

CLIMATE ACTION TRACKER

The Coal Gap: planned coal-fired power plants inconsistent with 2°C and threaten achievement of INDCs

Climate Action Tracker Update

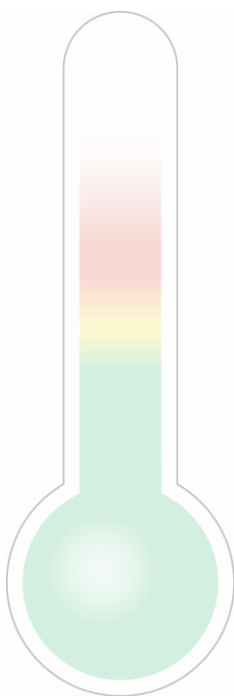
Pieter van Breevoort, Kornelis Blok
Ecofys

Markus Hagemann, Hanna Fekete, Niklas Höhne
NewClimate Institute

Bill Hare, Michiel Schaeffer, Marcia Rocha
Climate Analytics

Louise Jeffery
Potsdam Institute for Climate Impact Research

1 December 2015



Summary

- Holding temperature increase below 2°C, or below 1.5°C by 2100, requires a rapid decarbonisation of the global power sector. IPCC AR5 scenarios indicate that this sector needs to reach zero carbon emissions globally around 2050, 35 years hence. This means phasing out emissions from coal-fired power by 2050.
- Even with no new construction, emissions from coal-fired power generation in 2030 would still be 150% higher than what is consistent with scenarios limiting warming to below 2°C above pre-industrial levels (middle of the range). If the planned new coal capacity – estimated by the Global Coal Plant Tracker - were to be built, it would exceed the required levels by 400%.
- The planned new coal plants alone (globally, 2440 plants, totalling 1428 GW) could emit approximately 6.5 GtCO₂, 16 - 18% of the total allowed emissions in 2030 (under a 2°C-compatible scenario). Including existing capacity with a technical lifetime beyond 2030, total annual emissions from coal-fired power generation could reach 12 GtCO₂ in 2030.
- The CAT has assessed the impact of planned new coal plants both globally, and in the eight countries that each plan to build more than 5GW of coal power capacity: China, India, Indonesia, Japan, South Africa, South Korea, the Philippines, Turkey – plus the EU28.¹
- Of these nine countries (incl. EU28) all have a CAT-rated INDC of “inadequate” or “medium” (i.e. not sufficient to keep warming below 2°C), and have “current policy pathways” that are even less ambitious. Their combined planned new coal capacity (2011 new coal plants, totalling 1210 GW) could put them in an even worse situation, adding emissions of around 1.5 GtCO₂ to the CAT’s projected currently policy levels.
- In seven of the nine studied countries - China, EU28, India, Japan, South Korea, the Philippines, Turkey - planned coal plants threatens the achievement of the already only medium or inadequate INDCs.

¹ The USA only plans to expand coal capacity by 3.5 GW

- The estimated emissions impact of planned plants that have been announced and pre-permitted – i.e. not under construction or permitted – would be 3.5GtCO₂. Cancelling these plants could lead to emissions reductions of 2GtCO₂ below current policy levels, bringing countries closer to their proposed INDC levels.

In order to assess the impact of planned coal-fired power capacity on CO₂ emissions, the Climate Action Tracker (CAT) has sourced the coal plant data from the Global Coal Plant Tracker,² which tracks coal plants (existing, planned, announced). We compared the compatibility of projected coal power production with 2°C and 1.5°C pathways, as well as current policy scenario pathways.

The CAT looked at capacity listed under the Global Coal Plant Tracker that:

- has been announced,
- is in pre-permit phase,
- is permitted, and
- is under construction.

We refer to these combined four categories combined as *planned coal plants*, or *capacity*.

By 2030, plans would increase global coal-fired power capacity by over 40% ...

