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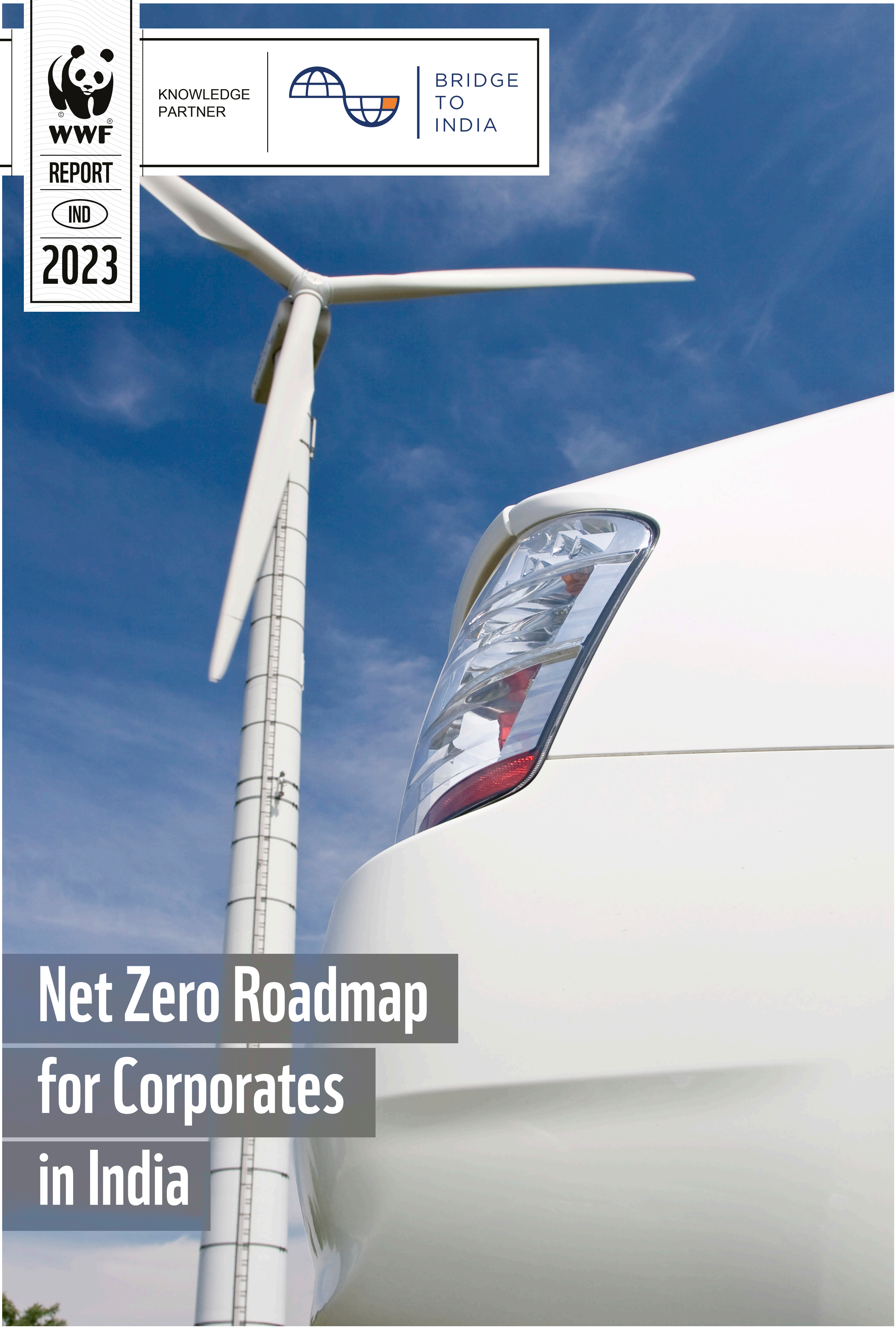

Net Zero Roadmap for Corporates in India

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Acronyms

AFLOU	Agriculture, forestry and other land use
BEE	Bureau of Energy Efficiency
BESS	Battery energy storage system
BUR	Biennial update report
CCUS	Carbon, capture, utilisation and storage
CDP	Carbon Disclosure Project
CERC	Central Electricity Regulatory Commission
COP	Conference of Parties
ECBC	Energy Conservation Building Code
ECIU	Energy & Climate Intelligence Unit
ESCerts	Energy saving certificates
ESG	Environmental, social and governance
ETS	Emission trading system
EU	European Union
EV	Electric vehicle
GDP	Gross domestic product
GHG	Greenhouse gas emissions
GTCO2e	Giga tonnes of carbon dioxide equivalent
IPCC	Intergovernmental Panel on Climate Change
IREDA	Indian Renewable Energy Development Agency
MNRE	Ministry of New and Renewable Energy
MOP	Ministry of Power
MOEFCC	Ministry of Environment, Forest and Climate Change
MTCO2e	Million tonnes of carbon dioxide equivalent
NDCs	Nationally determined contributions
NbS	Nature-based Solutions
PAT	Perform, achieve and trade
PLI	Production linked incentive
REC	Renewable energy certificates
REDE	Renewable Energy Demand Enhancement
RPO	Renewable purchase obligation
SBTi	Science Based Targets initiative
TCO2e	Tonne of carbon dioxide equivalent
UNFCC	United Nations Framework for Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

Preface

At COP26, India announced a target to achieve net zero emission status by 2070. As one of the fastest growing economies in the world, , India's target is crucial for meeting international climate goals. Corporate entities, being responsible for around half of total energy consumption, are expected to play a vital role in India's journey towards decarbonisation.

The Indian corporate sector has already started taking voluntary action with tentative steps to reduce emissions in the face of competitive pressure and investor demands. However, absence of globally recognised standards, lack of a clear policy framework and nascent state of some key technologies makes the path to net zero for corporates inherently opaque and uncertain. There are many instances of companies failing to make sufficient progress despite bold intent.

This report includes a comprehensive overview of the corporate decarbonisation scenario in India and aims to provide a tentative roadmap to help them achieve net zero targets. We have examined viable decarbonisation options in the Indian context and identified critical opportunities as well as barriers across policy, technology and financing domains. We acknowledge that financial viability of various options, which is beyond the scope of this report, will be an important factor while selecting the right mix of decarbonisation pathways and technology levers. The report also suggests policy measures and approaches by decision makers that could lead to meaningful systemic change in the Indian ecosystem. Keeping in mind the larger goals of WWF, we have also incorporated Nature Based solutions as one strategy to build on conventional decarbonisation levers and encourage corporations to incorporate nature positivity along with Net Zero in their target.

The report has been prepared largely using desktop research, drawing inferences from various international and Indian studies. We surveyed 21 leading companies that have already announced emission reduction targets and also studied annual reports of NSE100 companies to understand various steps taken by them on sustainability front and deconstruct broader challenges in the current ecosystem. We interacted closely with three companies in distinct sectors to understand their decarbonisation experience so far. We have prepared case studies for these companies to suggest how they can customise their roadmaps based on their unique characteristics.

We hope that this report and indicative roadmap provides useful guidance to corporates on steps to achieving net zero emission status and engages different stakeholders in accelerating progress in this direction.

Executive Summary

Increasing incidence of extreme climate events is inflicting grave economic loss beside environmental damage to the planet. The urgent need for climate action has led many countries to adopt emission pledges. For India, now committed to becoming a net zero emission economy by 2070, decarbonisation is critically urgent because of strong vulnerability to climate change and expected economic growth with transition from an agrarian to an industrial economy. As a developing country with increasing energy needs, India has a unique and massive opportunity to implement a bold climate sensitive growth plan.

The role of corporate entities, responsible for around half of India's total energy consumption, is vital in meeting decarbonisation targets. Faced with competitive pressure, investor pressure and reputational concerns, leading corporates have already started taking voluntary action even as any formal policy mandates are yet to be announced.

Corporate decarbonisation status in India

As of June 2022, 89 corporates in India have committed to science-based emission targets. Global initiatives like RE100, REDE, EV100, EP100, CDP have also witnessed strong participation by Indian companies. Our analysis of reporting by NSE 100 companies and a survey of 21 companies show that the Indian corporates are strongly engaged in sustainability and climate action.

Despite the bold intent, however, there are many instances of companies failing to take tangible steps. Absence of transparent standards, lack of a clear policy framework, high upfront cost, lack of technical expertise and nascent state of some key technologies are seen as key barriers in the path to net zero.

NSE 100 + Survey result summary below

Most of the surveyed companies have climate commitments to maintain competitive edge, corporate reputation and growing investors preferences. Renewable power and energy efficiency emerged as the most preferred decarbonisation levers. Technical and financial constrains corporates in taking decarbonisation action, whereas poor policy visibility and lack of regulations were cited as major external barriers in pursuing climate commitments. A conducive policy framework and financial incentives by the government were highlighted as the key enablers for corporate climate action.

A closer look at the top 100 NSE commitments reveals that 46% of companies have made climate commitments and 70% of the companies report carbon emissions. Many companies have joined initiatives like SBTi, REDE, RE100 and Carbon Disclosure Project (CDP). Based on our primary survey of 21 companies, key decarbonisation drivers for corporates are securing competitive advantage, growing investor preference and enhancing corporate reputation. The corporates also face many barriers including lack of policy stability, unproven technical solutions and reluctance to make financial investments at an early stage.

Achieving net zero

A multi-pronged approach encompassing a range of abatement options including reduction of resource intensity, replacement of emitting sources and offsetting emissions from hard-to-abate sources is necessary. While some of these options like renewable energy and energy efficiency are more accessible in terms of their maturity and cost attractiveness, others like battery storage, green hydrogen and carbon capture are in nascent stages. Crucially, corporates need to reconsider their approach to product innovation and design, corporate planning, supply chain engagement and employee training to achieve their climate objectives.

Government policy

A strong enabling policy and regulatory environment is critical for corporate decarbonisation. While several government initiatives have been designed over the years to help in emission reduction, the policy framework needs to constantly evolve in response to market needs, emerging technologies, new applications and business models. Each decarbonisation technology needs specific policy support in view of its market maturity and feasibility:

i. Ensure policy visibility and stability

ii. Provide financial incentives in the form of capital subsidies, tax incentives, operational subsidies for adoption of technologies

iii. Expand scope of policies and programmes to enable more participation and mandatory action

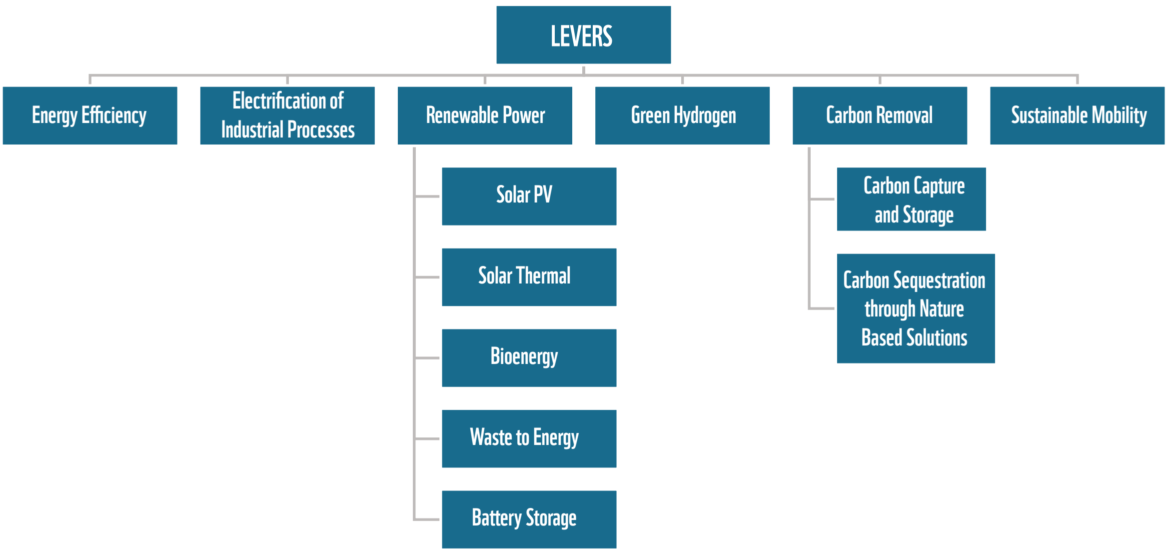
iv. Invest in R&D and facilitate pilot projects

v. Encourage collaboration across sectors to build shared infrastructure at minimal cost

vi. Develop technical standards for new technologies such as green hydrogen, electric vehicles, carbon capture and storage

In addition to developing technology specific initiatives, the government should set emission reduction targets for

Figure: Key decarbonisation technologies and complementary strategies



corporates, develop a robust mechanism for verification, monitoring and reporting of emissions, and create a pool of skilled workforce for effective implementation.

Roadmap to net zero

Developing an actionable and robust net zero roadmap involves detailed understanding of a company's emission profile and setting targets. Some essential principles for developing a roadmap are listed below:

i. Set up a clear methodology, consistent with international norms, for measurement and monitoring of emissions.

ii. Adopt a time-graduated framework with interim milestones in view of techno-economic viability of different options and expected evolution in technology and policy framework.

iii. Develop expertise in emerging technologies and business models through pilot projects.

iv. Assess social, environmental and financial impact of transition across supply chain, business teams and other stakeholders.

v. Undertake suitable training and reskilling programmes for work force across the business.

vi. Collaborate with and seek guidance from industry bodies and think-tanks like SBTi for sharing expertise and optimal implementation.

Corporates need to account for multiple considerations and carefully evaluate their specific needs while designing decarbonisation plan: nature of business, type and source of emissions, national and state level policy framework, technology maturity and viability, supplier and consumer perspective, investor expectations, business scale, financing ability etc. Key steps developing a company specific roadmap are shown in the figure below.

Figure: Indicative steps in drawing up a corporate decarbonisation roadmap

Measure current emissions and estimate future trajectory	Set targets	Establish criteria for evaluation of different decarbonisation options	Assess suitability of different decarbonisation options	Implement identified options
Baseline GHG inventory for scope 1, 2 and 3 emissions Use most recent year as baseline year	Multi-year targets with intermediate milestones Fixed level targets better than intensity or scenario-based targets	Policy and regulatory landscape Technology and market maturity Operational and financial feasibility Social and financial impact across supply chain, business teams and other stakeholders Competitive context	Carbon abatement potential Investment requirement Cost of abatement Track record of suppliers Operational and technical aspects	Choice of business model Vendor selection Contract negotiation Employee training Physical execution

Conclusion

While corporates face immense uncertainty in the path to decarbonisation, they also have a great opportunity to benefit from the fight against climate change. Proactive action can help corporates in improving business resilience, gaining competitive advantage and attracting capital from institutional investors.

It is crucial for corporates to develop a clear, time-bound decarbonisation roadmap taking into account various market approaches and unique needs of their businesses. The government needs to mandate targets and set up an independent monitoring agency for lending transparency to the entire process. It must also play an enabling role in facilitating adoption of low-carbon technologies by bringing down cost through initiatives such as R&D grants, infrastructure investments, tax incentives, manufacturing subsidies and assistance for small and medium enterprises.

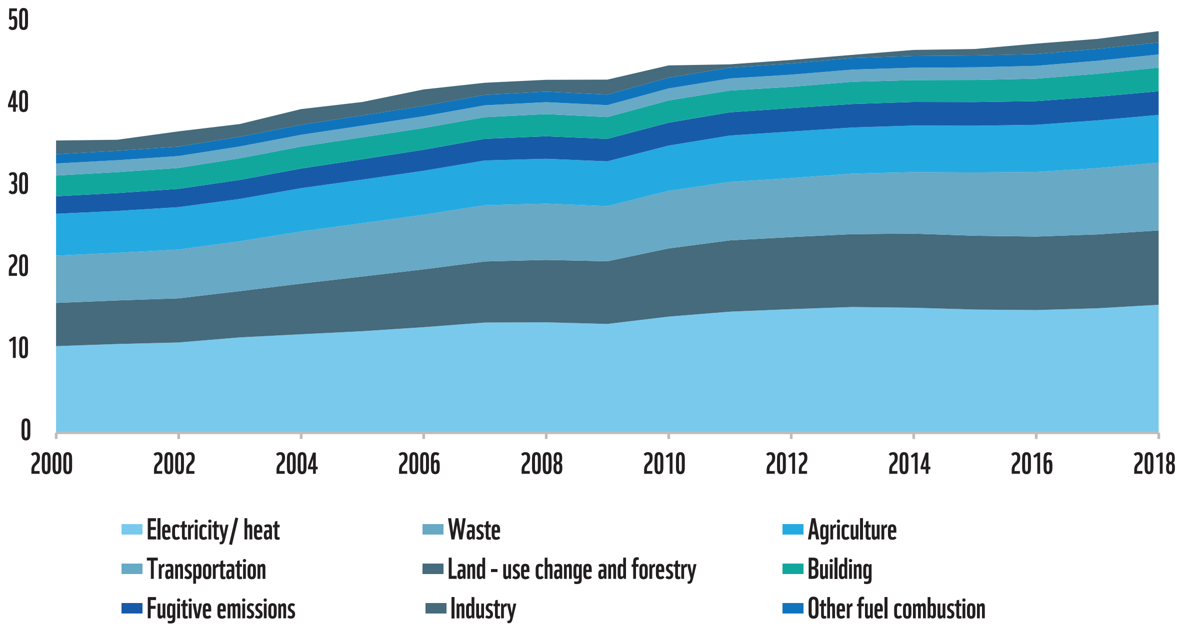
Chapter 1: Introduction

Rising global temperatures and increasing incidence of extreme weather events have led to an unprecedented urgency for climate action. As estimated in the Intergovernmental Panel on Climate Change (IPCC) assessment report 2021, average global temperature is expected to increase by 2.1-3.5ºC by 2100 in an intermediate emission scenario.[1] It is widely agreed that Nationally Determined Contribution (NDC) targets are grossly inadequate to restrict global temperature rise within 2ºC, let alone 1.5ºC by end of the century.[2] As per a study by Swiss Re Institute, insufficient climate action, apart from inflicting irreversible environmental and livelihood losses, is likely to reduce global GDP by 11-14% by 2050, affecting South Asian economies the most.[3]

Nearly 70% of total greenhouse gas emissions worldwide originate from power and heat production, industry and transportation sectors.

As per Climate Watch, an initiative by World Resources Institute (WRI) tracking global progress on climate change, achievement of Paris climate commitments (minimum decarbonisation rate of 2% per year) would stabilise emissions trajectory at current levels. Even if the climate pledges announced till COP 26 are implemented, the global temperatures will rise beyond 2 ºC by the end of this century. In the more ambitious scenario, increasing minimum decarbonisation rate to 5% would halve emissions by end of the century. However, in a no policy scenario, global emissions are

Figure 1.1: Global GHG emissions and its sources, giga tonnes of CO2 equivalent (GTCO2e)



Source: Climate Watch, World Resources Institute (WRI)[4]

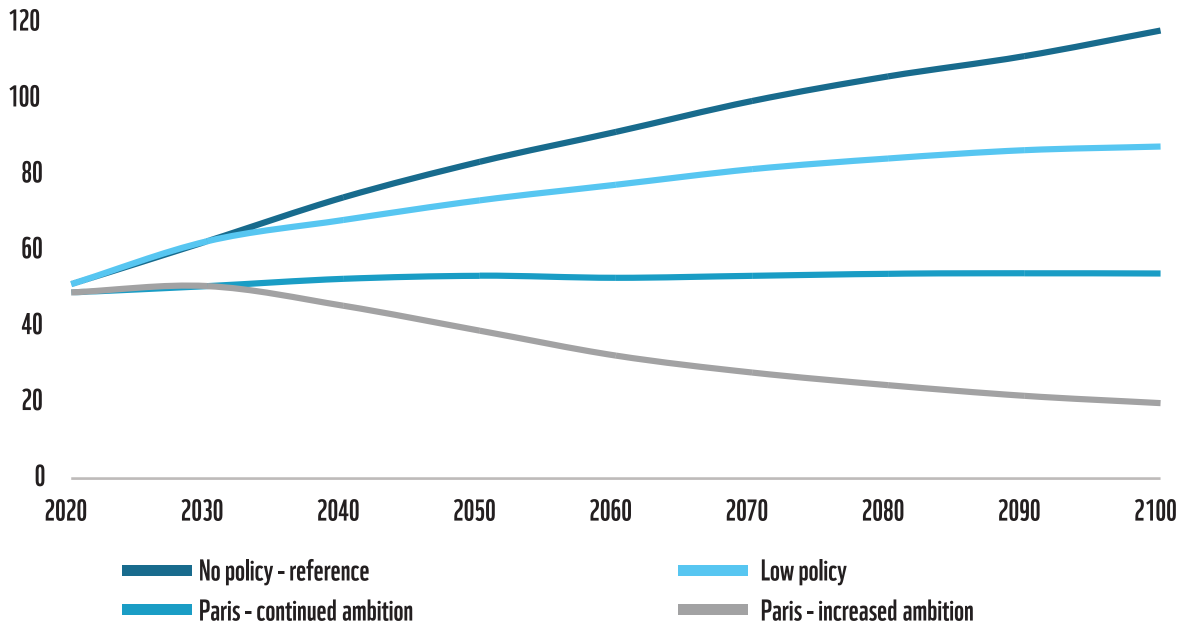
1 IPCC. (2021). Sixth Assessment Report Climate Change 2020: The Physical Science Basis. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf

2 IEA. (2021). COP26 climate pledges could help limit global warming to 1.8 °C, but implementing them will be the key – Analysis - IEA

3 Swiss Re Institute. (2021). The economics of climate change: no action not an option. swiss-re-institute-expertise-publication-economics-of-climate-change.pdf (swissre.com)

4 Climate Watch data. (2021). Global historical emissions. World Resources Institute (WRI). World | Total including LUCF | Greenhouse Gas (GHG) Emissions | Climate Watch (climatewatchdata.org)

Figure 1.2: Global GHG emission pathways, GTCO2e



Source: Climate Watch data, Climate Watch, WRI[5]

Notes:
Low policy scenario – no new GHG abatement actions until 2030 and minimum decarbonisation rate from 2030-2100.
No policy scenario – reference scenario with no new GHG abatement policies or measures until 2100.
Paris-continued ambition scenario – countries meet their NDC targets and decarbonise beyond 2030 as per their INDCs or a minimum decarbonisation rate of 2% per year.
Paris-increased ambition scenario – countries meet their NDC targets and continue to decarbonise beyond 2030 as per INDCs or a decarbonisation rate of 5% per year

expected to increase from 51 GTCO2e in 2020 to 83 GTCO2e by 2050.

