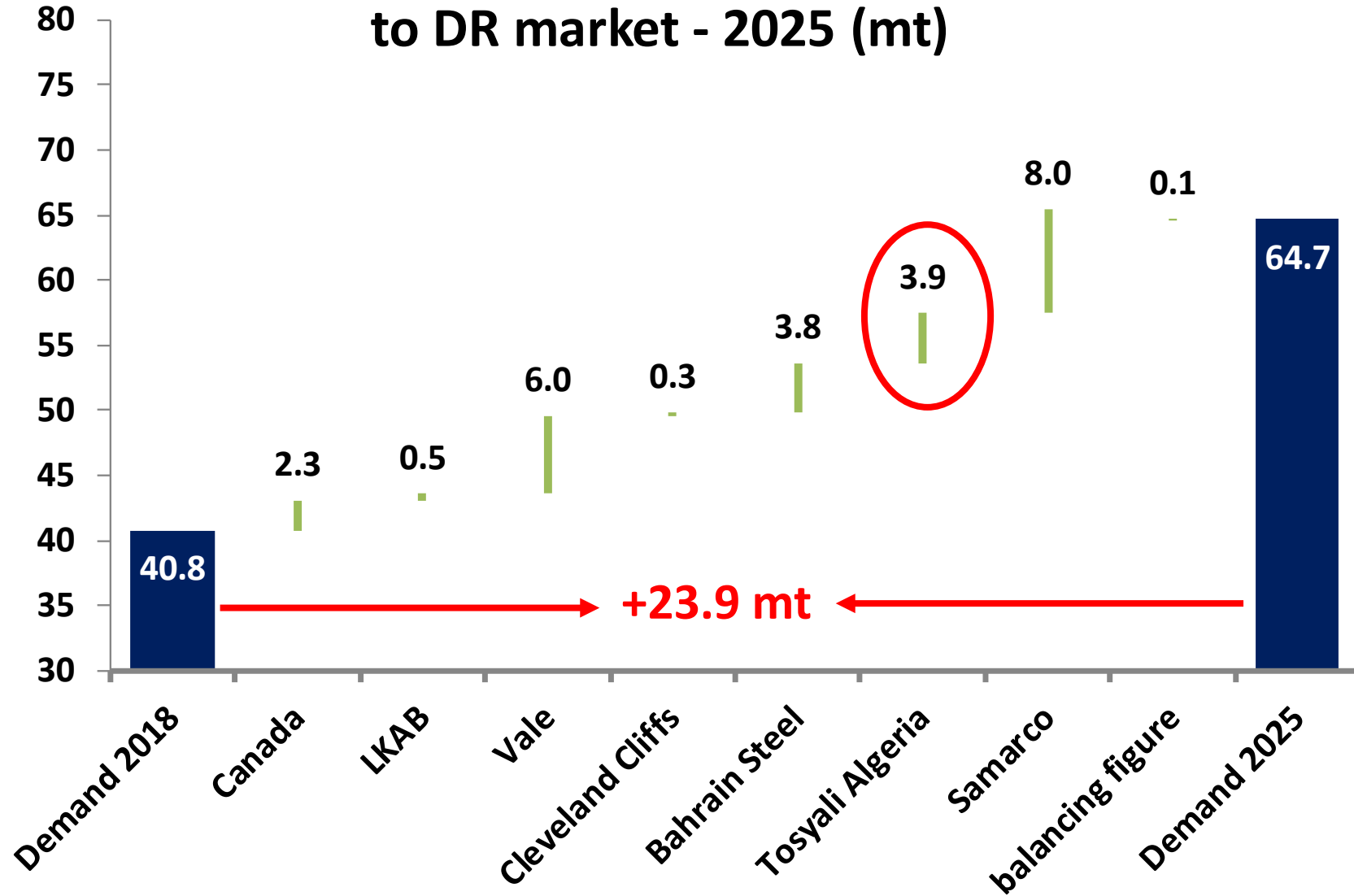
NB: 2018 supply included 0.9 mt Russian pellets and 1.0 mt South African lump ore

Potential incremental pellet supply to DR market - 2025 (mt)



