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A Study of Emissions at Global Level and India's Emission Mitigating Goals

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ABSTRACT

At the present scenario India exhibits multi dimensional changes such as rapid growth in renewable energy, appreciable reductions in coal imports as well as coal-fired "ultra-Mega power projects" which undoubtedly indicates transformation India's energy supply sector towards low carbon path. The ongoing growth of renewable energy and slowdown of coal in India is the most important development underway globally today coupled with China reducing its coal and carbon dioxide emissions. India ratified the Paris Agreement On 2 October 2016, India's Nationally Determined Contribution (NDC) targets to lower the emissions intensity of GDP by 33%–35% by 2030 below 2005 levels. The projections on the basis of currently implemented policies brings forth that the share of non-fossil power generation capacity will reach 38–48% in 2030, corresponding to a 25–31% share of electricity generation, and India's emissions intensity in 2030 will be 42–45% below 2005 levels. The new analysis finds global fossil fuel emissions grew by 0.7% in year 2014, then held steady in year 2015. Provisional data for the year 2016 predict a very small rise, of just 0.2%. This is a noteworthy slowdown in emission growth, compared to an average rate of 3.5% in the 2000s and 1.8% over the most recent decade, 2006-2015. Over the last decade, the average emissions from fossil fuels and industry account for 91% of human-caused CO_2 emissions, with 9% coming from land use change. Out of the 9.9bn tones of carbon in the form of CO_2 emitted from fossil fuels in 2015, 41% emitted from coal, 34% from oil, 19% from gas, 5.6% from cement production and 0.7% from flaring. In this background the paper on the basis of secondary data and reports studies the climate change goals for India.

INTRODUCTION

In 21st century India shines with exemplary changes such as rapid growth in renewable energy, appreciable reductions in coal imports as well as coal-fired "ultra-Mega power projects" which certainly is a move of India's energy supply sector towards low carbon path.

Under existing policies India is set to achieve its emissions intensity target, with the targeted 175 GW of renewable power capacity to be achieved by 2022. According to the new Draft Electricity Plan no new coal capacity, apart from the existing capacity, would be needed after 2022, though there is increase in demand. The implementation of The Draft Electricity Plan will lead India to achieve its NDC's 2030 40% non-fossil capacity target before 2022, and will reach 57% by 2027.

India ratified the Paris Agreement On 2nd October 2016, India's Nationally Determined Contribution (NDC) targets to lower the emissions intensity of GDP by 33%–35% by 2030 below 2005 levels, to increase the share of non-fossil based power generation capacity to 40% of installed electric power capacity by 2030 (equivalent to 26–30% of generation in 2030), and to create an additional (cumulative) carbon sink of 2.5–3 GtCO2e through additional forest and tree cover by 2030.

With the present implemented policies, it's projected that the share of non-fossil power generation capacity will reach 38–48% in 2030, corresponding to a 25–31% share of electricity generation, and India's emissions intensity in 2030 will be 42–45% below 2005 levels. So, under current policies, India will probably achieve its 40% non-fossil target, and is set to exceed its emissions intensity target by a broad margin.

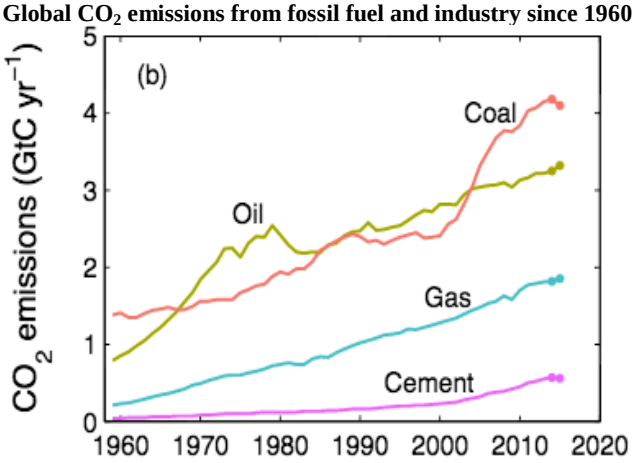
Under the present policies, between 2014 and 2030, it's estimated that the average annual growth rate for solar and wind power generation is around 3%—about half the growth rate of overall electricity production. During the above mentioned period, under our current policy pathway, capacity additions of 154–267 GW for solar and wind power, and 186–217 GW for coal power has been projected. In India at present 50 GW of coal-fired power capacity is under construction, with another 178 GW in the permitting pipeline (The Energy Mix, 2016). If all these plants are built, this would result in considerable overcapacity. Ultimately, this would lead to a greater creation of carbon-intensive power infrastructure in India than appears necessary.

