Before the Rajasthan Electricity Regulatory Commission

In the matter of:

Discussion Paper on Framework for Large Scale Integration of Renewable Energy using Energy Storage Systems and its impact on Tariffs

Submission by Prayas (Energy Group), Pune *31st March, 2021*

The Rajasthan Electricity Regulatory Commission (RERC) issued a discussion paper on '*Framework for Large Scale Integration of Renewable Energy using Energy Storage Systems and its impact on Tariffs*' in March 2021, and invited public comments on the same to facilitate the requisite regulatory intervention.

Firstly, we welcome this pro-active and timely initiative from RERC given that this topic is extremely critical for the future growth of the RE sector. Further, we fully acknowledge the need for further flexibility in the system as a means of reliably integrating cost-effective renewables and the important role that energy storage can play in this regard. Increasing flexibility in the power system is key to reliably integrate the state's commitment towards renewables. Increasing Battery Storage Systems is a key way of increasing flexibility and in line with the 'National Mission on Transformative Mobility and Battery Storage' approved by the Cabinet in March, 2019. Additionally, the price of batteries has fallen sharply, by 87% in real terms in the last decade from $1,100/kWh in 2010 to $137/kWh in 2020. By 2023, prices are predicted to be $100/kWh and $ 61/kWh by 2030. To take advantage of these global developments, it is important to kick start the deployment of large scale batteries and other economic storage solutions and gain valuable experience and reap its multiple reliability and economic benefits.

As noted in the paper, energy storage systems can be located with generation assets or be deployed as Transmission / Distribution elements or even be deployed at the consumer location behind the meter. In all the cases, storage systems can provide a variety of services like energy shifting / peak load management, a host of ancillary services like frequency and reactive power control, black start etc., increase system flexibility to absorb more variable RE and reduce curtailment, improve reliability & resiliency and even defer capital expenditures in certain cases. To further add to the regulatory complexity, storage systems can be set up in a manner that they can provide such multiple services through a single project/asset[1]. Prayas (Energy Group) has some comments and suggestions in this regard which are listed below:

1. Application of Storage with Generation:

This application for storage appears to be the most straight forward of the lot and would essentially be used for energy shifting and supply of RE during peak load times. It could also be used partly to firm RE schedules thereby avoid DSM penalties and also to reduce/eliminate curtailment. The Govt of Rajasthan Solar and Hybrid Wind Policies already mandate a minimum level of storage deployment along with RE generation assets in addition to the minimum RPO. Considering the RPO set by the RERC as shown in table 1, a RE capacity of roughly 10 GW would be needed by 2023-24.

[1] For a recent example in Delhi, please see - https://etn.news/buzz/3773-tata-power-nexcharge-install-india-s-first-community-energy-storage-project

Table 1: Estimate of RPO requirement and RE capacity needed by 2023-24.

Year	Power Purchase by DISCOM	RPO	Hydro Purchase	Non-Hydro Power Purchase	RPO Requirement	RE Capacity required assuming CUF of 20%
Units	MU	%	MU	MU	MU	MW
2020-21	83,445	16.65%	16,092	67,353	11,214	6,401
2021-22	87,988	18.30%	16,092	71,896	13,157	7,510
2022-23	92,778	19.60%	16,092	76,686	15,030	8,579
2023-24	97,828	21.00%	16,092	81,736	17,165	9,797

Considering the minimum storage capacity as 5% of RE capacity (as notified in the GoR policy), the state would need to deploy just under 500 MW of storage capacity by 2023-24 (Column 2 in table 2). The policy further states that, '*Minimum rated Capacity of Energy Storage System (ESS) shall be equal to 'X/2' MWh where 'X' is the installed capacity of the project in MW*'. Thus the minimum energy storage capacity deployed would correspond to 245 MWh (Column 3). Assuming daily cycling of the battery, this would translate to 245 MU/year, thereby meeting 0.09% of the total system load by 2023-24 (Column 4&5). If storage systems with longer duration are deployed, for e.g. 2 or 4 hour systems, then they would effectively supply 358-715 MU/year by 2023-24, thereby meeting 0.37-0.73% of the system load in that year (Column 7-11).

