

STRANDED INVESTMENTS

HOW INDIA IS WASTING BILLIONS ON IDLE COAL PLANTS

India sinking over ₹ 3 lac crores / \$ 49 billion to build idle coal plants; even more in the pipeline

Executive Summary

- 1** India is facing a coal power bubble that will have serious impacts on existing plant operators as well as the banking/investment sectors
- 2** Plant Load factors for coal and lignite are at historic lows - touching 60.87% and 54% in June and July 2016 respectively, mainly due to low demand coupled with new capacities coming online.
- 3** Another 65 GW of new coal is under construction, and 178 GW at various stages in the permitting pipeline. India has already committed to building about 140 GW of new wind and solar to meet its 175 GW target by 2022.
- 4** Assuming the 65 GW of under construction coal comes online by 2022, about 62 GW of coal power plants will be lying idle (assuming an electricity demand growth projection of 6.7% p.a., with the existing coal fleet rest running at about 64% - down from 75% in 2010).
- 5** The 61.7 GW of idle plants represents a stranded capital of approximately 3,20,000 Crore rupees (49 billion USD).
- 6** An industry-wide average PLF of 64% represents Rs 4.6 lac crore, or nearly \$70 billion in foregone earnings across the sector.
- 7** This projection assumes that none of the 178 GW in the permitting pipeline is built. If we assume that even 1/3rd of that is actually built, the situation become much worse.



"Anpara-D", a wing of the Anpara thermal power plant, 2011.

Introduction

Coal has been the mainstay of India’s power sector. Private investment in the power sector started with the Electricity Act of 2003 and privately owned power plants account for about 41% of installed capacity as of 2016. In 2012, about 700 GW of coal power applications were in the environmental clearance permitting pipeline, seven times the figure stated in the 2012-2017 Five Year plan. This boom in coal power plant proposals however was short lived. As of 2016, about 243 GW of coal remains in the pipeline (under construction, permitted and proposed) as many of the power plants proposed did not take off due to a wide variety of reasons such as land availability, finance shortfalls, legal challenges and community opposition.

Today, India has about 186¹ GW of operational coal power plants and 65 GW are under construction. Independent assessments by Coalswarm’s Global plant tracker, based on the information available from the Ministry of Environment, Forests and Climate Change indicate that there are about 178 GW of proposed power plants at varying stages of approval. The government has also indicated that 37 GW of old power plants will be retired for reducing emissions and increasing efficiency².



Essar power plant, Singrauli, Madhya Pradesh.

© Harikrishna Kairagadda / Greenpeace

India has been consistently increasing its annual coal capacity addition from 5.6 GW in the year 2007-08 to 19.5 GW in the year 2014-15 with a CAGR of 11%. As a result of a policy boost towards coal power plants India has a large future capacity that is in various stages of development.

Coal power capacity in India

Table 1 below shows cumulative coal capacity in India through 2022, if all coal plants currently under construction are completed. The projection incorporates the government’s recent announcement that it plans to shut down 37 GW of older coal plants, with the retirements spread out evenly from 2017 to 2026. Altogether, there would be 229 GW of coal-fired capacity in India by 2022, without including the 178 GW that are currently in the pre-construction stage.

Coal power capacity addition in India

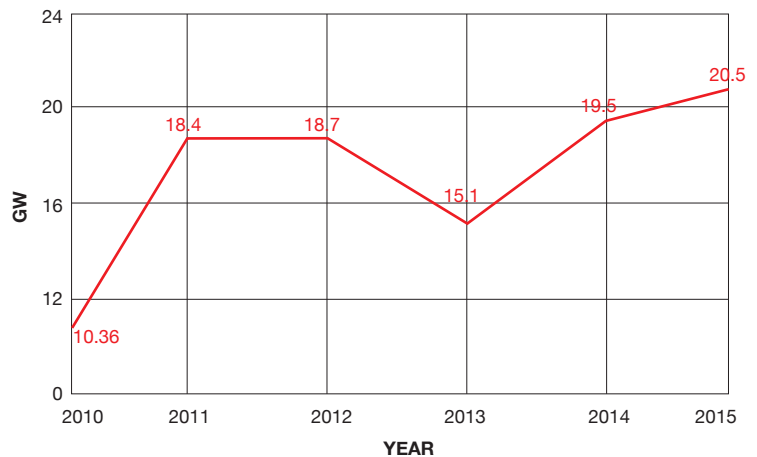


Table 2: India: power generation in 2022

OPERATIONAL (EXISTING +UNDER CONSTRUCTION)	RETIRED	PROPOSED (ASSUMING SAME AS 2016)	TOTAL OPERATIONAL (AFTER REDUCING RETIRED CAPACITY)
251 GW	22.2 GW*	178 GW	228.8 GW