The Energy Ministry's proposal to cancel the construction of four coal-fired Ultra Mega Power Plants (UMPPs) in June 2016 rolls out the uncertainty on the future of coal power capacity in India. The Draft Electricity Plan also confirms that no new coal capacity is needed after 2022, apart from the 50 GW that is already under construction and is likely to be ready by 2022. Based on the Draft Electricity Plan, it's projected that India will significantly cut short its emissions and, by 2030, its emissions intensity will be 51–53% below 2005 levels, exceeding its NDC target.

CO_2 emissions: The present scenario

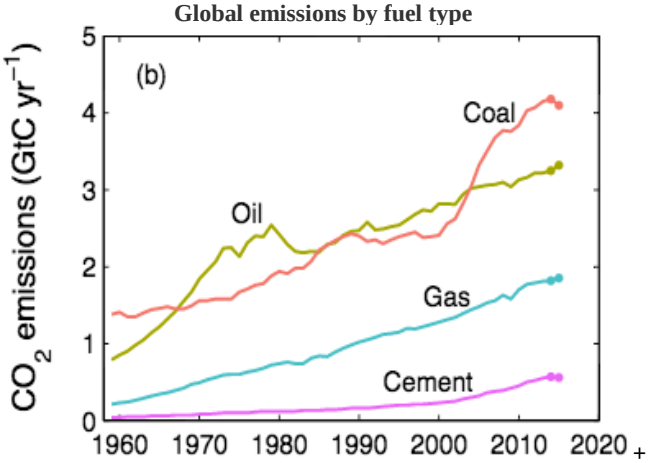
The observations from the Global Carbon Project is that the amount of CO_2 we put into the atmosphere from burning fossil fuels, gas flaring and cement production has held steady for three years in a row, neither increasing nor decreasing significantly. Growth in emission is typically expressed as a percentage increase or decrease on the previous year, or compared to a specific historical period. The new analysis finds global fossil fuel emissions grew by 0.7% in 2014, then held steady in 2015. Provisional data for 2016 predict a very small rise, of just 0.2%.

Global CO_2 emissions from fossil fuel and industry since 1960



Source: Le Quéré, C. et al. (2016)

Global emissions by fuel type



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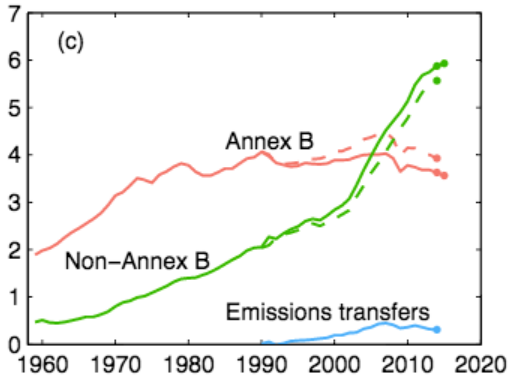
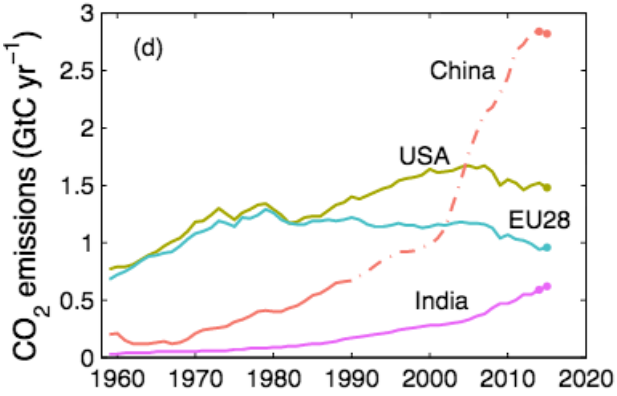
Territorial (solid) and consumption dashed) emissions by country group



