India

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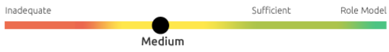
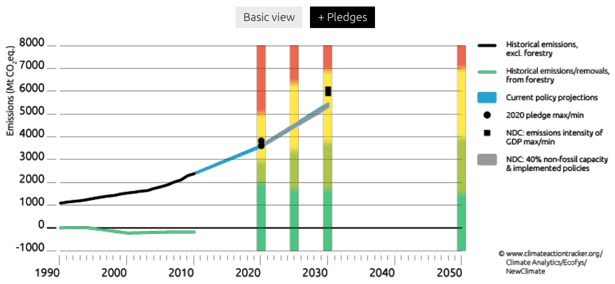
Rating





Note: Hover over the coloured bars for a pop-up with the fair emissions range per effort sharing category. More information here.

Assessment

The rapid growth in renewable energy in India, combined with sustained reductions in coal imports and increasing challenges to the viability of new coal-fired power plant construction—with ultra-mega coal projects cancelled—gives an indication of the transformation that is beginning in India's energy supply sector. With every sign that China is now beginning to reduce its coal and carbon dioxide emissions, developments in India are amongst the most important underway globally. Given its state of development, India could have been expected to increase its coal-fired power use for decades. However, there appears to be a transition underway with an extremely rapid growth in renewable energy installations, which has begun to displace planned coal at a scale that has surprised many analysts. India's Nationally Determined Contribution (NDC) under the Paris Agreement (PA) does not yet reflect these developments. With the currently targeted 175 GW of renewable power capacity to be reached by 2022, India is already set to overachieve its emissions intensity target. The likely continued expansion of renewables after 2022, for which no targets have yet been set, would result in India also overshooting its 2030 non-fossil capacity target. Thus India's Paris Agreement NDC commitment is weaker than actions resulting from current policies. Neither the NDC nor current policies are ambitious enough to limit warming to below 2°C, let alone the Paris Agreement's stronger 1.5°C limit, unless other countries make much deeper reductions and comparably greater effort.

On 2 October 2016, India ratified the Paris Agreement. India 's Nationally Determined Contribution (NDC) targets to lower the emissions intensity of GDP by 33% to 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 $GtCO_2e$ through additional forest and tree cover by 2030. For 2020, India has earlier put forward a pledge to reduce the emissions intensity of GDP by 20% to 25% by 2020 below 2005 levels. Both the NDC and Copenhagen pledge are in line with current policies and we rate them as "medium."

The "medium" rating indicates that India's climate plans are at the least ambitious end of what would be a fair contribution. This means they are not consistent with limiting warming to below 2°C, let alone with the Paris Agreement's stronger 1.5°C limit, unless other countries make much deeper reductions and comparably greater effort.

Existing policies and measures are described in detail in India's NDC. However, the description of the targets is very brief. India could increase the transparency of its NDC by describing the greenhouse gas and sectoral coverage and metric for the intensity target (e.g. constant or nominal GDP) as well as the way it envisages it will achieve the non-fossil power capacity target.

Given that the coverage is not specified, we have assumed that the 2030 intensity target excludes the agriculture sector, consistent with India's Copenhagen pledge to reduce the emissions intensity of GDP by 20% to 25% by 2020 below 2005 levels.

Under the assumption of a 7.2% annual GDP growth, we rate the absolute emission levels resulting from both the 2020 and 2030 intensity targets" medium." The non-fossil generation target would result in lower absolute emissions than the intensity target alone, effectively leading to a larger reduction in intensity than in the INDC target itself (see below). As the non-fossil generation target is conditional on the provision of resources, the CAT rating is dominated by the intensity target.

With currently implemented policies, including the target for 175 GW renewable energy capacity by 2022, we project the share of non-fossil power generation capacity will reach 39% in 2030, corresponding to a 24% share of electricity generation. Depending on the way India plans to achieve its 40% non-fossil target (i.e. by additional capacity of renewable energy sources, nuclear power or a combination of the two), we estimate reaching the 40% target would result in emissions savings of 15–54 $MtCO_2e$, or 0.2–1.0% below current policy projections. Achieving it by 2030 would see India exceeding its NDC intensity target by a wide margin: 41–42% below 2005 levels. If the non-fossil target were dominant in the NDC implementation, absolute missions would be lower, as noted above but the target would still be rated "medium".

