How can Discoms Optimise Power Procurement Costs?

The Case for Delhi to Exit the Power Purchase Agreement with NTPC Dadri Stage-I

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Executive summary

Decarbonising the power system is the largest component of measures required to meet the 2070 net-zero target. India will need to lower the contribution of thermal power, and deploy about 222 GW of solar and 122 GW of wind capacities by 2030, and grow these exponentially in the next four decades (Chaturvedi and Malyan 2021). The role of power distribution companies (discoms) is crucial here. Discoms are locked into inefficient procurement contracts in the form of long-term power purchase agreements (PPAs) (Garg 2021; CEEW-CEF 2022). This affects their financial health and imposes costs on end consumers. Hence, reviewing current power purchase portfolios and contracts is essential for creating financial and operational space for cleaner, cheaper and more efficient power, and to meet our decarbonisation targets cost-effectively.

We review one such long-term PPA of Delhi[1] discoms with the Dadri Stage-I ('Dadri-I') thermal power plant and examine the economic and operational case to exit this PPA. Our key findings include:

A. Discoms would have saved INR 650-690 crore in fiscal year (FY) 2019-20 by exiting the PPA with Dadri-I

Delhi discoms' procurement from Dadri-I has consistently fallen since at least FY 2018-19 because of its rising costs. In FY 2019-20, if the discoms had replaced the 2,039 million units (MUs) purchased from Dadri-I (Delhi SLDC 2020, 2021a) with purchases from the power exchanges (PX) or round-the-clock (RTC) renewable energy (RE) projects, they would have saved INR 650-690 crore. Most of these savings would be due to avoided fixed-cost payments. Even if market prices fluctuate beyond historically observed levels, procurement from the PX would still have been more economical because of avoided fixed-cost payments to Dadri-I. In future, attractive tariffs of RTC RE and constantly escalating coal prices would result in variable cost savings as well. Therefore, cleaner and more flexible options could economically fill the gap in energy procurement after the PPA exit.

B. Delhi has sufficient capacity and cost-effective options available to meet its load reliably

PPA exit decisions cannot be based only on an economic assessment and must consider adequacy of cost-effective supply. Since November 2020, while the discoms have scheduled negligible energy from Dadri-I, there is no evidence of adverse impact on supply reliability and procurement costs. The discoms have utilised the flexibility of PX to cater to demand swings. The average variable cost paid by Delhi's discoms weighted by the energy procured from thermal plants does not show a deviation since November 2020 and has remained below INR 3 per kWh.

Further, even without the 756 MW from Dadri-I, Delhi's discoms have PPAs with 6,777 MW of capacity (DERC 2021a), which is still over 90 per cent of the all-time peak demand of 7,409 MW observed in Delhi in February 2019 (Delhi SLDC 2021b). In the calendar year (CY) 2021, Delhi saw a demand higher than 7,000 MW only for three hours and a base load of 1,300 MW (Ministry of Power 2022). Thus, given the discoms' ability to meet demand through the PXs and the opportunity of procuring demand-side resources and cheaper RTC or load-following RE, removing Dadri-I's 756 MW tied-up under the PPA is unlikely to compromise supply reliability in the medium-term.

C. Stakeholders must come together to draw up a comprehensive framework for restructuring decisions and enable a transition to cost-effective contract terms

Our analysis shows that the PPA with Dadri-I in its current form imposes substantial fixed-cost burden on discoms. Keeping excess thermal capacity tied up in PPAs to meet peak load observed for very short durations or for other rare contingencies is highly expensive and adds to the consumers' burden.

The Dadri-I case study shows that the PPA exit route presents a significant opportunity to optimise power procurement by discoms. However, it raises the question of the approach and criteria discoms and regulators should consider for resource planning and cost-effective power procurement.

The Ministry of Power's (MoP) National Electricity Plan has identified 263 coal-based units worth 48.3 GW as candidates for retirement by 2027 based on useful economic life and emissions norms compliance (CEA 2018). The intent of Regulation 17 under the Central Electricity Regulatory Commission (CERC) Tariff Regulations (see Section 1.2) seems to have been to provide a legal basis for a commercial arrangement for plants older than 25 years to recover costs based on scheduled energy. Several states, such as Delhi, Haryana, Madhya Pradesh, Andhra Pradesh and Chhattisgarh, have requested the MoP for surrendering capacity in PPA-tied central sector generating stations (CSGS) (Garg 2021).

As more states seek to give up traditional PPA allocations in old CSGS, the MoP and the CERC must draw up a framework for examining the case to exit and reaching a new commercial arrangement, if needed. Along with rationalisation of PPA allocation

1. Unless stated otherwise, throughout this document, 'Delhi' is used to refer to the area of the National Capital Territory of Delhi served by BSES Rajdhani Power Limited, BSES Yamuna Power Limited and Tata Power Delhi Distribution Limited.

among states, the framework must integrate system reliability assessments and requirements for installing emission control equipment, and clarify alternate revenue streams for power plants whose PPAs may be expiring but can operate at a low cost. The Market-Based Economic Dispatch (MBED) and ancillary services market could be such avenues.

1. Introduction

The Dadri Stage-I ('Dadri-I') is a coal-fuelled power plant consisting of four units of 210 MW each, totalling 840 MW. It is a CSGS owned and operated by NTPC Limited. While it was commissioned between October 1991 and March 1994 (NTPC 2022), the commercial operation date ("COD"), as approved by the CERC,[2] is 1 December 1995. Table 1 shows the key statistics of Dadri-I. As of 2021, NTPC owns 46 per cent of all dispatchable capacity contracted by Delhi's power distribution companies (discoms) (DERC 2021a).

Table 1 Key statistics for Dadri-I

Plant capacity	**4 units x 210 MW (840 MW)**	
Delhi share	756 MW (90%)	
Current age	> 25 years	
Fiscal year	**2018–2019**	**2019–2020**
Average variable cost (INR/kWh)	3.59	4.19
Average fixed cost (INR/kWh)	1.0	1.0

Source: Authors' compilation from MERIT portal.

According to its guidelines in Office Memorandum No. 8/1/96-OM dated 27 April 2000, the Ministry of Power (MoP) allocated almost 90 per cent of the Dadri-I capacity to the erstwhile electricity distributor.[3] Upon privatisation of Delhi's distribution sector in 2002, the allocation of the power purchase agreement (PPA) with Dadri-I was transferred to the newly formed discoms—BSES-Rajdhani Power Ltd (BRPL), BSES-Yamuna Power Ltd (BYPL), Tata Power Delhi Distribution Ltd (TPDDL), and New Delhi Municipal Corporation (NDMC).