Table 2: Minimum and possible generation coupled storage capacities in the state

Year	Storage Capacity (5% of RE Capacity)	Minimum storage hours (1/2 of RE Capacity)			2 hour storage			4 hour storage		
Units	MW	MWh/ day	MU/ Year	Storage contribution to total demand (%)	MWh /day	MU/ Year	Storage contribution to total demand (%)	MWh /day	MU/ Year	Storage contribution to total demand (%)
2020-21	320	160	58	0.07%	640	234	0.28%	1,280	467	0.56%
2021-22	375	188	69	0.08%	751	274	0.31%	1,502	548	0.62%
2022-23	429	214	78	0.08%	858	313	0.34%	1,716	626	0.68%
2023-24	490	245	89	0.09%	980	358	0.37%	1,959	715	0.73%

The country has already seen bidding for storage coupled RE generation systems for supplying firm power as successfully done by SECI[2] last year. Bidding guidelines and SBDs (RfQ &PPA) for this kind of project are already in place through MNRE/SECI and the industry also has some experience in this regard. The framework pre-specifying a tariff for off-peak hours and discovering one for the peak supply hours (defined by the procurer along with a minimum annual CUF) appears to be appropriate for this kind of storage coupled RE system. The Rajasthan DISCOMs can take a call on the minimum hours of peak supply, minimum annual CUF etc. based on their load shapes, growth and other considerations. This storage application is the easiest to get started with considering the regulatory framework being already in place.

RERC should direct the DISCOMs to initiate procurement of storage coupled RE generation on the above lines and aim to meet at least 0.5-1% of its total demand through storage by 2023-24.

[2] https://mercomindia.com/greenko-renew-win-seci-solar-wind-auction-with-storage/

2. Model for Transmission Grid Connected Energy Storage System:

CERC is yet to come out with a formal framework for a separate ancillary services market or a framework for flexi bid orders in Power Exchanges within which storage systems can participate and compete. Storage systems can provide fast response and a variety of ancillary services which are critical for system operation and reliability/safety. Given the range of system services (frequency control, reactive power/voltage control, black start, minimising DSM penalties, ramping support, avoiding congestion and RE curtailment etc.) that can be offered by storage systems, it is best operated by a single entity, in this case the Rajasthan SLDC, thereby offering the most value/optimisation of the multiple value streams across the state. In terms of ownership, we agree that an independent storage system provider selected through transparent competitive bidding would be the right approach and payment for storage would be essentially on an availability basis. The entire cost would be pass through in terms of the Transmission ARR and would be spread across all user of the grid or beneficiaries of the storage service as the case maybe. The RERC would also have to come up with a framework for accounting for the charging of the storage system, mainly the allowable times for charging and for the storage system losses.

Since such storage systems have not yet been deployed at the transmission level in India and the cost-effectiveness of such systems for the multiple services they can provide is yet to be ascertained, RERC should proceed with giving the STU a go-ahead for a pilot project of 50-100 MW/25-100 MWh to be used for system services/ancillary services. This project would be used to discover prices, ascertain cost-benefits and streamline regulatory and contractual agreements for future use.

3. Model for Distribution Grid Connected Energy Storage System:

Similar to the Storage being used as a transmission element, it can also be used for multiple services at the distribution level. However unlike Transmission, we have a couple of examples of deployment of such systems in Delhi[3]. On similar lines, **RERC can direct Rajasthan DISCOMs to come up with a case for the use of storage and its costs/benefits based on which the ERC can allow it on a case to case basis, with costs being recovered as part of the ARR. Procurement should be allowed only through a transparent competitive framework.**

4. Storage to handle RE variability, improve grid integration

Storage can certainly be useful in reducing RE variability, reducing deviations from schedule and eliminating curtailment, thereby aiding in more reliable grid integration of renewables. However, given the present costs of storage coupled with the level of deviation bands and associated penalties in the Forecasting and Scheduling regulations, it is unlikely to be a cost-effective solution right now. Improving forecasting practices, aggregation of schedules across the state and effectively using the Real Time Market in the Power Exchanges (to sell/buy in near real time to make up the difference in the schedules) might be more cost-effective approaches to handle grid integration.

