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A STUDY ON IMPACT OF LOW CARBON TECHNOLOGIES IN REDUCING THE CARBON EMISSIONS IN INDIA WITH REFERENCE TO ENERGY SECTOR

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Abstract

India is one of the major emitter of greenhouse gases, rice paddies and cattle being the largest sources of emissions. It is expected to rise steeply, as the country is very vulnerable to climate change. The country has pledged a 33-35% reduction in the emissions intensity of its economy by 2030 compared to 2005 levels. The country also aims to generate 40% of installed electricity capacity through renewable or nuclear power by 2030. The success of this commitment is heavily dependent on climate finance, technology and capacity building support from developed countries. By 2030, India will require at least $2.5tn from both domestic and international funds. Economic growth and increasing prosperity, coupled with factors such as rate of urbanization, rising per capita energy consumption, and a growing middle class are likely to push energy demand further in the country.

Key words : Green House gas, climate finance, energy

Introduction

India has the fifth largest power generation portfolio worldwide. Coal and gas are the popular sources of energy and account for 58% and 9% respectively of the total energy consumed in the country. India has been rapidly adding capacity over the last few years, with total installed power capacity growing to 223 Giga Watts (GW) in March 2013 from 98 GW in March 1998. Economic growth and increasing prosperity, coupled with factors such as rate of urbanization, rising per capita energy consumption, and a growing middle class are likely to push energy demand further in the country.

India is one of the major emitter of greenhouse gases, rice paddies and cattle being the largest sources of emissions. It is expected to rise steeply, as the country is very vulnerable to climate change. The country has pledged a 33-35% reduction in the emissions intensity of its economy by 2030 compared to 2005 levels. The country also aims to generate 40% of installed electricity capacity through renewable or nuclear power by 2030. The success of this commitment is heavily dependent on climate finance, technology and capacity building support from developed countries. By 2030, India will require at least $2.5tn from both domestic and international funds.

Whereas, the carbon brief analysis at the time found India's emissions could increase 90% between 2014 and 2030 even if the pledge is met.

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Analysis

Out of the total emissions from various sectors in India, two third is contributed by the Energy sector. According to the analysis conducted by CSTEP during the year 2005-2013, shows that around 68% of total emissions is contributed through the energy sector and it is more than three times the emissions contributed by industry sector. There will be a dominance of energy related emissions in the Indian context, as the demand for energy sources are thriving in India.

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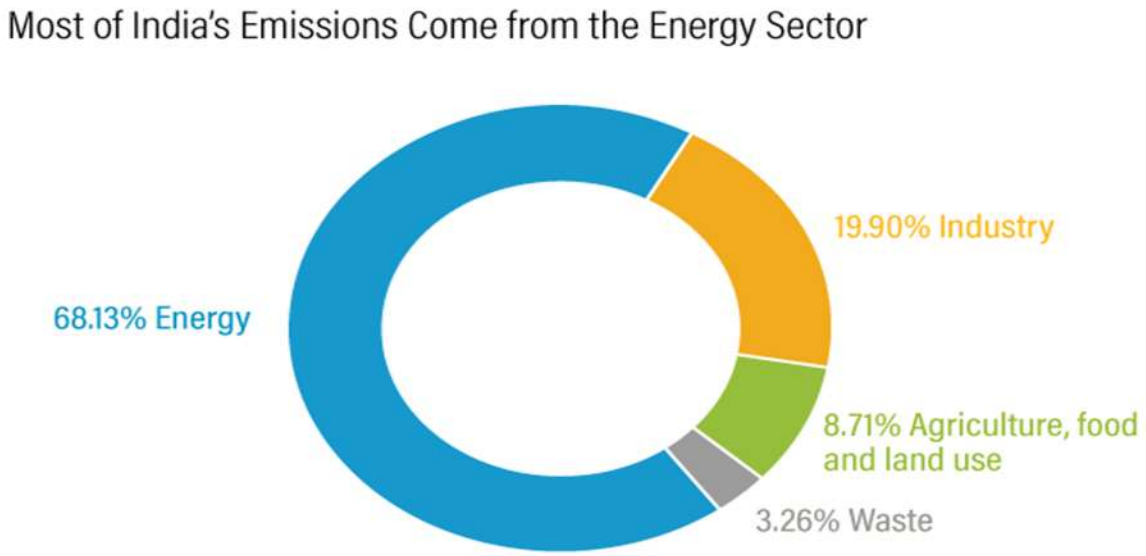
Within energy sector about 77% alone comes from the generation of electricity. This percentage is expected to decline as the government has taken major steps to cling towards renewable sources of energy. Initiatives like adoption of cleaner technologies, updating a fuel mix comprising 40% of non-fossil modes and packages on resources and energy efficiency.