Although India's 2022 renewable energy target represents a rapid increase in renewable energy generation, this is not enough to keep up with growth in electricity demand. Under current policies, we estimate the growth rate for solar and wind power capacity—at 12% per year on average—which exceeds the growth rate for coal-powered electricity capacity—at 5% per year on average—between 2013 and 2030. However, the absolute growth in coal-powered electric generating capacity would be significantly larger than the absolute increase in renewable/non-fossil generation capacity over the same period. 65 GW of coal-fired capacity is currently under construction in India, with another 178 GW in the permitting pipeline. However, it is expected that this would result in considerable overcapacity, should all these plants be built. Ultimately, this would lead to a greater lock-in of carbon-intensive power infrastructure in India than appears necessary. Uncertainty around the likely future build of coal power capacity is illustrated by the cancellation, proposed in June 2016 by the Energy Ministry, of four coal-fired Ultra Mega Power Plants (UMPPs). Leading coal power producers such as Adani appear to have suspended investments and further development in this area and instead have scaled up investments in solar and renewable energy in both India and Australia.

Pledges and targets

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—the 147th birth anniversary of Mahatma Gandhi. 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% to 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 $GtCO_2e$ through additional forest and tree cover by 2030

The coverage and metrics of the emissions intensity target are not specified in the NDC. In our analysis we have assumed that the target excludes the agriculture sector, consistent with India's 2020 pledge. Under the assumption of a 7.2% annual GDP growth (IEA, 2015a), the emissions level resulting from this target would be 5.9–6.0 $GtCO_2e$ (excluding LULUCF) by 2030. This is a factor of 5.4–5.6 above the 1990 level.

With currently implemented policies, including the target for 175GW renewable by 2022, we project the share of non-fossil power generation capacity to reach 39% in 2030. Depending on the way India plans to achieve its 40% target (i.e. by additional capacity of renewable energy sources, nuclear power or a combination), we estimate reaching this target would result in emission savings of 17–54 $MtCO_2e$ below current policy projections, resulting in an emissions level of 5.3–5.5 $GtCO_2e$ (a factor 4.9–5.0 above the 1990 level) by 2030. This is far below the emissions level required for India to meet its intensity target. Next to these mitigation targets, India's INDC also strongly emphasises adaptation measures.

Copenhagen pledge	
2020 target	20% to 25% below 2005 emissions intensity of GDP by 2020 [231-251% above 1990 by 2020 excl. LULUCF]
Coverage	Excluding agriculture sector
Conditions	None
Paris Agreement target	
Ratified	Yes
2030 targets	33% to 35% below 2005 emissions intensity of GDP by 2030 [442-458% above 1990 by 2030 excl. LULUCF] Non-fossil share of cumulative power generation capacity 40% by 2030
Coverage	Not specified
LULUCF	Additional (cumulative) carbon sink of 2.5–3 $GtCO_2e$ by 2030
Long term goal(s)	
Long-term goal(s)	Per capita emissions never to exceed those of the developed world

Although the INDC does not state this, we assume the target to create an additional carbon sink of 2.5–3 $GtCO_2e$ through additional forest and tree cover by 2030 to be cumulative, representing an average annual carbon sink figure of 167–200 $MtCO_2e$, over the period 2016–2020. Over half of this target could be achieved by the Green India Mission, which is expected to enhance the annual carbon sequestration by about 100 $MtCO_2e$.

2020 pledge

India has pledged to reduce the emissions intensity of its GDP by 20–25% in 2020 compared to 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 between 3.6 and 3.8 $GtCO_2e$ in 2020 (excluding LULUCF). This is a factor 3.3–3.5 above the 1990 level.

Long-term goal

In 2007, at the G8+5 Summit in Germany, then Indian Prime Minister Singh pledged that India's per capita emissions would never exceed those of the developed world. Given India's low per capita emissions, meeting this pledge does not require any emissions reductions compared to the current policy projections up to 2030, and this pledge is not shown in the figure. However, we take this pledge into account in the global pathway to 2100, when calculating the associated rise in global temperature. Over the period 2010–2030 we project per capita emissions to increase by around 84–88% from 1.9 to around 3.6 tCO_2e per capita (excluding LULUCF) by 2030. Although this represents a strong increase, India's 2030 per capita emissions will still be far below the 2010 world average of 6.7 tCO_2e per capita.

Fair share

We rate India's 2030 INDC and 2020 pledge "medium".

The pledges are in line with effort sharing approaches that focus on equal cumulative per capita emissions. Approaches that focus on historical responsibility and capability would require more stringent emissions reductions. Current policy projections for 2030 are in line with fair shares based on converging per capita emissions for all countries to the same level (equality), and staged approaches.