Despite the need to phase out emissions from coal-fired power generation to hold warming to below 2°C above pre-industrial levels, many governments - and the EU28 - are still planning to construct significant amounts of coal power capacity. In many emerging economies, coal capacity is constructed to meet rapidly increasing electricity demand, while in the EU28, new coal plants are mainly to replace existing capacity.

Table 2 in the Annex lists the CAT countries with more than 5GW of planned new coal capacity.

The future development of coal varies strongly by region. The decision to either add coal capacity - or focus on other ways to fulfil the demand - depends on a number of factors, such as the expected growth of demand and domestic access to resources.

The planned expansion of coal plants (2008 in total, equalling 1210 GW) in the nine studied CAT countries and the EU28 could produce more than 20 EJ (5556 TWh) of electricity a year and could lead to over 5 GtCO₂ of annual emissions.³ Globally, planned coal plants (2440 in total equalling 1428 GW) could produce more than 25 EJ (6944 TWh) of electricity per year and result in more than 6.5 GtCO₂ of annual emissions.

...at a time when rapid reduction in coal power is needed to stay below 2°C ...

To hold warming to below 2°C above pre-industrial levels, the power sector needs to decarbonise within the first half of this century. In most of the scenarios consistent with limiting warming to below 2°C in the IPCC Fifth Assessment Report (AR5),⁴ unabated coal-fired power⁵ declines rapidly and is phased out between 2040 and 2070, as shown in Figure

² CoalSwarm, Global Coal Plant Tracker: <http://endcoal.org/tracker/>

³ Based on regional estimates of capacity factors and emission factors in 2030 from the World Energy Outlook (WEO) 2014 Current Policy Scenario (IEA, 2014). IEA (2014). World Energy Outlook 2014. International Energy Agency (IEA), Paris.

⁴ IPCC (2014). Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

⁵ Not equipped with Carbon Capture and Storage (CCS)

1.⁶ The median annual electricity production in 2030 from coal in below 2°C scenarios is about 8 EJ (resulting in approximately 2 GtCO₂ of emissions), with an upper end of the range of 28 EJ (approximately 7 GtCO₂ of emissions).

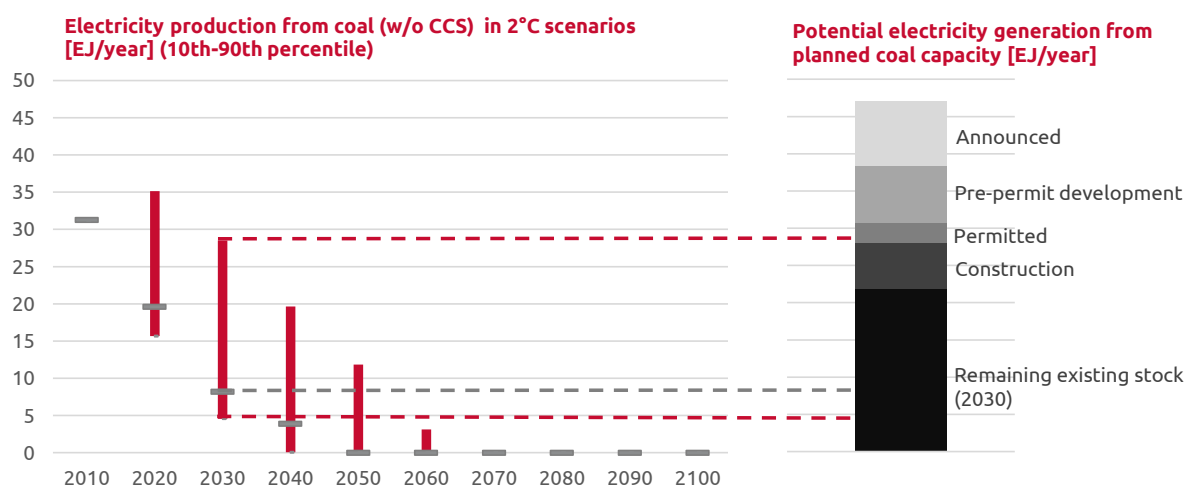


Figure 1 Coal-fired power generation (without CCS) in a selection of '2°C scenarios' included in the IPCC AR5 report.⁷ The ranges indicate the 10th to 90th percentile, while the grey line indicates median values. The median values show a rapid decrease of coal-fired power generation.