*Extrapolated from CEA announcement of its desire to shut down 37 GW over the next ten years.

¹http://cea.nic.in/reports/monthly/executivesummary/2016/exe_summary05.pdf

²<http://www.bloomberg.com/news/articles/20160506/india-seeks-to-shut-12-of-power-capacity-in-anti-pollution-move>

Overcapacity estimates

Based on the INDC (Intended Nationally Determined Contributions provided last year to the Climate Change treaty negotiations) submission of the government of India, electricity demand is projected to grow at about 6.7% each year, a slight acceleration from the FY2012-2015 average of 6.2%. That is, the total electrical demand will increase from 776 TWh in 2012 to about 1486 TWh by 2022. This is in sync with a GDP growth of 8.3% based on an elasticity for electricity consumption to GDP at 1.25³.

An estimate of the total power generation in 2022 for India is provided in the Table 2 below. The existing capacities are taken from CEA data and the projects under construction are sourced from Global Coal Plant Tracker (Coalswarm) and Platts World Electric Power Plants database. Using average PLF (Plant Load Factor) values from IEA for the year 2013 we estimate the total possible power generation for the year 2016. The PLF values for coal at 64% is 21 percentage points less than the normative PLF of 85% recommended by CEA. A higher PLF for coal is achievable and will increase the power generation from coal to a greater extent.

The power generation projection of 1349 TWh for 2016 also matches with the current scenario of power surplus in the country, and low PLF values reported for coal power in 2016. The 2022 power

generation is calculated by adding any plants under construction for coal, hydel, gas, nuclear and the official targets for wind, solar and biomass.



NTPC's Solapur power plant under construction, 2016.

Table 2: India: power generation in 2022

TYPE OF POWER PLANT	OPERATING CAPACITY IN 2016 (GW) ⁴	UNDER CONSTRUCTION (GW) (ADJUSTED FOR RETIRED CAPACITY)	TARGETS FOR 2022 (GW)	AVERAGE PLF % ⁵	AVERAGE POWER GENERATION IN 2016 (TWH) (USING AVERAGE PLF)	AVERAGE POWER GENERATION IN 2022 INCLUDING TARGETS AND UPCOMING PLANTS (TWH)
Coal*	186.29	42.8	-	64	1044.47	1282.74
Hydel	42.88	10.5	-	38	142.73	177.69
Gas	24.64	0.9	-	34	73.38	76.07
Nuclear	5.78	7.1	-	65	32.45	73.34
Wind	27.15	0.4	60	18*	42.88	94.61
Solar	7.80	1.0	100	11*	7.51	96.36
Biomass	4.86	0.03	10	38	16.31	33.29
Total					1349.68	1835.72

The power generation for 2022 is excluding the 178 GW of proposed coal power plants. Even if a third of this capacity (~58 gw) gets built, the overcapacity in the power sector will increase significantly.

**The PLFs for wind and solar are conservative and actual generation could be significantly higher.*

³<http://planningcommission.nic.in/sectors/index.php?sectors=energy>

⁴From CEA monthly reports. http://cea.nic.in/reports/monthly/installedcapacity/2016/installed_capacity-07.pdf

⁵World Energy outlook of 2015, published by the International Energy Agency. Data for the year 2013.

Energy efficiency measures

The National Mission for Enhanced Energy Efficiency (NMEEE), one of the 8 national missions under Prime Minister's National Action Plan on Climate Change is being led by Energy Efficiency Services Limited (EESL) along with Bureau of Energy Efficiency (BEE). EESL has long term plans to improve energy efficient appliances based on a business model with DISCOMS (electricity distribution companies). The areas of intervention are LED bulbs and tube lights, LED street lights, high efficiency agricultural pumps, solar agricultural pumps, energy efficient fans and efficient air conditioners. The targets for this plan are tabulated in Table 3 and show significant energy saving potential of about 191 TWh. It's not clear if the energy savings stated by EESL includes the additional savings in AT&C losses as well.

