



Agriculture Solar Feeders in Maharashtra

April, 2021

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Govt of Maharashtra's Solar Agriculture Feeder policy is likely to have a transformative impact not only for the reliability and day-time supply of electricity to farmers but also for the long term financial health of MSEDCL. MERC has approved 1826 MW of projects as of Feb, 2021 which will solarise over 5 lakh pumps, (12% of the total) (average 5 hp) in just a couple of years. Further, with the recent GoM cabinet decision to target 5000 MW under this scheme, this will increase to 30% of pumps. The total generation from 1826 MW (19% CUF) is likely to be 3029 MU, thereby contributing 31% of the total solar procurement of MSEDCL of 9,855 MU in 2021-22. Thus, solar feeders will have close to one third share of the solar RPO of MSEDCL. Further, MSEDCL is likely to save ~ Rs 300 crore/year of procurement costs from the 1826 MW of approved projects even without considering the additional savings from transmission charges & losses and the escalation in APPC. The fixed long term tariffs under the solar feeder program will not only lower MSEDCL's cost of supply but also go a long way in reducing the need for direct and cross subsidies, which is crucial for the long term financial sustaining of the distribution sector. This Maharashtra initiative has been aptly recognised for its financial and social benefits and been appropriately adopted under component A of the MNRE's KUSUM scheme. Further, the MNRE recognizing the importance of this farmer-centric yet fiscally prudent pathway for the power sector has finalised Guidelines for Development of Decentralised Solar Power Plants which nudges other states to adopt this approach even beyond the 10,000 MW earmarked under the KUSUM scheme.

History and Background

Unmetered and subsidised electricity to agriculture has played a key role in the growth of groundwater irrigation and agriculture production, but is also often seen as a major reason for the financial losses of distribution companies (discoms). Agriculture often gets poor quality, unreliable and night-time electricity supply. With close to 43.6 lakh agriculture consumers in 2019, Maharashtra has the largest share (~20%) of electric pump-sets in the country. Currently, the state government annually pays ~ Rs. 6,000 crores as subsidy to agricultural consumers. Growth in agriculture demand and rising cost of supply will only worsen the subsidy problem. To address these inter-linked problems, the Govt. of Maharashtra launched the [Chief Minister's Solar Agriculture Feeder Policy](#) (Mukhyamantri Saur Krushi Vahini Yojana) in June, 2017. Taking advantage of the low cost of solar PV and agriculture feeder separation, its basic aim was to provide reliable, adequate day-time electricity supply to farmers at a reasonable tariff, while also reducing the direct subsidy and cross-subsidy requirement of the State Govt and the sector respectively. Both MSEDCL and MSPGCL were implementing agencies for this policy.

A solar agriculture feeder is essentially a 2–10 MW community-scale solar PV power plant, which is interconnected to the 33/11 kV sub-station. A 1-MW solar plant can support around 350, 5-hp pumps (in terms of annual generation and pump consumption) which would be given reliable day-time electricity for 8–10 hours between 8 a.m. and 6 p.m. When solar generation is low, maybe due to cloud cover, balance electricity can be drawn from the electricity grid.

Alternatively, when pumping demand is low, maybe during rains, excess solar electricity will flow back to the grid. This allows for optimal sizing of the solar power plants. Project developers are selected through a competitive-bidding process and the entire electricity is bought by the discom through a 25-year contract. To ease project development, state government land near substations can be made available on lease at nominal rate. Lease of private land is also possible under the policy. Finally, groups of farmers can also develop projects through bidding process and sign PPA with MSEDCL. For more details on this policy, please see this [article](#) and [short video](#).

