THE ENVIRONMENT MANAGEMENT

20 Years

Indian Institute of Environment Management
SIES
RISE WITH EDUCATION

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A Quarterly E- Magazine on Environment and Sustainable Development

(For private circulation only)

Vol.: VI | January – March, 2020 | Issue: 1

Current Issue: Zero Carbon Emission by 2050: Challenges and Future Prospects

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From Director's Desk

We are very happy to release Volume VI: Issue 1 of The Environment Management, a quarterly newsletter on the theme 'Zero Carbon Emission by 2050: Challenges and future opportunities'. Intergovernmental Panel on Climate Change (IPCC) in 2018 advocated that for keeping climate change within safe boundaries, global emissions need to fall to zero within the next three decades. So, just how far have we got to go? Many countries have already taken a pledge to become Net Zero Carbon country but it is a daunting task that requires judicious planning, implementation of activities and strong economic commitments. India is aspiring to become a developed nation and is the third largest emitter of Greenhouse Gases (GHG). With second highest population and fastest growing economy, cutting emissions to zero will be a herculean task for India.

The current issue of newsletter commemorates - 20 years of SIES Indian Institute of Environment Management as a prominent R&D and Academic institute in the areas of sustainable environment management. The institute is recognized as a research centre in Environmental Sciences under University of Mumbai. The institute has successfully developed and propagated several technologies in the areas of sustainable conservation and management of resources, waste management, climate change vulnerability assessment, identification of adaptive and mitigation strategies with support of international, and national funding agencies, industries and other outreach institutions. Many alumnus of institute are highly placed as leaders in the areas of environment management and sustainability. We are marching forward with aim to be a premier Research, Academic and Training institute in Environment Management, to serve as a valuable resource for Industry and Society; and scale up as a Policy and Advocacy centre for government agencies.

The articles presented in the current issue are covering different aspects of GHG emission management and accounting.

We wish you a happy reading and safe home stay during Corona Pandemic.

Dr. Seema Mishra

Carbon Neutrality – A Case Study of KOEL, Kagal

Pravin Jadhav
RSM GC Advisory Services Pvt. Ltd.

Introduction

The global climate extreme events and increasing awareness on the business sustainability among the investors to customers call for real and measurable actions from the Corporations. The school strikes globally led by Greta Thunberg show the awareness on these issues. The failure to reach consensus at the recently concluded UN Climate Conference, COP25 in Madrid puts further emphasis on the non-state actors, importantly the Industry, which contribute significantly to the greenhouse gas (GHG) emissions.

Kirloskar Oil Engines Limited (KOEL or the Company) is a leading engineering conglomeratemanufacturing internal combustion engines, generating sets and parts, which are used for various applications, such as agriculture, industrial, stationery power plants and construction equipment.KOEL has a nation-wide network of operations that delivers high-quality products. It has advanced manufacturing units in India at Pune, Nashik, Rajkot and Kolhapur plants. Their state-of-the-art manufacturing facilities ensure that KOEL are manufactured in an optimized and eco-friendly manner.

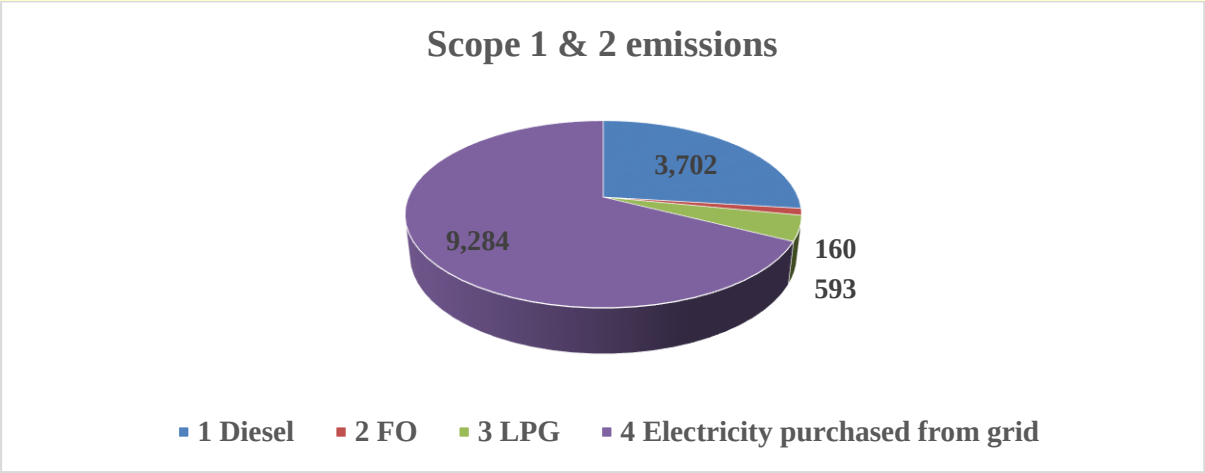
KOEL's manufacturing plant at Kagal is the biggest among its manufacturing facilities. Manufacturing facility is a state-of the-art plant, spread over a massive expanse of 163acres in a 5-star MIDC complex near Kolhapur, Maharashtra. This plant has been certified by IMS (QMS, EMS & OHSAS), for best of quality management, environment protection, health and safety practices. Complete range of KOEL Green Genset engines are manufactured at integrated Kagal facility. In 2018, the plant was awarded 'GreenCo Gold certification' by CII, and it is a manifestation of KOEL's commitment to environment and sustainability.

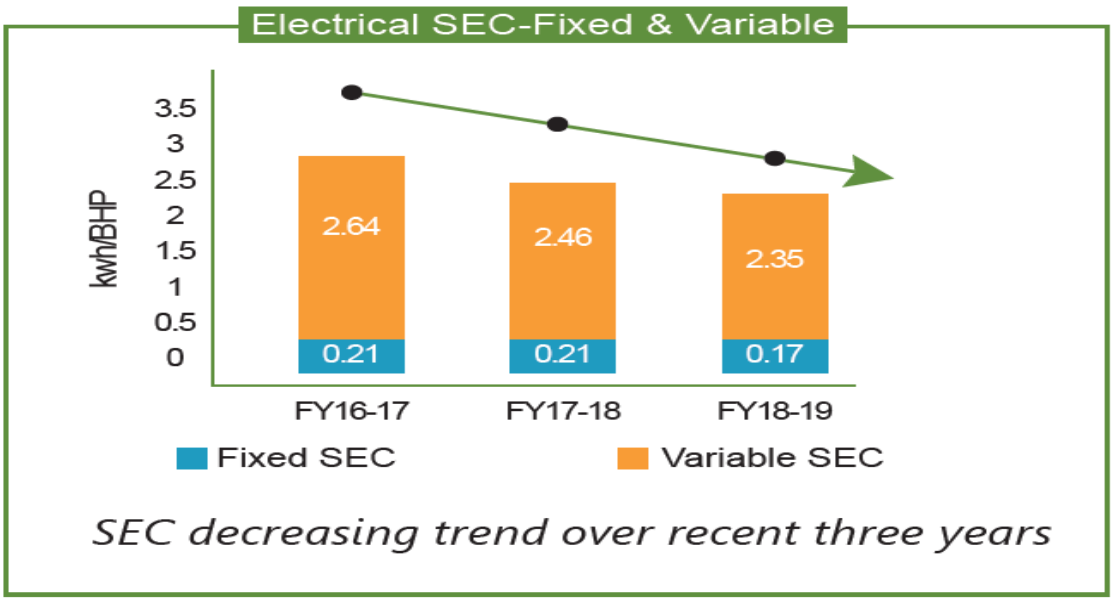
Energy consumption at Kagal

The various manufacturing processes, engine and DG set testing, utilities, admin and allied services require energy. The plant had following source wise energy mix in 2018-19.

This energy consumption is after years of investment into various energy efficient projects, track record of many years of national and state level energy efficiency awards. In total energy mix, the highest energy contribution comes from HSD. HSD is used mostly in the testing of DG sets as part of QC and efforts are underway to optimize the testing process to meet the stringent QC requirements. Due to various product mixes, sizes and Endurance pump witness testing demanded by customers' uniformity was not maintained to compare SEC. Hence, SEC will be compared based on BHP of production. Even though 90% Increase in load over base load, Electrical SEC was reduced by 11% with respect to FY16-17.

Source wise energy mix in 2018-19				
S.N.	Source	Consumption	Energy in GJ	% in total energy mix
1	National grid (via MSEDCL)	11,322 MWh	40,760.05	32
2	Renewable energy (captive solar, open access)	6,646 MWh	23,924.92	18.8
3	HSD	1,440 kl	52,210.78	40.9
4	LPG	202 ton	10,594.46	8.3
5	FO	50.37 kl	1,830	<1
6	Biogas	5,585 m^3	43.03	<1
7	Solar water heaters in canteen	19,558 kg steam	0.02	<1





Energy management at Kagal

Due to various product mixes, sizes and Endurance pump witness testing demanded by customers' uniformity was not maintained to

KOEL has undertaken various activities as part of the Climate Stewardship initiative[1]. The Climate Stewardship initiatives including targets relating to KOEL's carbon footprint reduction over time. Much before the energy efficiency was emphasized in organized industry forums, KOEL has been organizing the K Group level ENCON (short for the Energy Conservation) Awards, within its group companies.

KOEL has also been implementing energy conservation and participating in many national and state level awards. KOEL has been also publishing its sustainability reports from 2010-11.

Carbon Neutrality for 2018-19:

Publically Available Specifications, PAS 2060[2] by BSI, 'Specification for the demonstration of carbon neutrality' was used to declare a Qualifying Explanatory Statement in consultation with RSM GC Advisory Services. RINA Services S.p.A. has provided independent assurance for the same.

Scope	Emission sources
Scope 1	Fuel used in DG sets
	Fuel used in DG and Engine testing
	Fuel used in core baking process
	Fuel used in company owned vehicles
	Fuel used in company owned vehicles
	Fuel used in canteen
Scope 2	Electricity purchased from grid
Scope 3	

Transport and Distribution (Upstream)	Employee commuting (daily to office)	Yes
	Business travel	Yes
	Transportation of purchased materials or goods	No
	Transportation of sold products	No

Investment / leased assets / franchise	NA
Waste generated in operations	No
Electricity use by office equipment and computers (T&D losses)	Yes
Upstream leased assets (LPG used in canteens, in leased space)	Yes
Capital goods (office equipment and computers)	No
Purchase goods and services	No
In use and end of life	No
End of life and disposal	No
Downstream leased assets	NA
Processing of sold products	NA

Carbon Offsets:

KOEL has decided to offset the carbon footprint (after internal emission reduction measures

[1]A material indicator in the sustainability reporting journey from 2014-16 report

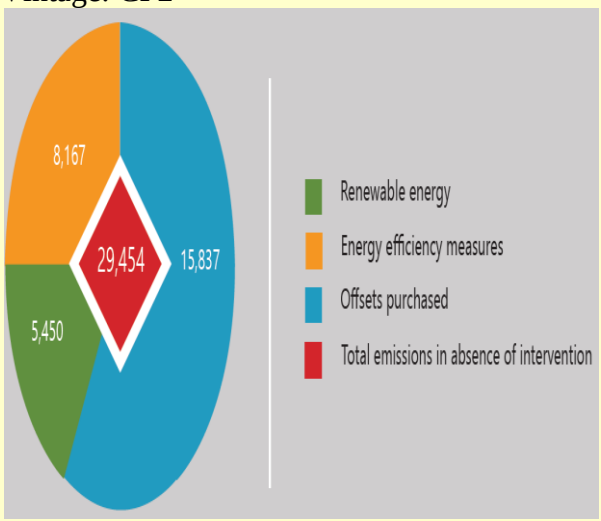
[2]https://www.bsigroup.com/en-IN/PAS-2060-Carbon-Neutrality/

