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CII

Confederation of Indian Industry

# DECARBONIZATION OF INDIAN INDUSTRIAL SECTOR

# DISCLAIMER



This report is a part of CII - Godrej GBC's effort to look at possible roadmap for decarbonization of Indian Industrial sector. The document estimates the emission reduction possible for the industrial sector based on study of 5 major sectors – Cement, Iron and Steel, Paper and Pulp, Textile and Chemicals.

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An initiative supported by Danfoss Industries Pvt. Limited.

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# ABBREVIATIONS

| | |
|---|---|
| BAU | Business as usual |
| BF | Blast Furnace |
| BOF | Basic Oxygen Furnace |
| BUR | Biennial  update report |
| CCU | Carbon capture, utilisatio |
| CCUS | Carbon capture, utilisation and storage |
| CDP | Carbon Disclosure Project |
| COP | Conference of the Parties |
| CPLC | Carbon Pricing Leadership Coalition |
| EAF | Electric Arc Furnace |
| EE | Energy-efficient |
| EP 100 | Global Initiatives to commit energy productivity improvement |
| EPD | Environmental Product Declarations |
| EU | European Union |
| EV 100 | Global Initiatives to accelerate the transition to electric vehicle |
| FMCG | Fast-moving consumer goods |
| GDP | Gross domestic product |
| GHG | Greenhouse gas |
| GW | Giga Watt |
| H2 | Hydrogen |
| IEA | International Energy Agency |
| IF | Induction Furnace |

# ABBREVIATIONS

| | |
|---|---|
| IPCC | Intergovernmental Panel on Climate Change |
| IPPU | Industrial Processes and Product Use |
| ISO 50001 | International Organization for Standardization For Energy Management |
| ISO 14064 | International Organization for Standardization for establishes minimum standards for compliance with these best practices. |
| ITC PSPD | India Tobacco Company Limited Paperboards and Specialty Papers Division |
| KPIs | Key performance indicators |
| LCA | Life Cycle Assessment |
| LDS | Low Demand Scenario |
| LULUCF | Land Use, Land-Use Change and Forestry |
| MDS | Medium Demand Scenario |
| MT | Million Tons |
| NDC's | Nationally Determined Contributions |
| RE | Renewable Energy |
| RE 100 | Global Initiatives to commit 100% RE |
| SBTI's | Science Based Targets |
| SEC | Specific Energy Consumption |
| SPB | Seshasayee Paper and Boards Limited |
| TOE | Tons of Oil Equivalent |
| UKG | Unit per Kg |
| US | United State |
| ZED | Zero Defect Zero Effect |

# KEY MESSAGES

| | |
|---|---|
| **Message 1** | India has not only made strong Commitments towards Decarbonization but also has achieved significant results through various efforts |
| **Message 2** | India's journey towards Net Zero would be challenging as India's GHG Emissions would be peaking by 2040s – Further Mitigation required to become NetZero by 2070 will be exponentially higher than historic performance |
| **Message 3** | 50 selected Indian companies included in this analysis can reduce their GHG emissions by 13.04 % in 2030 through their existing voluntary climate commitments, relative to their emissions in the Reference Scenario. Assuming that the entire industrial sector sets a similar level of ambition, we can expect potential additional emissions reductions of almost 5.6 percent of national emissions in 2030, in absolute terms |
| **Message 4** | Estimated emission Reduction for entire Industrial Sector in Business As Usual and Deep Decarbonization could be around 15.47% and 29.01% respectively |
| **Message 5** | Industrial Decarbonization - Energy Efficiency will play a major role by contributing 44% in BAU and 32% in Deep Decarbonization Scenario |
| **Message 6** | Iron and Steel - one of the hardest to abate sectors could reduce its emissions intensity by 16% in BAU Scenario and 24% in Deep Decarbonization Scenario |
| **Message 7** | In Steel sector, Energy Efficiency, Material Circularity and Renewable Energy are the top levers contributing 40%, 30% and 20% emission intensity reduction respectively in Deep Decarbonization Scenario |

| | |
|---|---|
| **Message 8** | Cement Sector – One of the most progressive sectors in the Indian Industrial sectors can reduce its overall emission intensity by 13.4% and 30.3% in BAU and Deep Decarbonization Scenarios |
| **Message 9** | Circularity and Material Efficiency Measures like Improving Clinker factor improvement, increasing additives in overall cement manufacturing will play a huge role in decarbonization efforts for Cement Sector (33% in BAU and 28% in Deep Decarbonization Pathways) |
| **Message 10** | Paper is one of the sector which has a huge potential in terms of becoming carbon neutral in near future. |
| **Message 11** | Energy Efficiency remains to play an important role in the overall Paper and Pulp sector decarbonization. Energy Efficiency can contribute to around 62% reduction in BAU Scenario and around 36% reduction in Deep Decarbonization Scenario for the decarbonization journey of paper sector |
| **Message 12** | Energy Efficiency and Biomass Utilization will play an important role in Textile Industry Decarbonization. While Energy Efficiency can contribute to 53% reduction in BAU Scenario and 46% reduction in Deep Decarbonization Scenario, Biomass and utilization of other cleaner fuels, could further contribute to 29% reduction in BAU scenario and 25% in Deep Decarbonization Scenario |
| **Message 13** | Chemical sector has significant amount of process emissions making it really challenging to decarbonize hence, to accelerate decarbonization, Hydrogen and CCUS will have to play a very significant role in overall Decarbonization of this sector |
| **Message 14** | Many of the futuristic technologies like Hydrogen, CCUS, Fuel Cells etc. are still in their nascent stages with high-cost implications. On one hand these technologies require a huge push on the policy front, but the Industry leaders also need to come forward and demonstrate its commitment towards adoption of the same |

# INDIA'S 5 COMMITMENT 'PANCHAMRIT' MADE AT COP26

1. India will achieve Net Zero by 2070
2. India will bring its non-fossil energy capacity to 500 GW by 2030
3. India will bring its economy's carbon intensity down to 45 per cent by 2030
4. India will fulfill 50 per cent of its energy requirement through renewable energy by 2030
5. India will reduce 1 billion tons of carbon emissions from the total projected emissions by 2030

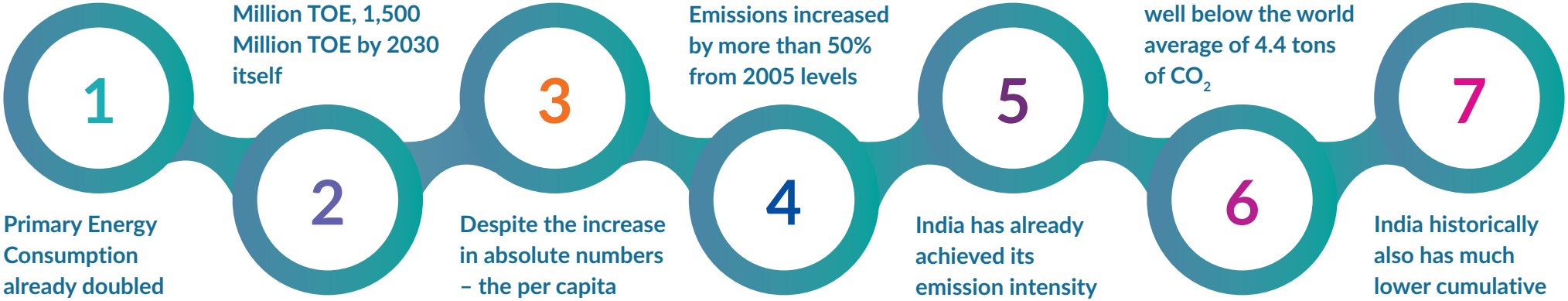
Prime Minister Shri M Narendra Modi at the COP26 summit in Glasgow on 1 November 2021

*Source: Press Information Bureau*

# INDIA'S UPDATED FIRST NDC'S UNDER PARIS AGREEMENT


*Source: Press Information Bureau*

# DECARBONIZATION OF INDUSTRIAL SECTOR, IT'S RELEVANCE IN INDIAN CONTEXT – PRIMARY ENERGY CONSUMPTION PROFILE



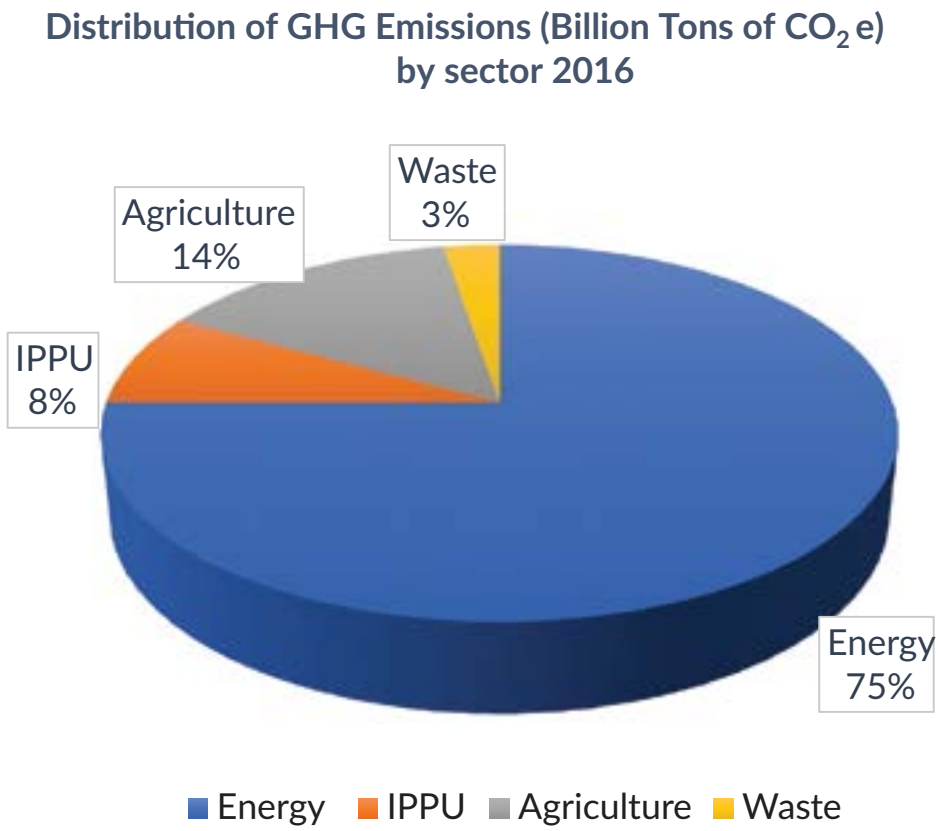

*Source - IEA India Energy Outlook*

# DECARBONIZATION OF INDUSTRIAL SECTOR, ITS RELEVANCE IN INDIAN CONTEXT – EMISSION PROFILE

| Sector | $CO_2$ Equivalent Emissions (billion Tons) |
|---|---|
| Energy | 2.13 |
| IPPU | 0.27 |
| Agriculture | 0.41 |
| LULUCF | -0.31 |
| Waste | 0.08 |
| Total without LULUCF | 2.83 |
| Total with LULUCF | 2.53 |

| Estimated Industrial Emissions* | 1.20 Billion Tons |
|---|---|

* Including Emissions from Industrial Electricity Consumption from energy subsection, manufacturing and industries emission from energy subsection, Industrial Processes and Product Use, this includes refinery but excludes manufacturing of solid fuels



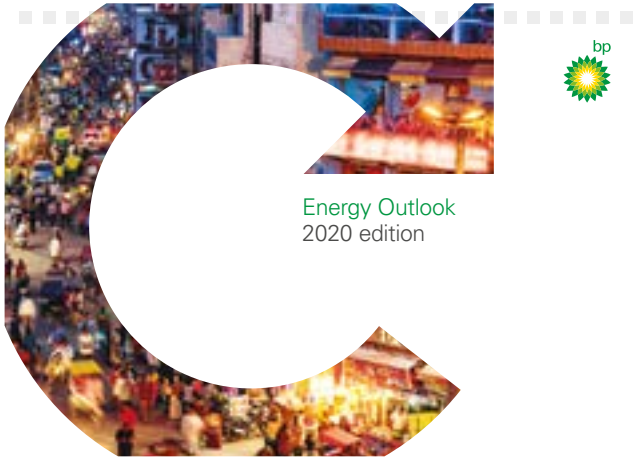

*India. Biennial update report (BUR). BUR3*

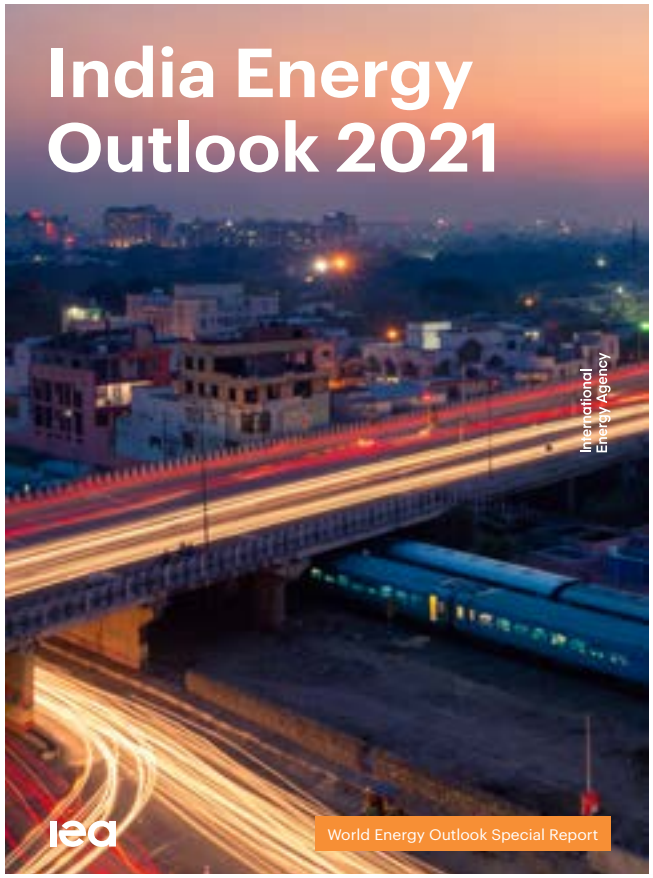
# KEY MESSAGE

## Message 1

India has not only made strong Commitments towards Decarbonization but also has achieved significant results through various efforts

# ANALYSIS OF ANALYSIS – LEADING REPORT ON INDIA'S DECARBONIZATION OR LOW CARBON APPROACH


*References*

*Shell - TERI Report - India: Transforming to a NET-ZERO Emission Energy System*

*BP Report - Energy Outlook 2020 Edition*

*IEA Report - India Energy Outlook 2021*

# ANALYSIS OF ANALYSIS – CONCLUSIONS FROM THE 3 REPORTS


**India's emission to peak around 2040**

**Primary Energy demand expected to be on rise and may double by 2040**

**India's net zero emissions pathways will be challenging as the rate of decrease of emissions required to achieve the net zero by 2050 onwards will have to be exponentially high compared to historic trends**

**Net Zero till 2050 – challenging in BAU scenario**

- Mitigation needed to achieve net zero exponentially higher than historic performance

**Renewable Energy & Energy Efficiency play important role**

- RE deployment expected to double (or even triple)
- 30% of industrial emission mitigation - dependent on EE measures

**Overall, all the pathways leading to net zero need to have huge investments made into some of the key technologies like CCUS, Energy Storage, Waste Heat Recovery etc.**

# KEY MESSAGE

## Message 2

India's journey towards Net Zero would be challenging as India's GHG Emissions would be peaking by 2040s – Further Mitigation required to become NetZero by 2070 will be exponentially higher than historic performance

# Strategies and actions towards Decarbonization by various corporates in the country



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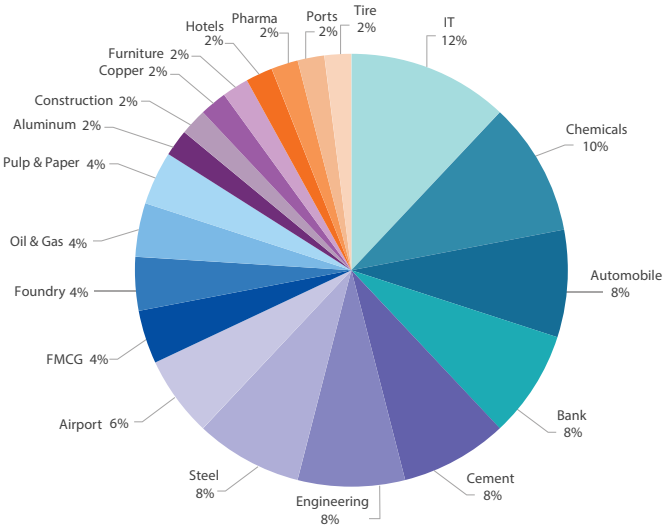
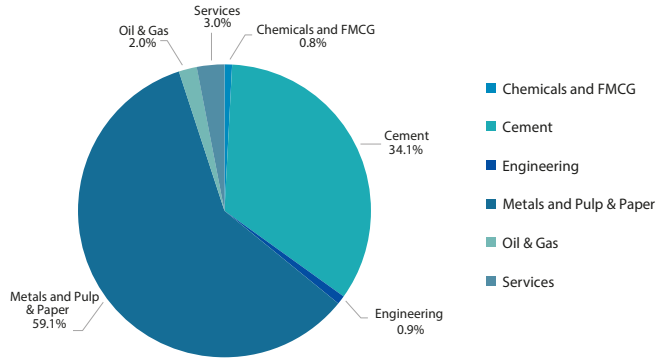
# POTENTIAL IMPACT OF CORPORATE CLIMATE ACTION IN INDIA