India: Power generation in 2016 and 2022

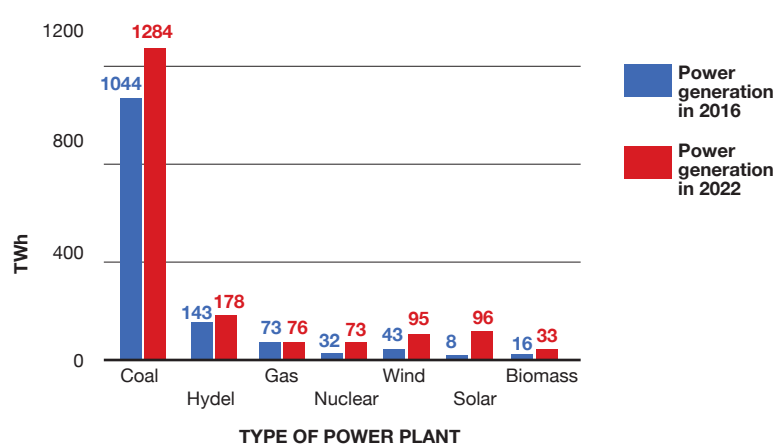


Table 3: Efficiency measures in india by EESL and BEE⁶

MARKET SEGMENT	YEAR	SCALE OF DEPLOYMENT	ANNUAL ENERGY SAVINGS (TWH)
LED street lighting	2018-19	35 million	8.999
LED lamps (DELPL)	2018-19	770 million	104.999
BEE 5 star fans	2018-19	16 million	1.841
LED tube lights	2018-19	16 million	0.418
Solar Agricultural pumps	2018-19	5 million	22.380
BEE 5 star air conditioners	2018-19	1.8 million	1.420
Efficient pump sets for agriculture (Ag DSM) ⁷	Not available	20 million	51
Total			191.01

A summary of the power generation and demand is tabulated in Table 4. The projection for power demand in 2016 and 2022 and is based on 6.7% annual growth rate using 2012 as the base year. Energy Efficiency savings of 191 TWh is deducted from the 2022 total

demand of 1486 TWh before 15% Aggregate Technical & Commercial (AT&C)⁸ losses are credited, yielding a total demand of 1489.25 TWh. In effect, energy efficiency measures are assumed to reduce transmission losses and commercial losses as well.

Table 4: India power demand vs generation

2012 POWER DEMAND	776 TWh
ESTIMATED 2022 POWER DEMAND (@6.7% GROWTH RATE FROM 2012)	1486 TWh
ANNUAL POWER SAVINGS DUE TO EFFICIENCY MEASURES IN 2020	191 TWh
ESTIMATED 2022 POWER DEMAND INCLUDING AT&C LOSSES @15%	1489.25 TWh
POWER GENERATION IN 2022 AT 64% PLF (EXCLUDING PROPOSED COAL CAPACITY OF 178 GW)	1835.72 TWh
EXCESS POWER GENERATION IN 2022	346 TWh

⁶Based on presentation by Mr Saurabh Kumar, MD, EESL in Energy Efficiency side event of IEA at COP 21. Available at: <https://www.iea.org/media/workshops/2015/cop21/energyefficientprosperity/S1India.pdf>