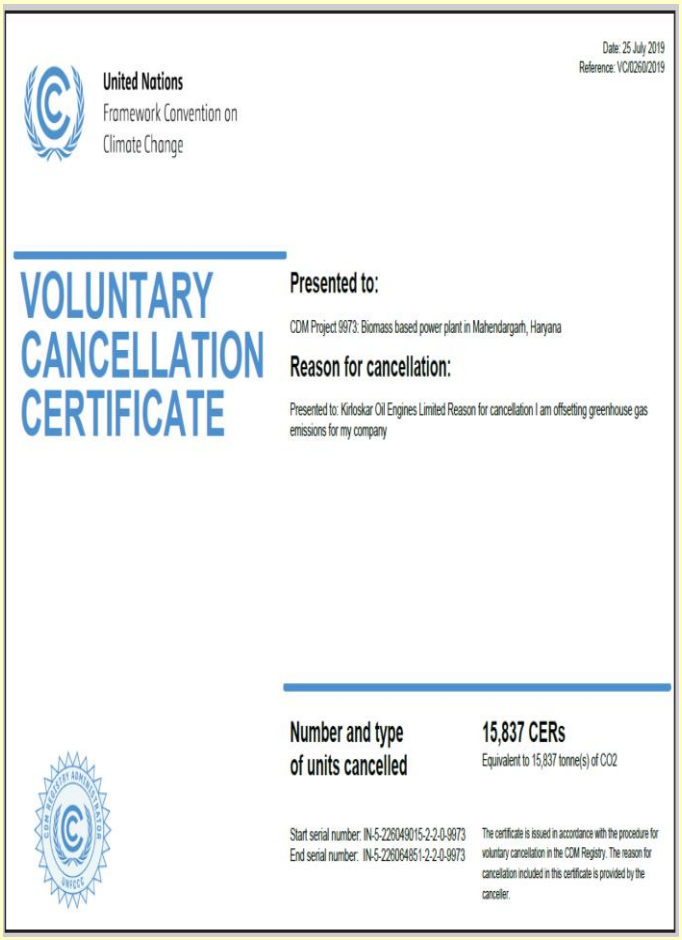
through energy efficiency and renewable energy) of FY 2018-19 by purchasing certified emission reductions from United Nations Framework on Climate Change (UNFCCC) issued projects. The emissions offsets are purchased from following project.

UNFCCC Reference Number: 9973

Serial number: NA

Vintage: CP2





Date: 25 July 2019
Reference: VC/0260/2019

United Nations
Framework Convention on
Climate Change

VOLUNTARY CANCELLATION CERTIFICATE

Presented to:

CDM Project 9973: Biomass based power plant in Mahendargarh, Haryana

Reason for cancellation:

Presented to: Kirloskar Oil Engines Limited Reason for cancellation I am offsetting greenhouse gas emissions for my company

Number and type of units cancelled

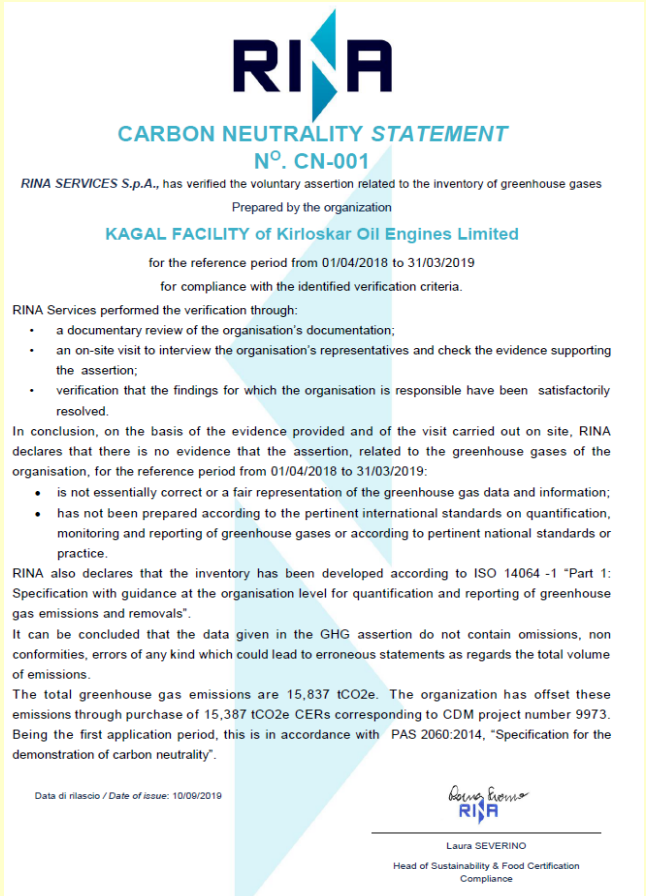
15,837 CERs

Equivalent to 15,837 tonne(s) of CO2

Start serial number: IN-5-226049015-2-2-0-9973
End serial number: IN-5-226064851-2-2-0-9973

The certificate is issued in accordance with the procedure for voluntary cancellation in the CDM Registry. The reason for cancellation included in this certificate is provided by the canceller.

Independent Assurance of the Carbon Neutrality



RINA

CARBON NEUTRALITY *STATEMENT*
N°. CN-001

RINA SERVICES S.p.A., has verified the voluntary assertion related to the inventory of greenhouse gases
Prepared by the organization

KAGAL FACILITY of Kirloskar Oil Engines Limited

for the reference period from 01/04/2018 to 31/03/2019
for compliance with the identified verification criteria.

RINA Services performed the verification through:

- a documentary review of the organisation's documentation;
- an on-site visit to interview the organisation's representatives and check the evidence supporting the assertion;
- verification that the findings for which the organisation is responsible have been satisfactorily resolved.

In conclusion, on the basis of the evidence provided and of the visit carried out on site, RINA declares that there is no evidence that the assertion, related to the greenhouse gases of the organisation, for the reference period from 01/04/2018 to 31/03/2019:

- is not essentially correct or a fair representation of the greenhouse gas data and information;
- has not been prepared according to the pertinent international standards on quantification, monitoring and reporting of greenhouse gases or according to pertinent national standards or practice.

RINA also declares that the inventory has been developed according to ISO 14064 -1 "Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals".

It can be concluded that the data given in the GHG assertion do not contain omissions, non conformities, errors of any kind which could lead to erroneous statements as regards the total volume of emissions.

The total greenhouse gas emissions are 15,837 tCO2e. The organization has offset these emissions through purchase of 15,387 tCO2e CERs corresponding to CDM project number 9973. Being the first application period, this is in accordance with PAS 2060:2014, "Specification for the demonstration of carbon neutrality".

Data di rilascio / *Date of issue*: 10/09/2019

RINA

Laura SEVERINO

Head of Sustainability & Food Certification Compliance

Glimpses of 20 Remarkable Years of SIES IIEM

Establishment of institute in February, 2000

Inauguration by Prof. N. C. Nigam, Chairman, AICTE in 2000

Visit of Justice V. R. Krishna Iyer

Students of PGDEM (2000-2002 batch)

Visit of Dr. R. A. Mashelkar, DG, CSIR in 2001

A view of Laboratory

Industrial visit of students

Monitoring of R&D project activities by Dr. Vimal Kumar, Head, Fly Ash Unit, DST, GoI

Journey To Cover Untapped Horizons….

Technology generation and upgradation for resource and environment management

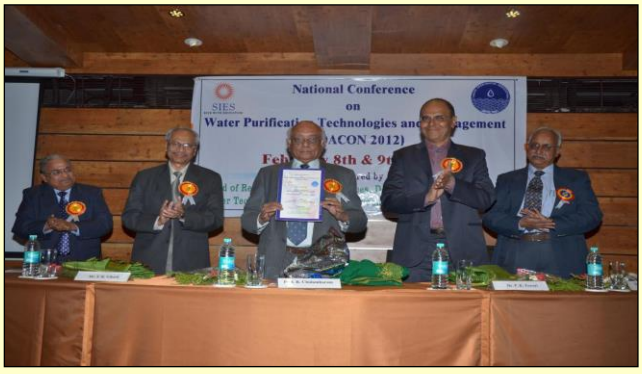
Field trials of technonology for optimization and upscaling

Technology demonstration to farmers for adoption

Sensitization drive for stakeholders

Training of officials of ULB on Solid Waste Management Rules, 2016

Clenliness drive with NMMC



Inauguration of National Conference on Water Purification Technologies by Dr. R. Chidambaram

Inauguration of International Conference on Environment Management and Sustainability by Dr. Rajendra Singh

Internal Carbon Pricing

Mr. Ashish Gupta, Chief Manager HSSE,
Baharat Petroleum Corporate Limited

Carbon pricing includes a range of tools that help us drive decarbonisation in a fair way, providing financial incentives to transition to low-carbon alternatives. Carbon pricing acknowledges the costs to society that carbon emissions create in the form of climate change, air pollution, and other adverse effects (sometimes called "externalities"). Governments implement carbon pricing in two key ways - through carbon taxes or through cap-and-trade or emissions trading systems.

Internal carbon pricing is a decision-making tool that companies use to understand their exposure to external carbon pricing schemes and guide their business decisions and investments. An internal price places a monetary value on greenhouse gas emissions, which businesses can then factor into investment decisions and business operations. Companies say that internal carbon pricing gives them an incentive to shift investments to low-carbon alternatives.

Companies use internal carbon pricing as a strategy to manage climate-related business risks and prepare for a transition to a low-carbon economy. Some sectors such as oil and gas, minerals and mining, and electric power have been using internal carbon pricing as part of their risk mitigation strategy since the 1990s. Some companies use internal pricing to help them prepare for future policies restricting carbon emissions.

According to 2016 disclosures to CDP (formerly the Carbon Disclosure Project), more than 1,200 companies worldwide are either pursuing internal carbon pricing or preparing to do so. While most of those companies are based in North America and Europe, the sharpest increase is in emerging economies, including India, Brazil, Mexico, and China.Internal carbon pricing can help companies advance greenhouse gas reduction targets, build resilient supply chains, gain a competitive edge, and showcase corporate responsibility and leadership.

Through the carbon action initiatives, investors are urging companiesto move beyond disclosure by taking three specific actions in response to climate change:

- **Make emissions reductions;**
- **Disclose emissions reduction targets publicly; and**
- **Invest in emissions reduction projects with a positive return.**

Thus, it has become more important than ever for organizations to not only disclose but also commit to actions that can lead to measurable

positive impacts. Setting an internal carbon price helps companies address climate risk and chart pathways to emissions reduction (ER) activities. While, levying a carbon fee on polluting business units, generates a separate fund to support climate actions, a shadow price on internal carbon emissions, can accuratelyassess the returns on low carbon projects. Companies thereby can select projects which give them maximum returns on their investment.

As on October 8th, 2017, 167 Parties have ratified the Paris Agreement, agreeing to limit global average temperature rise to well below 2°C compared with pre-industrial levels. According to a World Bank study, 101 governments plan to use carbon pricing andother market mechanisms to achieve theiremissions reduction goals. The study notesthat it is 32% cheaper to achieve NDCs withinternational trading.

Carbon Pricing Policy Developments

The EU ETS, (European Union Emissions TradingSystem)set up in 2005, is the world's first and biggest trading system, accounting for over three-quarters of international carbon trading. By putting a price on carbon, it placed climate change on the agenda of companyboards across Europe, as well as multinationals around the world. Many regions have followed suit like China.

The Government of Canada in December 2016 launched the Pan-CanadianFramework on Clean Growth and Climate Change, pricing carbon pollution being central to the framework. British Columbia, Alberta, Ontario and Québec have already introduced carbon pricing systems. The federal option willapply in provinces without a provincial carbon pollution pricing system in place in 2018. At the same time, Mexico seeks to implement the first Latin American ETS. Mexico already has a carbon tax on fossil fuel use and in August 2016, it signed a cooperation agreement to implement a voluntary ETS simulation for 60 major companies in thepower generation, manufacturing, and transport sector, and also a joint declaration on carbon markets collaboration with Québec and Ontario.

The ETS simulation is creating public awareness and preparedness for a national level ETS to be launched in 2018. Additionally, Chile and Colombia have also introduced carbon taxes, albeit with differentattributes. The recent development on this front is the signing of the Cali Declaration at the Presidential Summit of Pacific Alliance countries of Chile, Colombia, Mexico and Peru, held in June 2017. This declaration seeks to strengthen regional climate action and cooperation towards a common regional carbon market.

