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REINFORCING INDIA'S COMMITMENTS

DELHI TO PARIS | CORPORATE VISION ON CLIMATE CHANGE

Champion Partner

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Reinforcing India's Commitments
Delhi to Paris: Corporate Vision on Climate Change
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Foreword

प्रकाश जावडेकर
Prakash Javadekar

सत्यमेव जयते

राज्य मंत्री (स्वतंत्र प्रभार)
MINISTER OF STATE (INDEPENDENT CHARGE)
पर्यावरण, वन एवं जलवायु परिवर्तन
ENVIRONMENT, FOREST & CLIMATE CHANGE
भारत सरकार/GOVERNMENT OF INDIA

The Delhi to Paris: Corporate Vision on Climate Change document subtitled "Reinforcing India's Commitments" captures a snapshot of the numerous initiatives taken by the corporate sector to tackle climate change and depicts several innovations illustrating India's sustained efforts towards reducing its greenhouse gas emissions. I am indeed delighted to see a Document of this nature being released at the 21st Conference of Parties (COP21), when the global community seeks to reach a new international climate agreement. What is particularly noteworthy, is the fact, that this Document is being released at a Forum that benefits from the presence and support of a large number of stakeholders involved in climate negotiations. The need for acting on climate change across the globe has never been greater and I am happy to see corporate India responding positively and stepping up to the challenge.

India's Intended Nationally Determined Contributions (INDCs), prepared in a balanced and comprehensive manner, reflect issues related to mitigation, adaptation, finance, technology transfer and capacity building. India's ambitious INDC will be achieved with the partnership of all stakeholders.

India's INDCs center around India's policies and programmes on promotion of clean energy, especially renewable energy, enhancement of energy efficiency, development of less carbon intensive and resilient urban centres, promotion of waste to wealth, sustainable transportation network, abatement of pollution and enhancement of green cover. The Delhi to Paris: Corporate Vision on Climate Change document captures the corporate sector's contribution in many of these pressing issues. The corporate sector has the capacity to mobilize financial resources and technical capabilities, leverage the efforts of governments, engage civil society, and develop innovative climate services and adaptation technologies.

I am confident, that with the cooperation of all stakeholders and India's proactive attitude, India will innovate and achieve our INDCs. I value our partnership with TERI and now the members of its Business Council; a remarkable coming together of leading corporates of India, aiming to tackle climate change through innovative mechanisms. Together we will promote real positive action. I particularly applaud TERI and its Business Council members to have taken this Initiative to align the corporate vision with the Government of India's schemes and showcase India Inc.'s strength and commitments on a global platform. This is India's vision and the corporate sector is an important part of it.

(Prakash Javadekar)

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We wish to express our earnest thanks to Indian minister Shri Prakash Javadekar, Hon'ble Minister of State (I/C), Ministry of Environment, Forest & Climate Change, and Shri Suresh Prabhu, Hon'ble Minister, Ministry of Railways, for endorsing the Initiative. We also thank other Government agencies - Bureau of Energy Efficiency, Niti Aayog and Ministry of Finance for their constructive inputs and encouragement. We extend, sincere gratitude to our senior colleagues Amb. Ajai Malhotra, Mr Amit Kumar, Dr Prodipto Ghosh, Dr R K Pachauri, Dr Syamal Kumar Sarkar, Mr S Vijay Kumar for their support and guidance. TERI CBS is grateful for the financial support from all its corporate partners.

We gratefully acknowledge Team TERI comprising of members across divisions — **Energy Environment Technology Development**: Mr Shirish S Garud (Lead), Ms Astha Gupta; **Industrial Energy Efficiency**: Mr Girish Sethi (Lead), Mr N Vasudevan; **Green Growth & Resource Efficiency**: Dr Ritu Mathur (Lead), Dr Suneel Pandey (Lead), Mr Sourabh Manuja; **Sustainable Habitat:** Ms Mili Majumdar (Lead), Dr Hina Zia, Mr Sarbojit Pal, Mr Tarun Garg; **Water Resources**: Mr Anshuman (Lead) and Ms Sonia Grover; **TERI CBS**: Mr Abhishek Kaushik, Mr Arupendra Nath Mullick, Ms Jaya, Ms Manvi Bansal, Ms Smriti Bhatnagar, and Ms Avni Gupta.

It was a significant task to gather and engage with around 400 corporates, but the support and motivation by all made the task easier. We thank all the corporates for their participation, encouragement and for enabling us to achieve new heights.

Dr Annapurna Vancheswaran
Senior Director, Sustainable Development Outreach
The Energy and Resources Institute

Introduction

The year 2015 is pivotal with more than 150 world leaders adopting the new 2030 Agenda for Sustainable Development including the Sustainable Development Goals (SDGs) in September. Additionally, countries across the globe have released their country-specific Intended Nationally Determined Contributions (INDCs) that will be adopted at the 21st Conference of the Parties (COP21) in Paris. The implementation of the SDGs and INDCs will depend on the role that various stakeholders play and the partnerships they create. In this respect, corporate sectors contributions and their relevance to the Post-2015 development agenda is of significant importance. It is necessary to enhance existing as well as new initiatives to maximize the impact and contribute significantly towards tackling climate change.

The Delhi to Paris: Corporate Vision on Climate Change, a mega initiative of TERI Council for Business Sustainability (TERI CBS), led by business members aims to be the Indian corporate vision on the various aspects of tackling climate change and aligning this vision with the Government of India schemes. The initiative, subtitled Reinforcing India's Commitments focuses on four pressing themes that are of utmost importance to achieve a low-carbon and climate-resilient future–Improving the Efficiency of Energy Use, Expanding the Use of Renewable Energy, Ensure Water Availability in a Changing Climate, and Efficient Waste Management.

This initiative was launched at the High Level Corporate Dialogue (HLCD), the curtain raiser to TERI's flagship event, Delhi Sustainable Development Summit (DSDS) on February 4, 2015. The HLCD witnessed the participation of 250 mentors from across industries; over 100 leading companies; more than 45 CEOs; and over 120 senior colleagues from Governments, corporates, multi-lateral and bi-lateral organisations, and institutes.

Following the HLCD, TERI CBS conducted corporate consultations that witnessed participation from 200 companies and took place via webinars, thus making them carbon neutral. Discussions at the corporate consultations included India Inc.'s experiences, best practices, current interventions, and scope for improvement, thereby strengthening India's position with regard to tackling climate change on the global platform. Of the participating companies, 60 organisations submitted comprehensive case studies on the four identified themes, which have been analysed by TERI experts and are presented in the following pages.

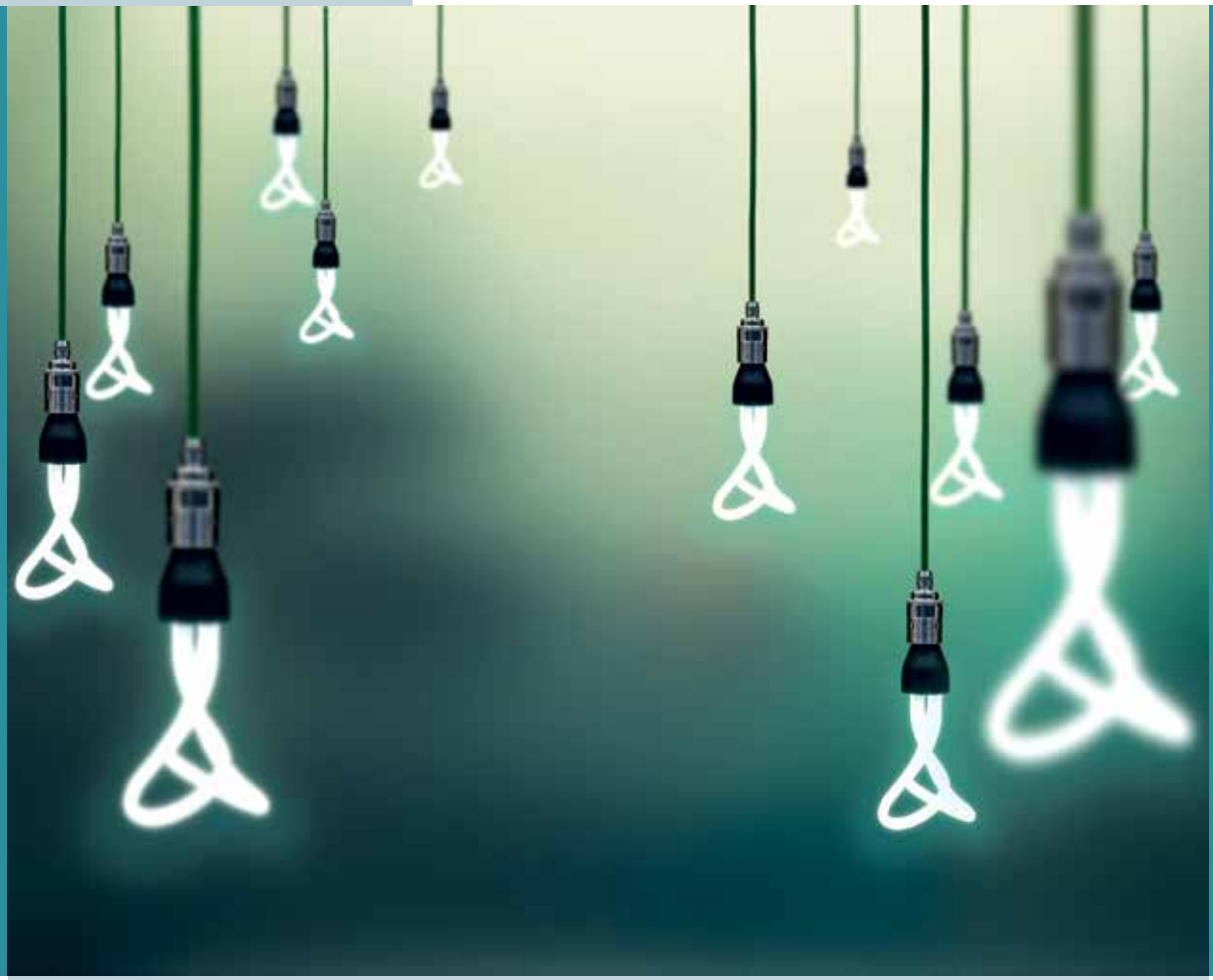
As a prelude to the discussions at COP21, TERI CBS hosted a National Seminar in November 2015. The National Seminar was a culmination of deliberations that began in February 2015, corporate consultations that took place throughout the year, and case studies received from participating companies. The Seminar aimed to strengthen India Inc.'s approach towards tackling climate change and witnessed deliberations between corporate leaders, policy makers and members of academia.

By emphasizing that the fight against climate change is not pro-environment vs. pro-development, but rather a business opportunity, HE Mr François Richier, Ambassador of France to India, set a constructive tone for the Seminar. Discussions during the panel sessions included collaboration opportunities for research; solutions to ensure accurate resource use disclosure; and opportunities for technological advancement and better return on clean investments. Suresh Prabhu, Hon'ble Minister, Ministry Of Railways, Government of India, stressed on the importance of Government and Business partnerships in reducing India's greenhouse gas emissions and

increasing resilience to climate change. Giving the valedictory address, Prakash Javadekar, Minister of State (IC), Ministry of Environment, Forest and Climate Change, Government of India stated that technological cooperation and dissemination across sectors with affordable costs is the key to achieve India's, INDCs and the corporate sector can play a key role in this regard.

TERI CBS's initiative is perhaps the largest and most comprehensive corporate sector enterprise participating at COP21. However, this enterprise is just the beginning. TERI CBS is continuously enabling best practices in the Indian corporate sector and showcasing them at national and international forums. The Delhi to Paris: Corporate Vision on Climate Change document is a vision that will be translated into action in the coming years.

Section I



Reinforcing India's Commitment on Climate Change

Improving Efficiency of Energy Use

Lead Partners

GAIL

WE MEAN BUSINESS

Energy CHAPTER

Improving Efficiency of Energy Use

Introduction

Industry, transport, and buildings are three key demand-side sectors of the Indian economy. With increasing economic activity and infrastructure development, the overall dependency on energy is increasing quite rapidly. The growth in energy demand in these sectors is dependent on technologies adopted in these sectors and the level of energy efficiency. As per various TERI estimates under the business-as-usual scenario, the energy demand in the three sectors is expected to increase by almost three times in the next 20 years. In terms of magnitude, industry and transport are the two major energy consuming sectors with the consumption in the transport sector is expected to increase by almost four times by 2031. India is in a unique position as a rapidly growing economy; it has a large manufacturing base and stock of infrastructure (including buildings) yet to be built. Accordingly, there is scope to align national development with efficient technology that can tie-in closely with India's sustainable development imperatives and economic growth potential, and thereby help in reducing the overall primary energy consumption in the country.

Industry

Current Energy Use Pattern

The industrial sector has been a major driver of growth in India, accounting for about 27 per cent of GDP during 2012–13.[1] The commercial energy consumption of the industry sector during 2011–12 was estimated to be 160 Mtoe[2] and was highest among other end-use sectors with a share of 45 per cent. India's industry sector comprises large industries, several of which have efficiencies that compare with the world's best, as well as Micro, Small, and Medium Enterprises (MSMEs) that often have widely varying levels of efficiencies. Almost 80 per cent of total energy consumption of the industry sector is accounted for by 10 industry sub-sectors, namely aluminium, cement, iron & steel, fertilizers, pulp & paper, textiles, Chlor-alkali (caustic soda and soda ash), petrochemicals, brick, and glass industries. Although these industries account for much of the energy use and some of the units in these sectors are already operating at high efficiency levels, there exists scope for improvement in these and many others.

The MSME sector in India holds special relevance in the Indian economy, contributing as it does 8 per cent of GDP, 45 per cent of manufacturing output, and 40 per cent of exports. The MSME sector is involved in manufacturing

1 Source: https://data.gov.in/catalog/gdp-india-and-major-sectors-economy-share-each-sector-gdp-and-growth-rate-gdp-and-other
2 TERI Energy and Environment Data Diary and Year Book, 2014–15

Practices: Corporate India

GAIL (India) Limited	
Case Study Title	Fugitive Methane Emission Management Initiatives
Site Location	GAIL Vijaipur Unit, District- Guna, Madhya Pradesh
Type of Intervention	Green House Gas (GHG) emissions reduction
Socio and environmental impacts	Through this initiative, GAIL Vijaipur has been able to reduce over 2.89 MMSCM (million cu. m./year) methane emission over its baseline of 2010-11 which is equivalent to revenue savings of over ₹ 3 crores per year and reducing 41,225 tonnes of CO_2e annually. This also led to improved safety and operational efficiency.

of about 6,000 products. Many of the MSMEs in India are clustered; it is estimated that there are about 200 MSME clusters that are in the medium to high energy intensive categories. The MSME sector thus lends itself to significant efficiency improvements in the industry sector. Sub-sectors include foundries, forging, secondary steel and aluminium, engineering, ceramics, bricks, glass, chemicals, etc.

Relevance in Context to Climate Change

The industry sector accounts for a major share of greenhouse gas (GHG) emissions primarily linked to fossil fuel combustion within the plants or indirectly linked to their electricity use. In addition, the industry sector also accounts for GHG emissions from processes adopted, for example, cement manufacturing. Industry sector accounts for the second largest consumption of coal. Cement and steel industries are among top consumers of coal in industry sector followed by brick-making, which however falls in the small scale sector. With the government's plans for high economic growth and a strong thrust towards "Make in India," the emissions from industry sector are bound to go up with the envisaged growth in manufacturing sector in the country in the coming decades.

Existing Policy Framework

Several policies and measures over the past years have contributed to continuous reduction in energy intensity in the industry sector. The Perform, Achieve, and Trade (PAT) scheme of the Bureau of Energy Efficiency (BEE) has been especially relevant in bringing about a systematic and integrated approach to energy efficiency improvement across the designated consumers under this scheme. Subsequent widening and deepening of the PAT scheme is also being planned. Apart from this, several other energy efficiency policy initiatives like the Standards and Labelling (S&L) Scheme of BEE for different appliances; promoting Energy Service Companies; certification, training, and capacity building for energy auditors and managers; etc. are playing a key role in promoting energy efficiency in the industry sector. Some of the existing policies of the Government of India that have helped to promote energy efficiency in the industrial sector include the following:

- Energy Conservation Act, 2001
- National Mission for Enhanced Energy Efficiency, 2008
  - » PAT
  - » Energy Efficiency Financing Platform
  - » Market Transformation for Energy Efficiency
  - » Framework for Energy Efficient Economic Development

Practices: Corporate India

IndianOil Corporation Limited	
Case Study Title	Managing energy responsibly
Site Location	Refineries of IndianOil Corporation Limited
Type of Intervention	Energy Conservation measures - ENCON measures implemented at 8 IndianOil Corporation refineries
Socio and environmental impacts	ENCON projects worth nearly ₹ 3,000 crore have been implemented over the past decade. These projects have resulted in fuel savings of 50,000-100,000 tonnes every year. In the past 3 years alone, projects under ENCON scheme of IOC have resulted in emission savings of 50,000 tonnes of CO_2. Efforts are on to undertake massive reduction in refineries footprint, by more than 15 per cent by 2020 from 2012-levels. ENCON projects implemented during the year 2012–13 resulted in savings of 120,000 Standard Refinery Fuel in Tonne (SRFT) valued at around ₹ 450 crores. An annual savings of 102,800 SRFT valued at around ₹ 420 crores and a saving of 107,000 SRFT valued at around ₹ 400 crores were achieved during the consecutive years i.e. 2013-14 and 2014-15 respectively.