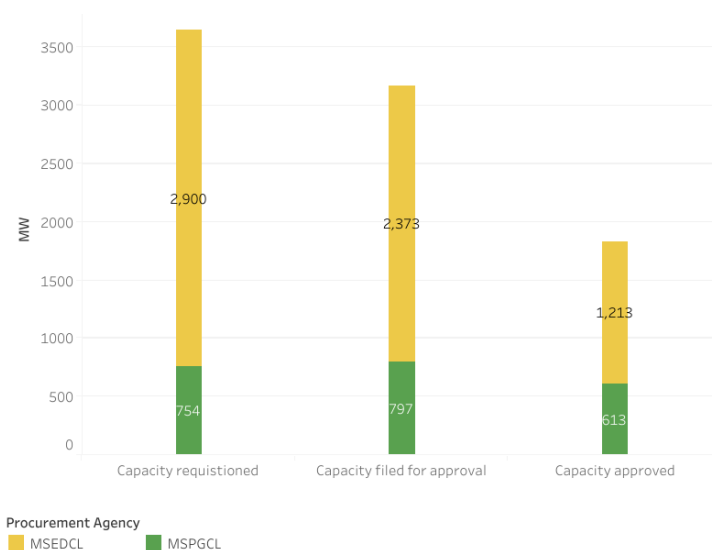
1. Progress under the program

Between the period of Jan 2018 - Feb 2021, a total of 22 regulatory orders have been passed by the MERC on the solar feeder program. A detailed analysis of these orders shows the progress in terms of capacity procurement, price discovery and geographical spread as detailed below.

Capacity procurement

As of February 2021, both the implementing agencies (MSEDCL and MahaGenco) have targeted a net procurement of ~ 3,654 MW of which MSEDCL accounts for ~80%. Out of 3,654 MW requisitioned, 600 MW is planned through the MoU route between EESL and MSEDCL while the balance is being procured through competitive bidding. While 3,170 MW have been filed for regulatory approval, the Commission has granted approval for the projects equaling 1,826 MW till nowⁱⁱ, with the split of 66% and 34% between MSEDCL and MSPGCL respectively. A detailed breakdown of the capacity tendered, filed for approval and approved by MERC is shown in Figure 1.

Figure 1: Solar feeder capacity tendered, filed for regulatory approval and approved



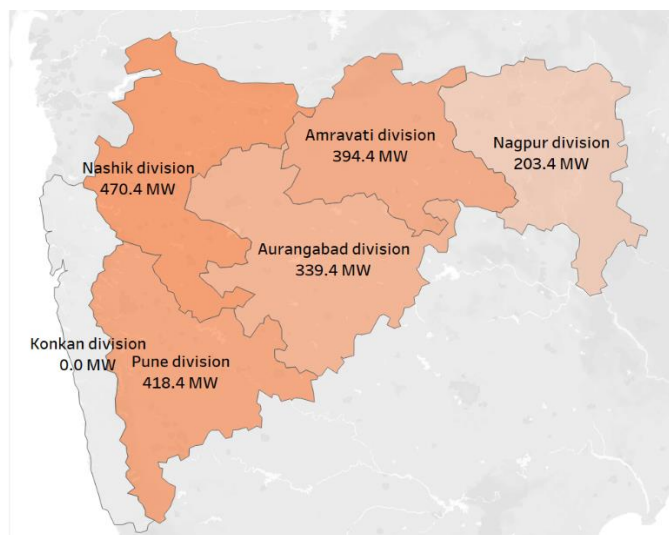
Source: Prayas compilation based on MERC orders, data as of February, 2021

Note: Capacity requisitioned by both MSEDCL and MSPGCL shown above excludes the capacity that was re-tendered due to less than satisfactory response from developers or due to MERC directing the procurement agency for negotiation of tariffs with developers. MSPGCL received approval for 100 MW capacity in May 2020. The capacity is allocated for Western and Northern Regions (50 MW each). These capacities have been included in Pune and Nashik divisions respectively in the above graph.

