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17<sup>th</sup> Arab Steel Summit  
and International Iron and Steel Exhibition

  
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# Challenges and Solutions in Operating a Direct Reduction Plant in the Middle East

  
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# OVERVIEW OF THE MIDDLE EAST'S DIRECT REDUCTION PLANT LANDSCAPE

- Current landscape of the DRI industry, clearly shows that the Middle East is indeed a powerhouse. In recent years, the region produced approximately 60.9 million tons of DRI, marking a significant increase over previous years.
- Middle East is home to key players such as **Saudi Arabia, Qatar, UAE, Bahrain, Oman, Egypt, Kuwait, and Algeria**. According to the recent 2023 production statistics released by Midrex. Saudi Arabia and Egypt rank among the top five producers globally.
- This region is truly a cornerstone of global DRI production

## FEW KEY PLAYERS IN MIDDLE EAST

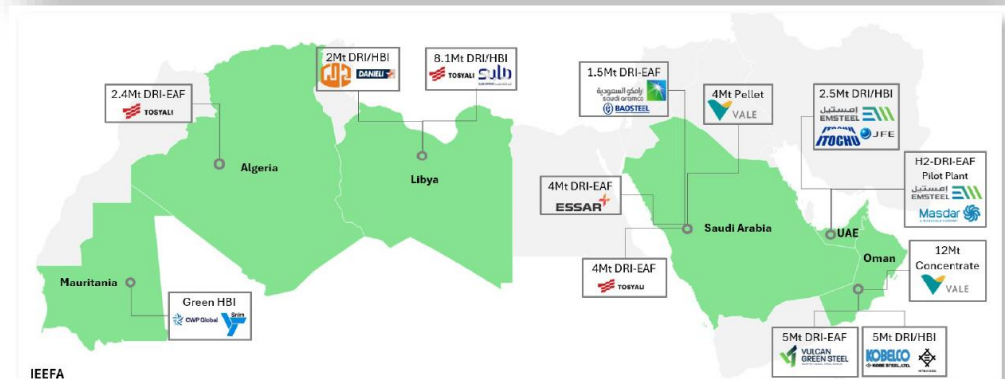
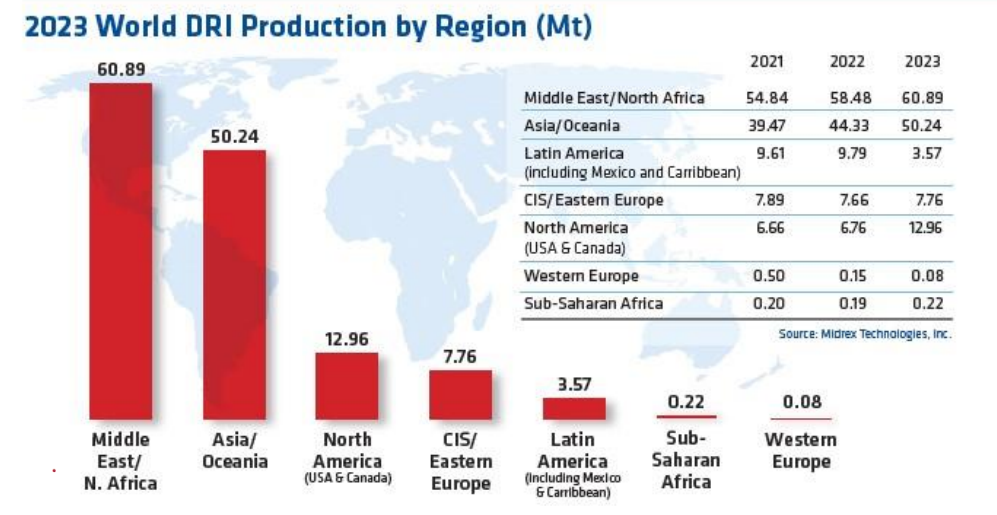
Saudi Arabia	- Saudi Iron & Steel Company (Hadeed)
Qatar	- Qatar Steel
UAE	- EM Steel
Egypt	- Ezz Steel, Suez Steel Company
Algeria	- Algerian Qatari Steel (AQS) ,Tosyali Algeria
Bahrain	- United Steel Company (SULB)