- Demand Side Management (DSM) Regulations by various electric utilities
- National Steel Policy (2012) formulated by the Ministry of Steel that aims at transforming Indian steel industry into a global leader while recognizing the importance of environmental sustainability.
- National Manufacturing Competitiveness Programme launched by the Ministry of MSME for improving competitiveness of MSME sector. Technology and Quality Upgradation Program (TEQUP) and Credit Linked Capital Subsidy Scheme (CLCSS) are also important schemes to promote energy efficiency in MSMEs.

Role of Corporates

A comparison of energy efficiency levels of different industry sub-sectors with the best available technologies at national and international level clearly illustrates that there exists ample scope to improve the energy performance of the Indian industry sector. The Indian corporate sector can play a significant role in ensuring that the efficiency of energy use in their existing manufacturing units remains high. There is a need for corporate level commitments at the top with clear targets for reducing energy consumption. Companies need to lay emphasis on continuous technological improvements through upgradation of their systems and processes, adoption of energy management standards, regular monitoring of various performance parameters, as well as capacity building of plant personnel for efficient operation of plant equipment. Adequate internal budgets for energy efficiency improvement projects will need to be earmarked for modernization and upgradation.

In addition, corporates will have to ensure that they deploy energy efficient (EE) technologies and processes while going in for new greenfield or brownfield projects. Switching to cleaner fuels like natural gas (based on its availability) could also be considered by the corporates as an option to improve energy efficiency and reduce GHG emissions. At present, energy conservation is still viewed by many industries as a cost rather than an investment. Collaboration with research and academic institutes will help in accelerating efforts towards adoption of EE technologies. Government support will be a key factor in this regard. Several energy audits undertaken by various agencies including TERI point to the fact that potential for improving the energy performance exists in many plants, especially in older units and MSME sector. The technological options available include the following:

- Sector-specific options in core plant and machinery;
- Cross-cutting technologies like boilers, pumps and blowers, compressors, refrigeration and air-conditioning, motors, etc.;
- Increasing recycling, better quality control and management practices within plants (including adoption of energy management systems); and
- Switch-over to cleaner and low carbon fuels wherever feasible like natural gas, biomass and solar thermal technologies (lower temperature heating).

Practices: Corporate India

Jubilant Life Sciences Limited

Case Study Title	Steam saving in Ethyl Acetate (EA) plants by heat recovery from hot streams to preheat cold
Site Location	Ethyl Acetate plants in Nira unit in Maharashtra
Type of Intervention	Pinch methodology applied in EA plant to minimize energy consumption in chemical process.
Socio and environmental impacts	In addition to direct economic benefit due to reduction in specific steam consumption, other indirect benefits were also harnessed out of this project implemented in EA plant. These are reduction in fresh water consumption in cooling tower, treated water consumption earlier needed for additional steam generation, water treatment chemical consumption, GHG and other gas emission (e.g. SOx, NOx, etc.) due to reduction in reduced steam equivalent fuel consumption.

However, it may be noted that many large industries in India in sectors like cement, fertilizers, etc. have improved their energy performance levels over the years through adoption of state-of-the-art technologies and implementation of energy conservation measures. For example, the Indian cement sector has continuously upgraded its technologies leading to substantial overall decrease in specific thermal energy consumption. The industry was using inefficient "wet process" technology earlier (94 per cent of installed capacity in 1960s) and gradually switched over to EE dry process technology (99 per cent of installed capacity in 2014) including latest technological options available in grinding processes.

Another example is of the Indian fertilizer sector. The overall specific energy consumption of fertilizer sub-sector improved from 12.48 Gcal per tonne of ammonia in 1987–88 to 8.49 Gcal per tonne of ammonia in 2013–14, which is comparable to global levels. In other sectors as well, there are similar opportunities that need to be recognized. At the same time, it is also true that options exist for efficiency improvement in many sectors. Many corporates have clear vision to reduce their direct and indirect GHG emissions through various in-house efforts. Some of them already have plans to go beyond their specific PAT targets and have initiated corporate level plans to reduce their emission intensities. For example, one of the companies in the Oil & Gas sector envisages a reduction of GHG emission intensity by 33 per cent by 2020 from base year of 2010–11. Leading corporates in this sector are undertaking initiatives for conservation of electricity, increased usage of renewable energy, reduction in flaring and fugitive emissions, etc. A leading private sector corporate in metallurgical sector is following 'zero discharge zero waste industry' concept. In the MSME sector also many bilateral, multilateral and government organizations have initiated projects to reduce energy consumption in the Indian MSME sector. The key approaches that have been adopted include technology development and demonstration, energy audits and implementation, capacity building at the local level, and concessional loans for clean technologies. It is important that the MSMEs benefit from these programs to promote energy efficiency and also to contribute towards energy efficiency improvement in this key sector of the economy. There are technological, financial, and institutional challenges that lie ahead in this vital sector and a lot more effort will be needed to make the Indian MSME sector competitive and vibrant to prosper in the globalized environment.

Firozabad glass cluster is located in Uttar Pradesh, India accounting for about 70 per cent of glass production in small scale sector. With support from the Swiss Agency for Development and Cooperation (SDC), a bilateral agency, TERI demonstrated energy efficient (EE) natural gas fired pot furnace system used for making glass bangles in the year 2000 in place of conventional coal/ gas fired systems. The project followed a 3-R approach (Reduce, Recover and Recycle), pooled in international expertise and utilized local resources for design, development, demonstration, dissemination and training. More than 90 per cent of pot furnace units in the cluster (about 82 pot furnace units) have adopted EE system and shown consistent energy saving of 30-35 per cent. The cumulative energy saving achieved at cluster level till the year 2014 is 125,000 toe and the corresponding GHG reduction was 320,000 tonne of CO_2.

Practices: Corporate India

Shree Cement Limited

Case Study Title	Installation of Waste Heat Recovery (WHR) Unit at Beawar Cement Plant
Site Location	Beawar, Rajasthan
Type of Intervention	Process Modification
Socio and environmental impacts	The annual savings under WHR project at its Beawar site includes 35,200 tonnes of fuel and 412,500 kilo litre of water. The investment for WHR boiler was ₹100 million per MW with a payback period of about 7 years. Shree Cement has cut down GHG intensity by 39 per cent as compared to its 1990 levels. The company also became self-reliant on power and is committed to installing WHR plants in all their upcoming projects.

Buildings

Current energy use pattern

Globally, buildings account for 40 per cent of the total electricity consumption and in India, the building sector accounts for approximately 30 per cent of the total electricity consumption. The potential for reducing electricity consumption is up to 60 per cent using EE technologies. The building & construction industry at present contributes about 10 per cent of GDP and is expanding rapidly at over 9 per cent per year spurred largely by the strong growth in the services sector.[3]

This fast-paced growth rate is resulting in rapid urbanization, high demand for infrastructure and buildings, and thus an increasing demand for energy. Urbanization in India has increased from 26 per cent in 1991 to 31 per cent in 2010 and is expected to increase to 34 per cent by 2015 and 36 per cent by 2020. Between 2014 and 2050, the urban areas are expected to grow by about 404 million people in India.[4]

The commercial building sector accounts for 28 per cent and residential sector for 72 per cent of total electricity consumption in buildings and which has been growing at a rate of 10–11 per cent per annum, much faster than the average electricity growth in the economy.

It is estimated that if buildings continue to be erected and operated in the conventional manner, electricity consumption in commercial buildings may increase by more than three times and in residential sector by more than two times by 2020–21 taking 2010–11 as the base year.

Relevance in Context to Climate Change

Considering the present energy consumption in buildings in India and its growth rate in coming years, it is critical that policy interventions are put in place to improve energy efficiency in both new as well as existing buildings in the commercial and residential sectors. The buildings sector is highly dynamic. Several codes exist, but there are also many implementation challenges. Moreover, the country context is different with India having a socio-economic profile and climate that is different from countries in the developed world. Innovation in materials, appropriate financing models, and integration of policy and regulation is required to bring about a transformation in this sector. Access to housing is still low, and the commercial sector also has significant infrastructure that remains to be built. Long-term policy initiatives that encourage the development of cutting edge research and cost-effective technologies can bring about substantial changes in the energy use in buildings.

3 Energy Assessment Guide for Commercial Buildings, April 2008, Developed and Published by: USAID ECO-III Project

4 World Urbanization Prospects: The 2014 Revision, United Nations. Available from: http://esa.un.org/unpd/wup/highlights/wup2014-highlights.pdf

Practices: Corporate India	Tata Steel Limited	
	Case Study Title	Clean power generation through utilization of waste pressure energy of Blast Furnace (BF) top gas.
	Site Location	Steel Works Jamshedpur
	Type of Intervention	Adoption of Clean Technology
	Socio and environmental impacts	At works level, CO_2 abatement from Top Gas Pressure Recovery Turbine (TRT) power contributes to 0.02 tCO_2/tcs. ₹40-45 crores per annum is the monetary saving considering present power generation and O&M cost. Conservation of non-renewable fuel sources (coal) and reduction in air borne pollutants PM, SOx and NOx in ambient air are the intangible benefits. Payback period for the project is around 4-5 years.

With several initiatives such as smart cities high on the government agenda and the understanding that there are several synergies between energy security, climate mitigation, urban planning, air pollution reduction, and better lifestyles, the buildings sector requires concerted action to prevent lock-ins and improve the energy intensity. The role of relevant and contextual materials/technologies both for building envelope and air-conditioning will play a crucial role in future. For a tropical and developing country like India, the penetration of air-conditioning is likely to grow at an accelerated pace. New approaches and technologies such as desiccant cooling systems, radiant cooling systems, geothermal, tri-generation, all-variable chiller plants, combined heat and power cycle, solar air-conditioning, etc., need to be further explored and propagated.

Existing Policy Framework

There have been several landmark initiatives taken by the Government of India, corporates, not-for-profit organizations for improving energy efficiency in commercial buildings. Some of the major initiatives are mentioned as follows:

- The Energy Conservation Building Code (ECBC) launched by the Government of India under the Energy Conservation Act 2001, for voluntary adoption in the country, sets minimum energy performance standards for commercial buildings.
- BEE has also developed a Star Rating Programme for existing commercial buildings, which is based on actual energy performance of the building, expressed as an Energy Performance Index (measured in terms of annual electricity consumption per unit of built up area).
- Under the Prime Minister's National Action Plan on Climate Change, the Government has launched eight national missions, of which National Mission on Sustainable Habitat focuses on higher energy efficiency levels in buildings.
- Under Smart City Programme, 80 per cent of buildings falling under Greenfield and Redevelopment zones need to be green and energy efficient.
- Standards and Labelling (S&L) program in India was launched in May 2006 with an objective to provide the consumer an informed choice about the energy saving of appliances and thereby cost saving potential of the relevant marketed product. Each appliance is ranked on a scale of 1-5 stars, with more stars indicating higher efficiency and more power savings.

Apart from the above-mentioned government initiatives, there exist green building rating systems that are facilitating construction of EE buildings. The total area registered under different building rating systems in India is given below:

- GRIHA: Green Rating for Integrated Habitat Assessment has 21 million sq m area of buildings registered.

Practices: Corporate India

Cognizant Technology Solutions India Pvt Limited	
Case Study Title	Creating a culture toward achieving Energy Efficiency
Site Location	Pan India
Type of Intervention	Energy program initiated in the year 2009 helped realize many benefits and also helped develop best practices through understanding of energy use, energy sources and opportunities for improvement.
Socio and environmental impacts	Overall the program produced a 51 per cent reduction in per capita carbon emissions and a reduction of 56 per cent in kWh/person/month from 2008 through 2014. The success of the program stems from the fact that the process fixes that we did three years ago continue to sustain and deliver energy savings even today. The scale of deployment (50 facilities across 10 cities) and the uniformity of the adoption is a unique factor of the program.

- LEED: Leadership in Energy and Environmental Design has 81 million sq m area of buildings registered.
- IGBC: India Green Building Council has 189 million sq m area of buildings registered.

Role of Corporates

- While the government has put in place several schemes and measures to bring in efficiency in the buildings sector, corporates can play a key role in accelerating this process. As per a study conducted by TERI,[5] in a conventional air-conditioned commercial building, approximately:
- 20 per cent savings can be achieved by incorporating passive design features like optimum orientation, envelope shading, daylight integration, etc.
- 30 per cent savings can be achieved by making the building ECBC compliant.
- 40 per cent savings can be achieved by incorporating both passive design features and making the building ECBC compliant.

As estimated by TERI, the overall energy saving potential in commercial buildings is around 8,700 GWH in existing commercial buildings and around 90,000 GWH in upcoming commercial buildings by the year 2021[6].

Leading corporates have taken steps to reduce energy consumption at their manufacturing facilities, offices, and warehouses through various methods including implementation of real-time energy monitoring system, regular energy audits of the facilities, retrofitting of existing buildings with EE equipment, complying with rating and certification programmes (BEE star rating, GRIHA, LEED), LEDs for lighting systems, etc.

Transport

Current energy use pattern

The transport sector represents the largest demand on hydrocarbons globally. In India, the sector is the second largest consumer of commercial energy and petroleum products, constituting about 98 per cent of the demand in 2011–12 (TERI, 2015). Between 2001 and 2011, the transport sector grew at 10 per cent annually, outpacing India's GDP growth (MoRTH, 2013).

Growth in the sector's energy consumption has been primarily fuelled by an unprecedented growth in road transport. Road transport, almost entirely dependent on petroleum products, consumed about 94.5 per cent of the total energy demand of the transport sector in 2011-12 (TERI, 2015). Road transport—both urban and inter-city

5 TERI study on 'High Performance Commercial Buildings in India' supported by BEE and United States Department of State.
6 *The Hindu*, Feb 7, 2015. Available from:http://www.thehindu.com/todays-paper/tp-features/tp-propertyplus/energise-your-building/article6866733.ece

Practices: Corporate India

ICICI Bank Limited	
Case Study Title	Energy Conservation at ICICI Bank Towers
Site Location	Pan India - All large office buildings of ICICI Bank
Type of Intervention	Control on operations of electrical equipment & replacement of old inefficient equipment where payback is about 2 to 3 years
Socio and environmental impacts	Cost benefit is approx. ₹ 160 million in energy expenses over last 2 years. The EC measures implemented were well within 3 years as that was the criteria set for choosing CAPEX intervention.

movement of passengers and goods—is estimated to have grown at a rate of about 10 per cent and 15 per cent annually between 2001 and 2011, compared to a growth of about 8 per cent and 7 per cent in the railways. Air passenger traffic grew the fastest, at 16 per cent annually over the same period (TERI, forthcoming). While there has been an enormous increase in the number of private vehicles in the country, increasing the overall volumes of energy demand and increasing India's exposure to energy risks, India has a good opportunity to move towards sustainable mobility. The country has one of the largest and well developed railway networks in the world, coupled with a long coastline and a large number of perennial rivers that could be used for efficient water-based transport. Strategies need to be therefore drawn up to incentivize their use.

Relevance in Context to Climate Change

Improvement in vehicle technology, integration of IT for enabling better traffic management, development of improved city infrastructure for decreasing transport-related energy use, etc. are areas where interventions are required. This holds special relevance in the context of the expected Intended Nationally Determined Contribution and the 'smart cities' initiative. Air pollution and congestion are assuming even higher importance and need to be adequately addressed. Rail based movement and public transportation using vehicles with higher fuel efficiencies coupled with cleaner fuels could be used to meet this challenge. In the interest of reducing GHG and particulate emissions from the sector, it is therefore imperative that the share of railways and water-based transport be increased, complemented by the use of pipelines wherever possible.

Existing policy framework

Having identified such large negative externalities from an unplanned transport sector, at the turn of the century, there were a large number of policies and programmes to address these issues. A large number of policies, programmes, and projects that have been taken up by the Government, corporate houses and other organizations have aimed at making the transport sector more sustainable by reducing the energy intensities and the resulting emissions from the sector. Some of the key policies that have been focused in this direction are as follows:

- National Urban Transport Policy
- Jawaharlal Nehru National Urban Renewal Mission (JNNURM)
- Auto Fuel Policy and vehicular emission standards
- Fuel efficiency norms for vehicles issued by BEE
- Rapid transport systems
- Smart Cities Mission and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
- Pradhan Mantri Gram Sadak Yojana (PMGSY)
- Dedicated Freight Corridor

Practices: Corporate India

Ministry of Environment, Forest & Climate Change (Govt. of India)	
Case Study Title	Indira Paryavaran Bhawan: Net zero energy green building
Site Location	New Delhi
Type of Intervention	Conservation of natural areas and trees to reduce adverse environmental impact, provide adequate natural light, shaded landscaped areas to reduce ambient temperature, maximize energy saving system, and minimize operation cost by adopting green building concepts.
Socio and environmental impacts	▪ Overall 67 per cent reduction in energy consumption with reference to GRIHA benchmark of 140kWh/sqm/year has been achieved ▪ The building is an energy positive building as the energy generated through 930 kWp of solar PV system installed at IPB is more than the energy requirement of the building. ▪ The building has also achieved LEED India Platinum Rating and GRIHA five-star rating.

Role of Corporates

While several policies and measures in the transport sector have been put in place, the growth of both passenger and freight demand that is anticipated with economic development of the country, it is expected to result in a spiralling of energy and emissions from this sector, unless large transformational changes are enabled. In parallel, corporate institutions that are both a consumer and provider of transport services in India could take initiatives to reduce the energy intensity of the sector.