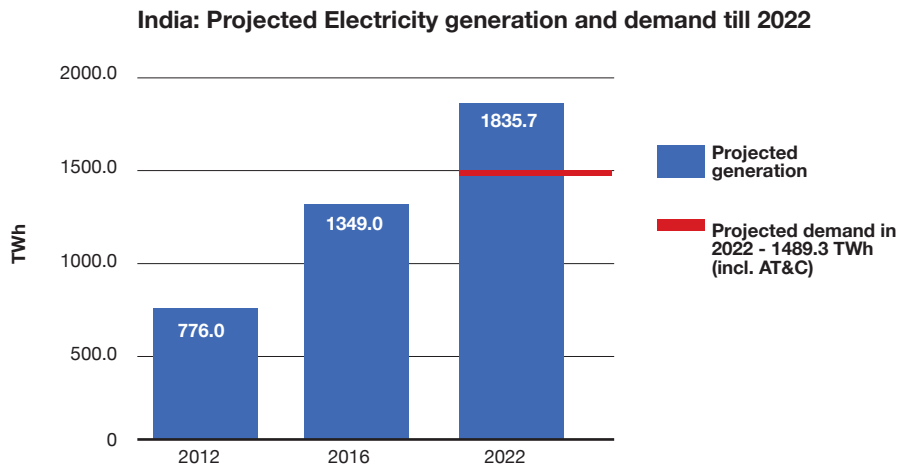
⁷Presentation by Mr Saurabh Kumar, MD, EESL. Available at: <http://foir-india.org/upload/PRESENTATION-BY-MR-SAURABH-KUMAR-MD-EESL-ON-24-06-2016-DURING-FOIR-WORKSHOP-AT-PUDUCHERRY.ppt> and <http://mnre.gov.in/file-manager/akshay-urjal/january-february-2016/EN/40-43.pdf>

⁸Based on the targets of UDAY (Ujwal Discom Assurance Yojana) http://powermin.nic.in/pdf/Power_Sector_Reforms.pdf

The power generation estimate in 2022 is about 1836 TWh, while this analysis puts the demand at around 1489.25 TWh, after accounting for a 15% AT&C loss. Since excess power cannot be generated it would mean that 346 TWh of power generation will need to be backed down in 2022. In terms of coal power alone, this would mean that 61.7 GW of coal capacity would be lying idle if the average PLF of the coal power sector remains at 64%.

The capital cost of this 61.7 GW of idle coal capacity would be around 3,23,925 Crore rupees taken at the rate of 5250 Crore rupees per GW⁹ at present costs (for supercritical boilers).

Additionally, there are 178 GW of coal power plants that are in varying stages of approvals. Even if one third of this capacity gets commissioned (around 58 GW), an additional 3,00,000 crore rupees (\$45 billion) of capital expenditure would be at risk as all of these plants would lie idle, or alternatively 58 GW of existing plants would have to be shut down as compensation.



To put it another way, 94% of the coal power capacity that is currently under construction will be lying idle in 2022 due to unplanned over capacity.

In other words at least 3.2 lac crore rupees (\$49 billion) of capital would be sunk on building idle coal power plants if the overcapacity situation is not corrected.

⁹indiaenergy.gov.in/docs/Thermal-power-generation-documentation.pdf 5250 cr/ GW for Super critical coal.



Coal Mining in Jharia coal field, Jharkhand. Lower power demand has an impact on coal production targets.

Over capacity directly affects return on investment

The overcapacity bubble also has serious implications on existing, operational power plants. The 64% PLF assumed in this analysis is itself sub-optimal. The Central Electricity Authority specifies a normative PLF of 85%. A 21% reduction in PLFs from normative levels translates into annual foregone earnings of over Rs 4.6 lac crore, or nearly \$70 billion. (assuming a conservative tariff of Rs 4/kwh, 1\$=Rs.67). At a 64% PLF, India's coal power industry's will continue to underperform financially.

Due to low procurement from distribution companies (DISCOM) the PLF of coal power plants has already decreased from a healthy 78.6% in 2007-2008 to 62.2%¹⁰ in 2015-16. This has also led to a situation where the country seems to have a surplus generation capacity even as power blackouts across the country are common¹¹.

A steep fall in PLF rates directly affects the return on investment of a coal power plant. In January 2016, 45 percent of power offered for sale on India's electricity exchange remained unsold, in another indication that India's power market is unable to afford the cost of the expanding supply of coal-fired power, despite large unmet electricity need in the country¹².

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/kWh¹³ for pithead coal and INR 5.15/kWh for imported coal, while prices for photovoltaic solar have already reached a low of INR 4.34/kWh¹⁴. State DISCOM'S have been unable to buy power at prices sufficient to cover the operating costs of generators, leading to 30 GW of stranded plants in 2016¹⁵.