1.1 The PPA between Delhi discoms and NTPC

BRPL and BYPL (collectively 'BSES') and NTPC signed a consolidated PPA dated 5 June 2008 ('the PPA') for various generating stations of NTPC.[4] It provided that the validity of the PPA with Dadri-I was up to 31 December 2012 or 25 years from the COD, whichever was later. Subsequently, the Delhi discoms and NTPC signed a supplementary PPA dated 29 March 2012 ('the SPPA'). The SPPA extended the validity of the original PPA with each generating station until the respective end of life considered in the tariff orders or regulations issued by CERC or Government of India allocations, whichever is later.[5]

1.2 Developments on exiting the PPA

Long-term PPAs between power plants and discoms typically do not have clear exit clauses, as is the case with the PPA between Dadri-I and Delhi's discoms. In 2017, TPDDL filed a complaint before the Competition Commission of India (CCI), submitting that NTPC was abusing its dominant position because the PPA did not have an exit clause qua the discoms. The CCI dismissed the complaint, stating that the discoms could approach the Government of India for reallocation of the power (CCI 2017).

In 2019, the CERC included a special provision in its tariff regulations to provide a commercial arrangement between beneficiaries of PPAs and power plants having completed 25 years from their COD. Regulation 17 of the 2019 CERC Tariff Regulations is reproduced below:

Dadri-I completed 25 years of operation from its approved COD on 30 November 2020. The discoms served a notice to NTPC to discontinue scheduling Dadri-I from 1 December 2020. Additionally, based on the request of Delhi's discoms, the Delhi Electricity Regulatory Commission (DERC) wrote to the MoP requesting deallocation from Dadri-I (DERC 2021b).

2. The COD is determined in accordance with the CERC (Terms and Conditions of Tariff) Regulations, 2009.
3. As required by the guidelines, beneficiaries of the allocated power (the discoms) signed PPAs with the generator. The OM No. 8/1/96-OM dated 27 April 2000 is no longer available in the public domain but its extract may be found in the order dated 3 July 2015 of the CERC in Petition No. 92/MP/2015 and 99/MP/2015 (Para 31) (CERC 2015). These guidelines are only applicable to projects for which PPAs have been signed up to 5 January 2011 and any extensions of these PPAs. Other projects are to be allocated by way of competitive bidding only for which the Ministry of Power notifies guidelines (Lok Sabha 2016).
4. The Dadri PPA is a composite agreement and covers NTPC's other coal and gas generation units, like Singrauli STPS, Rihand (Stage-I), Anta, Auraiya, Dadri Gas, Unchahar (Stage-I).
5. A copy of the PPA is not available in the public domain. However, some of its details have been provided in order dated 1 July 2021 of the CERC in Petition No. 60/MP/2021 along with IA No. 12/2021 (CERC 2021a).

CERC Tariff Regulations, 2019

Regulation 17 - Special Provisions for Tariff for Thermal Generating Station which have completed 25 Years of Operation from Date of Commercial Operation:

1. In respect of a thermal generating station that has completed 25 years of operation from the date of commercial operation, the generating company and the beneficiary may agree on an arrangement, including provisions for target availability and incentive, where in addition to the energy charge, capacity charges determined under these regulations shall also be recovered based on scheduled generation.
2. The beneficiary shall have the first right of refusal and upon its refusal to enter into an arrangement as above, the generating company shall be free to sell the electricity generated from such a station in a manner as it deems fit.

NTPC, however, continued to invoice the discoms. BSES petitioned before the CERC to set aside NTPC's invoices.

While BSES's petition was still open before the CERC, the MoP issued guidelines enabling discoms to relinquish their share from CSGS after the expiry of the term of the PPA, i.e., on completion of 25 years from the plant's COD or a period specified in the PPA (MoP 2021a). However, the request for relinquishment should be submitted only after the appropriate State Electricity Regulatory Commission's (SERC) approval and ensuring the adequacy of tied-up power with the discoms. The CERC took note of the guidelines in its order dated 1 July 2021 and ruled that while BSES was eligible to exercise the right-of-first-refusal under Regulation 17(2), the PPA subsists till the MoP deallcoates Delhi's share from Dadri-I (CERC 2021a). As per the Northern Regional Load Despatch Centre (NRLDC) (share allocation revision No. 1/2021-22 dated 1 April 2021 issued by Northern Regional Power Committee (NRPC)), the power allocation from Dadri-I still exists. The MoP asked DERC to scrutinise its resource adequacy before allowing discoms to exit from PPAs (Singh 2021). BYPL pointed out that Dadri-I is an "obsolete, commercially and economically unviable plant with a high tariff of more than INR 6.33 per kWh and creates an economic burden on account of higher tariff for the residents of NCT of Delhi" (BYPL 2021).

BSES appealed before the Appellate Tribunal for Electricity (APTEL) against CERC's order. The APTEL disagreed with the CERC in its order dated 8 February 2022 (APTEL 2022). APTEL ruled that Regulation 17 is applicable for plants that have completed their useful life while the MoP's allocation applies only to plants that have not completed their useful lives. The MoP cannot extend the useful life of the plants through continued allocation since there is a separate procedure prescribed in the Tariff Regulations on the extension of the useful life of plants. Hence, once a discom exercises its right under Regulation 17(2), scheduling from the generator should stop. Accordingly, the APTEL directed that NTPC cease invoicing BSES and refund payments made under previous invoices.

Subject to any appeal in the Supreme Court, the APTEL's order may set the precedent in application of Regulation 17. However, irrespective of the legal aspects of the matter, the economic and operational case to exit from Dadri-I is insufficiently examined in the public domain.

This brief examines the case for Delhi's discoms to relinquish their allocation from Dadri-I by analysing the power procurement from various power plants and related costs.[6]

2. The economic case for exiting Dadri-I

To examine the economic case for exiting the PPA, we estimate the costs incurred by discoms over the 20 months preceding the completion of 25 years of operation of Dadri-I in procuring energy from the plant. These costs are compared with the potential costs incurred if an equivalent amount of energy were procured from alternative sources. The comparison provides an estimate of the monetary savings that would have accrued to discoms if they had exited the PPA. Further, Section 2.3 examines the impact of not scheduling Dadri-I on the discoms. This is done by studying the period since November 2020, i.e., the period after the completion of 25 years of operation, when the discoms barely utilised Dadri-I.

