

COLLISION COURSE

The Incompatibility of India's Coal and Renewable Strategies

Christine Shearer
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COALSWARM

CoalSwarm is a network of researchers seeking to develop collaborative informational resources on coal impacts and alternatives. Current projects include identifying and mapping proposed and existing coal projects worldwide, including plants and infrastructure. CoalSwarm is the publisher of the [Global Coal Plant Tracker](#) and [CoalWire](#). For more information, visit www.coalswarm.org.

GLOBAL COAL PLANT TRACKER

The [Global Coal Plant Tracker](#) is a publicly accessible online database that identifies, maps, describes, and categorizes every known coal-fired generating unit proposed since January 1, 2010. Developed by CoalSwarm, the tracker uses public sources to document each plant and is designed to support longitudinal monitoring.

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INTRODUCTION

India's power ministry stated in June 2016 that the country has enough coal-fired plants to meet the demand of its electricity distribution companies through 2019. This would include coal plants currently under construction, as well as upcoming renewable energy projects. In response to its forecast, India's Ministry of Power suggested that developers should back off the development of new coal plants.¹ While a clear sign of a rapidly changing electricity sector, this announcement is not in the form of enforceable policy, and is only for the next three years.

The Ministry of Power's announcement reflects the country's growing glut in coal-fired generating capacity: from 2007 to 2015, the average coal plant utilization rate fell from 79 percent to 64 percent.² Moreover, coal plants are losing their place as the least-cost electricity option: average costs for plants coming online in 2020 are INR 4.40/kWh for pithead coal and INR 5.15/kWh for imported coal,³ while prices for photovoltaic solar have already reached a low of INR 4.34/kWh.⁴ State energy distribution companies have been unable to buy power at prices sufficient to cover the operating costs of generators, leading to 30 GW of stranded plants in 2016.⁵

Despite the growing overcapacity, large numbers of coal plants are under construction and moving through the pre-construction pipeline – enough to more than double India's current coal power capacity of 197 gigawatts (GW). According to a spring 2016 survey by CoalSwarm's Global Coal Plant Tracker, the country currently has 65 GW of coal capacity under construction, and an additional 178 GW proposed, for a total of 243 GW of coal plants under development. A typical coal plant is about 660 MW (0.66 GW); in all, there are 369 plants under development. (For state-by-state details, see Appendix A.)

CoalSwarm finds that India's operating and under construction coal plants alone are enough to exceed the country's electricity demand through 2022. This includes taking offline 37 GW of older coal plants currently proposed for retirement. Yet in addition the Indian government has proposed installing 100 GW of solar power (from 7 GW currently) and more than doubling installed wind power to 60 GW (from 26 GW currently) by 2022.

India's coal proposals therefore threaten to derail India's renewable ambitions. Once built, renewable energy is cheaper to operate than coal, since it requires no fuel inputs. In the face of oversupply, this would lead to further declining utilization rates and more unused plants for coal. However, once a coal plant is built there will be pressure for the plant to be used to recoup development costs, potentially leading to the preferential use of coal over renewable energy.

¹ ["India won't need any new power plants."](#) *Economic Times*, June 2, 2016.

² ["Growth of Electricity Sector from 1947-2015."](#) India Ministry of Power, April 2015.

³ ["The Rising Sun: Disruption on the horizon."](#) KPMG, November 2015, page 6.

⁴ ["Rs 4.34 a unit: Solar power tariff drops to record low."](#) *Times of India*, January 19, 2016.

⁵ ["India won't need any new power plants."](#) *Economic Times*, June 2, 2016.

The government of India should therefore take strong action to rein in further construction of new coal plants, as well as accelerate plans to close highly polluting, end-of-life coal plants. Facing their own prospects of excess coal power competing with lower-carbon and cheaper sources of electricity, China, Vietnam, and Indonesia have recently taken policy measures to reduce their number of proposed coal plants. Failing to shut down the coal power pipeline now will lead to one or the other consequence: lockout of renewable technologies or more stranded assets in coal plants.