India has implemented two types of policy instruments over the years which encompass domestic market mechanisms such as the renewable energy certificates markets (REC) and energy efficiency certificate markets

(PAT), and carbon pricing policies such as carbon tax in the form of coal cess which has grown from ₹50 a few years ago to ₹400 in 2016.The challenge now is to link such domestic measures, as well as the potential for linking with global carbon markets.

India's NDC

Out of eight Nationally Determined Contributions (NDCs) ratified by India, there are three key quantifiable goals on climate change mitigation and adaptation, namely:

- **Reduce the emissions intensity of its GDP by 33 to 35% by 2030 relative to 2005 levels;**
- **Achieve about 40% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030;**
- **Create an additional carbon sink of 2.5 to 3 billion tons of CO_2 equivalent through additional forest and tree cover by 2030;**

In order to achieve these goals, India proposes a host of measures, including deepening and broadening the scope of its existing policies. In addition, India seeks support in the form of technology transfer and low cost climate finance, from international parties as well as sources, such as the Green Climate Fund (GCF).As of now, India has not established either an explicit domestic carbon pricing policy or emission trading market. However, the two types of policy instruments implemented over the years, are:

- Domestic Market Mechanisms, such as the Renewable Energy Certificates Markets (REC) Energy efficiency certificate markets (PAT),
- Carbon pricing policies, such as carbon tax in the form of coal cess.

Relevance of Deploying Internal Carbon Pricing Mechanism by Companies

With an increasing domestic policy push on renewable energy and rising fuel levies, as well as India's NDC goal of emission intensity reduction, companies are exploring tools – such as voluntarily applying an "internal" carbon price – to address risks and opportunities related to climate change policies. In addition, India Inc. is increasingly looking atcarbon pricing as a good tool to make their investments future proof. An internal carbon pricing strategy could potentially accelerate the deployment of capital intensive low-carbon technology projects.

India estimates that at least USD 2.5 trillion (at 2014-15 prices) will be required for meeting India's climate change actions between now and 2030. While majority of climate mitigation actions can be made possible through support from international climate finance, a domestic carbon market mechanism can play a significant role in helping incentivize low carbon initiatives,

reducing abatement costs and meeting NDCs goals in a self-sustained environment.

In the Indian context, both voluntary and regulatory mitigation frameworks could play an important role in nation's low carbon development path. An internal carbon price can help in achieving emissions reductions and reducing investment related risks on low-carbon projects for companies that have taken up voluntary emission reduction targets. Similarly, companies participating in market based schemes (PAT and RPO) can leverage their actions using an internal carbon pricing metric and creating a new credit line (virtual or real) that can be tapped for implementation of low-carbon energy efficient projects.

The TCFD (Task Force on Climate-related Financial Disclosures) **defines an internal carbon price as "an internally developed estimated cost of carbon emissions." Internal carbon pricing can be used as a planning tool to help identify revenue opportunities and risks, as an incentive to drive energyefficiencies to reduce costs, and to guide capital investment decisions.**

Internal carbon pricing has emerged as a powerful approach to assessing and managing carbon-related risks and opportunities that may arise with the transition to a low-carbon economy. For many organizations, the most significant impacts of these risks will emergeover time and their magnitude is uncertain.

How Companies are responding -

Over the past few years, CDP has been tracking a steady increase in the number of companies embedding an internal carbon price into their business strategies. In 2014, 150 global companies were using internal carbon pricing to assess and manage carbon-related risks. This information was new to the marketplace and the trend has increased annually at a remarkable rate, with over 600 companies having an internal price on carbon in 2017.In India too, there is an impressive growth in the adoption of carbon pricing by companies: from 2 companies in 2015 to 14 companies in 2017 and 34 in 2019.

Internal Carbon Pricing – Emerging Best Practice

Companies, across all industries and geographies, have identified internal carbon pricing as an approach to building prudent buffers into their business models in preparation for a carbon-constrained future. The most sought-after benefits are that a company can use internal carbon pricing both as risk management tool and as part of its de carbonisation strategy. In many cases, companies report multiple objectives for using an ICP – particularly as internal and external developments occur that require a readjustment of the ICP approach to maximize its effectiveness. Table 1 shows the three common purposes for implementing internal carbon pricing and the associated objectives/outcomes.

1) Manage risks: Companies internalize the existing, expected or potential price of carbon— from an ETS, carbon tax, or implicit carbon pricing policy—to assess its risk exposure to regulations that affect the cost of emitting CO2e.

Purpose	Potential Objectives/Outcomes
Tool to assess and manage carbon-related risks	- Assess risk exposure - Inform strategic response and future-proof assets and investments against regulatory risk, including investment in new technologies or energy efficiency to decrease cost - Demonstrate management of risk to shareholders
Tool to identify carbon-related opportunities	- Reveal cost-cutting and resiliency investment opportunities throughout value chain - Change employee and supplier behaviour - Discover new market and revenue opportunities - Influence R&D investment decisions
Transition tool	- Align investment strategy with 2-degree scenario/align business with the Paris Agreement - Accelerate reduction of GHG emissions - Drive investment in energy efficiency initiatives, renewable energy procurement, R&D of low-carbon products/services - Generate revenue to re-invest in low-carbon activities

2) Reveal opportunities: Companies also use an internal carbon price as a tool to reveal potential opportunities that may emerge with the transition to the low-carbon economy. As policy and legal, market, technological and reputational factors shift, they also present opportunities for companies to seize. When used as a generic proxy in this way, an internal carbon price can help guide strategic decisions, such as low-carbon R&D to create the products and services of the future.

3) Transition Tool: A smaller number of organizations deliberately use an ICP to drive emissions reductions and incentivize support low-carbon activities – such as investments in energy efficiencies, clean energy, R&D of green products/services – in order to facilitate a company-wide low-carbon transition. This includes companies who utilize the voluntary carbon markets to offset their emissions, although increasingly the focus has been on driving down emissions within the company.

Scope of GHG Emissions Covered by the Internal Carbon Pricing Mechanism

Each company has both a unique GHG emissions profile and a unique decision-making process. In combination, these determine the degree of influence that

individual business units have over GHG emissions spread throughout the value chain. Examples of how different GHG emissions relate to different types of business decisions are provided in table

GHG Emissions	Examples of Relevant Decisions
Scope 1	Investment and production decisions
Scope 2	Energy purchasing decisions
Scope 3 upstream	Materials sourcing and procurement decisions
Scope 3 downstream	R&D decisions for innovative products for the current/future market

Carbon Price Level

Companies disclose a variety of approaches to determining an internal carbon price level(s) depending on the intended objective for its use as a tool. Due to competitiveness concerns, some companies do not disclose the actual price level(s) used; however, investors seek information which indicates the scale of the prices used, as well as the methodology used to determine the price. Common methodologies are outlined below:

Common Price Determination Methods[9]	
For Scenario Analysis/ Assessment of risk	For a Transition Tool that Drives Decarbonization
Based on price projections from existing or emerging carbon pricing regulations	Based on internal consultation (to determine price level needed to influence business decisions, or accelerate decarbonization)
Based on a benchmark against peers within a sector	Based on technical analyses of investment needed to achieve a specific climate-related objective (MAC curve)

The information on price levels can help aninvestor gauge the efficacy of a of the metric in terms of meetingits objectives, for example, an evolutionary price highlights that a company is planningsufficiently for the future. A framework and set of examples for the common types of pricingare outlined below.

- **Uniform pricing: a single price thatis applied throughout the company independent of geography, business unit or type of decision**
- **Differentiated pricing: a price that variesby region, business unit or type of decision**
- **Static pricing: a price that is constantover-time**

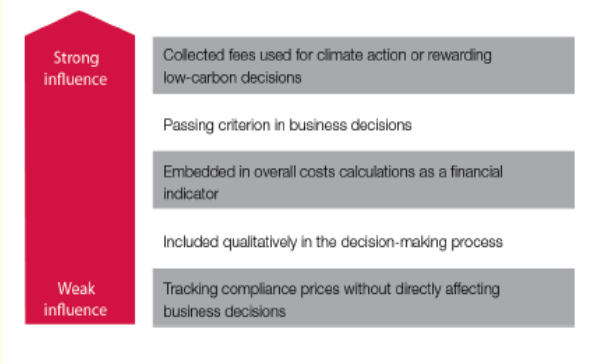
• **Evolutionary pricing: a price that develops over-time**

Business Application and Influence

An ICP mechanism can be integrated into a company's business decision-making process in a variety of ways. Each company has a unique application approach based on multiple factors, such as their internal corporate governance structure, emissions profile, position in the value chain and intended objective(s). In fact, some companies deploy multiple mechanisms within their organization to achieve distinctly different outcomes.

Assessing a company's ICP approach involves understanding how the tool is applied to business decisions, and the level of influence it has on the decision-making process (i.e. to what degree does a company enforce the use of the ICP). Commonly disclosed operational applications include:

- Capital expenditure decisions
- Operational decisions
- Procurement decisions
- Product and R&D decisions



Degrees of enforcement range significantly from including the ICP in cost calculations as a passive indicator to imposing it as a passing criterion in project decisions. Above figure shows examples of different applications of an internal carbon pricing mechanism and the associated level of influence on day-to-day business decisions. Popular 'types' of internal carbon pricing approaches have emerged in recent years and are commonly referenced in corporate disclosure. Definitions of the two are outlined below.

Shadow price: Most companies utilize a shadow price—attaching a hypothetical cost of carbon to each tone of CO2e—as a tool to reveal hidden risks and opportunities throughout its operations and supply chain and to support strategic decision-making related to future capital investments. Some companies with emissions reduction or renewable energy targets calculate their 'implicit carbon price' by dividing the cost of abatement/procurement by the tones of CO2e abated. This calculation helps quantifythe capital investments required to meetclimate-related targets and is as a benchmark for implementing amore strategic internal carbon price.

Internal fee: Internal fee mechanisms take this approach a step further by charging responsible business units for their carbon emissions. These programs frequently reinvest the collected revenue back into clean

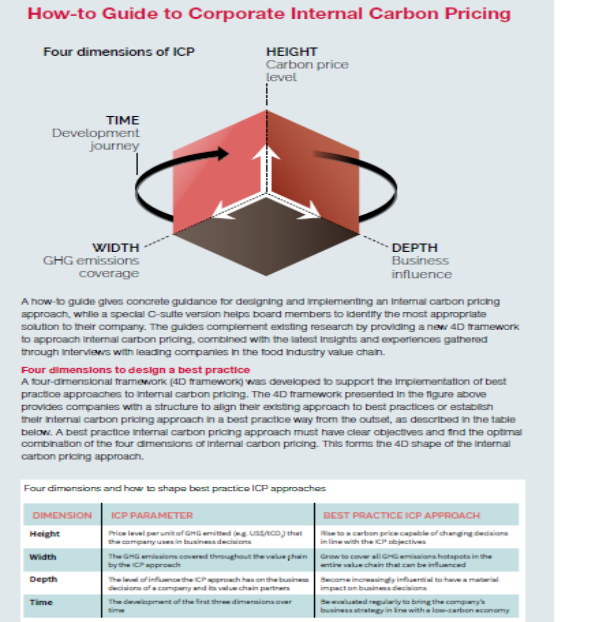
technologies and other activities that help transition the entire company to low-carbon

The combination of the type of pricing system used and the degree of influence it has can give a clear indication of the degree to whichit affects decision-making within the company, and therefore of its effectiveness in terms of achieving the outcome sought.

Tools for embedding aPrice- How to Design and Implement an ICP

ICP is a multifaceted tool that can support companies in identifying and acting on therisks and opportunities that accompany thistransition, However, the full potential of internalcarbon pricing is insufficiently embedded in the daily decision-making process of most companies. Based on findings from the Carbon Pricing Unlocked research partnership, Ecofys, a Navigant company, the GenerationFoundation and CDP published practical guidance to enable a wider use of best practiceapproaches to ICP globally.

The how-to guide provides step-by-step guidance for designing and implementing an ICP approach, while a special C-suite version helps board members to identify the most appropriate solution to their company. The guides complement existing research by providing a new 4D framework to approach ICP, combined with the latest insights andexperiences gathered through interviews with leading companies



There are many benefits and opportunities with setting up an internal price on carbon.