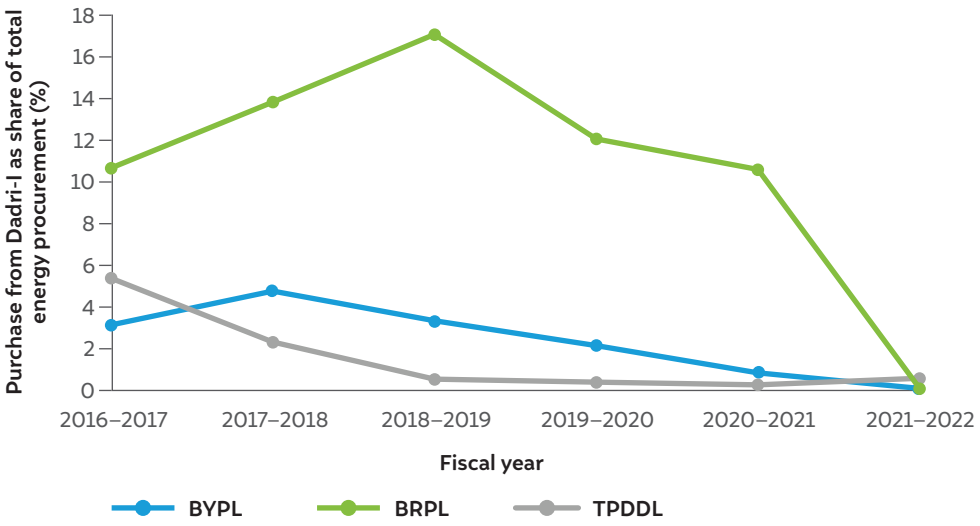
6. Our analysis is limited to three discoms – BYPL, BRPL, and TPDDL, since New Delhi Municipal Corporation (NDMC) and Military Engineering Services (MES) serve a relatively much smaller share of the consumers.

2.1 Delhi's energy procurement from Dadri-I has been dwindling

Delhi discoms' energy purchases from Dadri-I have consistently been dwindling since at least FY 2018-19 (Figure 1).

Dispatch data for CY 2020 and CY 2021 shows that only five per cent and one per cent of the declared generation of Dadri-I was utilised in respective years (Figure 2). Between 1 November 2018 and 31 October 2019 (pre-pandemic), just over half of Dadri-I's declared generation was scheduled. On 2 July 2021, when Delhi witnessed its FY 2021–22 peak demand, negligible energy was scheduled from Dadri-I. Further, according to the tariff orders, BYPL and BRPL did not project any power purchase from Dadri-I for FY 2021–22, while TPDDL provisioned for only 48 million units (MUs), about half a per cent of its total expected purchase from all CSGS.

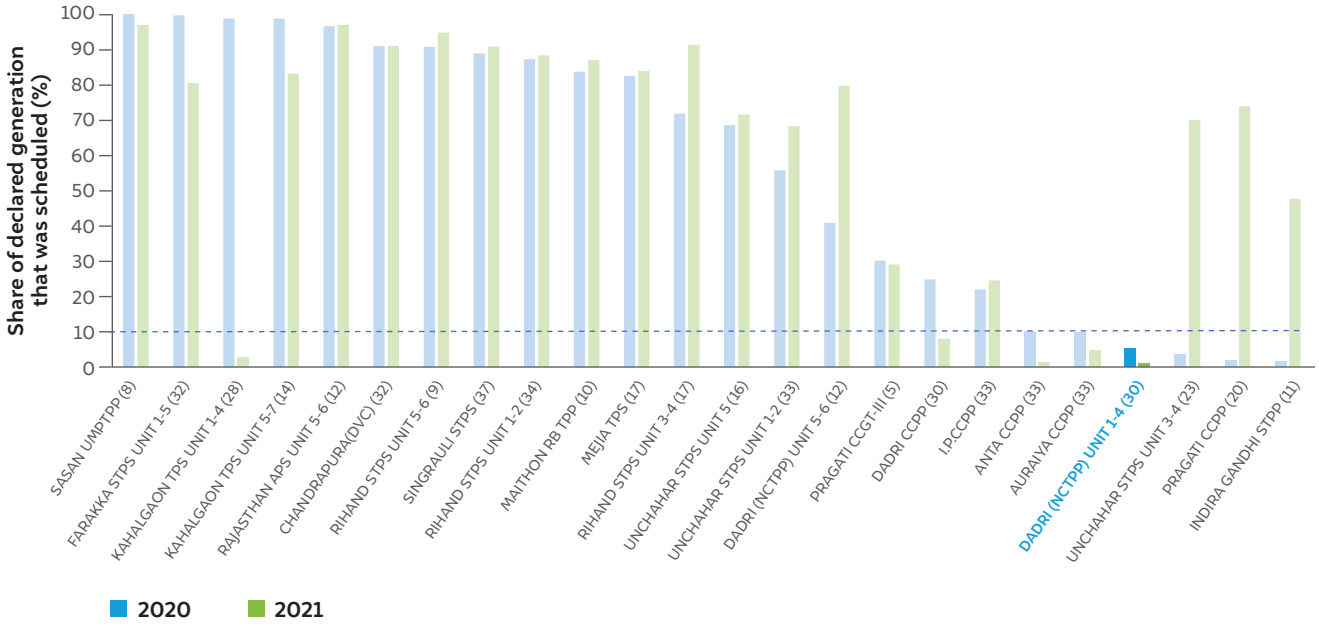
Figure 1 Dadri-I's share in total energy purchased by Delhi's discoms has been falling



Source: Authors' analysis based on true-up petitions submitted by distribution licensees and DERC's distribution tariff orders.

Note: For 2020–2022, the data represents ex-ante approved energy purchases by the DERC.

Figure 2 5% and 1% of Dadri-I's declared capacity was utilised in 2020 and 2021, respectively



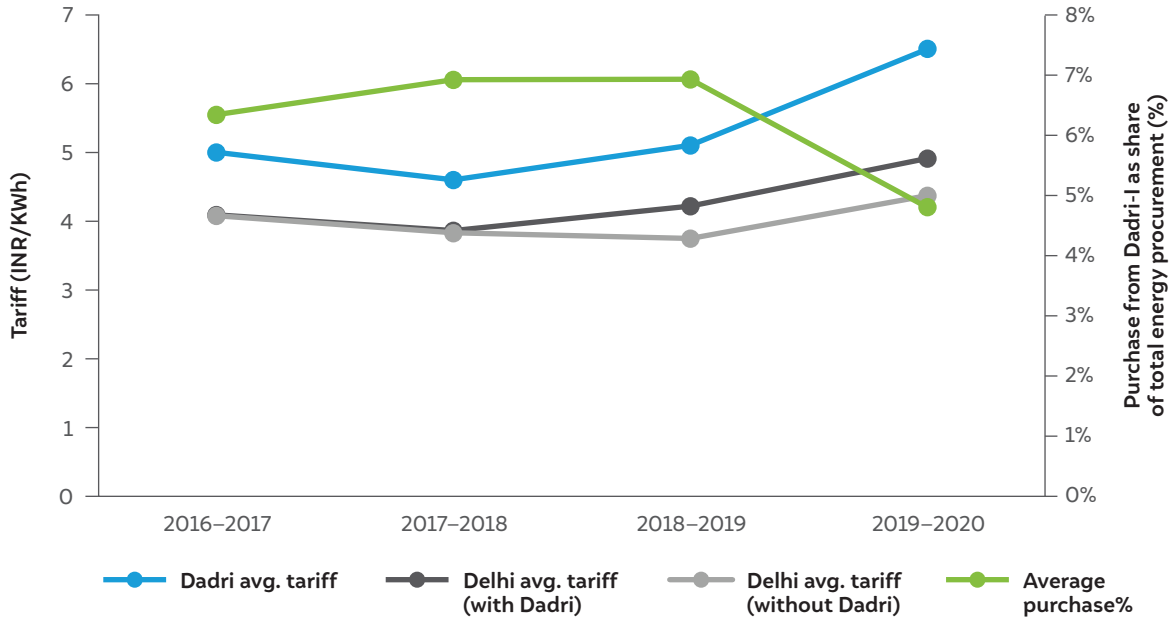
Source: Authors' analysis based on data from MERIT portal.