Geographical spread of projects and price discovery

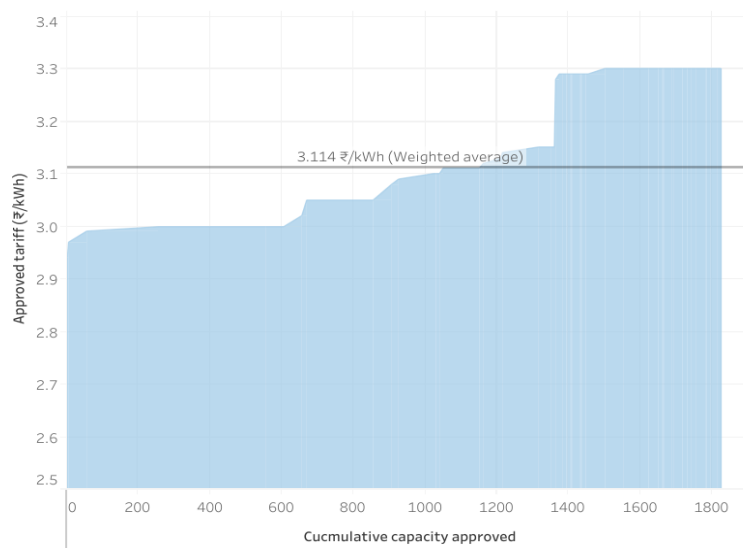
Analysis of approved projects suggests that 26% of the capacity will be installed in Nashik division, followed by 23% in the Pune region. Other regions include Amravati (22%) and Aurangabad (19%), while Nagpur region contributing the rest (11%). As expected, there are no projects planned for the Konkan region due to its very low agriculture sales. A division-wise breakup of the approved projects is shown in the figure 2. The tariffs for the approved projects of 1,826 MW range between ₹2.93/kWh and ₹3.30/kWh, with the weighted average being ₹3.11/kWh, indicating highly competitive tariff discovery compared to auctions conducted in similar time frame. Incidentally the older and much larger EESL projects (aggregate of 200 MW and 300 MW) based on the MoU route have one of the lowest prices at Rs 3/kWh.

Figure 2: Geographical spread of approved projects



Source: Prayas compilation based on MERC orders, data as of February, 2021

Figure 3: Cost curve for approved solar feeder projects



Source: Prayas compilation based on MERC orders, data as of February, 2021

2. Impacts of the Scheme

Number of Farmers/Pumps supported

Assuming an average size of a pump as 5 hp (3.73 kW) and annual hours of use as 1583 (as approved by MERC), the annual consumption per pump is 5905 kWh. Thus the 1826 MW of approved projects will solarise over 5 lakhs such pumps, assuming a capacity utilisation factor of 19%. This is close to 12% of the total electricity pumps in Maharashtra. Further, with the [recent GoM cabinet decision](#) to target 5000 MW under this scheme, it would solarise 14 lakhs such pumps (just over 30% of the pumps in Maharashtra) in coming three to four years.

Contribution to Solar RPO

The total generation from the approved 1826 MW (19% CUF) is likely to be 3029 MU. This can effectively contribute 31% of the total solar procurement of MSEDCL of 9,855 MU in 2021-22 (Order 322 of 2019). Thus approved projects under the solar feeder scheme will contribute 2.1% of the total MSEDCL procurement of 1,41,651 MU and have close to a one third share of the solar RPO.

Economic Savings

The weighted average price discovery at Rs 3.11/kWh is significantly less than even the APPC for MSEDCL, ~ ₹4/kWhⁱⁱⁱ. Hence there is close to ₹1/kWh saving, thereby avoiding ~ Rs 300 crore/year of procurement costs from the 1,826 MW of approved projects. This is even without considering the additional savings from transmission charges of ₹0.4/kWh, the avoided 9% losses (state transmission losses + 33 kV wheeling losses) and the escalation in APPC. The fixed long term tariffs under the solar feeder program will not only lower MSEDCL's cost of supply but also go a long way in reducing the need for direct government subsidies and cross subsidies from the sector, which is crucial for the long term financial sustaining of the distribution sector.