Selected Companies – 50 companies selected across various energy intensive and non intensive sectors such as Engineering, Metals, Pulp and Paper, Chemicals, Fast Moving Consumer Goods (FMCG), Services and Cement sectors


Analysis of 50 Companies from various sectors

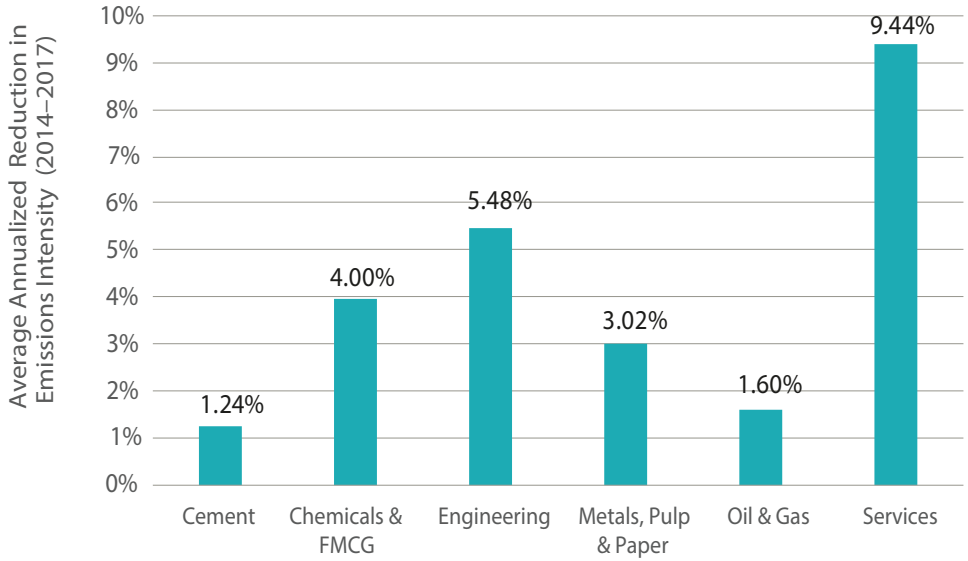



Sector-wise contribution as a percentage of the total emissions reduction impact of the 50 companies in 2030

*WRI - CII Working Paper : Potenital Impact of Corportate Climate Action in India*

# GHG REDUCTION TREND FOR SELECTED 50 COMPANIES

- Figure depicts the annualized reduction in GHG emission intensity for the companies included in the analysis (grouped by sectors)
- Annualized GHG intensity reduction ranging from 1.24% to 9.44 %
  - Cement – 1.24 %
  - Chemicals and FMCG – 4 %
  - Engineering – 5.48 %
  - Metals, Paper and Pulp – 3.02%
  - Oil and Gas – 1.60 %
  - Services – 9.44 %
- Reduction for energy intensive sectors shows lower GHG reduction compared to non energy intensive sector

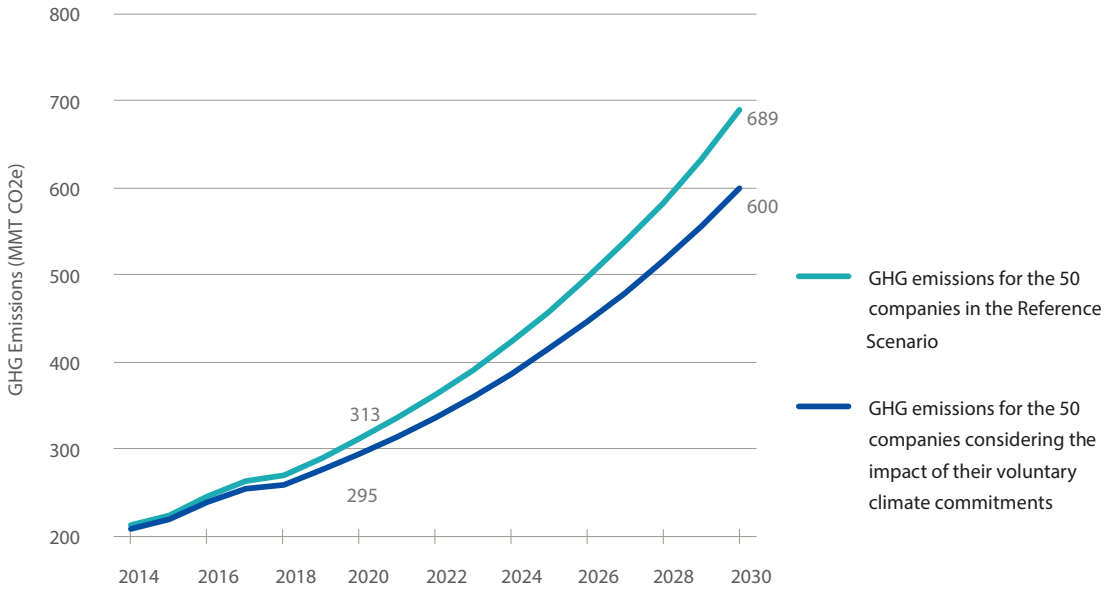



Sector wise GHG emission intensity reduction annually (2014-2017)

*WRI - CII Working Paper : Potenital Impact of Corportate Climate Action in India*

# AGGREGATE IMPACT OF VOLUNTARY CLIMATE INITIATIVES BY INDIAN COMPANIES

| Year | Total Emissions in Reference Scenario (MT $CO_2e$) | Total Emissions with Impact of Voluntary Initiatives (MT $CO_2e$) | Emissions Reduction Impact (MT $CO_2e$) | Emissions Reduction Impact (%) |
|---|---|---|---|---|
| 2020 | 312.53 | 294.54 | 17.99 | 5.76% |
| 2030 | 689.40 | 599.52 | 89.88 | 13.04% |




*WRI - CII Working Paper : Potenital Impact of Corportate Climate Action in India*

# KEY MESSAGE

## Message 3

50 selected Indian companies included in this analysis can reduce their GHG emissions by 13.04 % in 2030 through their existing voluntary climate commitments, relative to their emissions in the Reference Scenario. Assuming that the entire industrial sector sets a similar level of ambition, we can expect potential additional emissions reductions of almost 5.6 percent of national emissions in 2030, in absolute terms

# Corporate and Company Level Initiatives for Decarbonization - Examples

# CORPORATE/ COMPANY LEVEL INITIATIVES FOR DECARBONIZATION

## JSW Steel Limited

- JSW Steel and its subsidiaries together account for ~23% of India's steel production
- Internal Carbon Price- JSW Steel has adopted a shadow internal carbon price of USD 20/ton
- Targets for a better tomorrow! - JSW Steel, as well as JSW Energy, has set-up long term internal targets for all the sustainability KPIs across all locations
- JSW Steel, due to its consistent and comprehensive $CO_2$ emissions data disclosure, has also been ranked 1 by the CDP Steel Report 2019 in the Data Transparency rankings.

| JSW Steel | |
|---|---|
| Company-wide target for SEC for 2030 | 5.91 Gcal/tcs |
| Company-wide target for GHG emissions for 2030 | 2.00 $tCO_2$/tcs |
| Company-wide target for specific freshwater consumption for 2030 | 2.41 $m^3$/tcs |
| Company-wide target of waste recycling for 2030 | 100 % |
| To achieve a not net loss of biodiversity at all currently operating sites by 2030 | |

*www.jsw.in*

# CORPORATE/ COMPANY LEVEL INITIATIVES FOR DECARBONIZATION

## Dalmia cement (Bharat) Limited

- First heavy-industry globally to announce carbon negative targets
  - Aiming to become carbon negative by 2040
- Ranked 1st in global cement sector by CDP on business readiness for a low-carbon economy transition
- Usage of 100% renewable power under fossil free electricity initiative - 2030 (RE 100)
- 1st Cement Company to Join – EP 100 and RE100
  - Double energy productivity - 2030 (EP 100)
  - Carbon Capture and Utilisation (CCU) for process emissions & Carbon Sequestration - 2040

*www.dalmiacement.com*

# CORPORATE/ COMPANY LEVEL INITIATIVES FOR DECARBONIZATION

## ITC PSPD

- ITC PSPD
- Carbon positive (15 consecutive years)
- Renewable energy share – 48%
- Water positive (18 consecutive years), 26.5% reduction in specific GHG intensity in last 3 years
- Green cover for over 8,00,000 acres of land
- Targets committed (by 2028-29 - baseline 2018-19)
  - 27% reduction in SEC
  - 14% increase in RE share
  - 47% reduction in GHG intensity
  - 36% reduction in specific water consumption

*www.itcpspd.com*

# CORPORATE/ COMPANY LEVEL INITIATIVES FOR DECARBONIZATION

## Ultratech Cement Limited

- UltraTech aims to for 557 kg of carbon dioxide/ ton of cementitious material it produces by March 31, 2030, which is 22.2% reduction from March 2017
- Committed to reduce Scope 1 GHG intensity by 27% by 2032 from the base year of 2017
- Committed to reduce Scope 2 GHG intensity by 69% by 2032 from the base year of 2017
- Adopted internal carbon pricing – USD 10
- To be water positive by 5 times by 2024 (3.96 times water positive – FY 2021)
- Scale up the share of green power in the overall power mix to 34% by FY2024

*www.ultratechcement.com*

# CORPORATE/ COMPANY LEVEL INITIATIVES FOR DECARBONIZATION

## Tata Steel limited

- Tata Steel – adopted the Task Force on Climate-related Financial Disclosures (TCFD)
- Adoption of best available technologies for Waste Heat Recovery (WHR) such as Top Recovery Turbine (TRT), Coke Dry Quenching (CDQ), use of by-product gases in power generation
- Tata Steel has pioneered in steel recycling business in India by setting up a 0.5 MnTPA plant has been set up for processing steel
- Green Products : Use of LCA study for various products by Tata Steel
- Tata Steel also has set up a Centre of Excellence for implementing projects related to CO2 reduction, Carbon capture and use, increasing scrap utilization
- Tata Steel Group has been rated 'A-' in the 'Leadership Band' on Climate Disclosure in CDP's 2020 assessment

*www.tatasteel.com*

# CORPORATE AND COMPANY LEVEL INITIATIVES FOR DECARBONIZATION

## JK PAPER

- Carbon  and Wood positive
- Elementary Chlorine Free Technology
- One of the lowest water consuming paper plants in the country
- Renewable Energy Share of 62% (targeting 75% by 2025)
- J K  Paper has signed an Emission Reduction Purchase Agreement (ERPA) with the Bio Carbon Fund of the World Bank covering 1608 Ha mainly owned by small and marginal farmers associated with JK Paper's plantation program. This program provides additional income for participating farmers, besides reducing harmful green house gases and global warming

*www.jkpaper.com*

# CORPORATE/ COMPANY LEVEL INITIATIVES FOR DECARBONIZATION

## SPB

- Carbon  and Wood positive
- Increase in contribution of green power by 2% by 2022 (currently 55% share)
- Certified Under FSC (Forest
- CII GreenCo Rating Program
- Reduction in specific steam consumption by 3% and power consumption by 4%
- Buying products based on energy levelling

*www.spbltd.com*

# KEY MESSAGE

## Message 4

Estimated emission Reduction for entire Industrial Sector in Business As Usual and Deep Decarbonization could be around 15.47% and 29.01% respectively

# OVERVIEW OF DECARBONIZATION APPROACH

## GHG Inventorization

- Scope and Plan for Inventorization
- Setting Up Organization and Operational boundaries
- Setting up of Baseline
- Data Collection
- Selection of emission factors - IPCC datasets
- Inventorize - Scope 1, Scope 2, and Scope 3 emission estimation

## Target Setting

- Benchmarking and comparison with Peers
- Developing target in line with 2050 net zero commitment and 1.5 Deg Scenario
- Emission Reduction target setting - SBTi Approach
  - Commit a target
  - Develop a plan to execute emission reduction
  - Submit target to SBTi
  - Communicate Target to stakeholders
  - Disclose Progress
- Target Timelines
  - Medium Term : 2030
  - Long Term : 2050

## Developing Decarbonization Roadmap

- Identify Plans for decarbonizing all assets
- Identify scope of all levers for decarbonization
  - Energy Efficiency (Process and Electrical)
  - Electrification and Renewable energy
  - Utilization of zero carbon fuels - Biomass, Green Hydrogen
  - Material Circularity and Efficiency
  - Adoption of Latest Technologies - Energy Storage, Fuel Cells
  - Carbon Capture and Storage
  - Natural Sinks
- Evaluation of Options - Cost abatement analysis
- Carbon Offsets
- Internal Carbon Pricing

## Engage Relevant (all) stakeholders

- Supplier Network
- Client Network
- Shareholders
- Government and Relevant Agencies and Departments
- End Users

## Execution of Action Plan

- Top Management Commitment
- Prepare Timelines for execution
- Employee Awareness and Engagement
- Align Stakeholders
- Resource Allocation
- Implementation of Projects
  - Low Hanging Fruits
  - Technology Shift
  - Developing Low carbon Assets
  - Demand Side Reduction
  - Research and Developments
  - Accelerate Transition

Disclosures and Commitments

# Decarbonization pathways for Indian Steel Sector



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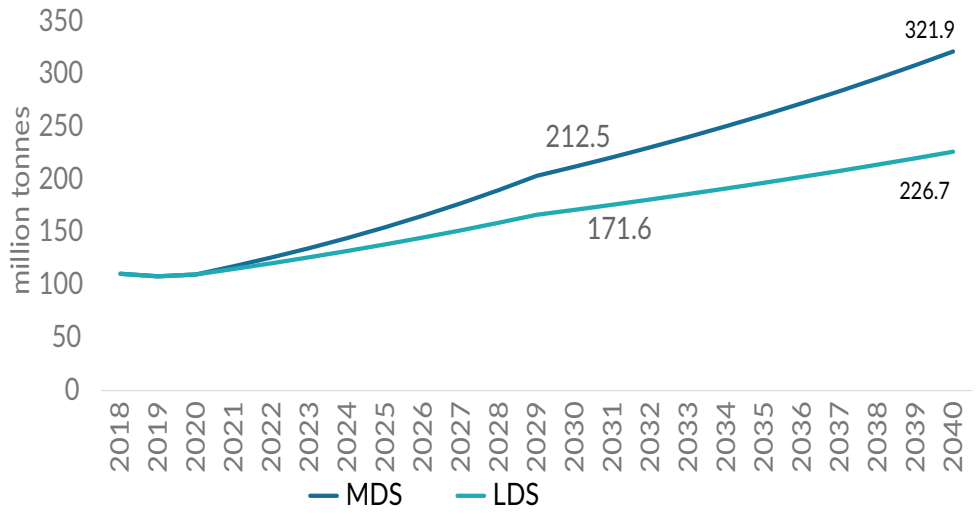
# CRUDE STEEL PRODUCTION