For service-led organizations, providing IT, educational, hospitality services, opportunities exist in introducing sustainability in employee mobility practices. IT services providers like Cognizant for instance, have started mapping their employee mobility demands and creating mobility plans and incentivizing public transport use. Given the large requirement of these companies to engage in mobility internally across their many offices or with clients spread across various parts of the globe, the need for air travel has historically been high. However, conscious efforts are being made for reducing air miles through effective use of IT and video conferencing facilities. Use of supply chain and logistics tools is increasingly finding its way into the manufacturing and related industries due to the clear economic advantages along with the co-benefits of reduced energy demand and lower emissions. Companies are proactively taking steps to move their inward or outward cargo by environmentally benign modes such as railways and waterways. Power generating companies have shown the way by transporting the coal required for their power plant entirely by inland waterways, and other companies are planning to do the same. Additionally, there have been efforts by large truck fleet users to be conscious about the energy efficiencies of the vehicles used for moving their raw materials and output.

Automotive companies, led by a strong market demand for efficient vehicles, have continuously been making efforts to increase the fuel efficiencies of their vehicle fleets even in the absence of any fuel efficiency regulations. With the introduction of fuel efficient vehicles in subsequent years, there would expectedly be a further increase in the efficiency of the vehicle stock of the country. In addition to this, there has been a conscious policy effort by the government through the Auto Fuel Policy to improve the fuel quality used for transportation in the country by the gradual improvement of the Bharat Stage emission standards. Larger and quicker uptake of such vehicles along with introduction of natural gas and other cleaner fuels would help improve the air quality across Indian cities. Indian Railways too have progressively improved their fuel efficiency by introducing both operational best practices and technical improvements. Improved traffic to energy ratios on account of increasing train lengths and track capacities, coupled with better planning in operations and modern locomotives, have led to improvement in railway efficiencies on both diesel and electric traction. The Railways are focused on reducing the energy intensities of rail transport by

Practices: Corporate India

ITC Hotels	
Case Study Title	'Responsible Luxury': Greenest Luxury Hotel Chain in the World
Site Location	ITC Grand Chola, Chennai
Type of Intervention	Implementation of energy conversation measures to comply with GRIHA five-star certification and LEED Platinum rating.
Socio and environmental impacts	▪ Overall 42 per cent reduction in energy consumption with reference to GRIHA benchmark of 450kWh/sqm/year has been achieved. ▪ The energy requirement shall be met through installed capacity of wind energy: 12,600 KWp, which is having an electricity generation potential of around 27,900,000 KWh/year.

moving to electrified traction for both passenger and freight transport. In addition to that, they have started using natural gas–based locomotives for use in their suburban network.

Pipelines offer a safe, efficient and cost effective way of transporting liquids and gases. GAIL (India) Ltd has taken a led to enable movement of both natural gas and petroleum products through its pipeline network which has led to enhanced energy efficiency in the transport sector.

In urban transport, efforts by Delhi Metro Rail Corporation (DMRC) have focused on taking forward the government policies on introduction of Mass Rapid Transit System (MRTS) across Indian cities. The Delhi Metro has been a successful model for providing fast and convenient public transport in one of the largest agglomeration in the world.

Promotion and adoption of such best practices across various industries and organizations would go a long way in improving the energy and emission intensities for the transport sector in India.

While reduction of energy and emissions is most challenging in the transport sector, it also offers huge scope for efficiency improvements. This is also an opportunity for international agencies, developed countries, and multinationals to assist India in meeting its development goals while focussing on sustainability. Corporate organizations with adequate resources need to take the lead in showing the way for sustainable transport by setting an example by which they meet their transport demands and the technologies they promote. Incentives to the end-user to choose efficient transport options coupled with adequate planning should encourage low carbon technologies for transport in the form of electric, hybrid, or fuel cell vehicles, efficient rail-based technologies, locomotives and train-sets, and other efficient forms of transportation.

Practices: Corporate India

Schneider Electric India Pvt Limited

Case Study Title	Schneider Energy Action programme
Site Location	Schneider's factories, offices, and warehouses, greater than 5,000 sqm in area
Type of Intervention	▪ Implementation of real-time energy monitoring system at 8 factories and cloud-based energy monitoring solutions at 17 sites. ▪ Energy audits were conducted at 15 sites and energy conservation measures were implemented. ▪ Thirteen sites received ISO 50001 certification and three sites received LEED certification.
Socio and environmental impacts	▪ Savings (Electricity): 30 per cent (~8 million kWh) savings at target sites (2011 baseline) and is equivalent to powering approximately 6,600 typical urban Indian homes annually. ▪ CO_2 Savings: 8,600 tonnes of CO_2 avoided at end of 2014 (2011 baseline) and is equivalent of taking approximately 1,600 typical Indian cars off the roads annually.

The case studies in this section are arranged sub-segment wise (industry, building, and transport) as per company name.

Section II

Reinforcing India's Commitment on Climate Change

Expanding the Use of Renewable Energy

Lead Partners

TATA WE MEAN BUSINESS Energy CHAPTER

Expanding the Use of Renewable Energy

Introduction

Renewable Energy (RE) is one of the cleanest sources of energy, which is critical not only in addressing issues like climate change but also ends the quest for energy security, economic growth, and environmental sustainability of all countries throughout the globe.

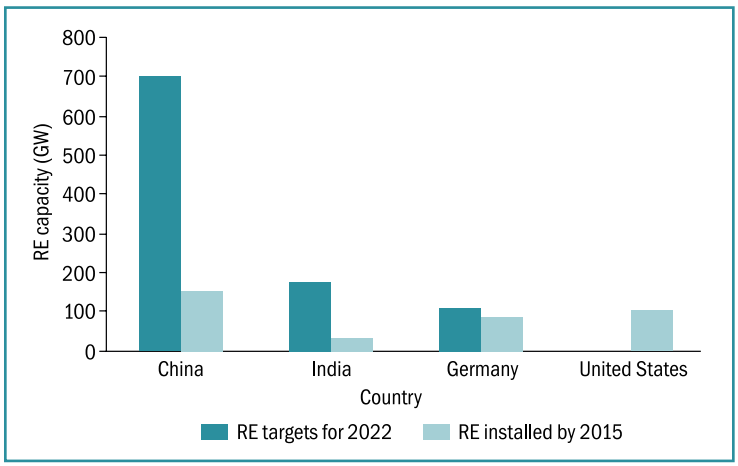


Figure 1: RE installed and targets by top four countries

According to research carried out by the Renewable Energy Policy Network for the 21st Century and the International Renewable Energy Agency, by the end of 2014, China, the United States, and Germany remained the top countries for total installed RE capacity. China[1] will lead RE even in the next 5 years with a proposed target of 700 GW compared to India, which has a proposed RE target of 175 GW. India will be at the second position in the world after China in installed RE capacity by 2022. Figure 1 shows the proposed (2022) and current (2015) installed capacity by top four countries: China, India, Germany, and the United States.

Context of Climate Change

India's pledge of its Intended Nationally Determined Contribution post-2020 for RE declares greater use of renewables mainly through solar and wind power and shifting towards supercritical technologies for coal-based power plants. It also mentions that India aims to achieve about 40 per cent cumulative electric power installed capacity from non-

1 http://climateactiontracker.org/countries/china.html

Practices: Corporate India	**Abellon Clean Energy Limited**
Case Study Title	Biomass Pellets & Pellet based Appliances: A cost effective, environment friendly and safe heat generation alternative for the commercial/industrial sector in India.
Site Location	Biomass pellet manufacturing facilities established in Gujarat with cumulative capacity of 1,00,000 tonnes per annum
Type of Intervention	Development and manufacturing of a range of pellet appliances to meet diverse commercial cooking and heating needs.
Socio and environmental impacts	▪ Payback period ranging between 3 to 6 months of purchase ▪ Efficiency comparable with LPG/Diesel/FO-based systems ▪ Reduced emissions, air pollution, health risks ▪ Income and employment opportunities

fossil fuel–based energy resources by 2030 with the help of transfer of technology and low-cost international finance including from the Green Climate Fund.

The Government of India has now planned to reach 175 GW of renewable-based power generation by 2022, up from currently installed capacity of about 36 GW. The CO_2 emission abatement achieved from the renewable power installed capacity was 84.92 million tonnes CO_2 eq./year as of June 30, 2015. The renewable power target of 175 GW by 2022 will result in abatement of 326.22 million tonnes of CO_2 eq./year.[2]

RE Scenario in India

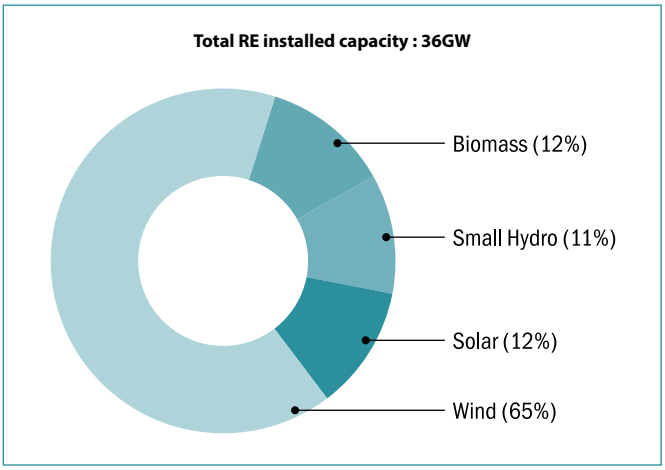


Figure 2: Distribution of RE source-wise installed capacity in India by June 30, 2015

According to Ministry of New and Renewable Energy (MNRE), India has an estimated RE potential[3] of about 900 GW from commercially exploitable sources such as Wind (100 GW, at 80 metre mast height), Small Hydro (20 GW), Bio-energy (25 GW); and solar power (750 GW), assuming 3 per cent wasteland is made available. The installed capacity of RE in India by 2015 is about 36 GW, which is 13 per cent[4] of total national electricity installed capacity. In the 36 GW installed renewables, 65 per cent is wind installation, 12 per cent solar and biomass each, and 11 per cent small hydro, as shown in Figure 2.

Between 2002 and 2015[5], the share of renewable grid capacity has increased over six times, from 2 per cent (3.9 GW) to around 13 per cent (36 GW). This momentum of a tenfold increase in the previous decade is to be significantly scaled up with the aim to achieve 175 GW RE capacity by 2022. The targets are distributed amongst the four sources of energy: solar, wind, biomass, and small hydro and are as shown in Table 1.

Table 1: RE source wise targets in India by 2022

Targets 2022	175 GW
Solar Power	100 GW
Wind Power	60 GW
Small Hydro	5 GW
Biomass Power	10 GW

2 http://pib.nic.in/newsite/PrintRelease.aspx?relid=128403
3 http://mnre.gov.in/file-manager/annual-report/2014-2015/EN/Chapter%201/chapter_1.htm
4 http://www.cea.nic.in/reports/monthly/installedcapacity/2015/installed_capacity-08.pdf
5 http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf

Practices: Corporate India	**Alstom India Limited**
Case Study Title	Technology Transfer: Alstom Global Hydropower Technology Centre, Vadodara
Site Location	Vadodara Centre: 78 tonnes Kaplan runner
Type of Intervention	▪ Made and delivered largest Francis turbine runners ▪ Execution of the Tehri Pump Storage project, which adopts variable speed technology
Socio and environmental impacts	▪ Launched Young Engineering Graduates in India, innovative induction programme by providing on-the-job training for effective transfer from the academic world into industry.

Energy storage technologies have gained importance and have tremendous potential considering the intermittent nature of RE and overall energy security of the country. According to India Energy Storage Alliance[6], the potential market for Energy Storage Systems (ESS) in India is estimated to be over 15 GW for all types of ESS technologies (including thermal storage) in India through 2020.

Existing Policy Framework

India started its RE initiatives way back in the 1970s after the Oil Shock of 1973. Initially, the focus was on social development and access to modern energy for rural and remote populations. Major focus was on biogas technologies, solar lanterns, street lights, home lighting systems, and so on for decentralized applications. The country has undertaken strong policy initiatives in the last decade for enhancing the deployment of renewables in the overall mix of energy including grid-integrated power production to address the issues of climate change and energy security. These initiatives include:

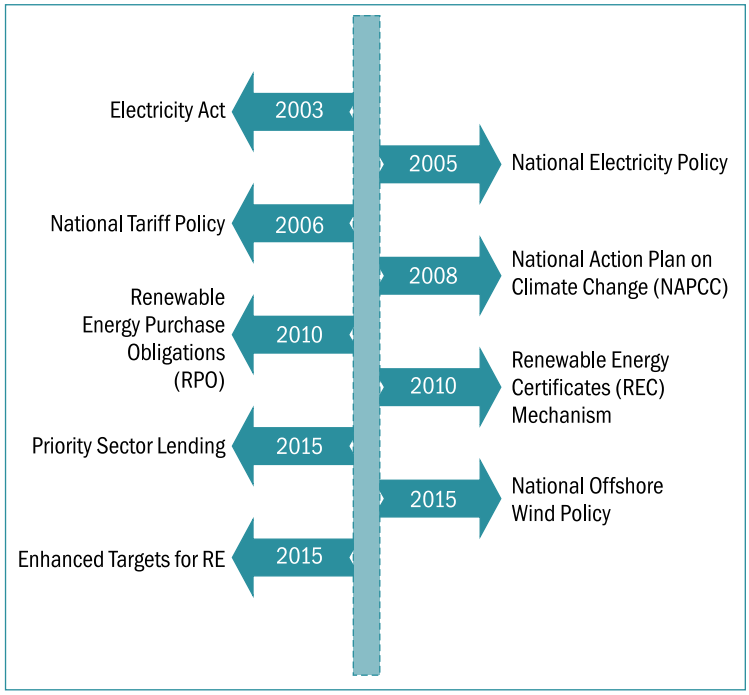


Figure 3: Enabling policy framework for renewable energy in India

- *Enhanced targets for RE, 2015* : India has announced an ambitious target of 175 GW of RE installations by 2022 with sources like solar, wind, biomass, and hydro contributing 100 GW, 60 GW, 10 GW, and 5 GW, respectively.
- *Electricity Act, 2003*: The Electricity Act 2003 has special provisions for RE power generation and utilization.
- *National Action Plan on Climate Change (NAPCC), 2008*[7]: NAPCC has set a target of 5 per cent RE purchase for FY 2009–10 with increase of 1 per cent in target each year for the next 10 years. The action plan has identified eight specific missions including the National Solar Mission.

6 http://indiaesa.info/index.php/news-details?newsid=21
7 http://cseindia.org/docs/photogallery/ifs/Renewable%20Energy%20in%20India%20Growth%20and%20Targets.pdf

Practices: Corporate India

Ankur Scientific Energy Technologies Pvt Limited	
Case Study Title	Ankur Biomass Gasifier For Boiler Application
Site Location	Madurai, Tamil Nadu
Type of Intervention	▪ Supply, installation, and commissioning of Biomass Gasification System for Thermal Application ▪ Automation of the gasifier, which is capable of handling a high fluctuating steam demand generation. ▪ Ease of operation and hold on process cost
Socio and environmental impacts	▪ Replace approximately 4,500–6,000 litres per day of furnace oil in the existing 6 TPH Boiler ▪ Payback—1 year ▪ Reduces CO_2 emissions, thus reducing global warming.

- *National Electricity Policy, 2005*: The policy aims to promote private participation in RE and reduction of capital cost of RE through competition. The policy also states that State Electricity Regulatory Commissions (SERCs) should specify appropriate tariffs to promote RE.
- *National Tariff Policy, 2006*: The tariff policy formulates that preferential tariff should be determined by SERCs to enable RE technologies to compete with other conventional fossil fuels and procurement of RE by distribution licensee should be done through competitive bidding.
- *Renewable Energy Purchase Obligations (RPO), 2010*: SERCs have set targets for distribution companies, which are obligated to purchase certain percentage of their total power requirement from RE sources.
- *Renewable Energy Certificates (REC) Mechanism, 2010*: This mechanism enables and recognizes inter-state RE transactions to address the mismatch between the availability of RE sources and the requirement of obligated entities to meet their stated RPO.
- *Priority Sector Lending, 2015*: RE sector is included as priority sector under the Reserve Bank of India (RBI) norms, which means banks are obliged to earmark certain percentage of their lending for the RE sector.
- *National Offshore Wind Policy, 2015:* Recently announced National Offshore Wind policy aims to explore and promote development of offshore wind farms in the Exclusive Economic Zones.
- *Proposed National Bio-fuel Policy, 2015*[8]*:* The policy seeks an amendment to the existing National Biofuel Policy 2008. The provision in the new policy is expected to allow manufacturers to sell the fuel directly to consumers in a free market economy especially to bulk customers like railways.