De-risk business and investments against future carbon pricing legislation - Under their commitments to the Paris Agreement, many governments are introducing various carbon pricing mechanisms to reduce emissions and meet their Nationally Determined Contributions. For companies to ensure long-term success, they will need to be prepared and well positioned to deal with these upcoming policies. Setting a price on carbon enables teams to test and assess the profitability of projects in different scenarios to make better decisions to future-proof their business. This can also serve to stimulate innovative ideas on how to best allocate capital to deliver higher returns in a low-carbon economy.

Answering to investors and consumers – awareness of the need for climate action is growing among consumers, and investors are

increasingly requiring disclosure of climate risk. Using an internal or shadow price on carbon can help you demonstrate to investors that you understand your exposure to future regulation. It shows your customers that you are ensuring that your future business is compatible with the ambition of the Paris Agreement.

Generate finance for cleaner alternatives + reducing emissions from a carbon fee – Going a step further and implementing a carbon fee can help companies generate the means to redistribute finance into energy efficiency initiatives that help minimize the business risks associated with climate change as well as helping to achieve the company´s GHG reduction targets.

It can be concluded that Carbon pricing is a critical tool in the global fight against climate change. A standardized mechanism to price carbon will enable business to recognize the cost of greenhouse gas emissions from their business activities, and thus catalyze industry-wide decarbonisation. Carbon Pricing Corridors provides financial institutions who are committed to climate action, an opportunity to integrate carbon pricing into investment decisions, optimize operational performance and mobilize finance towards a low carbon future.

References:

CDP Web Site

Green House Gas Protocol

Mr. Amit Darak,
Manager – Sustainability Services
KPMG India

Climate change impacts have been striking harder and more frequently than it was expected to by the climate scientists. The last five years were the warmest year on record, natural disasters have become frequents and intense. As the last few years witnessed unprecedented extreme weather throughout the world the global temperatures are on track to increase by at least 3°C towards the end of the century which is twice the temperature the countries had decided to achieve in the Paris agreement in order to avoid the most severe economic, social and environmental consequences. The near-term impacts of climate change add up to a planetary emergency that will include loss of life, social and geopolitical tensions and negative economic impacts. For the first time in the history of the Global Risks Report by the world economic forum, the environmental concerns dominate the top long-term risks by likelihood among members of the World Economic Forum's multi stakeholder community; three of the top five risks by impact are also environmental. "Failure of climate change mitigation and adaption" is the number one risk by impact and number two by likelihood over the next 10 years, according to their survey.

Industry-related greenhouse gas (GHG) emissions have continued to increase and are higher than GHG emissions from other end use sectors. A growing number of companies measure the greenhouse gas (GHG) emissions generated by their activity and assess their exposure to physical climate change impacts as well as changing market conditions and consumer preferences because of climate change. Increasingly, the assessment and management of actual and prospective climate change related impacts has become an important element of corporate strategy and risk management. At the same time, there is also an increasing demand from governments, investors and other stakeholders for corporate climate change-related information. Corporate greenhouse gas (GHG) footprint accounting is the first step in the management of climate performance. Decoding the GHG footprint of a company's value chain sets the base for developing a successful climate strategy for the company to avoid the climate related

business risks. The following questions can form the basis of a company's initiating steps towards GHG accounting:

"What is the climate impact of your business? How big is your organization's carbon footprint? How can you reduce emissions from your operations? Knowing your GHG footprint is important as it is the starting point for developing an effective corporate climate change strategy."

The Indian Prime Minister, Narendra Modi said that "each one of us has to discharge climate responsibilities based on our situations and capacities. I hope that work under the industry transition track will facilitate early diffusion of technology and support to developing countries in this journey". Industries contribute approximately one-fourth of India's total greenhouse gas (GHG) emissions.

Indian industries, through its engagement with the government's programs as well as CDP, has shown impressive progress over the years. The number of companies engaging with CDP has seen a steady increase and in 2019 there was a 13% hike with 59 companies responding to the CDP questionnaire as compared to 52 in 2018. The CDP responses have indicatedthat many companies have already been playing their part through setting emissions reduction targets in line with climate science, committing to using 100% renewable electricity or working to remove commodity-driven deforestation from supply chains. They are showing that all types of businesses – including carbon-intensive industries such as energy, chemicals and mining – can get on a low carbon path. And they are set to reap the benefits: Science based targets drive innovation, reduce costs, and enhance profitability, helping companies gain long-term competitive advantage and safeguard their future prosperity.

A CDP worldwide report stated that 6,900 companies reported to CDP in 2018 on the financial risks posed to them, both directly and indirectly, from climate change. Of them, the results for the top 500 companies in the world have showed that, $2.1 trillion in benefits is estimated from responses at 225 of those biggest companies. CDP also tallied up $970 billion at risk—more than half of it anticipated within 5 years—from the disclosures of 215 of the world's largest 500 companies.

Indian businesses recognize the rewards of sustainable business practices but are challenged by a lack of uniformity in GHG measurement guidelines and a national benchmarking system. GHG Accounting and reporting is required to be adhered to the principles of relevance, completeness, consistency, transparency and accuracy. The most widely used GHG frameworks are:

GHG Protocol Corporate standard: The GHG Protocol Corporate Accounting and Reporting Standard provides requirements and guidance

for companies and other organizations preparing a corporate-level GHG emissions inventory.

The standard covers the accounting and reporting of seven greenhouse gases covered by the Kyoto Protocol – carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PCFs), Sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3). It was updated in 2015 with the Scope 2 Guidance, which allows companies to credibly measure and report emissions from purchased or acquired electricity, steam, heat, and cooling.

IPCC Guidelines for National Greenhouse Gas Inventories: The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 Guidelines) were produced at the invitation of the United Nations Framework Convention on Climate Change (UNFCCC) to update the Revised 1996 Guidelines and associated good practice guidance1 which provide internationally agreed methodologies intended for use by countries to estimate greenhouse gas inventories.

ISO 14064: ISO 14064-1 specifies principles and requirements at the organization level for quantification and reporting of greenhouse gas (GHG) emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory.

ISO 14064-2 specifies principles and requirements and provides guidance at the project level for quantification, monitoring and reporting of activities intended to cause greenhouse gas (GHG) emission reductions or removal enhancements. It includes requirements for planning a GHG project, identifying and selecting GHG sources, sinks and reservoirs relevant to the project and baseline scenario, monitoring, quantifying, documenting and reporting GHG project performance and managing data quality.

ISO 14064-3 specifies principles and requirements and provides guidance for verifying and validating greenhouse gas (GHG) statements.

Way Forward:

The Paris agreement aims to strengthen the global response to the threat of climate change by keeping the global temperature rise to below two degree Celsius above pre-industrial baseline level. The agreement intends to build resilience to the impacts of climate change and climate capacity building, besides ensuring a consistent flow of finances with low GHG emissions and climate resilient pathways. The Indian companies to contribute to India's NDCs is required to ensure transparent, reliable and comparable method of estimating the impact of investments, on greenhouse gas emissions, through common principles for GHG accounting supported by credible and robust standards. Currently there are a few International Financial Institutions

who are working to develop best practices for reporting environmental and climate change impacts. However, there is a need to harmonize the different standards for GHG accounting, in order to make the resultant inventories comparable, transparent and robust.

This would help invoke trust amongst the various stakeholders and also form a basis to realize the future climate risks to businesses and strategizing apt short term and long-term responses.

Salient Technologies Transferred to Industries by SIES IIEM

Sr. No.	Areas of Consultancy	Major Deliverables
1.	Mass culturing of AM Fungi	Development of novel culture of AM fungi for mass application Development of lab for culturing of AM fungi and other biofertilizers
2.	Ethanol Production from Rice Industry Waste	Ethanol extraction from rice industry waste
3.	Treatment of leachate from Hazardous Waste	Low cost efficient technology for leachate treatment from hazardous waste management facility
4.	Disinfection of Ballast Water	Low cost disinfection techniques for ballast water
5.	Sewage Treatment / Recycling Plant	SBR model for the treatment of sewage waste
6.	CO_2 sequestration studies of afforestation projects	On site monitoring, data collection, interpretation and validation
7.	Water and energy auditing	Identification of potential losses and defining strategy for conservation
8.	Solid Waste Management	Characterization of waste, strategies for waste management and efficient technologies

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Why Fast Fashion shouldn't be a part of Tomorrow's Market

Ms. Priyal Shah,
Consultant,
World Resources Institute (WRI) India

Clothing provides us protection, is a means of expression of individuality, and in a country like India, the activity of making clothes has tied communities together for ages. The global fashion and apparel industry is expected to be worth $2 trillion in 20233.It touches everyone's lives due to its importance and scale, apart from its utility, and also generates employment by directly employing 300 million people worldwide across the value chain.

The adverse social and environmental impact the industry creates, outweigh the benefits it offers.For instance, a report from 2017 observed the minimum wage in the clothing industry to behalf of what can be considered as living wage. Moreover, over 50% of workers in India or in the Philippines were not paid the minimum wage4.Going by the 2015 greenhouse gas (GHG) emissions data, textile production emitted1.2 billion ton of GHGs, which is equivalent to all international flights and maritime shipping combined.With sales growing faster than GDP rates of most regions, the Environmental stress caused by this industry is projected to grow further.To put things into perspective, the fashion industry emissions may rise by over 60% by 2030 (from 2015 levels) and may use up a quarter of World's Carbon Budget associated with a 2°C pathway by 20505.If we continue on the current path, unchecked consumption would make it hard to meet future demand within the existing planetary boundaries.

The True Cost of Fast Fashion

The problem mainly lies in our linear production model and the way company's measure growth and success.Today's fashion industry follows the linear model of taking resources, making apparel and discarding them afteruse which is often short-term.It is also built on the premise of 'fast fashion' which means brands incessantly churn out inexpensive clothes with latest designs almost every week,which are often of low quality.To meet these

[3]https://blog.euromonitor.com/podcast/fashion-friday-global-apparel-in-2019-and-beyond/

[4] https://www.globalfashionagenda.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry_2017.pdf

[5]Circular Fibers Initiative analysis, Ellen MacArthur Foundation

demands, the industry relies heavily on non-renewable resources with more than 97% of input materials being virgin feed stock or resources that have previously not been used/processed.In 2015 alone the textile industry consumed 98 million tonof non-renewable resources. By 2050, in a business-as-usual scenario, this is expected to rise to 300 million ton.Clothing sales are projected to raisethree-foldin the same time period.

The explosive growth of fast fashion can be seen in the increase in the number of fashion seasons, upfrom 4-5 earlier to around 50-100 microseasons now.This has created a two-fold problem of overconsumption of virgin resources and waste generation at the end of apparel lifecycle. This results in 73% of materials being either incinerated or landfilled. There is however, another oft-ignored problem between the material input stage and the end of apparel lifecycle—the problem of underutilization of apparel.On one handconsumer purchasedoubled over 2000–2015, while on the other hand,consumers kept clothes half as less compared to 2000. Underutilization by prematurely disposing clothes before the end of their entire lifecycle amounts to a global annual loss of more than $500 billion.Therefore, the ineffectiveness of the current linear fashion system calls for a complete rethink of how our weproduce, sell and discard apparel.

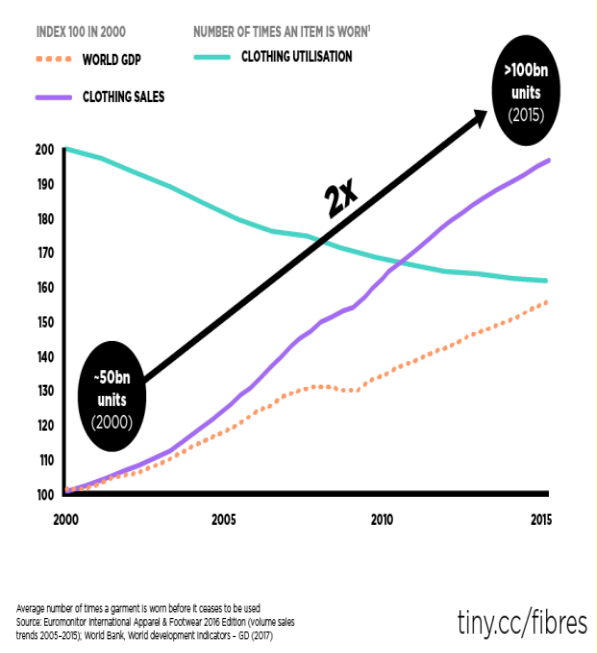

Figure 1: Growth of clothing sales and decline in clothing utilization since 2000

Source: Circular Fibres initiative, Ellen MacArthur Foundation

While there isn't a silver bullet in the current scheme of things, there is a better system in sight.

