Industrial Decarbonization: The Next Challenge

Rathin Kukreja
ICF
What we will discuss

- Need for Decarbonization
- Why Industrial Decarbonization
- Industrial Decarbonization - Why a Challenge
- Industrial Decarbonization-India Scenario
- Hard to Abate Sectors
- SWOT of Indian Industrial Sector vis-à-vis decarbonization
- Technology Options
- Technology Readiness Levels
- Way forward-Decarbonizing India’s Industrial Sector
Decarbonization and it’s need

Decarbonization is elimination of carbon dioxide from Energy sources i.e. net zero emissions

**Global temperature is on rise**
- Sea level rise
- Increase in average drought length
- Drop in crop yields.
- Frequent storms and flooding
- Effect Biodiversity and Ecosystem

**Paris Climate Agreement**
- Sets goal of limiting a global temperature rise to well below 2°C above preindustrial level
- Envisages efforts to limit the temperature increase even further to 1.5°C

**Roadmap (Achieving NDC Targets)**
- Reduction in CO₂ (Green house gas) emissions
- Increasing forest cover

The main benefiter from decarbonization is human health
Why industrial decarbonization

- The industry accounts for about quarter of the total GHG emissions with CO$_2$ comprising of more than 90 percent of direct GHG emissions.

- Transport, Power and Buildings sector have already seen breakthrough in technology innovations and upscaling their adoption to make them cost–effective. This has not been the case for industrial sector due to various challenges.

* Source: IEA
Industrial decarbonization – Why a challenge

Industry processes need temperatures of 500 °C and above. Such high process heat is difficult generated by renewable energy.

Industrial processes are highly integrated, making changes can be very complicated.

CO₂ emissions from feedstock requires process level changes, they cannot be simply eliminated by fuel change.

Existing facilities will require costly rebuilds or retrofits, as they are built for a lifetime of 30 years or more.
Industrial decarbonization – India Scenario

- India’s Industrial sector is second most emission intensive sector next to power.

- Decarbonization of industrial sector will therefore play a pivotal role in achieving the NDC targets.

- By 2050, nearly one-third of CO₂ emissions will be from Industrial sector under the Business As Usual (BAU) scenario

Electricity is the key sector for industrial decarbonization

If India’s emissions are to peak in 2030 and temperature increase to be limited to 2°C, then:

54% will be the share of electricity in the energy mix for industrial sector by 2050, as compared to 29 per cent in the BAU scenario*
Industrial decarbonization – Hard to abate sectors

Sectors with high share of emissions from feedstocks and high-temperature heat

- Iron & Steel
  - Process Heat >1500°C Required
  - Responsible for more than 75% of industrial CO₂ emissions

- Chemicals (Ammonia)
  - Complex Production Chain

- Non-metallic minerals (Cement)
  - Process Related GHG Emissions

- Refineries
  - Process And Market Obstacles

Decarbonization potential for India
635 Million Tons of CO₂ equivalent

India Industrial Emissions by Sector, 2015

- Iron & Steel: 32%
- Non-Metallic Mineral: 30%
- Chemical: 12%
- Refinery: 10%
- Non-Ferrous Metal: 9%
- Pulp, Paper and Print: 2%
- Textile and Leather: 1%
- Food and Beverages: 3%
- Machinery: 1%
- Other Sectors: 1%

* Source: GHG Platform India
SWOT of Indian Industrial Sector vis-à-vis decarbonization

**Strengths**
- Presence in private and public sector
- Abundant and low-cost labour
- Domestic demand for industrial products

**Weaknesses**
- No clear road map and policies
- Weak R&D setup
- Lack of technical know how

**Opportunities**
- Huge decarbonization potential
- Global Collaboration
- Reap benefits of cost-effective technologies

**Threats**
- Large unorganized sector
- Rising fuel and raw material cost
- Aging infrastructure
Decarbonization of industries – Technology options

- Energy Efficiency (EE)
- Renewable Energy
- Circular Economy & Demand Side Management
- Biomass as Fuel/Feedstock
- Hydrogen as fuel/feedstock
- CO$_2$ Carbon Capture Usage & Storage (CCUS)
- Electrification of Heat
- Other Novel Technologies
## Technology Readiness Levels (TRLs)

<table>
<thead>
<tr>
<th></th>
<th>CO₂</th>
<th>Hydrogen</th>
<th>Biomass</th>
<th>Heat Electrification</th>
<th>Other Novel Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron &amp; Steel</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>Electrolysis of iron ore</td>
</tr>
<tr>
<td>Chemicals (Ammonia)</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>Low carbon H₂ through electrolysis</td>
</tr>
<tr>
<td>Non-Metallic Minerals (Cement)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>Low-carbon cement</td>
</tr>
<tr>
<td>Refineries</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>Green Methanol</td>
</tr>
</tbody>
</table>

✔️ = TRL 6
✔️ = TRL 7-8
✔️ = TRL 8-9

ICF proprietary and confidential. Do not copy, distribute, or disclose.
Way forward - Decarbonizing India’s Industrial Sector

1. Prepare a comprehensive vision and blueprint for circular economy in India

2. Develop mechanisms for technology transfer from developed nations to India

3. Develop long term sector specific road maps for hard to abate sectors

4. Develop innovative carbon finance instruments to promote decarbonization

5. Increase awareness and Generate ‘call to action’ among stakeholders for industrial decarbonization
Thank you!

Contact Us:
Mr. Rathin Kukreja
ICF Consulting India Pvt. Ltd.
Contact No: +91 7087020172
Email: Rathin.Kukreja@icf.com