Below table shows the emission contribution of various sectors:



Source: GHG Platform India.

Over a period of time, the emissions in India have grown faster than the population. However, the per capita contribution is lower when compared to U.S and China.

Below table represents the carbon emissions of major countries.

Country	CO2e emissions
China	11 gigatons
USA	6.2 gigatons
India	2.8 gigatons

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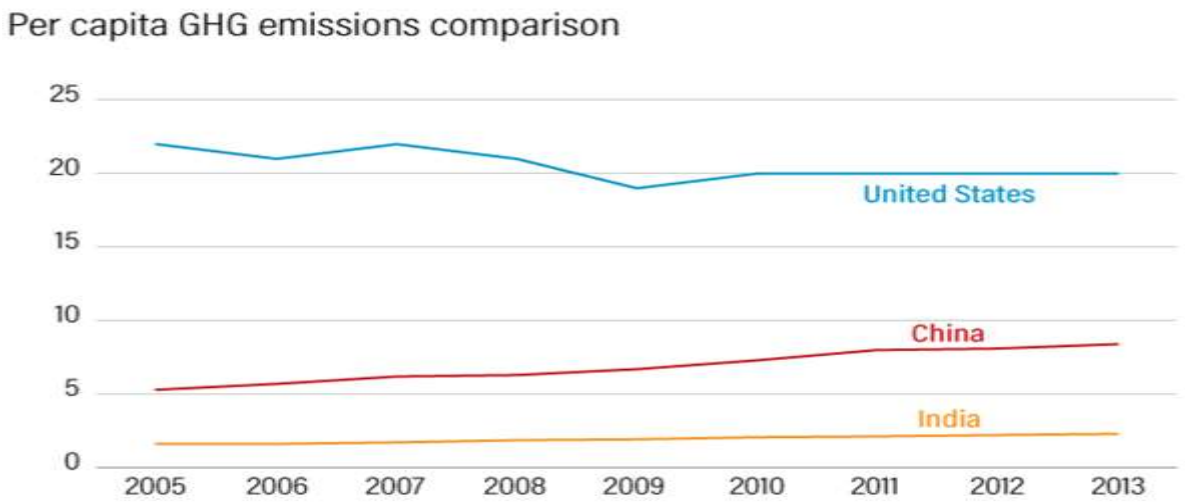

Source: GHG Platform India and Climate Watch.

The total electricity requirement in India is powered by four major sources:

Coal, renewable energy, natural gas and nuclear energy. Around 60% of India's power generating capacity comes from coal alone, whereas, the renewable energy sector contributes 30% and remaining 10% is made up by sources like natural gas and nuclear energy.