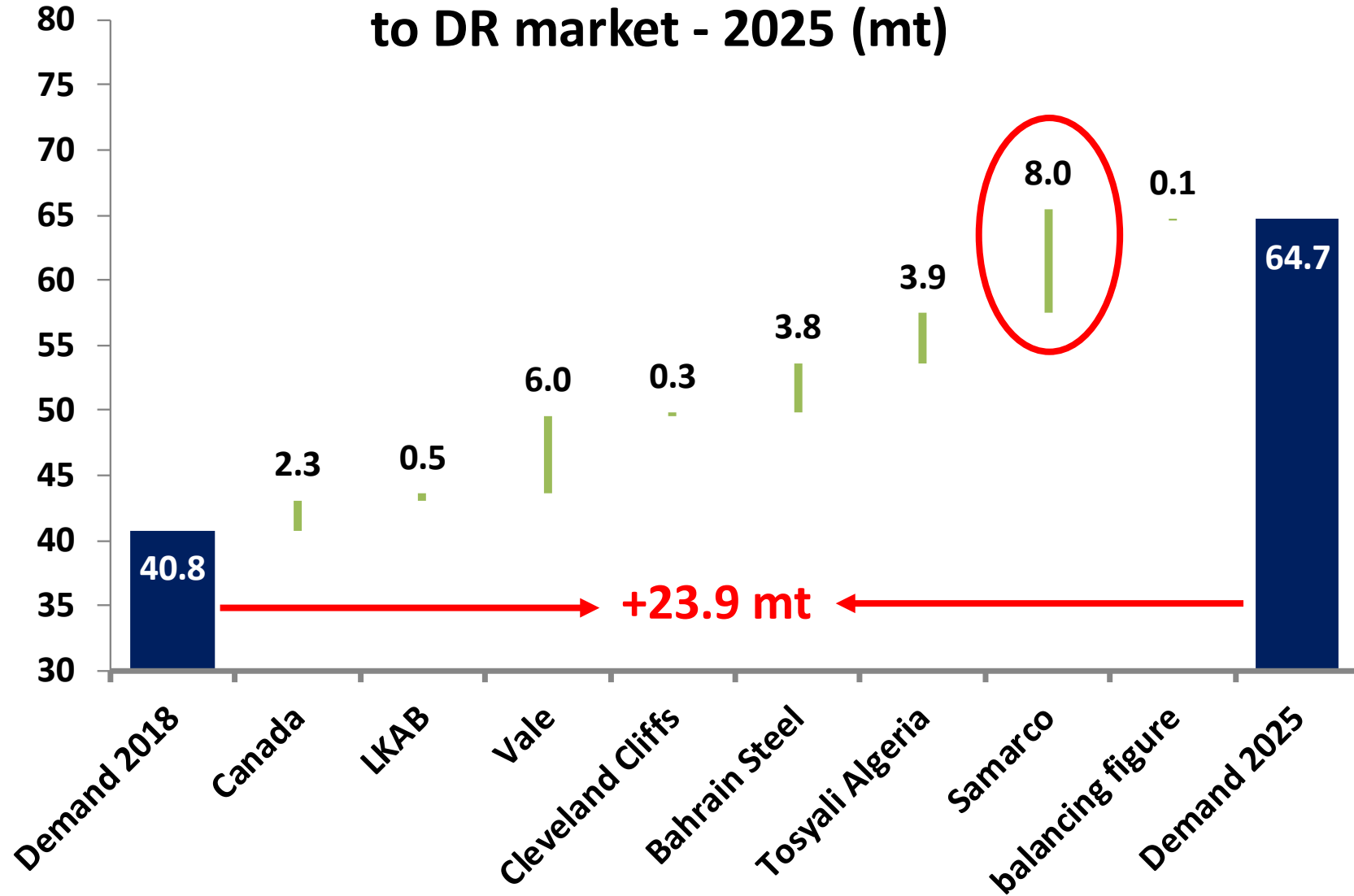
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Potential incremental pellet supply to DR market - 2025 (mt)