**MIDDLE EAST AND NORTH AFRICA**

# OVERVIEW OF THE MIDDLE EAST'S DIRECT REDUCTION PLANT LANDSCAPE

- The demand for direct reduction productivity, closely tied to global steel demand, is now on the rise
- The Middle East dominated the DRI market with a share of 39.3% in 2023 and are expected to grow by 5-6% by 2030.
- According to the World Steel Association, nearly 80 million tons of new DRI capacity expansions are forecasted globally by 2030, with 32 million tons coming from the Middle East. This proves that Middle East will continue to be a key player in global DRI production.
- The regional breakdown is as follows: Europe (including Russia) – 34 million tons ,Asia and Other – 14 million tons.
- Continuous investments in technological advancements and infrastructure development are pushing the regional DRI market forward.
- However, in this fast-changing and competitive environment, we must face the challenges to move forward and find new ways to stay strong in the global market.



# OVERVIEW OF QATAR STEEL DR MODULE KEY PERFORMANCE

Some of the impressive achievements of Qatar Steel's Direct Reduction plant.



**Qatar Steel, established in 1974 as the first integrated steel plant in the Arabian Gulf, is celebrating 50 years of excellence this year**



**DR Model-2 is the first combo module in the Midrex family capable of producing both Cold DRI (CDRI) and HBI.**



**Qatar Steel, achieved a remarkable 1.6 million tons of DRI production, operating for an impressive 8,048 hours, exceeding our annual rated capacity**



**A significant milestone was reached in the year 2023, when we exceeded 50 million tons of DRI production**



**Qatar Steel, also hold a continuous operation record of 6,023 hours, which we set in 2019 and received an Excellence Certificate from MIDREX**

# UNIQUE CHALLENGES IN THE MIDDLE EAST

Direct Reduction plants offers several advantages over traditional iron-making methods. However, these same advantages have gradually become challenges in the current context.

Two major challenges that are common to all DR plants across our region are listed.

## 1. Decarbonization focus in DRI Production

- Climate change is one of the defining challenges of our era, with the iron and steel sector responsible for approximately 7% of global CO<sub>2</sub> emissions.
- Direct Reduction Iron (DRI) processes typically produce fewer carbon emissions compared to traditional blast furnaces, making them a more environmentally friendly option.
- However, **reducing the carbon footprint further in existing DRI plants has become more challenging**

## 2. Feedstock Instability

- Challenges in obtaining DR-grade pellets for producing high-quality iron are a significant concern.
- **supplying high-purity DRI to Electric Arc Furnaces (EAF) is challenging due to feedstock supply issues**