Note: TWh – Terawatt Hour

Installed Capacity India Electricity Sector

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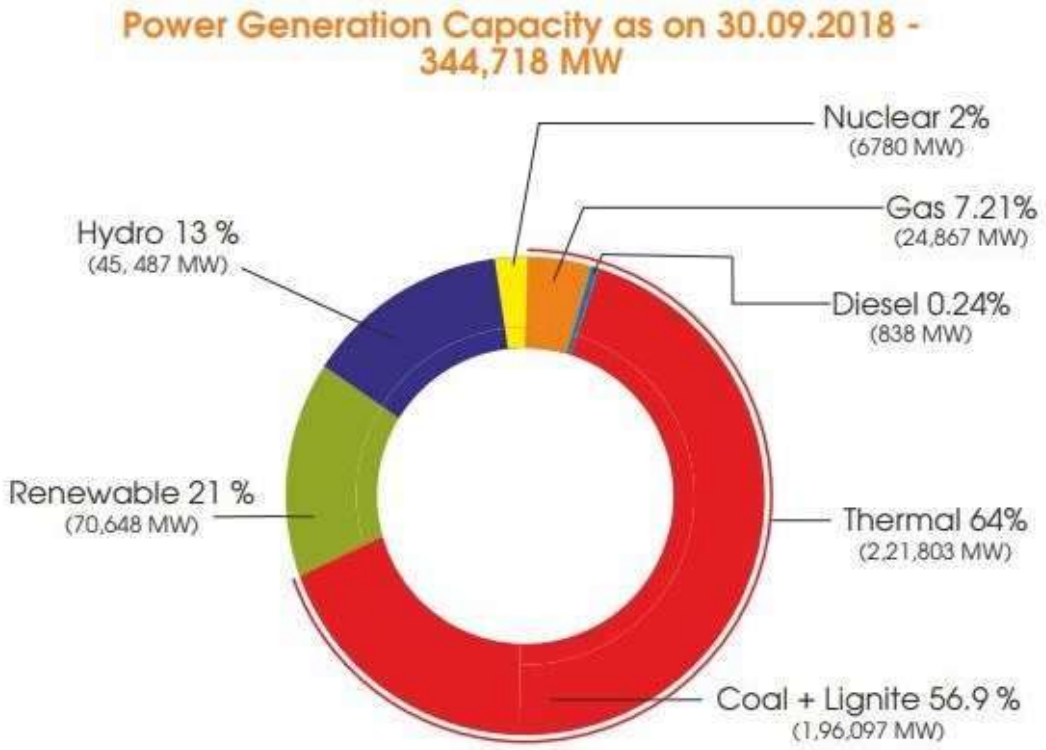
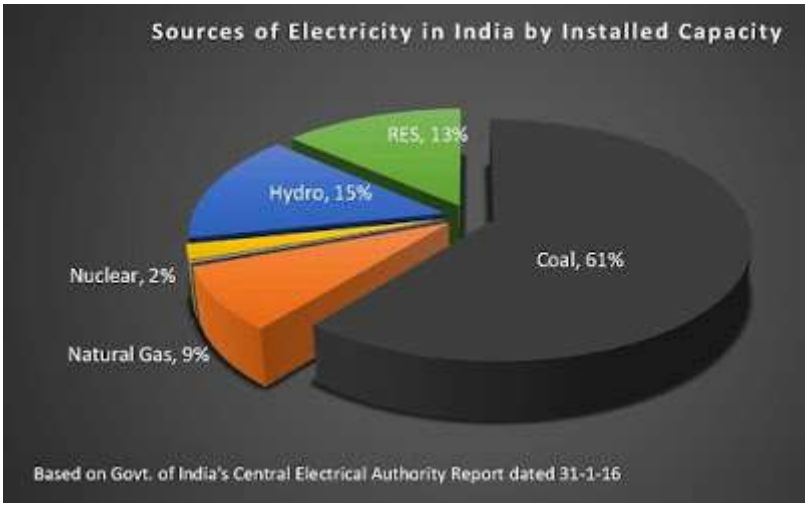


Sources	Thermal	Renewable	Hydro	Nuclear	Total
Share (MW)	2,21,803	70,648	45,487	6,780	344,718

However the actual capacity differs from the installed capacity. Coal dominates with around 77% of power generation coming in from coal. Only around 16% is contributed by renewable energy sector.

Electricity Generation sources in India as of April 2017



From the above data its evident that the energy sector is the major contributor for Greenhouse emissions in India. Hence decisive steps should be taken in order to drive future growth by limiting carbon emissions.