As of January 2022, 136 countries have announced net zero commitments with developed economies taking the lead.[6] India also recently pledged to achieve net zero status by 2070 but is yet to develop a comprehensive plan to reduce emissions, although efforts to introduce policies around RE procurement, improvements in energy efficiency and promotion of options like Green Hydrogen have been initiated.

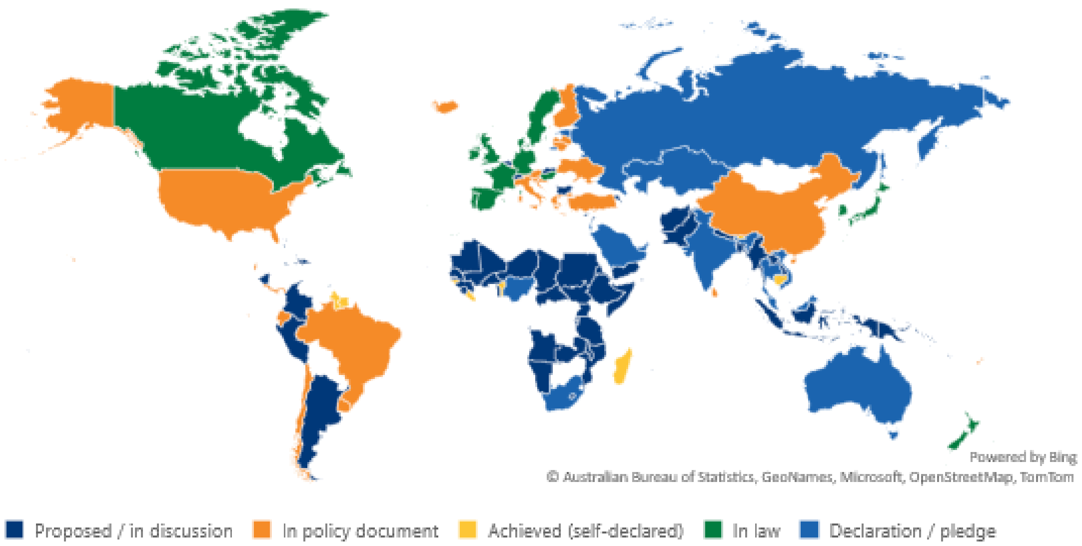
Net Zero commitments by countries across the globe cover 88% of global GHG emissions, 90% of GDP and 85% of the global population. Most of the countries target to achieve their pledges by 2050. Only 10 countries including India and China have targets beyond 2050, which climate scientists believe to be too late to meet desired goals.

1.1 Case for corporate action on climate change

Combating climate change is a shared responsibility between government, corporates and consumers. The corporate sector, estimated to account for nearly 70% of total GHG emissions across the world[7], has major responsibility as well as

5 Climatewatchdata (2021). Pathways. |Greenhouse Gas (GHG) Emissions | Climate Watch (climatewatchdata.org)
6 Energy & Climate Intelligence Unit, Data-Driven EnviroLab, New Climate Institute & Oxford Net zero (2021). Net zero tracker. Net zero Tracker | Welcome

Figure 1.3: Countries with net zero commitments and updated NDC targets, December 2021



Source: Energy & climate intelligence unit (ECIU), 2021

opportunity to benefit from fight against climate change:

a. **Better resilience and competitiveness:** Climate change is a potential 'threat multiplier' exacerbating business risks including value chain disruption, resource deficiency and production cost increase. Timely action can insulate supply chains and operations against growing climate change risks and improve business resilience.

b. **Enhanced business prospects:** Environmentally conscious consumers prefer products and services with a low carbon footprint. Climate-aligned product and service offerings can aid companies to position themselves strategically in the market, translating into higher revenues.

c. **Changing investor preferences:** Investors are increasingly more inclined towards climate conscious businesses with an eye on their longevity and growth prospects. Shift in investment preferences and growth of ESG-themed funds are already beginning to constrain funding choices for high carbon emitting sectors such as oil exploration and thermal power generation.

d. **Improved reputation and recognition**: Action on climate change results in enhanced brand image and improved public perception, creating a virtuous cycle for business growth and profitability.

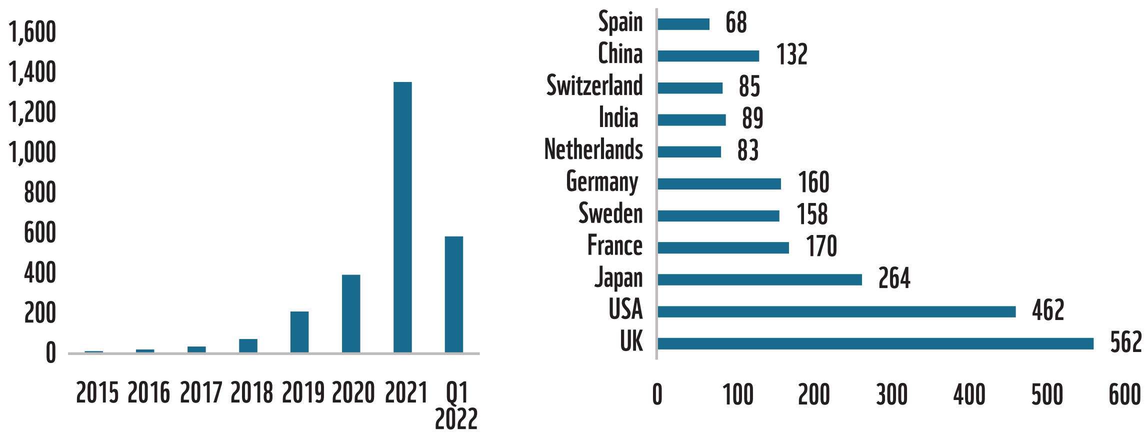
Science-Based Targets initiative (SBTi) is a multilateral body launched in 2015 to support corporates in setting and achieving climate goals consistent with the Paris agreement. More than 3,200 companies

7 Emissions Gap Report 2020 (unep.org)

globally have committed to climate action with SBTi, but only 1,503 of these companies have set science-based climate targets as of June 2022. More than 1,000 of these companies have aligned their targets with 1.5°C temperature allowance. The number of new commitments has increased sharply from just 12 in 2015 to 1,355 in 2021. Europe accounts for over 50% of global corporate net zero commitments followed by North America and Asia. Companies have reported to accrued benefits from setting science based targets which includes higher investor confidence, improved brand reputation, resilience against upcoming regulation, increased innovation and more competitive edge.[8]

In comparison to other countries, Indian corporates has shown very little participation in climate action, with only 29 corporates committed to net zero goal.

Figure 1.4: Number of corporates setting science-based climate targets, June 2022



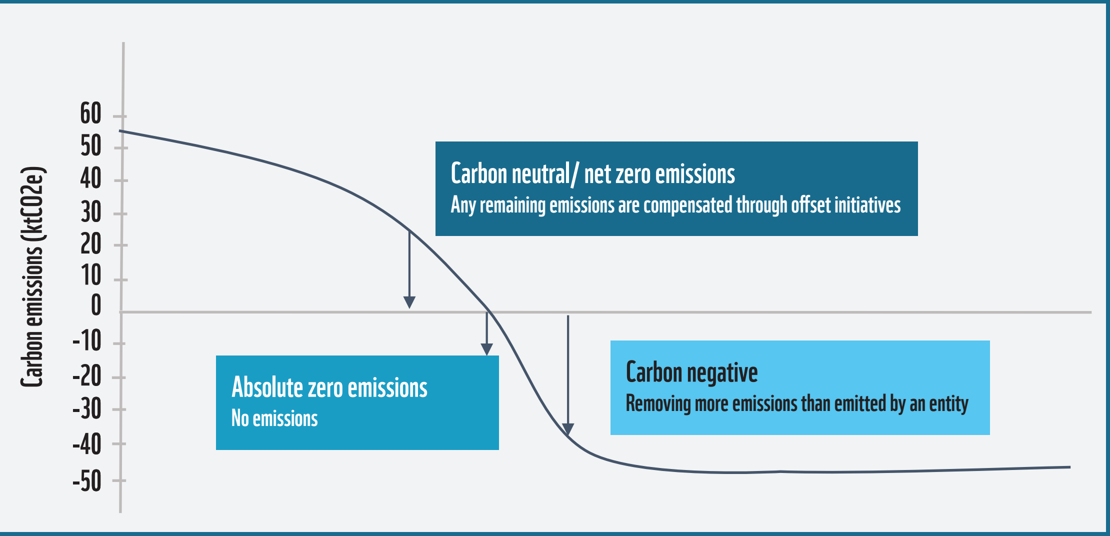
Source: SBTi database, 2022[9]

8 SBT (2018). Six business benefit s of setting science-based targets - Science Based Targets
9 SBT (2022). All companies taking action. https://sciencebasedtargets.org/companies-taking-action]

Unpacking the 'net zero' terminology

A myriad of climate commitments has emerged with varying terminologies like carbon neutrality, carbon negative and net zero emissions.

Figure 1.5: Varying climate commitments



Net zero, the most commonly used approach, refers to an 'equilibrium' state where all anthropogenic GHG emissions are matched by their removal. A widely recognised definition of 'net zero' is given by SBTi as a credible, science-based target aiming to "achieve a state in which activities within the value chain of a company result in no net impact on the climate from GHG emissions."

Net zero emission status may be achieved by eliminating absolute emissions entirely or offsetting residual emissions with carbon removal. The net zero approach relies mainly on unproven concepts like carbon capture, utilisation and storage (CCUS) or large-scale afforestation for carbon removal. As efficacy of large-scale carbon removal initiatives remains uncertain, it is best to strive for an 'absolute zero' emissions or a carbon negative target to assure success in the fight against climate change.

Source: ECIU, 2021[10]; Climate disclosure project (CDP), 2020[11]

10 Energy & climate intelligence unit. (2021). Net zero: why is it necessary? Energy & Climate Intelligence Unit | Net zero: why is it necessary? (eciu.net)
11 CDP. (2020). Foundations for Science-Based Net-Zero Target Setting in the Corporate Sector. foundations-for-net-zero-full-paper.pdf (sciencebasedtargets.org)

Need for robust monitoring of net zero target implementation

A broad chasm has often been observed between stated corporate targets and tangible action. There are many instances of corporates announcing bold commitments for reputational reasons or under pressure from various stakeholders but often, there is no definite timeline or strategy to accompany the targets. Absence of global standards and monitoring parameters obscures lack of progress. Until there are clear mechanisms to assign accountability globally, 'greenwashing' remains a pertinent risk.

As an example, many companies, with pledges to meeting their entire power need from renewable sources, have made scant progress over the years. Independent third-party verification is important to verify action by corporates.

Source: Corporate Climate Responsibility Monitor, 2022[12]

12 Corporate Climate Responsibility Monitor (2022). https://newclimate.org/sites/default/files/2022-06/CorporateClimateResponsibilityMonitor2022.pdf

Chapter 2: Corporate Climate Action in India

According to Global Climate Risk Index 2021, India is the seventh most affected country by consequences of climate change.[13] Receding glaciers in Himalayas, intense heat waves, increased incidents of flooding, erratic monsoons, tropical cyclones and diminishing ground water are likely to impact India severely in the coming years as per IPCC assessment report 2021, making urgent action an absolute necessity.[14] Recent studies suggest that 1°C of global warming would cost India 3% of GDP a year.[15] In a 3°C warmer world (from pre-industrial levels), the cost is estimated to rise to 10% of GDP a year. As per a recent study by Swiss Re Institute, India could lose up to a staggering 35% of GDP by mid-century in a severe 'no further mitigation' scenario.[16]

2.1 National emission levels

India is a fast-growing economy – annual GHG emissions currently estimated at 2.8 BTCO2e accounting for 7% share globally. Emissions grew at an average rate of 4% between 2011 and 2016 while GDP grew at 6.5% over the same period. In view of the expected economic growth and transition from an agrarian to a service-based/ industrial economy, there is a pressing need to decouple economic activity from GHG emissions.[17] India is a developing country with increasing energy needs which indicates a massive opportunity to take bold climate action and implement a climate sensitive growth plan.

13 Germanwatch. (2021). https://germanwatch.org/sites/default/files/Global Climate Risk Index 2021_2.pdf

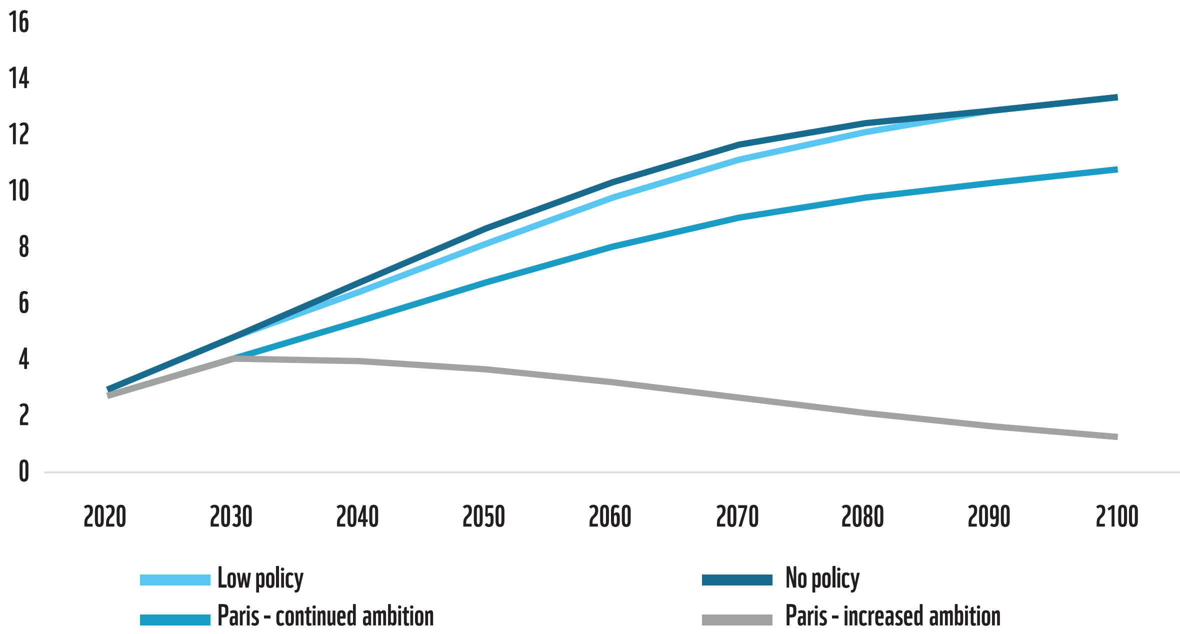
14 IPCCC. (2021). Sixth Assessment Report Climate Change 202: The Physical Science Basis. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf

15 Picciariello, A., Colenbrander, S., Bazaz, A. and Roy, R. (2021) The costs of climate change in India: a review of the climate-related risks facing India, and their economic and social costs. ODI Literature review. London.

16 The economics of climate change: no action not an option. Swiss Re Institute. April 2021. swiss-re-institute-expertise-publication-economics-of-climate-change.pdf (swissre.com)

17 India country summary. (2021). Climate action tracker. https://climateactiontracker.org/countries/india/

Figure 2.1: GHG emission pathways for India, GTCO2



Source: Climate Watch data, Climate Watch, World Resources Institute (WRI)[18]

Note: The pathways are based on global change assessment model
Low policy scenario – no new GHG abatement actions until 2030 and minimum decarbonisation rate from 2030-2100;
No policy scenario – reference scenario with no new GHG abatement policies or measures until 2100;
Paris-continued ambition scenario – countries meet their NDC targets and decarbonise beyond 2030 as per their INDCs or a minimum decarbonisation rate of 2% per year;
Paris-increased ambition scenario – countries meet their NDC targets and continue to decarbonise beyond 2030 as per INDCs or a decarbonisation rate of 5% per year

At COP26, India pledged to achieve net zero emissions by 2070 and made several additional commitments:

a. Reduce total projected carbon emissions by one billion TCO2 by 2030,

b. Reduce carbon intensity of the economy by 45% by 2030, and

c. Meet 50% of energy requirement from renewable sources

d. Develop 500 GW of non-fossil fuel-based power generation capacity by 2030.

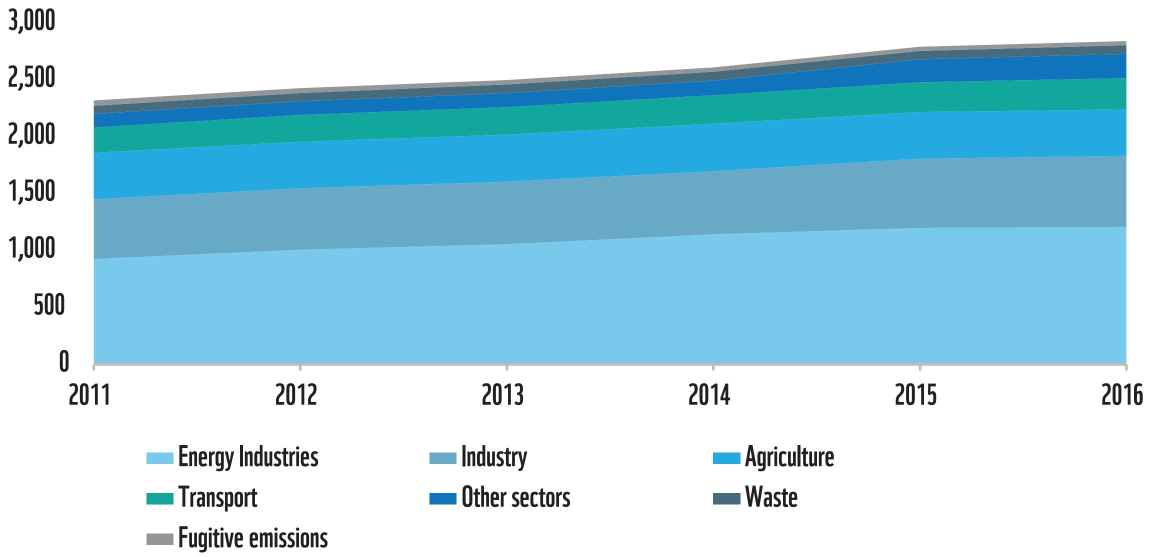
Some of these commitments have been incorporated into the recent revised NDCs India has adopted.The government is believed to be mulling setting decarbonisation targets for corporate emitters.