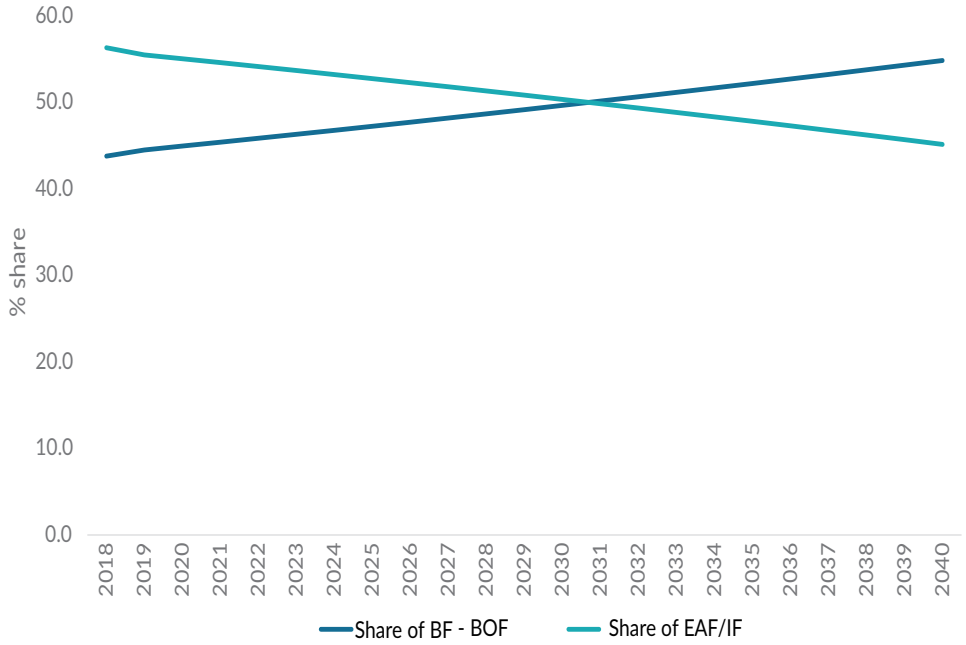
## Projection of Crude Steel Production




MDS – Medium Demand Scenario

LDS – Low Demand Scenario

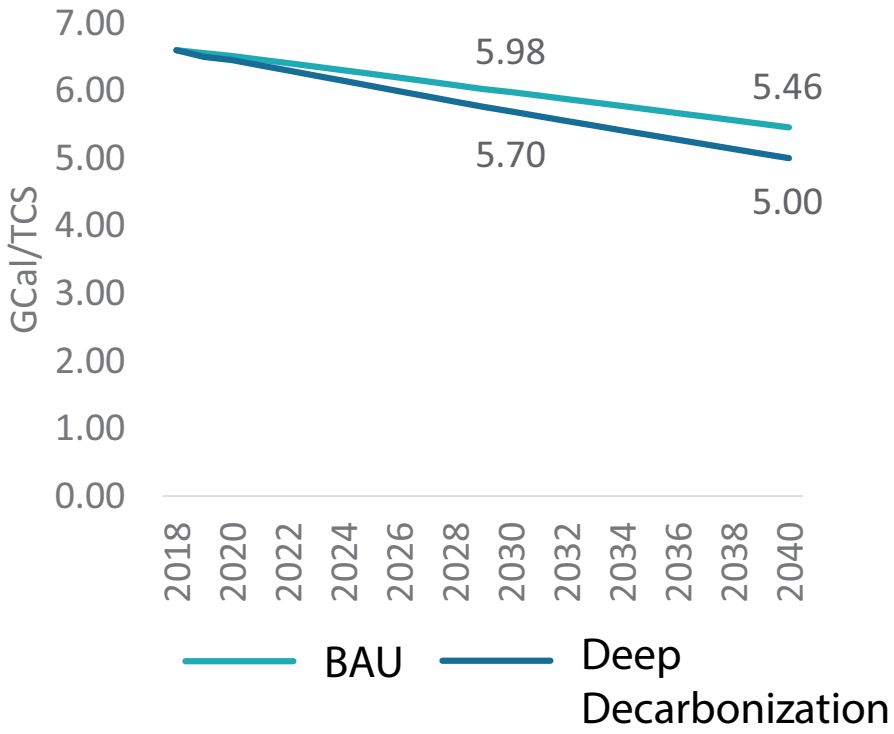
## Production of Crude Steel different routes



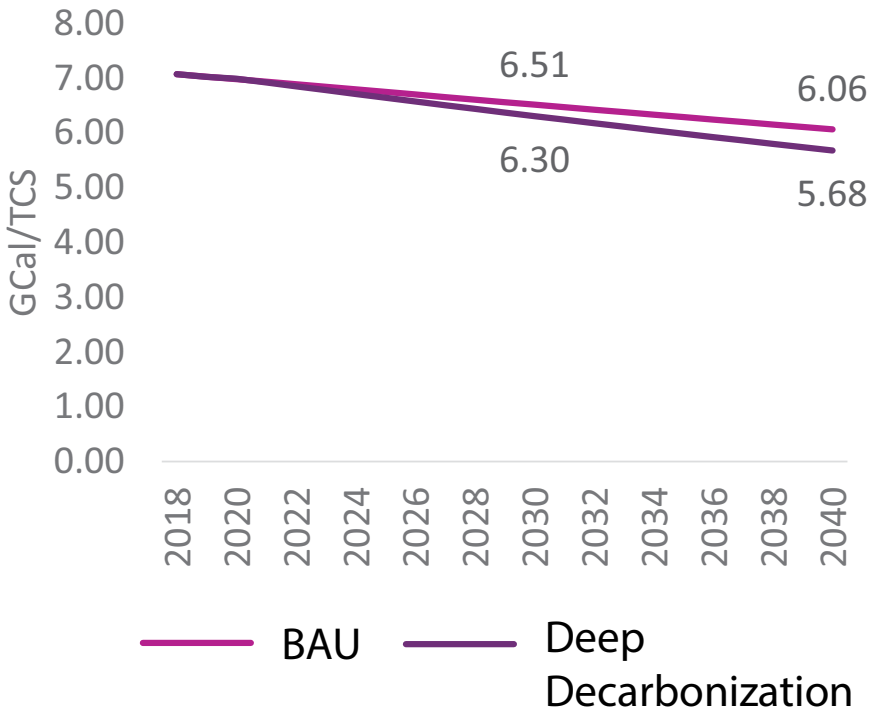

**CII Estimates*

# ESTIMATED SPECIFIC ENERGY CONSUMPTION

BAU vs Deep Decarbonization
Scenario - BF - BOF



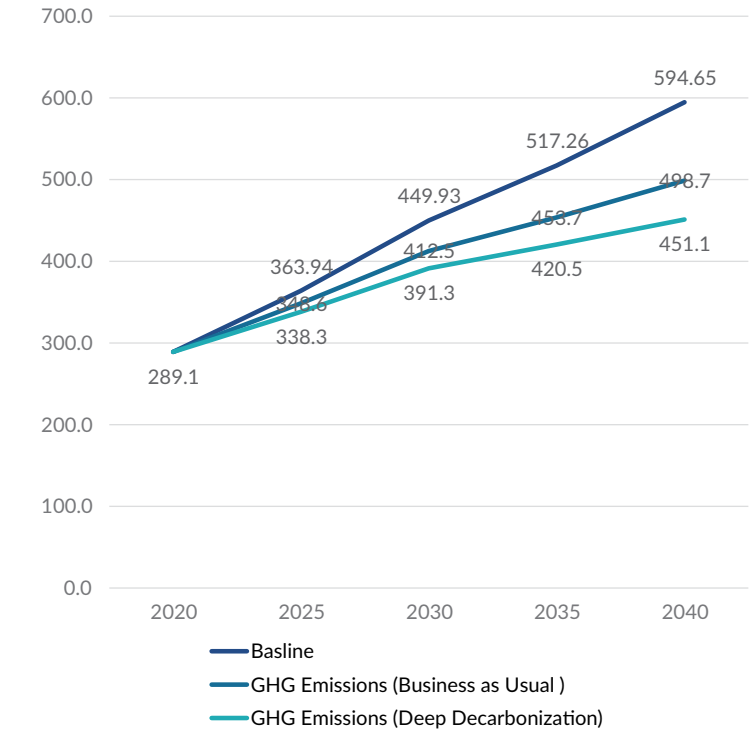

BAU vs Deep Decarbonization
Scenario - DRI - EAF/IF




*CII Estimates

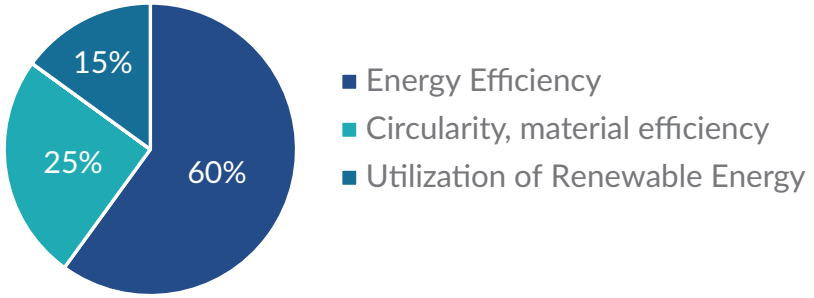
# ESTIMATED PROJECTIONS OF TOTAL GHG EMISSIONS (IMPACT OF LEVERS)

## GHG Emissions (Steel Production) Million Tons of $CO_2e$*

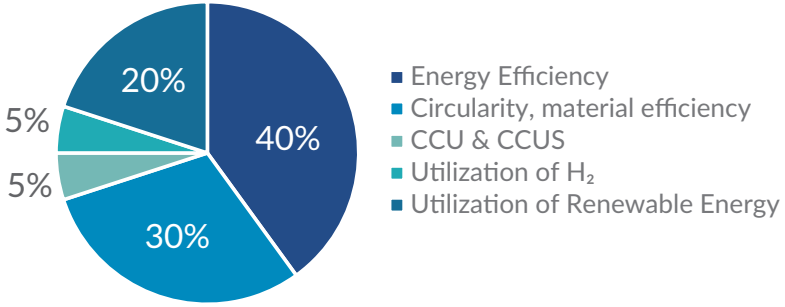



* Medium Demand Scenario

## Baseline Vs BAU




## Baseline Vs Deep Decarbonization



# KEY MESSAGE

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Industrial Decarbonization - Energy Efficiency will play a major role by contributing 44% in BAU and 32% in Deep Decarbonization Scenario

# KEY MESSAGE

## Message 6

Iron and Steel - one of the hardest to abate sectors could reduce its emissions intensity by 16% in BAU Scenario and 24% in Deep Decarbonization Scenario

# Decarbonization pathways for Cement Sector



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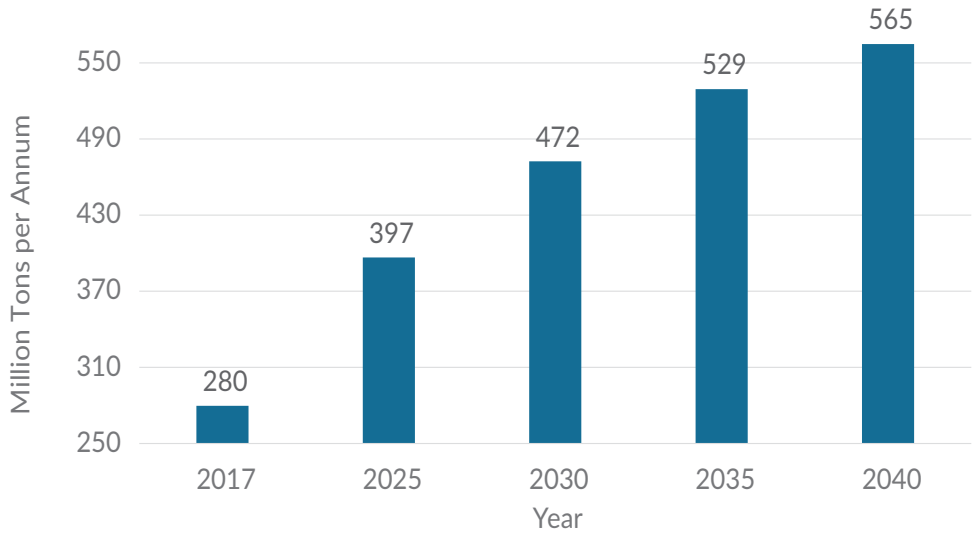
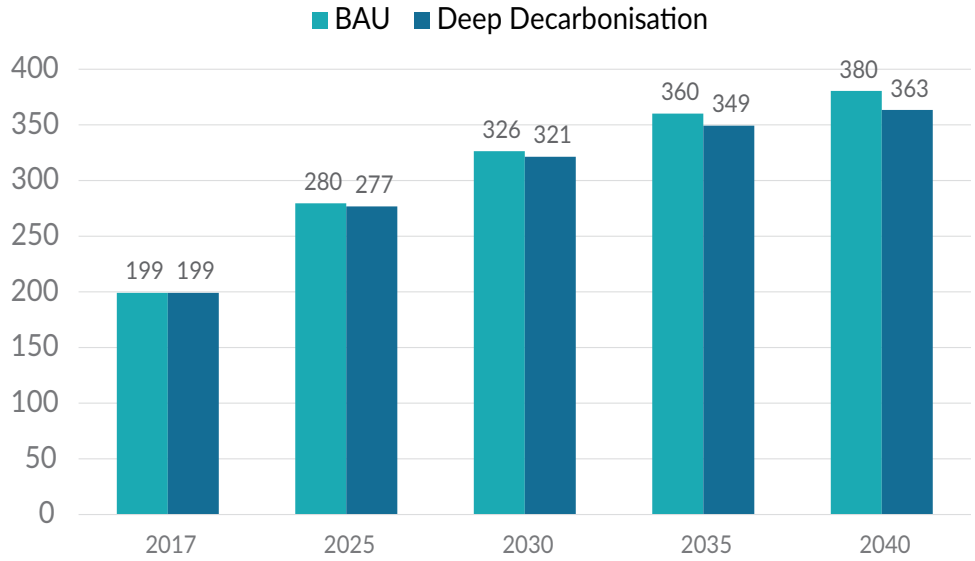
# ESTIMATED CEMENT & CLINKER PRODUCTION

