Coal expansion plans indicate the continuation and - in some cases - move towards high-carbon energy systems. Achievement of the respective INDC contributions seems difficult for many of countries with largest expansion plans if all new capacity is implemented, with the possible exception of India. In all cases new capacity, if built, will lock in substantial future emissions, which will make it hard for countries to ramp up their ambition in future review rounds under the Paris Agreement as required in light of the inadequate level of current commitments.

INDCs and coal

How climate plans (don't) link to ongoing expansion of coal-fired power generation

November 2016

Marion Vieweg

CURRENT FUTURE.

KEY TAKEAWAYS

- The expansion of coal-fired power generation is concentrated in quite a small number of countries. 88.7% of all new capacity additions are planned and constructed in 10 countries The top 5 countries cover 82% of new capacity and only two countries - **China and India - cover 70% of new capacity** with the third largest, Turkey, representing around 5% of new capacity.
- A conservative estimate would expect **annual emissions from new capacity of 4.2 $GtCO_2$** or 42% of current emissions from coal combustion for electricity and heat production.
- **For 1.5°C scenarios, emissions from new coal-fired power generation in 2050 would consume between 44% and 154% of emissions**, which would require most other emissions to go to zero or be compensated by negative emissions. For 2°C scenarios the emissions from these power plants would still represent a substantial share, between 21% and 36%.
- China: **Locking in between a quarter and half of allowed emissions** by one single emission source will make it hard to achieve the stated goals. Given the specifics of the Chinese energy system, capacity will likely lead to early closures and thus block investment that could be used to support a clean energy infrastructure.
- India: **New capacity would continue existing high-emission energy system patterns**, expanding them to a much larger level. While the INDC could potentially be achieved despite this development, the lock-in will make it hard for India to commit to more ambitious contributions in the future.
- Turkey: Current coal expansion plans point towards a **restructuring of the sector towards high-emission, coal-based generation**. Locking in up to a third of allowed emissions would make it challenging for Turkey to achieve their set commitment and even more to enhance ambition in the future.
- The disconnect between coal expansion plans and formulated climate goals also points to a lack of integration at the institutional level. A closer **integration of climate policy and energy policy** could help to align energy planning and climate goals, making achievement of NDCs more likely and enhancing opportunities for raising ambition in the future.

Content

INTRODUCTION

The Paris Agreement is a milestone in international climate diplomacy. The global community agreed to "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels", and to a new architecture with mitigation commitments from all Parties (United Nations, 2015). 189 out of 197 countries submitted their 'intended nationally determined contributions' (INDCs) (Joergen Fenhann, 2016), a new record in the UN system.

However, the synthesis report prepared by the UNFCCC secretariat in November already showed that while submitted INDCs substantially reduce emissions from previous estimates, they are not yet in line with least-cost 2°C, let alone 1.5°C pathways. The updated synthesis report in April confirmed this (UNFCCC, 2016).

At the same time, coal expansion seems to continue unabated, and some of the countries putting forward their climate commitments under the UNFCCC are planning and constructing new coal-fired power generation capacity at large scale (Global Coal Plant Tracker, 2016). This paper looks at how these coal plans and related national energy strategies link to the submitted INDCs, and analyses the implications for achieving stated commitments.

PLANS FOR NEW COAL-FIRED POWER

The Global Coal Plant Tracker estimates that currently 2,457 power plant units (Global Coal Plant Tracker, 2015b) with a total capacity of 1.427 GW are being constructed, are (pre-)permitted or announced. This is almost twice as much as the total existing capacity of China in 2014. 25% of global new capacity[1] is already under construction, roughly a third has been announced and the rest is in different stages of permitting (Global Coal Plant Tracker, 2016).

The expansion of coal-fired power generation is concentrated in quite a small number of countries. 88.7% of all new capacity additions are planned and constructed in 10 countries (see Table 1), the top 5 countries cover 82% of new capacity and only two countries - China and India - cover 70% of new capacity with the third largest, Turkey, representing around 5% of new capacity. Together these countries represent 35.3% of global emissions (UNFCCC, 2015).

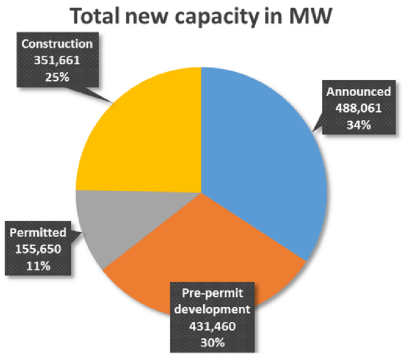


Figure 1 New capacity in MW by status

" 88.7% of all new capacity additions are planned and constructed in 10 countries "

[1] In the following the term 'new capacity' is used for all power plants that are announced, in pre-permitting or permitting stage or under construction