2.2 Sources of emissions

Energy sector comprising power generation and oil refining was the largest source of GHG emissions with 42.5% share in 2016. Industrial sector accounts for 22% of total emissions while agriculture and transport sectors account for14% and 10% share respectively.

18 Pathways (2021). Climatewatchdata, World Resources Institute (WRI) https://www.climatewatchdata.org/ghg-emissions?breakBy=sector&end_year=2018&sectors=total-excluding-lucf&start_year=2000

Figure 2.2 Sector-wise national BEE GHG emissions, million tonnes of CO2e (MTCO2e)



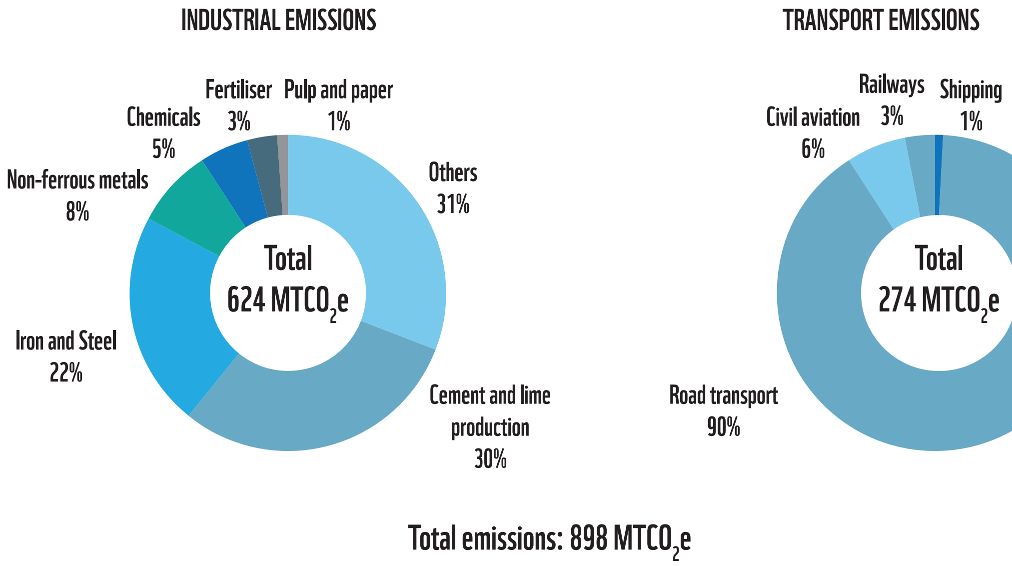
Source: MOEFCC, 2021[19]

Within industrial sector, cement, iron and steel, non-ferrous metals, chemicals and fertilisers are the largest emitters. Road transport is the largest contributor of transport sector emissions.

2.3 Corporate emission targets

Even as formal policy mandates are yet to be announced, some corporates have started to take voluntary action on climate

Figure 2.3: Different sources of industrial and transport emissions, 2016



19 MOEFCC. (2021). India: Third biennial update report to the United Nations Framework Convention on Climate Change. MOEFCC. INDIA_ BUR-3_20.02.2021_High.pdf (unfccc.int)

change and sustainability. Corporate action typically includes sustainability disclosures, procurement of renewable power, energy efficiency initiatives, switch to electric mobility, recycling, water and land management. Joining global initiatives such as SBTi, Carbon Disclosure Project (CDP) Renewable Energy Demand Enhancement (REDE) and RE100 has also become popular choice to gain formal recognition and market visibility:

a. **SBTi**: 91 Indian companies have joined SBTi so far and 38 companies have confirmed targets.

b. **REDE**: 30+ corporate groups or individual companies with a combined power consumption of 18 GW have joined the REDE programme.

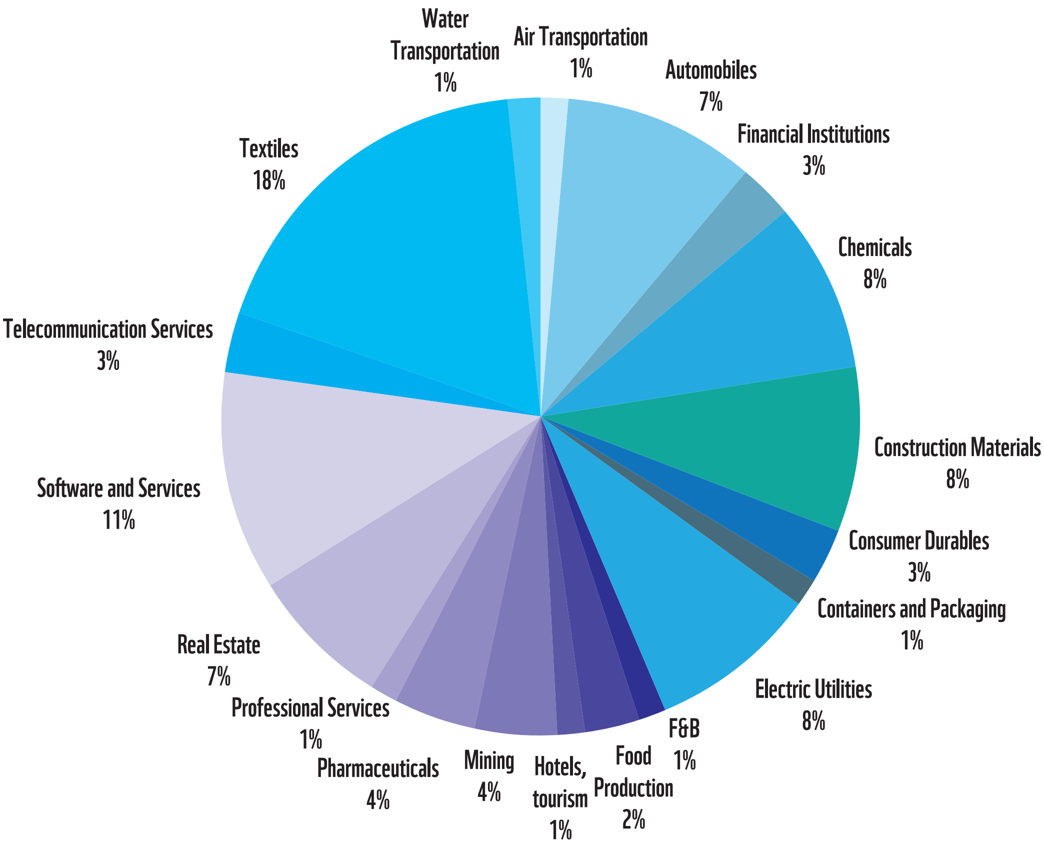
c. **CDP:** In 2021, 88 Indian companies disclosed information across CDP's three themes - Climate Change, Water Security and Forests

d. **RE100:** Eight companies headquartered in India have pledged to RE100, a commitment to source 100% of their power through renewable sources.

e. **EV100:** Eight companies headquartered in India have pledged to EV100, a commitment to electrify 100% of their transport fleet.

f. **EP100:** 12 Indian companies have joined EP100, an initiative focussing on emission reduction through energy efficiency. Companies are committed

Figure 2.4: Sectoral split for Indian corporates with climate commitments



Source: SBTi database

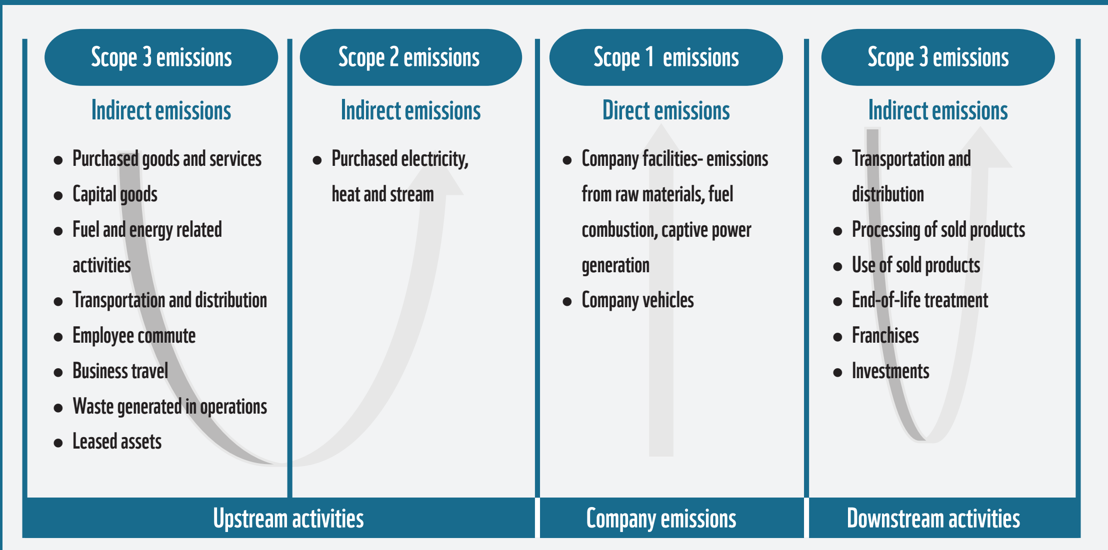
to doubling their energy productivity or implementing energy management systems or achieving net zero carbon building.

g. **Internal carbon pricing (ICP):** In 2021, 31 Indian companies adopted ICP, up from 20 in 2019.

Only 29 companies have committed to the net zero goal. Maximum participation in the SBTi programme has come from textile, software, automotive, construction and real estate sectors. Out of 38 companies with SBTi targets, most have set targets only for scope 1 and 2 emissions and only one company has committed to reducing all scope emissions.

Emissions of a company can be classified into three scope categories as shown below:

Figure 2.5 Explaining scope 1, 2 and 3 emissions



Source: US EPA[20]

20 US EPA (2021). Scope 1 and Scope 2 Inventory. Scope 1 and Scope 2 Inventory Guidance | US EPA

Some examples of emission reduction targets set by Indian corporates are given below.

Publicly available data on corporate net zero target indicates that most of the targets cover scope 1 and 2 emissions. Scope 3 emissions are rarely covered and so this exercise is quite inadequate, especially for some sectors. Corporates should collaborate with their suppliers and include scope 3 emissions in their climate targets for more meaningful climate action.

Table 2.1: Emission reduction targets of select Indian corporates

	Hindustan Zinc	Mahindra & Mahindra	Dr. Reddy's Laboratories	Infosys
Sector	Mining	Automotive	Pharmaceuticals	Information Technology
Emission profile	Heavy	Medium	Medium	Light
Emissions	(FY21)	(FY21)*	(FY20)	(FY21)
Scope 1	4.4 MtCO2e	38,114 tCO2e	319,190 tOC2e	8,678 tCO2e
Scope 2	307,068 tCO2e	175,862 tCO2e	154,836 tOC2e	68,673 tCO2e
Scope 3	4.2 MtCO2e		324,723 tOC2e	213,514 tCO2e
Baseline	2016	2018	2017-18	2020
Scope 1 and 2 target	14% reduction by 2026	47% reduction by 2033	55% reduction by 2030	75% by 2030
Scope 3	20% reduction by 2026	30% reduction by 2033	33% reduction by 2030	30% by 2030
Carbon neutrality	By 2050 (scope 1 and 2)	By 2040	No goal	Carbon neutral with use of offsets

Scope 3 emissions are not reported by the company

Source: SBTi and CDP databases

Sustainability disclosures by NSE 100 companies

An analysis of sustainability reporting by top 100 companies listed on the National Stock Exchange (NSE) shows that leading Indian businesses are beginning to engage in decarbonisation efforts.

46 companies have announced climate commitments in the form of net-zero carbon or GHG targets, carbon neutrality and/ or carbon intensity reduction.

70 companies report emissions annually.

73 companies are committed to reducing their emission levels.

62 companies are collaborating with suppliers for reducing their emission levels.

60 companies report emissions in absolute and/ or intensity terms.

Renewable power procurement and energy efficiency are more commercially mature and economically viable options.

Within renewable power, solar PV technology is the most preferred source.

Figure 2.6: Emission reporting by NSE 100 companies

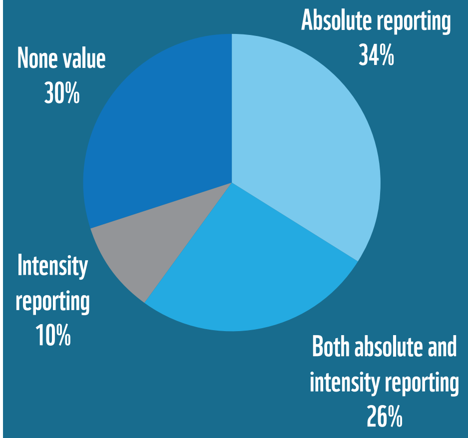


Figure 2.7: Source of renewable power for NSE 100 companies

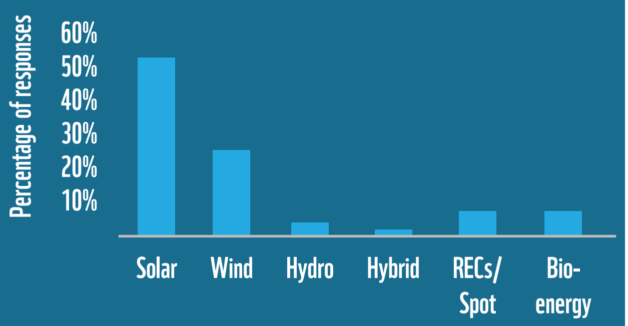
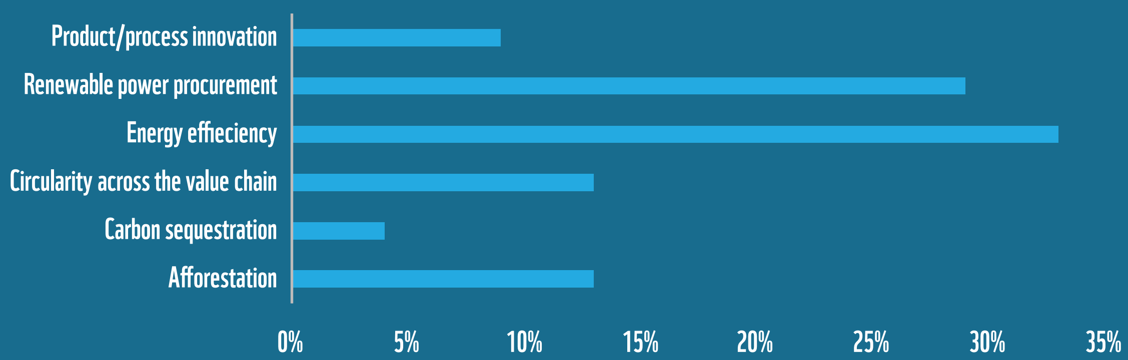


Figure 2.8: Decarbonisation levers adopted by NSE 100 companies



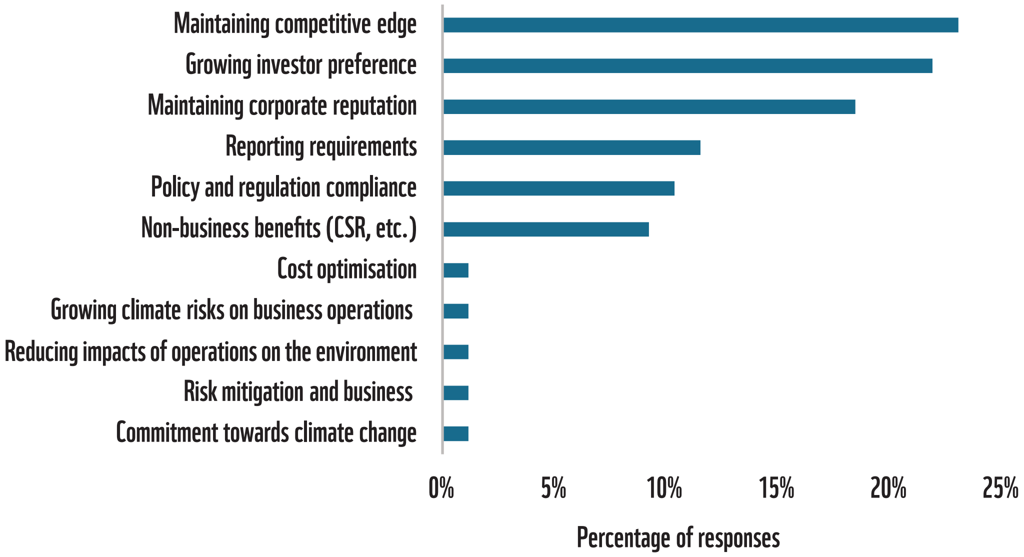
Chapter 3: Corporate Survey

A primary survey of 21 companies was completed by WWF-India and BRIDGE TO INDIA to gain a deeper understanding of the corporate scenario in India. 9 of the surveyed companies are part of the NSE100 list. The survey reached out to corporate consumers across a wide variety of sectors to gain insight into their net zero ambitions and progress to date. The goal of this study was to collect first-hand information about the experiences of companies, including key drivers and barriers towards setting net zero targets and achieving them. It is encouraging that the results of the survey show that decarbonisation has already become a top corporate priority. 19 of the 21 surveyed companies have already made climate commitments and estimate their carbon emissions. Some of the key highlights are below.

Renewable energy and energy efficiency were observed to be the most preferred decarbonisation levers partly in response to the number of government initiatives and mandates in recent years. However, almost 50% of companies have indicated that they find RE procurement to be challenging due

- 14 of the surveyed companies have adopted science-based targets.
- All 21 companies have adopted renewable energy procurement targets with 20 of these companies already procuring renewable power.
- 18/21 companies believe that climate commitment targets have affected their investment decision making process.
- 14/21 companies have estimated cost of pursuing a climate commitment strategy.
- At least 7/14 companies expect cost of pursuing a climate commitment to be moderate or significant.
- 21/21 companies have a sustainability team.
- 17/21 companies are working with their suppliers on sustainability initiatives.
- It was observed in the survey that market pressures like maintaining a competitive edge and meeting investor preferences were prioritised over mandatory measures like reporting requirements or policy and regulatory compliances.

Figure 3.1: Drivers for climate change efforts



to policy and regulatory uncertainly. *This points to the need to expand the scope of decarbonisation levers and promote other options in addition to RE and EE as Net Zero requires a comprehensive approach.*

Companies have also identified the key internal and external barriers they are facing in pursuing climate change commitments, as well their top requests from the government, which provides us with insight on what steps need to be taken both at company level and on the national stage, discussed in more detail in later sections of this report. As renewable energy is one of the most popular options for decarbonisation currently, the survey also explores the key challenges in sourcing Renewable Power.