Note: 1) The MERIT portal provides data on scheduled dispatch of plants. Actual generation may be higher or lower. 2) Age of the plants are indicated in parentheses on the x-axis. 3) Darker bars show instances of scheduled generation lower than 10 per cent of the declared generation. 4) The line indicates the 10% schedule mark.

The chief cause for this is Dadri-I's higher than average costs. The average per kWh cost of buying energy from Dadri-I has increased since FY 2016-17 (Figure 3). While this is consistent with the trend of higher costs for older plants, Dadri-I's costs are higher than the average per kWh tariff paid to PPA-tied plants.

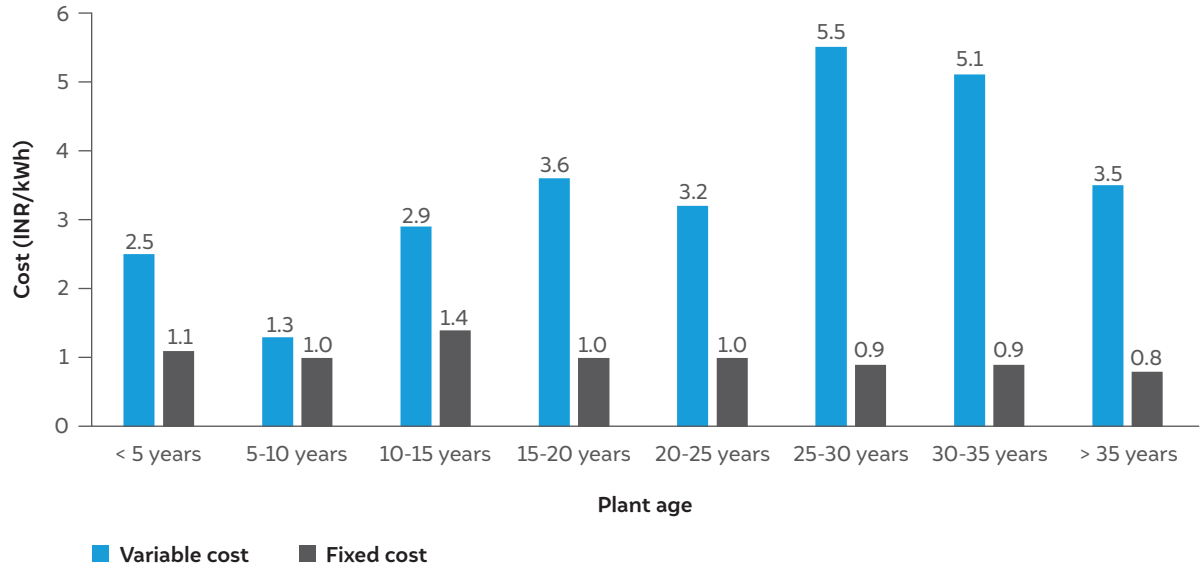
Exiting the PPA with Dadri-I could allow Delhi's discoms to purchase equivalent energy from cheaper sources or less expensive power plants of earlier vintages. Figure 4 shows that among the coal- and gas-based fleet tied under long-term PPAs, variable costs (VC) for plants older than 25 years are substantially higher than plants of earlier vintages, while fixed costs (FC) are lower. Delhi's long-term coal and gas capacity of more than 25-year old plants comprises only CSGS.

Figure 3 Dadri-I's average per kWh tariff is higher than the average per kWh tariff for all PPA-tied power



Source: Authors' analysis based on true-up petitions from Delhi's discoms.

Figure 4 Average variable costs of Delhi's coal and gas fleet is higher for plants older than 25 years



Source: Authors' analysis based on data from MERIT portal for February 2021 - March 2022

2.2 Aggregate cost savings from exiting the PPA

In FY 2019-20, Delhi's discoms scheduled about 2,039 MUs from Dadri-I against its declared availability of 5,849 MUs (Delhi SLDC 2020, 2021a), utilising 35 per cent of their entitlement on an average. In the 20 months preceding the end of 25 years since COD of Dadri-I, i.e., April 2019 to November 2020, Delhi's discoms scheduled about 2,261 MUs from Dadri-I against its declared availability of 9,817 MUs (Delhi SLDC 2020, 2021a). Table 2 shows a comparison of the total expenditure on purchasing these 2,261 MUs at:

1. the VC of Dadri-I and the FC paid as per declared availability. The monthly VC and FC are obtained from the MERIT portal (MoP 2022);
2. the minimum market clearing price (MCP) in each month discovered at the India Energy Exchange (IEX);
3. the maximum MCP in each month discovered at the IEX;
4. weighted average MCP of each month; and
5. levelised cost of energy (LCOE) of INR 3.6 per kWh for RTC RE supply (BloombergNEF 2020).

As Table 2 indicates, the total cost of procurement from Dadri-I between April 2019 and November 2020 was about INR 1,900 crore. Over half of this cost is the fixed-cost component. We find that Delhi's discoms would have saved over INR 1,050 crore across the period under consideration had the entire energy been procured at the monthly weighted average MCP at the IEX (Figure 5). On the other hand, considering an LCOE of INR 3.6 per kWh for RTC RE supply, the total saving would amount to INR 1,098 crore. For FY 2019-20, the corresponding savings are INR 650 crore and INR 690 crore, respectively. About 90 per cent of these savings would accrue from avoided fixed-cost payments to Dadri-I. These estimates are conservative as the discoms would have also saved on part-load compensation charges to Dadri-I for operating at plant-load factors (PLF) below 85 per cent (CERC 2017). Further, even if market prices fluctuate beyond historically observed levels, the procurement from the PX would have still been more economical because of the avoided fixed-cost burden imposed by the PPA.