... and even more is needed to stay below 1.5°C ...

In 1.5°C-compatible scenarios, the decline in power production from coal has to be even faster (Figure 2) although there is a very large overlap with ranges compatible with below 2°C. By 2030, the median production is 6.5 EJ (approximately 1.7 GtCO₂ of emissions) and the upper end of the range is 15 EJ (approximately 4 GtCO₂).

... So by 2030, existing and planned coal-fired power generation will be far higher than is compatible with either 2 or 1.5°C emission pathways

Figure 1 and Figure 2 also compare production under below 2°C and 1.5°C scenarios, with potential coal-fired power generation from existing stock and planned plants. Current capacity under construction and permitted – excluding capacity that is announced or in pre-permit phase - could generate 9 EJ of electricity, resulting in approximately 2GtCO₂ of emissions annually, by 2030.

Adding the planned plants to the existing stock that has a technical lifetime beyond 2030, emissions from coal power generation could total 12 GtCO₂. This exceeds the median value of the 2°C-compatible range by more than 400% and far exceeds production consistent with any 2°C or 1.5°C pathway.

Even electricity production from existing stock with a technical lifetime beyond 2030, would be at the high end of the 2°C-compatible range (more than 150% higher than the median value) and would far exceed the range of 1.5°C-compatible scenarios.

⁶ These 450 ppm scenarios ('Category 1') are those scenarios that reach a maximum atmospheric greenhouse concentration of 430-480 ppm CO₂-eq by the end of this century, making it likely to confine global temperature increase to stay below 2°C at the end of this century

⁷ Emission scenarios are excluded that (1) fail to limit warming to below 2°C with a likely (66%) chance; (2) deviate from central historical estimates of 2010 global emissions by more than 5%; (3) assume extreme negative CO₂ emissions in the order of -20 GtCO₂/yr by the end of the century; (4) involved a "deliberate" delay in mitigation action.

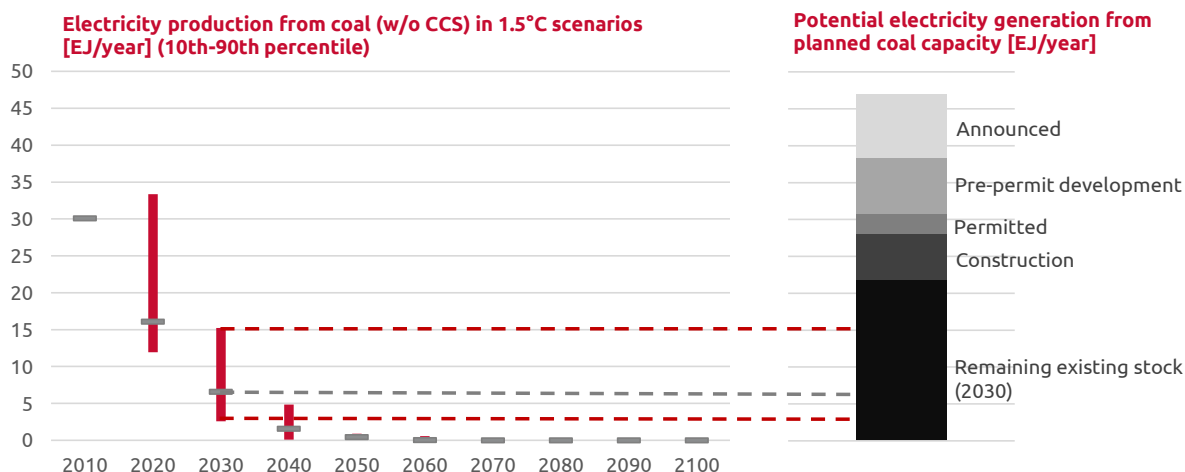


Figure 2 Coal-fired power generation (without CCS) in a selection of 1.5°C scenarios.⁸ The ranges indicate the 10th to 90th percentile, while the grey line indicates median values. The median values show a rapid decrease of coal-fired power generation.