Figure 3.2: Levers for decarbonisation by NSE100 Companies

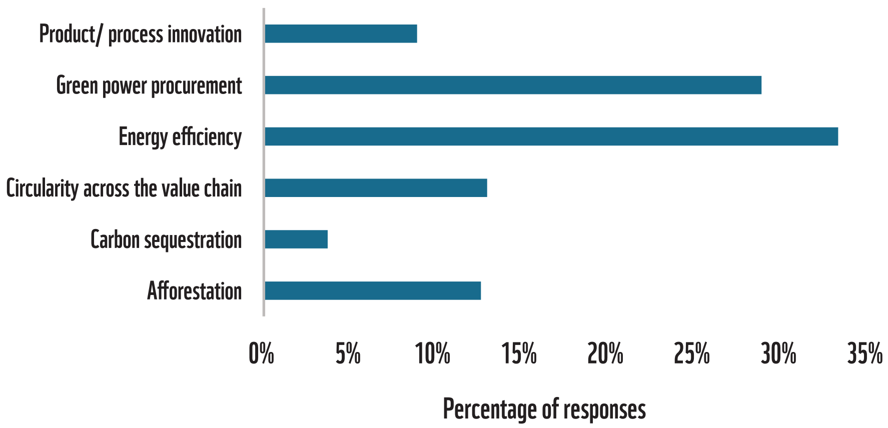


Figure 3.3: Barriers to pursuing climate commitments

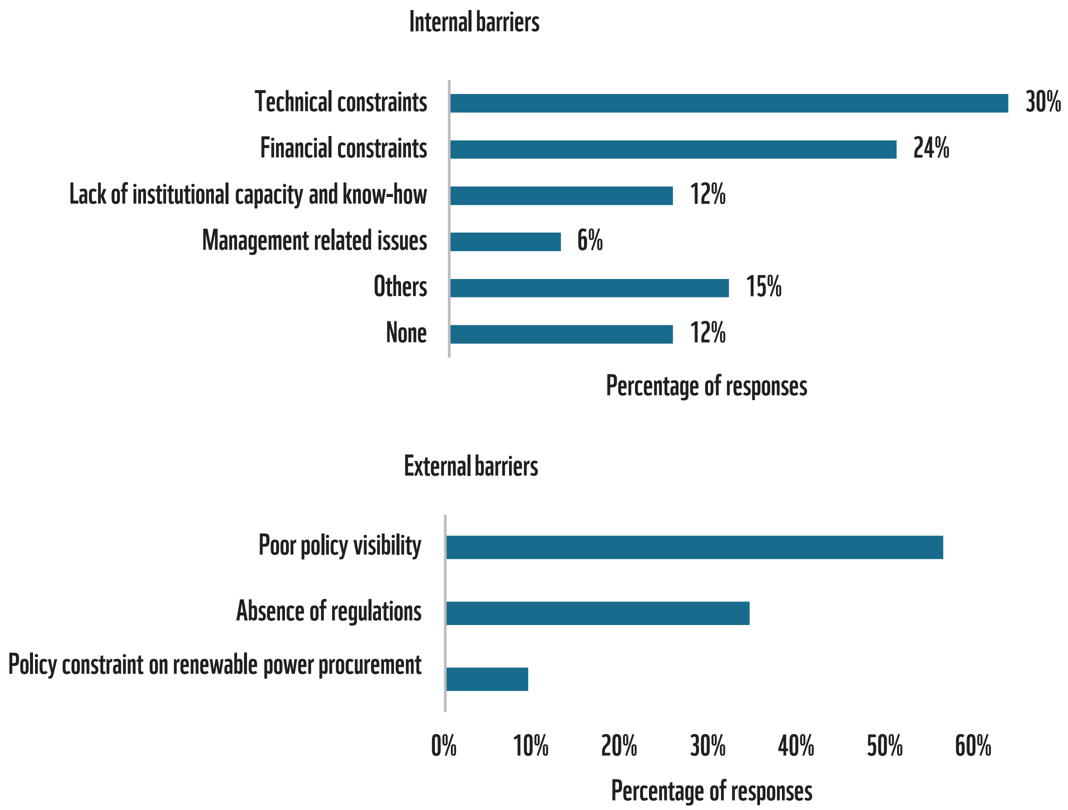
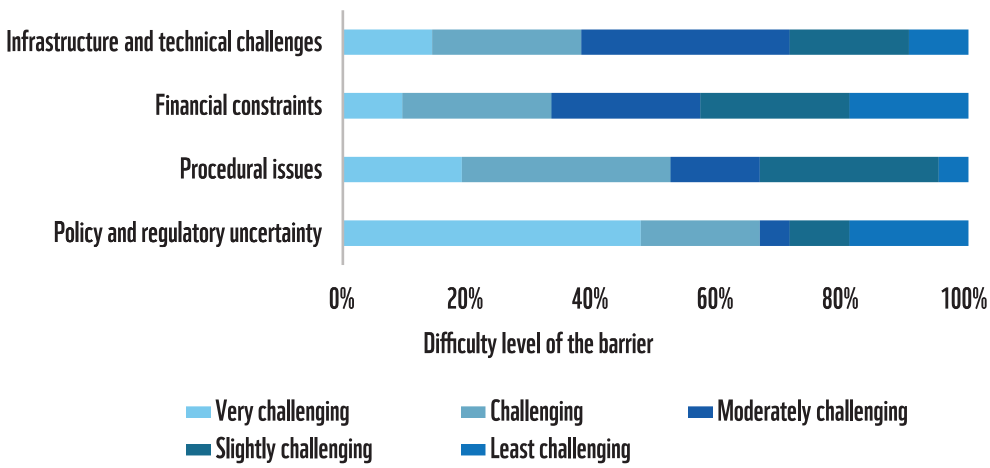


Figure 3.4: Key barriers in sourcing renewable power



The survey also looks at the key recommendations put forth by corporates in terms of requested Government initiatives, including technical, financial and policy framework.

It has been observed that corporate commitment to sustainability is getting stronger. Most companies are adopting business strategies and making pledges to reduce environmental impact of their business activities in the face of powerful drivers like maintaining competitiveness and meeting consumer and investor expectation. The key policy, regulatory, financial and technology related challenges slowing down action provides guidance on the next steps to be prioritised.

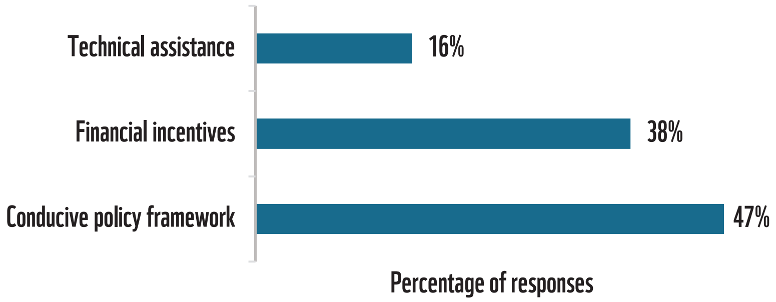
Key drivers

- Competitive advantage, growing investor preference and corporate reputation

Top barriers

- Technical complexity, financial constraints and lack of policy visibility
- Key suggestions for government
- Formulation of a conducive policy framework, financial incentives

Figure 3.5: Recommendations for government initiatives



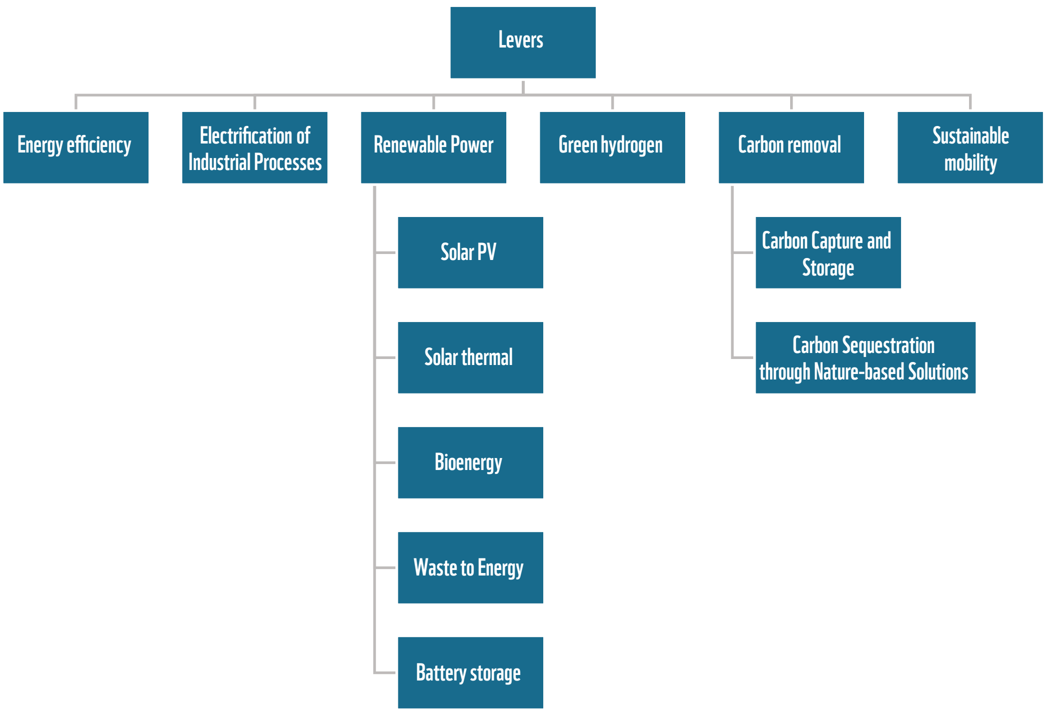
Chapter 4: Decarbonisation Technologies and Levers

Decarbonisation Technologies

Achieving net zero emissions, is an extremely complex and gradual process requiring interventions at multiple levels. A multi-pronged approach encompassing a range of abatement options including reduction of resource intensity, replacement of emitting sources and offsetting emissions from hard-to-abate sources is necessary. While some of these options like renewable energy and energy efficiency are more readily available in terms of their maturity and cost attractiveness, others like green hydrogen are in nascent stages. Companies also need to reconsider strategies for activities like supply chain engagement, sustainable mobility and circularity.

This chapter details the key decarbonisation levers, including the current status of technology maturity and viability, progress to date of adoption by corporates, ease of procurement in current scenario, expected trends and energy saving potential in coming years. It also puts forward specialised applications for industry, particularly for newer technologies.

Figure 4.1: Available decarbonisation technologies



4.1 Energy efficiency

Energy consumption by corporate accounts for 17% of total GHG emissions in the country. BEE has estimated energy saving potential at 79% and 23% under ambitious scenario, and 52% and 16% in a moderate scenario for corporate and transport sectors respectively over 2016 levels by 2031.[21]

Over the last decade, industrial and commercial establishments have made significant investments in energy efficiency measures in response to government schemes such as Perform, Achieve Trade (PAT) and Energy Conservation Building Codes (ECBC). Industrial businesses participating in the PAT scheme achieved total GHG emissions reduction of 31 MTCO2e (1.93% of India's emissions) in from 2012-2015 and 61 MTCO2e from 2016-2019 (2.5% of India's emissions) at a net investment of INR 288 billion (USD 3.9 billion).[22]

In the commercial sector, heating, ventilation and air conditioning (HVAC), lighting and electrical systems present key opportunities for reducing energy consumption. BEE has a star rating scheme for offices, hospitals, and malls.

Most energy efficiency technologies are financially attractive with payback periods ranging between 1-3 years, but high upfront cost and lack of awareness are major impediments. Reluctance of financial institutions to fund energy efficiency projects is also a significant barrier.[24]

4.2 Electrification of industrial processes

Electrification of industrial heating processes, dependent largely on fossil fuels, can be an effective decarbonisation route if a greater share of power is drawn from renewable sources. Power can be converted to heat or used to produce steam or increase material temperature in various industrial applications.

Table 4.1: Examples of energy efficiency measures adopted under PAT scheme

Sector	Energy efficiency measures
Cement	a. Alternative fuels and raw materials utilisation b. Waste heat recovery from pre-heater outlets c. Calcium looping as carbon capture technology
Fertilisers	a. Utilisation of CO_2 as feed for urea production b. Replacement of feedstock from furnace oil, naphtha, and coal to natural gas c. Installation of CO_2 recovery system
Iron and steel	a. Installation of top recovery turbine and pulverised coal injection in blast furnace b. Installation of converter gas recovery system in steel melting shop c. Hot charging of direct reduced iron in electric arc furnace

Source: BEE, 2020[23]

21 BEE, Unlocking National Energy Efficiency Potential (UNNATEE).
22 BEE. (n.d.). PAT-Read more. https://beeindia.gov.in/content/pat-read-more
23 BEE. (2020). Pathways for accelerated transformation in industry sector. https://beeindia.gov.in/sites/default/files/PAT%20Cycle-II.pdf
24 BEE. (2019). Unlocking National Energy Efficiency Potential (UNNATEE). https://beeindia.gov.in/sites/default/files/press_releases/UNNATEE Report.pdf.

Electrification is not a technically feasible option for some industrial processes including high temperature applications in sectors like cement, metallurgy, and chemicals.

The biggest barrier to electrification of industrial processes is relatively higher cost of power over direct combustion of fossil fuels on per unit of energy basis. High grid power tariffs for corporate consumers, to compensate for high grid losses and subsidies provided to other consumers, also make electrification financially unattractive. High upfront costs for equipment replacement and augmentation of power infrastructure are also significant hurdles.

4.3 Renewable power

Solar PV, wind and bioenergy are highly mature technologies. Reliable technology, attractive natural resource and falling cost – 20-50% cheaper in comparison to grid power for most consumers – have led to significant interest in renewable power procurement. But share of direct renewable power in total corporate consumption is still considerably small at about 7%.

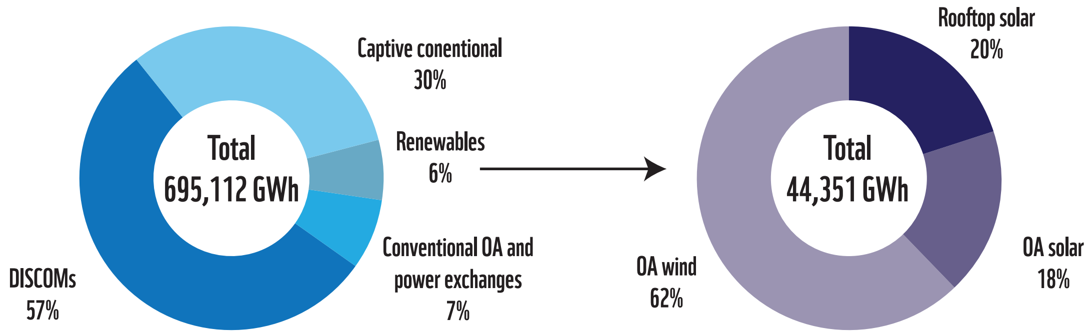
Table 4.2: Examples of Emission reduction potential through electrification

Emission reduction potential by 2050

Type	Emission Reduction (%)
Replacing oil-fired forging furnace with electric induction billet heater in forging industry	65
Replacing hot air generators with electric heaters in tea industry	85
Replacing coke-fired cupola furnaces in foundries with induction furnace	70

Source: TERI, 2021.[25]

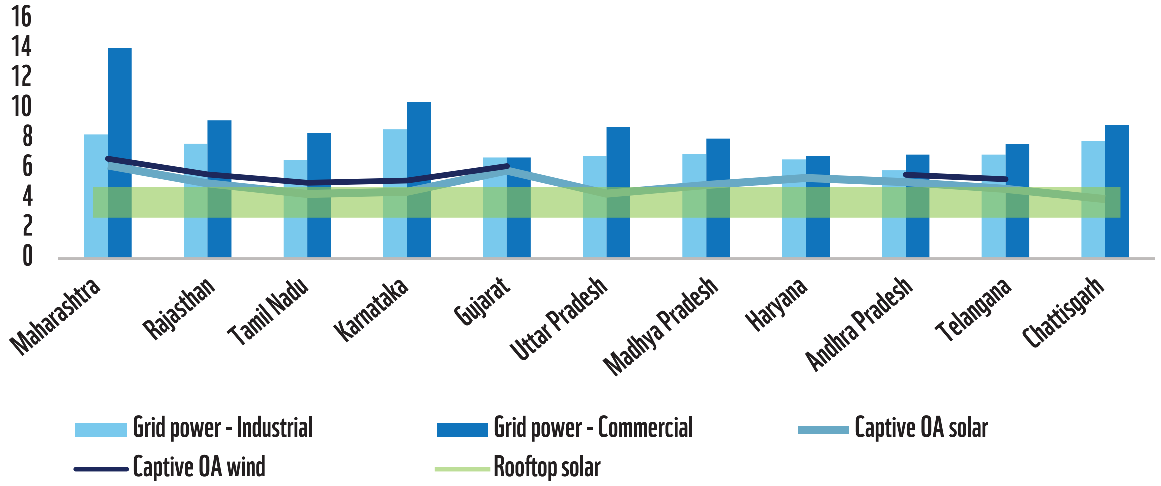
Figure 4.2: Power procurement by corporate consumers in FY 2020, GWh



Source: BRIDGE TO INDIA research
Note: Data is shown for 12 industrial states accounting for 71% of total C&I consumption.

25 TERI. (2021). Potential for electrifying Indian MSMEs. Discussion paper. TERI. potential-for-electrifying-Indian-msme.pdf (teriin.org)

Figure 4.3: Variable grid tariffs and landed cost of renewable power in FY 2022, INR/ kWh



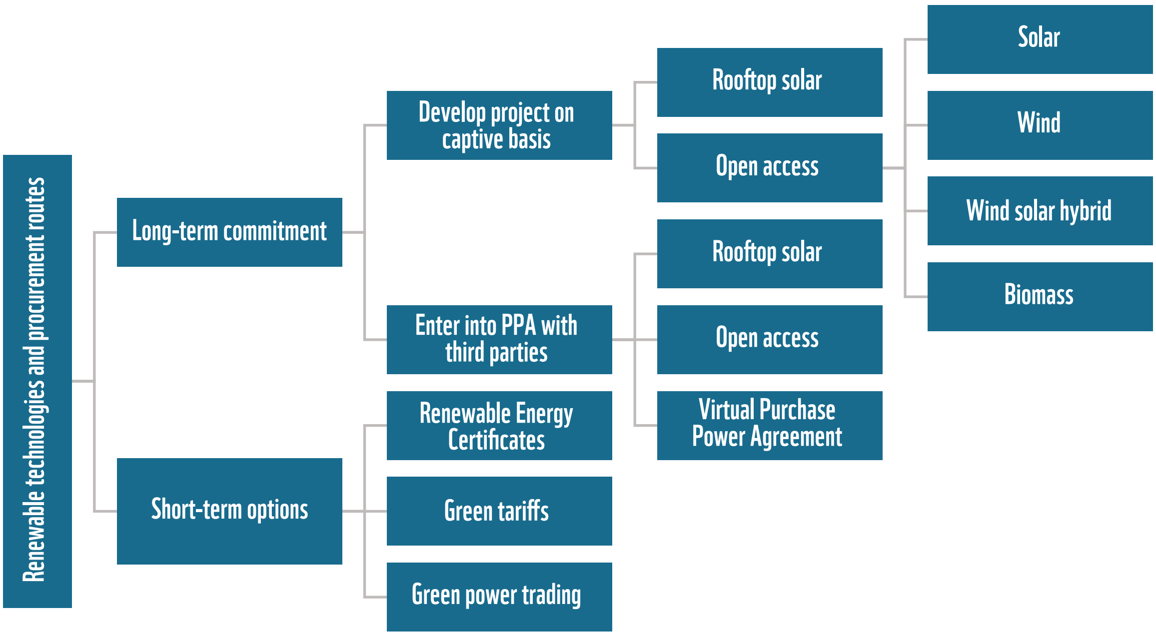
Source: BRIDGE TO INDIA research

Note: The chart shows total variable grid power cost including energy charges, surcharges and duties. Landed cost of open access (OA) renewable power includes power generation cost together with all applicable grid charges and surcharges.

The following chart shows attractive cost saving potential of renewable power in select states.

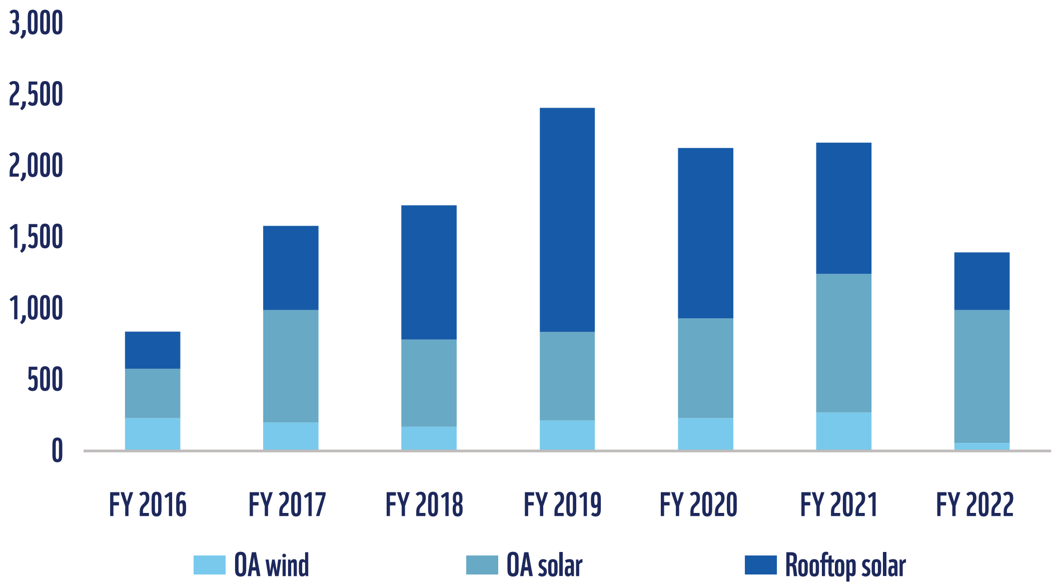
There are multiple technologies and business models available for renewable power procurement.

Figure 4.4 Renewable technologies and business models available for renewable power procurement



Source: BRIDGE TO INDIA research

Figure 4.5: C&I renewable power capacity addition



Source: BRIDGE TO INDIA research

Annual growth in rooftop solar and open access renewable capacity has been erratic mainly due to uncertain policy and cost volatility. Total installed capacity in FY 2022 in rooftop solar was at 7 GW whereas 5 GW and 7.6 GW through OA solar and OA wind respectively.