## UNIQUE CHALLENGES IN THE MIDDLE EAST

# Decarbonization focus in DRI Production

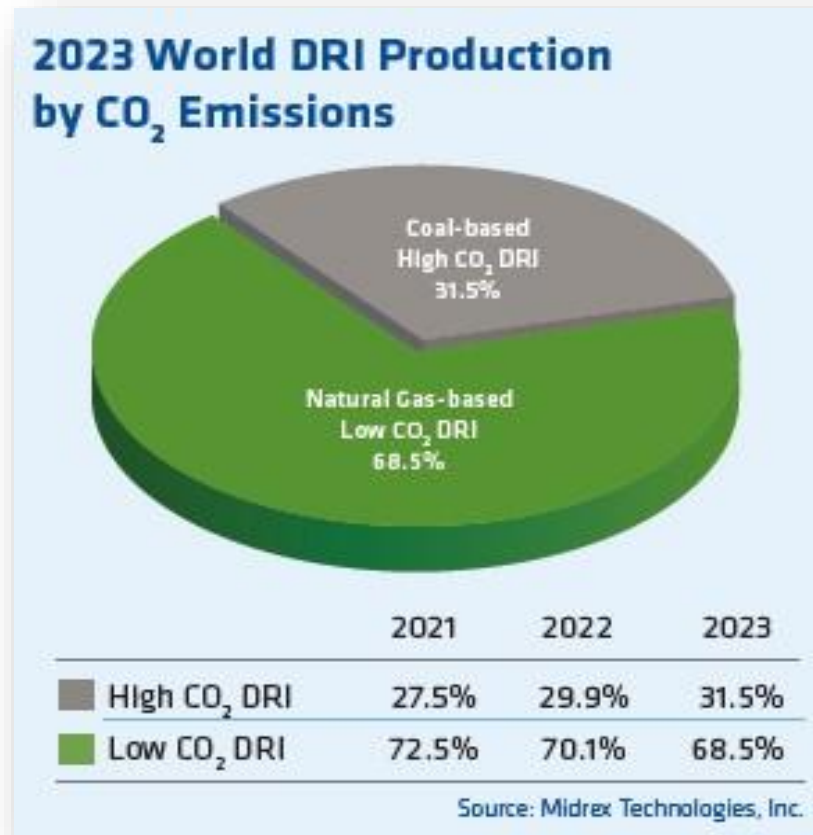


## SOLUTIONS TO THE CHALLENGE

## DECARBONIZATION FOCUS IN DRI PRODUCTION

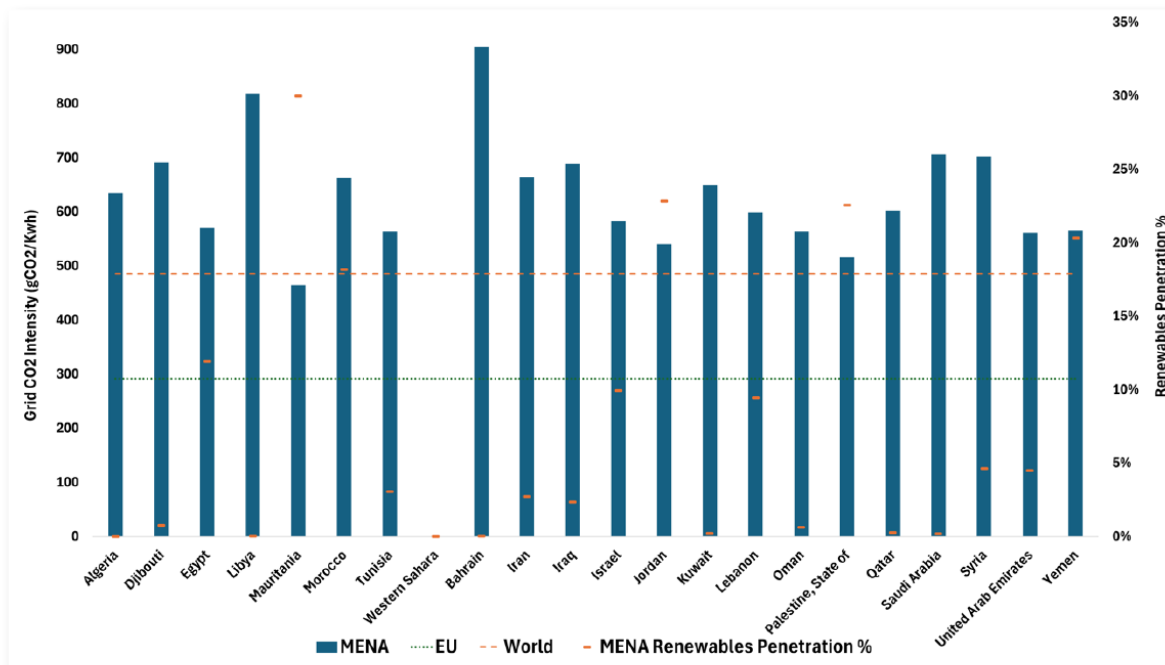
Iron and steelmaking are major contributors to greenhouse gas emissions, particularly CO<sub>2</sub>. The industry faces growing pressure to decarbonize, with many challenges to address.

- The global shift towards low-carbon steel production is pushing DR plants to transition from natural gas-based processes to green hydrogen, necessitating substantial investments in new technologies and infrastructure.
- The steel industry is responsible for about 7% of global CO<sub>2</sub> emissions. As commitments made at the COP26 global climate change summit in December 2021. At that meeting, many countries pledged ambitious emissions reduction goals, set targets for net-zero carbon by 2050.
- Furthermore, global steel demand is steadily increasing, with forecasts indicating that annual steel consumption could reach around 2.6 billion tons by 2050.
- We have never experienced this level of attention or support from so many people eager to help the industry achieve its sustainability targets



## DECARBONIZATION FOCUS IN DRI PRODUCTION

- Since 2016, the use of DRI, Hot DRI, and HBI in steelmaking has gained broad global acceptance. Today, hydrogen-enriched gas-based DRI plants are the most promising path to achieving the lowest carbon emissions in steel production
- DRI-EAF emissions originate from two major sources: Direct emissions from using Natural gas in the iron ore reduction process; and indirect or Scope 2 emissions, CO2 emissions from electricity consumption.
- Middle East grids are very high due to the reliance on fossil fuels for electricity generation, Middle East DRI-EAF facilities must urgently prioritize the gradual reduction of Scope 2 Co2 emissions.