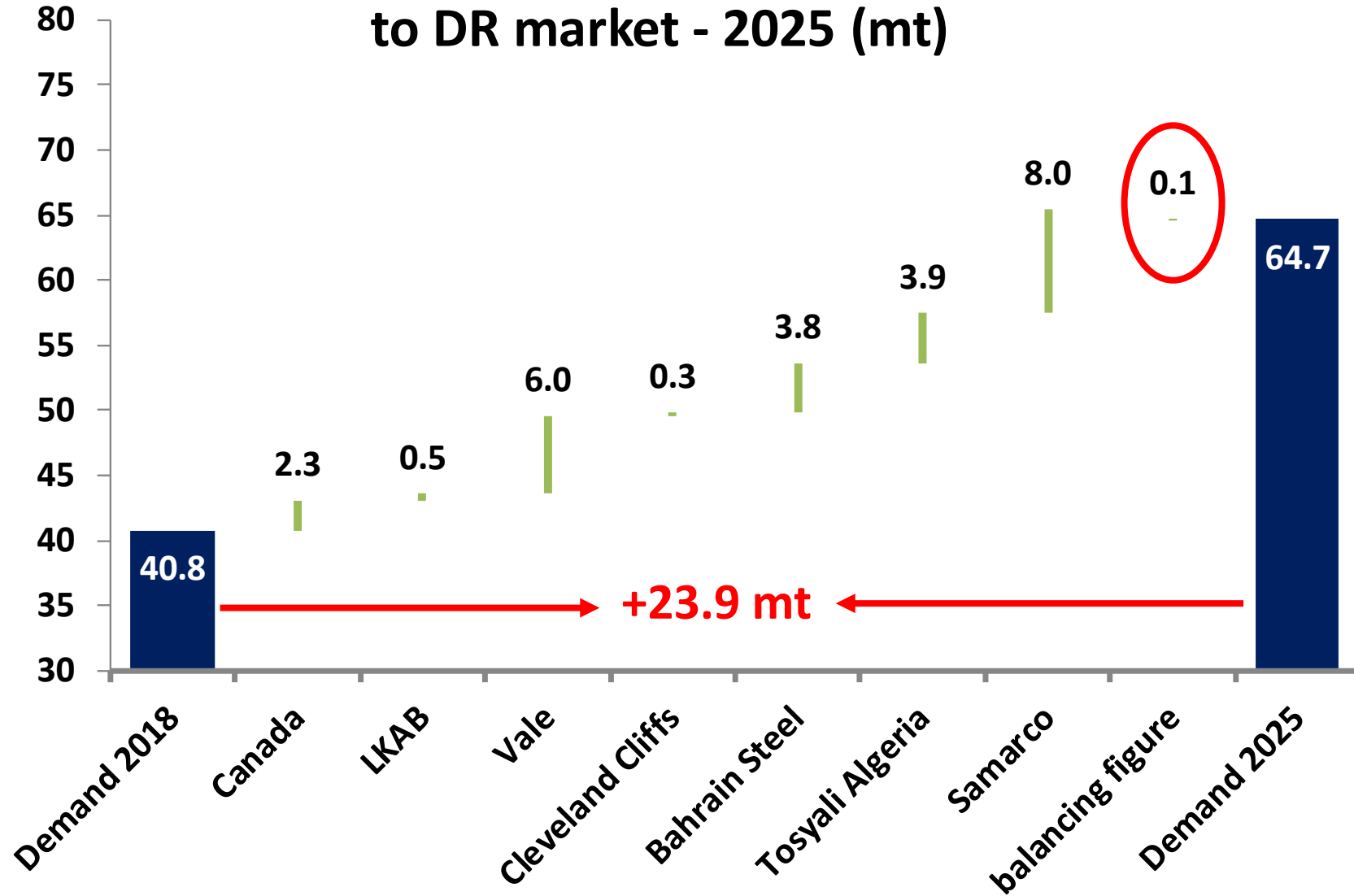
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Potential incremental pellet supply to DR market - 2025 (mt)



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Potential incremental pellet supply to DR market - 2025 (mt)



NB: 2018 supply included 0.9 mt Russian pellets and 1.0 mt South African lump ore

- **Nominal capacity 6 mt concentrate and 2 mt pellets**
- **Upgrading plan approved in 2018 due for completion in 2020:**
 - **beneficiation plant: concentrate quality to be upgraded to 70.5% Fe**
 - **pellet plant: addition of double deck screening, new mixer and pelletising disc - due for completion in April 2020.**
- **Plan is to produce 2.2-2.4 mt pellets with target specification of min. 67.6% Fe and max. 2.6% SiO₂. DR market is a key target.**

Russia - Metalloinvest (Lebedinsky + Mikhailovsky)

- **Current pellet chemistry: 66.0% Fe, 3.0% max. SiO₂ - has been supplied to several DR plants, but currently all sold to BF market.**
- **Future plans include addition of flotation circuits at both operations, enabling production of 70% Fe concentrate and pellets with 67.5% Fe and 1.65% SiO₂ - an investment decision is expected in mid 2020.**
- **Whether or not Metalloinvest offers such pellets to the market depends on the requirements of its HBI plants.**

- **Main current supplier is Kumba (Anglo American) from Sishen mine:**
 - about 1 mt DR grade was exported in 2018 + estimated supply to Saldanha Steel of about 0.8 mt
 - DR grade ore 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
 - production being expanded to 12 mt by 2022

Summary and Key Questions

- **What could go wrong in any given year?**
 - Further delays at Samarco
 - Mining problems in Brazil (affecting VALE, Minas Rio, others)
 - Labor problems in Canada, elsewhere
 - Pellet plant breakdowns
 - Logistic challenges: rail derailments, shipping Port accidents, etc.

- **What could go right?**
 - Faster, deeper ramp up at Samarco
 - Improved DR pellet feed availability: CIS, Canada, Sweden, Australia

Health warning: a forecast is not a prophecy!





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

- Various development projects:
 - **Kaunis Iron** started production at the Pajala mine in northern Sweden in July 2018 aiming to produce 69% Fe concentrate at 2 mtpy rate by Q1 2019 (former operator Northland Resources went bankrupt in 2014).
 - **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 mt from early 2020s - now undertaking bankable feasibility study
 - **Sydvaranger AS** plans to restart high grade concentrate production at the Bjørnevatn mine in mid 2019 (former operator Northern Iron ceased operations in 2015)