Rooftop solar

Rooftop solar is an attractive option for consumers as it requires no land or transmission infrastructure, installation times are very short at about 3-4 months, landed cost of power is lower than all other sources and regulatory approval process is fairly straightforward. Total installed capacity in the C&I segment is estimated at 6.2 GW as of 30 June 2021, growing by about 1,200 MW per annum over the last five years.

Consumers may install rooftop systems under net metering, gross metering, net-billing or behind-the-meter configuration depending on respective state policies. Rooftop solar can typically meet only about 10-15% of a consumer's power requirement. The biggest constraint for rooftop solar is limited availability of suitable rooftop space. Restrictive net metering provisions with capping on system size and delays in grid connectivity approvals limit the growth of rooftop solar projects. Financing can also be a challenge for smaller consumers.

Solar and wind OA

OA route, not subject to onsite space constraints, is attractive for consumers wishing to procure larger quantum of renewable power. Consumers may install renewable power projects themselves on a 100% captive basis but procurement for third-party developers under long-term 'group captive' PPAs is the most popular option.

Annual capacity addition has averaged at 1 GW in the last three years. Solar leads wind in new capacity addition by 3-4x because of wider solar resource availability, lower cost and simpler execution process. Wind-solar hybrid is beginning to gain popularity

Powering data centres with renewable sources

Shift towards digitalisation and 'virtualisation' due to COVID has accelerated growth in power consumption and emissions resulting from ICT. As per a study by S&P Global, companies can reduce their energy consumption by up to 79% by shifting IT operations from onsite servers to cloud servers and using artificial intelligence-supported smart systems. Around 4,200 tonnes of CO2e emissions/ MW can be saved annually through shift to renewable power-based cloud computing.

Some examples of data centres switching to renewable power:

- NTT Global Data Centres and Cloud Infrastructure are setting up a 50 MW captive solar power project to meet 83% of power demand in their Mumbai-based data centres.
- RackBank Datacentres is working with ReNew Power to source 100% renewable power for its hyperscale datacentre.
- Bharti Airtel, operating 10 data centres, has commissioned a 14 MW captive solar project for its data centre in Uttar Pradesh.

Source: AWS, S&P Global, 2021[26]

with consumers seeking more stable power output profile and even larger quantum of renewable power (up to 50-60% of their total requirement, as against only 25-30% of requirement for solar power) although availability is limited to only Gujarat, Karnataka and Tamil Nadu due to state policy and resource availability constraints. Over 50% of all new renewable power capacity is expected to be developed in wind-solar hybrid mode over the next few years.

MOP issued final green open rules which are very desirable for consumers but the challenge to get states and DISCOMs to align with the rules remains. The new rules allow small consumers with sanctioned load over 100 kW to be eligible for OA with banking provisions subject to an annual cap of 30% of power consumed from the local DISCOM. Rules propose OA applications to be provided approval within 15 days and uniform OA charges calculation methodology to be followed across all states.

In addition to the usual complexity associated with land acquisition and transmission connectivity process, OA renewable projects face critical policy-related challenges including project approval denials or delays, curbs on power banking and uncertainty in levy of grid charges.

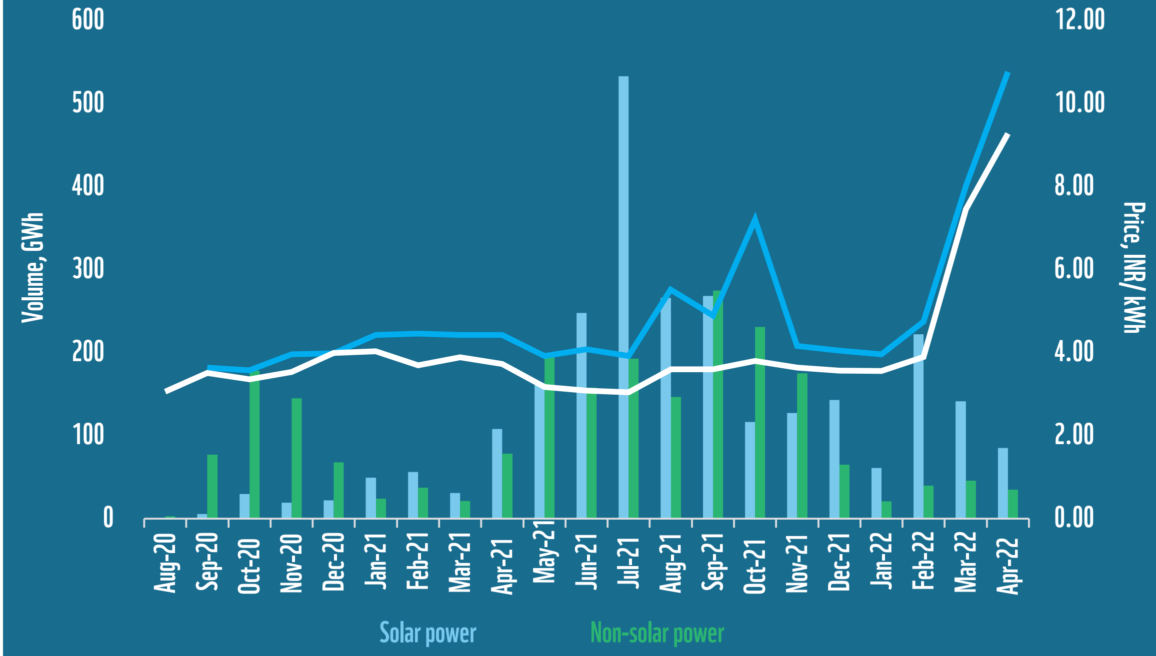
26 S&P Global, AWS. (2021). The carbon reduction opportunity of moving to the cloud for APAC. The carbon opportunity of moving to the cloud for APAC.pdf (awsstatic.com)

Green power exchange

Buying renewable power on a short-term basis over the exchange is an ideal option for consumers not keen on long-term PPA or capital investment commitments.

Exchange trading in renewable power, bundled with environmental attributes, commenced in August 2020. Solar and non-solar power can be traded on intra-day, day-ahead, daily and weekly basis. Traded volumes are still low (3% share of total green power generated in FY 2022) as most renewable power capacity is contractually tied up in long-term sale commitments. Seller interest is also limited by stringent scheduling requirements. Sellers are allowed to revise schedules only for daily and weekly contracts with two-day advance notice leading to high deviation penalty risk.

Figure 4.6: Green term ahead market (GTAM) trading volume and prices



Source: Indian Energy Exchange

Trading has been dominated by DISCOMs with procurement share of corporates estimated at only around 10-15%. Average price between August 2020 and April 2022 was INR 4.03/ kWh for solar power and INR 4.91/ kWh for non-solar power, broadly in line with cost of long-term OA power. Power prices increased sharply to INR 9/ kWh due to sudden jump in power and deficit in coal supply. Trading power on exchange exposes consumer to the risk of price volatility. But power exchange can be used as a short-term route to procure/ sell power as banking facility gets more restrictive and storage remains a commercially unviable option.

Green tariffs

Green tariffs – sale of renewable power by DISCOMs to consumers at a small premium to applicable grid tariff – have been tested in Karnataka and Andhra Pradesh, and recently approved in Maharashtra and introduced in Odisha, Telangana, Madhya Pradesh, Haryana and Uttarakhand. Consumers in these states can opt to pay a premium of INR 0.45-2/ kWh over grid tariff to procure renewable power on a short-term basis without any need for long-term purchase commitments or any capital expenditure. So far, uptake has been poor due to high procurement cost and retention of green attributes by the DISCOMs in these states.

Ministry of Power issued final open access rules to allow greater access to the green tariff route. However, consumers can purchase renewable power in steps of 25% of their total power demand going up to 100% for minimum one year. DISCOMs will issue a green certificate on yearly basis to consumers on their request beyond renewable purchase obligation of the consumer. However, the green certificate is not a recognised document to claim environmental attributes.

Renewable Energy Certificates (RECs)

Corporate consumers may buy RECs – each REC is equivalent to 1 MWh of renewable power – to fulfil RPO mandate or voluntary targets. RECs are well suited for corporates unwilling to enter long-term renewable power PPAs. Trading commenced in November 2021 after having been suspended since July 2020 due to a dispute over determination of price bands by CERC.

The REC scheme has been beset with frequent legal disputes over pricing and validity of RECs and eligibility of projects. Other problems include decline in new capacity addition registered under the mechanism (only 482 MW was added in 2020, 49% lower than annual average capacity added between 2017-2019) and limited supply. FY 2020 supply, of 11 million RECs, was sufficient to meet only 24% of solar deficit.

Solar thermal

Solar thermal based technologies are cost-effective and efficient technologies for low and high temperature thermal applications. They can be used in several industrial applications such as heating, drying, refrigeration, distillation, and power generation. However, there are multiple barriers to adoption – relatively higher cost, lack of standard equipment and system configuration, and lack of domestic manufacturing capability. During FY 2017-19, only 19,000 m2 of concentrated solar thermal technology capacity was installed against an MNRE stipulated target of 90,000 m2. In FY 2020, an additional 1,200 m2 capacity was added, however in FY 2021, no sanctions were given to projects.[27]

27 Final Report on Technical and Performance Evaluation of MNRE CST scheme, GERMI, 2020. https://mnre.gov.in/img/documents/uploads/file_f-1607698654092.pdf

Bio-energy

Biomass-based power generation and cogeneration are already being used extensively in sugar and paper mills. Biomass can also be converted into derivative products such as bio-char, bio-coke, bio-gas, and bio-oil for use in industrial heating processes. For example, bio-coke can partly replace coke in iron and steel industry while bio-char can be used in blast furnaces. Other uses include blending with other fuels like coal – Ministry of Power requires thermal power projects to blend at least 5% biomass with coal feedstock.

An estimated 230 million tonnes per annum of surplus biomass is available in the country translating to a potential power generation capacity of 28 GW.[28] However, availability is localised and varies through the year. Biomass is typically available only for 2-3 months in a year. Project developers often face supply constraints due to low mechanisation in agricultural practices and lack of aggregated supply sources.

Waste-to-energy

Electricity and heat can be generated through a variety of processes using animal, food and municipal waste. Dry waste can be directly incinerated to generate heat and power. Decomposition of organic waste using bacteria (biomethanation) produces bio- gas which can be burned for thermal applications or for power generation.

India has a waste-to-energy installed capacity of 317 MW and potential is estimated at over 9.8 GW.[29] Annual municipal solid waste availability, estimated at 52 million tonnes in 2019, is expected to increase to 164 million tonnes by 2031. However, getting access to consistent quality waste at a reasonable cost over long-term period is the biggest challenge for waste-to-energy projects. The other main barrier to growth of waste-to-energy capacity is high capital cost and cost of power (INR 7.00-8.00/kWh).

Companies in paper, food processing and pharmaceutical sectors are well suited to tap waste-to-energy route because of access to suitable in-house waste.

Battery storage

Battery storage is a vital technology for stabilising renewable power output profile and increasing power availability when solar and wind resources are not available, thus enabling their large-scale adoption. Batteries can also be used for other economically attractive applications like power back up, energy arbitrage based on time-of-day tariff and frequency response management. Global energy storage market has witnessed exponential growth in the last few years reaching more than 27 GW/ 56 GWh cumulative installed capacity by 2020[30]. Lead-acid is the well-established technology currently but lithium-ion batteries, with superior performance characteristics, are expected to account for bulk of future growth. As per Niti Ayog report, total installed battery capacity is expected to reach 260 GWh by 2030 in India.[31]

Rapid growth in electric vehicle market, coupled with falling raw material cost and improvement in manufacturing process has brought down cost of lithium-ion batteries by 17% CAGR in the last five years although prices have spiked over the last year due to material shortages and various

28 MNRE. (2021). MNRE Annual Report 2020-21. MNRE Annual Report 2020_Changes File_18.03.201.indd
29 MNRE. (2021). GEF-MNRE-UNIDO Project. https://bio-energy.isid4india.org/
30 BloombergNEF: 30% CAGR for energy storage to 2030 (energy-storage.news)
31 Niti Ayog (2022). www.niti.gov.in

supply side constraints. There are many potential applications for battery storage depending on power demand profile and supply situation of a consumer. It is already cost effective for power backup for critical uses and replacement of high cost diesel generators. With gradual reduction in cost, many other applications including peak load shaving, reduction in time-of-day tariffs and smoothing of renewable power output profile are expected to become financially attractive in the coming years. Developing battery projects with multiple use approach (value stacking) can make these projects financially viable.

In a recent study on adoption of behind-the-meter solar-plus-storage systems by HT consumers in Tamil Nadu, cost of solar-plus-storage was assessed to be INR 9.52/ kWh for commercial consumers and INR 8.35/ kWh for automotive industry consumers, making li-ion batteries unattractive for consumers in most cases. [32]

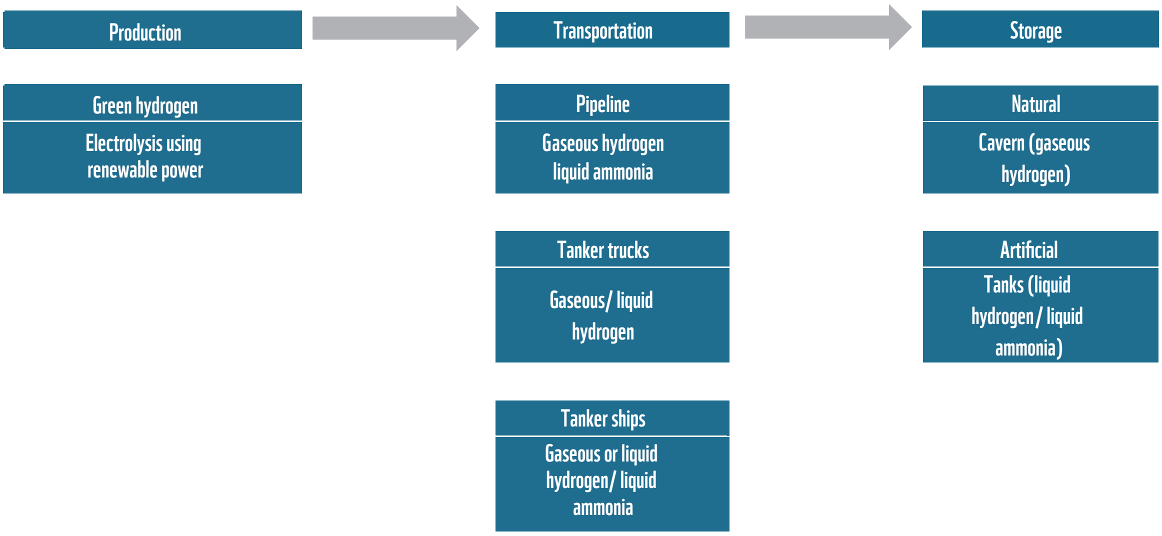
Besides high cost, general lack of technical awareness among consumers and system integrators is a significant barrier to adoption. Moreover, power sector regulatory framework also needs to evolve to incorporate various functionalities of storage systems.

4.4 Green hydrogen

Hydrogen is regarded as an essential technology for decarbonising power and heat generation. With higher energy-to-weight ratio and shorter 'charge' time in comparison to batteries, it can be a more effective option for storing energy for inter-seasonal use and use in heavy duty, long-distance transportation. It is an attractive option for "hard-to-abate" sectors like steel, aviation, shipping and buildings but only if produced in 'green' form with power from renewable sources like solar, wind and biomass.

32 Auroville Consulting (2021): 2021 Solar Plus Energy Storage. Feasibility of Behind-the-Meter systems for HT consumers in Tamil Nadu.

Figure 4.7: Hydrogen supply chain



Source: Reuß et al., 2019[33]

Barriers to adoption of green hydrogen today include high cost – about 2-3x times cost of conventional energy – as well as lack of electrolyser capacity and expensive infrastructure requirement for shipping, storage and conversion to power. Large investment tied in legacy assets and significant capital requirement for reconfiguration of facilities increases financial challenges associated with green hydrogen.

Most of the current applications of green hydrogen include onsite production and use to avoid transportation problems. Existing storage systems designed for natural gas or liquid fuels do not fulfil safety and cost requirement for large-scale hydrogen storage. Storage and supply of compressed hydrogen or conversion of hydrogen to liquid form to facilitate transportation are very energy-intensive processes. Conversion to ammonia, an alternate option, also entails significant additional energy and cost.

Cost of green hydrogen is expected to fall to INR 150/ kg by 2030 with improvement in electrolysis technology and scale.[34] Energy efficiency and operational life of electrolysers are also expected to improve significantly with large-scale commercialisation, which can make hydrogen commercially viable in the near future.

TERI has estimated hydrogen demand in India to increase from about 5-6 million tonnes pa at present to 20-30 million tonnes pa by 2050.[35] A Hydrogen Corpus Fund was set up in FY 2008 by Ministry of Petroleum and Natural Gas to support R&D efforts in hydrogen production and several pilot projects are underway.

Potential hydrogen applications across major industrial sectors are discussed below.

33 Reuß, M., Grube, T., Robinius, M., & Stolten, D. (2019). A hydrogen supply chain with spatial resolution: Comparative analysis of infrastructure technologies in Germany (repec.org)

34 Dayal, S., Hall, W., Renjith, G., Spencer, T. (2020). The Potential Role of Hydrogen in India: A pathway for scaling-up low carbon hydrogen across the economy. The Energy and Resources Institute. https://www.teriin.org/sites/default/files/2020-12/Report%20on%20The%20Potential%20Role%20of%20Hydrogen%20in%20India%20–%20%27Harnessing%20the%20Hype%27.pdf

35 Ibid

Table 4.3: Industrial applications of hydrogen

Refineries	Hydrogen is used to reduce sulphur content in petroleum products. Demand is currently estimated at 2.6 MT annually, increasing to 6 MT by 2050.
Fertilisers	Hydrogen is used for ammonia production which, in turn, is used to produce urea and other fertilisers. Demand is expected to be reach 7.5 MT by 2050 from current demand of 3 MT.
Chlor-alkali	Hydrogen is produced as a by-product and utilised for co-firing gas turbines to generate power.
Methanol production	Pilot projects for methanol-fuel blending have been implemented across many sectors and applications including railways, automobiles and cooking gas. Methanol fuel cells are also being used to power mobile towers.
Iron and steel	To reduce emissions from coal used in smelting process, natural gas can be blended with hydrogen. Smelting process powered by over 90% hydrogen feedstock can nearly fully eliminate carbon dioxide emissions. Cost of steel production from coal or natural gas is estimated at USD 300-400/ tonne while cost from hydrogen smelting is estimated at around USD 350-550/ tonne.[36] Green hydrogen based direct reduced iron-electric arc furnace will enable making of carbon neutral steelmaking.
Data centres	IT companies are considering using hydrogen and fuel cells to reduce reliance on diesel gensets and grid power. Microsoft has installed 250 kW fuel cells in its data centres in the United States and plans to install 3 MW fuel cells later this year.[37]

Source: BRIDGE TO INDIA research

4.5 Sustainable mobility

Electric vehicles

Electric vehicles (EVs) are regarded as the biggest decarbonisation opportunity for transport sector. While availability and technical performance of EVs continues to improve notably, lack of charging infrastructure and high cost are still significant barriers to adoption. As total cost of ownership (TCO) shrinks with higher use, use in corporate fleets – a fleet car typically travels 190 km per day as against breakeven distance of 164 km per day for an EV – is more cost attractive.[38, 39] Falling cost of EVs – TCO is expected to fall below conventional

Electric vehicles (4W)

Carbon abatement potential: 41 g CO2e/Km

Total cost of ownership saving: 0.64-0.9 INR/Km

36 Dayal, S., Hall, W., Renjith, G., Spencer, T. (2020). The Potential Role of Hydrogen in India: A pathway for scaling-up low carbon hydrogen across the economy. The Energy and Resources Institute. https://www.teriin.org/sites/default/files/2020-12/Report%20on%20The%20Potential%20Role%20of%20Hydrogen%20in%20India%20–%20%27Harnessing%20the%20Hype%27.pdf

37 Microsoft partners with Caterpillar and Ballard to test megawatt-scale hydrogen fuel cell backup generator - DCD (datacenterdynamics.com)

38 Kumar, P. & Chakrabarty, S. (2020). Total Cost of Ownership Analysis of the Impact of Vehicle Usage on the Economic Viability of Electric Vehicles in India. Total Cost of Ownership Analysis of the Impact of Vehicle Usage on the Economic Viability of Electric Vehicles in India - Parveen Kumar, Subrata Chakrabarty, 2020 (sagepub.com)

39 Kumar, P. & Kanuri, C. (2020). Total cost of ownership of electric vehicles: Implications for policy and purchase decisions. World Resources Institute. (PDF) Total cost of ownership of electric vehicles: Implications for policy and purchase decisions decisions (researchgate.net)

vehicle cost by 2030 – is also expected to help.[40] Corporates are beginning to adopt electric vehicles for both employee and goods transport. Many IT companies including Google, Wipro, Accenture, and Adobe have already deployed EVs for employee transport, while e-retailers and cab aggregators such as Amazon, Flipkart, Ola and Uber are gradually electrifying their fleets. An average 30% share of EV fleet by businesses, by 2030, is expected to reduce fuel consumption by 82 billion litres, equivalent to remissions reduction of 61 MT CO_2e per year.[41]

Biofuels

Bioethanol and biodiesel are the two most popular biofuels used for blending with gasoline and diesel respectively. Bioethanol has reached a blending rate of 10%. In FY 2020, 1,703 million litres of bioethanol was used resulting in emission reduction of 3.3 $MTCO_2e$.[42] Other biofuels such as bio-CNG and sustainable aviation fuel have also seen growing interest from the corporate sector. SpiceJet Airlines has established that carbon emissions can be reduced by 15% using biofuels in aviation.[43]

However, insufficient feedstock for biofuel production is a significant barrier. Ethanol demand is estimated at 4.5 billion litres to meet 20% blending target but current production capacity in the country is only 3.5 billion litres.[44] Poor grade of sugarcane produced in the country leads to low bioethanol yield.[45] Other main challenge for greater adoption of biofuels is design of vehicles, which need to be calibrated specifically for blended fuels.