## Estimated Cement Production

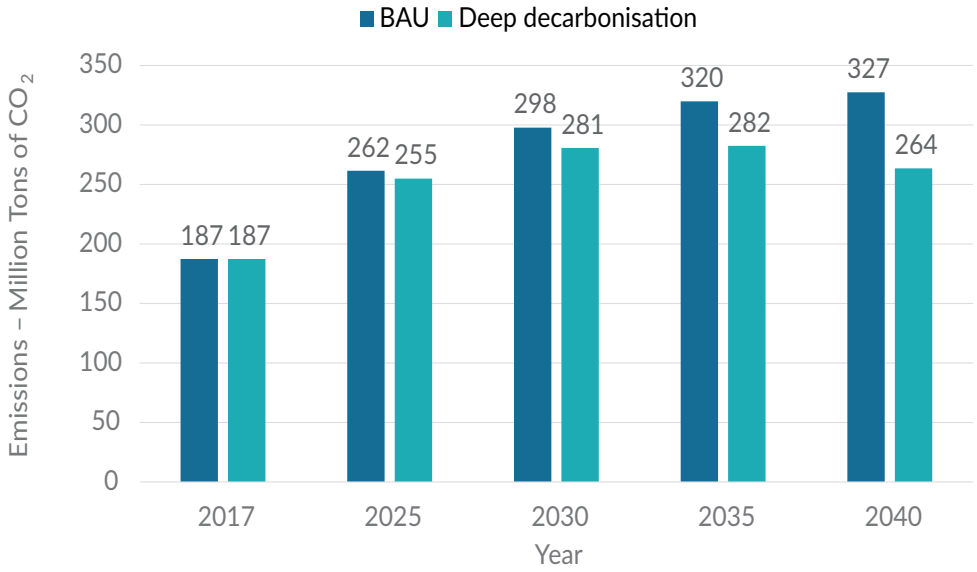


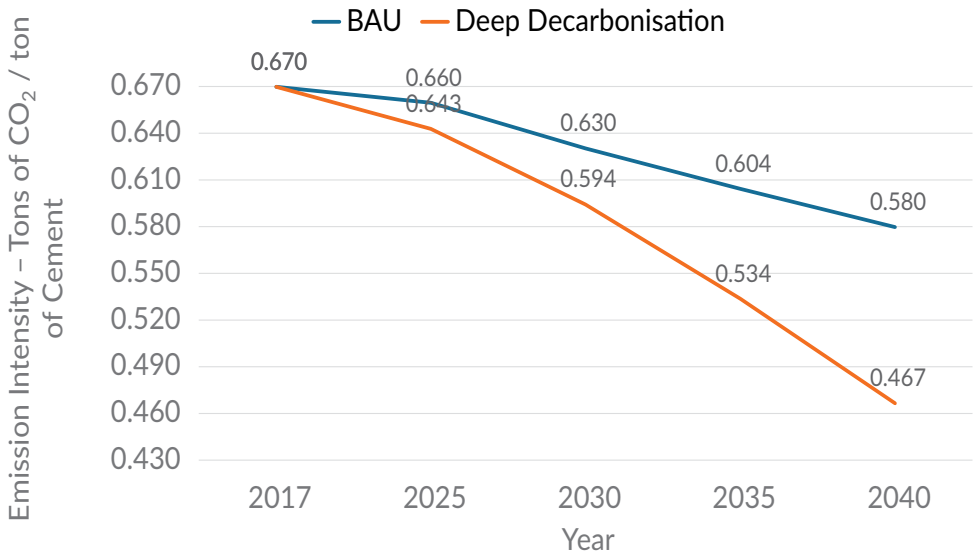

## Estimated Clinker Production




** CII Estimates*

# ESTIMATED PROJECTIONS: EMISSION INTENSITY & TOTAL EMISSIONS

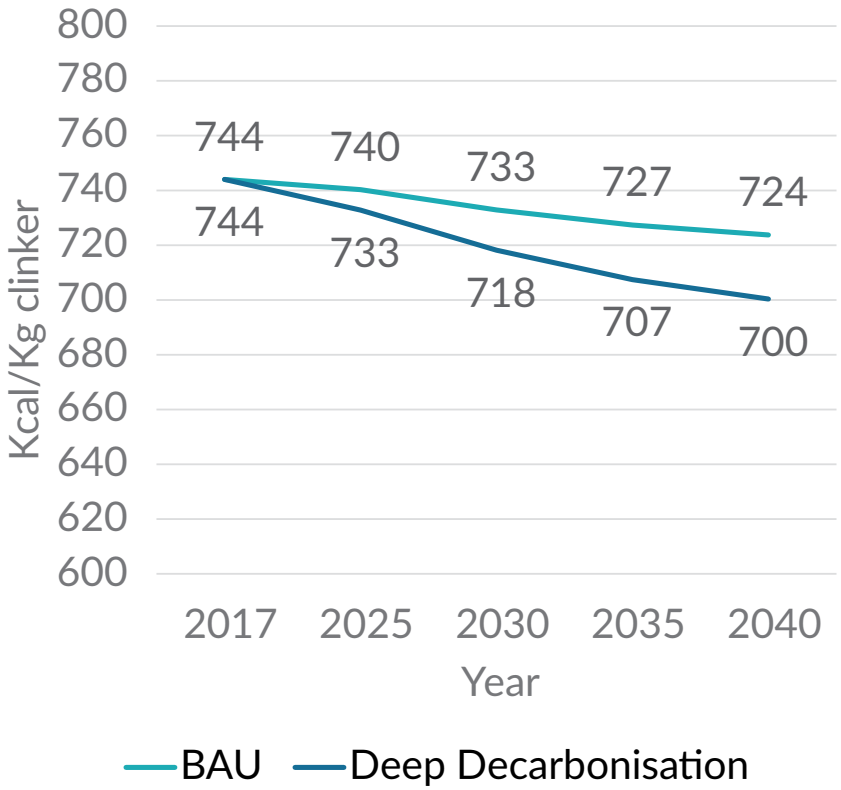


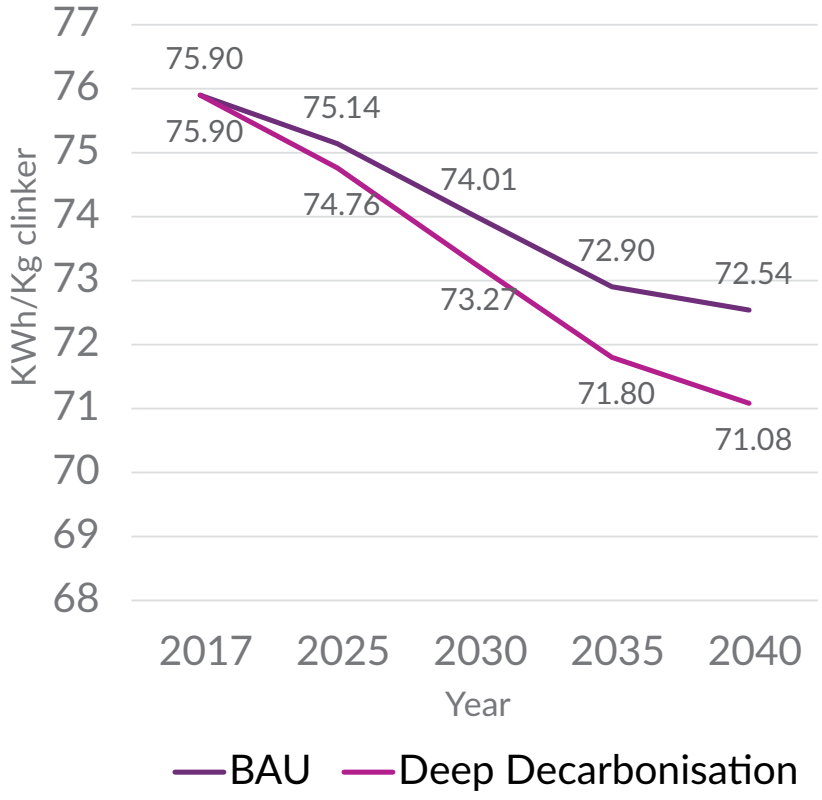

*CII Estimates

# SPECIFIC ENERGY CONSUMPTION (PROJECTED SCENARIOS)

Thermal SEC

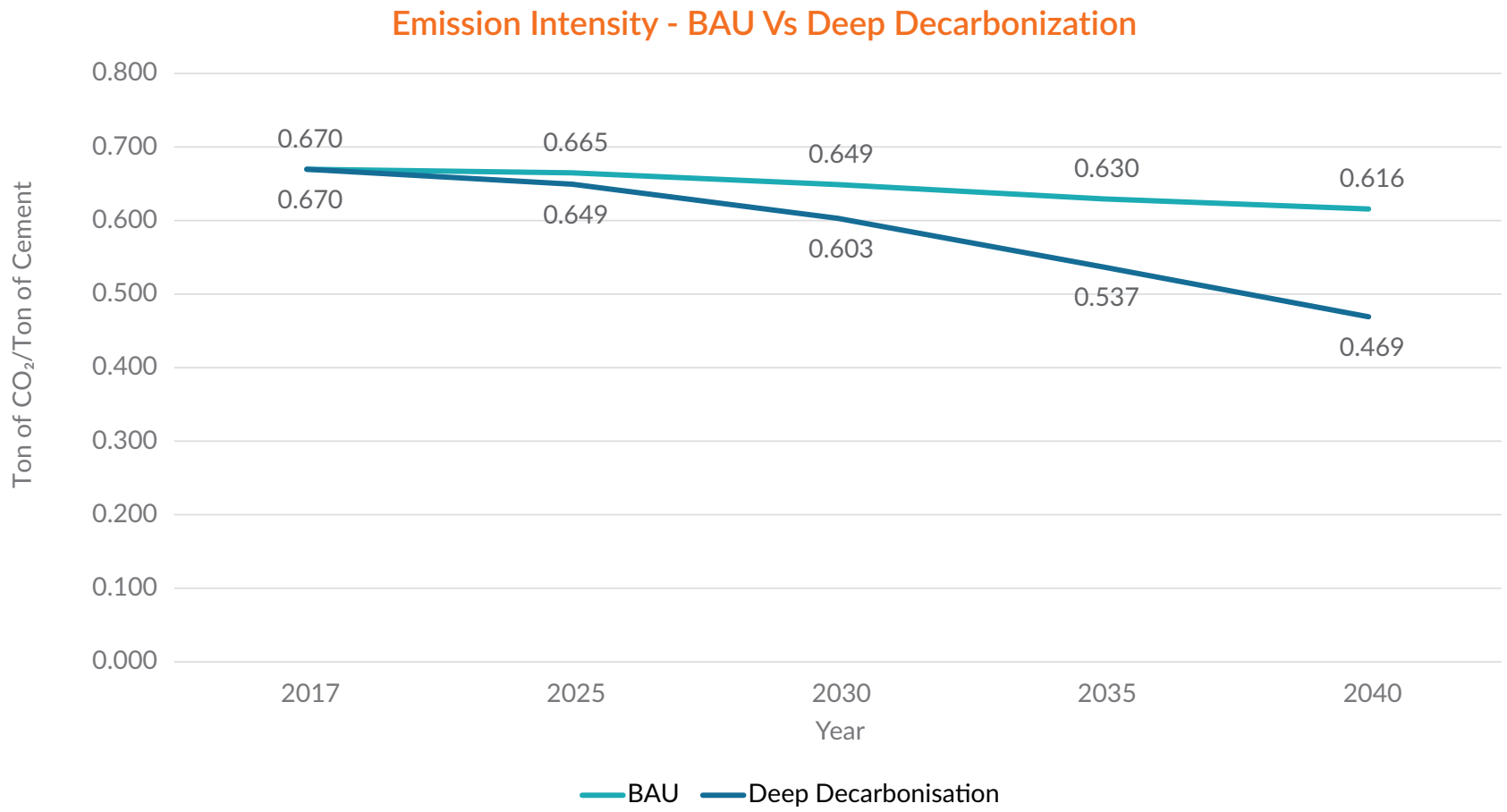



Electrical SEC




*CII Estimates

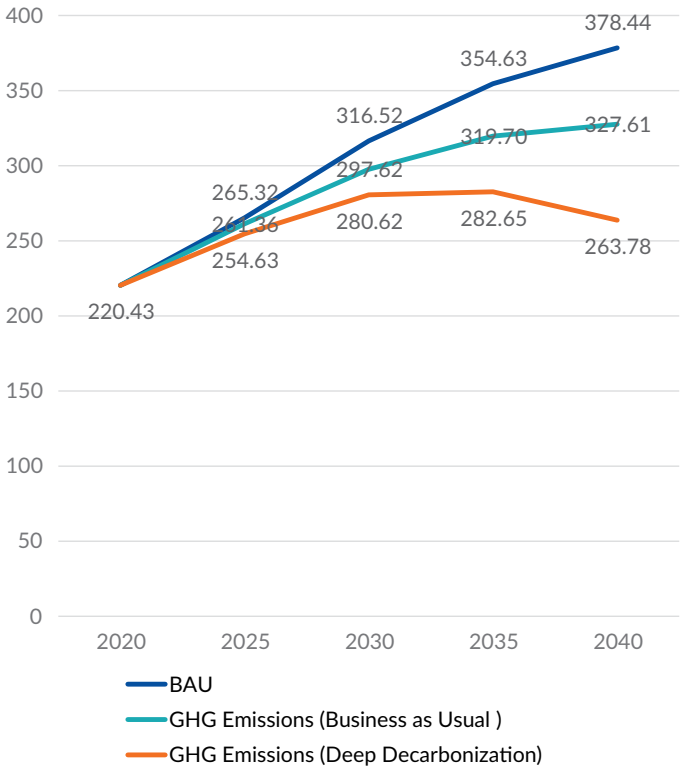
# PROJECTED EMISSION INTENSITY REDUCTION EMISSION INTENSITY



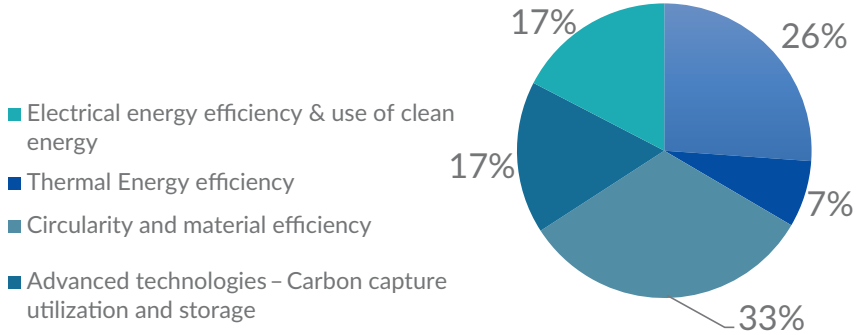

*CII Estimates

# ESTIMATED PROJECTIONS OF TOTAL GHG EMISSIONS (IMPACT OF LEVERS)

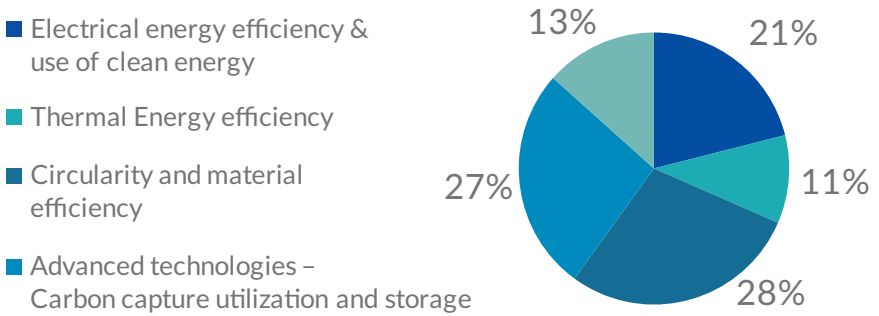
## GHG Emissions (Cement Production) Million Tons of $CO_2e$




## Impact of Various Levers of Decarbonization (Baseline Vs BAU)




## Impact of Various Levers of Decarbonization (Baseline Vs Deep Decarbonization)




**CII Estimates*

# KEY MESSAGE

## Message 7

In Steel sector, Energy Efficiency, Material Circularity and Renewable Energy are the top levers contributing 40%, 30% and 20% emission intensity reduction respectively in Deep Decarbonization Scenario

# KEY MESSAGE

## Message 8

Cement Sector – One of the most progressive sectors in the Indian Industrial sectors can reduce its overall emission intensity by 13.4% and 30.3% in BAU and Deep Decarbonization Scenarios

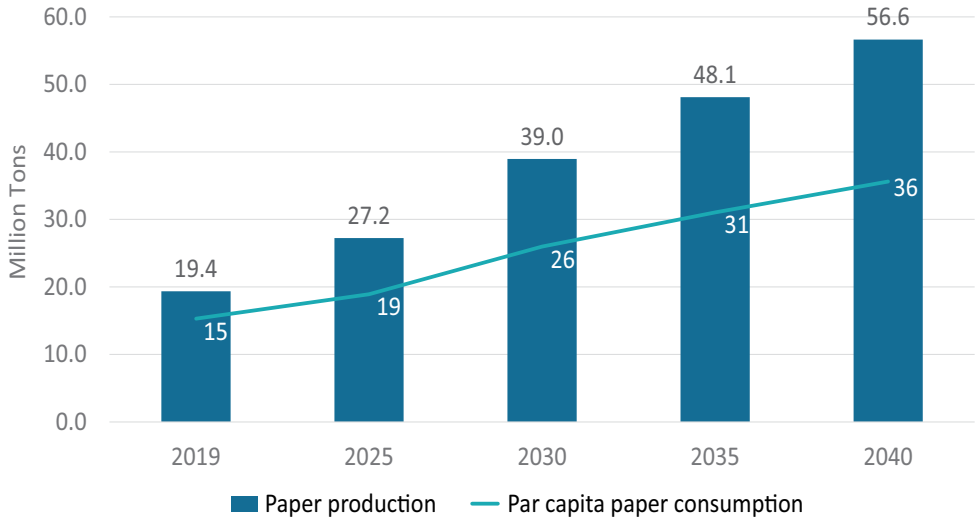

# Decarbonization pathways for Paper Sector



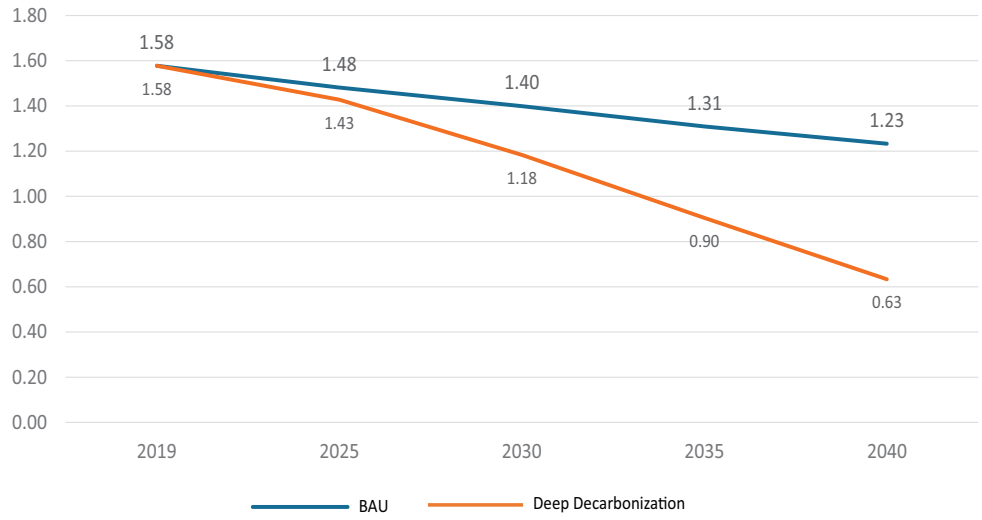
Confederation of Indian Industry

# ESTIMATED PRODUCTION & EMISSION INTENSITY

## Projected growth of Indian Paper Sector



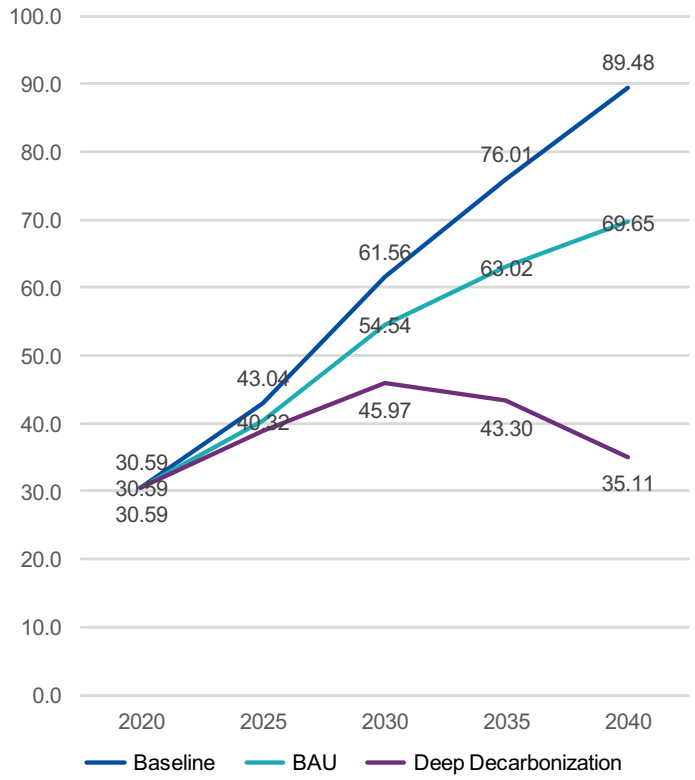

## Emission intensity, $TCO_2$/T of paper




*CII Estimates

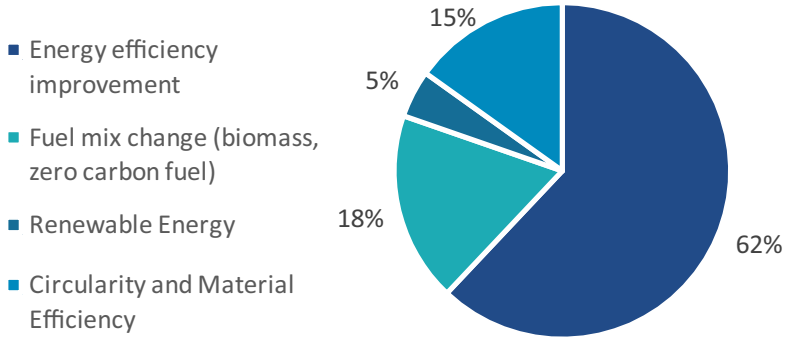
# ESTIMATED PROJECTIONS OF TOTAL GHG EMISSIONS (IMPACT OF LEVERS)