Circular Fashion

It is a fundamentally different fashion system that aims to replace harmful chemicals and materials with safe and renewable ones. It also includes increasing the utilization of apparel by adopting new business models (for example: re-commerce) and bring materials back in the economic system at the end of their useful life to recycle them into new clothes. Clothing Reuse is the most direct lever to design out waste and capture value that is currently being lost. If the number of times a garment is worn, on an average, is doubled, GHG emissions would be 44% lower. Clothing reuse has the potential to displace

linear sales, and also to reduce demand for virgin material and help preserve energy, water and labor embedded in the apparel.

Moving Towards Clothing Reuse

Brands measure success on the basis of the growth of their year on year apparel sales which depend highly on consumption of virgin resources. However, there is a need to understand that increasing value for shareholders simply by selling more clothes in high consuming and emerging economies is untenable in the long-term.There is a need to decouple growth and profit-making from resource use.New business models such as rental, subscription, re-commerce (selling pre-owned apparel) can help fulfill consumer needs and wants with significantly fewer resources by transforming the way apparel is produced, sold and discarded. For instance, Mud Jeans, a Netherlands-based denim brand offers its customer the option of leasing a pair of jeans instead of buying them. This ensures that the brand get the jeans back after its useful life. Later, based on the condition of the denim, the brand can either sell it as pre-owned apparel or send it for recycling. Over the years, conscious consumers have switched to sustainable fashion; however, individual action is too little compared to the magnitude of problem and hasn't challenged the current consumption model. This call for a business model change by creating a system where sustainability is achieved by default and the burden to be sustainable doesn't lie on the consumer alone.

The need for shift is clear, however,there are roadblocks in the adoption of new business models. World Resources Institute (WRI), a global research organization working at the nexus of environment, economic opportunity and human well-being,and Waste & Resources Action Programme (WRAP), a UK-based organization that works with various stakeholders to deliver practical solutions to improve resource efficiency, are working with leading apparel brands in the US, UK and India on their circular fashion initiative—Clothing Reuse Market Makers. The objective is to create favorable external conditions for the adoption of reuse business models such as rental, subscription, re-commerce, etc. in the apparel sector by working with various stakeholders within the apparel value chain.

SPECIFIC AREAS OF EXPERTISE AT SIES IIEM IN INDUSTRIAL R&D AND CONSULTANCY

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- Zero discharge
- analysis of samples
- Hazardous waste management
- Lab analysis services and desginig of lab

Ecology and Biodiversity

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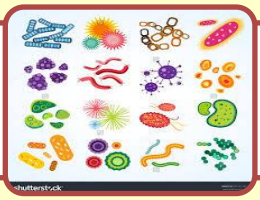
- Mapping of resources and modelling
- Eco restoration of resources



Microbial interventions in Environment Management

- Bioremediation and phytoremediation
- Mass production of Biofertilizers and biopesticides

Environment Management

Desigining of policies and plans as per agenda 2030 of Sustainable Development for industries and institutions
Climate change vulnerability assessment, identification of adaptation and mitigation technologies
CO_2 neutrality assessment in industries

Execution of CSR Initiatives

Defining of strategy, planning, implementation and execution of activities
Capacity building and skill development
Community mobilization for livelihood generation by developing theme based hubs

Other services

Survey and data analysis
Preperation of DPR, proposals, SOPs
Training Programmes, Customized events

Zero Carbon Emissions by 2050-Challenges and Prospects

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Introduction

Carbon dioxide (CO_2) is a crucial greenhouse gas that traps heat. It is released through human activities like deforestation and burning fossil fuels, also as natural processes like respiration and volcanic eruptions. Carbon dioxide, a key greenhouse emission that drives global climate change, continues to rise monthly. By trapping heat from the sun, greenhouse gases have kept Earth's climate habitable for humans and many other species. But those gases are now out of balance and threaten to vary drastically which living things can survive on this planet—and where.

Atmospheric levels of carbon dioxide—the most dangerous and prevalent greenhouse gas—are at the very best levels ever recorded. The levels of Greenhouse gases are so high mainly because humans have released them in the air by burning fossil fuels. The gases absorb solar power and keep heat on the brink of surface, instead of letting it escape into space. That trapping of warmth is understood because of the atmospheric phenomenon. In 1896, Swedish scientist Svante Arrhenius was the primary to link an increase in CO_2 gas from burning fossil fuels with a warming effect. The atmospheric phenomenon has been detected which is changing our climate now.

Carbon dioxide is that the primary greenhouse emission, liable for about three-quarters of emissions. It can linger within the atmosphere for thousands of years. In 2018, CO2 levels reached 411 parts per million at Hawaii's Mauna Loa Atmospheric Baseline Observatory, the very best monthly average ever recorded. Carbon dioxide is majorly emitted from burning organic materials like coal, oil, gas, wood, and solid waste.

Objectives of the study

Due to increasing emissions of carbon from various sources everyday, which is in turn depleting the ozone layer, it needs to be found out whether it is possible to decrease its emissions by 2050 through various means and the challenges and hindrances which will be faced and how they can be tackled.

Research design

It is a Descriptive type of research design as the problem of greenhouse gas emissions has been going on for some time now and ways and means are being adopted to reduce the overall

greenhouse effect which has been resulting in global warming.

Findings based on the literature review

Pandey and Pandey (2011) in their study on 'Carbon Footprint: Current Methods of Estimation' said thatExpanding nursery vaporous fixation in the climate is bothering the earth to cause appalling an Earth-wide temperature boost and related outcomes. Keeping the standard that just quantifiable is sensible, measurement of ozone harming substance escalation of various items, bodies, and procedures is going on around the world, communicated as their carbon impressions. The philosophies for carbon impression estimations are still developing and it is rising as a significant apparatus for ozone harming substance the board. The idea of carbon foot printing has penetrated and is being marketed in all the everyday issues and economy, however, there is little intelligence in definitions also, counts of carbon impressions among the contemplates. There are contradictions in the choice of gases, and the request for outflows to be secured in impression figuring's. Norms of nursery gas bookkeeping are the normal assets utilized in impression counts, although there is no required arrangement of impression check. Carbon foot printing is planned to be a device to direct the significant emanation cuts and confirmations, its institutionalization at worldwide level are subsequently vital.

In an article on 'CO_2 emissions structure of Indian economy', Parikh Jyoti, Panda Manoj, Kumar-Ganesh and Singh Vinay (August 2009) said that carbon dioxide (CO_2) emissions of the Indian economy are analyses by producing sectors and due to household final consumption.The analysis is predicated on an Input–Output (IO) table and Social Accounting Matrix (SAM) for the year 2003–04 which distinguishes 25 sectors and 10 household classes. Total emissions of the Indian economy in 2003–04 are estimated to be 1217 million tons (MT) of CO_2, of which 57% is thanks to the utilization of coal and lignite. The per capita emissions end up to be about 1.14 tons. The highest direct emissions are thanks to electricity sector followed by manufacturing, steel and road transportation. Final demands for construction and manufacturing sectors account for the very best emissions considering both direct and indirect emissions because the outputs from most the energy intensive sectors enter the assembly process of those two sectors. In terms of life style differences across income classes, the urban top 10% accounts for emissions of 3416 kg per annum while rural bottom 10% class accounts for less than 141 kg per annum. The CO_2 emission embodied within the consumption basket of top 10% of the population in urban India is one-sixth of the per capita emission generated within the US.

In the review article Lebunu and Wadu (2019) said that Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are the significant ozone depleting substances. Using the

respective Global Warming Potential (GWPs), the non-CO_2 gases are converted to units of carbon dioxide equivalent (CO2e).

The absolute units of CO2e then speak to a whole of the GWP of every one of the thre significant ozone harming substances. The classes considered for GHG discharge stock are the accompanying:

(i) Energy: power utilization, criminal discharges
(ii) Domestic segment
(iii) Transport
(iv) Industrial segment
(v) Agricultural exercises
(vi) Livestock
(vii) Waste

Vitality: power utilization, criminal emanations – GHG discharges from power use happen during the age of the power. Earlier studies have estimated the emission of gases due to power generation.

A far-reaching discharge stock for megacity Delhi, India for the period 1990-2000 has been created in which significant CO_2 emanations were found from the force plants.

- **Local or family unit division**:

Emissions from households and commercial establishments occur due to energy consumption for cooking, lighting, heating and household appliances.

In 2007, at the national level, the residential sector emitted 137.84 million tons of CO_2 equivalents and the commercial sector emitted 1.67 million tons of CO_2 equivalent

- **Transportation**

Discharges from the street transport segment are legitimately identified with the amounts of gas and diesel utilization and the expansion in both in the quantity of engine vehicles out and about and the separation these vehicles travel Traffic synthesis of six uber urban communities of India (Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad) shows that there is huge move from the portion of moderate moving vehicles to quick moving vehicles and open vehicle to private vehicle.

- **Agribusiness related activities**

Rural exercises contribute straightforwardly to discharges of ozone depleting substances through an assortment of procedures. The major horticultural wellsprings of GHGs are methane (CH_4) outflows from inundated rice creation, nitrous oxide (N_2O) discharges from the utilization of nitrogenous composts, and the arrival of carbon dioxide (CO_2) from vitality sources used to siphon groundwater for water system. All-consuming of biomass produces considerable CO_2 outflows. In India the yield squander produced in the fields is utilized as feed for cows, household bio fuel and leftover portion is singed in the field.

- **From Livestock**

There are two significant wellsprings of methane discharge from domesticated animals: Enteric aging coming about because of stomach related procedure of ruminants and from creature squander the board. In India over 90% of the all-out methane emanation from enteric maturation is being contributed by the

enormous ruminants (steers and bison) and rest from little ruminants and others. Creation and emanation of CH_4 and N_2O from compost relies upon edibility and structure of feed, types of creatures and their physiology, excrement the executives rehearse and meteorological conditions like daylight, temperature, precipitation, wind, and so forth.

- **Squander area**

The fundamental ozone harming substances produced from squander the board is CH_4. It is delivered and discharged into the environment as a side-effect of the anaerobic deterioration of strong waste, where-by methanogenic microbes separate natural issue in the waste.

Additionally, wastewater turns into a wellspring of CH_4 when treated or arranged anaerobically. It can likewise be a wellspring of N_2O outflows also because of protein content in locally created squander water. Mechanical wastewater with noteworthy carbon stacking that is treated under proposed or unintended anaerobic conditions will deliver CH_4. The above data depicts that the highest CO_2 emissions per capita come from the high-income.