Table 1 Overview coal expansion of the top 10 countries

		MW (January 2016)									Change since January 2015		
Rank by new capacity*	Country	Announced	Pre-permit development	Permitted	Construction	Total new capacity*	Share in global new capacity	Newly Operating (2010-2015)	Shelved	Cancelled (2010-2015)	Announced + Pre-permit + Permitted	Construction	Newly Operating (2010-2015)
1	China	251,960	214,574	42,380	202,899	711,813	49.9%	292,575	60,785	164,495	12,584	86,289	67,375
2	India	60,630	95,595	58,244	75,665	290,134	20.3%	98,410	85,065	305,272	-82,600	6,194	18,970
3	Turkey	31,969	29,925	5,095	2,965	69,954	4.9%	4,738	13,501	15,269	6,584	-2,070	1,207
4	Vietnam	15,620	10,400	14,820	12,140	52,980	3.7%	8,448	0	13,930	-3,380	-4,950	5,266
5	Indonesia	17,825	17,930	4,400	5,210	45,365	3.2%	11,795	1,450	5,465	12,665	94	2,636
6	Japan	7,982	10,407	3,022	1,977	23,388	1.6%	1,850	0	0	8,740	1,210	0
7	Pakistan	10,470	3,890	5,793	930	21,083	1.5%	0	5,800	7,620	12,573	930	0
8	South Korea	2,000	7,542	1,000	10,234	20,776	1.5%	1,740	0	3,840	10,442	-4,606	1,140
9	South Africa	2,315	3,735	600	8,743	15,393	1.1%	1,545	6,720	520	-1,280	-1,085	1,545
10	Myanmar	13,840	660	0	0	14,500	1.0%	0	905	4,720	6,315	0	0

*Announced + Pre-permit + Permitted + Construction

Source: (Global Coal Plant Tracker, 2016)

If all of the plants were built, they would emit an estimated 6.1 $GtCO_2$ per year, with 1.5 $GtCO_2$ per year just from those already under construction. A further 2 $GtCO_2$ per year is emitted by plants that started operating between 2010 and 2015 (Global Coal Plant Tracker, 2015a).

However, Shearer, Ghio, Myllyvirta, Yu, & Nace, 2016 come to the conclusion that globally there is a 50:50 chance that proposed coal projects will actually be implemented. Applying this to the announced and pre-permit development capacity, annual emissions from new capacity would be 4.2 $GtCO_2$. These numbers do not include any 'self-use' or 'captive' coal fired power generation capacity, which could add a substantial amount of future emissions, especially in China.

To put this in perspective: total emissions from fuel combustion reached 32.4 $GtCO_2$ in 2014, with coal used for electricity and heat production representing almost a third, at around 10 $GtCO_2$ (IEA, 2016b).

NEW CAPACITY AND THE PARIS AGREEMENT

The UNEP Gap Report 2015 estimated that pathways limiting warming to 2°C and 1.5°C[2] require limiting emissions to between 4 and 29 $GtCO_2e$ per year by 2050 (UNEP, 2015). Additionally, the Paris Agreement not only agrees to limit global warming to below 2°C, striving to limit it to 1.5°C. Article 4, para 1 also operationalizes the goal "… to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century…" (United Nations, 2015).

Some of the new capacity will be replacing old, less efficient installations, some is planned to address increasing demand. However, considering that coal-fired power plants are normally associated with a lifetime of around 40 years, the difference hardly matters. Emissions from new plants - if built - would still be around by 2030 and 2050, unless further action is taken[3].

While not all of the new plants will actually represent additional emissions[4], locking in 6 to 8 $GtCO_2$ per year just from coal will make it hard for the global community to achieve the Paris goals and will, at a minimum, produce a significant amount of stranded assets. Investments that could already be used to transition towards a cleaner energy supply.

" Investments could already be used to transition towards a cleaner energy supply "

[2] With limited action until 2020 (Cancun pledges) and least cost pathways afterwards

[3] For example by taking plants offline before the economic and technical end of their lifetime, generating extra cost in the future

[4] As some will replace old capacity and in some countries they will lead to a decrease in plant usage (see discussion on China below)

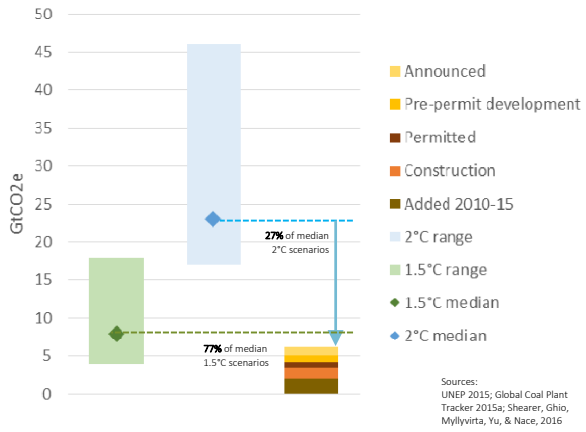
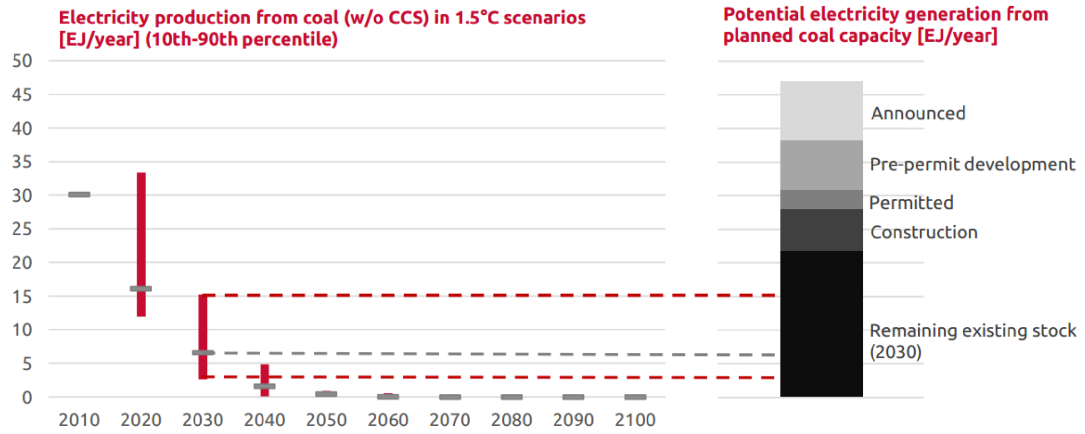


