### **DECARBONIZING STRATEGY BY 2030 & BEYOND**



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# Carbon Emission Reduction Initiatives In Iron and Steel sector

## **JINDAL STEEL & POWER- INDIAN OPERATIONS**





# **POSSIBLE GREEN PATHWAYS**

#### **1. Improvement in Existing Technologies**

Focus on raw material quality through beneficiation & Pelletization, Coke Dry Quenching, energy efficiency through waste heat recoveries, use of syngas in Blast Furnace, Redistribution of plant gases, productivity improvement, process improvement through digitalization, waste management and adoption of best available technologies (BAT)

#### 2. Maximize use of Scrap in BOF and EAF & RE

Maximizing use of Scrap in EAF and BOF. Use of renewable power in EAF and other units by minimizing Coal based power

#### 3. Breakthrough Technologies : Carbon Neutrality

Cold Iron Ore Briquetting, Fine Coal & Coke Briquetting, Green Hydrogen based steel making, Carbon Capture Utilization (CCU) including Carbon Recycling, Organic Rankin Cycle based Power Generation, Dry Slag Granulation,



#### **DECARBONISATION PILLARS FOR JSPL STEEL BUSINESS**

CO<sub>2</sub> Minimization

- Syngas based production
- Resource optimisation
- Pallet feed in blast furnaces
- Zero waste approach
- Cold Briquetting of Iron
   Ore

CO<sub>2</sub> Avoidance

• Heat recovery from off

• Dry Slag Granulation &

• Enhancing hydrogen

usages in steel making

heat recoveryUse of renewable

gases

power

Carbon

- Scrap based production CO<sub>2</sub> to CO
  - CO<sub>2</sub> to syngas
    Dry reforming of CO<sub>2</sub>
- Fuels Bioethanol

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 Chemicals – Methanol / Soda Ash

Utilization

**Carbon Capture &** 

 Biological – crude algae oil (biodiesel/ SAF)



# JSP IS DILIGENTLY WORKING TO MINIMIZE CO2 EMISSIONS





Focus on reduction of all three emissions i.e Scope 1,2 &3

#### **CARBON CIRCULAR ECONOMY**

#### **STEP 1 : CARBON CAPTURE** Carbon capture Technologies as part of iron production

- Running one of the India's largest fully automated Rectisol(gas sweetening) and MDEA plant.
- Total installed capacity of carbon capture of 3000
   Tons per day.
- ≻ Currently running at 2000 TPD.
- Lurgi Designed Cold Methanol based physical CO2 Absorption process.
- Tertiary Amine based CO2 Recovery process in DRI Plant.

# Developing low cost carbon capture technology



**RECTISOL Plant at Coal Gasification** 

#### **CO2 CAPTURING AND BY PRODUCTS RECOVERY IN COAL GASIFICATION**





# **STEP-2: CARBON RECYCLING**





#### **Carbon Recycling & Re-use**



#### Triple Module CO<sub>2</sub> treatment system for Carbon Circularity (With IIT-Mumbai)

# **CO<sub>2</sub> TO SYN GAS PRODUCTION**

**STEEL & POWER** 





# **RE- DISTRIBUTION OF PLANT GASES FOR CO2 REDUCTION**

#### **Optimization in current technologies**

- > Expansion of Coal Gasification plant.
- > PSA system for separating hydrogen from COG.
- Hydrogen as prime driver for captured CO<sub>2</sub> conversion into chemicals viz Bio-Ethanol.
- CO<sub>2</sub> based dry reforming of methane rich tail gas of COG
- ➢ 80% Carbon circulation via reforming , syngas conversion and CO conversion.
- Using hydrogen rich syngas to replace coke and CO in reduction process of iron ore.
- Commissioned Coke Dry quenching.
- Installing waste heat boilers for off gases
- Considering WHRB in various units



An overview of carbon circular Economy



# **Hydrogen and Steel Making - Facts**

- Hydrogen based reduction is endothermic reaction. Requires external source of heat/ energy to carry out reaction.
- Hydrogen can produce solid DRI instead of molten metal
- Shall require Electric Arc Furnaces to produce steel
   Renewable Energy for H2 and EAF
- Theoretically 54 Kg and practically around 70-80 Kg of Hydrogen is required to produce each tons of steel. 8-10 tonnes per hour of Hydrogen shall be required for 1 Million Tons of Steel Plant.
- Technically H2 based reduction is feasible but presently not economical
- Surging carbon dioxide prices and decreasing hydrogen prices are crucial to ensuring the economic viability of pure hydrogen-based steel production





# **STEEL SECTOR VISION FOR HYDROGEN USAGE**

Steel sector is one of the largest emitter of CO2 and considered as "hard to abate" sector. As Hydrogen can be an alternate reducing agent, it can be used as a tool for ensuring carbon neutrality in the Steel Sector. However, due to non availability of proven Hydrogen based technology, vision / mission of steel sector are as:

- To increase utilization of blended hydrogen gas (grey/ brown) with natural gas in the current gas based DRI plants from 60% to 70% by 2025
- Setting up pilot plants for Green Hydrogen for blending 2% green hydrogen by 2025 and 4% by 2030 in NG based DRI
- Promoting Syn gas ,having 50-60% Hydrogen, based DRI making with CCUS
- Promoting R&D and Technology Development for Hydrogen based steel making



# THANK You!