Make in India and Job Creation: Context of RE

Domestic manufacturing of components for wind and solar power generation has been common in India. In 2013[9], 700–800 MW of solar and 10,000 MW of wind manufacturing capacity existed. In case of wind energy sector, India has emerged as a major turbine manufacturing centre wherein 13 manufacturers are active in producing a range of different sized products, with a combined annual production of more than 9,500 MW by 2012. In case of the solar energy sector, 75 per cent of existing Indian solar capacity is of foreign origin despite a number of initiatives under the Jawaharlal Nehru National Solar Mission encouraging domestic content requirement in solar power projects. Recently, the government has declared various incentives to make domestic manufacturing more competitive. The government has already extended modified special incentive package scheme that offers additional benefits

8 http://articles.economictimes.indiatimes.com/2015-01-17/news/58175208_1_bio-diesel-purchase-policy-omcs-hsd
9 http://niti.gov.in/mgov_file/Report_on_India's_RE_Roadmap_2030-full_report-web.pdf

Practices: Corporate India

Hindustan Unilever Limited	
Case Study Title	Shift to Biomass Fired Burners
Site Location	Chiplun (HAG), Goa (BMB), Haldia (HAG), Haridwar (BMB), Hosur (BMB), Mysore (BMB), Nashik (BMB), Orai (BMB) , Rajpura (HAG and BMB)
Type of Intervention	▪ Installation of Biomass Fired Steam Boilers and Hot Air Generators. ▪ Modified the firing and the emission control techniques to facilitate feeding of briquettes ▪ Developed capabilities to burn process waste like spent tea and coffee and vegetable oil residue
Socio and environmental impacts	▪ Payback periods less than 3 years ▪ In 2014, we have emitted 44,924 tonnes of CO_2 less than 2008. ▪ In terms of Fuel Oil, we have reduced its equivalent consumption by more than 17,800 Tons in 2014 vs. 7,460 tonnes in 2008.

for projects in the country and solar panel component manufacturing companies will be able to avail the benefits. The scheme is not only applicable for new projects but also for expansion of existing projects. It further provides subsidy of 20 per cent and 25 per cent for investments in SEZs and non-SEZs, respectively, under new policy for electronics industry.

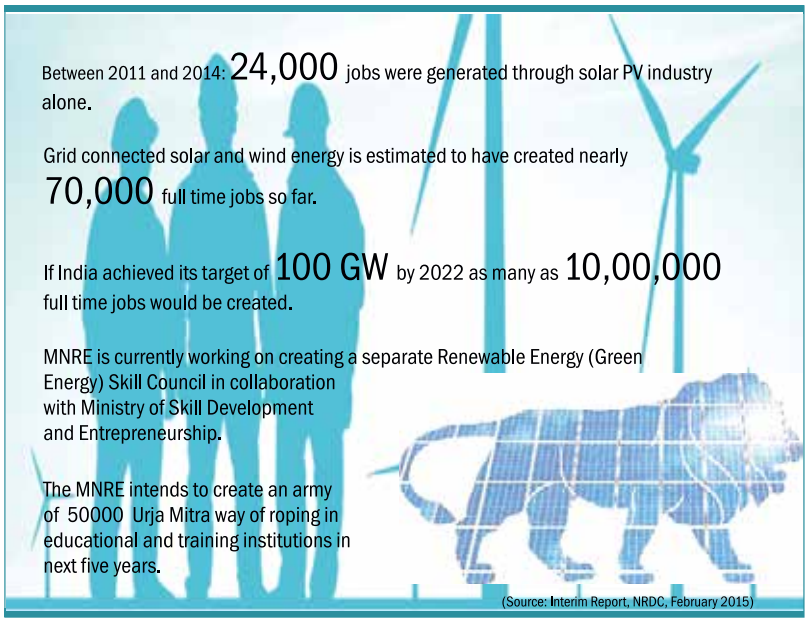


Figure 4: Job creation potential in RE sector and skill development initiatives under 'Make in India' programme

Figure 4 elaborates the job creation potential in RE sector with 100 GW target and the various steps initiated by MNRE for skill development, training, and capacity building in RE sector.

Suryamitra Skill Development Programs[10]**:** As part of the skill development initiative, MNRE is sponsoring Suryamitra Skill Development Programmes. The National Institute of Solar Energy is organizing "Suryamitra" skill development programmes, in collaboration with State Nodal Agencies, at various locations across the country. The duration of this skill development programme is approximately 90 days. The trained technicians will have enormous opportunities for employment in the growing Solar Energy Power project's installation, operation,and maintenance in India and abroad. The Suryamitra Programme is also designed to prepare the aspirants to become new entrepreneurs in Solar Energy sector.

Role of Corporates

Green Commitments by Different Stakeholders in India

In India, during the RE-INVEST (global investors' meet), held in February 2015, green energy commitments were shown by different stakeholders such as private sector companies (developers and manufacturers), public sector/ government companies, and financing institutions. Figure 5 gives the number of firms that have provided green energy commitments. It clearly shows that private sector has maximum commitments for development of RE

10 http://mnre.gov.in/file manager/UserFiles/Suyamitra-Skill-Development-Program-NISE.pdf

Practices: Corporate India

InSolare Energy Pvt Limited	
Case Study Title	Installing rooftop solar
Site Location	Manufacturing facility, Bihar
Type of Intervention	Installation of 900kW rooftop solar at industrial factory
Socio and environmental impacts	▪ By using solar the diesel usage is reduced by over 30 per cent ▪ The power supply at the factory has been stabilized.

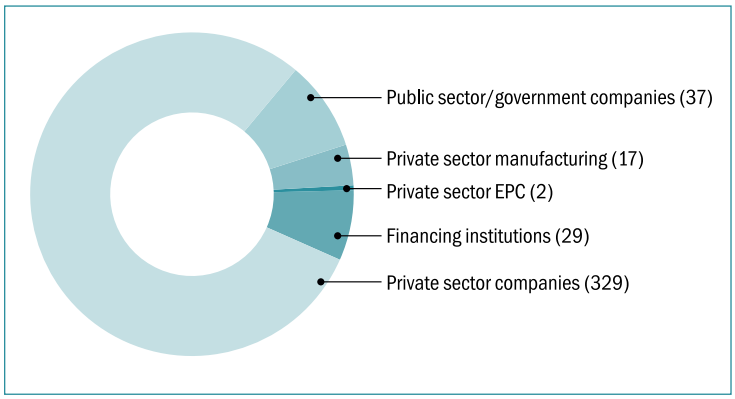


Figure 5: Total number of firms committed for development of RE projects in RE-INVEST, India

projects, with around 329 private companies committing to it, along with 17 private sector manufacturing companies. This results in the largest share of the private sector/ corporates in developing RE projects in future. Also, within the total capacity of 409 GW[11] committed by various stakeholders, private sector (developers and manufacturers) have committed 77 per cent of the total committed capacity as shown in Figure 6. Combined investment committed by banks and financial institutions is about US$ 42.67 billion for 70 GW of capacity addition by 2022.

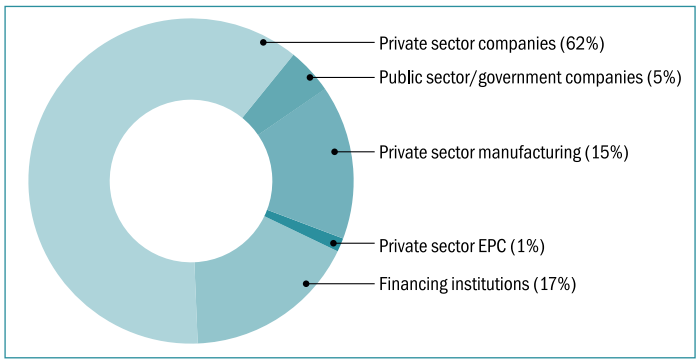


Figure 6: Total green energy commitments received by different players in RE sector

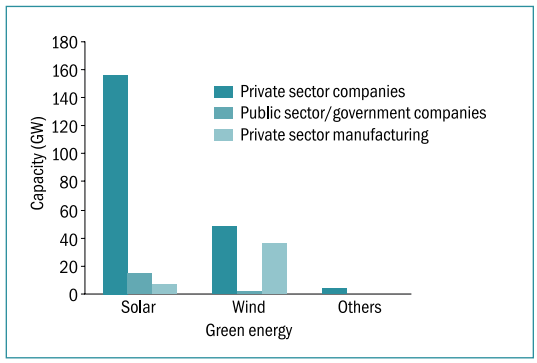


Figure 7: Total green energy commitments received by different players in RE sector

Particularly in case of manufacturing sector, Indian corporates have shown commitments in terms of manufacturing capacity (cell and module) and investment to develop solar module manufacturing units. Some corporates have collaborated with global solar research institutes for carrying out research and development of industrial scale crystalline silicon solar cell and module processing.

The green energy commitments from private players are inclined towards solar energy compared to other RE sources: (a) Solar energy sector (156GW), (b) Wind (48GW), and (c) other sectors: biomass and small hydro (4GW) (Figure 7).

11 MNRE Data

Practices: Corporate India	**Punjab Renewable Energy Systems Pvt Limited**
Case Study Title	Innovative Value Chain of Biomass Aggregation, Processing and Supply for Sustainability of Power Plants & Bio-Refinery Projects
Site Location	Aurangabad, Maharashtra
Type of Intervention	▪ Building sustainable supply chain for biomass (shredded cotton stalk) for 13 MW biomass based power plant ▪ Employment generation and rural income generation
Socio and environmental impacts	▪ Savings to farmers: Annual income generation potential of about US$3.3 million due to biomass logistics operations.

Responses from RE Corporates in India

The above figure shows green energy commitments for development of RE announced by various kinds of stakeholders in RE sector. Contact was also made with a few of the corporates including developers and manufacturers in RE sector in India. The data/information received from the key stakeholders such as Abellon Clean Energy Limited, Alstom India Limited, Ankur Scientific Energy Technologies Pvt Limited, GAIL India Limited, Hindustan Unilever Limited, InSolare Energy Pvt Limited, National Bank for Agriculture and Rural Development, Punjab Renewable Energy Systems Pvt Limited, Solkar Solar Industry Limited, Sunkalp Energy, Suzlon Energy Limited, Tata Power Solar, Welspun Renewable Energy Pvt Limited, YES BANK Limited.

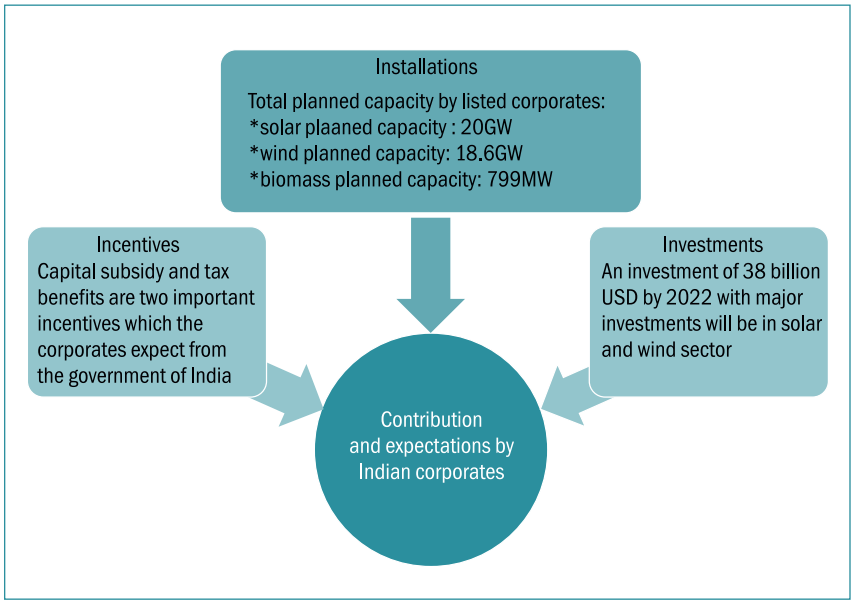


Figure 8: Contribution and expectations by Indian corporates contacted during the study (sample size: 40)

Figure 8 gives an overview of the contributions in terms of capacity addition and investment by 2022 expected by the sample of 40 corporates contacted during the study. They have also expressed the two key incentives expected from the government.

Barriers and Challenges Faced by Corporates and Industries

With the capacity addition and investment in development of renewable projects in India, there are various inhibitors or barriers anticipated by the corporate community. Following are the key barriers:

Fewer funding mechanisms	**Expectations from international community**
Raising debt investments for projects	
Complexity in regulatory and policy framework	**Expectations from Government of India**
Lack of enforcement mechanism to oversee regulatory compliance	
Land acquisition	

Practices: Corporate India

Suzlon Energy Limited	
Case Study Title	Kutch Wind Park
Site Location	Kutch Wind Park (1 GW)
Type of Intervention	120m Lattice/Tubular Hybrid Tower Technology
Socio and environmental impacts	▪ Estimated CO_2 emission reductions: 2.3 million tonnes per annum ▪ Estimated Coal Savings: 1.70 million tonnes per annum ▪ Equivalent number of trees planted: 195 million trees

Amongst the five key barriers or challenges mentioned, the most critical are fewer funding mechanisms and raising debt investments for projects. These two highlighted challenges demand contribution from foreign banks and financial institutions for bringing in new upgraded technology and advanced development of grid infrastructure for enhancing grid-connected power in India.

Best Practices from Corporates

There have been interventions by the corporates in the RE sector. In each RE sector, there have been best practices adopted by various corporates.

Wind Energy

Companies in wind energy sector have developed strong database for wind resource assessment and have made several investments in development of new and upgraded technologies and have built synergies with other institutions (academic institutions and vendors). They have advanced and improved product lifecycle management system and are in regular consultation with stakeholders for continuous upgradation in technology and related systems.

Solar Energy

Companies in solar energy sector have undertaken proper assessment of solar insolation/radiation level in terms of solar power generation capability and optimal design engineering. Some of the companies have also implemented a cost-effective mechanism to regularly clean inaccessible solar panels in a dusty part of the city in order to increase the generation and reduce payback. Some corporates are involved with research on utilising the heat from concentrated solar thermal plants by means of super critical CO_2 Brayton power cycle (with cycle efficiency

CaseStudyPicture1: MuruganTextiles-firstpowerloomproducertouse100percentrenewableenergy

Practices: Corporate India

TATA Power Solar Systems Limited	
Case Study Title	Tata Power Energy Club
Site Location	Murugan Textiles, Tamil Nadu
Type of Intervention	▪ 2 MW rooftop solar system (crystalline technology) ▪ A dedicated SCADA system is implemented to monitor the plant on a real-time basis.
Socio and environmental impacts	▪ Projected cost saving of ₹ 11 crores in 25 years ▪ Estimated energy generation: 3 million (per annum) ▪ CO_2 displacement: 2,567 tonnes (per annum) ▪ 10 acres of land space saved ▪ Accelerated depreciation ▪ Low break-even period of 6 years ▪ Fixed energy cost for 25 years

>50 per cent) producing electricity. They also suggested that during the non-sunny hours, the thermal energy can be stored in advanced thermal storage systems or fossil fuel based (typically natural gas) combustion system can cater the required heat source.

Biomass Energy

Companies in biomass energy sector have focused on heat generation rather than power applications from biomass resources as the former involves lower policy interventions and infrastructure investments. Biomass pellets when used in industrial furnaces can achieve efficiencies comparable with LPG/Diesel/Furnace Oil-based systems. Procurement and collection of different types of seasonal biomass agro-residues is also undertaken by private companies to sustainably run their large biomass power plants.

Small hydro

Companies in small hydro sector have executed the state-of-art pump storage project, which adopts variable speed technology. The companies have also launched an innovative induction programme to provide on-the-job training for effective transfer from the academic world into industry.

Financing institutions

Financial institutions like NABARD are setting up RE-based micro grids to provide electricity to more than 60 village households. Access to energy for rural population for development of the prepaid tailor-made meters, for example, is done through credit grant method. Also, the Indian Renewable Energy Development Agency Limited (IREDA)[12], a non-banking financial institution under the Ministry sanctioned loans amounting to ₹ 2,874.15 crores and disbursed ₹ 1,397.19 crores for the establishment of about 900 MW of installed capacity of power generation in the Financial Year 2014–15.

Solar Energy Corporation of India (SECI)

SECI[13] is an implementation and facilitation institution dedicated to Solar Energy sector. SECI was established under the administrative control of the MNRE, Government of India. SECI carries out wide range of activities to facilitate implementation of Jawaharlal Nehru National Solar Mission and achieving the targets set therein. These activities include developing Solar Technologies [solar photovoltaic (PV) and solar thermal] and provides consultancy in project management and turnkey services. The corporation is a member of the Solar Energy Research Advisory Council

12 http://mnre.gov.in/file-manager/annual-report/2014-2015/EN/Chapter%201/chapter_1.htm
13 http://www.seci.gov.in/content/innerpage/introduction.php

Practices: Corporate India

Welspun Renewables Energy Pvt Limited	
Case Study Title	Positive impact of solar PV power plant on environment including climate change
Site Location	Village Kanasar, Jodhpur, Rajasthan (50 MW)
Type of Intervention	Thin film solar PV power plant
Socio and environmental impacts	▪ There is significant reduction in ambient air temperature below the solar panels. ▪ Temperature of soil below the solar panel has decreased. ▪ Because of the presence of 'solar panels' and 'large areas' covered by solar array with huge RCC piling, soil erosion is minimized. ▪ Rain water collection has helped in conservation of water and increasing the water table ▪ Waste land has been converted into green area by successful plantation of Aloe Vera species underneath the solar panel . ▪ 58,111 tonnes of CO_2 emission reduction annually.

constituted by MNRE to analyse the existing research infrastructure in solar sector and then to set up a framework that would promote a conducive environment for accelerating research and development activities such as setting up calibration facility for solar radiation measuring sensors. SECI also plans to develop Solar Guidelines that would be a one-stop information and facilitation portal for all stakeholders in the solar sector.