3. Regulatory treatment of solar feeder projects by MERC

The MERC orders on the solar feeder program cover a range of issues and highlight the ongoing learnings and challenges/solutions faced by the procurers. These 22 orders are listed on this [page](#) for anyone interested in further details. Some highlights from these orders are noted below.

Deviation in Standard Bidding Documents (SBDs) and other Regulatory Approvals

There were a few issues which warranted a deviation in SBDs. These included

- Lowering the minimum project size to 2 MW from 5 MW ([Case No. 131 of 2018](#)) in the bidding guidelines.
- Revision in the off-take constraint compensation & in the performance bank guarantee amount as Rs. 20 Lakhs/MW instead of 4% of Project cost ([Case No. 141 of 2019](#))
- Change in law clauses for which MERC directed MSEDCL to incorporate a formula for DC capacity to be considered for Change in Law events and this was incorporated by MSEDCL in modified PPA. Further MERC directed MSEDCL to also include a standard formula to calculate the Change of law costs in per unit basis in line with that proposed by the GoI bidding guidelines for wind-solar hybrid projects. ([Case No 214 of 2020](#)).
- The procurer needed formal regulatory approval for various aspects of the program. Some of these include a) Counting generation towards solar RPO ([Case No. 270 of 2018](#)); b) Fixing (day-time) hours of

supply to agriculture (Case No. 178 of 2018) and c) Tariff adoption (Case No. 277 of 2018 and Case No. 308 of 2018) of discovered tariffs.

Due Contractual Processes and preference for competitive bidding

MSPGCL was one of the implementing agencies of the solar feeder policy of GoM. However, since MSEDCL was the final procurer and given that MSPGCL was not owning and building these projects themselves but contracting them through competitive bidding, there arose the issue of the contractual agreement between MSPGCL and MSEDCL. To overcome this issue, MSPGCL applied for a trading license through which it would supply this power to MSEDCL which was granted by MERC. (Case No. 172 of 2017 and Case No. 104 of 2018). For certain projects, MSPGCL after re-tendering/extending deadlines and other factors could not contract a developer. Therefore, to avoid further delays, MSPGCL approached EESL to develop 100 MW projects under the MoU route. While approving the rate for this MoU project between MSPGCL and EESL, the MERC clarified that the order shall not be treated as precedent and that future projects should be done through competitive bidding (Case No 10 of 2020).

Tariff Discovery, its Competitiveness and Revision of Ceiling Tariff

MERC had adopted tariff of Rs. 3.09-3.15/kWh for 235 MW in its order dated 27 November, 2018 in Case No. 277 of 2018. Using this as benchmark, when MSEDCL sought tariff approval for 1170 MW (in a tender for 1400 MW, where tariffs discovered were marginally higher (Rs 3.16/kWh-10 MW; Rs 3.28/kWh-60 MW; Rs 3.3/kWh-1100 MW), MERC declined to adopt tariffs for this capacity noting that they were clearly not in accordance with recent rates discovered by MSEDCL and instead directed MSEDCL to re-negotiate with the bidders (Case No. 64 of 2019 and MA No 7 of 2019). This was in spite of the Commission noting '*MSEDCL having conducted competitive bidding process transparently and as per MoP Guidelines*'.