In another article written by Myllyvirta (2020) on 'Analysis: Corona virus has temporarily reduced China's CO_2 emissions by a quarter', the author mentions that while battling against one of the most serious viral epidemics in the country, Electricity demand and industrial output in China remain far below their usual levels across a range of indicators, many of which are at their lowest two-week average in several years. These include:

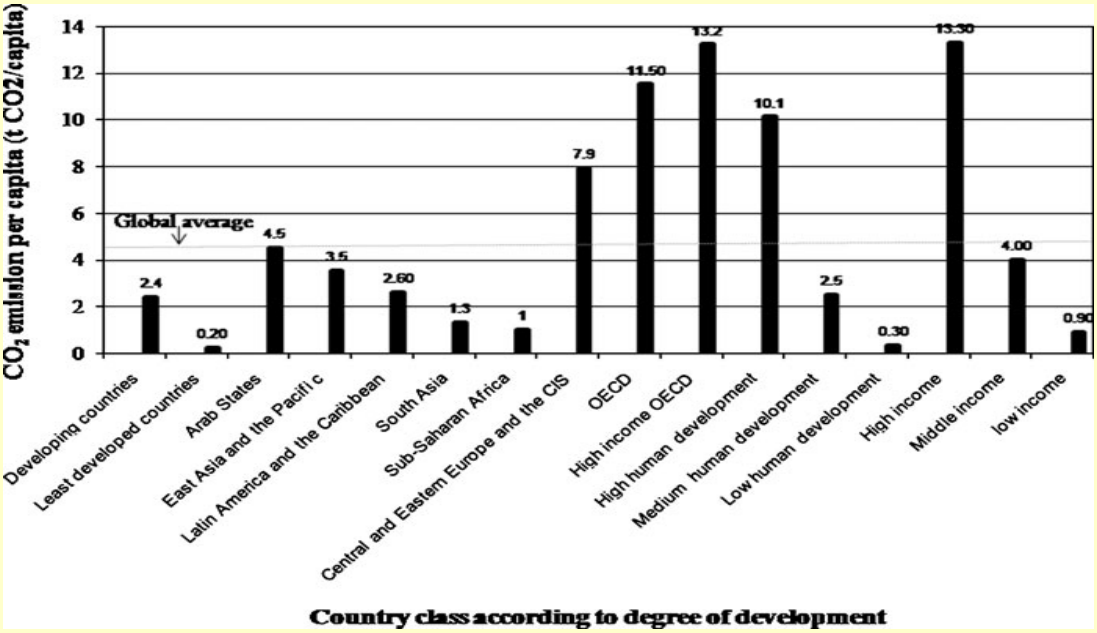
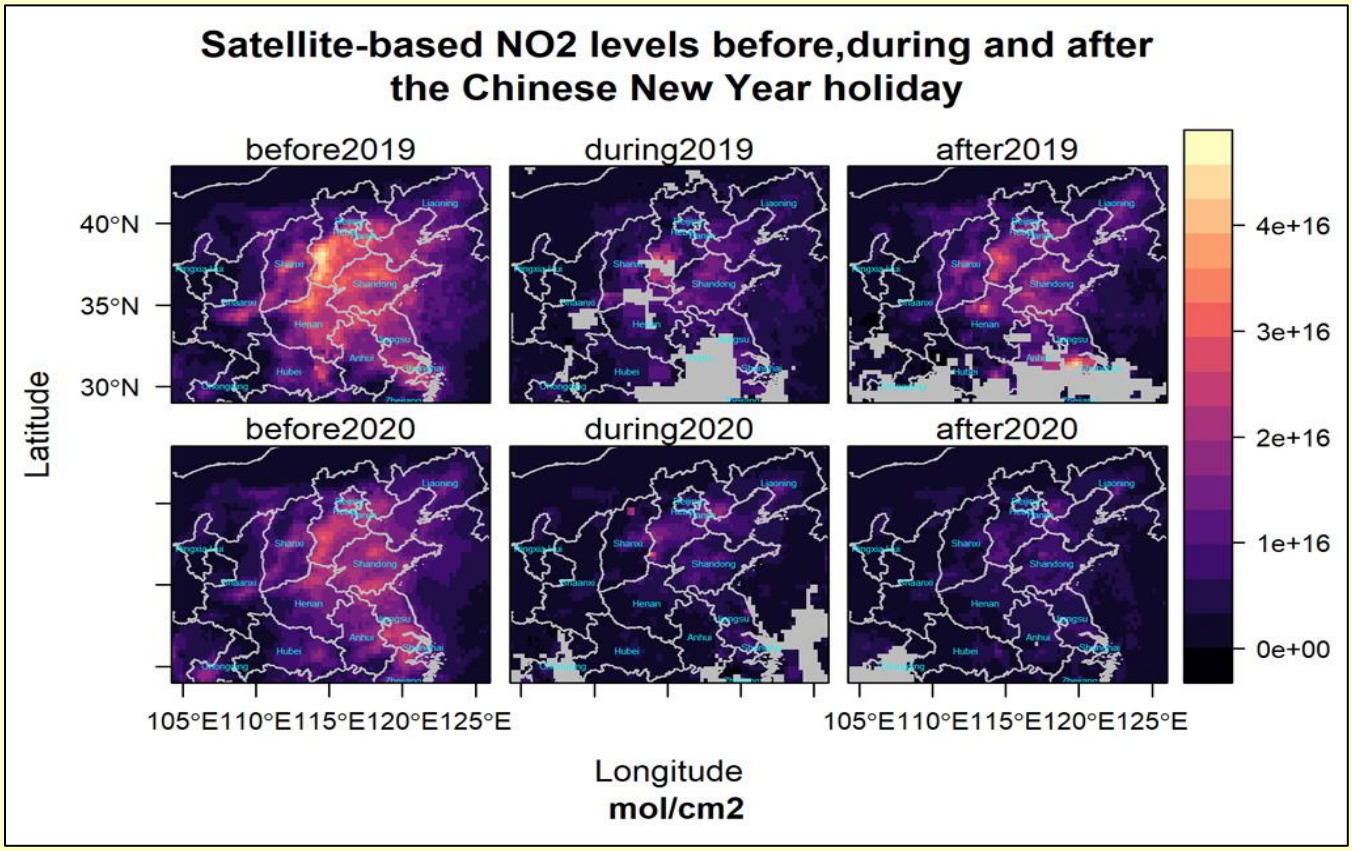


Fig. 1 Carbon footprint per capita in different classes on countries based on degree of development (based on UNDP 2007)

Coal use at power stations reporting daily data at a four-year low.

- Oil refinery operating rates in Shandong province at the lowest level since 2015.
- Output of key steel product lines at the lowest level for five years.
- Levels of NO_2 air pollution over China down 36% on the same period last year.
- Domestic flights are down up to 70% compared to last month.

The measures to contain corona virus have resulted in reductions of 15% to 40% in output across key industrial sectors



Average atmospheric levels of NO2 (molecules per centimeter squared) measured by the NASA OMI instrument.

Results and conclusion

India is currently second most populous country within the world and contributes about 5.3% of the entire global GHG emissions. Major cities in India are witnessing rapid urbanization. The standard of air within the major Indian cities which affects the climate also as health of the community may be a major environmental concern. Higher levels of consumption of energy have contributed to environmental degradation. Chennai emits 4.79 tonnes of CO_2 equivalent emissions per capita, the very best among all the cities followed by Kolkata which emits 3.29 tonnes of CO_2 equivalent emissions per capita. Also, Chennai emits the very best CO_2 equivalent emissions per GDP (2.55 tonnes CO_2 eq/Lakh Rs.) followed by Greater Bangalore which emits 2.18 tonnes CO_2 eq/Lakh Rs. Carbon Footprint of all the main cities in India helps in improving national level emission inventories. Within the previous couple of years, the recognition of Carbon Footprint has grown leading to the main metropolitan global cities to estimate their greenhouse gas emissions and thereby framing regulations to scale back the emissions. The information regarding emissions from different sector helps the policy makers and city planners to plan mitigation strategies that specialize in the actual sector which helps in improving the environmental conditions within the town. Implementation of emission reduction strategies in cities also helps in gaining carbon credits within the global markets, which has been an outcome of increased awareness about greenhouse gas emissions. Carbon footprint of major cities in India sector-wise would help the

planners in implementing appropriate mitigation measures.

Benefits of study

There are many good reasons to market sustainable development and reduce greenhouse gas emissions and other combustion emissions. The air quality in many urban environments is causing many premature deaths due to asthma, disorder, chronic obstructive pulmonary disease, carcinoma, and dementia related to combustion emissions. The worldwide social cost of pollution is a minimum of $3 trillion/year; particulates, nitrogen oxides and ozone related to combustion emissions are very costly pollutants. Better air quality in urban environments is one among the explanations for countries to figure together to scale back greenhouse gas emissions through the Paris Agreement on global climate change. There are many potential benefits related to limiting global climate change. Within the recent past, the concentrations of greenhouse gases within the atmosphere are increasing and therefore the number of weather and climate disasters with costs over $1 billion has been increasing. The typical global temperature set new record highs in 2014, 2015, and 2016. To scale back greenhouse gas emissions, the transition to electric vehicles and electricity generation using renewable energy must happen in unison with the goals of the Paris Agreement on global climate change.

Limitations

It is impossible to determine how global carbon and greenhouse gas emissions can be controlled and below what limit. Due to various economic and social circumstances, there is a huge variance in global GHG emissions, which cannot be completely defined and measured.

References

Myllyvirta Lauri (2020), 'Analysis: Corona virus has temporarily reduced China's CO2 emissions by a quarter', *Emissions*, www. carbonbrief.org, accessed on 19 Feb 2020

Pandey Divya, Agrawal Madhoolika& Pandey Jaishankar (2011), 'Carbon Footprint: Current Methods of Estimation', Environment Monitoring Assessment, 2011 Jul;178(1-4):135-60.

Parikh Jyoti , Panda Manoj, Kumar-Ganesh and Singh Vinay (2009), 'CO2 emissions structure of Indian economy', August 2009, Energy, 34(8):1024-1031

Wiley: Environmental Progress & Sustainable Energy.Reducing greenhouse gas emissions and improving air quality: Two global challenges by Larry E. Erickson, Published online 2017, Jun 29.

HebageLebunu and Wadu Jayantha (July 2019), 'Global Research on Carbon emissions-a Scientific review, *Sustainability*, 11, 3972, pp. 1-25

MAJOR AREAS COVERED UNDER OUTREACH ACTIVITIES AND COMMUNITY MOBILIZATION AT SIES IIEM

Technology Parks for Resource Management and Livelihood Generation

Implementation of ecotechnologies, resource mobilization, establishment of market linkages

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Pollution monitoring
Waste Management
Eco- friendly nursery, Aquaculture, Herbal and medicinal garden
Agriculture, organic, biofertilizers & pesticides

Training and Awareness Generation

Waste managment

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- JSW
- RCF
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- Agrisearch India Pvt. Ltd.
- Diva Envitech Pvt. Ltd.

Potential of Carbon Sequestration by Afforestation

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Carbon Sequestration is a process of capturing and storing global carbon dioxide for long term in plants, soil, geologic formations and ocean. It can be facilitated by natural as well as anthropogenic activities. With growing concern for climate change, considerable interest has been drawn to the possibility of increasing the rate of carbon sequestration by land use changes and plantation and geoengineering that involve capture and storage of carbon di oxide in geologic systems. Of the carbon emitted in atmosphere due to anthropogenic activities, about 45% remains in the atmosphere, 30 % is sequestered in marine ecosystems and rest in terrestrial ecosystem. As per estimation, terrestrial ecosystem sequesters around 2.6 gigatons of carbon annually. Hence, management of terrestrial ecosystem by land use changes and afforestation provides an ample scope for industries to exploit this sector for their carbon emission reductions and projecting neutrality. The article is an attempt to elaborate the potential of carbon sequestration by afforestration, factors affecting it and process of certification of carbon credits for projecting neutrality.

