Project Templates from Council on Energy, Environment and Water, India (ceew.in)
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Project 1: Market mechanism for thermal decommissioning

India is currently witnessing a clean energy transition. However, over 70% of its power generation continues to come from thermal power, and India has one of the largest coal fleets in the world (~11%). Over the last two decades thermal power experienced exponential but short-lived growth, with massive renewable energy commitments and market activity in recent years. This has resulted in overcapacity (and lower demand as compared to forecasts) of thermal power which results in backdowns, dampened spot market prices, and rapidly declining investor interest in thermal power. Further, the coal fleet also happens to be the biggest contributor to ambient air pollution and is one of the largest contributors to CO2 emissions.

As per the National Electricity Plan (CEA) 2017, net additions of close to 45 GW of coal fired generation capacity is expected by 2027. The aim of this additional capacity is to primarily meet peak demand. However, with the significant decline in the cost of renewable energy and the availability of flexible resources like battery storage, hydro power, and natural gas, the economics of thermal power for peak demand are becoming less compelling. This puts a large pipeline of existing and in-construction thermal assets under risk of financial viability.

Further, factors such as increasing coal prices, stricter coal power plant emission norms, and massive additions of RE capacity at record low prices have started making thermal power plants unviable with average utilisation of merely 51% at present, which is likely to drop further to 35-40% by 2022. With a technical requirement of minimum 55% at plant level, this is expected to lay strain on inefficient, high tariff and high emission plants which could precipitate financial distress for banks and NBFCs that have provided debt capital to these projects. Pre-empting this emerging challenge, CEEW proposes the designing of a bespoke market based solution that enables the early retirement of thermal assets.

Learning from the experience in other parts of the world, such as the EU's *'Just Transition Fund'* of nearly EUR 100 billion to provide financial and practical supports to coal regions (such as easier access to loans, financial support for decommissioning/early-retirement, re-skilling, etc.), we aim to explore the various means of accelerating the decommissioning of thermal assets which are no longer economically viable.

Further, we aim to build narratives around a just transition for India's climate policy, and how it fits with other transitions underway in the country be it urbanisation, industrialisation, labour reform, digitalisation, etc. Also, coal is a significant contributor to the economy of some of India's less affluent states (Jharkhand, Odisha & Chhattisgarh) and a major source of jobs. This makes it essential for the transition plan away from thermal power to also include socio-economic considerations and plans.

Value proposition and activities
Responding to the increasing demand risk plaguing thermal power projects, we propose to design a thermal plan decommissioning policy for India which will have the following components:

- A market mechanism to retire economically unviable thermal power plants keeping in mind the financial burden posed by the revised emission standards, and low plant utilisation factors
- Analysis of the economy wide value creation through a less thermal rich electricity system
- A just transition narrative based on socio-economic analysis including a plan for job creation, reskilling, etc.

This study will design a thermal power plant closure policy suitable for India which will take one of the following two forms (we will study and compare both before developing one into a proposed policy):

- **Option A– Thermal power transition facility for targeted closures**
  - Targeting of plants based on a criterion decided by the government based on factors such as CO2 emissions, CUF, variable cost, capacity, etc.
  - Financial support to thermal power plants for rehabilitation, plant decommissioning, re-skilling and early retirement of employees
  - Access to low interest loans for plant closures
  - Settlement of statutory dues at discounted prices
- **Option B - Market buyout of PPAs at discounted prices**
  - Discounted settlement mechanism to buy-out fixed cost component of running PPAs through a transparent and just process
  - Plants volunteer to participate due to mounting losses
  - In the absence of a carbon price in India, a market based mechanism for regulated thermal power plant closure may be adopted. Plants may bid competitively over the payment they require for closure and the plant with lowest quoted payment requirement (per kg CO2 of its emissions) may be required to close with payment from other coal power plants.