There are scenarios that allow more production from coal, but they would generally lead to a higher overshoot in CO₂ concentration and the need for negative emissions in the second half of this century (e.g. by deploying Bio-Energy-CCS on a large scale). This would lead to substantially higher mitigation costs (IPCC, 2014).⁴

Planned coal capacity could lead to emissions levels exceeding current policy levels

The coal plant plans from these nine countries could exceed the expected emissions from coal power under current policy projections by approximately 1.5 GtCO₂ in the CAT countries, corresponding to approximately 320 GW - or 530 average-sized coal power plants. Fortunately, not all planned capacity will be constructed. Shearer et al. (2015)⁹ found that an increasing number of coal plant plans are cancelled because of, for example, competition with renewables, and environmental concerns. The magnitude of total planned coal capacity makes it of pivotal importance that this cancellation trend continues.

⁸ Rogelj, J., G. Luderer, R. C. Pietzcker, E. Kriegler, M. Schaeffer, V. Krey and K. Riahi (2015). "Energy system transformations for limiting end-of-century warming to below 1.5°C." *Nature Clim. Change* 5(6): 519-527.
⁹ Shearer C., N. Ghio,, L. Myllyvirta., and T. Nace (2015). "Boom and bust – Tracking the Global Coal Plant Pipeline".