Figure 2 Annual emissions for 1.5°C and 2°C scenarios compared to emissions from new capacity in 2050

For 1.5°C scenarios, emissions from new coal-fired power generation in 2050 would consume a large share of allowed global emissions. Between 44% and 154% (median 77%) of emissions would come from these coal-fired power plants, which would require most other emissions to go to zero or be compensated by negative emissions. For 2°C scenarios the emissions from these power plants would still represent a substantial share, between 21% and 36% (median 27%).

The Climate Action Tracker illustrated this mismatch between new coal capacity and what is required to achieve 1.5°C scenarios (see Figure 3) based on electricity production. It shows that even already existing capacity, if operated for the full lifetime of the investment, would exceed demand in 2030 under low emission pathways.

Figure 3 Coal-fired power generation in 1.5°C scenarios vs. new capacity in 2030



Note: Coal-fired power generation (without CCS) in a selection of 1.5°C scenarios. The ranges indicate the 10th to 90th percentile, while the grey line indicates median values. The median values show a rapid decrease of coal-fired power generation

Source: (Breevoort et al., 2015)

At the global level it is clear that new capacity, if built, will make it more difficult and expensive to achieve emissions levels that are in line with 2°C and 1.5°C pathways and to achieve the goals set in Paris.

COAL IN NATIONAL ENERGY STRATEGIES

This section briefly outlines the role of coal within the national energy strategies for the top three countries with the largest coal expansion plans. It also discusses the role of local coal resources for expansion plans.

CHINA

Coal development in China has so far mainly been driven by national economics and availability of national coal (Myllyvirta, Shen, & Lammi, 2016). The last decade has seen an immense growth in added capacity for coal-fired power generation and the pipeline promises further capacity additions in the coming years (Global Coal Plant Tracker, 2016). It has also seen China turn from coal exporter to the largest importer globally despite of its large coal reserves (EIA, 2016).

" Low usage and the willingness of the Chinese government to close down plants before the end of their lifetime increase investment risk "

Recent capacity additions and plans for expansion are mainly driven by the provinces, since authority for permitting was transferred from the national level to the provinces in 2013. At the same time coal use for power generation has dropped in 2014 and 2015, driven by changes in economic structure, increased competition from renewables and government programmes to reduce air pollution. The effect of this dichotomy is a drop in usage rate for power plants from just over 60% in 2011 to 49% in 2015 (Shearer et al., 2016).

Due to these developments, additional capacity will not necessarily lead to additional emissions in the short to medium, as average operating hours decrease due to limited demand, assuming the recent trend continues. Low usage and related lack of profitability together with the proven willingness of the Chinese government to shut down plants before the end of their technical lifetime result in a lower assumed operating life of plants and increased investment risk, and will likely lead to large-scale stranded investments (Shearer et al., 2016) or a further drop in implementation rate.

In an attempt to align new capacity better with national climate, energy and air pollution goals, the national government has halted construction of 200 permitted coal-fired power plants (105 GW - as much as all installed electricity generation capacity in Spain). The published guidelines effectively delay approval for some plants or put off construction for capacity that has been approved but not yet started (Forsythe, 2016). If permanent, this would reduce the pipeline for China effectively by 28%. Latest news indicate that the national government is even stopping 30 coal-fired power plants already under construction, with a capacity of 17 GW (Myllyvirta & Mills, 2016).

INDIA

India currently operates 305 GW of power stations, 186 GW of which are coal (61%) (Government of India: Central Electricity Authority, 2016a). It has expanded its generation capacity at an immense pace. In 2012 only 200 GW were operating, with coal already representing the largest share at 56% (Government of India: Central Electricity Authority, 2012). 98 GW (52%) of coal fired capacity was added between 2010 and 2015. A further 75 GW were under construction in 2015. At the beginning of 2016, the country had plans for another 215 GW (Global Coal Plant Tracker, 2016).

Population growth, economic growth and increasing electrification of the population have quadrupled electricity demand between 1990 and 2012 (Government of Australia, 2015). The electrification rate increased from 51% in 1990 to 79% in 2012, but there remains almost a quarter of the population with no access (World Bank, 2016). Given this, it is surprising to see the plant load factor (usage) decrease from 77% in 2009/10 to 62% in 2015/16 with a forecast to further decline (Government of India: Ministry of Power, 2016). At the same time there were shortages in terms of energy and peak availability in 2015/16, although a surplus is projected for 2016/17 (Government of India: Central Electricity Authority, 2016b).

The government not only aims to improve the utilization of existing thermal power plants, it also has ambitious expansion plans for renewable energy. This could make some of the new coal capacity that is still in planning stages unnecessary. In April 2016 the Power Ministry already announced it had scaled back its

projected thermal power capacity growth forecast by 50GW, reducing the target from 289GW to 239GW by 2022. In line with this, the Ministry in June announced plans to cancel four proposed coal-fired power plants with a combined capacity of 16 gigawatts (GW). They were part of the 'ultra mega power plants (UMPP)' initiative, which forms part of the energy strategy, but has met with multiple delays due to various reasons, including local resistance and lack of interest from states (Buckley, 2016).