A comparison with China

China presently has over 1000 GW of thermal power generation capacity; coal accounts for over 900 GW. There are about 200 GW of coal under construction. Until recently, there were still 276 GW preparing to apply for permits or waiting for approvals. However, facing a coal power overcapacity crisis, the government has now suspended most of these projects, and is expected to suspend almost all of them.

The electrical demand growth rate of China is expected to be at 2.5% (till 2020) but the growth in 2014 was less than the forecast of 3.8% by the China Electricity Council. The demand growth was even less in 2015 at a meagre 0.5% as compared to 2014 and was the slowest growth rate since 1974!^{16,17}

Table 5: Coal power scenario in 2020 (China)

OPERATIONAL	RETIRING CAPACITY (ESTIMATES)	UNDER CONSTRUCTION	PROPOSED CAPACITY ADDITIONS	PROPOSED CAPACITY IF NEW OVERCAPACITY POLICY IS IMPLEMENTED STRICTLY (ESTIMATES)	TOTAL OPERATIONAL (AFTER REDUCING RETIRED CAPACITY)
912 GW	94 GW	200 GW	276.7 GW	165 GW	1192 - 1222 GW

¹⁰http://cea.nic.in/reports/monthly/executivesummary/2016/exe_summary-04.pdf, page 10.

¹¹<http://economictimes.indiatimes.com/industry/energy/power/for-the-first-time-in-history-india-will-not-have-power-deficit-situation-in-fy17/articleshow/52562666.cms>

¹²http://articles.economictimes.indiatimes.com/2016-02-08/news/70450201_1_power-exchange-india-energy-exchange-ix

¹³"The Rising Sun: Disruption on the horizon." KPMG, November 2015, page 6. <https://www.kpmg.com/IN/en/IssuesAndInsights/.../Documents/ENRich2015.pdf>

¹⁴Rs 4.34 a unit: Solar power tariff drops to record low." Times of India, January 19, 2016. <http://timesofindia.indiatimes.com/india/Rs-4-34-a-unit-Solar-power-tariff-drops-to-record-low/articleshow/50643394.cms>

¹⁵India won't need any new power plants." Economic Times, June 2, 2016. <http://economictimes.indiatimes.com/industry/energy/power/india-wont-need-extra-power-plants-for-next-three-years-says-government-report/articleshow/52545715.cms>

¹⁶<http://climatepolicyinitiative.org/wp-content/uploads/2015/12/Slowing-the-Growth-of-Coal-Power-in-China-%E2%80%933-the-Role-of-Finance-in-State-Owned-Enterprises.pdf>

¹⁷<https://www.chinadialogue.net/article/show/single/en/8558-China-s-power-sector-and-the-economic-new-normal>



Clouds of smoke and steam billow from under the haze in the gloomy sky, China.

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While additional power demand is slowing, annual capacity additions shot up in 2015 after the government brought in a policy change to allow provincial government to permit coal power plants and construction approvals. This led to a record surge in new coal power plants with 165 GW of coal plants receiving environmental permits in 2015.

In an attempt to resolve China's coal power overcapacity crisis, the country's top energy planners put in place a new capacity control and retirement policy in April 2016.¹⁸ However, Greenpeace¹⁹ has identified 165 GW of capacity that could still go ahead despite the curbs on approvals and construction starts, in addition to approximately 200 GW of capacity under construction. In total, China's coal-fired capacity could increase by an estimated 280-310 GW from 2015 to early 2020s.

China has a national target of 15% non-fossil energy mix by 2020. It is projected that non-fossil power generation will grow by 800-900 TWh from 2015 to 2020, based on wind and solar power installation rates achieved in 2015 and hydropower and nuclear power capacity already under construction. The non-fossil target is in sync with China's INDC submissions which speaks about increasing share of non fossil fuels in primary energy consumption to 20% by 2030.

In other words, China faces a situation in which over 35% of power demand needs to be supplied from non-fossil sources to meet the government's climate and energy targets. The capacity targets for wind, solar, hydro and nuclear power are also set in line with this goal. At the same time, so much coal-fired generating capacity is locked in that even without competition from other electricity sources, capacity utilization would be stuck at the very low level of 57%. Given the clean energy supply coming online, coal power plant utilization looks set to fall far below 40% without massive plant closures or cancellations.