Tentative outline

A. Thermal power transition facility
   a. Study of international coal transition funds/schemes
   b. Devising a methodology for applicability of thermal power plants requiring closure based on emissions, capacity, CUF, etc.
   c. Structuring and sizing India's thermal power plant closure facility
   d. Case studies for 2 coal power plants – estimation of closure costs per kg of CO2 emission
   e. Regulatory framework for rollout

B. Market based mechanism
   a. Outline for a market mechanism for regulated closure

b. Regulatory requirements for designing an effective discounted settlement process
c. Design of the compensatory mechanism for plant closure
d. Empirical illustrations for 2 power plants

Project 2: Rooftop solar market in India

Government of India has set a really ambitious target of 100 GW solar capacity by 2022, 40% (or 40 GW) of which is to be met through rooftop installations. But, as of August 2019, only 2.17 GW of rooftop solar capacity has been installed. Clearly, it would be impossible to meet these targets and to accelerate rooftop solar adoption in the country, if we don't understand the challenges and learn from them. In this context, I request you to answer the following questions.

1. What are the top 5 states in India in terms of solar rooftop capacity?
2. What are the key customer segments and which segment has seen the highest solar rooftop adoption across states in India? Also, comment why.
3. In your opinion, what are the 3 most important determining factors for a typical residential customer to go for solar rooftop in India? (You may also refer to net-metering regulations for any of the Indian states)
4. What are some of the learnings from the successes of the top states and challenges faced by those with lower rooftop adoption?

Project 3: Greening of corporate India

Demand for renewable energy (RE) from Indian corporates is on a dramatic upswing, with some of the notable corporate houses pledging to consume electricity solely from renewable sources. For instance, a consortium of industry leaders including Siemens Energy India, Thermax, Dalmia Cement, Shell Group of Companies India, Hindalco Industries and Tata Consulting Engineers has been formed to commit towards net-zero emissions by 2050. In addition, Tata Motors, Infosys and Mahindra and Mahindra have also committed to 100 per cent electricity consumption through RE.[1]

The reasons behind increasing RE adoption by businesses are two fold. Firstly, companies have signed up for achieving net zero emissions across their businesses. This includes measures such as switching to energy efficient appliances, reducing per capita electricity consumption and consuming energy from clean sources such as solar or wind. In many cases, RE adoption is also being driven by the fact that capital backing the companies is increasingly demanding green credentials.

On the other hand, electricity costs contribute significantly to their input costs (particularly for industries). With rapidly declining RE tariffs, companies are looking to improve their competitiveness by procuring cheaper solar/wind energy.

In this context, several enabling mechanisms have been created over the years to facilitate green procurement by Indian businesses. They provide flexibility and optionality to businesses in terms of choice, and include:

- Green tariffs

- Open access
- Renewable energy certificates
- Green procurement through power exchanges

However, it is also the case that certain bottlenecks exist that deter or discourage wide adoption of these mechanisms.

A brief description of each mechanism and some bottlenecks faced by them is provided below.

Green tariffs

Green tariffs are specialised retail tariffs charged by electricity distribution companies (discoms) for sale of renewable energy to their consumers. Businesses can voluntarily sign up for these tariffs and claim renewable energy consumption, while the discom procures electricity on their behalf from RE developers. The mechanism has been widely adopted in countries such as the USA where 3.7 GW of RE capacity has been added to the grid by subscribing to green tariff programs[2].

Adoption of such tariffs has been lackluster in India, with only a couple of discoms implementing the same. For instance, in Andhra Pradesh, industrial consumers have the option of choosing a special green tariff of 12.50 INR per kWh instead of a regular tariff of 11.30 INR per kWh. Meanwhile in Karnataka, such consumers have to pay a premium of 0.50 INR per kWh on top of any tariff in order to claim RE consumption. In a survey conducted by the World Resource Institute, only one green tariff subscriber was found in each of these states[3].

Open access

Open access (OA) allows corporates (commercial and industrial electricity consumers) typically with a load of 1 MW or above, to directly contract with a power producer or set up their own power generation project (captive) and use state grid to transport electricity. To do so, a corporate consumer needs to pay different charges such as transmission & distribution network charge, cross-subsidy surcharge, additional surcharge and load dispatch centre charge as fee. These charges are quite often complex to navigate. Moreover, they can also add up to a landed tariff that may be non-competitive with the discom tariffs.