TURKEY

Currently around 22% of total generation capacity is based on coal with an installed 16.6 GW. Most of this (12.9%) uses domestic coal. Based on the goal to utilize the existing coal reserves to decrease dependence on energy imports, efforts are under way to enhance lignite mining and coal-fired power generation (Republic of Turkey: Ministry of Energy and Natural Resources, n.d.).

" If all new capacity were built, this would almost double total existing generation capacity "

However, only 8 GW of the 70 GW new capacity is actually permitted or under construction. 32 GW are only announced and a further 30 GW under pre-permit development. Given that implementation rates have been low in the region with only around 20% of plans actually being implemented (Shearer et al., 2016), this could still see 12 GW new capacity coming online, which would - together with already permitted capacity and plants under construction - more than double current coal-fired generation capacity. If all new capacity were built, this would almost double total existing generation capacity.

Despite recent tragic accidents in the mining sector, growing civil society resistance and evidence that enhanced energy independence can be achieved with clean technologies at almost the same cost (Shearer et al., 2016) the Government of Turkey seems to stick to coal as a viable option. The 26 GW of solar and wind capacity goal included in the INDC is, however, a first sign towards a transition.

AVAILABILITY OF RESOURCES

National energy strategies are closely linked to the availability or lack of availability of resources. Some countries have large coal reserves and the expansion of coal-fired power generation is a stated strategy to reduce energy imports (Turkey) or diversify between nationally available resources (Vietnam). China is still the largest producer of coal and holds the 3rd largest global reserves with around 13%, but is a net importer since 2009. India holds the 5th largest reserves and is the third largest producer of coal, but production hasn't been able to meet demand over the last decades, making it also a net importer (EIA, 2016). Indonesia and South Africa are net coal exporters and also utilize the resource for power generation.

The challenge in all these countries is to develop alternative business models and employment opportunities to the current (or planned) coal mining and power generation. Managing this structural change is no simple task[5]. Reducing national coal use and raising exports is no environmentally viable solution and - if climate action is taken seriously at a global level - also no economically viable option in the long term.

The Republic of Korea and Japan are coal importers for all coal used in power production and coal expansion is seen as a necessity rather than being desirable. Both countries have no or next to no own coal reserves and also lack any substantial other fossil fuel resources (EIA, 2016). Not surprisingly, electricity generation from nuclear power is an important element in both countries. After the Fukushima incident in 2011 and the shut down of most of the nuclear generation capacity, Japan replaced the missing capacity with coal, gas and oil in the short run and implemented drastic energy savings measures. In the long run it plans to continue efficiency measures, but coal expansion plans indicate that decarbonizing the system is not a priority.

Developments in the power sector seem to be driven by market forces rather than climate considerations in most countries. However, in some cases, international commitments as well as national environmental, social and other considerations seem to increasingly influence decisions.

[5] For a discussion see for example: "The Paris Agreement and Ms. Meier": http://current-future.org/index.php/25-blog/44-the-paris-agreement-coal-and-ms-meier-2

INDCS AND COAL

For some of the top 10 countries, new capacity would represent a substantial share of allowed emissions under the submitted INDCs. Annual GHG emissions from new capacity would constitute between 7% (Japan) and 39% (Vietnam) of total allowed emissions in 2030[6] under the respective INDCs[7].

Four countries out of the top 10 mention coal explicitly in their INDC, with China, India and South Africa mentioning the use of clean coal technologies, including the building of (ultra-) supercritical plants, combined cycle power plants and a general increase of efficiency of existing power plants as part of mitigation efforts. Japan specifies coal as part of the energy mix in 2030 at 26%, roughly returning to levels before the Fukushima incident, after which the share of coal-fired electricity generation increased to 32% in 2013 (World Bank, 2016). There is no mention of coal in the other 6 INDCs.

This analysis will not discuss the adequacy of commitments. I assess the magnitude of potential emissions from new capacity in 2030 compared to allowed emissions under submitted INDCs. As highlighted above, aggregate commitments fall short of achieving the desired limitation of global temperature and we can assume that any revision of commitments and related increase in ambition will increase the role of new coal capacity in meeting - or failing to meet - these commitments.

CHINA

China communicated multiple goals as part of their INDC:

- Peaking of CO_2 emissions around 2030, or earlier if possible;
- Lower the carbon intensity per unit of GDP by 60% to 65% below 2005 levels by 2030;
- Increase the share of non-fossil energy sources in the primary energy consumption to around 20%; and
- Increase the forest stock volume by around 4.5 billion cubic metres, compared to 2005 levels.