4.6 Carbon removal

Carbon capture, utilisation and storage (CCUS)

CCUS – involving capture, transportation, utilisation and storage of CO_2 – can be used to sequester hard-to-abate process emissions from industries such as power generation, metals, cement, fertilisers and refrigeration. It can also play a role in production of blue hydrogen by retrofitting natural gas power plants.

Viable technologies include chemical absorption for use in power generation and industrial production, and physical absorption for use in ethanol and hydrogen production etc. After capturing, CO_2 can be transported through pipelines, ships or trucks for use as input in processes or products such as building materials, chemicals or permanent storage in geological reservoirs.

Some industry expects remain unconvinced of CCUS potential because of its failure to live up to years of promise with failed pilot projects and extremely high cost. Total operational capacity across the globe is estimated at only 40 $MTCO_2e$, mainly in the US.[46, 47] It is also believed to create perverse incentive to postpone mitigation actions by offering a signal to continue use of fossil fuels.

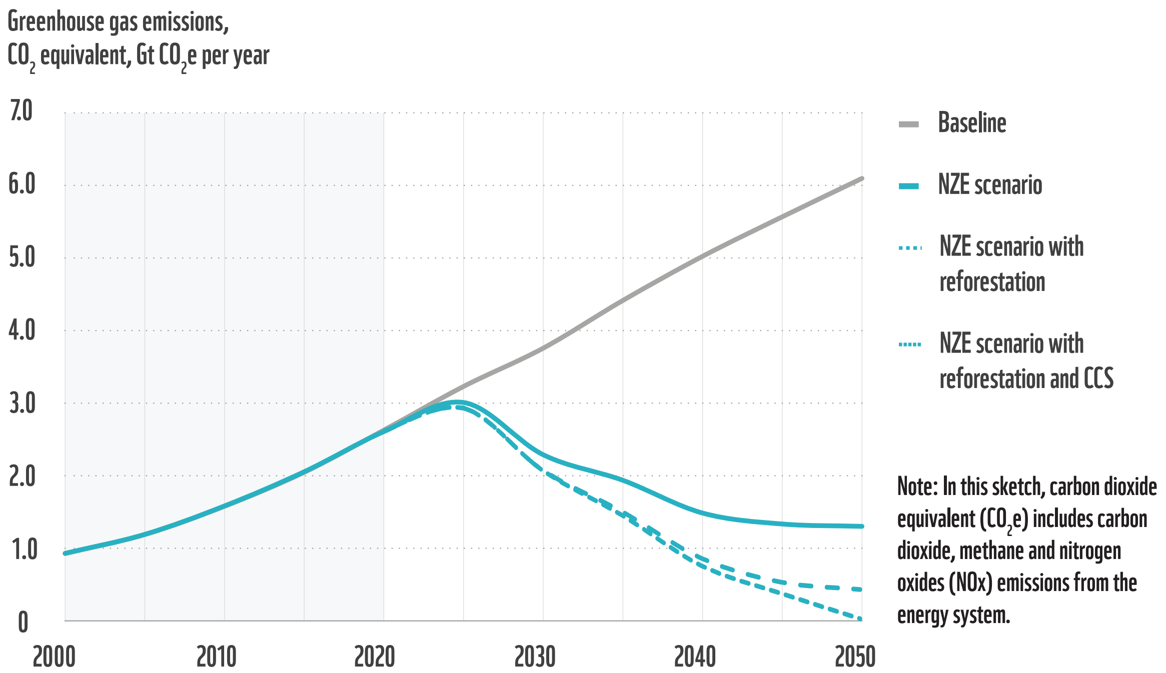
40 CEEW. (2020). India's electric vehicle Transition. CEEW-India's-EV-Transition-Post-COVID-19-22Dec20.pdf
41 WBSCD. (2019). India Business Guide to EV Adoption. WBCSD_India_Business_Guide_to_EV_Adoption.pdf
42 MOEFCC, Third Biennial Update Report. MOEFCC. (2021). India: Third biennial update report to the United Nations Framework Convention on Climate Change. INDIA_ BUR-3_20.02.2021_High.pdf (unfccc.int)
43 Bose, K. (2018). SpiceJet's biofuel-powered flight will help environment, boost farm income. Business Standard. SpiceJet's biofuel-powered flight will help environment, boost farm income | Business Standard News (business-standard.com)
44 World Biofuel Day Webinar document, Ministry of Petroleum and Natural Gas. http://petroleum.nic.in/sites/default/files/WBD_10aug20.pdf
45 Mandal, M. (2020). Why Is India Struggling So Much to Get Its Biofuel Plan Right? The wire. Why Is India Struggling So Much to Get Its Biofuel Plan Right? - The Wire Science
46 April 2021. About CCUS
47 Global Status of CCS 2020, Global CCS Institute, https://www.globalccsinstitute.com/wp-content/uploads/2020/11/Global-Status-of-CCS-Report-2020_FINAL.pdf, Pg 18

A cluster approach can help in aggregating demand, scaling up infrastructure requirements and reducing costs. Zero Carbon Humber, an industrial cluster based in the UK has proposed to install two CCUS projects with 12 companies sharing the facilities. This cluster was provided with USD 102 million of government funding.[48]

The Global CCS Institute has estimated India's carbon storage potential at 47 GTCO2e but a detailed assessment is required to estimate true potential.[49] TERI has estimated that for transition to a net zero economy by 2050, the country would need total CCUS capacity of 400 MTCO2e per year across cement, biofuels and iron & steel industries.[50]

CCUS is at a nascent stage of development in the country with only pilot and demonstration projects in process. Besides technology complexity, huge investment and high cost of generation– 63-75 % increase in base cost– are major barriers in adoption.[51] Effective cost of carbon abatement is estimated at USD 15-25/ TCO2e for natural gas processing and ethanol production, and USD 40-120/ TCO2e for cement and power generation sectors by TERI.[52] Greater environmental and health risk arising from possible leakage during transportation or storage of CO2 are also major concerns.

Figure 4.8: Role of carbon sequestration in net zero scenario in India



Source: TERI, 2021.

48 Zero Carbon Humber. (2021). £75 MILLION BID WIN FOR ZERO CARBON HUMBER'S NET ZERO AMBITION https://www.zerocarbonhumber.co.uk/news/75-million-bid-win-for-zero-carbon-humbers-net-zero-ambition/

49 Zero Carbon Humber. (2021). £75 MILLION BID WIN FOR ZERO CARBON HUMBER'S NET ZERO AMBITION https://www.zerocarbonhumber.co.uk/news/75-million-bid-win-for-zero-carbon-humbers-net-zero-ambition/

50 Global storage portfolio, Global CCS Institute 2016. Global storage portfolio: a global assessment of the geological CO2 storage resource potential (globalccsinstitute.com)

51 TERI & Shell (2021). India: Transforming to a net zero emissions energy systems. https://www.teriin.org/sites/default/files/2021-03/India_Transforming_to_a_net-zero_emissions_energy_system.pdf

52 Malyan, Ankur, and Vaibhav Chaturvedi. 2021. Carbon Capture, Utilisation and Storage (CCUS) in India: From a Cameo to Supporting Role in the Nation's Low-Carbon Story. New Delhi: Council on Energy, Environment and Water. ceew-study-on-the-role-of-carbon-capture-utilization-and-storage-in-india.pdf

India joined Accelerating CCS Technologies, a multilateral initiative to support research and development of CCUS technologies in 2020. The Department of Science and Technology released a call for proposals in March 2021 for granting transnational funding for projects aimed at developing CCUS technologies. It also provided funding of INR 186 million (USD 25 million) to 19 carbon capture research projects in FY 2020.[53] In the corporate sector, Dalmia Cement has announced plans to set up a of 0.5 MTCO2e per annum CCUS facility at its Tamil Nadu plant. Indian Oil Corporation is in the process of building a 13.7 MTCO2e per annum CCUS system at its Gujarat refinery. A few pilot projects are being implemented by state owned enterprises including National Aluminium Company, Oil and Natural Gas Corporation and Bharat Heavy Electricals. At a smaller scale, companies like Globus spirits have the capability to capture Co2 which is formed as a byproduct of ethanaol production, and produce industrial and food grade Co2 instead of releasing it into the atmosphere.

Nature-based Solutions for Carbon Sequestration

Creation of nature-based carbon sinks such as forests is another viable option in India with its large geographic area and suitable climate. As per TERI estimates, up to 900 MTCO2e per annum carbon removal by 2050 can be achieved through forestation of around 40 million hectares, equivalent to 50% of current area under tree and forest cover.[54, 55]

India has targeted to create an additional carbon sink of 2.5-3 BTCO2e by 2030 under Its NDC to the UNFCCC. Indian government issued a draft national forest policy in 2018 that targeted forest and tree cover for over 33% of total geographical area. However, no target year has been set in the policy and based on last assessment by Forest Survey of India, only 21.71% is currently covered with carbon stock.[56]

However, the opportunity for nature-based solutions is wider than just afforestation. An emerging area of interest for both Governments and Corporates are Nature-based Solutions (NbS). Forests are generally the most well-known path for natural carbon sinks but there are many more natural ecosystems, including peatlands, mangroves, wetlands, savannahs, coral reefs and other landscapes or seascapes. The unique benefit of NbS is that it seeks to protect or restore natural and modified ecosystems in a manner that addresses societal challenges such as climate change, human health, food and water security, while simultaneously providing human well-being and biodiversity benefits. Nature-based solutions go beyond Net Zero and pave the path for a nature positive future. A corporation can establish itself as a climate leader by financing and supporting additional climate and nature solutions and engaging responsibly and actively with all stakeholders across their supply chain. They can also actively engage with consumers to promote a nature positive stance.

Sectors such as agriculture, fisheries and forestry, energy, tourism, infrastructure and extractive processing industries and trade in particular can adopt many nature-based solutions to promote sustainability in their activities and along their supply chains. Companies should initially

53 Department of Science & Technology. (2020). Accelerating CCS technologies. DST Jointly Launches Accelerating CCUS Technologies (ACT) Call.pdf

54 TERI & Shell (2021). India: Transforming to a net zero emissions energy systems. https://www.teriin.org/sites/default/files/2021-03/India_Transforming_to_a_net-zero_emissions_energy_system.pdf

55 TERI. (2021). Will India attain its forestry NDC target of achieving 2.5–3 billion tonnes of CO2equivalent through additional forest and tree cover by 2030. will-india-attain-forestry.pdf (teriin.org)

56 FSI. (2021). https://fsi.nic.in/isfr-2021/chapter-2.pdf

prioritise emissions and impacts on nature directly related to their value chain. After accomplishing this, they can expand efforts by investing in further protection or restoration. To become nature positive, companies should follow the below strategies

- Ensure their supply chains include no deforestation or land conversion, in addition to directing finance towards compensatory activities.
- Finance is better directed toward interventions that reduce impact on nature first, before investing in restoration.
- Interventions should also be part of a broader landscape/seascape action plan and designed at scale, which can be developed in collaboration with multiple stakeholders including Governments and local communities. Interventions designed in this manner can achieve numerous benefits which link nature and climate, while also benefitting local communities people.
- Interventions should be designed keeping in mind future events and risks associated with climate change

There are a number of tools and coalitions that can be useful to corporates interested in exploring nature positive solutions. The Science Based Targets Network provides information on how companies can assess, prioritize, measure, address and track their impacts and dependencies on nature in its Science Based Targets for Nature[57] Guidance document. Further, IUCN has released a Global Standard for Nature-based Solutions which provides a framework for companies to verify if an intervention qualifies as NbS and also provides guidance on designing and scaling up solutions[58]. Business for Nature is another global coalition that brings together business and forward-thinking companies to implement nature related solutions proactively.

The Accountability Framework initiative[59] (AFi) focuses on enabling ethical supply chains for agricultural and forestry products, where commodity production and trade are fully protective of natural ecosystems and human rights. AFI supports companies and other stakeholders in setting strong supply chain goals, ensuring action, and creating means to track progress. Forests Forward[60] is another corporate program that works with companies around the world on topics like forest footprint and provide support for on-ground actions including forest restoration.

There have been many instances of corporates working with Governments and local communities to implement nature related solutions. As an example, through a public-private partnership, Unilever[61] has partnered with NGOs and district governments in Indonesia and Malaysia to obtain jurisdictional certifications from the Roundtable on Sustainable Palm Oil (RSPO) which ensures that local mills and thousands of smallholder farmers in Unilever's supply chain adhere to RSPO standards. Alongside efforts to reduce carbon emissions, Mahindra[62] plants trees through the Mahindra Hariyali Sustainable Initiative to provide both climate mitigation and biodiversity co-benefits.

57 https://www.naturebasedsolutionsinitiative.org/news/science-based-targets-for-nature-sbtn/
58 https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf
59 https://accountability-framework.org/home/about-the-initiative/
60 https://www.worldwildlife.org/initiatives/forests-forward
61 https://www.foodingredientsfirst.com/news/unilever-partners-with-indonesian-governments-in-palm-oil-pledge.html
62 https://www.businessfornature.org/s/Mahindra_Business-Action-on-Climate-Nature_102921.pdf

4.7 Complementary strategies

Figure 4.9: Complementary strategies

4.8 Carbon pricing and trading

A market-based carbon trading and pricing mechanism are also important interventions for decarbonisation of the corporate sector.

There are two types of carbon trading mechanisms: i) cap-and-trade; and ii) baseline-and-credit. Under cap-and-trade system, a regulatory body imposes a ceiling on carbon emissions based on its nature of operations and scale. This system is more progressive over the baseline-and-credit system, where all businesses across different sectors are set same pro rata targets based only on their respective historic emissions.

Transparent carbon pricing and benchmarking, besides acting as a penalty mechanism for non-compliance with targets, can provide useful guidance to companies for evaluating investment decisions in alternate technologies. Moreover, a uniform carbon price across sectors allows businesses with the most cost-effective decarbonisation options available to reduce emissions first.

Thirty-two carbon markets, covering total 10 GTCO2e representing 17% of global GHG emissions, are currently operational around the world.[63] Total value of global carbon market increased by 23% in 2020 to reach EUR 238 billion with The European Union Emission Trading System (EU ETS) accounting for 90% of the global market value.[64]

India does not have any emission trading market at present, but internal carbon pricing can help businesses to mitigate climate related risks and identify opportunities for a low carbon future. 11,600 Indian companies are believed to be pricing or planning to price carbon internally.[65]

4.9 Circular economy

India is the third largest consumer of raw materials and recycles only 20% of input materials while Europe recycling rate stands at 70%.[66] Resource extraction in India is significantly higher at 1,580 tonnes/ acre in comparison to the world average of 450 tonnes/ acre.[67] Different strategies for adopting a circular business model include shift to recyclable inputs, recovering and recycling of materials, providing products as service, extending life of product by repair and refurbishment, and providing shared access to increase utilisation rate of products and prolong their life.

Circular business strategies can create additional value for companies and reduce emissions. As an example, as per Ellen McArthur Foundation, circular economy principles can help mobility sector create benefit of USD 482 billion and 68% less emissions by 2050 by designing vehicles for longer use and using materials for reuse and remanufacturing.[68]

Inadequacy of suitable technologies may mean that using circular strategies may not be viable for all materials, for example, composite products like cartons or fibreglass. Moreover, cost of recycled materials is higher than cost of virgin

63 World Bank. (2021). Carbon Pricing Dashboard | Up-to-date overview of carbon pricing initiatives (worldbank.org)
64 Refinitiv. (2020). carbon-market-year-in-review-2020.pdf (refinitiv.com)
65 Chandra, T. (2021). Pricing carbon: Trade-offs and opportunities for India | ORF (orfonline.org)
66 Karthik, P. (2020). As India rebuilds its economy, it is time to make it circular and sustainable | ORF (orfonline.org)
67 MOEFCC. (2019). Draft National Resource Efficiency Policy, 2019. Draft-National-Resourc.pdf (moef.gov.in)
68 Ellen McArthur Foundation. (2016). Circular economy in India: Rethinking growth for long-term prosperity (ellenmacarthurfoundation.org)

India Plastics Pact

India Plastics pact, a collaborative effort between WWF India and CII, supported by WRAP and UKRI promotes a circular economy for plastics by public-private collaboration that enables innovative ways to eliminate, reuse, or recycle the plastic packaging across the plastics value chain and collectively achieve the long-term targets. The vision of this initiative is a world where plastic is valued and doesn't pollute the environment. The key goals are to

- Create a unified national framework to drive action for a circular economy for plastics
- Set collective targets for transition to a circular economy for plastics in India
- Develop a roadmap to reach the targets and stimulate progress through collaborative, action-oriented work streams
- Measure and report progress with accurate and timely data
- Empower action by businesses, the government and the entire value chain
- Support effective policy to accelerate progress
- Engage citizens to promote reuse, recycling and prevention behaviours

materials due to requirement of additional infrastructure for collection of discarded goods, warehousing and processing.

There have also been changes at regulatory level in India to promote circularity. The Ministry of Environment, Forest and Climate Change (MoEFCC) amended the Plastic Waste Management Rules 2016 and notified guidelines on Extender Producer Responsibility (EPR) on plastic packaging along with prohibiting single use plastics. The inclusion of enforceable prescription of minimum level of recycling of plastic packaging waste and use of recycled plastics is likely to strengthen circular economy of plastics, promote innovation in technology and a move towards sustainable plastic packaging by businesses[69].

69 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1799170

4.10 Supply chain engagement

A significant amount of emissions are embedded in supply chains of companies. Small-scale suppliers and consumers may have little access to technology and financial expertise necessary for decarbonisation. Larger companies can use their strong creditworthiness and financial capacity to assist supply chains to reduce upstream and downstream emissions:

- Influence business affiliates, subsidiaries and suppliers to develop decarbonisation plans
- Design clear procurement policies warranting urgent action by suppliers
- Help suppliers avail finance for procuring renewable power or accessing new technologies like storage, energy efficiency and EVs
- Enable innovative business models for suppliers to adopt new technologies
- Engage and collaborate with suppliers for adoption of new materials with lower carbon intensity and higher recycling potential
- Engage with customers to promote extended use patterns and create demand for low carbon products

Chapter 5: Government Policy

The business case for commercial and industrial consumers to set and adhere to Net Zero Targets has been well established and Indian corporates have shown strong inclination to achieve these targets. However, policy instability has been consistently identified as one the key barriers for Corporates to meet their targets. In order to achieve Net Zero at the national level, there needs to be a strong enabling policy and regulatory environment which is crafted with involvement from key stakeholders including government agencies, businesses, civil society and think-tanks.