China could have 1200 GW of coal-fired power plants in operation and under construction by 2020, an overcapacity of at least 400GW. This represents wasted capital expenditure of approximately 1.4 trillion RMB (200 billion USD).²⁰ By early 2020s, coal power generators could be losing 500 billion yuan (80 billion USD) per year due to the reduction in utilization of coal-fired capacity. After the retirement of older plants, the average age of the coal-fired fleet will be just 10 years, meaning that retiring large additional amounts of capacity to resolve the situation will also represent major stranded capital cost.

Due to reduced power generation of existing coal plants combined with aggressive building of new ones, average PLF has fallen to 49.4 % in China, the lowest level since 1969. The Chinese government projects that the PLF rate for thermal power will further drop to 45.7 percent in 2016. By early 2020s, the amount of overcapacity could exceed 400GW, depending on how many projects could still be started under the new rules. In other words, average PLF could fall to around 35%, an incredibly low level that spells hardship and very poor financial performance for utilities.

Table 6: China power demand and generation

2015 POWER DEMAND	2020 POWER DEMAND (@2.5% GROWTH RATE)	NON-FOSSIL POWER GENERATION REQUIRED TO MEET 2020 TARGETS	COAL POWER GENERATION IN 2020 (@ 57% PLF)
912 GW	94 GW	276.7 GW	165 GW

¹⁸http://www.gov.cn/xinwen/2016-04/25/content_5067562.htm, http://www.nytimes.com/2016/04/26/business/energy-environment/china-coal.html?_r=0

¹⁹<http://www.greenpeace.org/eastasia/press/releases/climate-energy/2016/Over-1-trillion-rmb-wasted-coal-power-China/>

²⁰ CAPEX estimates are based on averages of reported costs for different project types compiled from project documents

Conclusion

The Indian power market is starting to respond to the coal overcapacity issue, with a slowdown in new projects, particularly from the private sector. Government-owned NTPC however continues to add large coal capacity, with plans to add about 31 GW of coal by 2032.²¹ However, with 65 GW under construction and another 178 proposed, it is clear that the market response is insufficient and the government needs to intervene to ensure that precious capital is not squandered and the banking system is not exposed to additional risk in terms of non-performing loans to the coal sector.

Curtailing renewable energy development to boost the coal sector is not an option, for several reasons:

- India has garnered much praise in the international community for its pledges on carbon intensity reduction and ambitious renewable energy goals. Failure to meet these goals will imply a serious loss of face.
- Renewables have significant potential external, environmental benefits over coal,

in terms of reduced air and water pollution and consumption, deforestation, displacement of communities etc.

- With a 10 or 20 year time horizon, it is becoming clear that coal is no longer the least-cost option in terms of providing electricity to the consumer, with solar PV and wind now already cheaper (in several cases) than coal, and with costs for renewables continuing to fall as costs for coal continue to rise.

Overcapacity in the coal power sector is already causing a humongous waste of capital which could be better used in many other economic sectors. Project lenders and banks are still feeling the impact of reckless lending to the coal power sector in the 2008-2012 period, with many projects either abandoned, delayed or struggling for viability. The lessons of the past must be heeded if we are to avoid an even more disastrous repeat.

NOTES:

This briefing is based on three reports that have been published this year.

Boom and Bust, Published March 2016 by coal Swarm, Greenpeace and Sierra Club. available at: https://sierraclub.org/sites/www.sierraclub.org/files/uploads-wysiwig/Final%20Boom%20and%20Bust%20report_0.pdf

Collision Course, Published July 2016, Coal Swarm, available at: <http://endcoal.org/wp-content/uploads/2016/07/CollisionCourse.pdf>

Burning Money-How China could squander over one trillion yuan on unneeded coal-fired capacity, Published July 2016, Greenpeace East Asia, available at: <http://www.greenpeace.org/eastasia/press/releases/climate-energy/2016/Over-1-trillion-rmb-wasted-coal-power-China/>

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Published by Greenpeace India Society in September 2016

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²¹<http://www.irade.org/national-Presentations/Session%201/Presentation%20by%20Shri%20AK%20Gupta,%20NTPC.pdf>