Climate Change Policy Framework and Forestry Sector

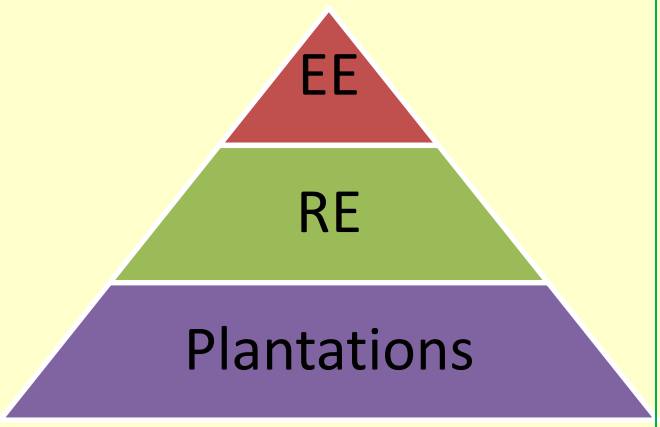
The critical role of forests in climate change mitigation and adaptation is now widely recognized. Forests contribute significantly to climate change mitigation through their carbon sink and carbon storage functions. They play an essential role in reducing vulnerabilities and enhancing adaptation of people and ecosystems to climate change and climate variability, the negative impacts of which are becoming increasingly evident in many parts of the world. Different protocols, conventions and agreement have identified forestry sector as a major area for carbon sink. The first commitment period of Kyoto Protocol (2008- 2012) emphasized that parties should promote sustainable forest management for conservation and enhancement of forests as sinks and reservoirs of greenhouse gases and afforestation and reforestation activities. REDD and REDD^{+} significantly advocated for the deforestation, reduction in degradation and Forest Carbon Partnership Facility, respectively. The Paris Agreement has also advocated carbon neutrality by enhancing sinks and reservoirs of GHGs and among that forestry sector was prominent. In India's Intended Nationally Determined Contributions (INDCs) creation of an additional carbon sink of 2.5 to 3 billion tons of CO_2 equivalent through additional forest and tree cover by 2030 is promoted. Some of the significant initiatives of India towards Afforestration are listed below:

- Green India Mission,

- National Agro-forestry Policy,
- REDD+ programmes,
- Joint Forest Management,
- National Afforestation Programme
- Devolution of about USD 6 billion under Compensatory Afforestation to states
- Green highway
- Green Wall

Current Approaches towards Carbon Neutrality in Industries

The Special Report of the Intergovernmental Panel on Climate Change (IPCC) on the impacts of an average global temperature increase of 1.5 °C above pre-industrial levels is decisive in affirming that human activities have already caused approximately 1 °C of global warming over pre-industrial levels, with a likely range of 0.8 °C to 1.2 °C, and that, with current expected trends in global emissions, the 1.5 °C level will be reached between 2030 and 2052.Limitation of the average global temperature increase to 1.5 °C in relation to the pre-industrial period is crucial as it may prevent irreversible impacts of global warming. The difference between an increase of 1.5 °C and 2 °C is significant in terms of impacts and consequences for ecosystems and the economy, especially given that these are global average values and that the average temperature increase in more vulnerable areas of the planet could be even higher. To achieve the carbon neutrality energy efficiency, renewable energy and CO_2 sequestration by plantation are the best option for industries (Figure 1).



Carbon Sequestration through Afforestation

Plantations on presently non-forested land provide an opportunity to industries for clean and efficient means of absorbing atmospheric CO_2. It has multiple benefits-

- offset against continuing greenhouse gas emissions
- Timber production
- Environmental protection
- Added biodiversity
- Land rehabilitation
- Ancillary Benefits

Factors Affecting Carbon Sequestration by Plantation

- **Type of Land Use:** The degraded lands have poor survival rate of saplings and growth of trees. Plantation after integrated management of land by using biological and chemical inputs is advocated.
- **Climate Change (Temperature and Precipitation)**: Climate change correlated with trends of temperature rise, decrease in rainfall and in the amount of snow has a wide range of negative impacts on environmental systems, including forests. However, afforestation activities are better to modulate the impacts of climate change.

- **Stand Structure (Tree species and light interception):** A proper plantation strategies viz. distance of trees, plantation angle and tree species plays very important role in maximizing the benefits of project. The tree to tree and row distance generally depends on the morphological features of trees. The angle of plantation at 45degree is best to get sufficient resources for all the trees. The selection of tree species should be based on the biogeographical regions. The fast growing multipurpose tree species are recommended for getting optimal benefits. For Afforestation native species should be promoted to reduce invasion and associated competitiions.For agroforestry based systems exotic tree sps. can be promoted under proper management. Further, wood density is an important factor in supporting the sequestration.
- **Age of the Tree Stand:** The carbon sequestration in trees increase and decrease with the age of plantation. Different studies has indicated that CO_2 sequestration by trees are maximum between the age of 25 -50 years. A tree absorbs between 7 kg to 21 kg of CO_2 per year in tropical countries. In temperate countries it is less up to 25 – 30%.
- **Availability of the Nutrients:** The availability of nutrients in ample amount is one of the important factors for optimizing the photosynthetic rate of trees and CO_2 sequestration. The concentration of nitrogen, phosphorus and potassium in sufficient amount is required for good growth of trees.
- **Organic inputs:** The organic content in soil supports proper mineralization of nutrients and growth of plants. In fast growing trees plantation it is generally more due to more amount of litter and in tropical countries soils get more organic inputs from litter due to faster degradation rate that depends on the atmospheric temperature.
- **Forest Use and Management:** The un harvested forests generally sequester more amount of CO_2 from the atmosphere. The exploitation of forests for timber or other products affects the potential of trees.
- **Environmental Pollution:** The plantation situated near cities and industrial areas have poor stand quality and growth. Deposition of particulate matter on the leaves affect the rate of sequestration.

Methods for Calculation of Carbon Sequestration

Following methods are normally used for the calculation of CO_2 sequestration by a tree species:

- USED Method – Survival factor and age of tree
- Total Biomass Method – Height, DBH and Wood Density
- Allometric Equations

The method for the calculation of carbon sequestration depends on the tree species, climatic conditions and type of plantation viz. in forest or outside forest area. The biomass method is recognized by IPCC and is applicable for multiple tree species and climatic conditions.

Certification of Plantation Projects for Carbon Emission Reduction

Registration of Forestry Carbon Project' – for Verified Carbon Standard (VTS) is prerequisite for authentication of carbon sink and neutrality.

Recommendations for Industries for Attaining Carbon Neutrality through Afforestation

Currently, industries are considering plantation as a most suitable method that supports CSR activities as well as projecting carbon neutrality. Following important aspects are important while considering plantation based initiatives for carbon emission reduction.

- Promote scientific afforestation on degraded land.
- Select site specific tree sps.
- Promote MPTS for agroforestry systems
- Promote integrated system of plantation-based livelihood generation approach.
- Purchase certified emission reductions from UNFCCC.

The afforeastation programmes have indeed significant scope in reducing carbon emission with other benefits. However, selection of site, tree species, forest use pattern and method of CO_2 calculation are important factors for accruing considerable benefits.

FUTURE PLANS FOR R&D BASED PRODUCT DEVELOPMENT AND CONSULTANCY

- Mass production and commercialization of novel cultures of beneficial microorganisms having potential in N fixing, P solubilizing, Zn solubilizing, endophytes, AM Fungi, degraders of cellulosic materials and activated sludge process.
- Development of microbial products for improving climate change adaptation of crops and stress resistance.
- Extraction and commercialization of enzymes for pharma and food industry.
- Accreditation of lab from CPCB and NABL

Round Table Summit on Zero Carbon Emission by 2050: Challenges and Future Prospects
Organized on
Saturday, 15th February, 2020; Auditorium, SIES SOP

A Round Table Summit on the theme 'Zero Carbon Emission by 2050: Challenges and Future Prospects' was organized on 15th February, 2020 at SIES, Nerul Campus. The main objective of the summit was to deliberate on the policies, pertinent technologies, current practices in industries and future planning for the management of carbon emission. The event was sponsored by Bharat Petroleum Corporation Ltd. Dr. P. Rambabu, CEO, RSM GC Advisory, Mumbai has inaugurated the event. Dr. Seema Mishra, Director, SIES IIEM welcomed all the guests. In her welcome address, she emphasized that from Kyoto Protocol to Paris Agreement many mechanisms have been proposed but significant reductions in emissions have not been recorded. IPCC in 2018 advocated that for keeping climate change within safe boundaries, global emissions need to fall to zero within the next three decades. Many countries have already taken pledge to become net zero carbon country by 2030. For India, with second highest population and fastest growing economy, it will be a daunting task. The summit was started with a keynote lecture by Dr. Rambabu. The major highlights are as below:

Keynote Lecture by Dr. P. Rambabu, CEO, RSM GC Advisory, Mumbai

Dr. Rambabu has delivered his keynote lecture on the theme of Summit 'Zero Carbon Emission by 2050: Challenges and Future Prospects'. He highlighted that global temperature is rising by 0.2^0 C per decade and IPCC (2018) in its report mentioned that global temperatures have already increased by 1^0C and if proper actions are not taken now it will increase by 2ºC by 2060. The rise in temperature is causing irregular rainfall pattern, temperature rise and flooding in many parts of the world. It will have severe consequences on the food production, health, public health, biodiversity and economy at the Global level. He indicated that to limit the warming to 1.5^0 C, CO_2 emission should fall by about 45% by 2030 and 'net zero' by 2050. This requires following initiatives:

- Deep emission cut in all the sectors
- Technological innovations
- Behavioural change
- Increased investment in low carbon options

He has shared a carbon neutral plan of European Union, as per that for 'net zero' growth following measures are urgently required:

- Maximization of energy efficiency including zero emission buildings through eco designing and eco labeling.
- Deployment of renewable energy in tune of 80%.
- Adoption of clean, safe and connected mobility by utilizing hydrogen for de carbonization, smart charging and refueling stations are required. City planning, clean and shared transport sector are some of the areas that require proper implementation.
- Circular economy concepts in different processes. Increased use of biomass, hydrogen and renewable synthetic gas for the reduction of emissions.
- Smart network infrastructure by retrofitting of available infrastructure.
- Bio economy and creation of bio sinks through agroforestry based systems for the improvement of nutrient use efficiency and soil carbon.
- Carbon capture and storage as a hydrogen and biomass are some of the alternatives.
- Further, Dr. Babu emphasized that integration of carbon neutrality actions with SDGs and political initiatives in carbon free economy is a way forward to zero carbon emission that require strong commitments for proper implementation and timely upgradation of pertinent technologies.

Session: Carbon Neutral Future: Opportunities and Case Studies Session
Chair: Dr. P. Rambabu

The session has covered six presentations on different aspects of carbon neutrality with case studies. The details are as below:

1. Mr. Amit Darak, Manager Sustainability and Risk Assessment, KPMG

Mr. Darak presented on the topic, 'GHG Accounting Frameworks'. He highlighted on the global risks, their impacts and how these risks and impacts are interconnected globally. The Carbon Emissions is evolving as a composite metric to evaluate a company's performance that helps in the assessment of potential risks on the business, evaluation of operational and financial performance. Mr. Darak stated that India's corporate sector can play a crucial role in reducing the country's emission by 33-35% by 2030 intensity. As per CDP Global India Report (2019) upto 90% of the responding 59 companies had a total of 293 emission reduction initiatives (ERI) active within the reporting year that will help in timely realization of goals. By accounting carbon footprints in organizational, value chain and product system the performance can be monitored regularly for developing control mechanism and effective strategies. He touched upon the details of scopes of GHG Accounting Framework as per ISO 14064 with emphasis on the requirement of harmonized robust, transparent, cost effective and comparable standards.

2. Mr. Vivek Rastogi, Head HR, Bharat Petroleum Corporation Ltd., Mumbai

Mr. Rastogi has presented the initiatives of BPCL towards carbon neutrality through two movie clips and a book. The first movie clip presented details on cutting emissions by implementing improved technologies in fuel extraction, refining and transportation. The second clip was about the recycling and reuses of water in that a joint project of BPCL and RCF was presented. The book was compiling the details of CO2 offset by BPCL through plantation activities that they have conducted with SIES IIEM. The BPCL is mapping their Business Goals with Sustainable Development Goals and they are recognized by FUTURESCAPE and The Economic Times as a third best company in Responsible Business ranking. 3. Mr. Vishal Bhavsar, Head – Corporate Sustainability, Ultra Tech Cement Mr. Bhavsar has presented on the topic, 'Carbon Emission Management at Ultra Tech Cement' in that he deliberated on the 2 degree climate change scenario as per Paris Agreement. He presented the carbon budget at below 2° C and below 1.5° C as per Science Based Targets (WWF International, 2017). The cement sector is very difficult area for the abatement of carbon emission for that decarbonization of heat inputs by carbon capture and storage are the useful technical solutions. Mr. Bhavsar has highlighted the Science Based Targets (SBT) related low carbon technology roadmap that outlines 45% reduction in GHG emission intensity. The carbon capture and storage is not economically viable by 2030 for the cement industry of India. The improvement in clinker to cement ratio is a relatively low cost option though dependent on market and geographic conditions for that policy advocacy may be necessary to leverage this effectively. The Ultra Tech Cement is company under Aditya Birla Group that is having Sustainability Framework that focuses on local laws, international standards and best practices for the responsible stewardship, stakeholder engagement and future proofing of business strategy. The Ultra Tech Cement has committed for 25% reduction in carbon emission by 2021 as compared to 2005 level by following initiatives: Use of internal carbon price

- Adoption of TFCD framework
- Low clinker cement
- Reduction in resources at end use
- Waste heat recovery, energy efficiency
- Alternate fuel and renewable energy
- Commitment to double energy productivity through EP100
- Further, he stated that his company is upgrading technologies from time to time for achieving the targets.