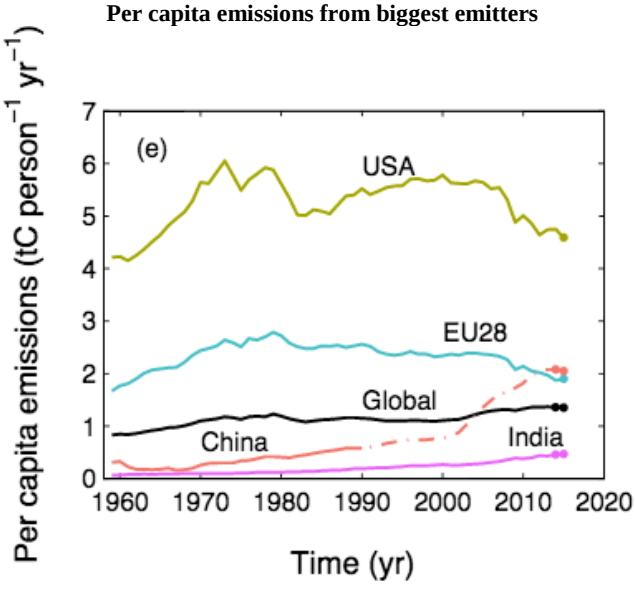
Source: Le Quéré, C. et al. (2016)

Territorial emissions from biggest emitters



Source: Le Quéré, C. et al. (2016)

Per capita emissions from biggest emitters



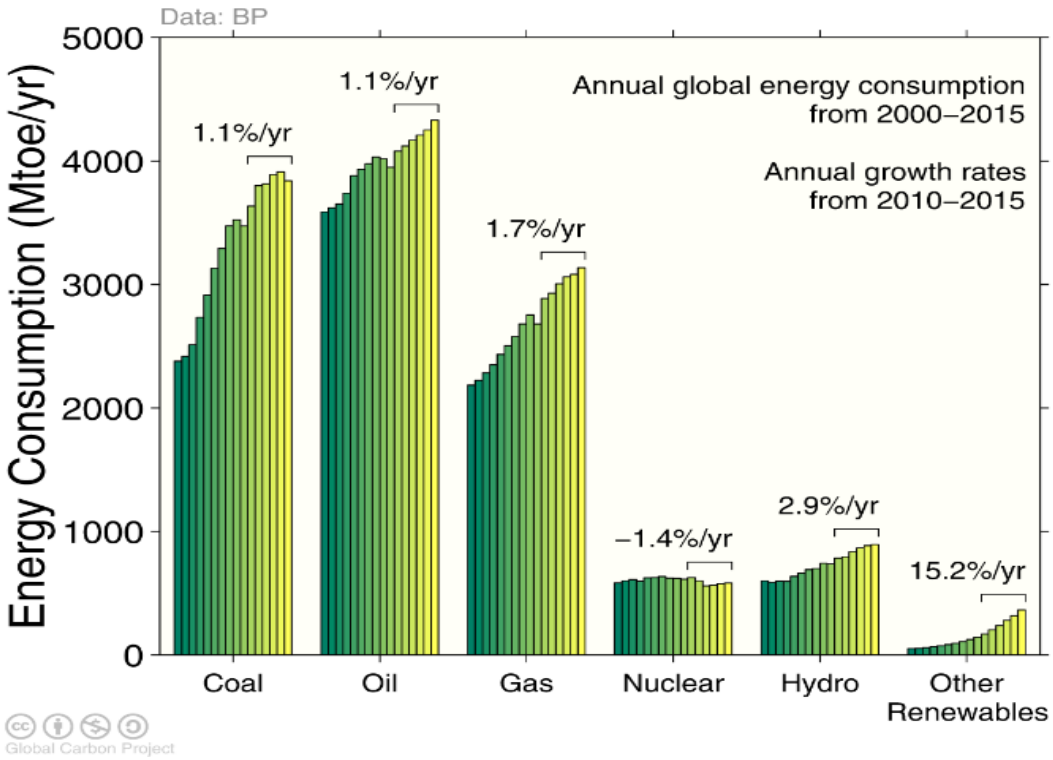
Source: Le Quéré, C. et al. (2016)

But as long as we are emitting CO_2, it continues to increase in the atmosphere – and it is doing so at record levels. The year 2016 was the first full year in which atmospheric CO_2 concentration stayed above the 400 ppm milestone. Rising concentrations will certainly lead to rising temperatures. The WMO has confirmed that 2011-2015 was the hottest five-year period on record and it predicted 2016 to be hotter, beating 2015 into second place with a global average temperature of 1.2ºC above the long-term average. This will mean 16 of the 17 warmest years on record will be since 2000.