While several government policies and initiatives have been designed over the years to help in reduction of emissions, the current policy framework needs to evolve in response to market needs, emerging technologies, new applications and business models. Following are some broad systemic level approaches that the government could undertake:

- Review the overall emissions across sectors at a systemic level
- Prioritize the highest emitting sectors, based on historic, current and future emissions trajectories
- Review current critical gaps/issues and the level of deep reductions needed to achieve the Net Zero target at a country level and at a sectoral level.
- Accordingly develop an enabling ecosystem to address the gaps and issues through the right policy and regulatory framework, through development of clear standards, mandates and incentives, sector lending and financing mechanisms
- Prioritize research and innovation to catalyze faster NET Zero adoption
- Designate clear roles and responsibilities of different government agencies as part of this process
- Streamline processes including procedures for approvals and establishment of clear tracking, monitoring and enforcement mechanisms
- Develop new and strengthen existing centres of excellence for facilitation of pilots
- Strengthen and synergise networks with businesses, industry associations, think tanks, civil society organizations for enabling this systemic change

The government must create synergies with existing schemes and create a common emission reduction denominator to avoid overlap between different emission reduction initiatives. Emphasis must also be laid on creating tailored skilling and training programmes to develop a pool of expert sustainability professionals.

Some specific policy suggestions for specific decarbonisation pathways are discussed below.

5.1 Energy efficiency

Initiatives such as PAT, Standards and Labelling Programme, Energy Conservation Building Code (ECBC), Building Energy Efficiency Programme and India Cooling Action Plan have been immensely successful in reducing energy demand and carbon emissions. In order to accelerate energy efficiency measures by corporates, following policy support is recommended:

- Expand scope of schemes like PAT and Standards and Labelling Programme to include more participants, appliances and allow voluntary participation
- Mandate energy audits, baseline development and energy management systems for all corporate entities
- Provide financial incentives, cheaper funding and guarantees to Energy Service Companies
- Link programmes such as Building Star Rating scheme with performance-based incentives
- Facilitate access to affordable finance for energy efficiency projects

5.2 Renewable power

The government has been driving penetration of renewable power through a series of supportive measures including Renewable Purchase Obligation (RPO) targets for select consumers, 40% accelerated depreciation, 'must run' status, exemption from inter-state transmission system (ISTS) charges and construction of dedicated transmission lines. The government has also launched production linked incentive (PLI) schemes aggregating INR 421 billion (USD 5.6 billion) for advanced battery storage and PV module manufacturing. Issue of recent open access rules, liberalising this market and expanding coverage to all consumers with connected load of more than 100 kW, is a great step forward in this direction.

Policy initiatives recommended to accelerate renewable procurement by consumers are as follows:

Ensure long term policy and regulatory stability

a. Provide a minimum 5-year policy visibility for long-term planning and grandfathering protection to older installations from any subsequent policy changes

b. Formulate specific solar-wind hybrid policies for all states with attractive wind resource

c. Increase RPO scope to cover all large consumers (with connected load of more than say, 1 MW)

Diversify avenues for RE procurement

a. Enable business models like virtual PPAs, sleeved PPAs and subscription based PPAs for all consumers irrespective of their consumption quantum, connected load or voltage level

b. Bring new technologies such as solar thermal, wind-solar hybrid, battery storage, pumped hydro storage under REC mechanism with adequate multipliers

c. Promote energy storage and hydrogen technologies through mandates, capital subsidies and generation-based incentives

Facilitate ease of procurement for consumers

a. Remove all procurement or project size caps

b. Defer grid charges for all rooftop solar installations (below a certain size, say 1 MW) completed in a specified period

c. Ensure timely project approvals by building operational and technical capacity of DISCOMs and state nodal agencies

d. Provide affordable financial solutions to end consumers

Facilitating greater penetration of renewable power would require the government to play a key role in augmentation of transmission and distribution infrastructure, ensure grid stability through battery storage systems and enable development of wholesale power market.

5.3 Green hydrogen

The green hydrogen policy issued by Ministry of Power in February 2022 provides ISTS charge waiver, monthly banking facility and faster project approvals to enable easier access to renewable power for hydrogen producers. The government is also believed to be in advanced stages of considering demand aggregation, electrolyser manufacturing incentives and consumption mandates to promote use of green hydrogen by refineries, steel and fertiliser producers.

Further policy measures are recommended to accelerate deployment of this nascent technology:

a. Facilitate pilot installations with R&D grants and capital subsidies to reduce cost for early adopters

b. Explore potential geological sites for hydrogen storage to make storage an affordable option

c. Specify technical standards for hydrogen transportation, storage and handling

d. Mandatory procurement by sectors like steel, fertiliser industries

e. Offer capital subsidies in form of viability gap funding to reduce cost for early adopters and define clear mandates

5.4 Carbon sequestration and offset

Use of carbon sequestration technologies and mechanism like CCUS and carbon sinks can be facilitated with following initiatives:

a. Encourage public sector companies to build pilot CCUS projects using different technologies to validate techno-economic feasibility

b. Provide financial incentives in the form of tax credits, capital support and operational subsidies to reduce cost

c. Facilitate development of CCUS hubs to share costs of CO2 transport and storage infrastructure

d. Mandate businesses dependent on forest and agriculture to undertake afforestation and reforestation projects

5.5 Sustainable mobility

Indian government has set a target of blending gasoline with 20% ethanol and diesel with 5% biodiesel by 2025. Capital subsidy of INR 20 billion (USD 266 million) has been provided to twelve integrated bioethanol projects. For increasing availability of affordable transport fuels and better use of waste, a Sustainable Alternative Towards Affordable Transportation scheme was launched in 2018 with a target production of 15 million metric tonnes of compressed biogas by 2023. The Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme aims to boost EV market growth through several financial incentives for commercial and passenger EVs in the form of capital subsidies, road tax rebate and registration fee waiver.

Recommended policy interventions for sustainable mobility are listed below.

a. Provide land grants, subsidised infrastructure and financial incentives to augment domestic manufacturing of EVs

b. Accord priority sector lending status to EV financing to mobilise funding

c. Improve conventional vehicle scrappage policy

d. Develop public charging infrastructure by setting targets for real estate developers, distribution companies, gasoline outlets as well as fleet owners

e. Issue clear standards for EV supply equipment to ensure compatibility across multiple technologies

f. Encourage investment in new technologies and bio-refineries for 2G ethanol, derived from agricultural waste to reduce burden on edible biomass

5.6 Carbon pricing and trading

Carbon trading is a critical additional lever for corporates struggling to achieve net zero goals because of operational challenges.

a. Adopt a cap-and-trade based emission trading system starting with sectors with the highest contribution to emissions

b. Consider levy of a carbon tax on corporates to reduce relative cost of decarbonisation measures

5.7 Circular economy

The government has issued various policies for improved management of plastic, electronic, construction and metallic waste. Extended Producer Responsibility and Zero Effect, Zero Defect schemes have been launched with financial incentives for MSMEs to ensure higher quality manufacturing with minimal adverse impact on environment. More industry specific initiatives are needed to enable a circular approach to material use:

a. Develop industry specific roadmaps and targets for highly polluting industries including aluminium, iron and steel, cement, pulp and paper, and pharmaceuticals

b. Create labelling metrics to indicate use of recycled goods, sustainable sourcing and recycling potential to help consumers make informed choices

c. Create industrial clusters for businesses to use waste generated by other businesses

d. Developing policies for end-of-life waste management and identifying critical stakeholders across the value chain for mandatory action

Chapter 6: Roadmap to Net Zero

The path to pursue climate commitments is complex and continually evolving. While there are a number of plausible pathways, uncertainty in business volume, policy framework, technology evolution, supply eco-system and cost makes it challenging for companies to evaluate options and make commitments. Businesses are generally not keen to commit too early, when technology is immature and/ or cost is too high, potentially putting them at a disadvantage over their peers. Intricate global supply chains and multiplicity of stakeholders also make planning net zero pathways an inherently complex process.

Developing the net zero roadmap involves four essential steps: measuring emissions, setting targets, developing criteria to evaluate decarbonisation options, and identifying suitable levers depending on each company's operating and financial context.

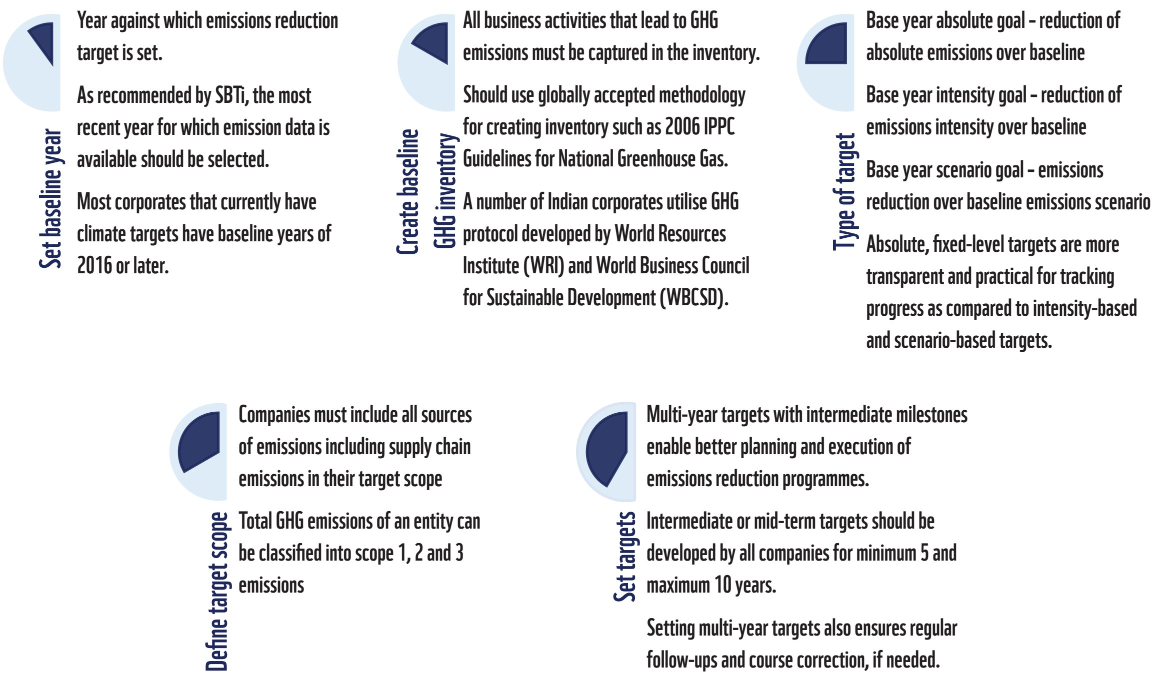
6.1 Setting targets

Consistency in definition of targets, measurement and monitoring of emissions are crucial first steps to create desired impact.

6.2 Developing assessment criteria

Corporates need to account for multiple considerations and a careful evaluation of their specific needs and circumstances while designing decarbonisation plans: type and source of emissions, location, national and state level policy framework, supplier and consumer perspective, investor expectations, business scale, financing ability etc.

Figure 6.1 Setting net zero targets



Source: SBTi

Table 6.1: Key considerations and challenges for decarbonisation

Key factors	Challenges
Nature of business: Sources of emissions and, consequently, decarbonisation pathways vary by industry. Decarbonisation of industries such as mining, and cement manufacturing is more challenging as compared to service industry on account of hard-to-abate emission sources.	Heavy emitting industries with process emissions need to rely on a mix of various technologies and market mechanisms to offset their emissions. These options may not be easily available to corporates due to reasons such as unavailability of technology, high capital costs, locked-in capital assets etc. Additionally, hard to monitor fragmented supply lines and knowledge gap amongst suppliers make mitigation of supplier related emissions difficult.
Policy and regulatory landscape: consistent, predictable policy environment is required at national, state and local levels for adoption of measures such as renewable power procurement, energy efficiency and fuel switching.	The policy and regulatory framework is evolving rapidly presenting various potential conflicts for businesses: – Inconsistency between national and state level policies; – Lack of long-term predictability; – Poor enforcement; – Lack of clear implementation procedures. Example: MNRE has set national level RPO target of 21% for FY 2022 but states have devised different RPO trajectories, for example: Uttar Pradesh 14%, Bihar 17%. Some states have not even enforced RPOs and extended implementation deadlines without penalties, while in other states, procurement of renewable power is hindered by delays in project approvals, policy uncertainty and lack of visibility over grid charges (see chapter 4 for more details).
Technology maturity and viability: Access to low-carbon technologies – at scale, affordable cost and operationally viable – is a major factor in adoption of decarbonisation strategies.	Many crucial technologies such as green hydrogen, carbon capture and electric mobility, critical for decarbonisation, are still inaccessible due to high cost, limited availability and/ or low awareness. Moreover, cost and complexity of new technology adoption are likely to fall progressively with higher adoption, providing a strong incentive to businesses to delay implementation.
Access to finance: Reducing GHG footprint requires sizable investments across the value chain: a. Adoption of new, low-carbon technologies b. Research for development of low-carbon products and processes c. Realignment of supply chains d. Skilling and retraining	Conflict with financial needs of core business and/ or day-to-day financial pressures can restrict magnitude of climate action and prolong implementation timelines. Access to climate finance is a major concern particularly for medium and small-scale enterprises.

Key factors	Challenges
Ensuring social justice: Decarbonisation attempts could result in abrupt changes in value chain affecting upstream and downstream business viability and/ or loss of jobs.	Decarbonisation roadmap should be planned with sufficient consideration for affected workers and supply chains. As an example, coal sector employs an estimated workforce of nearly 450 million excluding the informal workforce.[70] Transition from a coal dependent to a renewable powered economy will have to ensure a just transition. Phasing out fossil fuels will lead to loss of income and employment for masses which needs to be sensitively handled. Poor working and living conditions for people dependent on coal mining is widely known. RE provides a perfect opportunity to formalise the informal sector of coal industry. An active dialogue with all affected stakeholders is essential for a socially and environmentally just transition to net zero. Companies must ensure workforce retention, reskilling and redeployment to preserve interests of local communities while implementing net zero plans. Loss of livelihood, pressure from workforce or other adverse social impact may also be used to justify insufficient climate action. Government should devise a proper formal strategy to ensure just climate action.

6.3 Adopting suitable decarbonisation options

In view of the differing techno-economic feasibility of different options and rapid pace of change in technology and policy framework, it is best for companies to adopt a time-graduated framework for reducing emissions. An indicative roadmap to achieve net zero has been developed.

70 Coal-Dependence-Need-Just-Transition_WP1.pdf (teriin.org)

Net zero roadmap for corporates

Decarbonisation levers and strategies

Energy efficiency
- Identify processes to improve energy efficiency
- Incorporate internal energy efficiency targets
- Share energy efficient practices with suppliers

Electrification of industrial processes
- Assess technology electrification prospects for different processes
- Prioritise low and medium temperature heat processes

Renewable energy (power/electricity) & thermal
- Install onsite solar PV/ micro-wind/hybrid projects
- Procure through solar, wind or hybrid open access projects
- Buy from green term ahead market
- Install small battery backed systems
- Use energy storage value stacking
- Buy RECs
- Avail green tariffs
- Use demand side management
- Pilot installation of solar thermal equipment
- Blend biomass with coal in boilers and heating applications
- Replace fossil fuels with energy generated from waste

Green hydrogen
- Develop demonstration projects

Sustainable mobility
- Deploy EV charging infrastructure and convert intra-city transport fleet to EVs
- Use of bioethanol and bio-CNG compatible vehicles
- Incentivise use of EVs by employees

Carbon removal

Carbon capture, utilisation and storage

Carbon removal through nature based solutions
- Source sustainable materials
- Adopt zero deforestation policies for company & suppliers
- Use livestock management practices

Carbon pricing and trading
- Levy of internal carbon price
- Use carbon trading mechanism to offset residual emissions

Circular economy
- Redesign and innovate to create circular products
- Conduct pilots for alternative material use
- Collaborate for recycling by-products
- Build recycling programmes

Supply chain engagement
- Design clear procurement policies
- Provide financial assistance to suppliers
- Share knowledge, technology and resources across supply chain
- Technical tools for GHG monitoring and reporting

Short term (0-3 years)

Applicable for Industries with Heavy Emissions

Applicable for Industries with Medium Emissions

Invest in energy efficient equipment or retrofit old equipment

Invest in combined heat and power generation

Invest in energy efficient equipment or retrofit old equipment

Convert inter-city transport fleet to EVs

Shift to hydrogen based heavy transportation

Blend hydrogen to co-fire gas turbines

Develop shared infrastructure for storage and transort

Pilot projects in collaboration

Use CCUS for hard-to-abate process emissions

Adoption of zero emission farm machinery

Build farmers' capacities to adopt improved agricultural practices

Build product portfolio made of 100% sustainable materials

Limit use of carbon offsets

Stop the use of carbon offsets

Create secondary markets and diversify product categorisation

Use of digital technologies to track product life cycle stage

Develop end-of-life recycling infrastructure for all products

Adopt extended user responsibility

Create innovative business models & build partnerships

Partner with other companies to develop sector wise standards

Select suppliers with carbon neutral portfolio

Medium term (3-10 years) | **Long term (above 10 years)**

Applicable for Industries with Light Emissions

Case Studies

We have looked at three companies in different sectors and designed an illustrative roadmap for decarbonisation based on their respective emission mix and business needs.

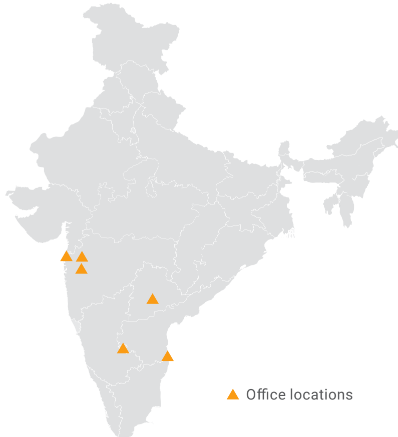
LTI

A Larsen & Toubro Group company

- An information technology products and service company: cloud service, digital consultancy, infrastructure management services.
- FY 2022 revenues: INR 164 billion (USD 2.1 billion)

Target: Achieve carbon neutrality by 2030

- Includes scope 1, 2 and 3 emissions
- Levers used: renewable energy, energy efficiency, circular economy, sustainable transport
- 50% renewable energy share by 2030



RENEWABLE ENERGY

Progress so far
- 33% power met from renewable sources in FY 2022
- Procurement modes: rooftop solar, open access, green tariffs, RECs

Way ahead
- Greater use of green tariff route
- Use of innovative business models for RE procurement by lessee- procuring via open access through landlord

ENERGY EFFICIENCY

Progress so far
- 68% reduction in power consumption as per BAU due to work from home mode in FY 2022
- Optimisation of data centres, HVAC & UPS systems
- LEED and USGBC certification for office buildings

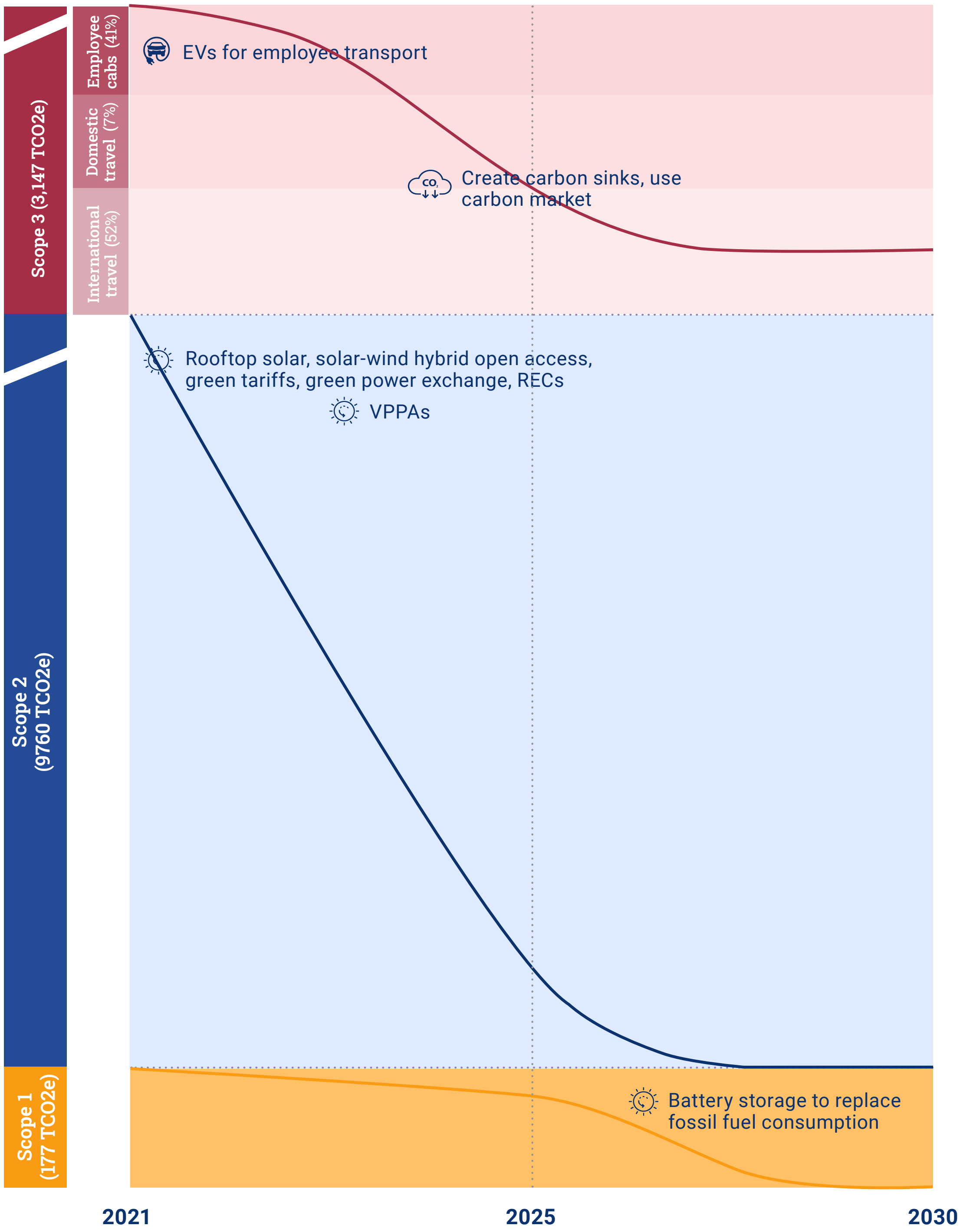
Way ahead
- Use digital technologies to optimise power consumption
- Retrofit campuses to convert into green buildings