GLOBAL COAL PLANT TRACKER METHODS AND CATEGORIES

The data provided in this report on India's coal plants proposals is from CoalSwarm's [Global Coal Plant Tracker](#), which surveyed and assessed the status of all India coal plant proposals through May 2016. Project permitting is available on the India Ministry of Environment, Forest and Climate Change (MoEFCC) website. Projects that have been reported in the press or by sponsors but have not yet formally entered the permitting process are categorized as "announced." Companies that have completed the first permitting step and received a Terms of Reference letter from the MoEFCC are categorized as "pre-permit development." Plants that have received environmental clearance are categorized as "permitted." Any proposal that shows no activity for at least two years is classified as "shelved," and no activity for four years or more as "cancelled."

INDIA'S COAL PROPOSALS

As illustrated in Figure 1, India currently has 56 GW of proposals in the announced stage, 78 GW in the pre-permit development stage, 44 GW permitted, and 65 GW under construction. Altogether 243 GW of coal-fired generating capacity is under development, more than the country's total operating coal capacity (197 GW). (For all coal proposals and coal plants by state, see Appendix A.)

While significant, the proposals represent a marked slowdown for India. In 2011 a study by Prayas Energy Group found that 512 GW of proposed coal-fired generating capacity had received either preliminary or final approval from the India MoEFCC, an amount more than five times the installed capacity at the time. Prayas warned that the situation was overheated and would end with "stranded assets of plant and transmission facilities" and impacts that "will be borne to a significant extent by the common people, the country and the environment."⁶

⁶ Dharmadhikary, S and S Dixit, "[Thermal power plants on the anvil: Implications and need for rationalisation](#)." Prayas Energy Group, 2011.

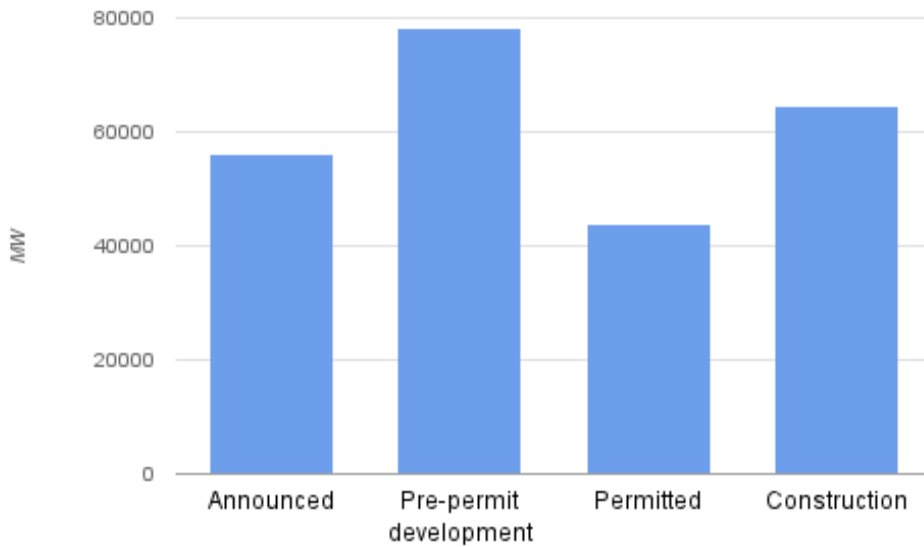


Fig. 1: Coal-fired proposals (MW) in India by category, as of May 2016.

CoalSwarm tracked proposed coal plants in India in 2012 and 2014.⁷ Since the first assessment the amount of proposed coal-fired generating capacity has fallen by half, from 464 GW in 2012 to 243 GW in 2016 (Fig. 2). Not all or even most coal proposals have been commissioned. From the beginning of 2010 to May 2016, just over 261 GW of coal-fired capacity was implemented (i.e., in construction or completed) while 431 GW was halted (i.e., shelved or cancelled), for an overall implementation rate of 38 percent. Delays have been extensive and widespread, reflecting financial distress by many of the proponents, loss of coal allocations, and an inability to secure permitting and/or compulsory land acquisition due to community resistance.

⁷ Shearer, C, N Ghio, L Myllyvirta, T Nace, "[Boom and Bust 2015: Tracking the Global Coal Plant Pipeline](#)." CoalSwarm, Sierra Club, March 2015.