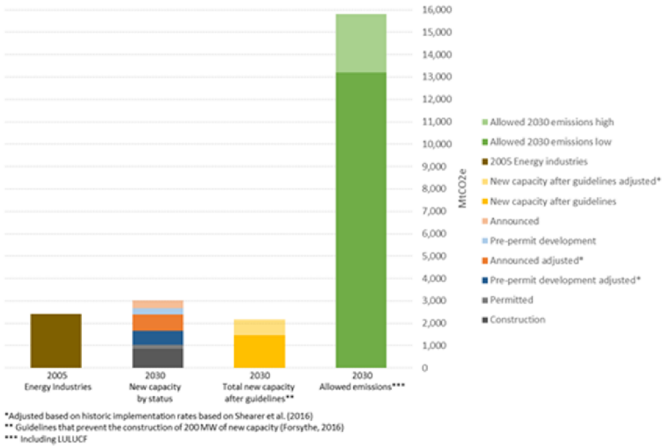


Figure 4 Estimated emissions from new capacity and allowed emissions under the INDC in 2030 for China

Quantifications of the allowed total emissions in 2030 resulting from this INDC vary between 13.2 $GtCO_2e$ (NewClimate Institute, Climate Analytics, & Ecofys, n.d.)[8] and 15.8 $GtCO_2e$ (Australian-German Climate & Energy College, 2016a). Emissions from new capacity in China could be 2.4 $GtCO_2$[9] to 3 $GtCO_2$, representing between 15% and 23% of this, depending on the range in allowed emissions and assumptions on the implementation rate of planned capacity.

As such, this does not sound problematic. To further put these numbers in perspective, we can compare emissions to the latest available historic inventory for 2005. New capacity, if fully built, would emit 25% more than the total energy industries sector in 2005 (Government of China, 2012), the year China overtook the US as the largest emitter globally.

[6] Shares calculated based on (Australian-German Climate & Energy College, 2016a; Global Coal Plant Tracker, 2015a). The range for each country depends on ranges in allowed emissions and whether full or adjusted implementation is assumed.

[7] No information on allowed emissions in 2030 is available for Pakistan and Myanmar

[8] 13.6 $GtCO_2$ excluding LULUCF and an assumed 0.43 $GtCO_2$ sink from LULUCF

[9] Based on (Shearer et al., 2016) this analysis assumes an implementation rate of 68%, applied to announced and pre-permit development capacity

Adding around 3.6 $GtCO_2$ annual emissions from already existing plants that would still be around in 2030 (Breevoort et al., 2015), emissions from coal-fired power generation alone could represent 27% to 50% of allowed emissions in 2030. Considering the already low usage rate and expected further drop in demand from efficiency measures, it is, however, more likely that any new capacity actually built will lead to stranded assets within the near future.

Locking in between a quarter and half of allowed emissions by one single emission source will make it hard to achieve the stated goals. Given the specifics of the Chinese energy system, capacity will likely lead to early closures and thus block investment that could be used to support a clean energy infrastructure.

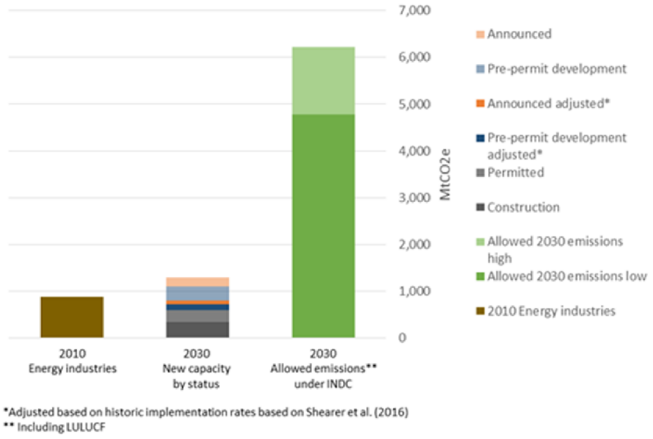


Figure 5 Estimated emissions from new capacity and allowed emissions under the INDC in 2030 for India

INDIA

India's INDC consists of qualitative and quantitative contributions. The three main quantitative elements are:

- To reduce emissions intensity of GDP by 33% to 35% by 2030 from 2005 levels;
- To achieve a share of non-fossil based energy resources of about 40% cumulative 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 carbon sink of 2.5–3 $GtCO_2e$ through additional forest and tree cover by 2030.

The range in intensity target together with uncertainty on the development of future GDP results in allowed emissions between 4.8 $GtCO_2e$ and 6.2 $GtCO_2e$ (Australian-German Climate & Energy College, 2016b), effectively increasing total emission by 2.5 to 3.3 times compared to 2010. For India new coal-fired power generation capacity would emit between 0.8 $GtCO_2$[10] to 1.3 $GtCO_2$, representing between 13% and 27% in allowed emissions in 2030.

Considering that capacity added between 2010 and 2015 is likely to still be around in 2030 this would add another 427 $MtCO_2$ of emissions. Together this would represent up to 36% of allowed emissions in 2030, without taking into consideration older capacity that could still be operating. Using IEA data for CO_2 emissions from fuel combustion as a proxy for the share of coal in electricity production (IEA, 2016a), emissions from coal-fired power generation were around 30% in 2010. This indicates that current plans to expand coal-fired capacity largely continue current trends and cement a centrally organized fossil-fuel based energy system design, although this will finally depend on actual implementation and usage rates.

Given the overall large increase in emissions that would be allowed under the INDC, achieving the contribution seems in line with current coal expansion plans. With the global ambition level still falling short of the agreed objectives, Parties will be expected to review their contribution and ramp up ambition. Locking in a substantial amount of emissions will make it harder for India to commit to any more ambitious contribution in the future, as this would then likely entail premature closure of power plants.

New capacity would continue existing high-emission energy system patterns, expanding them to a much larger level. While the INDC could potentially be achieved despite this development, the lock-in will make it hard for India to commit to more ambitious contributions in the future.