SUSTAINABLE MOBILITY

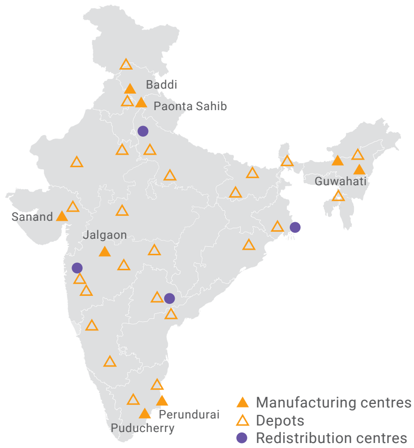
Progress so far
- 84% reduction in travel emissions in FY 2022
- Converted 25%+ cab fleet to CNG at two offices
- Utilise platforms like smart commute/ workplace to aggregate cab rides

Way ahead
- Air travel – use fuel-efficient airplanes with biofuel capabilities; explore possibilities of contracts with airlines to procure emission offsets
- Install EV charging infrastructure at office premises
- Collaborate with B2B service providers and cab aggregators to use EV fleets
- Hybrid work model to reduce employee commute

Net zero roadmap for LTI



marico



- A consumer goods company with presence in over 25 countries: coconut oil, value-added hair oils, edible oils, healthy foods (oats, honey, immunity drinks) personal grooming products (aftershave, hair cream)
- FY 2021 revenues: INR 62 billion (USD 821 million)

Target: Achieve net zero in global operations by 2040

- Includes scope 1, 2 and 3 emissions
- Levers used: renewable energy, energy efficiency, recyclable packaging, carbon sequestration
- Transition to 100% renewable energy mix by FY 2040
- Transition to 100% carbon neutral operations by FY 2040

RENEWABLE ENERGY

Progress so far
- 72% energy met from renewable sources
- 86% of thermal energy produced from biomass
- 36% of power met from wind and solar
- Business models: CAPEX and OPEX

Way ahead
- More solar-wind hybrid power and deployment of storage capacity to address intermittency issues
- Facilitate financing for MSME suppliers

ENERGY EFFICIENCY

Progress so far
- 72% energy intensity reduction achieved
- 79% and 31% energy intensity reduction from thermal and electrical applications respectively
- Energy efficiency through process optimisation and technological change

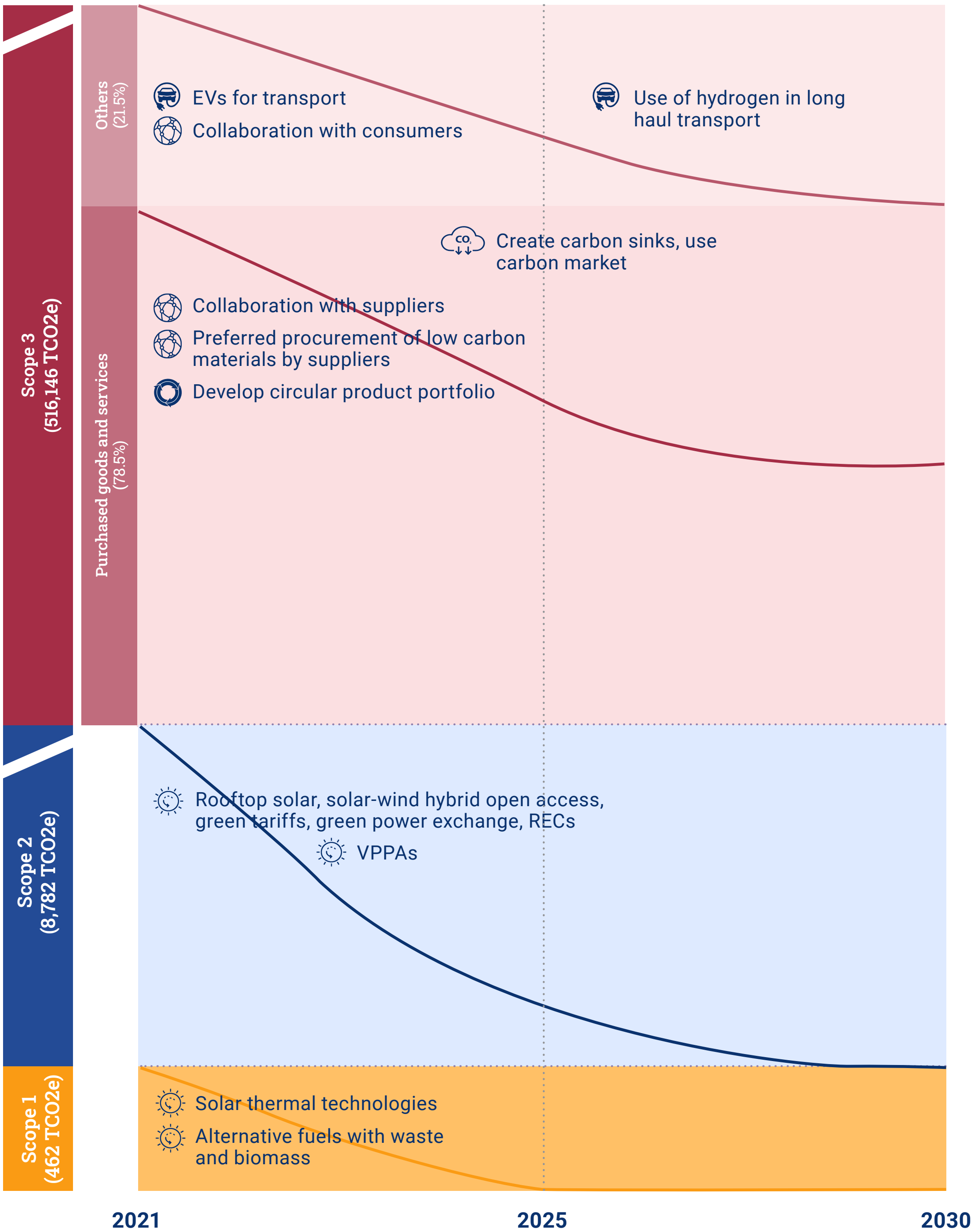
Way ahead
- Expansion of waste heat recovery technologies
- Explore other energy efficient technologies like solar thermal
- Low-carbon technological interventions for process optimisation and effectiveness

RECYCLABLE PACKAGING

Progress so far
- 95% of packaging material is recyclable
- Developing and innovating design and formulations of packaging

Way ahead
- Use of alternate biodegradable material for packaging
- Optimise use of packaging material in transport of raw materials and finished goods
- Enhance usage of post-consumer recycled plastic in packaging portfolio
- Measure reduction in carbon footprint from sustainable packaging related interventions

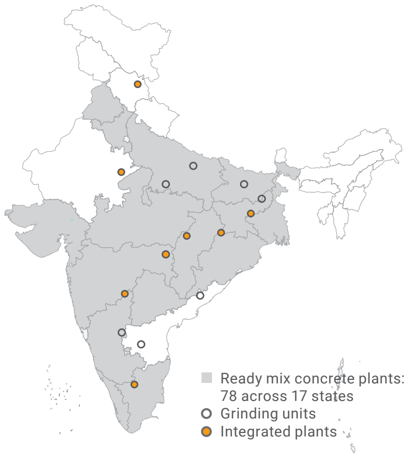
Net zero roadmap for Marico



- Producer of cement, concrete, construction chemicals, dry mixes and green construction products
- FY 2021 turnover: INR 158.14 billion (USD 2 bn)

Target: Achieve carbon neutrality by 2050

- Target includes scope 1 and 2 emissions
- Levers used: renewable energy procurement, energy efficiency, circular economy



RENEWABLE POWER

Progress so far
- 4.6% energy from renewable sources
- 82 MWp solar and 19 MW wind capacity
- Business models: CAPEX and PPA

Expectations
- Stable and uniform policies across all states
- Development of battery backed system and wind-solar hybrid projects
- Waiving off charges and restrictions in open access projects

ENERGY EFFICIENCY

Progress so far
- 187 green building centres
- Waste heat recovery systems (WHRS) – generated 47 GWh in FY 2021
- Substituted 7.25% of thermal energy with alternative fuels and raw materials
- Electrical energy consumption is 78.55 KWh/t of cement

Expectations
- Include WHRS in renewable power portfolio
- Electrification of industrial processes
- Deploy renewable thermal technologies

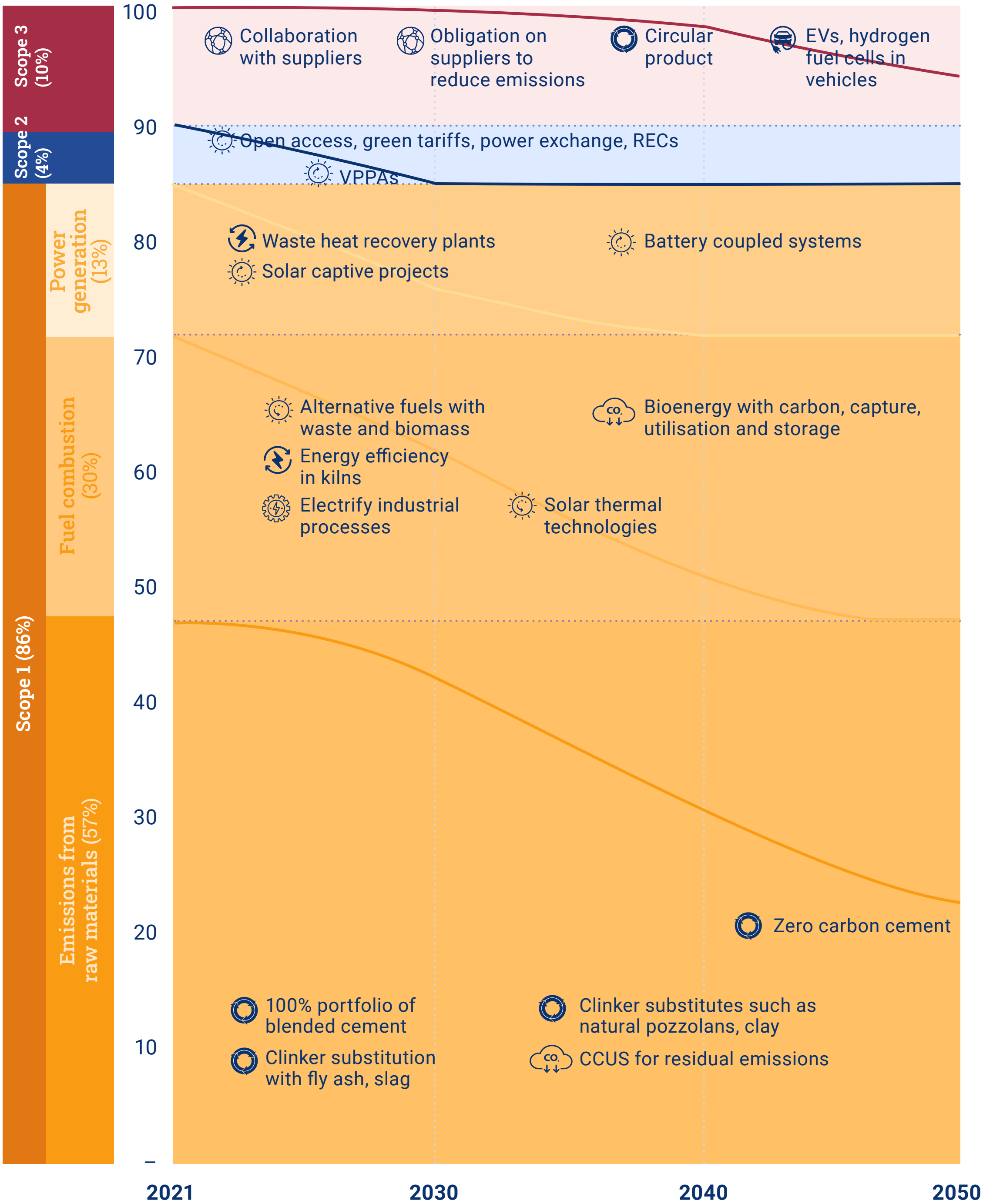
CIRCULAR ECONOMY

Progress so far
- 90% of cement portfolio comprises of blended cements which utilises fly ash, slag and reduced clinker
- 11.36 million ton of waste-derived resources consumed in 2021
- 0.57 million ton of total waste co-processed at cement plants

Expectations
- Viable transportation of fly ash from power plants to cement industry
- Alternative inputs for reducing limestone consumption

*Baseline year is 2018

Technology roadmap expectation to support net zero journey



Note: This is a tentative suggested net zero plan. It does not show actual plan or commitment by the company.

Conclusion

Despite growing climate urgency and intense public scrutiny, there is as yet little clarity on transition to a zero-emission economy. Some decarbonisation routes like renewable power and energy efficiency are techno-economically feasible but many critical technologies including battery storage, green hydrogen and CCUS are still in early stages of maturity.

Some businesses have begun to adopt voluntary net zero targets but, in most cases, there is no definite timeline or strategy to accompany the targets. They face uncertainty in policy framework, unproven technologies, lack of credible supply eco-systems and high cost making it extremely challenging for them to evaluate various decarbonisation options. Moreover, eliminating carbon emissions requires complete business transformation and acquiring new skill sets. Approach to each business function including product design, procurement, finance, marketing and employee training needs to be reconsidered.

While any formal policy mandates are yet to be announced, corporates should proactively take voluntary action recognising both urgency and opportunity to benefit from fight against climate change. Proactive action can help corporates in improving business resilience, gaining competitive advantage and attracting capital from institutional investors. It is crucial for corporates to develop a clear time-bound strategy taking into account various available technologies and approaches.

Multiple considerations and specific needs and circumstances of a business – size, type of industry, sources of emissions, financial and operational capacity – need to be accounted for while designing a decarbonisation plan. Some essential principles for developing a roadmap are listed below:

i. Clear methodology, consistent with international norms, for monitoring and verification of emissions

ii. Time-graduated framework with interim milestones in view of techno-economic viability of different options and expected evolution in technology and policy framework

iii. Emphasis on developing expertise in emerging technologies and business models through pilot projects

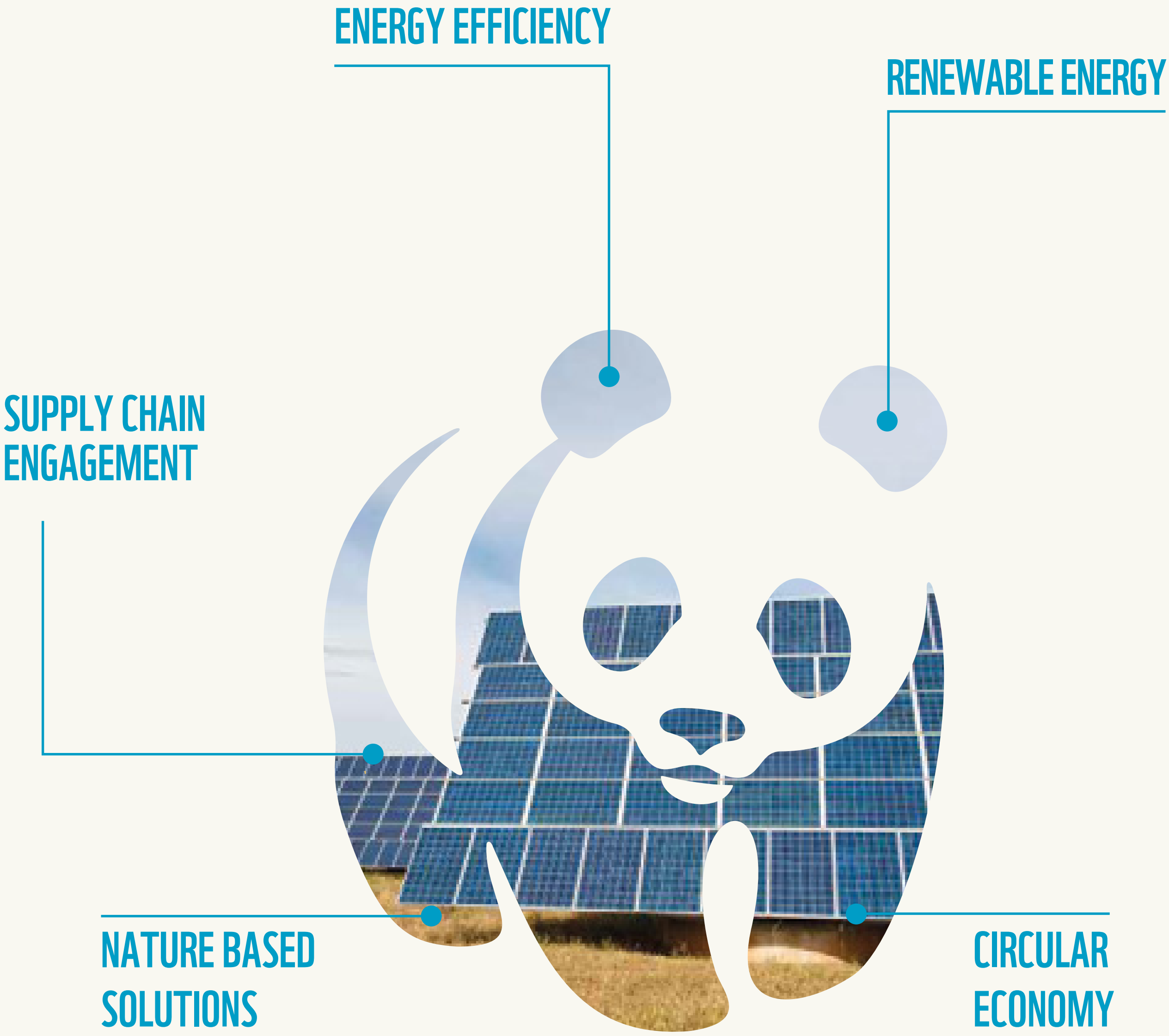
iv. Mitigation of social and financial impact across supply chain, business teams and other stakeholders

v. Active collaboration with peers, industry bodies, policy makers and think-tanks like SBTi for sharing expertise and optimal implementation

This report also offers an indicative roadmap and individual case studies for Indian corporates based on the principles highlighted above.

Role of government

The government has a critical role in facilitating corporate decarbonisation. It should mandate targets and set up an independent monitoring agency to validate actions by corporates for lending transparency to the entire process. Second, it must play an enabling role in facilitating adoption of low-carbon technologies by bringing down cost through initiatives such as R&D grants, expanding requisite infrastructure, tax incentives, manufacturing subsidies etc. As an example, initiatives like solar park scheme, concessional GST rate, transmission charge waiver, development of green energy corridors and capital subsidies for consumers have been instrumental in growth of solar sector. Third, financing and technical help should be extended specially to small and medium enterprises, a significant source of supply chain emissions, with relatively scarce resources.



WWF

NET ZERO ROADMAP FOR CORPORATES IN INDIA

IND

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