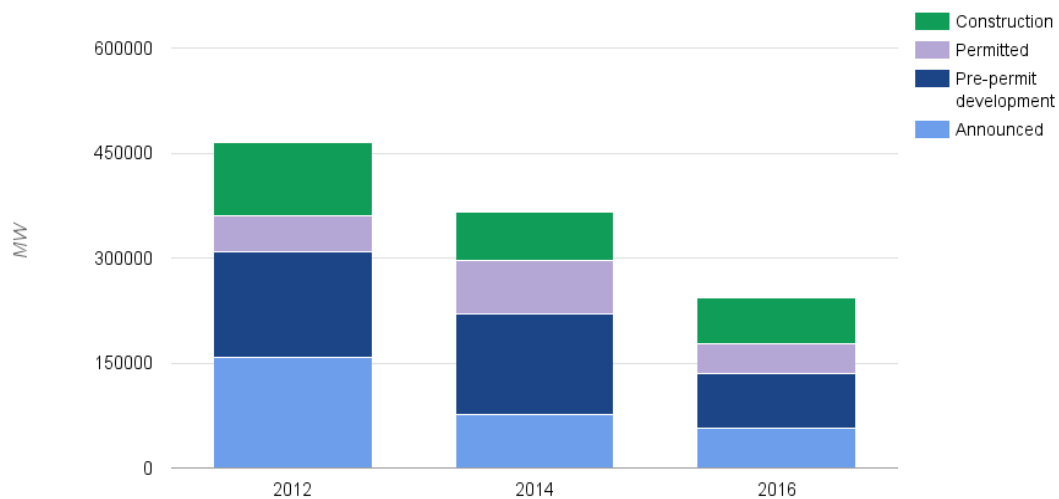


Fig. 2: Coal-fired proposals in India by category (MW), 2012–2016.

INDIA'S COAL PLANTS

From 1960 to 2006 India added few coal plants, averaging under 500 MW a year in the 1960–70s and around 2,000 MW a year in the 1980–90s (Fig. 3). This changed dramatically in 2007, when the government embarked on an aggressive push to expand power capacity. Since 2011, India's power sector has added between 15 GW and 22 GW of coal power each year. The year 2015 was the first dip in India's nearly decade-long uninterrupted coal growth, from a high of over 22 GW in 2014 to just over 20 GW in 2015.

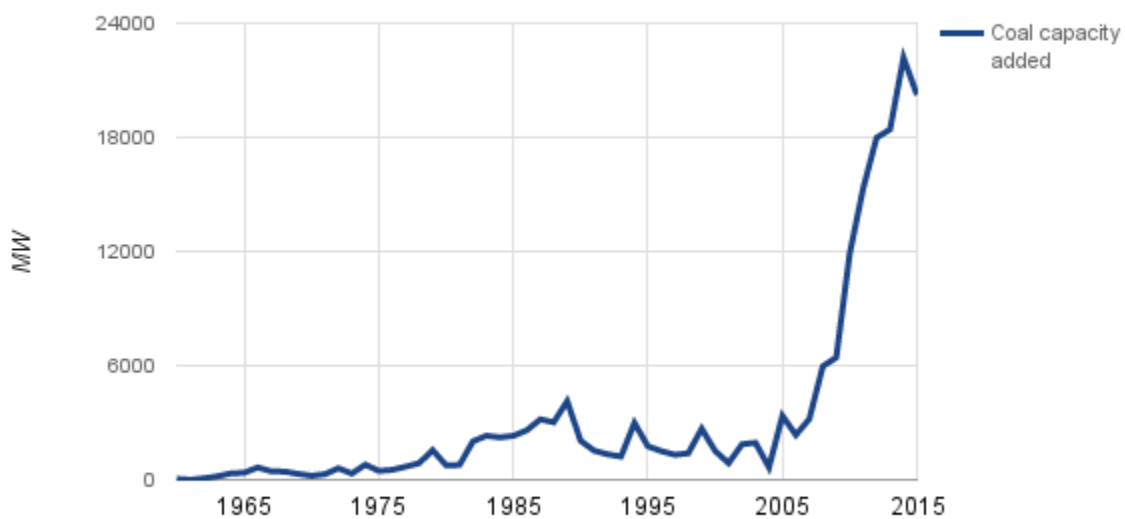


Fig. 3: Annual coal-fired capacity additions in India (MW), 1960–2015.

COAL PLANTS UNDER CONSTRUCTION

Figure 4 shows the projected commissioning date for coal plants currently under construction. All but 23 coal units under construction have an estimated year listed by their sponsor or the India Ministry of Power for completion; of the 23 units that did not have a timeline, twelve were assigned the year 2018 and eleven the year 2019 as a proxy completion date.