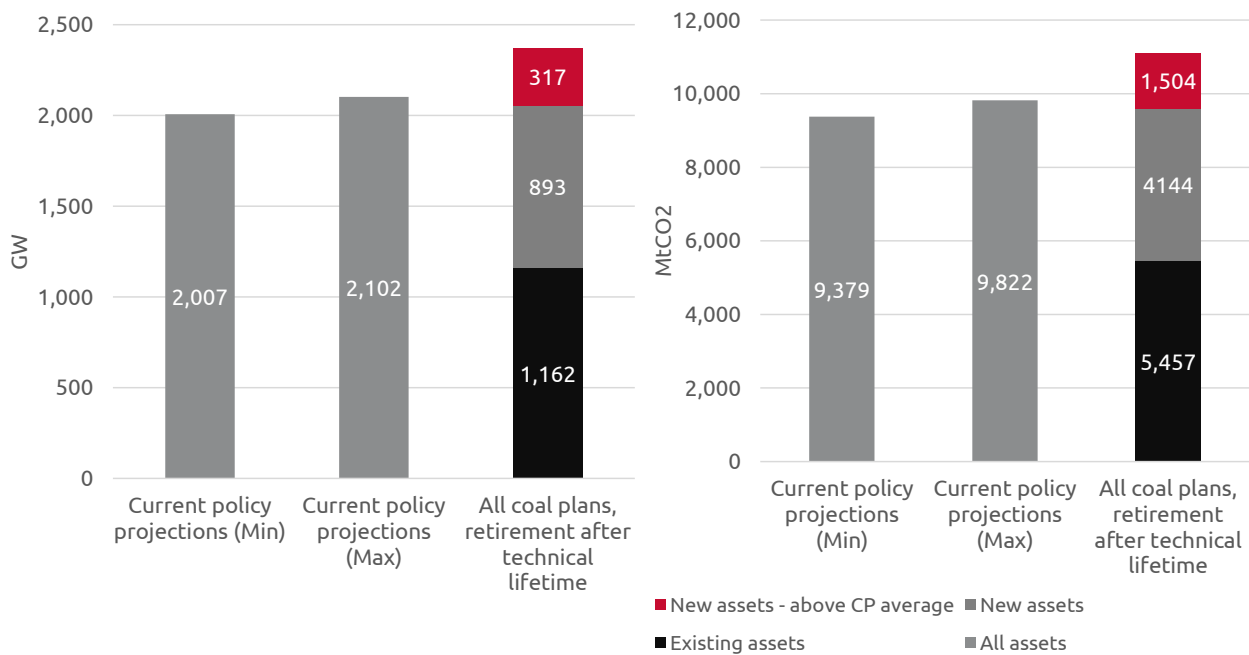


Figure 3: Coal capacity (left graph) and emission (right graph) development under current policy projections (grey bars) and planned coal capacity plus retirement of plants after their technical lifetime (blue green and orange bars) in 2030

While, in principle, current policy projections should take account of planned coal plants, in reality this is not necessarily the case. Current policy projections account for the plans for renewables, and projected energy demand, and assume that coal will be replaced by renewable energy. As a result, more coal could be replaced than is currently planned. In essence, this means that if renewables are expanded as planned, and the demand growth develops as foreseen, a large number of the coal plants might become obsolete. This could be partially counteracted by the early retirement of existing coal plants or reduced full load hours. Consequently, if planned coal plants are built as foreseen, they could lead to the reverse effect, effectively displacing planned renewable energy capacity.

The situation with the planned coal plants differs largely from country to country. For China, the planned capacity could result in an increase over the current policy emissions of 1 GtCO₂, by far the largest amount of all countries. Again, not all announced plants are being built (Greenpeace, 2015)¹⁰ and early retirements are already happening in China (e.g. in Beijing).

In other countries or regions such as India, Japan, Turkey or the EU28, the planned coal plants lead to a smaller - yet significant - increase of approximately 200 MtCO₂ annually for each country/region. For South Africa, South Korea or the Philippines, the planned capacity leads to only very small emissions increases. For Indonesia, it would even lead to lower emission levels – because Indonesia’s current policy projections have extremely high forecasts for coal plant growth.

In relative terms, the picture is quite different. While in China the planned coal capacity leads “only” to an emissions increase from coal of approximately 20%, the planned coal capacity in Turkey in particular suggests that emissions from coal could more than double. It’s a similar picture for Japan, which has seen a recent surge in planned coal plants after the nuclear disaster in Fukushima. Yet other regions such as the Philippines or the EU28 can

¹⁰ Greenpeace (2015). “Is China doubling down on its coal power bubble?” <http://www.greenpeace.org/eastasia/publications/reports/climate-energy/climate-energy-2015/doubling-down/>

still expect significant emissions increases over their current policy projection. For all regions except South Africa and Indonesia, planned coal plants could therefore lead to significant increases in emissions above current policy projections.

Table 1 Emissions (MtCO₂) from coal power by country under current policy projections and the planned coal capacity in 2030

	Current policy pathway	Planned coal plant plus retirement after technical lifetime	Diff. planned coal plant to average current policy pathway	Difference as % average current policy pathway emissions
China	5,587-6,031	6,913	1,105	19.0%
India	1,754	1,973	218	12.4%
Indonesia	701	315	-386	-55.1%
Japan	240	385	146	60.8%
South Africa	172	156	-16	-9.3%
South Korea	202	239	37	18.5%
The Philippines	59	81	22	37.7%
Turkey	180	380	199	110.6%
EU28	485	663	178	36.8%

The increase on top of current policy projections puts countries on pathways that are opposite to where they need to achieve their INDCs. Given the INDC levels in the studied countries are already rated medium or inadequate, this takes them even further away from what would be needed to meet 'fair share' levels.

Cancelling announced and pre-permitted coal plants can reduce the emissions gap by 2 GtCO₂ below current policy levels...