Clean Technologies and their contribution

In view of the dominant contribution by energy sector for CGHs, The Indian government has taken several initiatives to curb carbon emissions through the use of clean technologies.

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Renewable energy is the key to ensuring India's transition towards low carbon economy. India has aimed at having 40% of total installed capacity from renewable energy by 2040. A significant portion of this will come from solar and wind, which is expected to account for 340 GW of installed capacity by 2040.The Renewable energy market is currently valued at US$ 17 billion and is growing at an annual rate of 15%. The demand for energy is increasing in India due to high rate of Industrialisation and urbanisation. This gives immense opportunities for growth in this sector. The government has estimated that the country would require an additional 150 GW of power capacity over the next five years. In order to meet the same, 200 billion dollar investment is underway.

Some of the important sources of renewable energy:

- **Solar Energy**

Solar, a potential source of renewable energy has huge growth prospects, when compared to its installed and actual capacity of 100,000 MW and 2647 MW respectively. This demand is due to two major factors: around 300 million people in India do not have access to electricity and India has around 300 sunny days, which leaves a huge potential for the renewable energy companies to tap.

- **Wind Energy**

Another important source of renewable energy is wind energy. The country has the fourth highest wind installed capacity in the world with the total installed capacity of 34.98 GW as on October, 2018 against a target of 60GW by 2022. India's offshore wind energy potential is slated at around 350 GW10. Setting up wind energy projects, however, do come with a few risks. Cost of debt in India via commercial banks proves to be unfavourable for companies investing in projects, despite government subsidies. Margins of wind projects can also be impacted due to supply chain in India with shortages of critical components. A host of government incentives (covered in a later section) and favourable foreign policy on investments coupled with a huge untapped potential for wind energy poses a massive opportunity in this space. Swiss start-ups and SMEs can focus on entering the market in areas such as engineering design and consulting for setting up both onshore and offshore wind projects.

- **Biomass**

Biomass another source contributing more than 32% of the primary energy consumption, is available to almost 70% of the Indian population. It accounts for 12.8% of the total renewable energy capacity installed. With an estimated availability in India of about 500 million tons of biomass per year, 120 - 150 million tons is available for power generation. The major advantages of entering the biomass sector in India are the policies and incentives. A company can claim 80% depreciation in the first year for equipment such as turbines and co-generation systems. Additionally, biomass projects attract income tax holidays of up to 10 years.

- **Small Hydro Projects**

Another important source of renewable energy is small hydro projects. Small hydro projects are those that have a capacity of less than 25 MW. They are regulated by the Ministry of New and Renewable Energy as opposed to regular hydroelectric power, which is regulated by the Ministry of Power. Small Hydro Projects (SHP) are advantaged with not facing deforestation and resettlement issues like their larger counterparts and have the requirements to meet electricity requirements in remote areas. According to the International Journal of Electrical Engineering and Technology (IJEET), there are a total of 5415 potential sites to set up small hydro power plants in India. The total potential capacity of these sites put together will yield about 14.3 GW of power.

- **Biofuels**

Biofuels: As biofuels seek to supplement petroleum and diesel, the intent of the Indian Government is to increase energy security while keeping a check on energy prices. However, the reality in India is that most biodiesel producers have started using inedible oils and oil waste (due to lower prices) instead of Jatropha seeds, which is an agro-product and therefore offers opportunities for agriculture too. Second-generation biofuels derived from non-food sources such as Karanja oil (Pongamia oil derived from seeds of the Millettia tree) and micro algae are considered as the most suitable options for addressing energy security in India.

Challenges

The main sources for renewable energy are solar plants, wind farms and hydropower dams, all of which require significant investment. India hopes to attract $100 billion per year (10) to fund its investments in renewable

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energy. However, there are many hurdles that need to be jumped in order to procure investments for renewable energy projects.