The "medium" rating indicates that India's climate commitments are at the least ambitious end of what would be a fair contribution. This means they are not consistent with limiting warming to below 2°C, let alone with the Paris Agreement's stronger 1.5°C limit, unless other countries make much deeper reductions and comparably greater effort.

Unlike other developing countries such as China, India has not yet announced a peaking year for GHG emissions. Based on our effort-sharing analysis, India's emissions indeed would not need to peak before 2050 to contribute a fair share of global emission reductions. However, to be rated "sufficient," India's emissions growth would have to slow down compared to current policy projections.

Current policy projections

Our analysis shows that the India can achieve its NDC target with currently implemented policies, i.e. it would not have to put any other policies in place. Under current policy projections, greenhouse gas emissions (excluding LULUCF) are projected to reach a level of 3.6 $GtCO_2e$ in 2020 and 5.4–5.5 $GtCO_2e$ in 2030. This is a 50% increase in emissions from 2010 levels by 2020 and a more than doubling of 2010 levels by 2030. This growth is in line with the 2020 intensity pledge, and exceeds the 2030 intensity target, but whether India will achieve its targets depends on actual economic growth. We assume a 7.2% GDP (real) growth per year for both the targets and current policy projections (IEA, 2015a). The Indian Government targets higher GDP growth of around 8% per year in its 12th Five Year Plan (Government of India, 2013) and NDC (Government of India, 2015a), but has not yet been able to achieve its aspirations. In a speech to members of the U.S. Congress Prime Minister Modi said that its annual growth goal must "be achieved with a light carbon footprint, with greater emphasis on renewables" (IEEFA, 2016).

India's total emissions have been growing steadily since 1990. The overall growth slowed down around the year 2000 as land use changed from being a small source of emissions in the first inventory year—14 $MtCO_2e$ in 1994—to a large sink, with removals of 223 $MtCO_2e$ in 2000 and 175 $MtCO_2e$ in 2007. Based on projections from the Planning Commission Government of India (2014), this carbon sink is expected to increase to 206 $MtCO_2e$ in 2020 and 228 $MtCO_2e$ in 2030 under the National Green India Mission (GIM). These projected sinks are equivalent to 6% and 4% of GHG emissions excluding LULUCF in 2020 and 2030, respectively.

Population is one of the main drivers of India's projected GHG emissions. By 2028 India is projected to overtake China as the largest country in terms of population. During the period 2010–2030, India's population is projected to increase by 24% (or 297 million people), reaching 1.53 billion people (UN, 2015, medium fertility projections) by 2030. Over the same period, we project per capita emissions to increase by around 84–88% to 3.6 tCO_2e per capita (excluding LULUCF) by 2030. Although this represents a strong increase, India's 2030 per capita emissions will still be far below the 2010 world average of 6.7 tCO_2e per capita.

India launched its National Action Plan on Climate Change (NACC) in 2008, which outlines eight national missions in the area of sustainable development (Government of India, 2008). India's 12th Five Year Plan for the period 2012–2017 (Government of India, 2013) proposed a re-organisation of the NACC. The Five Year Plans provide the basic direction for government activities, addressing all sectors and policy areas. Our analysis includes the 11th and 12th Five Year Plan.

Power sector policies

The power sector accounted for 32% of India's total emissions (excluding LULUCF) in 2010. Given that the fuel mix is dominated by coal-fired generation (71% in 2012; IEA, 2014), the emissions intensity of electricity supply in India is relatively high (926 gCO_2/kWh in 2012). On the other hand, per capita electricity demand in India is very low at around 700 kWh/capita in 2012, a quarter of the global average in that year (IEA, 2014; UN, 2013). In 2012, 21% of the population—265 million people—still had no access to electricity (World Bank, 2015).

In June 2014 the Government of India announced its commitment to achieving 24x7 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 6% a year (IEA, 2015a). 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.

The original targets of the 'National Solar Mission" were 10 GW of solar power capacity by 2017 and 20 GW by 2022 (MNRE, 2010). Cumulative installed solar power capacity in India reached 4 GW in July 2015 (MNRE, 2015c). 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. India currently targets a cumulative installed capacity of 175 GW by 2022. This target consists of 100 GW solar, 60 GW wind, 10 GW biomass and 5 GW small-scale hydro (MNRE, 2015a). Wind power is supported via a Generation Based Incentive, while state-level feed-in tariffs apply for all renewables. 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.