Table 2 Total expenditure in purchasing 2,261 MUs in different scenarios

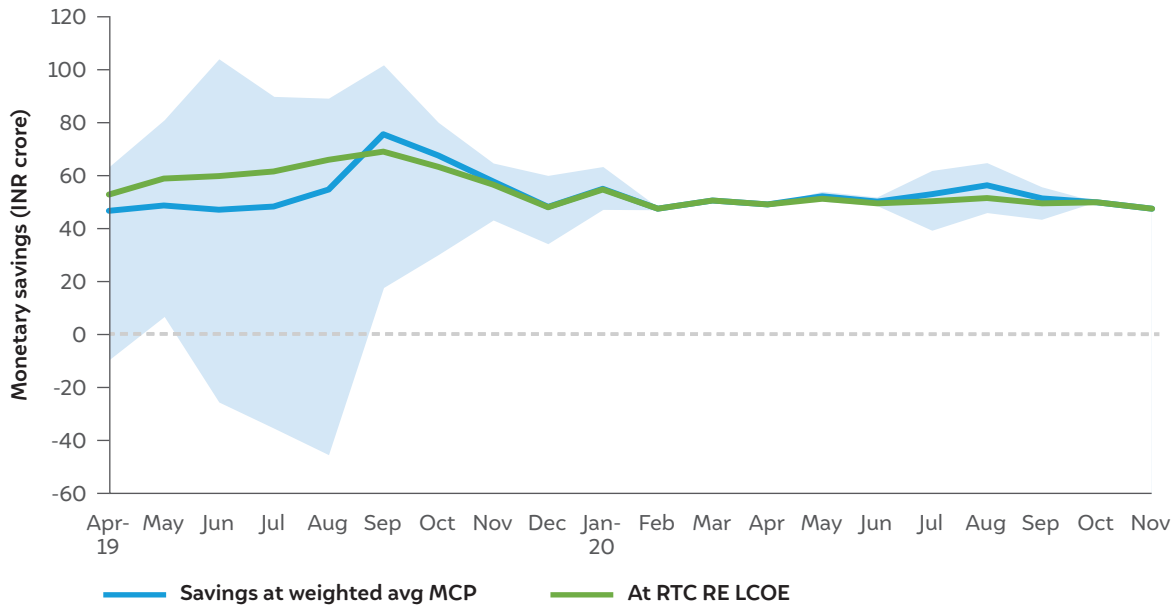
	Total fixed cost payable to Dadri-I	Total variable cost payable to Dadri-I	Cost at minimum MCP of IEX	Cost at maximum MCP of IEX	Cost at weighted average MCP at IEX	Cost at LCOE for RTC RE
Total expenditure in (INR crore)	978	923	573	1369	844	814

Source: Authors' analysis based on data obtained from the MERIT portal and IEX.

Note: The estimated cost of procurement from the PX accounts for four per cent point-of-connection (POC) losses based on Power System Operation Corporation Limited's (POSOCO) weekly estimates (POSOCO 2022), and INR 0.4 per kWh POC charges (DERC 2021c).

Image: iStock

Figure 5 Delhi's discoms could have saved INR 1,050 - 1,098 crore over 20 months

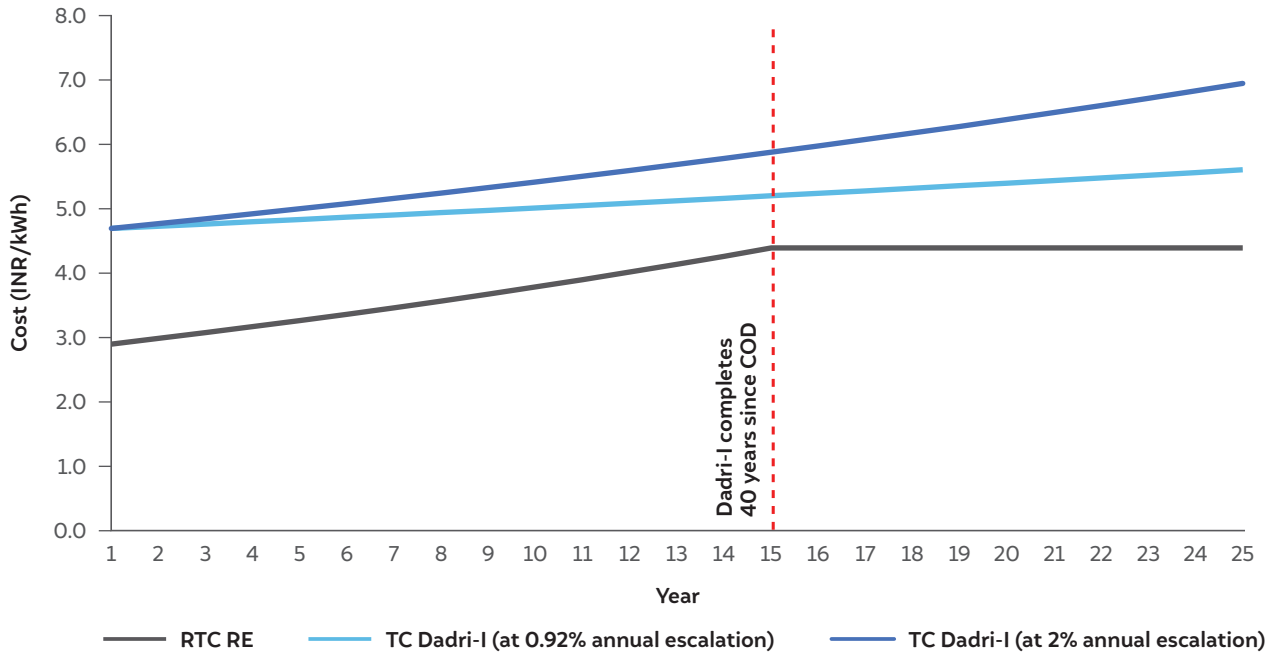


Source: Authors' analysis based on the MERIT portal and IEX.

Note: 1) The blue shaded area shows the range of monetary savings if an equivalent amount of energy procured from Dadri-I were procured from the IEX. The upper bounds are for procurement at the minimum MCP, and the lower bound is for the maximum MCP observed in the given month. 2) Negative area shows a net loss.

Further, the cost advantage of procuring energy at RTC RE LCOE would be long term, as shown in Figure 6. We assume that the power plant has an outer operating limit of 40 years, the price of domestic coal increases at 0.92 per cent per annum (CERC 2021b), and conservatively, there are constant fixed costs. We consider the latest RTC RE auction that had a discovered tariff of INR 2.9 per kWh for the first year, a three per cent escalation rate for the next 14 years and a stable tariff for the remaining 10 years. It is clear that Dadri-I would consistently be more expensive than a new RTC RE plant on total cost (TC) basis over the next 15 years.