- Carbon Border Adjustment Mechanism (CBAM) regulations , under EU carbon pricing, every additional 100kg of CO2e costs about €7, and this is expected to double by 2030.
- According to Ember data, The fossil fuel-based grid's carbon intensity in Middle East countries exceeds the global average.
- Middle East countries average CO2 emissions were 650 grams of CO2/kWh.

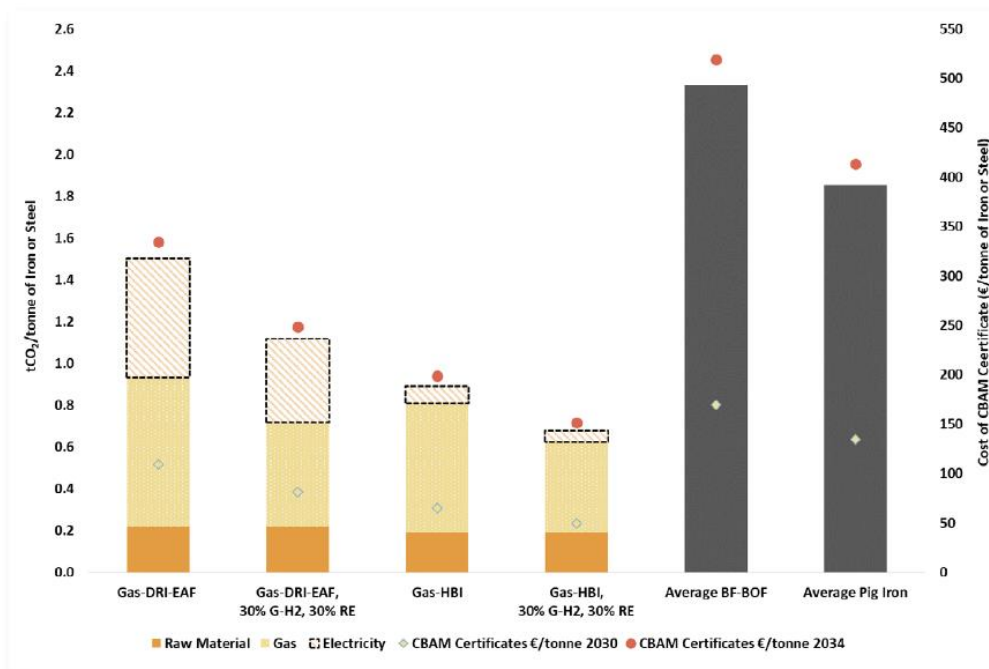
Sources: Ember, IEEFA



# DECARBONIZATION FOCUS IN DRI PRODUCTION

- Mitigating CO<sub>2</sub> emissions in the iron and steel industry has become a critical global objective. To meet the challenge of decarbonization, we need to be prepared to adopt new technologies to cut CO<sub>2</sub> emissions wherever possible

## Middle East iron and steel CO<sub>2</sub> emissions and CBAM certificates required by 2030 and 2034



- Hydrogen ironmaking is a promising solution for the future, but there are still some challenges to scaling it up cost-effectively to meet global demand.
- Middle East steelmakers may require fewer CBAM certificates than other regional competitors. This could potentially shift trade flows to the European Union (EU).