Our study indicates that Corporates and FIs have strong commitments in terms of capacity addition and investments for the renewable energy sector. Promotion of their best practices could be useful while India envisages an ambitious target of 175 GW of renewable energy deployment by 2022. Research and development to introduce and build strong infrastructure for grid integration of RE, promoting solar thermal technologies integrated with energy storage systems for heat and power application and encouraging expandable mini grids in large numbers in rural areas are some of the key measures that could be adopted by the Government of India. Indian corporates have already taken the lead to promote and expand the use of renewables in India, however there exists huge opportunity for international community to provide support for effective technology transfer, innovative financing and capacity building in the Indian renewable energy sector.

Practices: Corporate India

YES BANK Limited	
Case Study Title	Fueling Green Economy of India through Innovative Financing Models
Site Location	Pan India
Type of Intervention	▪ Commitment of funding 500 MW or higher of RE at UN Climate Summit, 2014 ▪ Committed to funding 5 GW in next 5 years at RE-INVEST, 2015 ▪ Funding close to 1,100 MW of RE in FY 2014–15 ▪ Issued India's first-ever Green Infrastructure Bonds in Feb 2015, raising ₹ 1,000 crores (~USD 160 million) to fund its RE commitments ▪ Raised another ₹ 315 crores (~USD 50 million) from IFC through its Masala Bonds listed on the London Stock Exchange
Socio and environmental impacts	Say YES to Sustainable MSMEs: YES Bank promoted environmental sustainability and Occupational Health and Safety (OHS) within the Indian micro, small,and medium enterprises (MSME) sector. Under the initiative, OHS systems were strengthened in 50 foundry MSMEs benefitting 907 workers, and energy efficiency projects were implemented in 20 MSMEs, improving their energy efficiency in the range of 15–20 per cent resulting in reduction of 1,787 tonnes CO_2 per annum.

Section III

Reinforcing India's Commitment on Climate Change

Efficient Waste Management

Partner

Dalmia Bharat Cement

Efficient Waste Management

Introduction

As urbanization in India is taking place at a fast pace, the urban population which is reported at 410 million (32 per cent) in 2014 is expected to grow to around 814 million (50 per cent) by 2050 (UNDESA 2014). That means that half of the total population in the country would be living in cities by 2050. The urban population with increase in incomes and aspirations have also witnessed high consumption and thereby high waste generation. As industrial waste management is in the domain of corporate sector and is not as problematic as urban waste management, the scope of this paper is restricted to desired actions in municipal waste streams to make their management more efficient.

With increasing population, the management of municipal solid waste (MSW) in the country has emerged as a severe problem not only because of the environmental and aesthetic concerns but also because of the sheer quantities generated every day. In addition to the MSW, waste streams like domestic sewage, e-waste, packaging waste and construction and demolition debris are also making life of urban local bodies difficult as it is their responsibility to manage them. The e-waste is of particular concern as it is not only one of the fastest growing waste streams but its improper management is also introducing different hazardous/toxic chemicals in the ecosystem. Packaging waste comprises a wide range of materials that are derived from multiple items used as packaging material. Presently, packaging material waste is being managed along with municipal solid waste. The packaging material can be

Case Study Picture 1: Overview of alternative fuels and raw materials (AFR) Shed & Conveying, Ambuja Cements

Practices: Corporate India	**Ambuja Cements Limited**	
	Case Study Title	Waste Management & Co-Processing Activities at Ambuja Cements
	Site Location	Pan India
	Type of Intervention	Utilization of wastes from different industrial, agricultural, and municipal sources as alternative fuels and raw materials (AFR) that can help in conserving scarce conventional fuels used in kilns and captive power plants.
	Socio and environmental impacts	Ambuja achieved a thermal substitution rate of 3.95 per cent in 2014 as compared to 3.65 per cent in 2013, showing an increase of more than 8 per cent. This added financial value to Ambuja Cements Limited.

broadly classified as food and non-food packaging materials. Non-food packaging makes up almost 80–90 per cent of packaging by weight and its quantity is rising day by day. Some amount of recyclable packaging waste—such as paper, plastic, glass, metal, and cartons—is not picked up, because it is soiled substantially or is directly buried under a huge pile of waste in the bin or at the disposal site. Quite often, rag pickers focus their search and recovery on a few varieties of recyclables that have good monetary returns. Other materials are discarded. Hence, a greater part of the potentially recyclable waste from streets and bins ends up at the disposal site, along with other domestic waste and street sweepings. Rag pickers, who search disposal sites as well as streets, nevertheless recover some of those materials; however, most of the packaging waste gets buried. It is expected that generation of all the urban waste types would increase till the consumption levels stabilize.

Segregation at source, collection, transportation, treatment and scientific disposal of waste is largely insufficient leading to degradation of environment and poor quality of life. Efficient technologies for MSW management minimize the management cost through recovery and reuse, enabling to keep cities clean and free from pollution. Unmanaged landfill sites and improper organic waste treatment without methane recovery are the major contributors to GHG emissions from waste. The key issues impacting proper management of MSW include the following:

- Limited primary collection and segregation of waste at the doorstep;
- Reluctance in public to take ownership of waste management at the local level;
- Unavailability of adequate funds;
- Lack of access to proper waste processing technology; and
- Unscientific management of MSW dump sites.

Waste Generation Trends in India

The Central Pollution Control Board (2014) reports that urban areas in India generate 1,44,165 Tonnes Per Day (TPD) of MSW and 80.3 per cent of this is collected and of which, 71.6 per cent remains untreated. Hence, the MSW disposed of in disposal sites is an enormous 1,11,294 TPD which requires around 800 hectares of land area per year (equivalent to the area of 184 Olympic stadiums). The solid waste generations are expected to cross 125 million tonnes by the year 2051 and over 85 million tonnes in the year 2031 (assuming per capita waste generation to be 0.55kg/c/d). In 2013, the per capita waste generation in India ranged from 0.17 kg/c/d to 0.67 kg/c/d which is still quite low as compared to Australia (6 kg/c/d) and US (4.4 kg/c/d).

In addition, as per the statistics of Global e-waste Monitor (2014), the total national generation of e-waste is around 1.7 Million tonnes per annum out of which only around 0.349 Million tonnes per annum are treated by 138 nos. of authorized recycling facilities in India. As far as domestic sewage is concerned, metro cities, Class I cities and Class II towns in India generate around 62,000 MLD of wastewater and effectively treat only 30.5 per cent (18,883 MLD) of

Practices: Corporate India

Earthsoul India Pvt Ltd	
Case Study Title	Compostable Bio Bin Liners for Home Wet Waste Collection
Site Location	Bangalore
Type of Intervention	The intervention was intended to educate the households of around 420 apartments on the application of 100 per cent compostable and biodegradable bin liners for all the kitchen wet waste and induce them into segregation at source.
Socio and environmental impacts	Complete elimination of plastic waste from the wet source and hence societies and municipal bodies.

it. Additionally, about 1,237.2 MLD of installed capacity remains unoperational and about 2,528.4 MLD capacity is in construction stage. Around 628.6 MLD of treatment capacity still remains in proposed stages (CPCB, 2015).

Status of municipal waste processing technologies in India

The technologies for processing or treatment of organic fraction of MSW which have found some degree of acceptance in India include – aerobic composting, anaerobic digestion, direct combustion of wastes either in incinerators or co-processing in cement kilns, and processing of waste into RDF and using it as a fuel. India reportedly salvages and recycles around 60 per cent of MSW generated from urban areas, though most of it is collected and recycled by the informal sector using rudimentary technologies. It is reported that in developing countries around 15–20 million people are engaged in waste recycling activities—in some cities that accounts for 2 per cent of the population. More than 1 million people in India are engaged in waste recycling activities. It is also reported that the informal sector (rag pickers) removes around 10–15 per cent of waste everyday from city streets and is key to the solid waste management system in any city. There is therefore a need for skill enhancement, modernization of recycling technologies, and institutionalization of the informal sector.

The present status on number of established MSW processing plants (other than waste recycling) across the country has been presented in Figure 1 below:

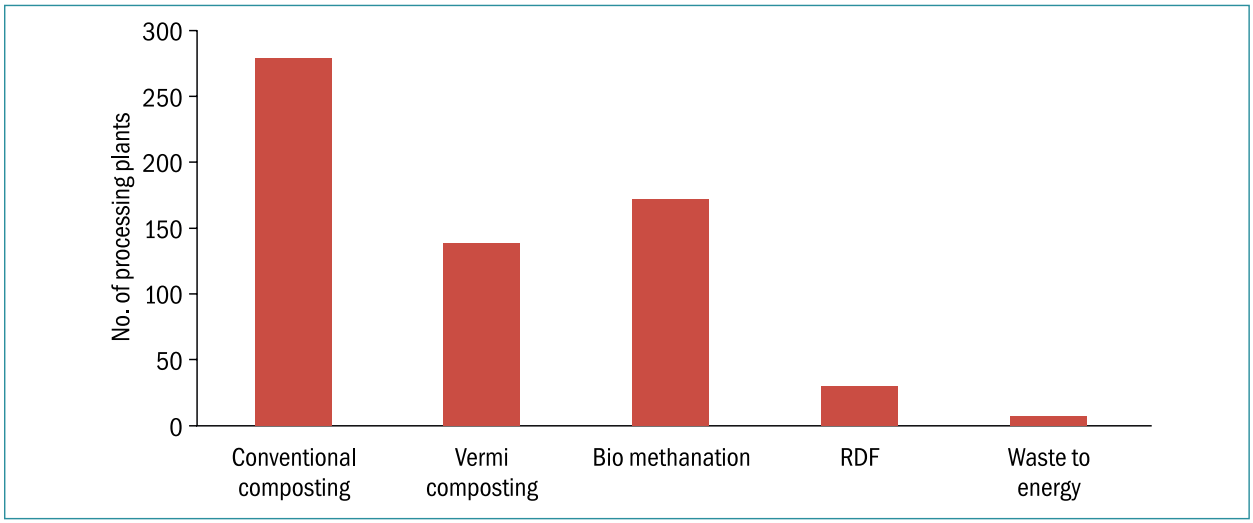


Figure 1: Established solid waste processing plants in 22 states of India

Figure 1 clearly indicates that the biological waste processing continues to dominate the municipal waste treatment comprising conventional composting, vermi composting and biomethanation. RDF-based or direct combustion-

Practices: Corporate India

Johnson Matthey Chemicals India Pvt Limited	
Case Study Title	Waste Reduction by Process Recycling
Site Location	Johnson Matthey Plants in India
Type of Intervention	With due consultation and risk assessment for usage, the dust produced in the processes at Johnson Matthey was recycled back into the process without compromising quality of product.
Socio and environmental impacts	Overall reduction in waste from 7 per cent in May-15 to Nil in June-15. From June-2015 to August-2015, the sites have saved approximately ₹ 5,00,000 by Waste Recovery

based waste-to-energy projects are still at a nascent stage in the country. As of now, India has a 16 MW project installed in New Delhi for generating power from MSW. Two more incineration-based plants are coming up in Delhi with 12 MW and 24 MW power generation capacity, respectively. A project for power generation from MSW in Bengaluru is about to begin and shall produce 8 MW of electricity.

One useful option for GHG mitigation in the waste sector is co-processing of MSW as a fuel in cement kilns. A White Paper by Confederation of Indian Industry (CII) indicates that use of alternative fuel in the Indian cement industries has a huge potential. Thermal substitution of just 5 per cent in cement industry can reduce India's emissions by about 0.1 per cent. Companies like ACC, Ambuja, Ultratech, and Dalmia, have been using different types of waste materials as an alternate fuel. It is reported that Ambuja consumed about 1.74 lakh tonnes of waste in 2013 as compared to 1.5 lakh tonnes in 2012 as an alternate fuel in its kilns. Similar figures have been reported for other cement companies as well. This activity not only reduced the negative impact of waste on the environment but also reduced its overall ecological footprint by reducing its use of natural resources. While industrial wastes are relatively homogenous, their use as an alternate fuel is preferred over MSW. To improve the acceptability of MSW as an alternate fuel, local governments will have to ensure supply of pre-processed waste to achieve homogeneity.

Another related issue is with respect to historical land disposal of the waste. The landfill sites in large cities which have exhausted their useful life need to be closed and rehabilitated. The landfill gas (LFG) contained in these landfills however will be required to be either flared or gainfully used while closing the landfills. Then only the closed site can be put to alternate use. A pilot study conducted by TERI and supported by the MoEFCC for the Okhla landfill at Delhi indicated that around 2500 m^3/hour of LFG can be safely harvested during the closure of the landfill. In addition, Gas Authority of India Limited (GAIL) has set-up a pilot project at active landfill site of 27 ha at Ghazipur landfill in Delhi to explore the option of extraction and gainful usage of LFG. During 2014–15, about 200 MT of fugitive Methane emissions going into the atmosphere have been destroyed which is a reduction of 5,000 tonnes of CO_2 equivalent. The project has been validated by the Designated Operational Entity (DOE) and successfully registered with UNFCCC for availing carbon credits under Clean Development Mechanism. In order to further improve the living conditions of the local populace, it is now planned to utilize the low quality LFG to produce about 30 KW of power through installation of Micro Turbine.

Greenhouse Gas Mitigation Potential in Waste Sector in India

Taking account of existing policy commitments and assuming that those recently announced are implemented; whenever necessary, a diversion from Government projections/ forecasts has also been assumed. The compounded annual growth rate (CAGR) of GHG emissions from solid waste is estimated as 2.55 per cent between the years 2011 to 2031 and 2.69 per cent between the years 2011 to 2051, with respect to GHG emissions of 13.75 million tonnes CO_2 eq. in the year 2011. In addition, improper operation and management of sewage treatment plants (STPs) and handling of sewage sludge also contributes to uncontrolled GHG emissions.

Practices: Corporate India

OCL India Limited	
Case Study Title	Efficient Waste Management though Slag and Fly Ash Utilization in Blended Cements
Site Location	Rajgangpur and Kapilas, India
Type of Intervention	Complete utilization of the fly ash generated in own captive power plant. Clinker factor optimization and reduction in the specific CO_2 emissions per ton of cement.
Socio and environmental impacts	The initiative helped in safe disposal of incremental 270,558 tonnes of blast furnace slag and 15,325 tonnes of fly ash from our captive power plant. The intervention also avoided approximately 260,439 tonnes CO_2 from equivalent cement production.

Proper and efficient waste management also has the potential to reduce GHG emission contribution from waste sector. For instance, as per the World Bank, waste composting has net GHG emission reduction potential of 1.16 Gg CO_2 eq. / Gg MSW (World Bank, 2006). The potential for anaerobic digestion is even higher with gainful use of biogas. Proper incineration of combustible waste can not only reduce the net GHG emission but also result in substantial waste volume reduction. The cost for installing and operating incineration plants in India is around 1/3rd, compared to Western Europe and US (Table 1). To achieve efficient waste management and GHG emission abatement, among the waste processing options discussed in the IPCC's AR5 report, the options which have been brought into use or being tried in India include—waste recovery and recycling/reuse, composting and anaerobic digestion, landfilling and methane capture, and energy recovery from waste, following thermal route either in incinerators or in cement kilns.

Table 1: CAPEX and OPEX of Incinerator plants in different regions in the world

Region	CAPEX in ₹/MW (Million)	OPEX in ₹/MW/yr (Million)
US	130.00–351.00	5.85–13.00
Western Europe	130.00–351.00	5.85–13.00
India	53.95–78.00	1.79–5.84

Source: World Energy Council

Similar to MSW processing, huge opportunities lie in anaerobic treatment of domestic sewage and sewage sludge and technology options like constructed wetlands which can operate either on power generated in the treatment process or do not require much power to operate. Construction, operation, and maintenance of these options however would require training and skill development in the local utilities.

Existing Policy and Directives

Though Municipal Solid Waste (Management and Handling) Rules were notified as early as 2000 and emphasis on efficient waste management has also been adequately laid down in National Environmental Policy, 2006 and National Action Plan on Climate Change, 2008, the waste management scenario in most cities is far from satisfactory. The renewed impetus on effective waste management has been provided in Swachh Bharat Mission announced by Government of India in 2014 which clearly provides an opportunity to manage the municipal solid waste in an efficient manner. The various ways in which this can be achieved for reducing packaging wastes and e-wastes are described as follows:

- Alternative packaging—Use of fabric or jute packaging instead of traditionally used polythene bags which are difficult to collect and recycle.

Practices: Corporate India	**Ricoh India Limited**	
	Case Study Title	'Comet Circle' for Circular Economy and Sustainable Society
	Site Location	India and Group sites
	Type of Intervention	Product Lifecycle Management: Aspects of end-to-end including from recyclable designing to resource efficient development to regenerating deployment to recirculating end-of-life management.
	Socio and environmental impacts	This 'cradle-to-cradle' approach of the Comet Circle has led to a decrease of total lifecycle CO_2 emissions of product by 35.8 per cent in FY 2014 from the FY 2000 level.

- Lesser packaging without sacrificing product quality.
- Segregation at source to enable efficient recycling of waste.
- Treatment of organic waste to get beneficiary products, thereby reducing GHG emissions.
- Designing products for disassembly so that majority of their components can be recycled at the end-of-life.
- Utilization of waste packaging as a fuel for combustion to recover energy.
- Proper recycling of e-waste to recover useful precious and semi-precious metals in an eco-friendly manner.