Figure 6 Total per unit cost of Dadri-I would be consistently higher than that of an RTC RE plant over the next 15 years



Source: Authors' analysis.

Note: The figure shows the per kWh cost of an RTC RE plant over its useful life of 25 years, starting in 2021. At the 15-year mark Dadri-I would be 40 years old.

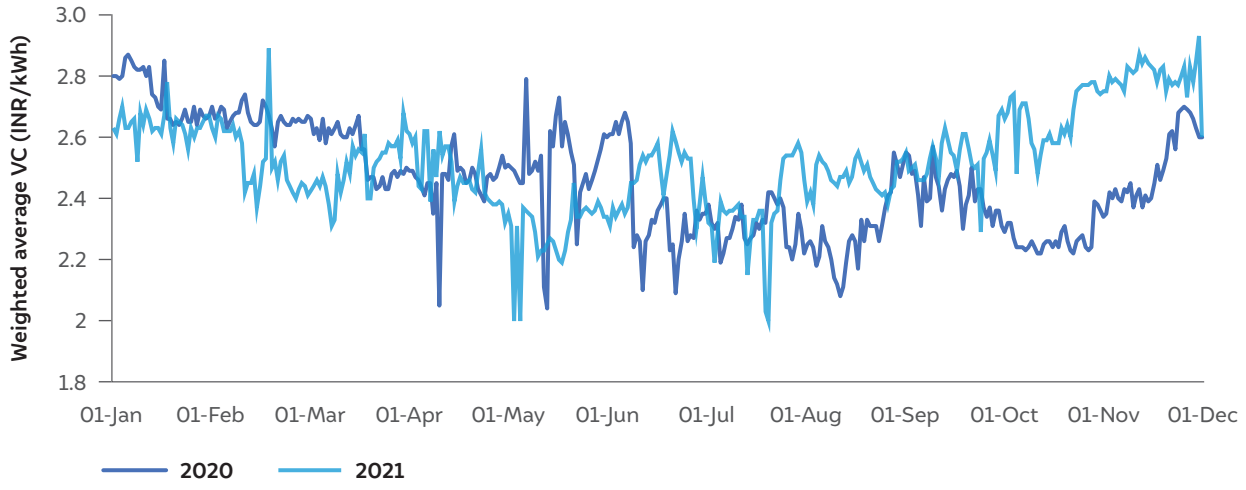
Thus, our analysis shows that the economic case for Delhi to exit the PPA with Dadri-I is strong, especially on account of avoided fixed-cost payments. The monetary savings from such an exit are likely to be higher in the future as the cost of coal increases, while the RE tariffs either fall or flatten out.

2.3 Delhi is meeting demand at reasonable costs without Dadri-I

An absence of Dadri-I in Delhi's dispatch does not add to the cost burden of the discoms. Between 1 November 2020 and 31 October 2021, when purchase from Dadri-I was almost negligible, Delhi's daily weighted average VC of power procurement did not exceed INR 3 per kWh (Figure 7). Thus, Delhi's discoms have served their demand at reasonable costs without dispatching Dadri-I.

In addition to procurement through cheaper PPAs, Delhi's discoms can utilise short-term markets, including power exchanges (PX), bilateral trading, and banking, to leverage flexibility and complementarity in demand across regions and optimise their cost of procurement. Despite having substantial capacity tied up in long-term PPAs, Delhi procures capacity worth about a sixth of its average load from the PX in some hours, especially during the September-March period (Figure 8).

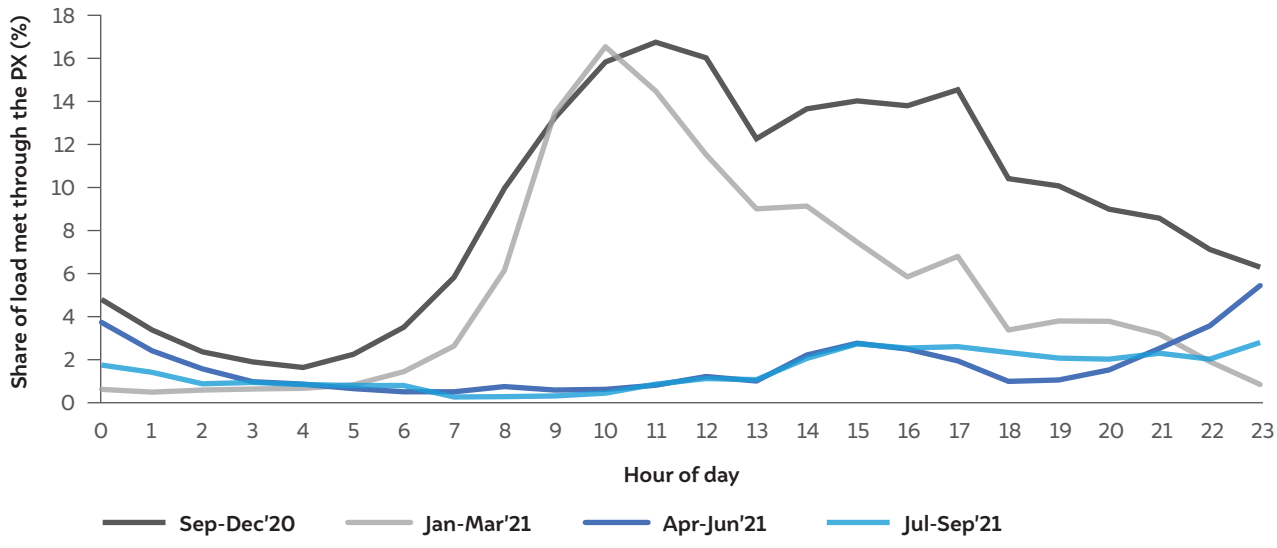
Figure 7 Daily weighted average VC from thermal stations have remained below INR 3 per kWh in 2020 and 2021



Source: Authors' analysis based on data from MERIT portal.

Note: The figure shows weighted average VC of PPA-tied thermal plants only, excluding procurement from short-term markets and other sources.

Figure 8 Delhi procures up to a sixth of its average load from PX in some hours



Source: Authors' analysis based on data from Vidyut Pravah portal.

Note: The Vidyut Pravah portal shows PX purchases by all consumers in Delhi. Actual hourly PX procurement by discoms may vary from the average values shown in the chart.