Potential sources of emissions:

Over the last decade, emissions from fossil fuels and industry alone account for 91% of human-caused CO_2 emissions, with 9% coming from land use change. Of the 9.9bn tonnes of carbon in the form of CO_2 emitted from fossil fuels in 2015, 41% came from coal, 34% from oil, 19% from gas, 5.6% from cement production and 0.7% from flaring.

Energy consumption by fuel source from 2000 to 2015, with growth rates indicated for the more recent period of 2010 to 2015



Source: BP 2016; Jackson et al 2015; Global Carbon Budget 2016

For the period 2010-2015, energy from renewable sources grew by 15.2% per year when compared to 1.7% per year for gas and 1.1% per year for oil and coal both.

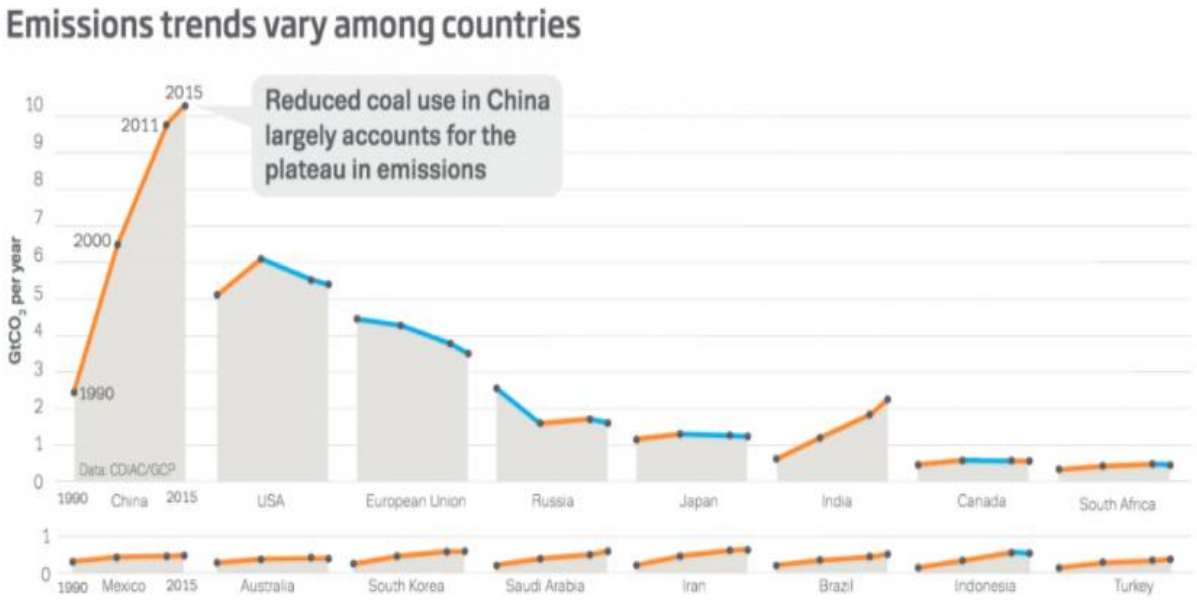
Weather peak of global CO_2 emissions:

Three years with very insignificant growth in fossil fuel emissions have raised hopes that we're witnessing a peak. But scientists are a bit cautious about over interpreting a few years of data. Dr Glen Peters, senior researcher at the Centre for International Climate and Environmental Research in Oslo (CICERO) and project manager of the Global Carbon Project, tells Carbon Brief: "Emissions have levelled out, but it's too early to say whether that's a peak in global emissions.

Major emitting countries stance on the issue:

The reason for the recent slowdown in global emissions is diverging energy use in China. In 2015, China's domestic emissions dropped by 0.7% and a further 0.5% fall are expected in 2016. This is then compared to an average rise of 5% per year over the previous ten-year period. China is the world's biggest emitter, with a share of 29% of global emissions in 2015. Any reduction in China's meteoric rise in CO_2 emissions since the early 2000s is, therefore, likely to have major global consequences. In 2016, the dip in emissions projection for China is largely down to a reduction in coal emissions of 1.8%, though this will be partly offset by a growth in emissions from oil of 4%, from natural gas of 7.2% and from cement production of 2.6%, provisional figures for January to September suggest. Despite stable emissions of the past few years, China emitted almost twice as much CO_2 in 2015 as the next biggest emitter, the United States. In 2015, the US Clean Power Plan puts a national limit on greenhouse gas emissions for the first time. The Clean Power Plan aims for a reduction in greenhouse gas emissions associated with coal, oil, and gas-fired power plants by 32% below 2005 levels by 2030. It stresses on the electricity sector, which is a good thing. Electricity generation from fossil fuels is the major industrial source of CO_2 emissions and 31% of the US total. Since 2000, emissions have shown an upward trend among the industrialized countries that ratified the Kyoto Protocol. Donald Trump's plans to exit the Paris climate agreement will have a negative impact on the goal of reducing emissions. In the recently concluded G20 meet, all the countries were motivated to assess subsidies with inefficient fossil fuel usage.

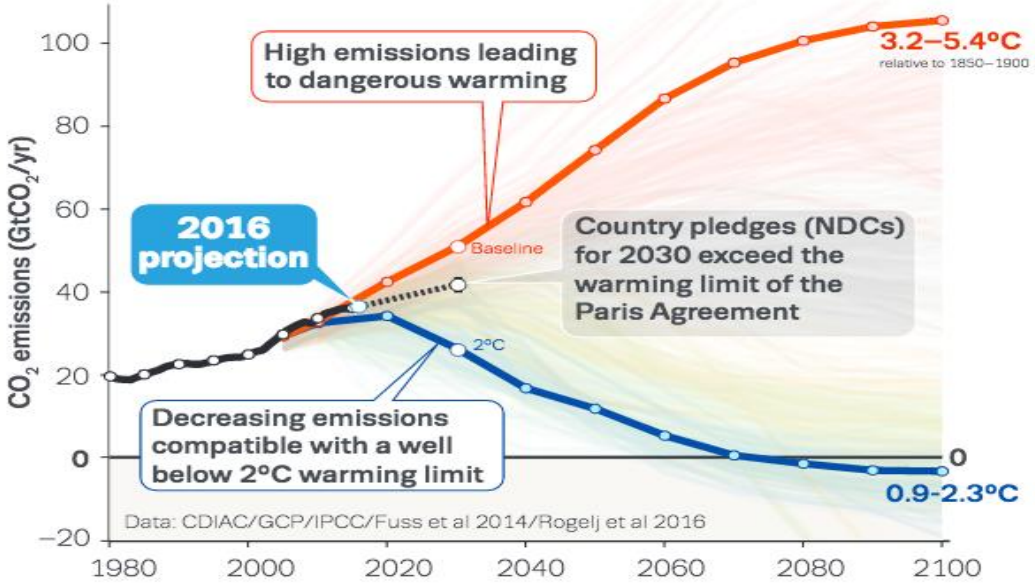
Emissions trends in different countries from 1990-2015. Orange lines indicate growth, blue indicates reductions.



Source: Le Quéré, C. et al. (2016)

As the second biggest emitter, the US is accounts for 15% of global emissions in 2015. Burning more of oil and gas, but less coal, made the US's emissions fall 2.6% in 2015 and they were expected to fall a further 1.7% in 2016. The EU's emissions increase by 1.4% in 2015, despite having declined over the long term. The bloc is the world's third largest emitter, responsible for 10% of global CO_2 emissions in 2015. In stark contrast, emissions are rising across the developing world. India, which shares 6.3% of global emissions, saw its emissions rise by 5.2% in 2015.

Global CO_2 emissions since 1980 (solid black) and country pledges under the Paris Agreement (dashed) compared to a high emissions scenario (orange) and a scenario compatible with limiting warming to 2ºC above pre-industrial levels (blue).



Source: Le Quéré, C. et al. (2016) based on Rogelj et al, (2016)

If the world chases the Paris Agreement's more ambitious limit of 1.5C, the timescales over which global emissions need to peak and start falling rapidly are much shorter. New Analysis from Climate Dynamics observes that to keep warming well below 2ºC and to pursue the goal to limit it to 1.5C in the most cost-effective way, rich countries must phase out coal-fired electricity by 2030, China by 2040 and the rest of the world by mid-century.