Source: IEEFA

Note: Gas-based Direct Reduction-Electric Arc Furnace (Gas-DRI-EAF), Green Hydrogen (G-H<sub>2</sub>), Renewables (RE), Blast Furnace-Basic Oxygen Furnace. Emissions (tCO<sub>2</sub>/tonne): Iron Ore Pellets 0.137, Pig Iron 1.855, Steel (BF-BOF) 2.33, Electricity 0.65 (tCO<sub>2</sub>/MWh), Natural Gas 0.056 (tCO<sub>2</sub>/GJ). Consumptions: Gas 11GJ/t(DRI/HBI), Iron Ore Pellet 1.385 t/t (DRI/HBI), Pellet 1.6t/tSteel, EAF electricity 0.750MWh/tSteel, DRI electricity 0.125MWh/tDRI. Carbon Price: 150 (€/tCO<sub>2</sub>), Proportion of reported emissions obliged to buy CBAM certificate by 2030=48.5% & 2034=100%.

## SOLUTIONS TO THE CHALLENGE

- Middle East can generate renewable energy from solar and wind sources at costs well below the global average. Our region photovoltaic potential is the highest in the world, offering a consistent and reliable energy supply. This remarkable natural advantage significantly eases the transition to clean energy and green steel compared with other regions.

### **Strengthening CO<sub>2</sub> Reduction Competency**

Middle East must pprioritize adopting a gradual substitution strategy. Need to focus on gradually reducing CO<sub>2</sub> emissions from possible roots.

Example transitioning to low-emission electricity sources. start by shifting gradually towards renewables is much essential by 2030.

Focus on switching our energy sources to renewables like wind, solar, and nuclear.

### **Feasibility of Hydrogen Integration in DRI Technology**

The Middle East has the opportunity to transform its current gas-based DRI plants into hybrid systems using NG-H<sub>2</sub> before fully switching to hydrogen. A short-term solution could involve using available hydrogen to replace natural gas consumption to the greatest extent feasible. This approach could serve as an important initial step in the transition for MENA producers.

### **Decarbonization new initiatives**

Middle East steel producers must take the initiative to proactively address changing market and operating conditions. This includes developing hydrogen infrastructure and energy systems simultaneously.

The green hydrogen industry is struggling investment. collaborations between hydrogen developers and steelmakers must be significantly scaled up. Strengthening this partnership is crucial in the MENA region