Short-term options may carry a price risk. For example, clearing prices at the PX were exceptionally volatile in October 2021. The causes included poor demand projections by discoms, supply-side scarcity resulting from inadequate stockpiling of coal by generators, and supply disruption due to a longer-than-expected monsoon (Tongia 2021; Sarasvati 2021; Dahiya and Ghildiyal 2021). On 4 October 2021, hourly average clearing prices on the Day-Ahead Market (DAM) were above INR 12 per kWh during 5–9 PM, when Delhi discoms met 9–15 per cent of their load by purchasing from the PX (Figure 9). This may have caused the average daily VC to shoot up on that day. However, PX may still provide flexibility in meeting daily peak loads at costs lower than projected total costs of Dadri-I.

Further, as per the draft National Electricity Policy, the share of total power transacted in short term markets is envisaged to increase to 25 per cent by 2023-24 (MoP 2021b) from the current 3-6 per cent (CERC 2021c). Higher liquidity levels in the market moving forward can ensure less volatility in prices.

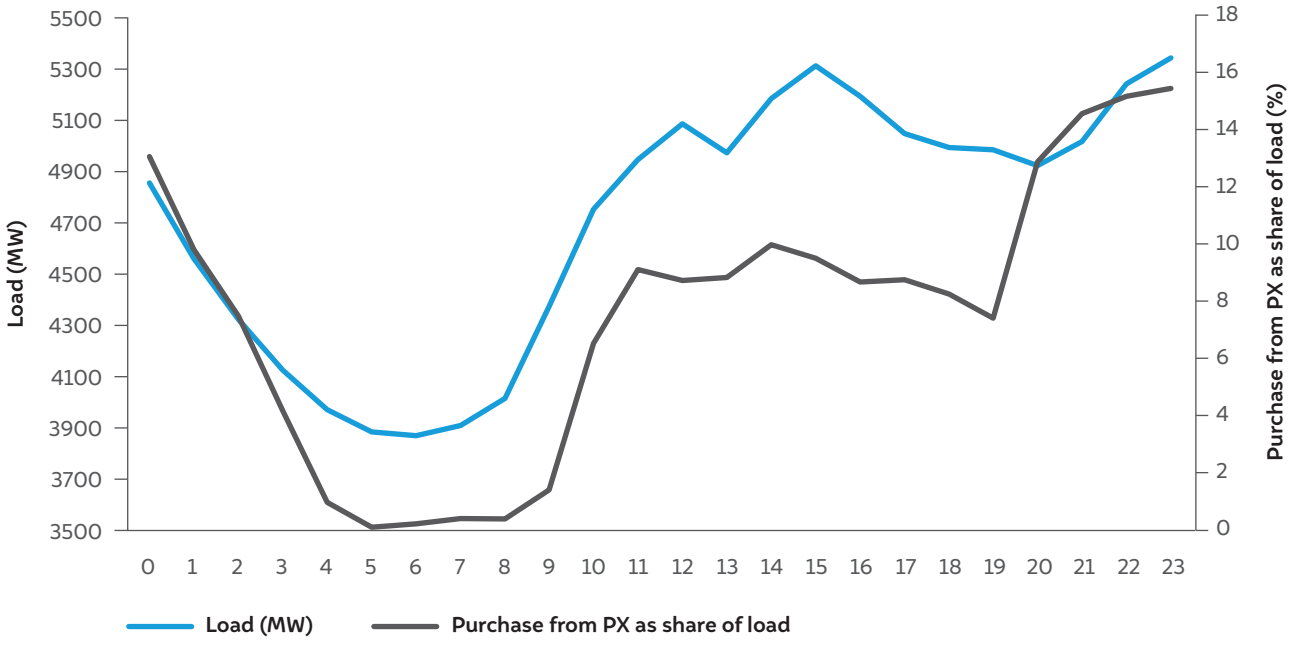
3. The operational case for exiting Dadri-I

Beyond the economic case, the decision to reallocate capacity from Dadri-I also depends on Delhi's longer-term preparedness to meet demand. This section examines the likely impact of exiting the PPA with Dadri-I on Delhi discoms' ability to cater to demand over the medium-term.

3.1 Delhi has adequate tied-up resources

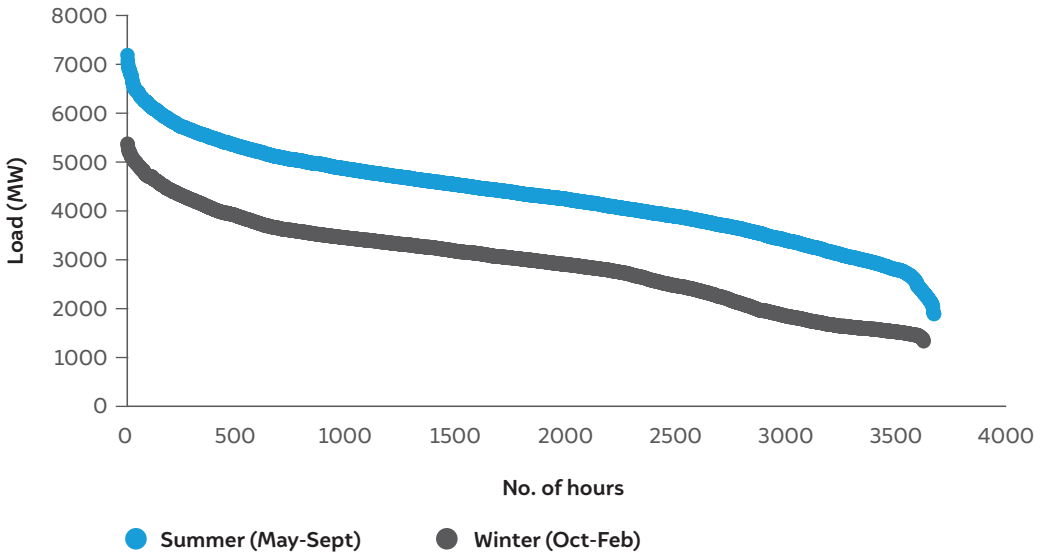
Delhi has adequate dispatchable capacity under long-term PPAs to cater to its demand for the near future. For FY 2021-22, Delhi has long-term PPAs with about 6,777 MW of capacity (excluding Dadri-I) (DERC 2021a), of which 60 per cent is coal-based thermal, about 10 per cent is hydro-electric and 7 per cent is variable renewable energy (wind and solar) capacity. In all, Delhi's discoms have 6,284 MW worth of dispatchable

Figure 9 Delhi procured up to 15 per cent of load from PX on 4 October 2021



Source: Authors' analysis based on data from Vidyut Pravah portal.