[10] Based on (Shearer et al., 2016) this analysis assumes an implementation rate of 30%, applied to announced and pre-permit development capacity

TURKEY

Turkey aims to reduce economy-wide GHG emissions by up to 21 from business-as-usual (BAU) level by 2030. According to the INDC this would result in allowed emissions of 929 $MtCO_2e$. In their INDC, Turkey does not quantify the contribution of different sectors, but includes ambitious goals for solar and wind (10 GW and 16 GW respectively) until 2030.

New capacity would emit between 86 $MtCO_2$ and 304 $MtCO_2$, representing 9% to 33% of allowed emissions in 2030. Implementation rates have historically been very low in Turkey, with an estimated 18% (Shearer et al., 2016). Unless this holds true also for the future, emissions from new capacity could arrive at almost triple of 2010 emissions from the whole energy industries sector.

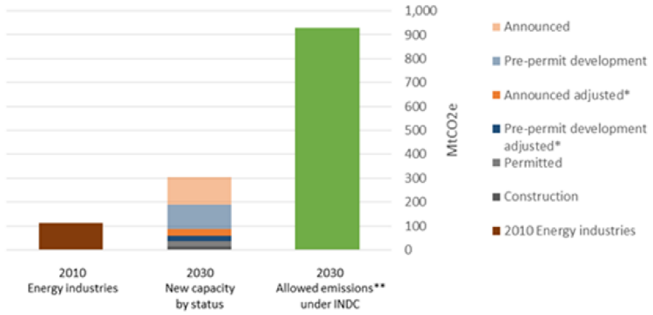


Figure 6 Estimated emissions from new capacity and allowed emissions under the INDC in 2030 for Turkey

In 2010 around 31% of total emissions came from the energy industries sector. With all new capacity installed, coal-fired power generation alone would constitute up to 33% of allowed emissions. This seems to indicate a shift towards coal, from the current share of 22% in the generation mix, despite the ambitious expansion plans for solar and wind.

Current coal expansion plans point towards a restructuring of the sector towards high-emission, coal-based generation. Locking in up to a third of allowed emissions would make it challenging for Turkey to achieve their set commitment and even more to enhance ambition in the future.

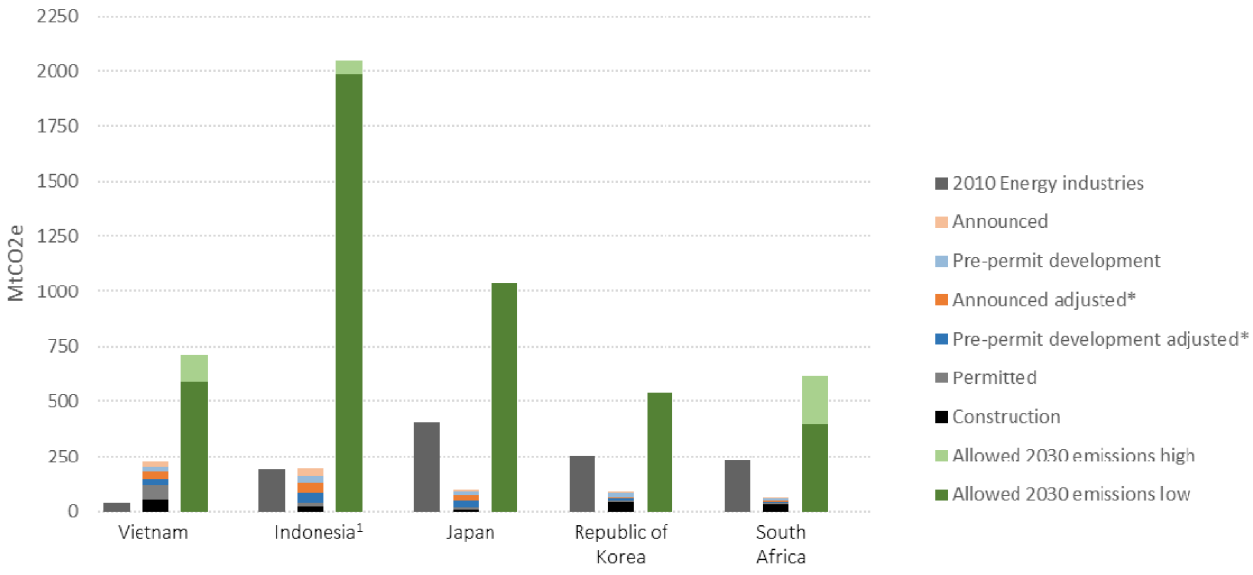
OTHER TOP 10

For the other countries in the top ten we see roughly two different situations:

In **Vietnam** and **Indonesia** new capacity represents a substantial addition to current energy industries emissions. In the case of Vietnam it would even lead to emissions that could be almost 5 to 6 times higher than total energy industries emissions in 2010, representing between 26% and 39% of allowed emissions in 2030. In Indonesia new capacity is 68% to 104% of 2012 energy industries emissions and only 6% to 10% of allowed emissions in 2030 due to the large share of emissions from land use, land use change and forestry (LULUCF). These represented 52% of total emissions in 2012 and are expected to contribute 87% of the mitigation effort by 2020 (Republic of Indonesia, 2015). For both countries the aggressive coal expansion plans indicate the pursuit of a high-carbon energy system with negative effects on the ability to meet their submitted contribution and the options for enhanced ambition in future reviews of contributions. Vietnam and Indonesia expect emissions reductions to come mainly from other sectors, particularly the land use sector, while the energy industries contribute little.