PARIS AGREEMENT TARGETS

India ratified the Paris agreement exactly one year after the submission of its Intended Nationally Determined Contribution (INDC), on 2 October 2016. Since India did not submit an NDC prior to ratification, the INDC became its first NDC. It includes the following main elements (Government of India, 2015a):

- ✓ "To reduce the emissions intensity of GDP by 33%–35% by 2030 below 2005 levels".

- ✓ "To increase the share of non-fossil based energy resources to 40% of installed electric power capacity by 2030, with help of transfer of technology and low cost international finance including from Green Climate Fund (GCF)".
- ✓ "To create an additional (cumulative) carbon sink of 2.5–3 GtCO2e through additional forest and tree cover by 2030".

The coverage and metrics of the emissions intensity target are not specified in the NDC. These emissions are 6.1–6.2 times greater than 1990 emissions levels. Depending on the way India plans to achieve its 40% non-fossil capacity target (e.g. by additional capacity of renewable energy sources, nuclear power or a combination), we estimate that reaching this target would result in an emissions level of 5.2–5.3 GtCO2e (a factor of ~5.4 above 1990 levels) by 2030.

If fossil fuel- based power plants are replaced by nuclear, an additional 51 MtCO2e can be reduced compared to the scenario in which they are replaced only by solar capacity. This is due to the higher load factor (electricity generation per GW installed) of nuclear energy compared to solar energy. Although not stated in the NDC, we assume that the target to create an additional carbon sink of 2.5–3 GtCO2e through additional forest and tree cover by 2030 is cumulative, representing an average annual carbon sink of 167–200 MtCO2e over the period 2016–2020.

2020 PLEDGE

India has pledged to reduce the emissions intensity of its GDP by 20–25% in 2020 below 2005 levels. This target does not cover emissions from the agricultural sector. India proposed the target during the Copenhagen negotiations and submitted it to the Copenhagen Accord on 30 January 2010. The quantification of this pledge covers a range of emissions between 3.6–3.8 GtCO2e in 2020 (excluding LULUCF). These emissions are 3.7–3.9 times greater than 1990 emissions levels.

POWER SECTOR POLICIES

The power sector accounted for 38% of India's total emissions (excluding LULUCF) in 2014. In June 2014, the Government of India announced its commitment to achieving a reliable electricity supply for all by 2019 (Forum of Regulators, 2014). Population growth, increased access to electricity and economic development are expected to result in a rapid growth of electricity demand in India. Over the next decade, India is likely to have the fastest-growing electricity market of any of the world's biggest economies (IEEFA, 2015). In our projections, we assume a growth of electricity demand of 5.2% a year (IEA, 2016).

On the federal level, India has implemented two major renewable energy-related policies. The 'Strategic Plan for New and Renewable Energy' provides a broader framework (outlining the mission, objectives, goals, implementation, and evaluation plan for India's renewable energy sector) and the 'National Solar Mission', launched in 2010, contains capacity targets for solar energy. Since the election of Prime Minister Modi in May 2014, the Indian Government has put climate change policy higher on the political agenda.

In November 2014, the government announced plans to increase its solar capacity to 100 GW installed capacity by 2022. This scaling-up of the national solar mission was officially adopted in August 2015 (MNRE, 2015b). By the end of 2014 the Government of India had approved plans for 25 Solar Parks and Ultra Mega Solar Power Projects, with a combined capacity of over 20 GW, to be developed in the coming five years (MNRE, 2014a). In the first half of 2015, targets for other renewable energy sources were also increased. Wind power is supported via a Generation Based Incentive, while state-level feed-in tariffs apply for all renewable. These are regulated by the Electricity Act (2003) and the National Tariff Policy (2006).

Renewable Energy Certificates (RECs) are in place that promote renewable energy and facilitate Renewable Purchase Obligations (RPO), which legally mandate a percentage of electricity to be produced from renewable energy sources. In April 2015, the RPO was revised upwards, from 3% by 2022 to 8% by 2019.

The Ministry of Power announced in April 2015 that every new coal-fired power plant would have to be accompanied by a renewable power plant of at least 10% of the generating capacity (IEEFA, 2015; Kenning, 2015). Given the supporting mechanisms and policies in place, it is expected to be feasible that India will meet its ambitious renewable energy targets.