### **The Road to decarbonization Won't Be Smooth**

## UNIQUE CHALLENGES IN THE MIDDLE EAST

# Feedstock Instability

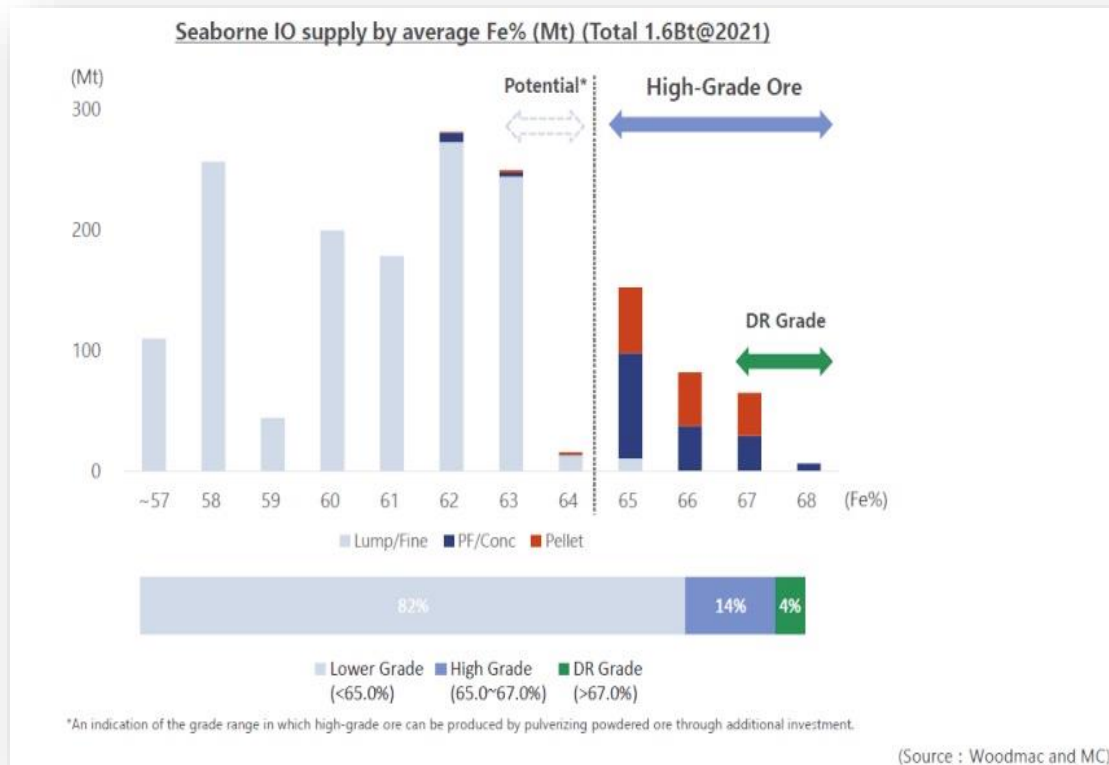


## SOLUTIONS TO THE CHALLENGE

## FEEDSTOCK SUPPLY INSTABILITY

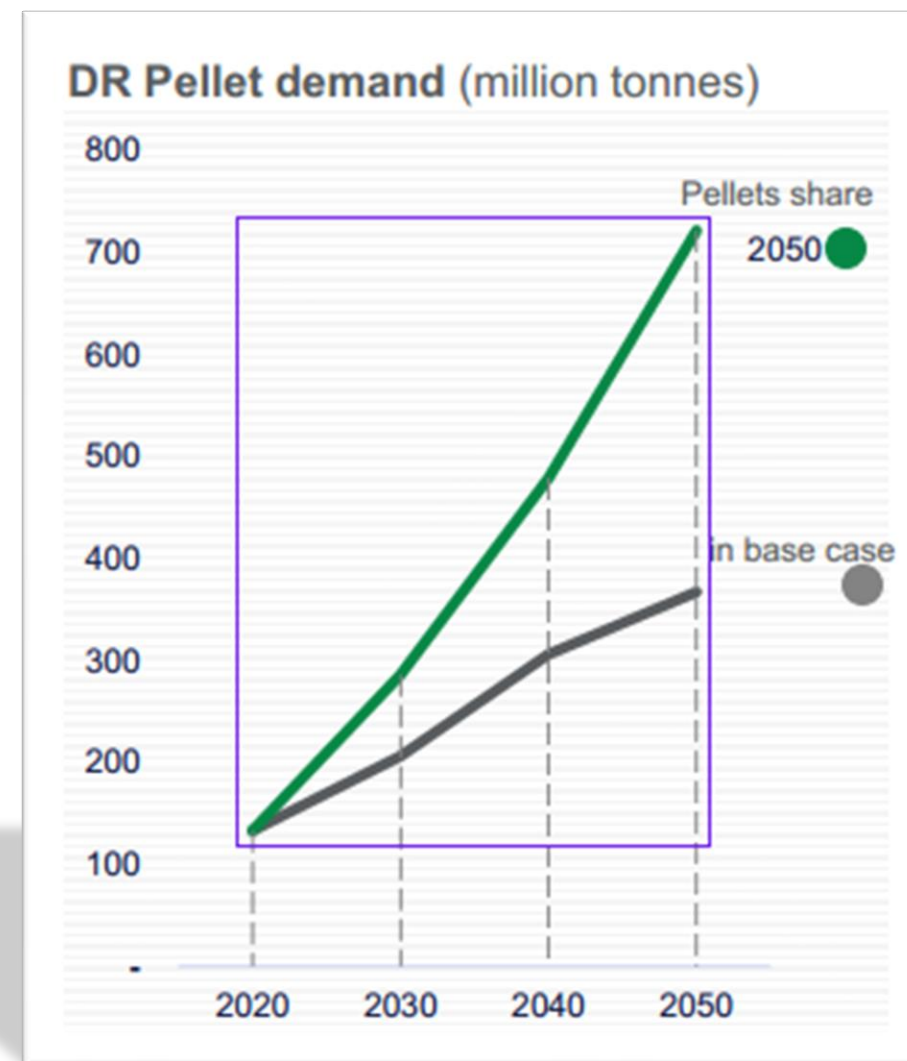
In Direct Reduced Iron (DRI) plants, many variables affect operating costs, with raw materials being a major factor.