However, given the rapid growth of electricity demand and the prevailing dominance of other energy sources such as coal, the total impact of the renewable energy policies and targets is expected to be low compared with the potential of renewable energy, especially for solar power (MNRE, 2014b). With current policies, we project the share of non-fossil power generation capacity to reach 45% by 2022, the target year for 175 GW renewable energy. Given the rapid growth of total power generation capacity, we project this share to then decrease to 39% by 2030—in the absence of post-2022 renewable energy targets. The 39% share of non-fossil capacity corresponds to 24% non-fossil power generation. If India were to achieve its ambitious targets for 2022, the 40% target of non-fossil power capacity generation by 2030 would be within reach. If renewables continue to grow after the 2022 target is met, then India is likely to overachieve its non-fossil capacity target.

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). Under current policies, we project the coal-fired power capacity in India to increase by a factor of 3.8 in the period 2010–2030. India's 12th Five-Year Plan sets a target of 60% for new coal plants using supercritical technology, but currently most plants still have less efficient subcritical technology (IEA, 2015a). Policy measures to make sure new units have efficiencies consistent with supercritical or ultra-supercritical technology will not come into effect until 2017 (IEA, 2015b).

About 65 GW of coal-fired capacity is currently under construction in India, with another 178 GW in the permitting pipeline. However, it is expected that this would result in considerable overcapacity, should the entire pipeline be realised (Krishna & Fernandes, 2016). Uncertainty around the likely future build 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 appeared 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).

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. In our current policy projections, we assume coal-fired power plant capacity will increase by 177 GW from the current level of 186 GW, reaching 363 GW 2030. Should the developments outlined above, combined with the rapid growth of renewables, continue for much longer, they would be a strong indication that India is beginning a long-term transition towards a diversified, low carbon power supply.

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).

Apart from rapid electricity demand growth, another challenge India faces is its high power grid losses. India has the highest aggregate technical and commercial (AT&C) grid-loss rate in the world (IEEFA, 2015), estimated at 26%. 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).

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. The scheme covers 478 of the country's industrial and power generation facilities in eight sectors that, in total, cover 60% of India's 2007 GHG emissions.

The target is to achieve an average 4.8% reduction of Specific Energy Consumption (SEC) of the participating facilities in 2015 (below the 2007–2010 baseline level). These targets are calculated for each installation separately; more efficient plants have lower SEC targets compared to more inefficient plants. Installations that exceed their target can sell Energy Saving Certificates to installations that did not meet their target. (EDF, CDC Climat Research & IETA. 2015). The effect after 2015 heavily depends on the rules governing the continuation of the scheme, which have yet to be decided. In its NDC, the Government of India states that the scheme will be widened and deepened in the next cycle, including additional sectors like railways, electricity distribution and refineries (Government of India, 2015a).

Assumptions

Historical emissions

Historical emissions are a combination of CO_2 from fuel combustion from IEA (2015c), CO_2 emissions from cement production from CDIAC (2014), other CO_2 emission from JRC/PBL (2012), and non-CO_2 emissions from USEPA (2012). LULUCF emissions are taken from UNFCCC (2014) for 1994 and 2000, Government of India (2012) for 2007 and Planning Commission Government of India (2014) for 2010.

Current policy projections

Current policy projections are based on the World Energy Outlook 2015 Current Policy Scenario (IEA, 2015a) combined with the US EPA non-CO_2 emissions projections until 2030 (US EPA 2012) and extrapolation of other CO_2 emissions based on JRC/PBL (2012), CDIAC (2014) and WBCSD/IEA (2013). The increased renewable energy targets, which were not yet included in the Current Policy Scenario, were additionally quantified and are expected to result in emission savings of 100 $MtCO_2e$ beyond the Current Policy Scenario in 2020 and 62 $MtCO_2e$ in 2030.

2020 pledge and NDC

For consistency with the current policy projections, the intensity targets for 2020 and 2030 are quantified based on GDP assumptions from the World Energy Outlook (IEA, 2015a). GDP is assumed to grow by on average 7.5% in the period 2014–2020, and 7% in the period 2020–2030. This is roughly in line with the historical GDP development until 2014 and projections to 2019 from the IMF (2015). The 2020 pledge excluded agriculture. We assumed this is also the case for the 2030 target, even though it is not mentioned in the INDC. If agriculture were to be included, the resulting emissions level would be 15% higher (6.8–7.0 $GtCO_2e$).

For the 40% non-fossil power generation capacity we analysed two ways of achieving the additional capacity needed beyond currently implemented policies and show the range of these two options, 1) based solar power, and 2) based on nuclear power. These two options represent the extremes in terms of emissions reductions. The emissions reduction compared to current policies is 17–54 $MtCO_2e$.

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