Role of Corporates

The key challenges in achieving proper urban waste management across the country are listed as follows:

- Growing consumption levels by the aspiring population
- Inability to source segregate the municipal waste to ensure efficient dry waste recycling
- Urban Local Bodies (ULBs) are unable to recover cost for waste management services
- Need for skill development in the formal and informal sector
- Establishing market for waste-derived compost and recycled products
- Development of regional recycling infrastructure, e.g. regional recycling parks
- Organized e-waste collection and eco-friendly recycling
- Raise awareness to avoid huge cost of inaction

Some of these key challenges present business opportunities for the corporate sector. To bring in efficiency in municipal solid waste management, the Indian corporates can help local governments in the following manner:

- Work with local governments in cities (in which they operate) to ensure that at least 50 per cent of organic waste generated is either composted or digested to produce biogas.
- Provide indigenous technology option for more efficient resource recovery (e.g. precious/semi-precious metals extraction, recovery of rare earth metals) from e-waste.
- Putting up bio-methanation plants for biogas and landfill closure and LFG recovery infrastructure to help the local government address the problem of waste management.
- Private sector can also contribute towards training and capacity building of ULBs in operating STPs and management of sewage for water, energy, and nutrient recovery.
- Reducing packaging so that less and less packaging waste comes in municipal waste streams.
- Help local governments with appropriate technical know-how and financial support for Meeting the unmet demand for sewage collection and treatment.

Practices: Corporate India

TATA Consultancy Services Limited	
Case Study Title	Climate Change & Road Map for Sustainable Waste Management at TCS
Site Location	TCS Pan India
Type of Intervention	Application of waste management technologies to mitigate GHG emissions from waste and the usage of anaerobic digestion to manage wet wastes.
Socio and environmental impacts	Remarkable increase in onsite (degradable) waste processing (2,084 tonnes) into wealth. Production of environmentally sustainable products, i.e. Biogas for use in canteen as an alternate source of energy and partially replace LPG, thereby giving monetary benefits as well. Bio-fertilizer generated is used for maintaining lush green, biologically diversified landscapes. The carbon footprint has also been reduced by avoiding 796 tCO_2e GHG emissions.

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Practices: Corporate India	**Tetra Pak India Pvt Limited**	
	Case Study Title	Establishing ecosystem for recycling of post-consumer Tetra Pak Cartons
	Site Location	Pan India
	Type of Intervention	Tetra Pak carton recycling initiative takes a four-pronged approach: Partner with recyclers that see the benefit of recycling post-consumer cartons, Establishing collection networks by engaging waste pickers, Investing in educating consumers and others in the waste chain about the recyclability of Tetra Pak cartons and proper waste management practices, and Driving thought leadership on waste management.
	Socio and environmental impacts	More than 30 per cent of used cartons are getting recycled in India. More than 16,000 waste collectors associate themselves in collecting cartons.

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Practices: Corporate India

Wipro Limited	
Case Study Title	Waste Management in WIPRO
Site Location	WIPRO Campuses in India
Type of Intervention	The main goal of mixed solid waste management is reducing and eliminating adverse impacts of waste materials on human health, environment and reduction of waste ending up in landfills.
Socio and environmental impacts	The initiative contributed immensely to public health by reducing the ill effects of unscientific landfills in the communities, which result in contaminating ground water and polluting the environment apart from being a source of many vector-borne diseases. It also helped in conservation (Reuse and Recycling) of resources.

Section IV

Reinforcing India's Commitment on Climate Change

Ensuring Water Availability in a Changing Climate

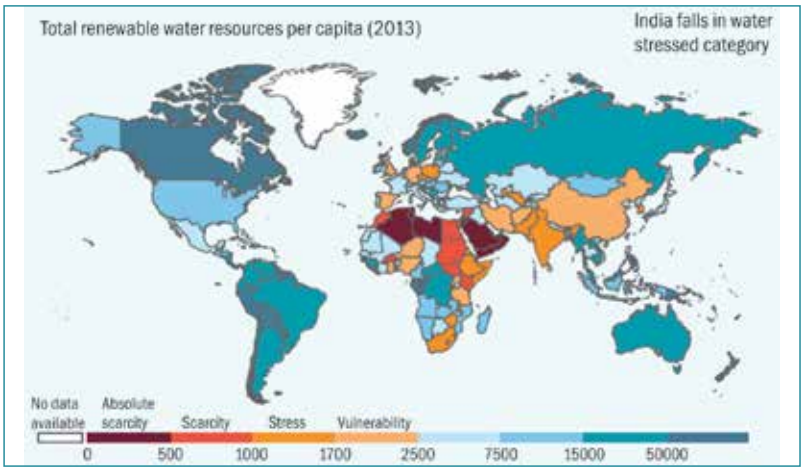
Lead Partner

TATA

Ensuring Water Availability in a Changing Climate

Background and Relevance

Water is a finite resource and its future availability is set to be a significant challenge amongst all the users or sectors due to continually rising and competing demand, inefficient use, pollution, and potential risks due to climate change. The continuously declining per capita water availability in India from about 5,177 m^3 in 1951 to 1,545 m^3 in 2011[1] has put the country into the 'water stressed' category and is close to being categorized as 'water scarce'.[2] India's water demand mainly from the agriculture, industrial, and domestic sectors is expected to reach 1,500 BCM (billion cubic meters) by 2030 while the current supply is only about half that (i.e., 744 BCM).[3] An estimate by World Bank suggests that the water demand for industrial uses and energy production will increase from 67 BCM in 1999 to 228 BCM



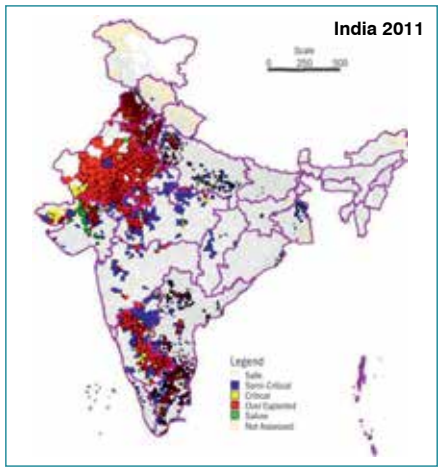


Figure 1: State of water availability (L); and, State of groundwater use in India (R)
Source: World Water Assessment Programme (WWAP), 2015. The UN WWDR-2015: Water for a sustainable world, Paris, UNESCO

Source: Dynamic groundwater resources of India: CGWB. 2014

1 Sources: Central Water Commission, National Institute of Hydrology. 2008. "Preliminary consolidated report on effect of climate change on water resources". New Delhi: Ministry of Water Resources; and Press Information Bureau (2012).
2 A situation of per capita water availability falling below 1,700 m^3 is termed 'water stressed' while that of per capita water availability falling below 1,000 m^3 is termed 'water scarce'.
3 Source: 2030 Water Resources Group. 2009. "Charting our water future: economic frameworks to inform decision-making", Executive Summary.

Practices: Corporate India

Arvind Limited	
Case Study Title	Turn of the century –Recycle water to Sustain Fashion
Site Location	Santej unit
Type of Intervention	Water Recycle and Reuse
Socio and environmental impacts	▪ Zero Liquid Discharge technology has led to minimization of waste water discharge and led to reduction in withdrawal of ground water. ▪ Four stage water recycling plant recycled 94 per cent of the waste water which can be re used in processes MVRE technology along with salt crystallization technology produces highly purified salt, which is being used in Dyeing instead of dumping in landfills. Overall, the technologies employed by the company reduce groundwater consumption, minimize waste water discharge, maximize water recovery and bring economic stability

by 2025, an annual growth rate of 4.2 per cent.[4] Many river basins in India are already water stressed while several regions in the country have an overexploited state of groundwater. Out of a total of 6,607 units (Blocks/Mandals/ Talukas) assessed for status of groundwater in India, about 10.5 per cent (697) are categorized as semi-critical, 3.3 per cent (217) as critical and about 16.2 per cent (1,071) are categorized as over-exploited[5] (Figure 1). Many of the water intensive industries (e.g., 70 per cent of thermal power plants) are located in water scarce or water stressed regions of the country that pose a potential risk to their water use.[6]

Even though the water demand amongst various sectors in India has been continually increasing, the water use in these sectors remains inefficient. Agriculture/irrigation sector (with about 80 per cent of water use) has low average water use efficiency (about 38 per cent). Compared to international standards, Indian industries consume relatively higher amount of water for production. Further, surface and groundwater pollution due to untreated/partially treated sewage and industrial wastewater in many parts of India continues to be an area of concern. The already mounting stress on water resources in India is expected to be further exacerbated by the potential impacts of climate change which is expected to affect the hydrological cycle as well as the frequency and intensity of precipitation (rainfall) across various regions. This is likely to have a direct effect on the run-off rates and influence the occurrence and intensity of floods and droughts which may indirectly affect the ground and surface water supply for irrigation, domestic, industrial use, hydropower generation, etc.

State of Industrial Water Use in India

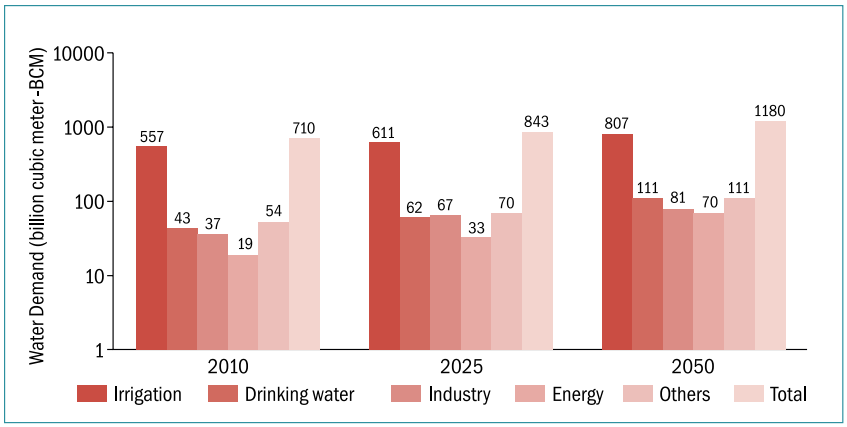


Figure 2: Projections of water demand in various sectors in India (Data source: NCIWRD & MoWR)

Industries consume significant volume of water for various direct and indirect processes. The water demand by Indian industries (including energy) is projected to grow from 56 BCM (in 2010) to 100 BCM in the year 2025 and is further projected to increase to about 151 BCM by the year 2050.[7]

Indian industries are known to consume relatively higher amount of water for production. Currently

4 Source: India Infrastructure Report (2011).
5 Source: Dynamic groundwater resources of India: Central Ground Water Board, 2014.
6 Based on Source: World Resources Institute, 2010, Financial risks from water constraints on power generation in Asia
7 Source: NCIWRD projections, Report of the Working Group On Water Resources For the XI Five Year Plan (2007-12); Ministry of Water Resources, 2006

Practices: Corporate India

Dalmia Cement (Bharat) Limited	
Case Study Title	Water conservation measures at Dalmiapuram Cement Works, Tamil Nadu, India
Site Location	Dalmiapuram Cement Plant, Tamil Nadu, India
Type of Intervention	Water conservation drive through various process related improvements and awareness generation.
Socio and environmental impacts	The daily water consumption of Dalmiapuram cement plant was 2,360 cu.m. in FY 2013. It was reduced to only 1,509 cu.m. due to the initiatives taken. It is an impressive 36 per cent reduction due to the initiatives taken, such as switching to air cooling instead of water cooling for clinker cooler and monitoring daily water consumption, in daily water consumption achieved within two years at Dalmiapuram plant.

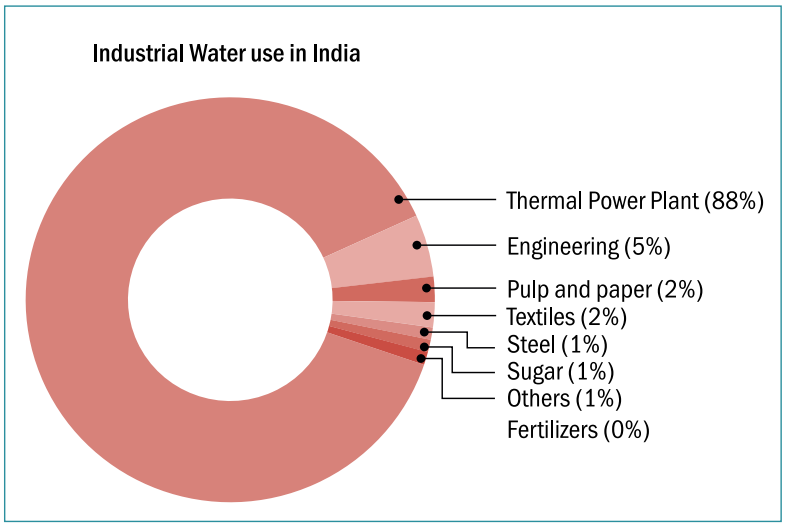


Figure 3: Water use in various industries in India

the Indian industries consume about 2 to 3.5 times more water per unit of production as compared to similar plants operating in other countries. The ratio of water consumption and economic value creation (at $7.5) is low as compared to many other countries such as Argentina ($30), Brazil ($23.4), Sweden ($92.2), and UK ($443.7).[8] Most of the industrial water demand comes from water intensive industries such as thermal power plant, engineering, pulp and paper, textile, steel, sugar, etc. According to a study, thermal power plants in India consume the maximum amount of water (87.8 per cent) followed by heavy engineering (5.05 per cent), Pulp and Paper (2.26 per cent), Textile industries (2.07 per cent), Steel (1.29 per cent), Sugar (0.49 per cent), Fertilizers (0.18 per cent) and others (0.78 per cent)[9] (Figure 3).

Of the total power production in India of 27,502.95 MW (as on May 31, 2015)[10], 69.5 per cent is produced thermally[11] and the rest is generated by hydro, renewable energy sources, and through nuclear. Since the thermal power sector has the highest water consumption and demand, it would be of great significance to optimize the water use and enhance the water use efficiency in the thermal power plants. An estimate (2012) for thermal power plant suggests that for every MW of power produced, Indian thermal power plants consume about 80 m^3 of water compared to less than 10 m^3 water consumption in developed nations. This is mainly attributed to the once-through cooling system.[12]

8 Source: www.cseindia.org; World Bank (2001).
9 Source: CSE based on the wastewater discharged data published by CPCB in "Water quality in India (Status and trends) 1990 - 2001"
10 Source: Ministry of Power
11 Source: http://www.cseindia.org/userfiles/17-38%20Power(1).pdf
12 Source: Centre for Science and Environment. 2012. Down to Earth supplement

Practices: Corporate India

Hindustan Coca-Cola Beverages Pvt Limited	
Case Study Title	Water Stewardship
Site Location	Goblej , Ahmedabad
Type of Intervention	Rainmaker– Water For Future: Rainmaker is an innovative and rigorously tested beverage process water recovery system that uses proven, state-of-the-art technologies to provide water for reuse in approved operational processes, such as clean-in-place and bottle-washing activities. The system takes process water which is normally used once, treated, and discharged and further purifies it to high standards, using technologies such as chemical treatment and/or biological treatment in a membrane bioreactor, ultra-filtration, reverse osmosis, ozonation, and ultraviolet sterilization. The result is a new source of extremely high-quality water that meets and/or exceeds even the most stringent drinking water standards and sets a new benchmark for the industry.
Socio and environmental impacts	▪ Environmental Aspect: Improvement in water consumption per litre of beverage production (WUR/Water Usage Ratio). ▪ Water consumption reduced from 1.85 per litre of beverage to 1.7 per litre.

Textile industries require large quantum of water and consume about 0.8 BCM of water annually (India Infrastructure Report 2011). As per the National Indian Textile Research Association (NITRA), the specific water consumption of textile industries ranges from about 70–100 litres/kg of cotton fabric processed and about 25–70 litres/kg of synthetic fabric processed.

Various industries require large quantities of water for their manufacturing processes, and at the same time discharge significant volumes of wastewater. A rough estimate from the Central Pollution Control Board (CPCB, 1999–2001) suggests that out of a total of about 83,000 MLD (million litres per day) of water discharged by all the industries in India, about 66,700 MLD (~80 per cent) is the cooling water discharge from the thermal power plants.

Potential Opportunities for Efficient Water Use

It is essential that the current and future path of growth and development in India encompasses the strategies to address the water scarcity involving interventions like demand management, enhancing water use efficiency, water conservation, recycle and reuse, etc., through an integrated approach. In view of their corporate structure, technical know-how, etc., industries are better placed as compared to other sectors to improve water-use efficiency and reduce water consumption in the short run. An immediate opportunity lies with water intensive industries in which interventions for efficient water use and reduction in water consumption can bring about considerable improvement in the industrial sector.

A case in point lies in the Thermal Power Plants that are the largest consumers of water in the industrial sector. There exist a range of interventions which can be adopted by the thermal power plants to reduce their water consumption. A study by TERI (2015)[13] on selective industries indicates that there is a significant water saving potential in thermal power plants with short term interventions like recirculation/reuse of ash water from ash dyke, increasing the Cycle of Concentration (CoC), reuse/recycle wastewater (zero discharge) as well as long term interventions like switching from wet ash handling to dry ash handling and shifting from conventional wet cooling to dry cooling system (where applicable). Preliminary estimates of the study indicate that, depending upon the capacities of the different plants, the above-mentioned short term interventions have a water saving potential varying from 8–66 per cent (6,240 to 2,36,923m^3/day) with an estimated annual financial savings in the range of ₹1 to ₹42 crore. Similarly, the long term interventions mentioned above indicate a water saving potential in the range of 47–83 per cent (19,083 to 2,65,872 m^3/day) with corresponding potential annual financial savings of about ₹3.4 to ₹47.8 crores[14].