- Ensuring a consistent supply of high-quality raw material is crucial for these plants. However, the availability and cost of this raw material are subject to market dynamics, impacting both production stability and profitability
- DR-grade pellet supply limitations are not just about availability—they also affect the quality of the DRI and, ultimately, the efficiency of Electric Arc Furnaces
- However, the supply of these pellets is constrained by limitations on both the availability of high-grade ore and pelletizing capacity.
- The market for DR pellets and pellet feed is expected to increase more than fivefold by 2050.



## FEEDSTOCK SUPPLY INSTABILITY

- The steel industry will face increasing pressure to meet decarbonization targets, high-grade, low-impurity ores are likely to be well positioned in the market, as demand for high-quality pellets and lumps is expected to rise
- This shift will drive steel mills to prioritize the use of more efficient, high-quality feedstock to reduce energy consumption and emissions.
- Most of the new DR projects announced are expected to be in production by 2030. This could lead to a significant demand.
- No doubt, high-grade, low-impurity ores demand will rise, leading to an increasing cost for these products over time.
- This makes feedstock supply instability a major hurdle that we need to overcome.



• Source: Wood Mackenzie

## SOLUTIONS TO THE CHALLENGE

### **Strategic Raw Material Sourcing**

Secure long-term contracts with a variety of suppliers. This will help ensure a steady flow of Raw materials

### **Investing in Local Pelletizing Capacity**

Increased pelletizing capacity will be necessary; investing in local pelletizing capacity will allow us to produce pellets closer to home, reducing our reliance on external markets and stabilizing our supply.

### **Advanced Raw Material Processing Techniques**

Implementing advanced raw material processing techniques, such as mixing lower-grade pellets and lump ores with high-quality iron ore. This will allow us to maintain consistent production even when supply fluctuations occur.

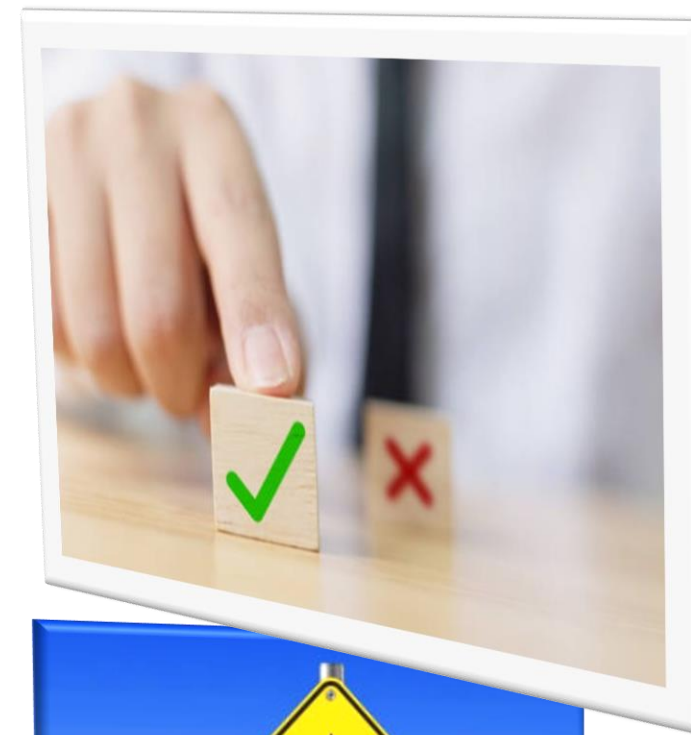
### **Integrating Pelletizing Plants and Strategic Partnerships**

Finally, palletization plant combined with DRI and EAF processes should be part of an integrated plan for new DR plants, rather than focusing combination of DRI and EAF plan

## CONCLUSION

- The DRI industry has a strong history of overcoming challenges, and current challenges, such as decarbonization & rising feedstock demand, are just the latest in a series of obstacles.
- Our industry's history of innovation and strength, positions us well to tackle these challenges, with key strategies include accurate forecasting, gradually shifting to low emissions electricity and replacing gas with hydrogen and partnerships with right technology providers.
- Middle East DRI plants will continue to grow and adapt to changing demands. Recent announcements on developing low-emissions iron and steel capacities in the Middle East highlight our region's potential to continue to be a key player in global DRI production.

**WE CAN'T SPELL CHALLENGE  
WITHOUT CHANGE.**



  
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**Thank you**