With current policies, we project the share of non-fossil power generation capacity to reach 43% by 2022, the target year for 175 GW renewable energy. This share will either decrease to 38% or increase to 48% by 2030, depending on whether or not the renewable energy deployment trend is continued post-2022. Although committed to diversifying power supply and supporting renewable energy, the Indian government also supports the domestic coal industry. This is reflected in its aim of doubling India's domestic coal production to 1.5 billion tonnes by 2020, and to end the need for import of thermal coal (IEEFA, 2015). In December 2016, the Central Electric Authority (CEA) published the Draft Electricity Plan, which provides electricity demand forecasts for the period 2017–2027, and calculates installed capacities from conventional and renewable energy sources needed to meet that demand (Government of India, 2016a). To finalise the Draft Plan, it is undergoing a consultation process in which the CEA is seeking feedback from stakeholders.

The Draft Plan incorporates the impact of demand-side management as well as numerous energy efficiency and conservation measures that substantially reduce electricity demand. Considering additional capacity from nuclear, hydro, gas and renewables, the study reveals that no new coal-fired generation capacity is required during the years 2017–2022.

Uncertainty around the future construction of coal power capacity is illustrated by the June 2016 proposed cancellation of four coal-fired Ultra Mega Power Plants (UMPPs) by the Energy Ministry (IEEFA, 2016). Leading coal power producers such as Adani appear to have suspended investments and movement forward in this area and have instead scaled up investments in solar and renewable energy in both India and Australia (Mittal, 2016, Parkinson, 2016).

According to The Energy and Resources Institute (TERI) current installed capacity and the capacity under construction would be adequate to meet India's electricity demand by 2026, which indicates that no new coal based capacity will be deployed before 2026 (The Energy and Resources Institute, 2017). The report also estimates that after 2024 all new capacity can be renewable if they become cost competitive and

the grid is able to accommodate increased amounts of variable sources of generation (The Energy and Resources Institute, 2017). These developments and the apparent softening of commitments to build the currently planned coal capacity are not yet reflected in the energy and emissions scenarios for India.

OTHER POLICIES

In 2010 the Indian Government introduced a coal tax of 50 rupees (0.8 USD) per metric tonne of coal produced and imported to acknowledge the externalities related to coal use and to encourage a shift away from coal-fired power. Since then, this tax—now called the Clean Environment Cess—was doubled three times, reaching 400 rupees per tonne in the 2016–2017 budget. The revenues from the coal tax feed into the National Clean Environment Fund, which provides finance to renewable energy projects. Part of the revenue has been earmarked for the implementation of 'Ultra Mega Solar Power' projects (IEEFA, 2015; Mahapatra, 2016).

In May 2015 the "National Smart Grid Mission" was approved to bring efficiency in power supply and facilitate the reduction in grid losses and outages (Government of India, 2015b).

India finalised its first light vehicle fuel-efficiency standards in 2014; these were scheduled to take effect in April 2016, but their implementation was postponed by a year (TransportPolicy.net, 2017). The standards are scheduled to come into force in April 2017, setting efficiency targets for new vehicles that weigh under 3,500 kg with no more than 9 seats (The International Council on Clean Transportation, 2014). The efficiency targets start at the equivalent of 130 gCO2/km in 2016-17 and fall to 113 gCO2/km in 2021-22 (The International Council on Clean Transportation, 2014). The standards are based on the average weight of the fleet that manufacturers will sell in a year and the Ministry of Road Transport and Highways (MORTH) is responsible for implementing the standards under the regulations of Bureau of Energy Efficiency (BEE). Currently there are no CO_2 emission standards for light commercial vehicles.

In 2013, the Indian Government set up the National Electric Mission Mobility Plan (NEMMP) 2020 (Government of India, 2015c). As part of the Mission, the Department of Heavy Industry launched the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME India) scheme. The scheme aims to support the development of the hybrid/electric vehicle market and targets a deployment of 6–7 million vehicles per year by 2020 (Government of India, 2015c). India's vision for electrification of vehicles was also reflected in a recent statement by Indian Power Minister Piyush Goyal who said: "by 2030, not a single petrol or diesel car should be sold in the country." (The Times of India, 2017).

Under the 'National Mission on Enhanced Energy Efficiency,' India implemented its 'Perform, Achieve and Trade (PAT)' Mechanism, which resembles an emissions trading scheme (ETS). The first phase of the PAT scheme ran from 2012 to 2015. Currently the scheme is in its second phase (2016–2019). PAT differs from traditional cap-and-trade systems as it sets intensity-based energy targets.

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