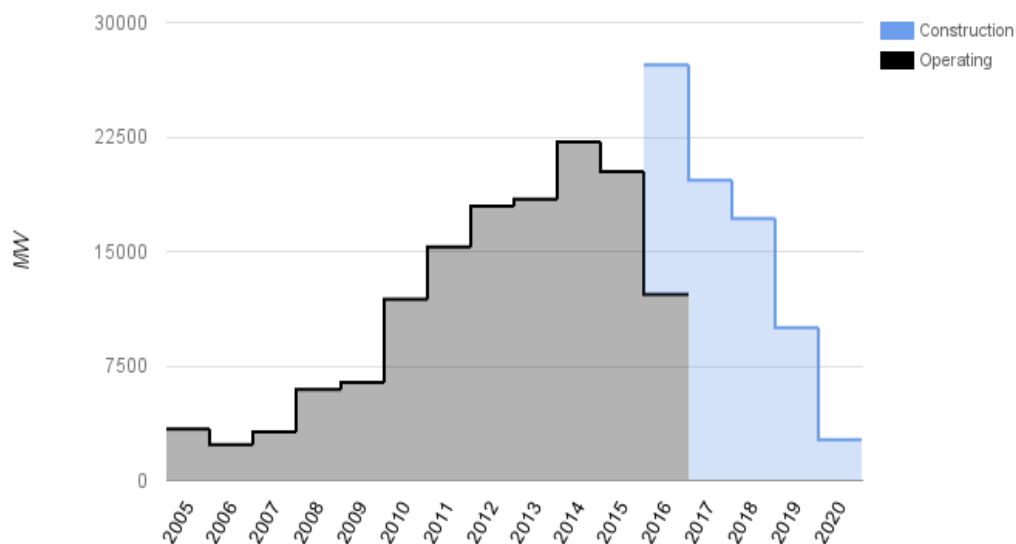


Fig. 4: Recent coal-fired capacity additions and projected additions for coal plants currently under construction. The grey area shows coal-fired capacity additions in India since 2005, including plants commissioned up to May 2016. The blue area shows projected commissioning for coal plants under construction.

According to current projections for coal plants under construction, the amount of new coal capacity coming online will increase to its highest annual level yet in 2016, at 27.2 GW, and then decline slightly to 19.7 GW in 2017. Many proposals currently planned for completion in 2016 and 2017 may be delayed, pushing the projections back and smoothing out the steep decline after 2019. Additional plants may be ultimately abandoned, due to issues such as public opposition or problems with financing. Even if all projects under construction are completed by the end of 2020 (76.7 GW), it will represent a slowdown of the country's 2011–2015 construction coal boom (94.1 GW).

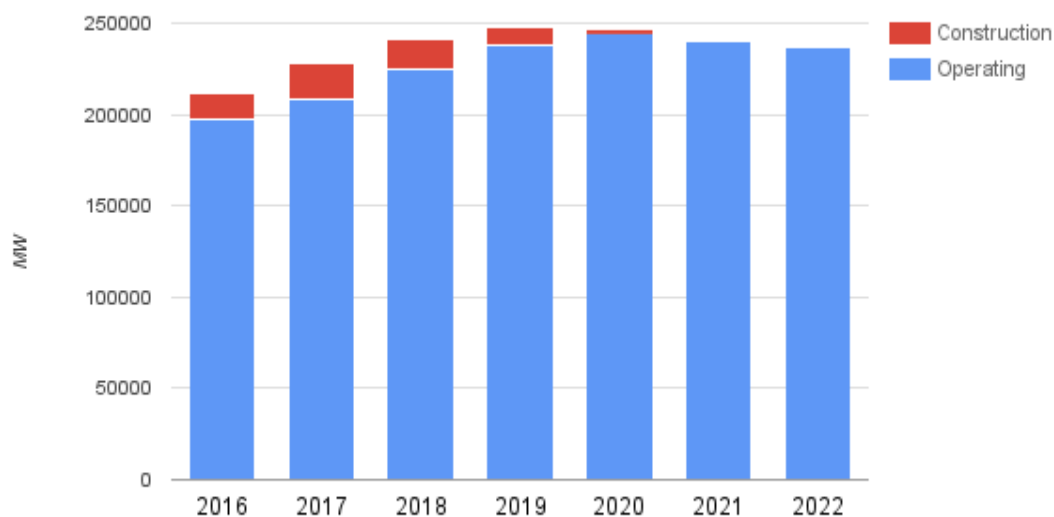


Fig. 5: Cumulative coal capacity in India, 2016–2022. The red area shows the amount of coal-fired capacity that would be added each year by coal plants currently under construction. Blue areas include retirements.

