Managing India’s Electricity System Transition

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INDIA FACES MULTIPLE CHALLENGES IN REACHING ITS AMBITIOUS RENEWABLE TARGETS

In order to meet its growth targets in a sustainable manner, India has set ambitious renewable energy targets. In the Paris COP in 2015, India announced an explicit target of 175GW of renewable energy capacity by 2022, and an implicit target of 350GW of renewable energy by 2030. Recently, at the 2019 Climate Summit in New York, the 2030 target was raised to 400GW.

While India has made significant progress—reaching 80.46GW of renewable energy capacity in June 2019—India still has a long way to go towards reaching even the 2022 targets. This is despite the Indian government’s claims regarding their confidence in reaching the targets. Reaching these targets may not be easy due to many factors, including the slowing down of electricity demand growth due to India’s economy starting to lose steam. We discuss other key factors below.

First, in this context, it is a bit worrisome that India continues to build greenfield coal power plants that would compete with renewable power to meet India’s energy demand. While there is welcome news that India is unlikely to build new coal plants after 2022, in 2018 alone 36GW of coal plants were under construction and 63GW were under various stages of permitting. In fact, in part due to competition with demand, we are already

1 Here, by renewable energy, we mean non-large-hydro and non-nuclear renewable energy sources (i.e., wind, solar, biomass, etc.)
7 See https://ieefa.org/india-coal-plant-cancellations-are-coming-faster-than-expected/
starting to see curtailment of renewable power and cancellation of renewable energy contracts. This is starting
to create a higher risk environment for renewable energy investing.⁸

Second, in the same context of meeting demand, increasing renewable energy penetration has put increasing
pressure on existing coal plants. Coal plants in India are incentivized to run at average plant load factors (PLFs)
of 85%. However, the average PLF of coal-based power plants has decreased from 79% in 2007-08 to 62% in
2015-16.⁹ The Central Electricity Authority has estimated that all coal-based power plants may see a further fall
in capacity utilization—to as low as 50% by 2022—as additional renewable electricity generation capacities
come online.

This can result in many coal-based plants becoming economically unviable, a phenomenon known as asset
stranding. This may create a pushback against increasing renewable deployment, in particular in the context of
the financial woes that coal-based power plants are facing in India.¹⁰ While the reasons for these financial woes
are manifold—including the shortage of coal itself¹¹—the risk of pushback against renewable energy deploy-
ment is real, including pushback based on research supported by the office of the Chief Economic Advisor at the
Ministry of Finance.¹²

Third, as renewable energy penetration increases in the power grid, the need for flexible resources goes up.¹³
This is due to the fact that renewable energy sources—primarily wind and solar, which are the mainstay of In-
dia’s renewable targets—are inflexible in nature. That is, wind and solar generate electricity independent of the
demand profile, i.e., they generate power simply based on prevailing nature conditions. The resulting increased
flexibility requirements show up in various ways, including ramping requirements and energy shifting across the
day.¹⁴

INDIA WOULD NEED TO USE A MULTI-PRONGED STRATEGY

Thus, India is faced with multiple questions. One, should it build any more coal plants given the twin issues of
flagging demand growth and ambitious renewable energy targets? Two, how should it address the twin issues of
higher system flexibility needs for renewable energy integration and asset stranding of existing coal plants that
have significant sunk costs that still need to be recovered? In my opinion, India should follow a three-pronged
strategy, as outlined below.

The first strategy may be fairly straightforward, and is something that India has already committed to post-2022.
That is, to not build any more greenfield coal plants at all—similar to recent announcements by the states of Gu-
jarat and Chhattisgarh¹⁵—and to build only greenfield renewable energy plants. This would allow India to move
towards its renewable energy goals in a concrete way even in presence of flagging demand growth.