Figure 10 In CY 2021, Delhi's baseload was about 1,300 MW, while it saw a load of more than 7,000 MW only for three hours



Source: Authors' analysis based on hourly demand data from the MERIT portal.

capacity tied up in long-term PPAs. This is equivalent to almost 85 per cent of its all-time highest peak load of 7,409 MW witnessed on 2 July 2019 (Delhi SLDC 2021b), more than 1.5 times the average daily peak demand in the CY 2021, and nearly five times Delhi's base load of about 1,300 MW (Figure 10).

For FY 2021–22, Delhi's discoms had adequately tied up resources to meet their total energy requirement (6,972 MUs, 14,368 MUs, and 9,663 MUs for BYPL, BRPL, and TPDDL, respectively) without scheduling Dadri-I (DERC 2021a, 2021d, 2021e).

3.2 Delhi needs flexible options for the future

The analysis above shows that, in the near term, Delhi's discoms have adequately tied up dispatchable capacity to meet a large part of the annual peak load. Further, they can cost-effectively utilise short-term procurement to manage demand volatility, for which the DERC allows expenses. This is true despite low- to no-dispatch from Dadri-I over the past year.

Delhi is projected to have a peak demand of about 9,000 MW by 2026-27 (CEA 2017). Considering a surrender of Dadri-I from total capacity currently tied up in PPAs, Delhi will still have about three-fourths of its 2030 peak demand serviceable through long-term PPAs. Further, plants such as Dadri-I are likely to run on low PLFs as more RE penetrates the system. Therefore, it does not seem prudent for discoms to lock themselves in PPAs with such plants.

3.3. Ensuring grid safety and security

Dadri-I is a component of the Delhi Islanding Scheme, which ensures supply continuity for critical loads in Delhi. Considering Dadri-I's low scheduling, the Delhi system operator is reviewing the Islanding Scheme in coordination with the discoms (NRPC 2021).

The necessity of Dadri-I in Delhi's Islanding Scheme must also be critically assessed, given the heavy cost implications on discoms and consumers. The system operator should assess whether the reliability services or the islanding arrangement can be provided more efficiently and cheaply by any other system assets and alternatives, including storage. These system requirements should be reviewed frequently and updated to make informed procurement decisions.

4. Conclusion and recommendations

Our analysis has demonstrated the case for discoms to exit the inflexible PPAs with old thermal power plants by studying the case for Delhi to give up the Dadri-I allocation. **We conclude that Delhi must not continue with inefficient older plants that have high VC.** Many states have sought to exit from PPAs with thermal plants completing 25 years of operation, such as Odisha, Rajasthan, Punjab (Hindustan Times 2021) and West Bengal (Government of West Bengal 2022). Through this case study, we highlight the importance of making such analyses available in the public domain. We also arrive at the following pertinent questions and issues that policymakers must deliberate upon:

Evolving electricity markets

India is expected to begin the transition to the market-based economic dispatch (MBED) mechanism from 2022. In the first phase, all NTPC plants will be dispatched on a central platform as per their VC. At the same time, the requirement for discoms to comply with the renewable purchase obligation (RPO) targets will become stringent, requiring a higher share of RE in discoms' power mix. In this scenario, would Dadri-I and other similar plants be required to play any critical role? For example, **can older PPAs be re-structured for other services such as meeting peak loads and balancing requirements? Or can such plants participate in the proposed ancillary services market?**

Conflicting processes and requirements

On the one hand, there are national-level assessments for coal capacity retirements. At the same time, the candidates for retirement are also expected to comply with the pollution norms and install flue-gas desulfurization (FGD) equipment. While some plants such as Dadri-I are being considered for PPA exits, these are also the ones that have made or will make additional investments in pollution control equipment. These additional investments may limit exit processes since the investment must be recovered. **How can these evaluation and approval processes be synchronised and conducted as per a clearly defined process?**

Re-allocation of PPAs

Several states are submitting exit requests to the MoP. MoP's existing power allocation guidelines require that the plants be reallocated to another state before a state can relinquish its allocation. However, the guidelines do not cover situations like the case of Dadri-I where the useful life is over. Considering opportunities for these plants, like MBED and the ancillary services market, must the allocation guidelines be revisited? What factors must be assessed while the case for re-allocation or exit is being examined by the relevant regulator? How can the regulatory processes be improved so that the conditions and procedures are clear to all stakeholders? **What considerations need to be kept in mind for any re-allocation of generation and transmission capacity shares under such PPAs, if a state's request for exit is found to have merit?**

Recommendations

Cheaper alternatives and supporting market-based procurement frameworks need to be tapped or developed over the next five years. For example, Delhi is already exploring the potential of renewable energy sources to fulfil future demand (DERC 2021a) and of behind-the-meter distributed energy systems amongst commercial, industrial, and residential consumers. Delhi's discoms have also been leveraging the advantages of rooftop solar systems (Kuldeep et al. 2019), piloting demand response programmes (Hale et al. 2018) and, more recently, examining the role of battery energy storage systems (BESS) and urban microgrids to aid network and power procurement planning for the future. Further, solar-wind hybrids can be a cost-effective option until, and even after, grid-scale storage becomes economical. Estimates suggest that solar PV-plus-storage PPA could be INR 3.32 per kWh by 2025, falling to INR 2.83 per kWh by 2030 (Deorah et al. 2020), much more cost-effective than the observed VC of coal units dispatched today. Energy efficiency measures have the potential to moderate demand growth. Mechanisms like time of day (ToD) tariffs can also aid in shifting demand to match renewable energy generation profiles. Such measures will also save precious money for the discoms through avoided FC implications. Further, the availability of seasonal contracts or contracts beyond 11 days can help discoms manage the price and demand variability cost-effectively. **Therefore, we recommend that:**

1. The CERC and SERCs allow discoms to make room for flexible and cost-effective procurement instead of continued lock-in under inflexible PPAs with coal plants with high VC that will be operating at further reduced PLFs in the near-future.
2. Exit guidelines and relevant regulations must translate to a process that requires sign-off from all

concerned stakeholders such as the system operator, CEA, and pollution control agencies at the state/central level before exit decisions are made. The regulator and the system operator must also specify the roles efficient plants must play post deallocation or PPA restructuring.

3. The CERC and SERCs develop and implement enabling regulatory frameworks that allow discoms to enter shorter-term contracts via or outside the PX and harness the system flexibility. Once the rules regarding forwards and derivatives are finalised, discoms could enter into contracts for up to one year. Financial contracts may be offered under the Securities and Exchange Board of India (SEBI), and discoms could hedge their price and volume risks.
4. Discoms be required to submit robust bottom-up estimations of demand growth and likely changes in load shapes every two to three years for regulators to make informed decisions. This can be enabled through economic disincentives like lower return on equity (RoE). Discoms must be held accountable through strong monitoring and verification mechanisms.

Image: iStock

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