In order to reduce the impact of coal-related emissions, an effective measure would be to cancel all announced and pre-permitted coal-fired power plants. For the nine countries we studied, this would lead to a total emissions reduction of 3.5 GtCO₂.

As planned coal plants could result in emissions 1.5GtCO₂ higher than current policy projections for these countries, this measure would reduce the projected emissions from coal by 2 GtCO₂ below the current policy projections.

This would require cancelling the plans for 775 GW of coal capacity, or 1,171 coal-fired power plants. Since these plants are only in very early planning stages, it can be assumed that there would only be limited financial loss from stopping these plants. These Governments need to act to stop these plants today: the mitigation costs could explode if they cancel them at a later stage. Alternatively, coal-fired power plants could be retired early, before they reach end of their lifetime and return on investment, which would also lead to additional costs.

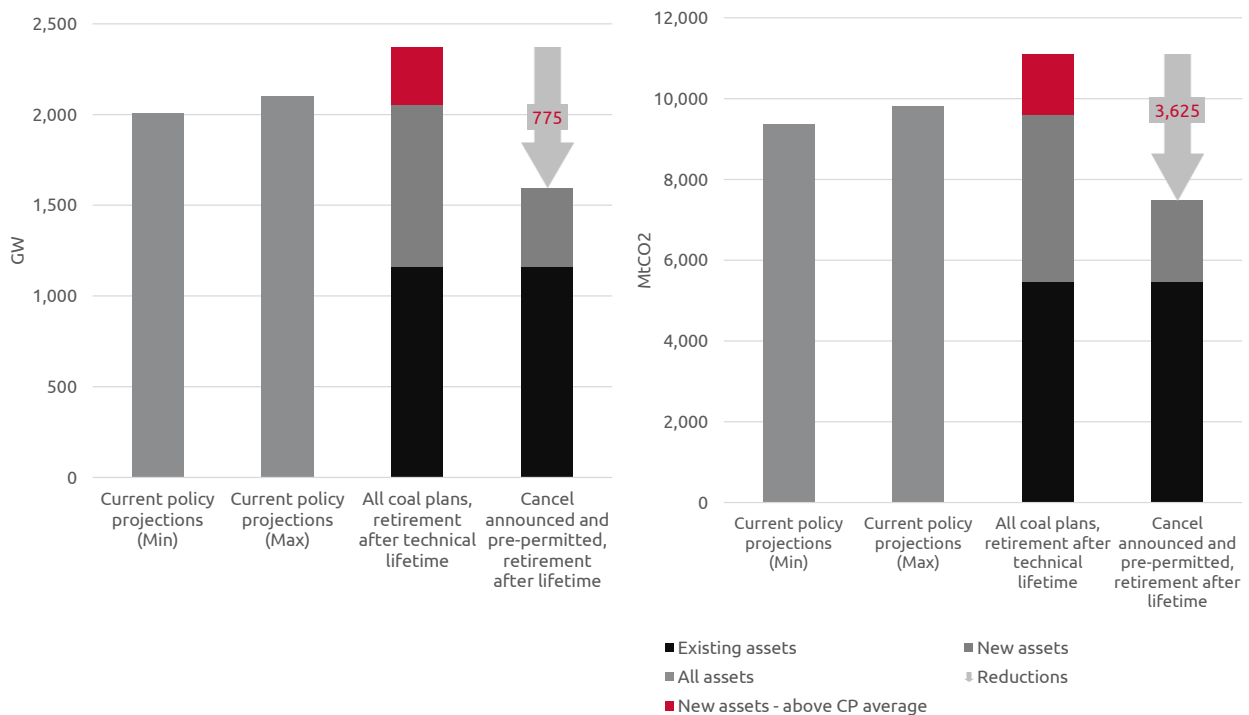


Figure 4: Decrease in installed capacity (left) and emission (right) achieved through cancelling announced and pre-permitted power plants in the selected CAT countries in 2030

By far the biggest impact could be achieved in China, which could reduce emissions by 2.2 GtCO₂ if it were to cancel 722 planned plants.