One of key challenges deterring corporates from opting for open access is frequent revision of charges owing to policy uncertainty (especially around cross-subsidy and additional surcharges). This discourages corporate consumers from entering into either medium term or long-term contracts with generators or developers under open access. For instance, Haryana's solar policy notified in 2016 waived off key open access charges for a period of 10 years. But in 2019, the policy was amended to withdraw these waivers for third party mode of open access thereby hampering the viability for key industries to source electricity through RE open access.

With surplus power in the grid, the electricity prices on power exchanges have fallen substantially. Corporate consumers take advantage of this low price by using short-term open access to get less expensive power from the market when the price is lower than the discom's tariff (even with open-access charges added). These consumers switch part—or all—of their load back and forth between the market (open access) and discom, increasing discoms' difficulties in planning, stranding their generation capacity, disrupting grid stability, and negatively impacting small consumers of the discom.

Renewable energy certificates

Renewable Energy Certificates (REC) is a mechanism that allows buyers (discoms and corporates) to buy the environmental aspect of green power without having to buy green power itself. RE project developers claim RECs (1 REC = 1 MWh) by supplying the energy generated to discoms and trade it once every month over the power exchanges. The instrument is typically used to fulfil RPO requirements of obligated entities such as state discoms and captive/open access generators of non-RE power.

RECs have historically seen demand fall well short of supply. This is partly because REC purchase is almost entirely done to meet RPOs, with practically zero purchases done on a voluntary basis. Underpinning this is the fact that the share of discom participation on both the REC supply and demand sides remains disproportionately low. . Moreover, an order by Central Electricity Regulatory Commission (CERC) in June 2020 on the removal of floor price led to the suspension of REC trading by Appellate Tribunal for Electricity (July 2020) due to an arbitration over the issue. Such frequent reduction of floor price and forbearance price (price cap) has been a key challenge and has made the REC market less attractive or riskier for RE developers who claim for and trade RECs.

Green term ahead market

On 21 August 2020, short-term trading of renewable energy was launched by Indian Energy Exchange (IEX) Green term ahead market (GTAM) allows a discom or corporate electricity consumer to procure solar or non-solar RE on an intra-day and day ahead basis from merchant RE developers or those with surplus capacity.

Since its launch, GTAM has attracted distribution companies in Haryana, Dadra and Nagar Haveli, Tata Power Distribution and corporate consumers such as Amplus, Jindal, Vedanta and Dalmia. It had seen volumes traded growth up to 150% to 208 million kWh in October 2020 as compared to September 2020[4]. But one of the challenges currently faced is low adoption by discoms (volumes purchased by top 5 discoms represented 78% of total cleared volume for the period from August till November 2020[5]) and low buy to sell volume ratio. Active capacity building of discoms and corporates needs to be undertaken by IEX to ensure sufficient liquidity in the market. A possible solution to increase volumes can be to allow sellers to sell surplus solar power in a hybrid mode (bundled solar and non-solar) on a round-the-clock basis. This would also allow for solar power to be sold during evening hours benefitting both generators and consumers.

While volume risk is one of the challenges of GTAM, payment risk is minimal for this market when compared to the transactions through long term PPAs, which are plagued by months of payment delays. This is due to a requirement for an upfront payment by a buyer on the trading platform. Recent policy/regulatory developments are expected to promote merchant RE project development with sale of energy in the GTAM. These developments include a transition towards innovative RE tenders and allowing sale of curtailed renewable energy in these markets (Ministry of Power, 2020). But an increase in GTAM's liquidity on the buy side is crucial for unlocking finance for merchant RE capacity development in India

Proposed study

In this context, a study is needed to clearly identify the bottlenecks in RE procurement by corporates in India and to recommend requisite interventions to promote an increased and seamless adoption of RE. The study's scope of work is captured below.

- Review of existing RE procurement mechanisms for corporates in India
    - Identify bottlenecks with existing mechanisms in India (green tariffs, open access, RECs and green term ahead market).
    - Consult corporate (industrial and commercial) consumers to identify challenges and interventions required.
- International review
    - Conduct a review of mechanisms for corporate RE procurement in RE rich countries such as the US, Germany, Norway, etc.
    - Identify potential mechanisms (such as virtual PPAs and peer-to-peer trading), their advantages/disadvantages and relevance for India.
- Recommendations
    - Recommend policy/regulatory interventions required for addressing the bottlenecks in existing mechanisms in India.