## GHG Emissions (Pulp and paper) Million Tons of $CO_2e$

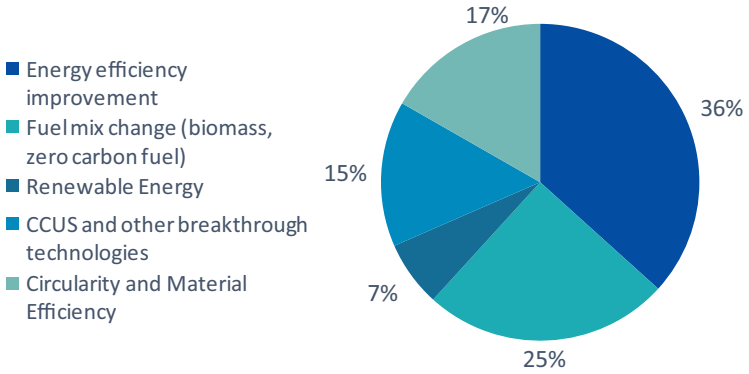



*CII Estimates

## Baseline Vs BAU




## Baseline Vs Deep Decarbonization



# KEY MESSAGE

## Message 9

Circularity and Material Efficiency Measures like Improving Clinker factor improvement, increasing additives in overall cement manufacturing will play a huge role in decarbonization efforts for Cement Sector (33% in BAU and 28% in Deep Decarbonization Pathways)

# Decarbonization pathways for Textile Sector



Confederation of Indian Industry

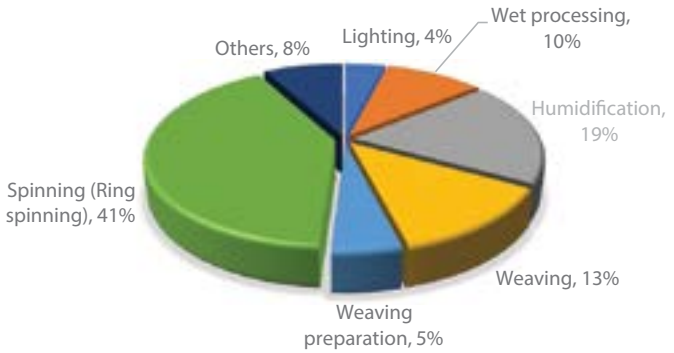
# SPECIFIC ENERGY CONSUMPTION – TEXTILE INDUSTRY

| Parameter | Unit | SEC various sections Average |
|---|---|---|
| Electrical UKG* up to winding (Yarn-40s count) | kWh/kg | 5.37 |
| Electrical UKG (Open-end Yarn) | kWh/kg | 1.35 |
| Electrical UKG (Fiber Dyeing) | kWh/kg | 0.46 |
| Electrical UKG (Weaving)@ 60 PPI | kWh/kg | 3.43 |
| Thermal SEC (Weaving)@ 60 PPI | kcal/kg | 1,231.11 |
| Electrical UKG (Knitting) | kWh/kg | 2.13 |
| Electrical UKG (Cotton based fabric) | kWh/kg | 1.50 |
| Thermal SEC (Cotton based fabric) | kcal/kg | 7,170.67 |
| Electrical UKG (Polyester cotton based fabric) | kWh/kg | 1.71 |
| Thermal SEC (Polyester cotton based fabric) | kcal/kg | 8,564.53 |
| Electrical UKG (Lycra Fabric) | kWh/kg | 1.21 |
| Thermal SEC (Lycra Fabric) | kcal/kg | 4,517.77 |
| Electrical UKG (Wool based fabric) | kWh/kg | 1.00 |
| Thermal SEC (Wool based fabric) | kcal/kg | 3,630.36 |

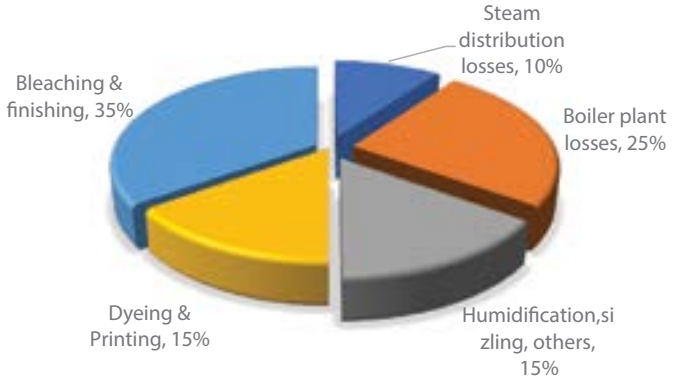
**Unit per KG of Yarn*

*Bureau of Energy Efficiency*

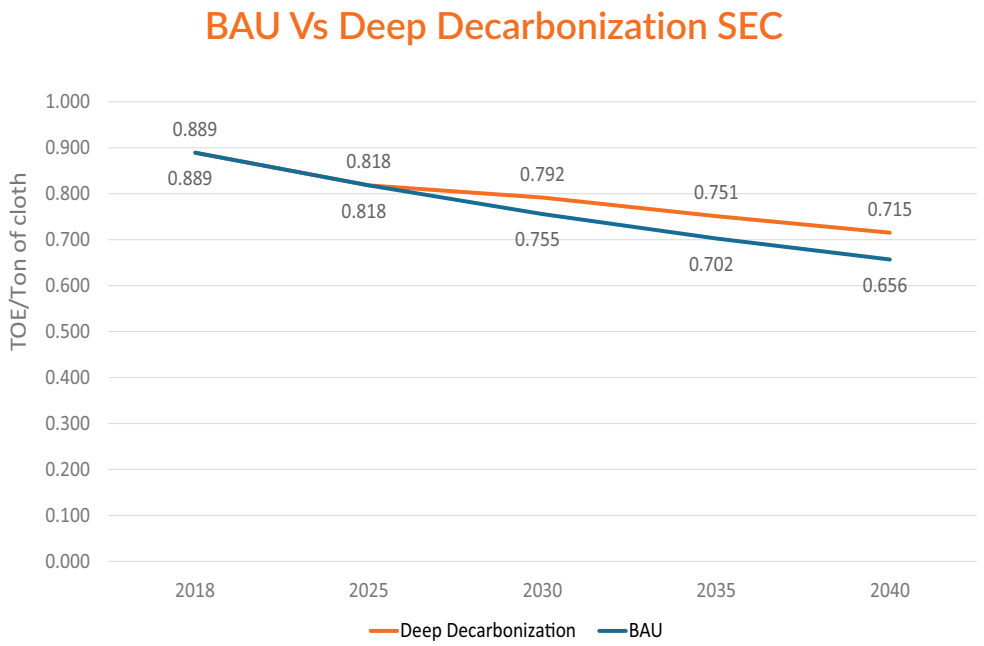
## Electricity use in a composite textile plant

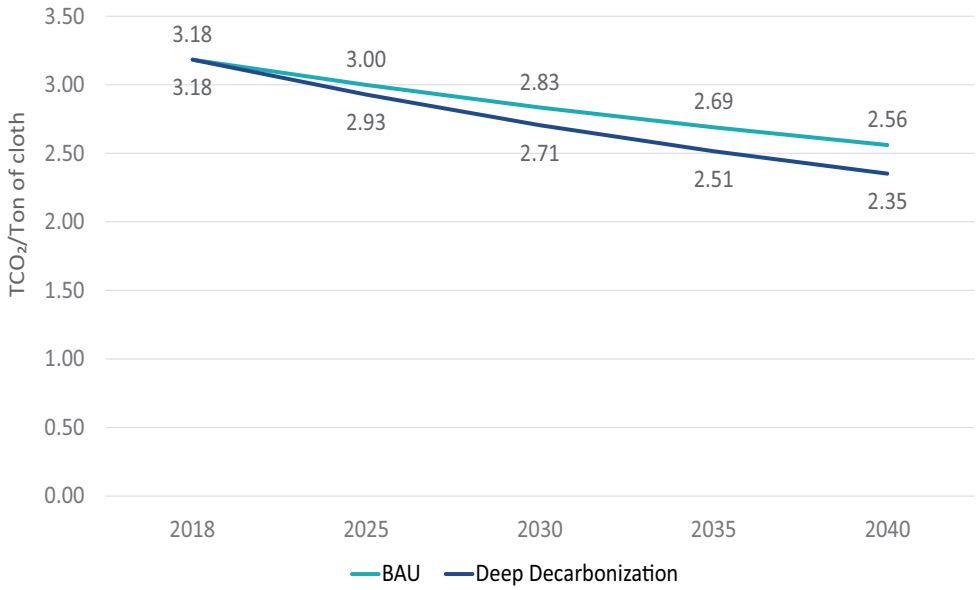



## Thermal energy use in a composite textile plant



# PROJECTIONS : SPECIFIC ENERGY CONSUMPTION & EMISSION INTENSITY

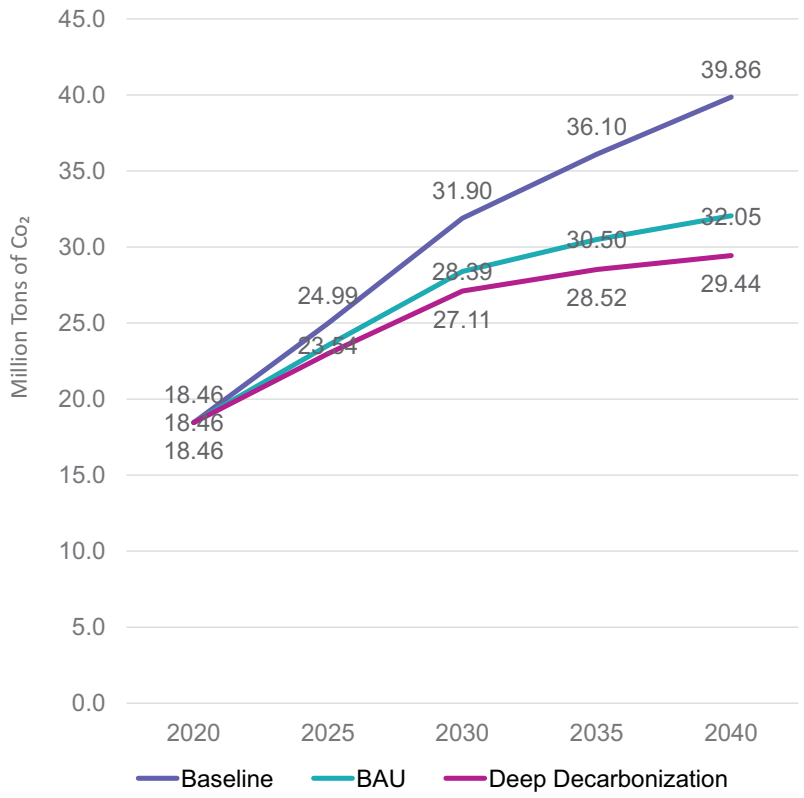


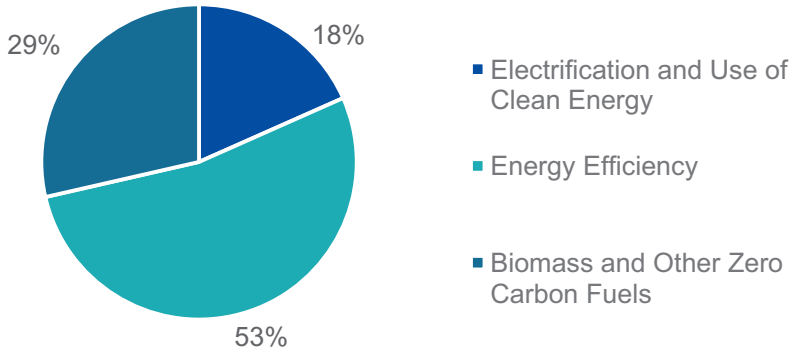

*CII Estimates

# ESTIMATED PROJECTIONS OF TOTAL GHG EMISSIONS (IMPACT OF LEVERS)

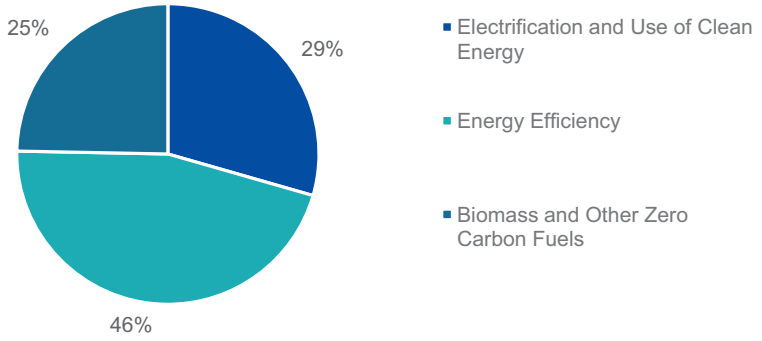
## GHG Emissions (Textile)




## Baseline Vs BAU




## Baseline Vs Deep Decarbonization




*CII Estimates*

# KEY MESSAGE

## Message 10

Paper is one of the sector which has a huge potential in terms of becoming carbon neutral in near future.

# KEY MESSAGE

## Message 11

Energy Efficiency remains to play an important role in the overall Paper and Pulp sector decarbonization. Energy Efficiency can contribute to around 62% reduction in BAU Scenario and around 36% reduction in Deep Decarbonization Scenario for the decarbonization journey of paper sector

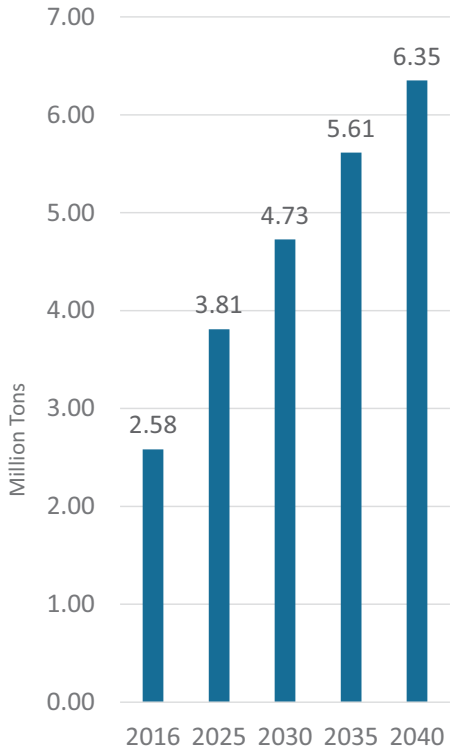
# Decarbonization pathways for Chemical Sector



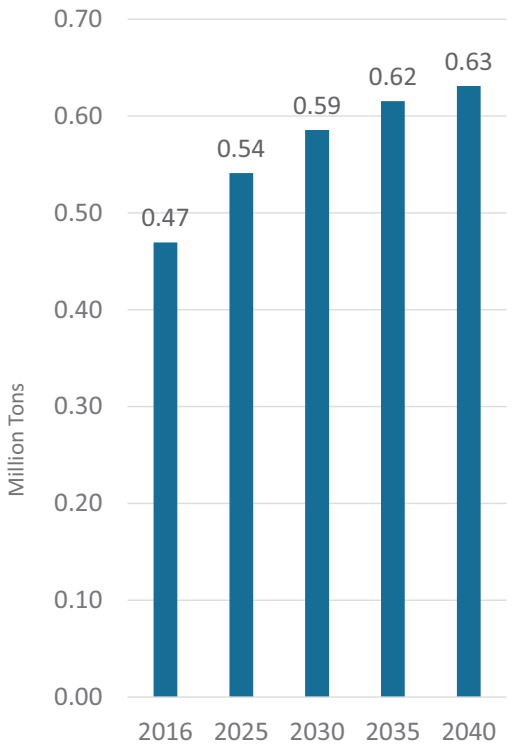
Confederation of Indian Industry

# ESTIMATED PROJECTIONS : SODA ASH, CARBON BLACK AND ETHYLENE PRODUCTION

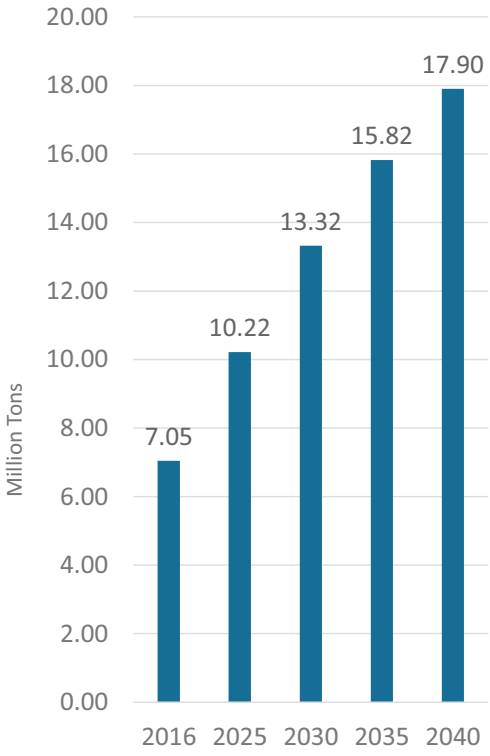
In the Chemicals Sector to understand the overall all low carbon transition, 3 major chemical - Soda Ash, Carbon Black, and Ethylene have been selected for the study. These 3 chemicals contribute to more than 70% of the overall emissions from the sector, thus making them representative of the overall chemical sector.