For **Japan**, **South Africa** and the **Republic of Korea** new capacity signifies only a smaller share of historic energy industry emissions and represents much lower shares of allowed emissions under the INDC in 2030. For Japan the latter would be between 7% and 9%, for South Africa 8% to 16% and for the Republic of Korea 12% to 17%. For the last two countries the shares are still quite substantial and new capacity is mainly comprised of plants already under construction with relatively small additional capacity planned. In Japan most new capacity is still in the planning stage. How far new capacity plays a part in achieving the INDC requires more in-depth analysis of the energy systems and age structure of the countries, but the relatively low share of allowed emissions could indicate that INDCs could be achieved.

Figure 7 Estimated emissions from new capacity and allowed emissions under the INDC in 2030



*Adjusted based on historic implementation rates based on Shearer et al. (2016)
[1] Historic emissions for 2012

Sources: (Global Coal Plant Tracker, 2015a; Government of South Africa, 2014; Republic of Indonesia, 2015; UNFCCCC, n.d.)

Some of the countries clearly view new, more efficient coal-fired power plants as a viable mitigation option, in spite of the long life-time of the investment. In other countries there seems to be a disconnect between climate commitments and energy planning, with other sectors contributing disproportionately in relation to their relative importance for future GHG emissions.

Table 2 Overview of INDCs, new coal capacity and coal indicators for the top 10 countries

	New capacity				Coal indicators				INDC									
															Economy Wide GHG Emissions Target			
Country	Rank in new coal capacity	New capacity	Annual emissions from new capacity	Share of allowed emissions with INDC*	Existing coal power generation capacity	Current share of coal in electricity production 2013 (1971)	Known coal reserves	Export / import balance of coal (+ net export / - net import)	Base Year / Latest historic data year	Type of target	Base Year CO_2e Emissions	Including LULUCF?	Projected / Target Year	Projected CO_2e Emissions BAU	Allowed CO_2e Emissions with INDC	Unconditional Reduction	Conditional Reduction	Coal mentioned	How?
*Data source***	*Coal Plant Tracker*	*Coal Plant Tracker*	*Coal Plant Tracker*	*Own calculation*	*EIA International Energy Statistics*	*World Bank Indicators*	*BGR Energy Study 2014*	*EIA International Energy Statistics*	*INDC*	*INDC/ own assessment*	*INDC*	*INDC/ own assessment*	*INDC*	*INDC*	*INDC*	*INDC*	*INDC*	*INDC*	*INDC*
China	1	711,813 MW	3,016 $MtCO_2e$	19% - 22%	793,800 MW (2014)	75.4% (70.1%) ↑	Hard coal: 120,697 Mt (rank 1) Lignite: 7,350 Mt (rank 6)	-	2005	Base year intensity	Intensity[4] 1.276 tce per RMB 10,000 Yuan Emissions[4] 7,046 $MtCO_2e$	yes	2030	not relevant	13,600 $MtCO_2e$ - 15,800 $MtCO_2e$[11]	• Peak CO_2 emissions around 2030 and make best efforts to peak early and lower CO2 emissions per unit of GDP by 60% to 65% from 2005 levels • To increase the share of non-fossil fuels in primary energy consumption to around 20%; and • To increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level.	none	yes	• To control total coal consumption; • To enhance the clean use of coal; • To increase the share of concentrated and highly-efficient electricity generation from coal; • To lower coal consumption of electricity generation of newly built coal-fired power plants to around 300 grams coal equivalent per kilowatt-hour;
India	2	290,134 MW	1,289 $MtCO_2e$	21% - 26%	187,860 MW (2016)	72.8% (49.1%) ↑	Hard coal: 81,897 Mt (rank 2) Lignite: 4,755 Mt (rank 11)	-	2005	Base year intensity	Intensity[5] 35.14 $kgCO_2e$/ INR1,000 Emissions[6] 1,914 $MtCO_2e$ (1,334 $MtCO_2e$)[7]	yes	2030	not relevant	4,800 $MtCO_2e$ - 6,200 $MtCO_2e$[11]	• Reduce emissions intensity of GDP by 33 to 35 percent by 2030 from 2005 levels • 40 percent cumulative electric power installed capacity from nonfossil fuel based energy resources by 2030 • To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030	none	yes	• Shifting towards supercritical technologies for coal based power plants improve the efficiency of coal based power plants • 144 old thermal stations have been assigned mandatory targets for improving energy efficiency • Stringent emission standards being contemplated for thermal plants would significantly reduce emissions
Turkey	3	69,954 MW	303 $MtCO_2e$	33%	n.a.	26.6% (30.5%) ↓	Lignite: 2,055 Mt (rank 20)	-	2012	Reduction below baseline	440 $MtCO_2e$	yes	2030	1,175 $MtCO_2e$	929 $MtCO_2e$	21% reduction in GHG emissions from BAU by 2030	none	no	
Vietnam	4	52,980 MW	232 $MtCO_2e$	33% - 39%	15,000 MW (2015)	19.5% (73.3%) ↓	Hard coal: 3,116 Mt (rank 13)	-	2010	Reduction below baseline	247 $MtCO_2e$	yes	2030	787 $MtCO_2e$ (excl. IP)	724 $MtCO_2e$ (unconditional) 590 Mt CO_2e (conditional) (excl. IP)	8% below BAU scenario	25% below 2030 BAU scenario	no	
Indonesia	5	45,365 MW	197 $MtCO_2e$	10% - 12%	23,970 MW (2013)	51.2% (0.0%) ↑	Hard coal: 13,511 Mt (rank 9) Lignite: 9,002 Mt (rank 5)	+++	2010	Reduction below baseline	1,800 $MtCO_2e$	yes	2030	2,881 $MtCO_2e$	2046 $MtCO_2e$ (unconditional) 1988 $MtCO_2e$ (conditional)	Reduce emissions by 29% compared to the business as usual scenario by 2030	Additional 12% reduction	no	
Japan	6	23,388 MW	97 $MtCO_2e$	9%	30,537 MW (2015)[1]	32.4% (11.9%) ↑	no national production[3]	- - -	2013	Base year emissions	1,313 $MtCO_2e$[9]	yes	2030	not relevant	1,042 $MtCO_2e$	26% by fiscal year 2030 compared to 2013 (25.4% reduction compared to FY 2005)	none	yes	• Coal as part of the energy mix in 2030 at 26% of 1,065 billion kWh • Pursuit of high efficiency in thermal power generation (USC, A-USC, IGCC, etc.)
Pakistan	7	21,083 MW	91 $MtCO_2e$	n.a.	n.a.	0.1% (1.2%) ↓	Lignite: 2,857 Mt (rank 13)	n.a.	1994	no information	167 $MtCO_2e$[8]	no information	no information	no information	no information	"Pakistan will only be able to make specific commitments once reliable data on our peak emission levels is available."	none	no	
Republic of Korea	8	20,776 MW	88 $MtCO_2e$	16%	26,096 MW (2014)	41.4% (6.9%) ↑	Hard coal: 139 Mt[3]	- - -	2012	Reduction below baseline	688 $MtCO_2e$[8]	no	2030	851 $MtCO_2e$	536 $MtCO_2e$	37% below 2030 BAU	none	no	
South Africa	9	15,393 MW	65 $MtCO_2e$	11% - 16%	37,745 MW (2014)	93.7% (99.8%) ↓	Hard coal: 9,893 Mt (rank 10)	++	2010	Reduction below baseline	518 $MtCO_2e$[10]	yes	2030	no information	398 $MtCO_2e$ - 614 $MtCO_2e$	none	Limit emissions to between 398 and 614 $MtCO_2e$ by	yes	Two new high efficiency coal-fired power stations are nearing completion as part of the ageing plant replacement programme
Myanmar	10	14,500 MW	62 $MtCO_2e$	n.a.	120 MW[2]	4.3% (3.9%) ↑	Hard coal: 3 Mt Lignite: 3 Mt	n.a.	2005	Policies and actions	-57 $MtCO_2e$[8]	yes	2030	no information	no information	none	List of mitigation actions in the forestry and energy sectors	no	