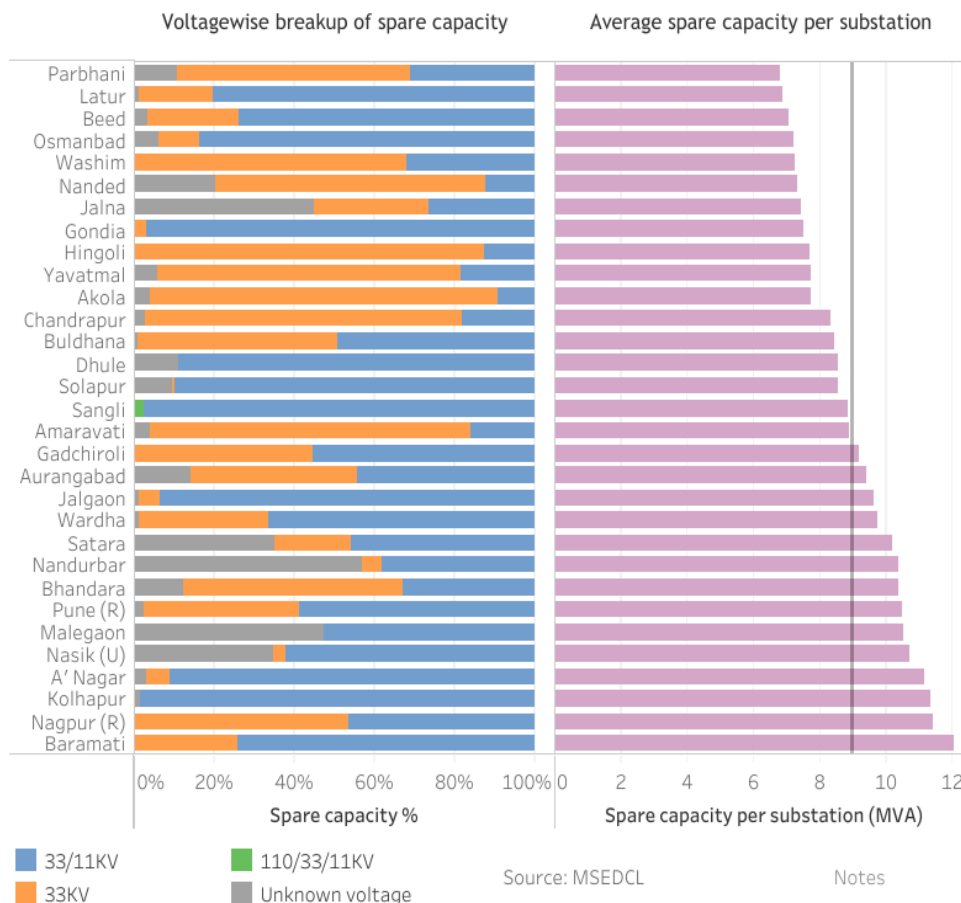
Considering that an aggressive ceiling rate could have been one of the reasons for the poor bidder response in recent bids, MSEDCL revised its ceiling tariff from Rs 3.15/kWh to Rs 3.3/kWh. In this regard, it is important to note that, '*The Commission reiterates that the ceiling rate is to be decided by the Distribution Licensee based on its own prudence, no prior approval of the Commission is required*'. (Case No 323 of 2019 and Case No 80 of 2020). However, MERC would consider the appropriateness of the tariff at the time of tariff adoption.

Shift to Open Tendering and creating land bank for faster/smoothen implementation

To fast track the process and encourage higher/continuous participation of project developers, MSEDCL has now shifted to open/continuous bidding (Case No 214 of 2020 and Case No 189 of 2020). It would also publish distribution sub-station wise solar evacuation capacity in Agriculture dominated districts. As per the data published by MSEDCL, there are 2725 sub-stations across 31 circles with a total spare capacity is 24,474 MVA. Average spare capacity varies from 6.8 to 12 MVA across different circles and 9 MVA per sub-station overall. Details are given in the figure 4.

Further, an online land bank is being created by MSEDCL to assist in smooth and fast implementation of the scheme. In tenders wherein land is provided by MSEDCL, the ceiling tariff would be Rs 3.11/kWh as against Rs 3.3/kWh wherein land is not provided. Further lease rates for such lands should be based on commercial analysis by the DISCOM. (Case No 214 of 2020)