Figure 5 shows cumulative coal capacity in India through 2022, if all coal plants currently under construction are completed. The projection incorporates the Indian government’s recent announcement that it plans to shut down 37 GW of older coal plants,⁸ with the retirements spread out evenly from 2017 to 2026. Altogether, there would be 237 GW of coal-fired capacity in India by 2022, without accounting for any pre-construction coal proposals. This compares to the 197 GW of coal fired power plants in operation as at end of May 2016.

The Indian government projects a growth in electricity demand of 6.7 percent annually through 2030, from 776 Terawatt-hours (TWh) in 2012 to 1,484 TWh in 2022.⁹ At a 75 percent utilization rate, India’s 2022 coal fleet will be capable of generating 1,640 TWh of electricity, more than the country’s projected electricity demand. Yet India has also proposed installing 93 GW of new solar power and 34 GW of new wind power by 2022. Even if no further coal capacity enters into construction, the large amount already under construction threatens to lock out solar and wind, or alternatively, end up as stranded assets.

⁸ Singh, RK, “[India Seeks to Shut 12% of Power Capacity in Anti-Pollution Move.](#)” *Bloomberg*, May 6, 2016.

⁹ [India's Intended Nationally Determined Contribution](#). UNFCCC, September 25, 2015.

PRE-CONSTRUCTION COAL PROPOSALS

Unlike coal plants under construction, most coal proposals in the pre-construction pipeline (permitted, pre-permitted, and announced) do not have a specified year for completion. To examine how this pipeline may affect future capacity growth, this analysis assigned a completion date to all such units: 2020–2021 for permitted, 2022–2023 for pre-permitted, and 2024–2025 for announced. This gives each project four to five years to complete the permitting process, and an additional four to five years for construction.

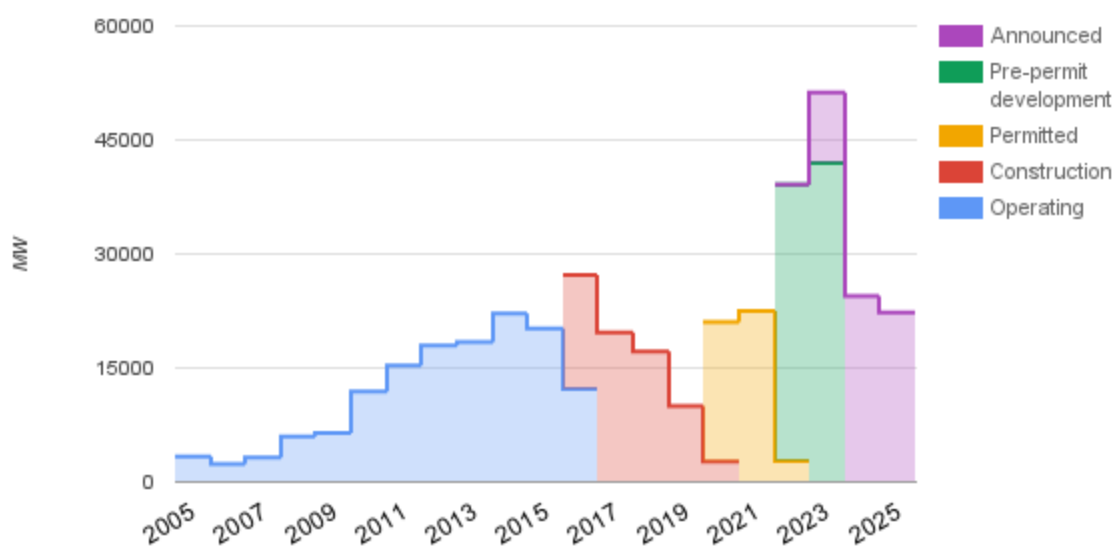


Fig. 6: Annual coal-fired capacity additions by status category, 2005–2025.

Based on the projected commissioning dates, Figure 6 shows annual coal power capacity additions from 2016 to 2025 by plant status category. Plants currently under construction and permitted would continue adding around 20 GW a year of coal-fired capacity through 2022.