* Assumption: all planned capacity is operational by 2030

** Data from other sources is highlighted and individual sources provided in footnotes

n.a. = not available

[1] https://www.jepic.or.jp/en/data/japan_data.pdf; including dual fuel plants

[2] ADB: Country Operations Business Plan: Myanmar, 2015–2017, Sector Assessment Energy

[3] Source: EIA International Energy Statistics, Analysis: https://www.eia.gov/beta/international

[4] China's Second National Communication, page 102

[5] India's First Biennial Update Report, page 66 (at constant 2004-05 prices, excluding emissions from agriculture)

[6] CAIT

[7] CAIT, excluding agriculture as indicated in the INDC

[8] UNFCCC Data Interface

[9] Calculated based on 2030 emissions as provided in the INDC

[10] South Africa's 1st Biennial Update Report

[11] Australian-German Climate & Energy College (2016). INDC Factsheets: total emissions including agriculture

THE WAY FORWARD

The analysis presents a mixed picture and needs to be interpreted in light of the overall inadequacy of global commitments, which calls for much enhanced ambition. For the top 5 countries with the largest pipeline for new capacity, achievement of the respective contributions seems difficult if all new capacity is implemented, with the exception of India, where allowed emissions under the INDC are potentially high enough to accommodate the additional coal capacity. While the national government in China is actively engaged in preventing some of the addition of new capacity, the other four countries - India, Turkey, Vietnam and Indonesia - seem set on pursuing a high-carbon energy system. This will lock in substantial future emissions, which will make it hard for countries to ramp up their ambition in future review rounds under the Paris Agreement.

For Japan, South Africa and the Republic of Korea the relatively low share of new capacity in allowed emissions under the INDC indicates that INDCs could be achieved despite new capacity additions. No detailed information is available to assess the coal expansion plans in Pakistan and Myanmar.

The disconnect between coal expansion plans and formulated climate goals in some countries also points to a lack of integration at the institutional level. A closer integration of climate policy and energy policy could help to align energy planning and climate goals, making achievement of NDCs more likely and enhancing opportunities for raising ambition in the future.

This analysis only provides a first indication of the implications of new capacity on countries' energy systems and climate goals. More in-depth analysis of drivers for coal development in each country is required to provide a full picture and to enable the development of tailored strategies to overcome barriers that currently still make coal a favoured power generation solution. This should include country-specific analysis of actual cost of coal compared to renewable sources and the technical, financial and capacity barriers to enhanced renewable investment. It also requires a stronger focus on the structural change required to move away from coal-based power generation and how this can be supported by the international community.

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