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⁸ See https://economictimes.indiatimes.com/industry/energy/power/growth-in-indias-renewable-energy-sector-has-slumped-to-
a-five-year-low/articleshow/72899445.cms
⁹ See https://www.livemint.com/Industry/5vduPwYwJAKM4LPk458n0K/Falling-capacity-utilization-forces-Indias-coal-fuelled-pro.
html
¹¹ See https://economictimes.indiatimes.com/industry/energy/power/fuel-doubts-leave-power-plants-stranded/article-
show/64892339.cms
¹² See https://www.financialexpress.com/economy/cea-arvind-subramanian-wants-coal-as-major-fuel-says-india-should-not-get-
distracted-by-carbon-imperialism/813123/
¹³ See https://energy.economictimes.indiatimes.com/energy-speak/energy-transition-renewables-in-india-s-electric-future/3964
¹⁴ See https://climatepolicyinitiative.org/publication/an-assessment-of-indias-energy-choices/
¹⁵ See https://qz.com/india/1709483/after-gujarat-indias-chhattisgarh-wont-build-coal-power-plants/
Second, India would need to examine its existing coal fleet from two different contexts: 1) managing potential economic stranding of these coal plants due to increasing renewable penetration and flagging demand growth; and 2) managing the flexibility requirements in the presence of high penetration of renewable energy. In this context, converting some of the existing baseload coal plants to flexible coal plants could be a potential win-win solution.

While the question of what fraction of the existing coal plant fleet—and, more precisely, which specific coal plants—should be converted to flexible operation is key, and should be resolved using system level analysis (such as ones attempted in the Greening the Grid studies\textsuperscript{16}), another key question is the additional costs involved in doing so.

In our work\textsuperscript{17}, we have shown that the additional costs involved are low to moderate (i.e., 5-10\%) in absolute terms. Furthermore, we have shown that using coal plants flexibly may be the lowest cost option for India—by a factor of up to 4-20—when compared to other potential options such as hydro and batteries. This creates a strong case for converting some of the existing baseload coal plants to flexible ones.

Finally, the conversion of some of the existing baseload coal plants to flexible operation, may still leave many existing coal plants that do not need to be run at all. The Greening the Grid studies find that 46GW of existing coal plants would run at close to zero utilization.\textsuperscript{18} This begs the question: Could such coal plants not be run at all and instead be simply retired, particularly in the context of the average costs of solar and wind energy falling below the variable costs of coal-based energy?\textsuperscript{19}

Here, the solution lies in thinking about cost-effectively retiring these coal plants, which again need to be identified via system-level analysis. In this context, our recent analysis shows how these coal plants can be retired cost-effectively via a process called securitization.\textsuperscript{20} Under this process, the existing commitments to investors can be refinanced via cheaper public sector bonds that are funded via ratepayer surcharges. We show that, by doing so, a sample five-year plant could result in public savings of 31.57%.

By using this multi-pronged strategy of building only renewable energy plants going forward, converting some of the existing baseload coal plants to flexible plants, and cost-effectively retiring the remaining stranded coal plant, India can meet its multiple goals of meeting its renewable targets, ensuring that its power grid’s flexibility needs are met cost-effectively, and further reducing its social costs by cost-effectively retiring stranded coal plants.

**ABOUT THE AUTHOR**

Gireesh Shrimali is a Precourt Scholar at the Sustainable Finance Initiative (SFI) at Stanford University. His research focuses on the intersection of policy and finance: in climate in general and energy in particular. At SFI, he is examining energy system transitions, with a focus on the design of effective policies and financial instruments. His recent work has largely focused on India, in particular on how India can get to its ambitious renewable energy targets.

\textsuperscript{16} See [https://greeningthegrid.org/where-we-work/greening-the-grid-india](https://greeningthegrid.org/where-we-work/greening-the-grid-india)
\textsuperscript{18} See [https://www.nrel.gov/docs/fy17osti/68720.pdf](https://www.nrel.gov/docs/fy17osti/68720.pdf)
\textsuperscript{19} See [https://authors.elsevier.com/a/1adKX14YggfIfX](https://authors.elsevier.com/a/1adKX14YggfIfX)
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