Also notable though are the reductions that some of the emerging economies could achieve, especially India and Turkey. The large amounts of new coal capacity planned in these regions could have a relatively significant impact. In India, stopping new coal fired power plants to be built could mitigate 0.7 GtCO₂, provided low carbon technologies are implemented. This means alternative technologies - such as energy efficiency, renewable energy - will have to be deployed to meet the projected growth in electricity use in these regions.

For already developed countries/ regions such as the EU or Japan, the impact will be very limited, and these governments should consider early retirements of existing plants to further reduce the emissions gap.

Emissions in 2030 from existing and new capacity and reductions by cancelling announced and pre-permitted plants [MtCO₂]

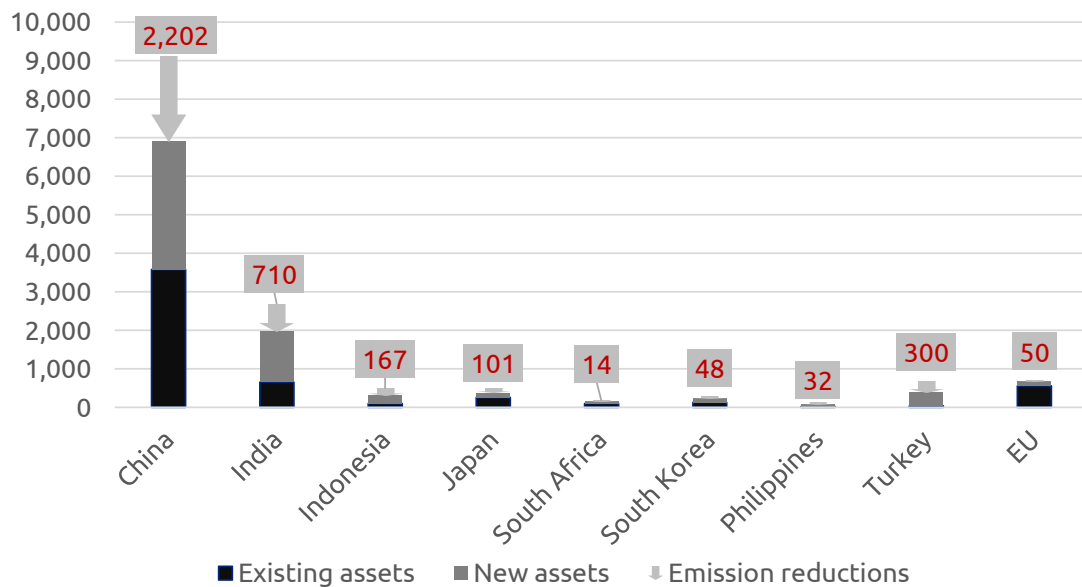


Figure 5: Emission from coal plants by country and emissions reductions that can be achieved through cancelling announced and pre-permitted power plants in the selected CAT countries in 2030

...but even more is needed to transform the power sector

While cancelling the announced and pre-permitted coal-fired capacity could significantly reduce the emissions gap between current policies and 2°C pathways, a large gap still remains.

If all planned coal capacity were to be built and put into operation, and if existing plants are not retired before the end of their technical lifetime, total emissions from coal power generation by 2030 could reach 12 GtCO₂, whereas emissions levels from coal power should not exceed 7 GtCO₂ - and should preferably stay below 2 GtCO₂.

The coal plants currently permitted and under construction alone could push emissions above 2°C-compatible pathways. Building now will lead to additional costs: either because plants have to retire early or run at very low capacity factors, or more expensive mitigation measures will be needed in the second half of this century.

Low carbon alternatives to coal, such as wind power, solar PV, geothermal energy and bio-waste are available now, most of them at costs that are decreasing every year, and most of them also bring significant co-benefits, such as reduced local air pollution. Another option that is often overlooked is the saving of electricity by enhancing the efficiency of electricity consumption and reducing grid losses.