4. **Ms. Priyal Shah, Consultant, Climate, World Resources Institute, India Ms. Shah has presented on the topic,** '

Unchecked Consumption in Tomorrow's Markets' with focus on clothing utilization through reuse business model. She has highlighted that Fashion & Apparel industry is worth $1.3 trillion. It is growing faster than GDP growth rates in most regions. Indian apparel market poised to be worth $59.3 billion in 2022 (6th largest in the world). With rise in World's GDP, the growth in sales and decline in utilization of clothing is observed that is resulting in overconsumption of resources and generation of waste. As per a study every second one garbage truck of textile is landfilled or burnt that is releasing 5,00,000 tons of microfibers in ocean each year. The clothing

sales is expected to rise three folds by 2050 with high consumption of non renewable resources and about 26% share in carbon budget. Ms. Shah has advocated the need of new textiles economy through: Phasing out of substance of concern that release microfibers in environment

- Increased clothing utilization
- Radically improved recycling
- Effective use of resources and move to renewable inputs
- The clothing reuse is the best option for decreasing waste and pollution that will help in lowering 44% GHG emissions. This can be implemented through re commerce, rental, repair, subscription and services. She has presented a case study of MUD Jeans, Netherlands that has provision for users to lease jeans by paying a membership fee. The consumers can swap their jeans for a new pair, continue using it for long time or return it by getting a voucher for a new purchase.

5. Mr. Rohit Gupta, Co- Founder and Director, Tesla Innovations Pvt. Ltd., Mumbai

Mr. Gupta has presented on the topic, 'Compliance Vs Carbon Neutrality – A Concern for Industries' in that he emphasized on the synchronization of compliance and carbon neutrality framework. It is a time to rework on standards and permissible limits for pollution control and management. He further stated that upgradation of technologies, process efficiency improvement and cost effective systems are prerequisite for reducing carbon emission by giving an example of waste water treatment sector. He cited the case study of Bill Gates backed carbon capture plant.

6. Dr. Seema Mishra, Director, SIES Indian Institute of Environment Management, Nerul, Navi Mumbai

Dr. Mishra has presented on the topic, 'Potential of Carbon Sequestration by Afforestation' in that she has highlighted that in first commitment period of Kyoto Protocol (2008- 2012) the major emphasis on carbon offset is by forest afforestation and reforestation. In second commitment period of Kyoto Protocol (2013-2020), the focus shifted to forest reforestation, rehabilitation of degraded land and low impact logging through REDD and REDD+ initiatives. The Paris Agreement has also stressed on carbon neutrality by increasing natural sinks and reservoir's for GHG. After Paris Agreement, India's INDCs focused on reduction in the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level and creation of an additional carbon sink of 2.5 to 3 billion tons of CO_2 equivalent through additional forest and tree cover by 2030. She highlighted that Green India Mission of Government of India and other important initiatives towards increasing natural carbon sinks. For attaining carbon neutrality in any sector energy efficiency and renewable energy are important sectors and after that the potential of natural carbon sinks especially plantation is significant. The CO_2 sequestration by plantation in tropical countries is about 7 to 21 kg/tree/year and it is 25-30% less in temperate countries. The factors affecting CO_2 sequestration in tree are as below:

- Type of land use
- Type of climatic conditions
- Stand structure
- Age of tree stand
- Soil nutrient profile especially organic carbon
- Forest use and management practices
- Environmental pollution due to anthropogenic activities etc.

Dr. Mishra presented different methods commonly used at the global level for the estimation of CO_2 sequestration by tree. Among these methods, the method based on height and dbh measurement and algometric equations are most preferred and accurate in comparison to US Energy Development method in that age and survival factor of plantation is considered. The tree growth and CO_2 sequestration is site and age specific. She advocated the registration and certification of plantation projects for CO_2 sequestration as per Verified Carbon Standards is necessary to get benefits of the projects. For taking benefits of carbon neutrality the industries may purchase certified emission reductions from UNFCCC and by conducting plantation on degraded land with scientific approach. For afforestation programmes native fast-growing tree species are recommended, however, for agroforestry systems multipurpose exotic tree species can be promoted under proper management. Further, she advocated the promotion of integrated plantation-based livelihood generation systems for securing

optimal benefits by utilizing CSR funds of industries. The summit has provided an active platform for discussion. Dr. Vijay Kulkarni, Executive Vice President, Shapoorji Pallonji Infrastructure and Capital Ltd. and Mr. Vinod Sant, Ex. DG, National Safety Council were special guests in the summit. The summit was attended by participants from Maharashtra Energy Development Authority, Centre for Environment Education and Development, Environment Management Centre, students from VJTI, SIES have actively participated and contributed significantly in the deliberations. The summit got over after presenting Vote of Thanks by Dr. Devayani Savant, Deputy Director, SIES IIEM.

Presentation by Mr. Vishal Bhavsar

Some Glimpses of Round Table Summit

Keynote lecture by Dr. P. Rambabu

Presentation of Ms. Priyal Shah

Lecture by Mr. Amit Darak

Mr. Rohit Gupta Giving his lecture

Panel during the Summit

Participants in summit

Release of book of BPCL

Prakkathan- A Students Fest on Environmental Sustainability

on 13th February, 2020

The third edition of Prakkathan – a student's event on Environmental Sustainability was organized on 13th February, 2020. The Chief Guest of the event was Dr. Vijay Kulkarni. He delivered 'Prof. Purushottam Khanna Memorial Talk' on the theme 'EIA Prospects and Retrospect' in that different aspect of Environment Impact Assessment was highlighted in detail. Around 50 students have participated in the event from different colleges of Mumbai, Navi Mumbai and Thane. The students have actively participated in quiz, debate and business pitch competitions. The chief guest of valedictory function was Dr. Milind Vaidhya, Principal SIES ASCN. He emphasized the need to student laid programmes for developing sensibility in students towards environment and leadership skills for tackling major issues related to environment.

Training Programme on Total Solid Waste Management for different Stakeholders of SIES, Nerul Campus

on 11th February, 2020

The training programme on Total Solid Waste Management was organized on 11th February, 2020 to sensitize different stakeholders viz. housekeeping staff, security guards, gardeners, canteen staff, temple staff and students from different institutions of SIES, Nerul campus. The training programme was conducted in English as well as Marathi languages. The emphasis was laid on the correct methods for the disposal of solid waste, methods for recycling as well as waste management facilities at SIES, Nerul campus. To evaluate the impact of training pre and post knowledge assessment of participants was conducted. Total 45 supporting staff and 35 students have participated in the event.

SIES IIEM DEDICATED TO ENVIRONMENT MANAGEMENT THROUGH R & D AND OUTREACH ACTIVITIES

ABOUT SIES IIEM

- SIES IIEM was established in 1999. It has been contributing in the fields of R&D activities and Academics in the areas of Environment Management and Biotechnology.
- IIEM is recognized by Department of Scientific and Industrial Research for research activities and has successfully completed various research projects with funding from DST, BRNS, DBT, ICMR, MOEFCC, MMREIS and several other agencies.
- IIEM also conducts consultancy services, organizing seminars, workshop and providing community service through research and creating awareness.




INFRASTRUCTURE AND FACILITIES

State of Art Facilities to conduct R & D and consultancy in the areas of Environmental Science and Management. Laboratories are equipped with the advanced equipments (HPLC, AAS, GC, HVS etc.)

CONSULTANCY SERVICES

GREEN MANAGEMENT

Environmental Monitoring and Analysis

- Water, Soil, Air, Waste
- Eco-toxicity studies

Conservation of Resources and Biodiversity

- Eco restoration of Resources
- Biodiversity mapping and indexing

Waste Management

- Wastewater management for zero discharge
- Solid waste management
- Industrial sludge management
- E- waste management

Expertise in:

- Advanced oxidation processes
- Aerobic and anaerobic processes
- Bio- and phyto- remediation

EIA and Sustainability Solutions for Mitigation of Climate Change Vulnerability

GIS based Environmental Planning and Management

- Natural resource mapping
- Groundwater recharge study
- Site selection
- Database management

GREEN COMMUNICATION

Providing CSR Solutions for Environment and Society

- Environmental Education
- Training and Awareness programme
- Water audit and energy audit
- Carbon footprint mapping
- Capacity building
- R&D proposals and report writing
- Events – workshops, seminars and conferences

Areas of Research	Specific Areas
1. Total Water Management	1. Purification of drinking water by using low cost techniques. 2. Management of nitrite contaminated wastewater 3. Textile wastewater management. 4. Phytoremediation. 5. Oil spill management by biosurfactants. 6. Management of brine generated from water purification technologies. 7. Assessment and management of marine pollution
2. Solid Waste Management	1. Management of industrial waste. 2. Management of MSW and other solid wastes. 3. Management of agro- residue.
3. Applied Biotechnology	1. Utilization of biofertilizers and biopesticides in soil fertility management and agriculture. 2. Exploitation of beneficial microorganisms in remediation of heavy metals, oil pollution etc.
3. Management of Natural Resources	1. Pollution monitoring and management 2. Ecorestoration. 3. Studies on Climate Change. 4. Biodiversity Studies. 5. GIS & Remote Sensing

MAJOR FUNDING AGENCIES

- Ministry of Environment Forest and Climate Change
- Department of Science and Technology
- Department of Biotechnology
- Board of Research in Nuclear Sciences
- Indian Council of Medical Research
- Mumbai- Metropolitan Region- Environment Improvement Society

OUTREACH ACTIVITIES

Environment in Headlines

Drop in Emissions from Coronavirus will not Solve Climate Crisis

UN chief General Antonio Guterres stated that while the global outbreak of coronavirus may have caused a temporary drop in emissions that cause global warming, it would not end the problem and might even divert attention from the fight. "It is important that all the attention that needs to be given to fight this disease does not distract us from the need to defeat climate change," he said.

The Straits Times, March, 2020

Gasification with CO_2 storage reduces the costs of the EU's zero carbon strategy by 40%

The energy transition to decarbonise the EU's economy fully by 2050 is objected by many European countries due to economic obligations. An illustrative example of this is that even before the start of this transition, the announcement of a green tax on fuel in France has already evoked a wave of protest from the yellow vest movement. Clearly, it is important to decarbonise the EU's economy at the lowest possible cost. These costs can be substantially lowered through producing hydrogen by gasification of biomass and coal in combination with CO_2 capture and storage.

Voxeu.org, March, 2020

As Temperatures Increase, Forests are Having More Trouble Soaking up Carbon

According to a new study published in Nature by an international team of researchers, human activity is also leading to a situation where tropical rainforests (a major sequester of carbon dioxide) are not only losing their ability to soak up carbon but could actually be adding to the problem in the coming years. The anthropogenic factors (i.e. industrialization, modern transportation, and fossil fuel consumption) are not only causing far more carbon to be produced but are also hurting the planet's ability to sequester it. Ultimately, the combination of increased temperatures, drought, forest fires, pests, and unnatural deforestation (land clearance and logging) is causing the remaining trees to become overtaxed.

Universe Today, March, 2020

Olympic Games to Become "Climate Positive" from 2030

From 2030 onwards, each Organising Committee for the Olympic Games (OCOG) will be required to go beyond the current obligation of reducing and compensating carbon emissions directly related to their operations. The International Olympic Committee (IOC) will create an "Olympic Forest", which will contribute to the un-backed great green wall project in Africa and help the IOC move towards becoming a climate-positive organization.

Olympics, March, 2020

Articles, photos etc. are invited for next issue (April - June, 2020) of the Newsletter on the theme 'Biodiversity Conservation and Management'