Figure 4: Circle and voltage wise spare capacity for MSEDCL sub-stations



Source: Prayas compilation based on MSEDCL data

4. Learnings for other states and way forward

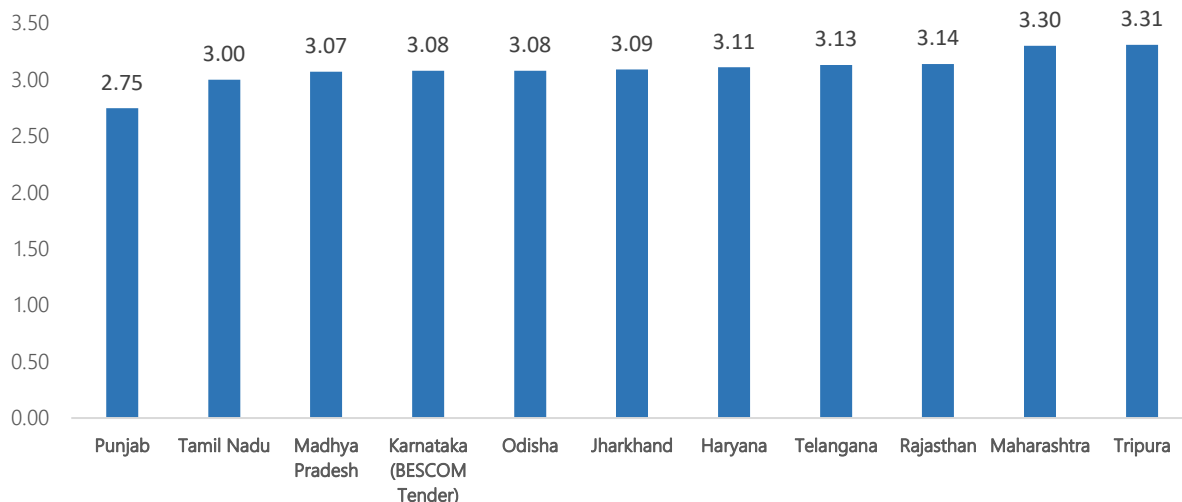
Maharashtra is leading the way in implementing the solar feeder program which is a precursor to KUSUM-A and modified KUSUM-C (feeder level solarisation). It was not all smooth sailing and the process faced some temporary hiccups in terms of poor response from bidders in some tenders. According to MSEDCL, 'such poor response is especially on account of un-viability of the Tariff and the unavailability of low cost lands in the State. Therefore, MSEDCL could hardly arrive at the situations to conduct e-reverse auction under MSKVY Tenders' (Case No 214 of 2020).

However, learning from that experience, MSEDCL & MSPGCL have proactively taken various steps (open tendering, higher ceiling rate, land banks etc.) to ensure successful implementation of this policy. There are practical lessons for other states for rapidly scaling up such a program (KUSUM-A and C) and for a smoother implementation of the same.

- a. Setting up an appropriate benchmark tariff which adequately captures the smaller project sizes and higher transactions costs is imperative to ensure good participation and competition in the bidding process. MSEDCL has increased its benchmark tariff to Rs 3.3/kWh from the initial 3.15/kWh citing it as one of the possible reasons for poor participation in some tenders. Further in comparing these with large projects, one needs to factor in the avoided transmission charges and losses and smaller size and

distributed nature of these projects. A state wise comparison of tariffs set by SERCs for KUSUM-A projects is shown in figure 5 below. Procurers should quickly revise these tariffs if needed based on the response in the tenders.