Further as a first step, the RERC should review the implementation of the F&S regulations in the state and come up with a timeline to make the allowable deviation bands more stringent going forward.

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[3] https://www.tatapower.com/media/PressReleaseDetails/1617/tata-power-collaborates-with-aes-and-mitsubishi-corporation-to-power-up-south-asias-largest-grid-scale-energy-storage-system-in-india and https://mercomindia.com/tata-power-nexcharge-battery-community-energy-storage/

Secondly, the RERC should amend the F&S regulations such that the DISCOMs do not continue to bear the cost of deviation penalties by wind and solar up to 15% absolute error. A better and more equitable approach would be such that the deviation penalty caused due to wind and solar should be borne by these generators. To operationalise this, a suggested approach (as operationalised in Maharashtra[4]) is outlined below.

- First, the SLDC calculates the contribution of solar and wind deviation to the total deviation charge for the state at its periphery.
- Secondly, they collect deviation charges for wind and solar deviation in accordance to absolute error at each pooling station.
- Thirdly, if the total deviation penalties collected from the wind and solar projects are lower than what wind and solar power deviation contributed to the state deviation penalty, then the balance is additionally recovered from the generators (through their QCAs) in proportion to their deviation.

In essence, the entire cost of deviation caused due to wind and solar is finally passed back to the generators, thereby allaying the fears of the DISCOM which would have had to bear the brunt in the absence of this provision. This additional settlement is required due to difference in existing penalties for wind and solar generators connected to InSTS and existing frequency linked deviation settlement mechanism at the state periphery. This is an important step going ahead, especially when the share of wind and solar energy is expected to rise sharply.

Further, tightening the allowable DSM bands coupled with passing back the entire deviation penalty to the RE generators would ensure that the RE generators give adequate attention to the issue of grid integration and use cost-effective measures (incl. storage as the case may be) to reduce deviations / deviation penalties.

Hence rather than mandating storage for reliable RE grid integration, RERC should first amend their F&S regulations to make the allowable DSM bands more stringent and pass back the entire deviation penalty caused by wind and solar to the RE generators.

5. Using grid scale battery storage systems for reliable electricity supply to public hospitals and health centres

RERC could direct the DISCOMs to explore the possibility of bulk procurement by DISCOMs or through SECI/EESL for standardized storage assets/services for social/critical applications. e.g. for increasing reliability of supply in Govt. hospitals, PHCs as one of the first applications. This could be supported by State Govt grants given the importance of the application.

As of 31st March, 2019, Rajasthan has 13,512 Sub-Centres, 2082 PHCs and 571 CHCs. Deploying standardized electric storage projects/services in such Centres for improving the reliability/resiliency of supply and reducing the use cost diesel power generation would be a great example of combining a

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[4] See MERC F&S regulations (Regulation 12(d)) and procedure (Regulation 10-12). Specifically, Regulation 12(d) Deviation Accounting
(d) Any shortfall in the aggregate amount of Deviation Charge payable by Solar and Wind Energy Generators at the State periphery and the amount receivable from them by the Pool Account shall be paid by the respective QCAs in proportion to their deviation reflected at the State periphery.

critical social need with electric storage deployment at scale. Surveys of the national rural health mission indicate that many of the sub-centres and of the primary Health Centres (PHCs) in India lack access to electricity. Solar+Storage units could be considered for these centres, especially in remote regions.

6. Monitoring and Reporting

For storage being used as a transmission and/or distribution element and providing multiple services, the RERC should put in place a strong monitoring and reporting framework. Data on energy charging/discharging, losses, availability, use in multiple ancillary / system services etc. should be comprehensively documented for storage systems set up by licencees and utilities. 15-minute data should be shared at a regular frequency with the RERC and appropriate aggregate data and reports should be placed in the public domain for scrutiny. Similarly, RERC should direct the DISCOMs to come up with a framework for registering all Behind the Meter (BTM) storage systems installed directly by consumers in an online database.

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