There are a few potential challenges in achieving this solar capacity as the land use per capita of relatively low at around 2.59 square km per 1000 people. Another factor hindering the progress of solar energy is the use of photovoltaic technology, which has high distribution and transmission losses. In case of Biomass energy, there are several challenges associated with the supply of biomass. Agricultural biomass is only available for 2 -3 months in a year. Added to this there are logistical challenges of transporting fodder from farms to power plants.

Setting up small hydro projects are risky for international ventures – there are irregularities in the policy of allotting potential sites by state governments coupled with lack of inter grid connectivity due to land terrains for transmission of power. However, there is still potential to deploy small hydro projects as non-grid connected generators of electricity that cater to local clusters of inhabitation. However, the recent past has again seen the growth of small-capacity plants that produce bio-fuels for local populations (such as large privately owned transport fleets). This is definitely an area of interest, as international ventures (especially those with better technologies that offer higher yields) can enter this sector in a cost-effective manner.

Dark trend

The consumption of coal saw a significant rise in India, compared to the United States and China

	Coal primary energy demand (Mtce)	Growth rate (%)
	2018	2017-2018
United States	451	-4.5%
China	2,771	1%
India	600	5%
Europe	462	-2.6%
Rest of the World	1,113	1.4%
WORLD	**5,397**	**0.7%**

Source: IEA

India emitted 2,299 million tonnes of carbon dioxide in 2018, a 4.8% rise from last year, according to a report by the International Energy Agency (IEA). India's emissions growth this year was higher than that of the United States and China — the two biggest emitters in the world — and this was primarily due to a rise in coal consumption. China, the United States, and India together accounted for nearly 70% of the rise in energy demand.

India's per capita emissions were about 40% of the global average and contributed 7% to the global carbon dioxide burden. The United States, the largest emitter, was responsible for 14%.

As per its commitments to the United Nations Framework Convention on Climate Change, India has promised to reduce the emissions intensity of its economy by 2030, compared to 2005 levels. It has also committed to having 40% of its energy from renewable sources by 2030 and, as part of this, install 100 GW of solar power by 2022.

However the IEA report, made public on Tuesday, showed that India's energy intensity improvement declined 3% from last year even as its renewable energy installations increased 10.6% from last year.

Conclusion

Broadly, there are large opportunities across multiple sectors (clean energy, energy efficiency, and waste management) for clean technology adoption in India. Acute shortage of power and poor grid connectivity are the cause of a burgeoning energy demand in India. While there are a number of advantages and opportunities for ventures seeking to enter the Cleantech sector in India, a number of challenges still remain.

As can be seen, there are several challenges that India still faces as it attempts to conduct its low carbon transition. These challenges include, but are not limited to, obtaining funding for renewable energy projects,

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resolving inefficiencies in the coal sector, building capacity and infrastructure in the natural gas and renewable energy sectors and proper management of India's upcoming urban transition. It should be acknowledged that India has many opportunities to help conduct the transition as well. Policy shifts designed to increase private capital funding for renewable energy projects, technological shifts aimed at solving the inefficiencies in the coal sector, and updated methodologies for the management of urban sprawl in India's growing cities could be the key to ensuring that India is the first emerging economy in the world to manage a successful low carbon economic transition.

Despite the importance of meeting broader development goals, an impending demographic shift, rapid urbanisation and a shifting economic makeup, India has made a substantial commitment to upholding its global moral obligations. According to the IEA's New Policies Scenario (2), India will continue to remain below the world average in carbon emissions per capita for the next 35 years. Through both its actions and words, India has shown that it remains committed to a low carbon transition despite its development and economic needs. It remains to be seen whether the rest of the world will follow in India's footsteps.

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https://www.thehindu.com/sci-tech/energy-and-environment/indias-carbon-dioxide-emissions-up-5/ar In this scenario, there is a real possibility for Swiss startups for setting up of micro-solar stations that are located close to rural clusters. This has proven to be a viable business model by renewable energy generating companies in India (mentioned in a later section).

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