Figure 5: Tariffs for solar projects under KUSUM-A in various states



Source: Prayas compilation based on various SERC orders and DISCOM tenders

- b. Preparatory work in terms of creating land-banks and publishing sub-station wise spare capacity can accelerate the deployment process significantly. A campaign on farmer awareness to participate in this scheme in terms of deploying projects or contributing to the land-bank is vital to its success.
- c. The direct economic benefit of these projects in terms of subsidy and cross-subsidy savings coupled with 'ease of implementation'^{iv} means that States should plan for a comprehensive and universal coverage of agriculture under solar feeders with yearly targets in the coming years.
- d. Apart from the more routine regulatory approvals for tariff adoption, change in SBDs, counting of generation towards solar RPO, the procurer needs to provide adequate clarity in terms of 'Change in Law' provisions, off-take compensation and inter-connection and transmission responsibilities. This would not only ensure more participation but also potentially avoid projects getting stuck in legal proceedings later on.
- e. While GoI KUSUM guidelines note a project size of 0.5-2 MW, states should ideally adapt this to their state's requirements and tender projects accordingly. This would be based on pumping load per feeder, average pumps sizes, annual hours of use, land and sub-station availability etc. States should pro-actively encourage area specific projects sizes, even if they are higher than 2 MW.
- f. Finally, state govts and SERCs need to actively respond through amendments in policy and regulation/practice directions to address implementation and state-specific issues on a regular basis to ensure a high pace of deployment.

5. Conclusions

The Maharashtra led solar feeder initiative has been aptly recognised for its financial and social benefits and been appropriately adopted under component A and C of the [MNRE's KUSUM scheme](#). Further, the MNRE

recognizing the importance of this farmer-centric yet fiscally prudent pathway for the power sector has finalised [Guidelines for Development of Decentralised Solar Power Plants](#) which nudges other states to adopt this approach even beyond the 10,000 MW earmarked under the KUSUM scheme. Even the recent [Lok Sabha Standing Committee on Energy's report on MNRE's Demand for Grants \(2021-22\)](#) noted the preference of states for Component-C, which has been recently modified to allow for feeder level solarisation. Thus, States should plan for universal coverage of agriculture under solar feeders and use this opportunity for not only improving quality of supply to farmers but to simultaneously use this as a critical component to improve DISCOMs financial viability.

For more details about the agriculture solar feeder framework please visit our [webpage on solar feeders](#) and the associated [solar feeder page on the data portal](#).

ⁱ This article is part of an ongoing series called Power Perspectives which provides brief commentaries and analysis of important developments in the Indian power sector, in various states and at the national level. The portal with all the articles can be accessed here: <https://prayaspune.org/peg/resources/power-perspective-portal.html>. Comments and suggestions on the series are welcome, and can be addressed to powerperspectives@prayaspune.org.

ⁱⁱ While this data is slightly dated, MSEDCL has contracted 965 MW of which 258 MW has been commissioned as of October, 2020.

ⁱⁱⁱ http://cercind.gov.in/2021/whatsnew/Proposal-National_APPC-2021-22.pdf

^{iv} As per the official Minutes of Power Ministers Meeting in 2020,

"Hon'ble Minister during the RE session stated that PM-KUSUM scheme will not only benefit farmers by providing day time reliable power and additional income but will also help States and Discoms in reduction of subsidy burden on electricity consumption for agriculture. He further added that feeder level solarisation being proposed for Component-C of PMKUSUM Scheme has the benefits of ease of implementation and recovery of investment in 3-4 years. The Ministry is in discussion with NABARD to provide soft loans to States / Discoms for this purpose and Central PSUs like SECI, NTPC, PGCIL, etc. will help States in implementation of feeder level solarisation. He informed that for separation of agriculture feeders, States can also avail of assistance under a new scheme for reforms being prepared by MoP."

^v During the evidence, in response to a query about low utilization of funds and non-achievement of targets under KUSUM Scheme, the representative of the Ministry deposed as under:

"The scheme guidelines were framed in 2019 and after that, there was interaction with the States to know their demands and that took some time. By the time the scheme reached a stage where it could be implemented, it was affected by COVID-19. Component B has been a problem because of the financial position of the States. They have not been able to commit their contribution of 30 per cent of their share. Maharashtra has not issued any letter of award so far. Some States have been better. I do not think that we will see a very speedy progress in Component B unless States come on board and there are some signs that the pace is picking up. But we are very hopeful of Component C. There has been a huge demand from States and that demand is more than four to five times of what we can allocate and that is because of the fact (that) States will not have to contribute 30 per cent of subsidy for solarisation of agriculture. So, we are hopeful that what we are not able to do in Component B, we will be able to make up by good performance in Component C".

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