Soda Ash




Carbon Black

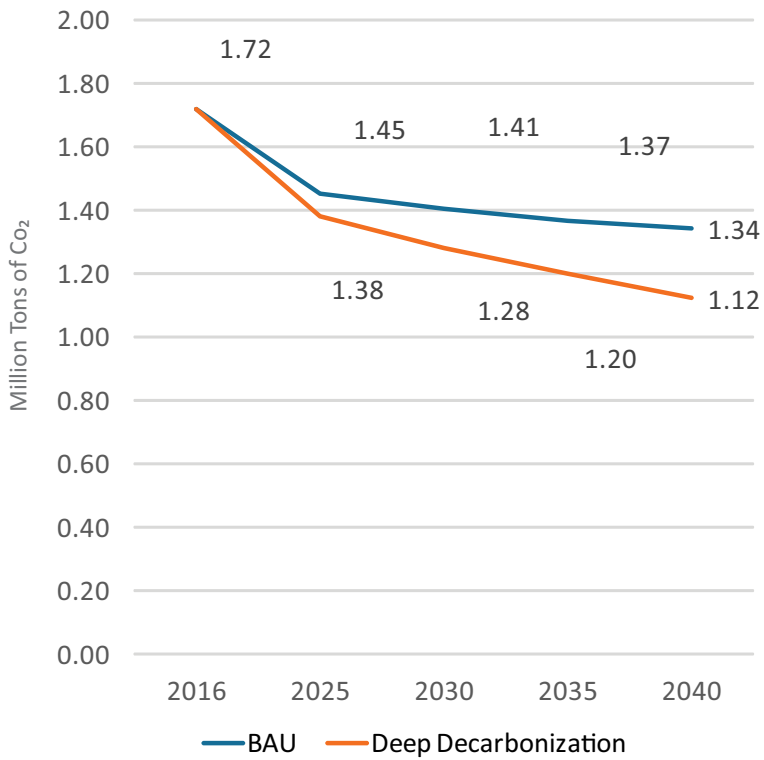



Ethylene

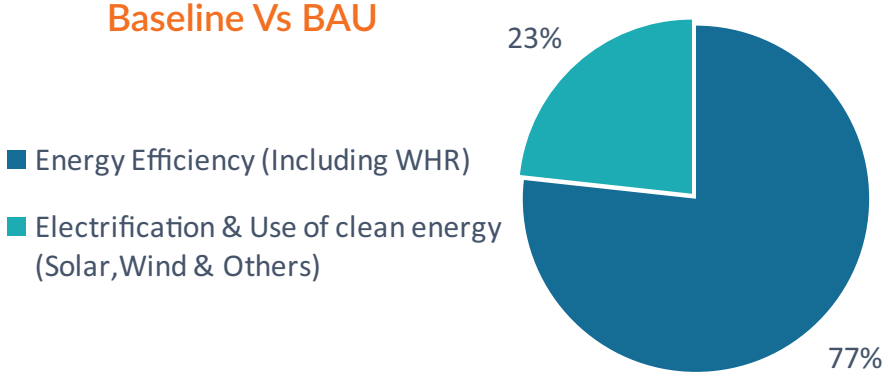
**CII Estimates*

# ESTIMATED PROJECTIONS OF TOTAL GHG EMISSIONS (IMPACT OF LEVERS) - SODA ASH

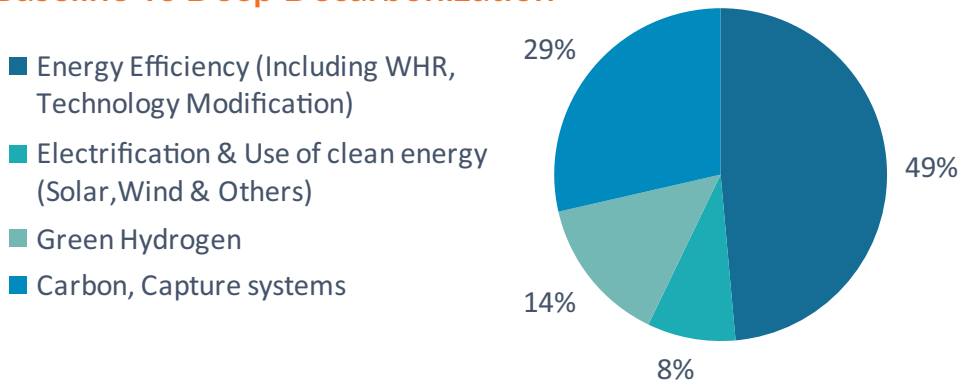
## GHG Emissions (Soda Ash)




## Baseline Vs BAU



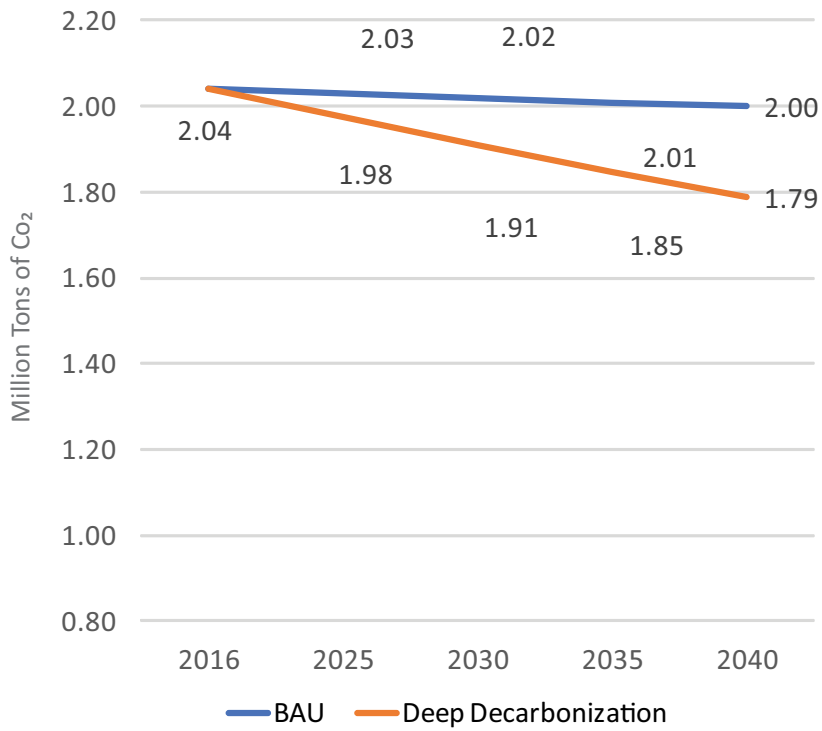

## Baseline Vs Deep Decarbonization



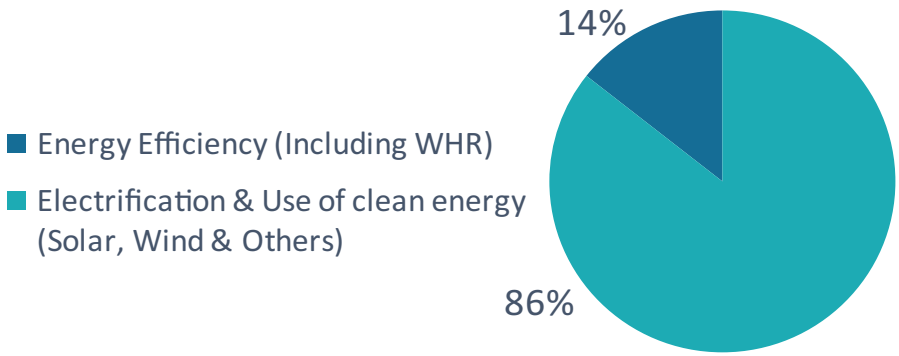

*CII Estimates

# ESTIMATED PROJECTIONS OF TOTAL GHG EMISSIONS (IMPACT OF LEVERS) - CARBON BLACK

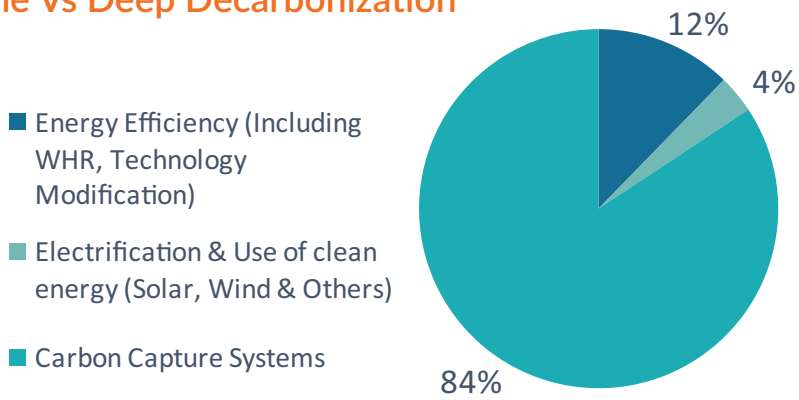
## GHG Emissions (Carbon Black)




## Baseline Vs BAU



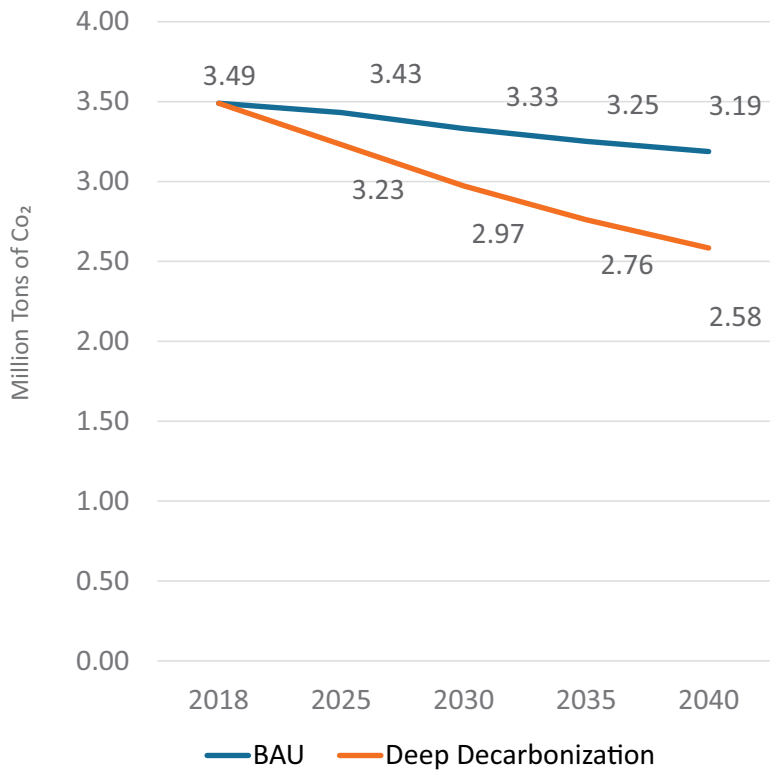

## Baseline Vs Deep Decarbonization



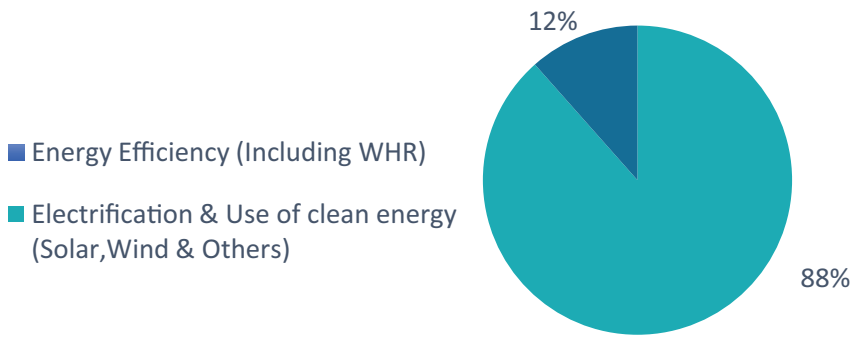

*CII Estimates

# ESTIMATED PROJECTIONS OF TOTAL GHG EMISSIONS (IMPACT OF LEVERS) - ETHYLENE

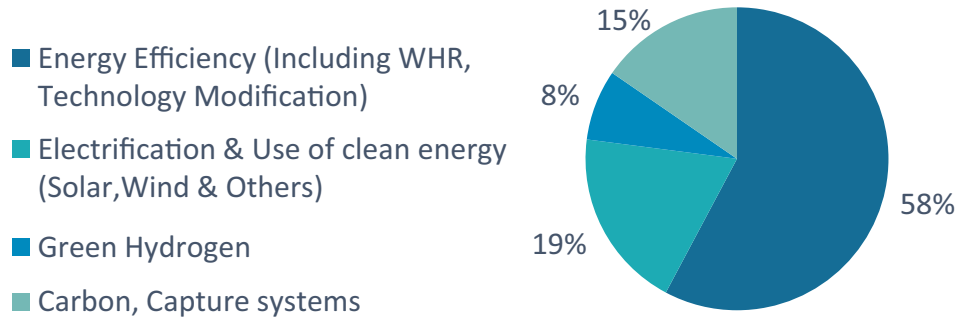
## GHG Emissions (Ethylene)