For proposals in the pre-permit and announced stage, typical rates of attrition suggest that most will not be built, given India's 2010–2016 implementation rate of 38 percent of all coal plant proposals. Still, even if 38 percent of announced and pre-permit proposals are completed, India's coal power capacity would grow by an additional 51 GW, further threatening to lock out the country's planned renewable capacity additions.

CLIMATE IMPACTS

Coal burning is estimated to be the largest source of heat-trapping carbon dioxide (CO₂) emissions on the planet, making up 42 percent of all CO₂ emissions in 2014, according to the Global Carbon Budget. Coal plants are a particular concern for the climate because many operate for forty years or more. To capture these cumulative climate effects, Davis and Socolow have advocated looking at the “committed” CO₂ emissions of power plants over their expected lifetimes, rather than just the annual CO₂ emissions.¹⁰ Figure 7 looks at the estimated annual emissions of coal plants that were commissioned in India between 1960 and 2015 over a 40-year lifetime.

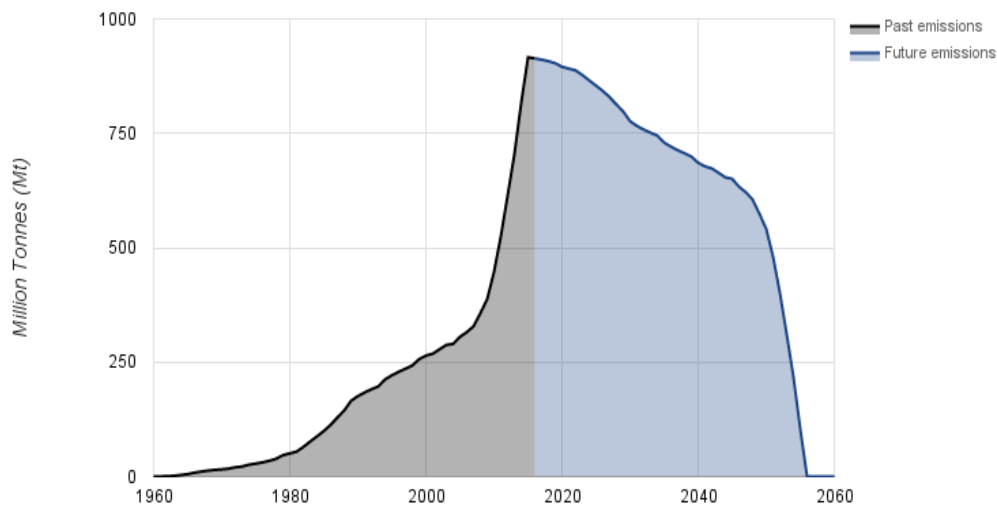


Fig. 7: Estimated annual CO₂ emissions from India coal plants that began operating 1960–2015 over their full lifetimes. Parameters for estimating CO₂ emissions can be found [here](#).

Assuming a 40-year lifetime, the plants will emit a total of 38.6 billion tonnes (gigatonnes [Gt]) of CO₂, unless retired early. Of this, 28 Gt would be released from 2016, meaning most of the emissions have yet to be realized, and remain “committed” emissions. The emissions estimate takes into account plant type, where known, and thus incorporates India’s recent move toward more efficient supercritical plants over subcritical plants.

¹⁰ Davis, SJ and R Socolow, “[Commitment Accounting of CO₂ Emissions](#).” *Environmental Research Letters* 9 (8), August 2014.

Figure 8 looks at estimated CO₂ emissions for India's currently operating, under construction, and pre-construction proposals. Since not all plants in the pre-construction stage are likely to be built, the figure looks at emissions if 38 percent of the proposals are built, the 2010–2016 implementation rate for coal proposals in India.