13 Source: TERI 2015 Study on benchmarking industrial water use to assist policy for enhancing water use efficiency in India

14 Figures are indicative and meant to highlight the opportunities. The actual figures may vary depending upon plant capacities and water use practices.

Practices: Corporate India

Hindustan Construction Company	
Case Study Title	Ujjivana: Let's drive change
Site Location	Mhalungi River (20 functional site locations)
Type of Intervention	Rejuvenation of Diversion Based Irrigation (DBI) System on Mhalungi River
Socio and environmental impacts	▪ The wells that used to run dry after the rainy season showed significant water retention. This shows substantial groundwater level increase across the area even though farmers used the well water for irrigation. ▪ 706 million litres of water was conserved using the canal system, post the 2014 monsoon. The rejuvenation of canal system ensured sufficient water availability in both Kharif and Rabi seasons. The farmers started bringing the entire available area under cultivation and could expand their range to include crops such as carrot, peas, cauliflower, cabbage, broccoli, red cabbage, tomatoes, beans and chilli.

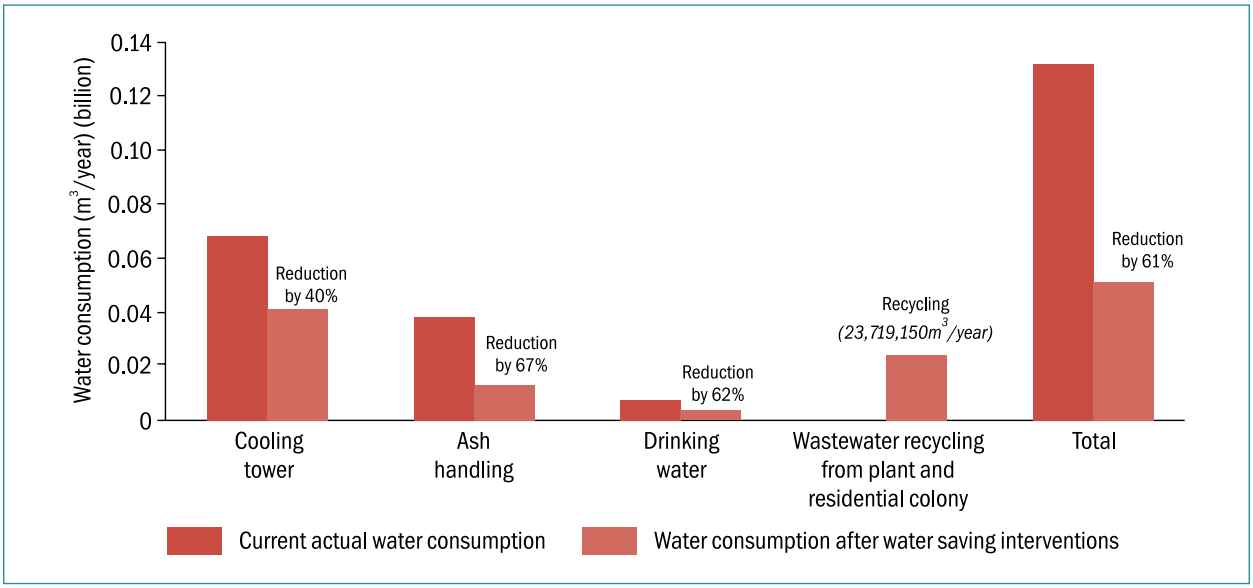


Figure 4: Potential water savings in audited thermal power plant (an example) (Source: TERI Policy Brief, Issue 6, December 2012)

Water audit conducted by TERI for a thermal power plant of about 3,000 MW capacity revealed that recycling the drain wastewater can save about 17.9 million m^3/year with an associated financial saving of about ₹7.2 crore/year.[15] Water saving interventions in the plant involving recycling/reuse of wastewater and water used for ash handling, as well as reduction in specific water consumption of the cooling towers, could potentially reduce the water consumption by up to about 60 per cent (Figure 4).

A few power plants have already adopted some of these interventions and have reduced their specific water consumption. A rough estimate suggests that by converting all the thermal power plants in India to closed-cycle cooling systems, about 65,000 MLD of fresh water can be saved.[16]

15 TERI Policy Brief, Issue 6, December 2012; Enhancing water-use efficiency of thermal power plants in India: need for mandatory water audits.
16 Source: Centre for Science and Environment. 2012.

Practices: Corporate India

ITC Limited	
Case Study Title	ITC's Integrated Watershed Development Programme: Supporting Sustainable Agriculture
Site Location	Initiated in 2000–01, the ITC's Programme currently operates in over 1,182 villages covering nine Indian states—Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, and Telangana.
Type of Intervention	Integrated Watershed Development in moisture stressed districts of India to protect farmers from extreme weather episodes
Socio and environmental impacts	▪ ITC's Programme currently covers 2,00,186 ha. 1,483 WUGs have built 6,464 water-harvesting structures and created a water storage capacity of approximately 24.97 million kL supporting a return to double-/multi-cropping and crop diversification towards commercial varieties. ▪ There has been an average rise of 10–20 per cent in productivity across all ITC project areas which has significantly raised household incomes. ▪ Civil work on structures and the rise in agricultural activities in the village have generated 47,33,000 person-days of employment, especially benefitting the landless, helping to reduce seasonal out-migration. ▪ Regeneration of water resources has improved the availability of drinking water points in the village.

Another example can be of the Pulp and Paper industry that has significant water consumption. Various sector specific opportunities exist in Pulp and Paper industries for reducing the water consumption which includes interventions like using continuous counter current processes during pulp washing, recycling water through ultra-filtration in closed loop, using vacuum flume tank to recycle water, reuse/recirculation of about 80 per cent of waste water discharge, etc. The water saving potential that can be achieved through such interventions vary in the range of 3–78 per cent.

In the textile sector, examples exist of industries that have adopted 'Zero Liquid Discharge' and are reusing the treated wastewater in their processes. Textile units in Tirupur have installed ZLD system. Textile industrial units who are using ZLD system have reported reduction of fresh water demand by almost 87–91 per cent.

A 2010 estimate of NCIWRD (National Commission for Integrated Water Resources Development) for total water withdrawal/utilization for energy production is about 19 BCM. Considering this and based on identified range of water saving potential (TERI 2015), a rough estimate indicates that the volume of water that can be potentially saved in thermal power plants ranges between about 2.8 BCM to 6.8 BCM representing a potential saving of 25–60 per cent.[17]

It is evident from the above that there exist considerable opportunities in various industrial sectors to reduce their specific water consumption and fresh water demand by interventions such as optimization and reuse/recycle of their process water, reuse/recycle of wastewater, use of efficient technologies, and other water conservation interventions.

A study by CWC (Central Water Commission) and NCIWRD[18] estimates that out of the total water used by industries and power sector together (viz. 56 BCM), a significant 8 BCM of water can likely be saved by increasing the industrial water use efficiency. This is equivalent to about 80 per cent of drinking water supply needs of rural India and about 24 per cent of drinking water supply needs of urban India (2010 figures).

Case Study Picture 1: Kantai Bandhara on Girna River Dam on Girnar river by Jain Irrigation

17 Rough estimates based on TERI study (2015). The actual range of potential savings may vary depending on the capacity and water use practices of the industries.
18 Source: Guidelines for improving water use efficiency in irrigation, domestic & industrial sectors; Central Water Commission, Ministry of Water Resources; 2014

Practices: Corporate India

Jain Irrigation Systems Limited	
Case Study Title	Construction on Dam by Jain Irrigation on River Girna
Site Location	Near Jalgaon on River Girna
Type of Intervention	Dam (weir) on River Girna
Socio and environmental impacts	▪ Increase in the area under irrigation by 4,000 acres. ▪ Enhanced biodiversity (Green cover, aquatic species provides economic value in the area). ▪ Reduced water stress on ground water resources for agriculture and industry in the area.

Existing Relevant Policy Directives and Corporate Initiatives

The Government of India launched its National Water Mission (NWM) under the National Action Plan on Climate Change (NAPCC, 2008). The National Water Mission is functional under the Ministry of Water Resources, River Development, and Ganga Rejuvenation (MoWR, RD & GR, respectively) and has identified goals that emphasize on increasing the water use efficiency (by 20 per cent), integrated water resource management, promotion of water conservation, wastewater recycle and reuse, water audits, focussed attention on over-exploited areas, data in public domain, assessment of impact of climate change on water resources, etc.

Besides the above policy directive, the MoWR, RD & GR have recently launched 'Namami Gange' programme that amongst others activities, focusses on rejuvenation of river Ganga, conservation of water bodies including ground water, wastewater management, etc. In general, water governance and management is supported by the National Water Policy (2012) in India.

In addition to the Government's efforts, there are a few examples of private sector initiatives as well. ITC introduced a programme on adaptation to climate change impacts through diversification of farming systems including research and development (R&D), farmers' education, watershed development, water conservation, and leveraging digital technology and customized extension services to empower farmers, and raise rural incomes. ITC's e-Choupal initiative has extensively engaged farmers to promote sustainable and adaptive agricultural practices.[19]

PepsiCo India is involved in promoting water-saving strategies such as direct seeding of rice that helps growers avoid water-intensive steps in rice cultivation. This process of direct seeding avoids three water intensive steps in the procedure and saves significant amount of water. PepsiCo also partnered with Punjab Agri Export Corporation (PAGREXCO) to start a 'Citrus Development Initiative', to promote crop diversification and help farmers adapt in a water-constrained climate. The company introduced citrus plantation which is less water intensive as an alternative to water intensive paddy.[20] There are several other corporate entities that are engaged as far as promotion of water conservation and climate change adaptation interventions are concerned.

Industries need to be encouraged by effective incentive and disincentive mechanisms to motivate them to adopt and promote interventions on water conservation and efficient use.

19 Source: https://unfccc.int/files/adaptation/application/pdf/itc.pdf (Accessed on January 2, 2015).
20 Source: https://unfccc.int/files/adaptation/application/pdf/pepsico.pdf (Accessed on January 2, 2015).

Practices: Corporate India

Lavasa Corporation Limited	
Case Study Title	Wastewater treatment—recycle and reuse
Site Location	Lavasa, Sahyadri range, Western Ghats
Type of Intervention	Waste water treatment and management
Socio and environmental impacts	▪ Construction of sewage treatment plant was initiated for collection, treatment and recycle/reuse of treated sewage effluent. Tertiary treatment was focussed on chemical treatment for removal of fine particles, filtration, i.e., rapid sand gravity filter and disinfection with ultra-modern technology. ▪ The qualities of outlet parameters are very stringent as compared to local government bodies and are maintained throughout the year. ▪ The treated sewage is 100 per cent reused/recycled and used for construction, horticulture, etc. ▪ Reduction in water loss from 2013 to 2015 was 8.8–8.6 per cent, also water cost was reduced to ₹ 24.84 /cu.m. from ₹ 31.48 /cu.m.

Way Forward for Corporate India

The road to sustainable water use ensuring water availability must go through integrated water management, participatory planning, and implementation. Industries have a major role to play in not only transforming their own policies and operations to enhance water use efficiency, but also pivot their role in reducing the growing stress on the water resources in the regional context, as well as their value chain. In meeting this challenge, there is an opportunity to increase efficiency and productivity in a sustainable way.

The key areas of interventions where corporates can play a major role include conducting water audits, mapping water footprints and undertaking water conservation and efficiency improvement interventions within the industry and its entire value chain. Besides this, several water efficiency and conservation related interventions can be undertaken with involvement of the local communities at the watershed and basin scale under the Corporate Social Responsibility (CSR) activities. Apart from ensuring water availability this shall also foster community resilience to water stresses in the region.

Corporates have an opportunity to be proactively responsive to the potential vulnerabilities of climate change and water scarcity by leading the initiatives on efficient water use and resource conservation, while also setting a benchmark for regulatory environment. While there are several sectoral opportunities discussed in preceding sections, some of the key interventions that can be enumerated for industries in India include:

- Ensuring interventions for enhancing water use efficiency (with identified and set targets, e.g. by 20 per cent, net water positive, or water neutral), as well as assessing and reducing industrial water footprint (within the industry and its value chain). This needs to be supported by a renewed Corporate Water Policy and its implementation framework along with adequate financial outlay.These include an integrated industrial water management strategy which optimizes efficient use of water within industry and its entire value chain, improves water productivity, reduces losses, and promotes water conservation interventions (such as rainwater harvesting, groundwater recharge, etc.)

Practices: Corporate India

Mahindra & Mahindra	
Case Study Title	*Smridhhi ki Asha*
Site Location	Damoh district of Madhya Pradesh, comprising 32 villages
Type of Intervention	Integrated watershed management programme
Socio and environmental impacts	▪ Mahindra group spearheads interventions to incorporate the 3R's of water conservation: reduce, replenish, and recharge ▪ The programme with an aim to maximize the productivity from every drop has successfully completed the first phase of IWMP in the Damoh district on March 31, 2014, comprising 32 villages. Some of the benefits reaped are: ▪ Owing to the construction of 28 check dams, 37 ponds and tanks, the community now has an incremental storage capacity of 1,486.65 million litres. ▪ Additionally, 1,100 soil and water conservation structures like stone outlets and gully plugs have been built. ▪ Trenches and bunds on a stretch of 318 km have been constructed. ▪ More than 2,790 farmers received improved variety of seeds in the Rabi (wheat and chickpea) and Kharif cycle (paddy, pigeon pea, black gram and soybean). ▪ Also, vegetative plantations increased to 130.38 ha of land and the tree cover has increased by 30,000 trees. Farmers have registered productivity increase by 25–30 per cent. ▪ Furthermore, 384 self-help groups (SHG) have been constituted and 318 individuals have been directly linked to economic activities.

- Initiating or enhancing the recycle/reuse of wastewater (with a dynamic target, e.g. 60–80 per cent) with an ultimate goal to achieve zero liquid discharge (ZLD) in the industry. This can also involve potential reuse of treated wastewater from other industries or sectors (e.g., treated domestic wastewater) wherever feasible.
- Internalize and conduct regular mandatory water audits: This shall provide opportunities to identify losses/wastage in the system and help optimization of water use in various processes along with recycle and reuse of process and wastewater and associated co-benefits like energy savings, etc.
- Identify and establish benchmarks for industrial water use: Industries should establish benchmarks for industrial water consumption and use efficiency based on efficient water use practices. These benchmarks, for example, could be on (minimal) quantity of water used/unit of product, or concentration of pollutant reduced (beyond regulatory requirements) per unit of wastewater discharged. Industries that have taken initiatives and have best practices should share and disseminate the knowledge and information.
- Technological and process improvements: Use of latest water saving efficient technologies, e.g. for treatment and reuse of wastewater, ozonation cooling and process improvements such as enhancing the CoC of the cooling system or shifting to dry cooling systems (where feasible) etc., should be appropriately identified and applied. Such improvements can save significant volume of water.
- Automation should be introduced in monitoring and sharing data with a centralized control system and established management information system (MIS) with use of latest ICT tools and techniques (e.g., SCADA, GIS, Cloud based system, etc.)
- Industries should support regional water management by sustainably reducing the shared risk (physical, regulatory, and environmental) on water through participatory water

Case Study Picture 2: Gomati canal with lift irrigation, TATA Chemicals

Practices: Corporate India

TATA Chemicals Limited	
Case Study Title	Integrated water management Programme
Site Location	Okhamandal, Mithapur, Gujarat
Type of Intervention	Integrated water management
Socio and environmental impacts	In the last 76 years of existence, the company faced severe drought situations when fresh water became an issue for its business sustainability. ▪ With an objective to utilize this diminishing resource cautiously and build an effective water management system, TATA revamped its technologies and implemented operations through innovative ways to reduce its dependency on external fresh water resources. ▪ TATA Chemicals Limited have reduced lake water consumption significantly from 2,145,000 cu.m. down to 547,000kL per year. ▪ Through community participative approach and collaboration with government and non-government organizations, TATA Chemicals Limited initiated watershed development projects in Okhamandal region to reduce water stress in the area.

conservation and watershed management involving local communities and other stakeholders under public–private partnership (PPP) mode and CSR initiatives. Such regional interventions include, for example, micro-irrigation system, household rainwater harvesting, check dams, groundwater recharge, rejuvenation of water bodies, drinking water provision, etc.

- Industries can also support nationwide programmes (e.g., National Water Mission, Namami Gange, etc.) aligning water conservation and efficiency interventions with the objectives and goals of government, with a special reference to National Water Mission objectives.
- Industries should also conduct scientific water vulnerability assessments for citing of their plants in context of regional water availability scenarios and sectoral water demands, in order to ensure sustainable operations and reduce potential water related risks.