## Baseline Vs BAU

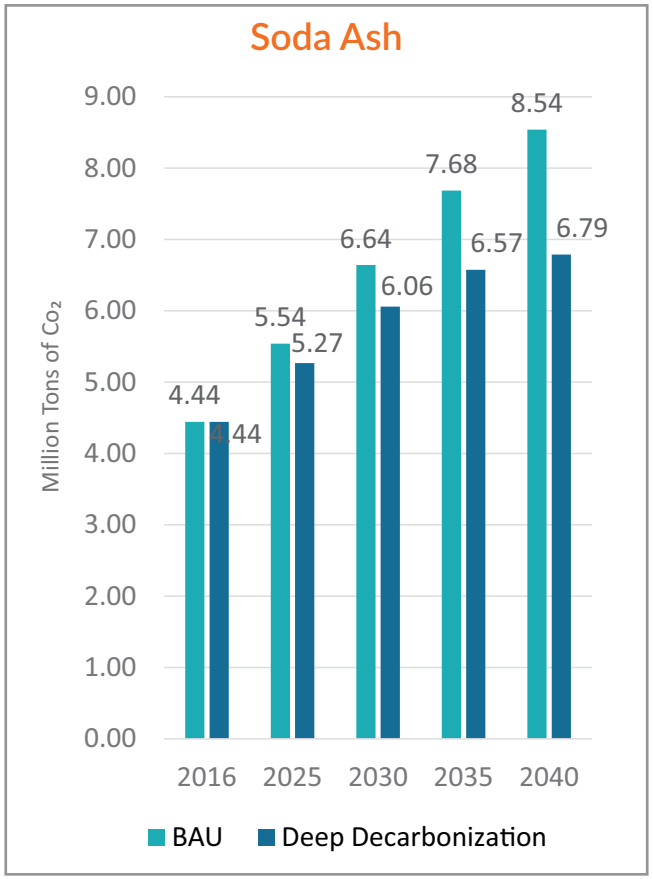


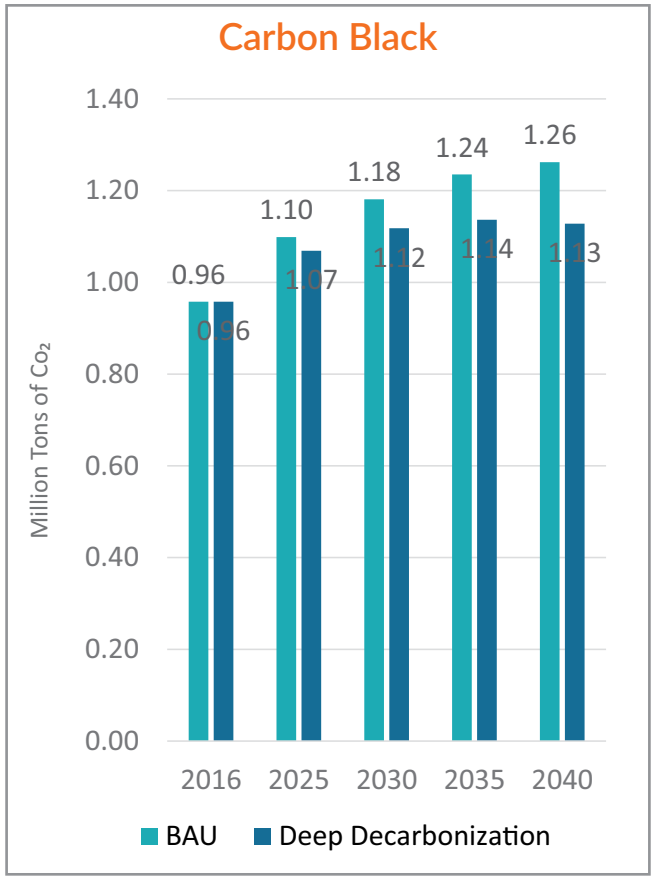

## Baseline Vs Deep Decarbonization

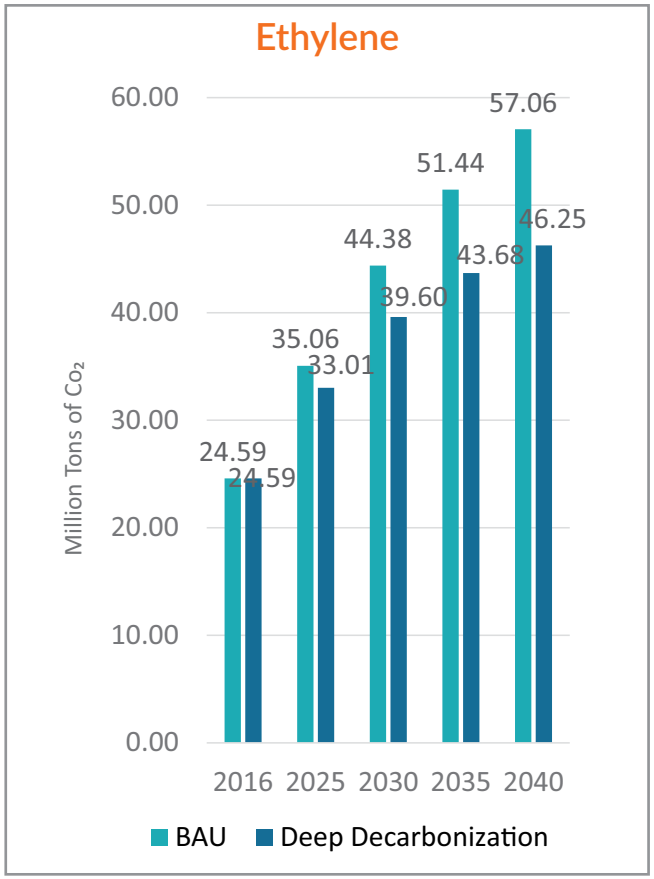



*CII Estimates

# ESTIMATED EMISSIONS



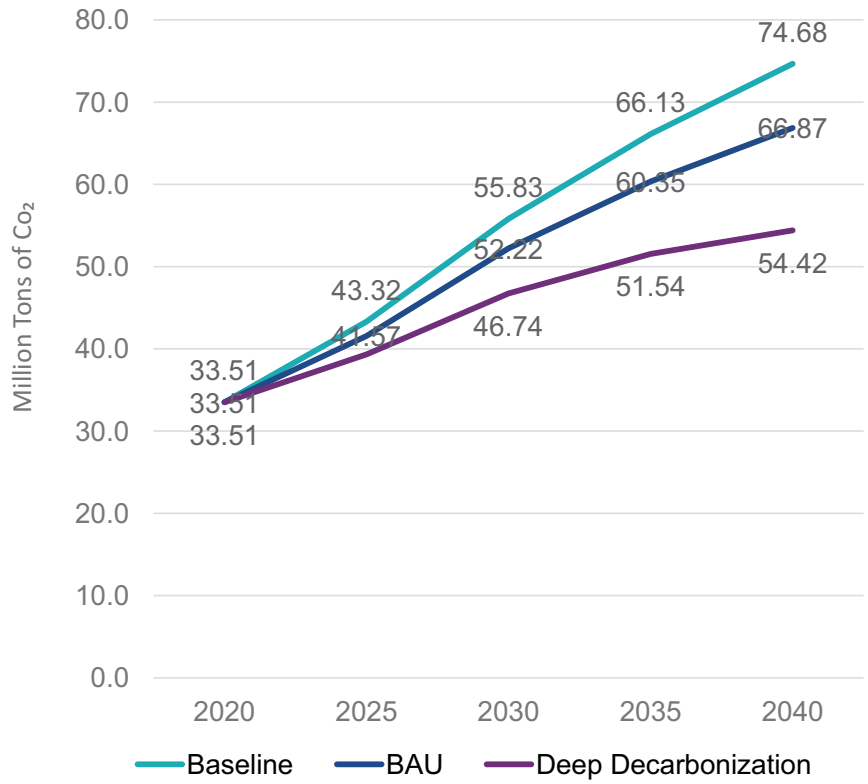



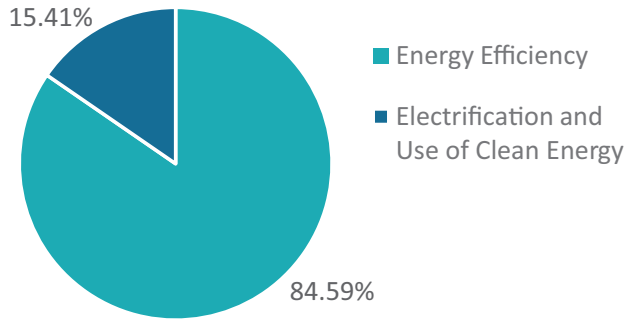

*CII Estimates

# ESTIMATED PROJECTIONS - TOTAL EMISSIONS (COMBINED FOR ALL 3 SELECTED SECTORS)

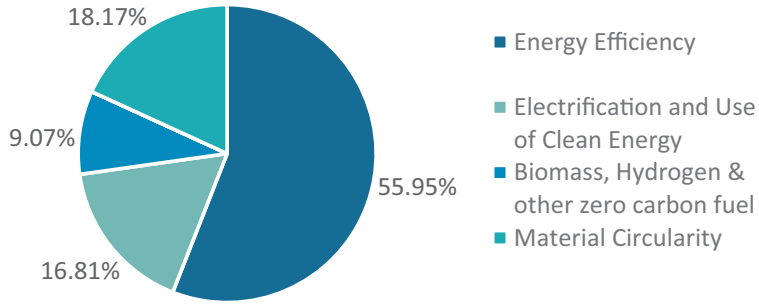
## GHG Emissions (Chemical Sector*)




## Baseline Vs BAU




## Baseline Vs Deep Decarbonization




**CII Estimates*

# KEY MESSAGE

## Message 12

Energy Efficiency and Biomass Utilization will play an important role in Textile Industry Decarbonization. While Energy Efficiency can contribute to 53% reduction in BAU Scenario and 46% reduction in Deep Decarbonization Scenario, Biomass and utilization of other cleaner fuels, could further contribute to 29% reduction in BAU scenario and 25% in Deep Decarbonization Scenario

# Summary of Results from Analysis of 5 Selected Sectors

# KEY MESSAGE

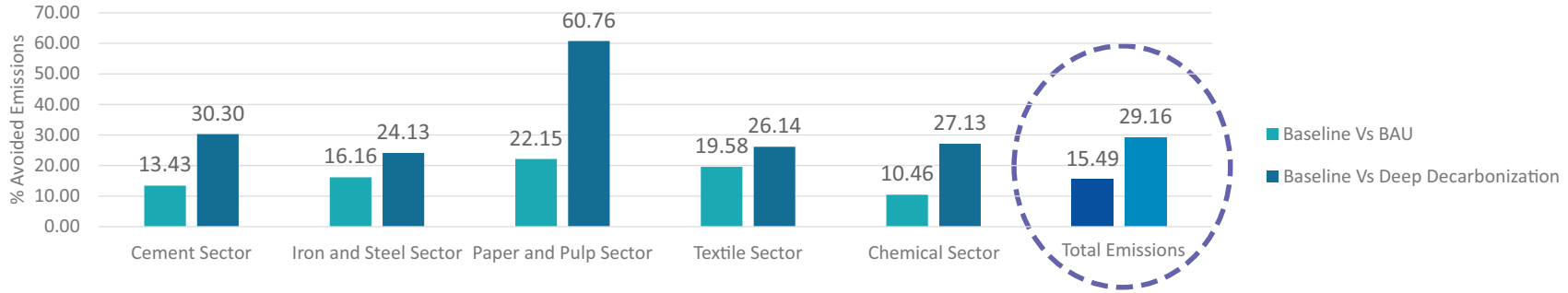
## Message 13

Chemical sector has significant amount of process emissions making it really challenging to decarbonize hence, to accelerate decarbonization, Hydrogen and CCUS will have to play a very significant role in overall Decarbonization of this sector

# ESTIMATED AVOIDED EMISSIONS FROM 5 SELECTED SECTOR FROM BASELINE YEAR TO YEAR 2040

| Sector Name | Baseline Emissions | Emission in 2040 with no change in Emission Intensity | Emission in BAU sector (2040) | Emission in Deep Decarbonization Scenario (2040) | Baseline Vs BAU (Avoided Emission %) | Baseline Vs Deep Decarbonization (Avoided Emission %) |
|---|---|---|---|---|---|---|
| | | Million Tons of $CO_2$ | | | (Avoided Emission %) | (Avoided Emission %) |
| Cement Sector | 220.43 | 378.44 | 327.61 | 263.78 | 13.43 | 30.30 |
| Iron and Steel Sector | 289.13 | 594.77 | 498.62 | 451.23 | 16.16 | 24.13 |
| Paper and Pulp Sector | 30.59 | 89.48 | 69.65 | 35.11 | 22.15 | 60.76 |
| Textile Sector | 18.46 | 39.86 | 32.05 | 29.44 | 19.58 | 26.14 |
| Chemical Sector | 33.51 | 74.68 | 66.87 | 54.42 | 10.46 | 27.13 |
| Total Emissions | 592.12 | 1177.22 | 994.81 | 833.98 | 15.49 | 29.16 |

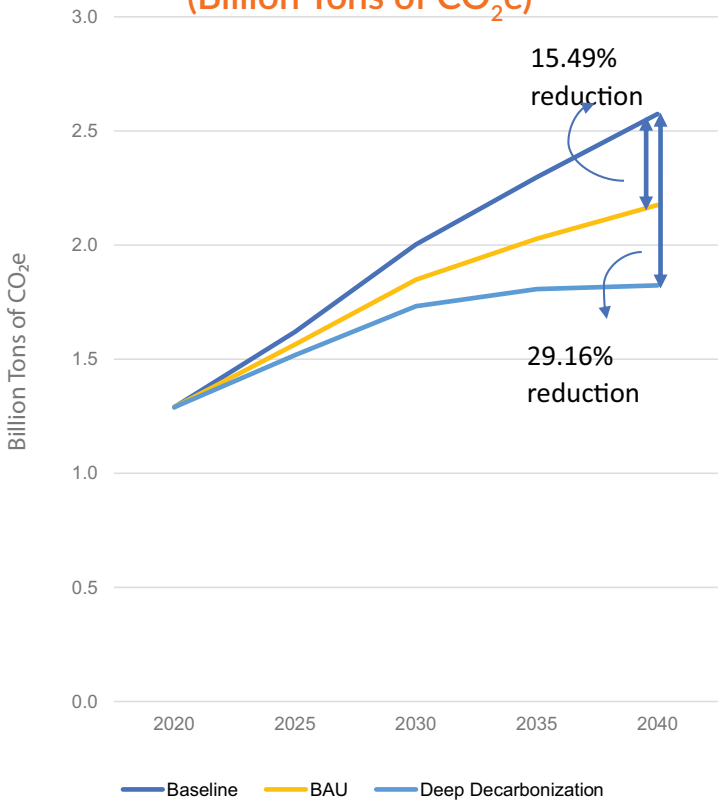
## Avoided Emissions from 5 Selected Sector from Baseline Year to Year 2040 (BAU Vs Deep Decarbonization Scenario)



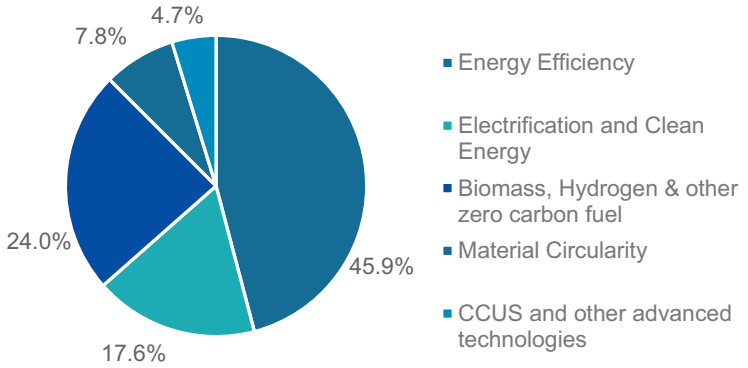

*CII Estimates

# ESTIMATED EMISSION REDUCTION FOR INDUSTRIAL SECTOR

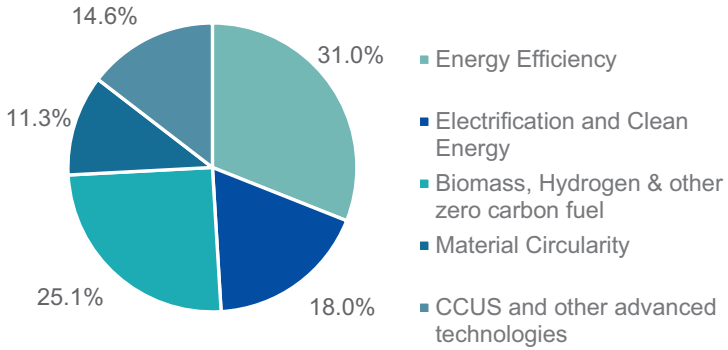
## Industrial Emissions Extrapolated to 5 selected sector's Emission reduction (Billion Tons of $CO_2e$)