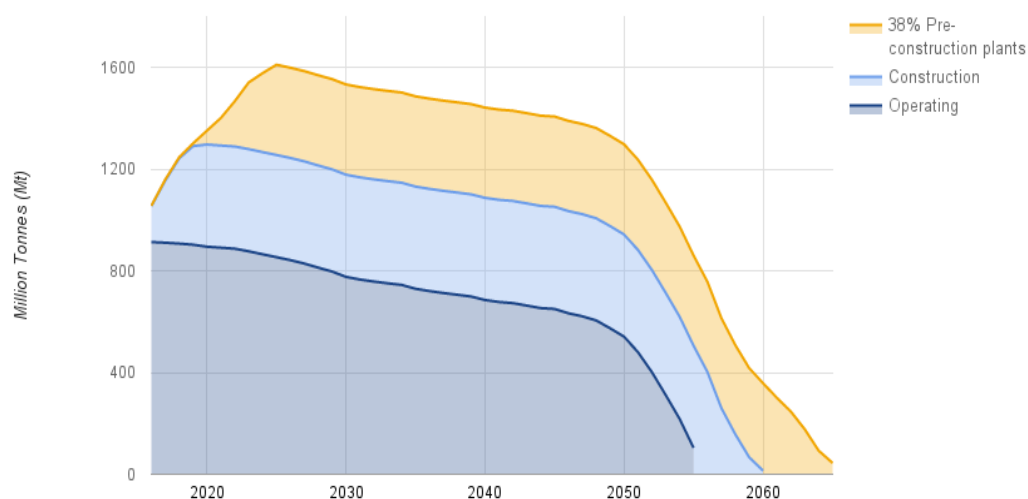


Fig. 8: Annual estimated CO₂ emissions from 2016 for operating and proposed coal plants over their lifetimes, assuming a 38 percent implementation rate for pre-construction plants.

As can be seen in Figure 8, coal plants under construction since 2016 would put the year of peak CO₂ annual emissions from India's coal plants at 2020, while the pre-construction pipeline would push annual peak emissions further back to 2025 at the earliest. Altogether, coal plants under construction and in the pipeline would add an additional 31 Gt of CO₂ over their lifetimes, nearly matching the 38.6 Gt lifetime emissions of every coal plant already built in India since 1960.

ENVIRONMENTAL IMPACTS

India's coal proposals would also put further demands on the country's stressed environmental resources. Greenpeace found the water requirements of India's operating coal plants are already unsustainable given the country's drought: several plants were forced to temporarily shut down this year due to a lack of water for cooling, costing US\$350 million in lost revenue the first five

months of 2016.¹¹ Looking at NASA satellite data, the organization also found the country's per-capita particulate matter pollution is now worse than China.¹² According to the World Health organization, half of the world's 20 most polluted cities are in India.¹³

POLICY OPTIONS

India's situation is not unique. Increasingly, central governments have recognized the problem of excessive coal capacity and are moving to curb coal plant development:

- **China:** In March 2016, the central government ordered 13 provincial governments to suspend new power plant approvals. In addition, the central government halted new coal construction in 15 provinces. In April the government took the further step of introducing policy mechanisms suspending approvals of new coal plants in 28 of China's 31 mainland provinces. Overall, the Chinese clampdown on coal plants is estimated to affect about 105 GW of capacity under development.¹⁴
- **Vietnam:** In March 2016, Vietnam released its revised Power Development Plan VII. Under the plan, 23 GW of new coal plants that had appeared in previous plans were eliminated.¹⁵
- **Indonesia:** In June 2016, Indonesia's state-owned electricity company PLN released the final version of its 2016-2025 Electricity Plan. Under the plan Indonesia will develop 34 GW of coal power capacity, down from 42 GW under the previous long-term plan.¹⁶

Fortunately, the well-defined tiers of India's environmental permitting system provide a clear means for differentiating among projects in the development pipeline. The most critical component of the pipeline is the 44 GW of capacity that has received Environmental Clearance, the final approval step prior to entering construction. It is this cohort of projects that present both the greatest urgency as well as greatest opportunity for the government to meaningfully head off the impending collision between India's renewables goals and the country's worsening excess of coal power capacity.

¹¹ Fernandes, A and RJ Krishna, "[Water shortages threaten coal company revenues.](#)" Greenpeace, 2016.

¹² "[India overtakes China's air pollution levels in 2015.](#)" Greenpeace, February 22, 2016.

¹³ "[Delhi no more the most polluted city in the world, says WHO report.](#)" *The Times of India*, May 12, 2016.

¹⁴ Boren, ZD, "[China to suspend new coal power plant approvals.](#)" *Energy Desk*, April 13, 2016; Forsythe, M, "[China Curbs Plans for More Coal-Fired Power Plants.](#)" *New York Times*, April 25, 2016.

¹⁵ "[Vietnam needs a 21st Century electricity plan.](#)" German Energiewende, June 23, 2016.