Case Study Picture 3: Integrated water resource management project (locals happy to be working together) in Rajasthan, HSBC India

Practices: Corporate India

The Hongkong and Shanghai Banking Corporation Limited, India (HSBC India)	
Case Study Title	Water resource management for adaptation to climate change through community action in the Thar Desert, India
Site Location	HSBC supported Jal Bhagirathi Foundation (JBF) to implement an integrated water resource management project in Pali district (Potaliya village), and Barmer district (villages of Kalavatsar, Gangawas and Thumbli) in Rajasthan
Type of Intervention	CSR project on Integrated Water Resource Management to enable access to safe Water, Sanitation, and Hygiene towards Climate Change Adaptation in the desert region
Socio and environmental impacts	▪ The villages receive about a week's rainfall in a year. The intervention has made water available in these villages for 11-12 months in a year as against about 6 months earlier. ▪ Village-level community-water harvesting structures have increased storage capacity and improved access to water during the stressed months before and after monsoon. ▪ Water catchment common land and village pasture land have been developed so that help increase water holding capacity of the landscape, check desertification and make more fodder available for animals. ▪ 100 household-level underground water harvesting structures have helped improve access to water, reducing the drudgery of women who had to fetch water as headload from long distances. ▪ Construction of 300 household-level toilets has helped improve access to hygienic sanitation. Behaviour change communication and capacity building of the communities have helped them adopt these and avoid open defecation. This has also helped empower women with enhanced security and privacy as they had to earlier walk away from home to lonely fields in order to relieve themselves often in the dark before sunrise or after sunset

Reinforcing India's Commitment on Climate Change

Way Forward

Way Forward

Several corporates in India have put their best foot forward and showcased success stories across a wide array of options and sectors in moving towards a more efficient and cleaner environment. Moreover, as the country aspires to balance the challenges of sustainability, while focussing on its development priorities, a large window of opportunity exists across sectors for India to take advantage of leapfrogging to more efficient and cleaner fuel and technology alternatives, rather than get locked-in to options that can be avoided.

However, how much of the potential can actually be tapped across each of the sectors depends on a multitude of factors, including progress with regard to investments, R&D, the policy and regulatory environment, etc. Providing an environment that is most conducive to enabling transitions to these alternative options is therefore the need of the hour, so that all stakeholders, including corporates, can further enhance and upscale efforts to reduce GHG emissions.

Globally, mechanisms that provide technology and finance to assist change would undoubtedly help in accelerating the transition. At the national level, conducive policies and guidelines, standards and labelling programmes, and adequate regulatory measures to provide clear and consistent signals to industry, manufacturers, and consumers can further facilitate the deployment of alternative options.

In the industrial sector, policies that help to accelerate the Perform, Achieve and Trade (PAT) scheme to promote energy efficiency in more industries, develop customized schemes, and enhance Research, Development & Demonstration (RD&D) efforts to facilitate adoption of energy efficient technologies in MSMEs and strengthen Demand Side Management (DSM) programmes to promote energy efficiency in different end-use sectors could play an important and facilitative role.

Another key area where corporates need to play a major role is in the renewables domain. While the Government has clearly put forward its aspirations to accelerate the penetration of renewable energy technologies in its INDC, there remain several dimensions where efforts need to be made to step up activity and accelerate the integration of renewable energy sources as a major component of India's energy mix.

While corporates must ramp up activity to manufacture RE components, support infrastructure and systems, and increasingly integrate RE in their energy use, these efforts should also be supported by having in place policies to restrict dumping of low quality RE products and components, incentivizing quality domestic goods via excise exemptions and soft loans, having processes and guidelines that facilitate the development of Indian standards, testing and quality control of RE devices and systems, enabling single window clearance for approvals related to RE projects and imposing stringent quality clearance standards for domestic manufacturing of RE products and components.

The buildings sector has considerable scope for efficiency improvements. Progress towards green buildings could be accelerated by making Green rating mandatory. The Government of India (GoI) has acknowledged the Green Buildings Rating System, Green Rating for Integrated Habitat Assessment (GRIHA), as India's own rating system in its Intended Nationally Determined Contributions (INDC) document submitted to the United Nations Framework Convention on Climate Change (UNFCCC) and, as per several mandates issued by GoI, minimum GRIHA 3-star rating for government and PSU buildings is a norm. Green rating as per GRIHA could also be mandated for the corporate sector, which would ensure mandatory incorporation of requirements of Energy Conservation Building Code (ECBC) in the buildings of corporate sector, in addition to their meeting other requirements of green

buildings. Facilitating deep retrofits through ESCOs by developing suitable financing options and implementing energy efficiency retrofits can reduce energy consumption in existing buildings (estimated at up to 35 per cent energy saving through suitable retrofits). Measures such as mandatory energy reporting for the buildings sector would not only enable transparency but also performance evaluation and improvement. Further, a thrust towards upscaling R&D efforts by providing dedicated funds for innovative research could prove helpful, especially in domains such as the Smart Cities initiative.

Similarly, in the transport sector, ensuring a conducive policy environment that facilitates further involvement of private investment in manufacturing, rolling stock, operations, construction and use of IT-enabled services for improving efficiencies is required. Corporates also need to be able to play a bigger role in enhancing the use and adoption of alternative fuels and increasing electrification of the transport sector.

Apart from the energy sector, corporates have an important role to play in the waste sector. Maximising resource and energy recovery from waste would reduce landfilling footprint across cities and address the problem of land availability for identifying suitable waste disposal sites to a great extent. It would also help local governments reduce GHG emissions currently attributed to the waste sector in an efficient manner. Engaging the corporates in partnerships and providing a platform to join hands in helping the Government in its development agenda can be mutually rewarding. Incentivizing such partnerships may be possible by allowing better cost recovery on waste management services to attract private financing and technical know-how; having regulated targets for waste minimisation, reuse, recycling and required targets for virgin materials displacement in production inputs; putting in place regulation relevant to the waste management "market", i.e. permitting/licensing requirements for waste handling, storage, treatment and final disposal; and recycled materials standards; facilities standards, including pollution control technologies; and improving the financial viability of waste-to-energy projects, rationalising feed-in tariffs, and making it mandatory for State Electricity Boards (SEBs) and Distribution Companies (Discoms) to compulsorily buy power generated by the waste-to-energy plants.

The water sector is another crucial sector where corporates can play an important role in improving efficiencies. Several challenges remain and some of the crucial elements that should be appropriately addressed include the establishment of standards and benchmarks for industry specific water consumption. Setting benchmarks based on capacities, type of industry, technical and economic feasibility, preceded by extensive water audits, could enhance water use efficiency and water conservation objectives. Policies for promoting and incentivizing water use efficiency and water conservation with effective incentive and disincentive mechanisms with identified targets (e.g. percentage reduction in Specific Water Consumption (SWC), net water positive or water neutral, zero discharge, volume or percentage of wastewater reuse/recycle, etc.) could help in significantly reducing industrial water footprint involving the industry and its value chain. Further, regular water audits should be made mandatory in order to identify losses/ wastage in the system and help optimization of water use in various processes along with recycle and reuse of process water and wastewater and associated co-benefits like energy savings, etc. Furthermore, encouraging information and data sharing on industrial water use and best practices in the public domain could also go a long way in promoting efficiency.

Reinforcing India's Commitment on Climate Change

Corporate Partners

Champion Partner

YES BANK Limited

YES BANK, India's fifth largest private sector Bank with a pan India presence across all 29 states and 7 Union Territories of India, headquartered in the Lower Parel Innovation District (LPID) of Mumbai, is the outcome of the professional & entrepreneurial commitment of its Founder Rana Kapoor and its Top Management team, to establish a high quality, customer centric, service driven, private Indian Bank catering to the future businesses of India. YES BANK has adopted international best practices, the highest standards of service quality and operational excellence, and offers comprehensive banking and financial solutions to all its valued customers. YES BANK has a knowledge driven approach to banking, and offers a superior customer experience for its retail, corporate and emerging corporate banking clients. YES BANK is steadily evolving as the Professionals' Bank of India with the long term mission of "Building the Finest Quality Large Bank of the World in India" by 2020.

Lead Partners

GAIL (India) Limited

With a turnover of ₹ 56,569 crores, GAIL (India) Ltd. stands tall as youngest Maharatna company of the nation. Being India's largest natural gas company ranks top gas utility in Asia. As an integrated energy major, GAIL owns around 11,000 Km Gas Pipelines, 2040 Km LPG Pipelines, seven gas processing plants of 1.4 MMTPA LPG / Liquid Hydrocarbons capacity and gas based petrochemical plant of 410,000 TPA polymer capacity. GAIL is a pioneer in City Gas Distribution business with 8 JVs and a subsidiary GAIL Gas Ltd. GAIL has also diversified into solar and wind power generation with installed capacity of 123 MW. Its international impression towards long term business goal has led to set up a wholly- owned subsidiary company viz. GAIL Global (Singapore) Pte. Ltd. at Singapore & GAIL Global (USA) Inc. at Texas, USA towards sourcing LNG import, petrochemicals trading and overseas investments.

Tata Group

The Tata group comprises over 100 operating companies in seven business sectors: information technology and communications, engineering, materials, energy, chemicals, services and consumer products. The group has operations in more than 100 countries across six continents, and its products and services are available in over 150 countries. The total revenue of Tata companies was $ 96.8 billion in 2012-13, with 63 per cent of this coming from business outside India. The Tata name has been respected in India for more than 140 years of its adherence to strong values and business ethics. Going forward, Tata continues to focus in new technologies and innovation to drive its business.

Co – Associate

Ingersoll Rand

Ingersoll Rand (NYSE:IR) advances the quality of life by creating comfortable, sustainable, and efficient environments. Our people and our family of brands—including Club Car®, Ingersoll Rand®, Thermo King®, and Trane®—work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. Ingersoll Rand products range from complete compressed air systems, tools and pumps to material and fluid handling systems. In India, Ingersoll Rand has been present for nearly 100 years now. The organization is committed to India and is implementing strategies for product innovation and design for Industrial Technologies, Food Safety, Energy Efficiency, and Sustainability. The company is based out of 18 locations in the country with three world-class manufacturing facilities at Chennai, Naroda, and Sahibabad; and two Engineering and Technology Centres at Bengaluru and Chennai.

Subscriber

BMW Group

The BMW Group has its sights set firmly on the premium sector of the Indian automobile market with its three brands— BMW, MINI, and Rolls-Royce. BMW India : Headquartered in Gurgaon, BMW India is a 100 per cent subsidiary of the BMW Group. BMW Financial Services India is a 100 per cent subsidiary of the BMW Group and operates with three business lines—Retail Finance, Commercial Finance, and Insurance Solutions (through cooperation partners). The BMW Group is one of the most successful manufacturers of automobiles and motorcycles in the world. The success of the BMW Group has always been built on long-term thinking and responsible action. Sustainability is firmly embedded in the BMW Group's culture and corporate strategy. The company has therefore established ecological and social sustainability throughout the value chain, comprehensive product responsibility, and a clear commitment to conserving resources as an integral part of its strategy.

DNV – GL

Driven by our purpose of safeguarding life, property, and the environment, DNV GL enables organizations to advance the safety and sustainability of their businesses. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Combining leading technical and operational expertise, risk

methodology, and in-depth industry knowledge, we empower our customers' decisions and actions with trust and confidence. We continuously invest in research and collaborative innovation to provide customers and society with operational and technological foresight. Although we began our journey in 1864, our reach is global. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping customers make the world safer, smarter, and greener.

Gujarat Energy Development Agency (GEDA)

Gujarat Energy Development Agency (GEDA) is one of the premier organizations in the field of renewable energy development and energy conservation in India. It is the State Nodal Agency (SNA) for the Ministry of New and Renewable Energy Sources (MNRE) and the State Designated Agency (SDA) for Bureau of Energy Efficiency (BEE) for the State of Gujarat. GEDA has played an important role in making the renewable energy and energy efficient technologies economically and commercially viable and making Gujarat a leader in this sector. GEDA is working in nonconventional energy sector since 1979. GEDA has been conferred more than 30 National awards in the last few years. It has pioneered policy for harnessing Solar Energy and made Gujarat the No. 1 state in Solar Power. The Solar Park of Gujarat has the capacity to generate 590 MW of Solar Power and 100 MW of Wind Power, making it the biggest solar-wind hybrid park in the world.

Dalmia Cement (Bharat) Limited

Dalmia Cement (Bharat) Limited is a subsidiary of Dalmia Bharat Limited (DBL). Dalmia Bharat Group is amongst top five cement producer in India with total installed capacity of 24 million tons. We are pioneers and market leader in India for super specialty cements used for oil wells, railway sleepers and air strips. Dalmia Bharat group has been in existence for more than 75 years with well diversified geographical presence in India. Dalmia helped Indian railways by developing cement concrete sleepers to replace wood in 1974 when the term sustainability was largely unknown in the Indian subcontinent. Dalmia group is the largest producer of Portland Slag Cement in India and we are using alternative fuels and raw materials to reduce our carbon footprint for a sustainable business case.

Hitachi India

Hitachi started its business in India in the 1930's. Currently, Hitachi has 30 business bases and over 10,000 employees in India. In addition to being a leader in construction machinery and air-conditioning systems, the Hitachi Group in India is expanding on its 'Social Innovation Business', such as information & telecommunication systems, power systems, industrial, transportation and urban development systems. Together with further localization, Hitachi aims to contribute to a sustainable society in India as well as the country's economic growth.

Tata Chemicals Limited

Tata Chemicals Limited is a global company with interests in businesses that focus on LIFE: Living, Industry and Farm Essentials. It is the pioneer and market leader in India's branded Iodised salt segment. With the introduction of an innovative, low-cost, nanotechnology-based water purifier, it is providing affordable, safe drinking water to the masses. It is the world's second largest producer of soda ash with manufacturing facilities in Asia, Europe, Africa and North America. The company's industry essentials product range provides key ingredients to some of the world's largest manufacturers of glass, detergents and other industrial products. With its farm essentials portfolio the company has carved a niche in India as a crop nutrients provider. It is a leading manufacturer of urea and phosphatic, fertilisers and, through its subsidiary, Rallis, has a strong position in the crop protection business.

Tata Steel

Tata Steel, the flagship company of the Tata Group, has a crude steel production capacity of nearly 30 MnTPA. A Fortune 500 company, the Tata Steel Group is the world's second-most geographically diversified steel producer, employing over 80,000 people in nearly 50 countries. The Group's Vision is to be the world steel industry benchmark in "Value Creation" and "Corporate Citizenship" through the excellence of its people, its innovative approach and overall conduct. The Tata Steel Group recorded a turnover of US$ 22.32 bn in the year ended March 31, 2015. Tata Steel's global journey began with the aim of achieving a larger geographic footprint and to service a global customer base, including the mature markets of UK and Europe and the fast-growing markets in South East Asia and China. Apart from its Indian operations, the Tata Steel Group today comprises mainly its European operations through Tata Steel Europe and its South-East Asian operations through Tata Steel Thailand and Natsteel

Special Partner

We Mean Business

We Mean Business is a coalition of organizations working with thousands of the world's most influential businesses and investors. These businesses recognize that the transition to a low carbon economy is the only way to secure sustainable economic growth and prosperity for all. To accelerate this transition, we have formed a common platform to amplify the business voice, catalyze bold climate action by all, and promote smart policy frameworks.

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TATA CHEMICALS

TATA
TATA CONSULTANCY SERVICES

TATA
TATA POWER SOLAR

VERSA DRIVES

WAAREE
One with the Sun

WELSPUN
Dare to Commit
Renewables

YES BANK

Visit TERI CBS website for full version of the case studies.

teri | Council for Business Sustainability

TERI Council for Business Sustaintability (TERI CBS) is an independent and credible platform for corporate leaders to address issues related to sustainable development and promote leadership in environmental management, social responsibility, and economic performance (the triple bottom line). With a vision to create synergy for the corporate sector to move towards sustainability, TERI CBS was setup by The Energy and Resources Institute (TERI) in 2001. Presently, the network has more than 100 corporate members across India representing a varied section of Indian industry. Subject experts from these member corporates identify and conceptualize projects and a team of industry members and TERI researchers then work to develop appropriate solutions and strategies for use by the industry. We connect companies, partners, stakeholders and government organizations to address issues and opportunities among sectors and in supply chains. We emphasize on responsible and profitable solutions for corporates with our expertise and experience at TERI CBS.

TERI CBS empowers corporates with the requisite to identify sustainability issues essential to their organization, decipher the approach to address the issues, guides you to operationalize the approach and assists you to report your achievements. TERI CBS provide expert guidance in the field of Co-Creating, Business Solutions, Sustainability Advisory Services, Training and Capacity-Building, Business Responsibility and Transparency, and Policy Advocacy.

OUR INITIATIVES

Energy CHAPTER

CSO Forum 2013-2014 Chief Sustainability Officers'

INDIA GHG PROGRAM

Energy Chapter

The "TERI CBS Energy Chapter" is an effort to provide a collaborative platform for various stakeholders to create a larger impact. The Energy Chapter brings together stakeholders representing the energy value chain and influencing energy demand, including energy producers, bulk consumers, and technology providers. The Chapter envisages creating economically viable and technologically proven solutions that can be adopted by industry and community and cater to grid supported larger demand as well as distributed off-grid energy access. The Energy Chapter is established with the vision of supporting India's twofold energy security agenda through supply management by mainstreaming and increasing the clean energy share in energy mix use by commercially viable new and renewable energy (RE) sources. Additionally, the Energy Chapter also provides solutions for energy demand management with incremental energy efficiency (EE) through commercially viable and business-justifiable solutions.

The mission of the Energy Chapter is to

- Create awareness and a capacity building platform for EE and RE technologies.
- Offer an industry-led platform to stakeholders of energy sector for collaboration.
- Identify and showcase medium- and long-term business-justifiable EE and RE technology deployment.
- Help develop grid and off-grid RE at scale.
- Encourage technology innovation and implementable solution creation (EE and RE).
- Engage with policy makers to address policy gaps and barriers in a constructive environment.

The Energy Chapter is guided by a special steering committee that comprises representatives from leading corporates of India representing the complete energy value chain.

Co Chairs

NTPC A Maharatna Company

WELSPUN Renewables Dare to Commit

Steering Committee

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To know more about the TERI CBS Energy Chapter activities, visit us at:
http://cbs.teriin.org/energychapter.php

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