Acknowledgements

Ted Nace, of CoalSwarm for providing the latest data from the Global Coal Plant Tracker (2015).

Joeri Rogelj for providing the coal power production data in 1.5°C compatible pathways studied in Rogelj et al. (2015).

Annex – country specific data

Table 2 Planned/announced coal capacities and estimated impact on CO2 emission. Source: Global Coal Plant Tracker (2015), IEA (2015) and Enerdata (2015).¹¹

	2014	Planned		2030 if all planned plants are built	Announced or pre-planned		Estimated new capacity in 2030 if announced and pre-planned are cancelled	
	Capacity (GW)	Capacity (GW)	Number of plants	Capacity (GW)	Capacity (GW)	Number of plants	Capacity (GW)	Number of plants
China	895	712	1171	1479	471	722	241	449
India	197	290	446	434	156	201	134	245
Indonesia	26	45	119	67	36	79	10	40
Japan	68	23	45	70	18	34	5	11
South Africa	41	13	24	35	3	9	9	15
South Korea	29	21	26	47	10	12	11	14
The Philippines	5.6	12	60	17	7	30	5	30
Turkey	15	71	93	80	63	73	8	20
EU28	185*	22	27	142	11	11	11	16
Total of countries analysed	1280	1210	2011	2372	775	1171	435	840
World total*	1 851	1428	2440	2703	923	1420	505	1020

*2013 (IEA, 2015).

¹¹ IEA (2015). World Energy Outlook 2015. International Energy Agency (IEA), Paris. Enerdata (2015). Global Energy & CO2 Data



The Climate Action Tracker is an independent science-based assessment that tracks the emission commitments and actions of countries. It is a joint project of the following organisations:

Climate Analytics

Climate Analytics is a non-profit institute based in Berlin, Germany, with offices in Lomé, Togo and New York, USA, that brings together inter-disciplinary expertise in the scientific and policy aspects of climate change with the vision of supporting science-based policy to prevent dangerous climate change, enabling sustainable development. Climate Analytics aims to synthesise and advance scientific knowledge in the area of climate, and by linking scientific and policy analysis provide state-of-the-art solutions to global and national climate change policy challenges. Contact: Dr. h.c. Bill Hare, +49 160 908 62463

www.climateanalytics.org

Ecofys – Experts in Energy

Established in 1984 with the mission of achieving “sustainable energy for everyone”, Ecofys has become the leading expert in renewable energy, energy & carbon efficiency, energy systems & markets as well as energy & climate policy. The unique synergy between those areas of expertise is the key to its success. Ecofys creates smart, effective, practical and sustainable solutions for and with public and corporate clients all over the world. With offices in Belgium, the Netherlands, Germany, the United Kingdom, China and the US, Ecofys employs over 250 experts dedicated to solving energy and climate challenges. Contact: Prof. Kornelis Blok, +31 6 558 667 36

www.ecofys.com

Potsdam Institute for Climate Impact Research (PIK)

The PIK conducts research into global climate change and issues of sustainable development. Set up in 1992, the Institute is regarded as a pioneer in interdisciplinary research and as one of the world's leading establishments in this field. Scientists, economists and social scientists work together, investigating how the earth is changing as a system, studying the ecological, economic and social consequences of climate change, and assessing which strategies are appropriate for sustainable development. Contact: Dr. Louise Jeffery, louise.jeffery@pik-potsdam.de

www.pik-potsdam.de

NewClimate Institute

NewClimate Institute is a non-profit institute established in 2014. NewClimate Institute supports research and implementation of action against climate change around the globe, covering the topics international climate negotiations, tracking climate action, climate and development, climate finance and carbon market mechanisms. NewClimate Institute aims at connecting up-to-date research with the real world decision making processes. Contact: Prof. Dr. Niklas Höhne, +49 173 715 2279

www.newclimate.org