¹⁶ "[Rencana Usaha Penyediaan Tenaga Listrik, 2016-2025.](#)" PT PLN (Persero), June 10, 2016.

CONCLUSION

The amount of coal power capacity under development in India has been slowing, but is still substantial at 243 GW, and is on track to reach its largest annual addition ever this year. Coal plants currently operating and under construction alone would exceed India's electricity demand through 2022. Further additions to the coal fleet threaten to crowd out India's renewable ambitions, which are increasingly offering the least-cost energy option, or create stranded coal plant assets operating well below their designed utilization rates.

India should therefore consider concrete measures to suspend the large cohort of coal projects already permitted from entering construction, and to prevent plants at earlier stages in the development cycle from receiving permits. Failing to close the coal plant pipeline would mean locking the country into more expensive and underutilized coal plants at the expense of lower cost and cleaner renewable energy options.

APPENDIX A

	Announced	Pre-permit development	Permitted	Construction	Operating	Shelved	Cancelled
Andhra Pradesh	6,640	9,630	4,100	3,420	10,307	10,180	35,797
Assam	0	660	0	500	250	0	1,820
Bihar	4,000	1,320	0	5,210	4,740	10,580	24,720
Chhattisgarh	660	8,490	320	11,525	21,569	8,280	26,740
Delhi	0	0	0	0	839	0	0
Gujarat	1,320	2,600	9,800	1,435	16,990	12,000	20,030
Haryana	0	800	0	0	6,175	0	3,580
Himachal Pradesh	0	0	0	0	30	0	0
Jharkhand	6,920	6,880	1,100	4,389	8,614	11,160	33,365
Karnataka	1,600	3,720	660	3,620	6,550	1,580	14,780
Kerala	0	0	0	0	0	0	1,320
Madhya Pradesh	1,600	7,820	9,120	4,840	18,487	15,600	30,760
Maharashtra	660	3,550	500	7,650	16,024	8,640	42,985
Meghalaya	0	0	0	0	0	0	740
Odisha	9,840	5,160	1,935	6,080	15,316	13,365	29,920
Puducherry	0	0	0	0	0	0	1,980
Punjab state	0	1,320	0	0	2,680	1,320	7,170
Rajasthan	1,600	2,230	250	2,640	8,914	2,640	120
Tamil Nadu	11,310	7,345	11,295	2,640	16,248	6,480	14,640
Telangana	0	5,800	0	3,000	6,535	0	5,610
Uttar Pradesh	9,320	6,520	4,620	5,300	21,274	6,380	11,140
Uttarakhand	0	0	0	0	43	0	0
West Bengal	660	4,540	0	2,270	15,382	3,140	12,420
Total	56,130	78,385	43,700	64,519	196,967	111,345	319,637

Table 1: Coal plant proposals (MW) by state, as well as all currently operating coal plants, and projects shelved or cancelled since 2010.

	Announced	Pre-permit development	Permitted	Construction	Operating	Shelved	Cancelled
Andhra Pradesh	4	14	6	6	39	13	33
Assam	0	1	0	2	1	0	4
Bihar	1	2	0	11	16	13	19
Chhattisgarh	1	14	2	23	89	14	37
Delhi	0	0	0	0	7	0	0
Gujarat	2	4	14	4	69	15	26
Haryana	0	1	0	0	21	0	5
Himachal Pradesh	0	0	0	0	1	0	0
Jharkhand	9	5	2	12	60	16	35
Karnataka	2	5	1	6	21	5	18
Kerala	0	0	0	0	0	0	2
Madhya Pradesh	2	11	14	7	60	24	39
Maharashtra	1	6	1	18	46	20	41
Meghalaya	0	0	0	0	0	0	3
Odisha	8	8	7	13	98	20	21
Puducherry	0	0	0	0	0	0	3
Punjab state	0	2	0	0	4	2	10
Rajasthan	1	4	1	4	45	4	1
Tamil Nadu	9	17	18	4	84	12	18
Telangana	0	11	0	4	31	0	6
Uttar Pradesh	4	8	7	11	92	11	19
Uttarakhand	0	0	0	0	1	0	0
West Bengal	1	7	0	6	67	6	16
Total	45	120	73	131	852	175	356

Table 2: Coal plant proposals (number of plants) by state, as well as all currently operating coal plants, and projects shelved or cancelled since 2010.