## Baseline Vs BAU Scenario for Entire Industrial Sector



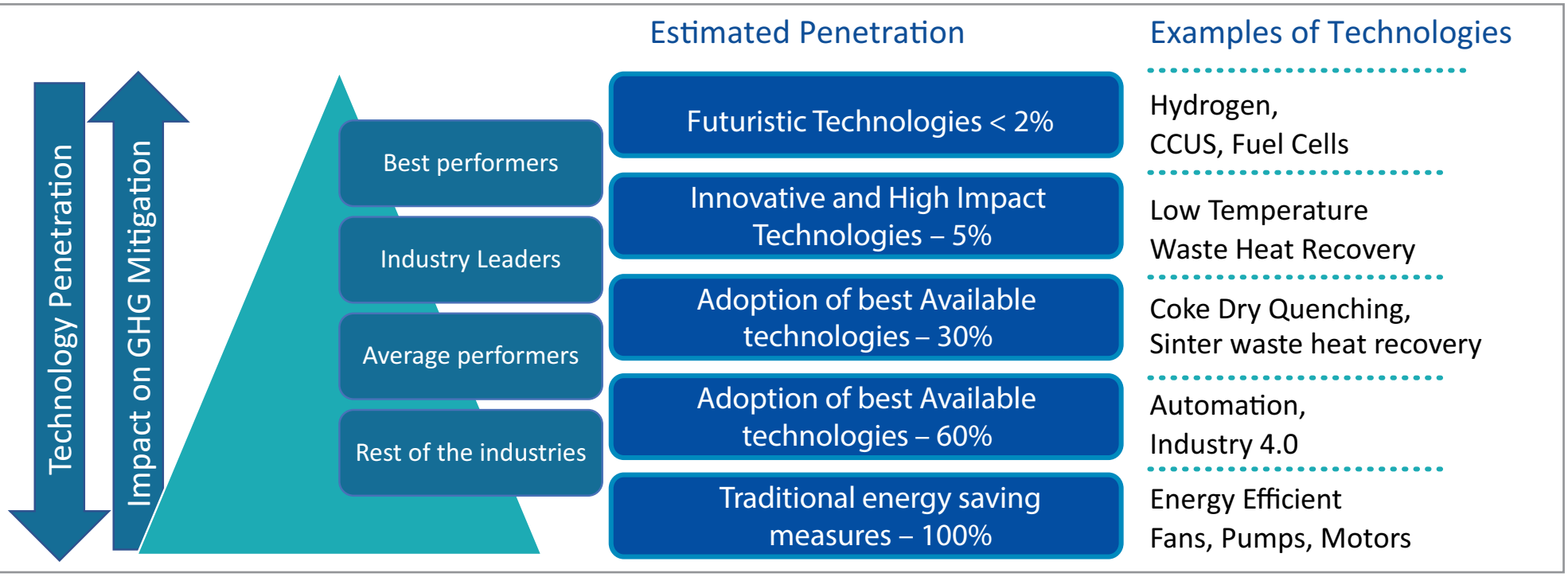

## Baseline Vs Deep Decarbonization Scenario for Entire Industrial Sector




*CII Estimates

# Conclusions

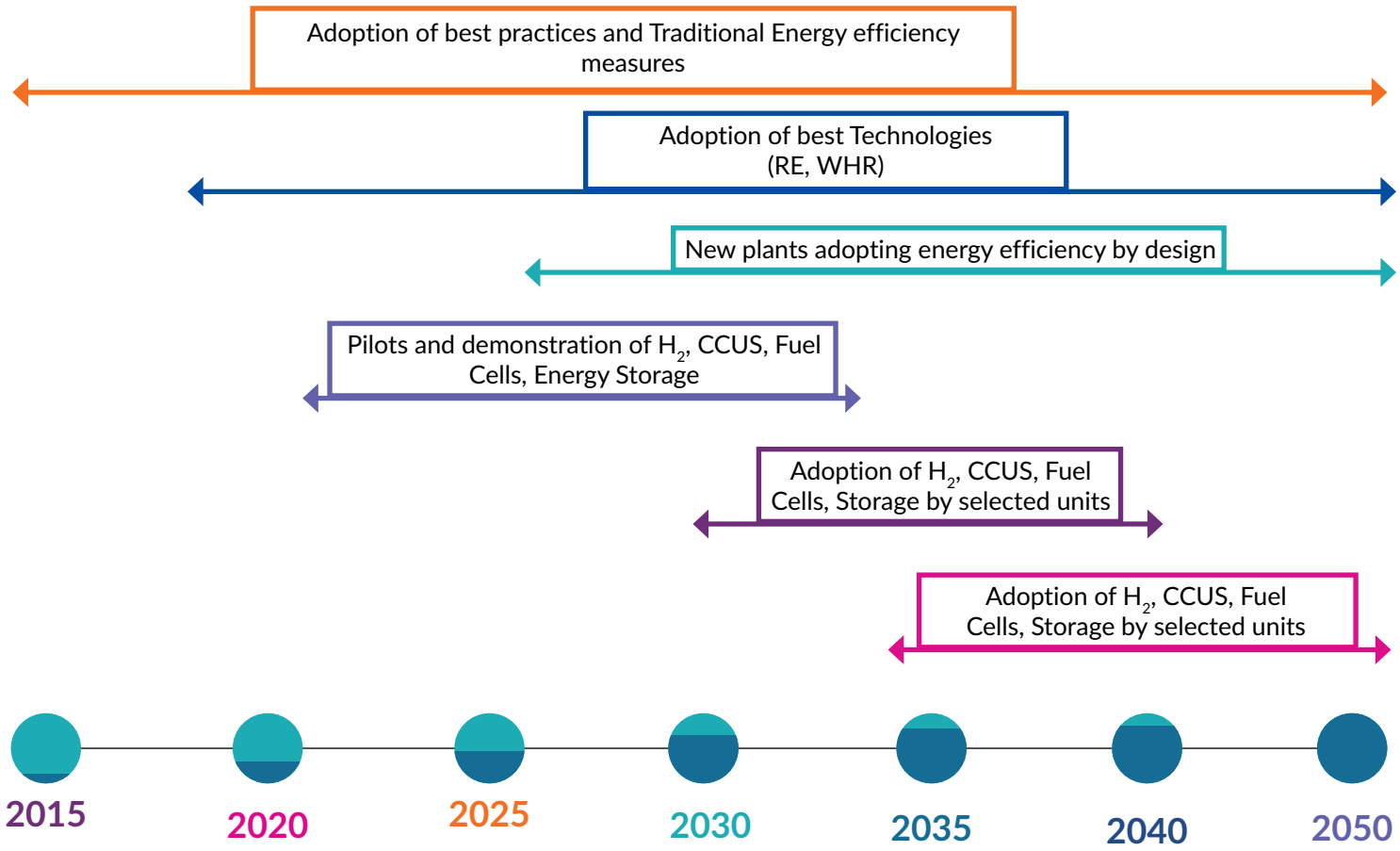
# DECARBONIZATION OF INDIAN INDUSTRIAL SECTOR – KEY IMPACT TECHNOLOGIES



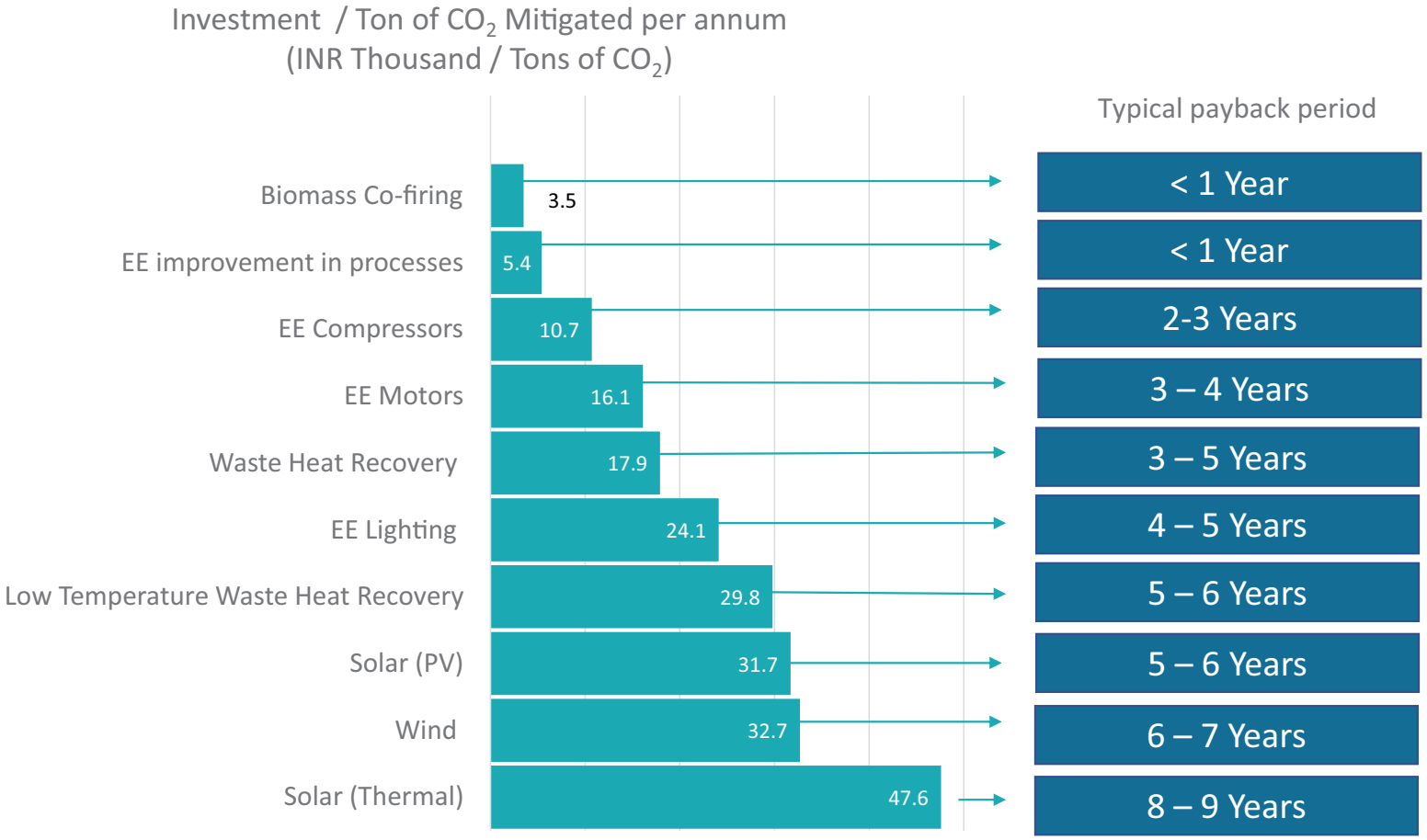

**Futuristic Technologies – Require Significant Policy Push from government to reduce the cost of technology adoption, also the industry leaders and best performers need to show real commitment towards their adoption for the others to follow**

**CII Estimates*

# TECHNOLOGICAL ROAD MAP FOR DECARBONIZATION



# INVESTMENT REQUIRED FOR KEY TECHNOLOGIES




*CII Estimates

# KEY MESSAGE

## Message 14

Many of the futuristic technologies like Hydrogen, CCUS, Fuel Cells etc. are still in their nascent stages with high-cost implications. On one hand these technologies require a huge push on the policy front, but the Industry leaders also need to come forward and demonstrate its commitment towards adoption of the same

# INTERVENTIONS FOR ACCELERATING DECARBONIZATION

**Energy Efficiency**

- Strengthening PAT Scheme
- Incorporating EE as a mandatory criteria in Public/Industry Procurement guidelines
- Promoting EE through Technology Innovations
- Developing Ecosystem for EE Financing

**Electrification and Use of Clean Energy – Renewable Energy (Solar, Wind and others)**

- Replicating Flexible RE policies in states
- Strengthening REC Mechanism
- Decarbonizing Coal based Power – Supercritical Power Plants, Biomass cofiring, phasing old and inefficient plants
- Higher focus on electrification of key processes and technologies from various industrial sectors

**Circularity and Material Conservation**

- Developing policies to promote Circularity and Resource Efficiency
- Promoting Increased AFR in Cement, Scrap utilization in Steel Sector
- Promoting Green Public Procurement
- Extended Producers Responsibility
- Creation of RE business models – RE products, services, efficient packaging
- Tax Exemptions on recycled products and SOPs on Eco Labelled Products

# INTERVENTIONS FOR ACCELERATING DECARBONIZATION

## Biomass, Hydrogen and Other Zero Carbon Fuels

- Incentivizing Stakeholders like farmer, Poultry and Dairy industries, Municipalities for Biomass Utilization
- Promoting Alternate Fuel Utilization, Biomass Cofiring
- Promoting Ethanol blending
- Hydrogen – Tax Waivers for Electrolysers, electricity duty on RE for Hydrogen production
- Promoting hydrogen blending in CNG
- Carbon Pricing / Carbon Tax
- Technology Transfer
- R&D, Pilots

## Carbon Capture Utilization and Storage

- Suitable Carbon pricing mechanism to make CCS profitable
- Policy level Interventions from government – subsidies etc.
- Significant investment and financing by private sector

# CONFEDERATION OF INDIAN INDUSTRY

The Confederation of Indian Industry (CII) is a non-government, not-for profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has around 8,000 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 200,000 enterprises from around 240 national and regional sectoral industry bodies.

CII – Sohrabji Godrej Green Business Centre (CII – Godrej GBC), a division of Confederation of Indian Industry (CII) is India's premier developmental institution, offering advisory services to the industry on environmental aspects and works in the areas of Green Buildings, Energy Efficiency, Greenco, Renewable Energy, Green Business Incubation and Climate Change activities. CII-Godrej GBC works closely with the stakeholders in facilitating India to emerge as one of the global leaders in Green Business by the year 2022.

CII – Godrej GBC in association with Danfoss Industries Pvt. Ltd. as a part of this study looked at possible emission reduction of the Indian Industrial sector under various low carbon scenarios based on the various low carbon levers like Energy Efficiency, Electrification and Renewable Energy, Biomass and other zero carbon fuel utilization, Circularity and Material efficiency and Advanced Technologies like CCUS and others.

To know more, please visit www.greenbusinesscentre.com

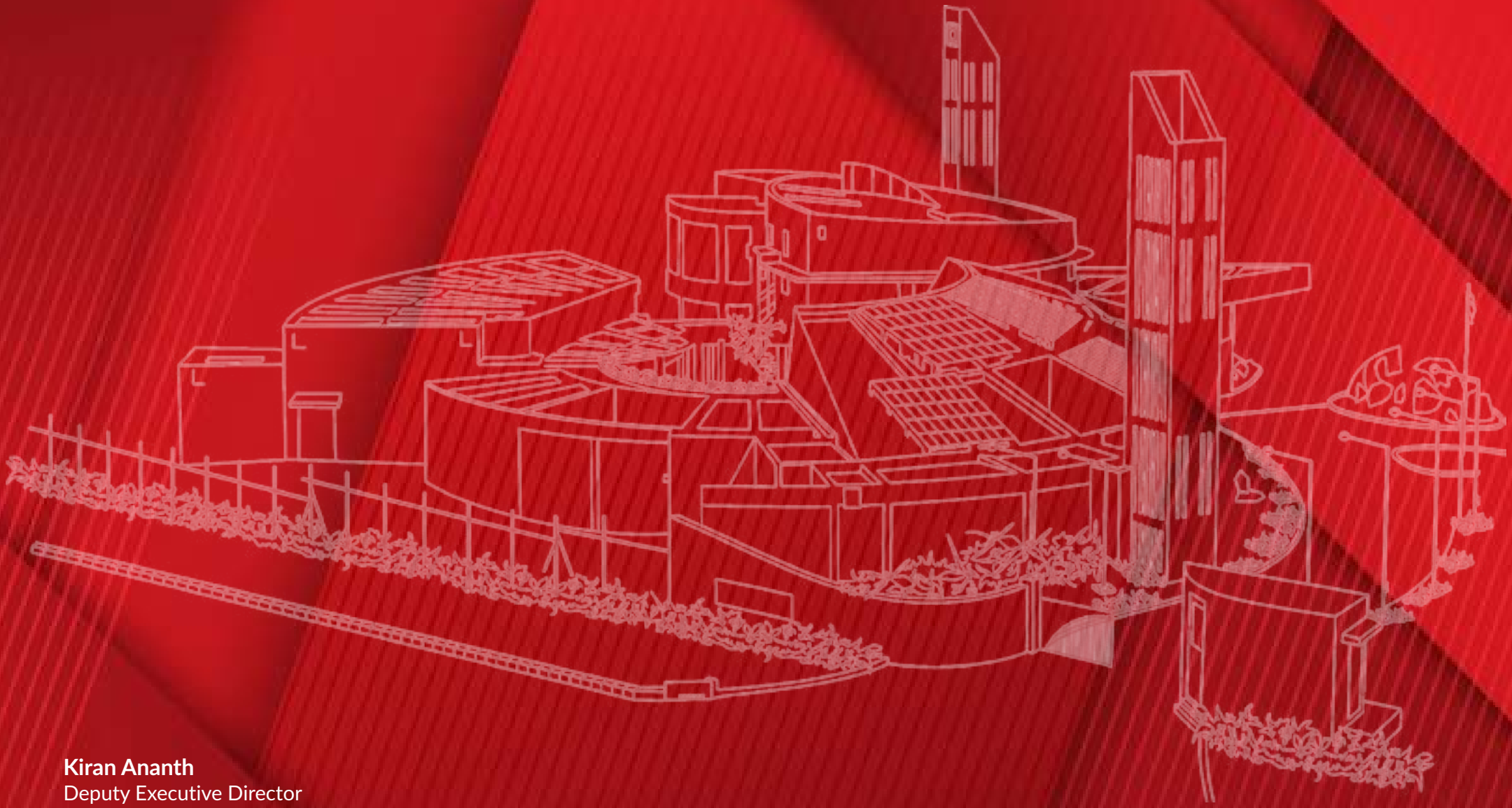
# DANFOSS INDIA

Danfoss India, is a 100-percent owned subsidiary of Danfoss Group and is an industry leader focused on providing energy efficient solutions for a sustainable tomorrow. Danfoss India serves a wide range of industries that rely on Danfoss products for like Drives, heating valves, controls & solutions for refrigeration, air conditioning, heavy industries, HVAC, district cooling and under floor heating applications.

Established in 1998, Danfoss India is headquartered in Oragadam Chennai. True to its promise of energy efficiency, the 500-crore manufacturing facility at Danfoss' Oragadam campus is a LEED Platinum rated facility with an on ground solar installation and has a focus on R&D and houses NABL accredited application lab facilities. The focus of this centre is to design and innovate products for climate and energy for both India and outside market. Danfoss' nation-wide sales and support network comprises of 10 offices, 3 manufacturing sites, a strong network of channel partners and 1000+ employees pan India.

Danfoss India has won several awards for its excellence in environment management, CSR & sustainability, EHS, Shop floor, Logistics & Supply Chain, etc. The organisation focuses on engineering tomorrow's solutions, as on september 2022. Mr. Ravichandran Purushothaman is the President of Danfoss in India.

To know more, please visit www.danfoss.in



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