

HB 773 Storage Report
Annotated Draft Outline

Objectives for the Report

Address all topics in the legislation

Incorporate research from prior reports; update where appropriate

Continue communicating with PC 44 about how best to complement its work

Address the specific nature of pre-existing programs and policies such as MD's RPS and net metering law

Incorporate qualitative input from stakeholders listed in the legislation

In addition to reviewing formal reports, seek in-person feedback on the outcomes of projects and policies in other states

Ask stakeholders to indicate their priorities for State action and explain their reasoning

Provide policymakers with a means to readily understand the key issues related to each policy option

1. Executive Summary
2. Energy Storage Technologies
 - 2.1. Types of Energy Storage – High-level discussion of mechanical, thermal, battery, other technologies. Include assessment of common vs. uncommon/experimental applications. Sidebar discussion of pumped hydro as a mature technology with little need for incentives.
 - 2.2. Performance Characteristics – Explanation of rated power and duration—the two parameters that determine what service(s) a storage device is best suited to provide. Additional characteristics include: round-trip efficiency, construction costs, operation costs, etc.
 - 2.3. Applications of Storage – High-level discussion of services organized by type: ISO/RTO services, utility services, customer services.

2.4. Illustrative Examples of Storage Projects – Survey of projects to include: microgrid (MD, NY); large-scale utility-owned batteries (AZ, CA); thermal (HI); aggregated residential storage used as a grid resource (TBD).

3. The Cost and Value of Storage
 - 3.1. Total Cost of Storage – Introduction to the core elements of installed cost (hardware; engineering, procurement, and construction; soft costs) and cite cost information from recent projects in the region or broader cost trends.
 - 3.2. Cost Measurements – Explanation of the two forms of cost measurement based on duration (\$/kWh) and rated power (\$/kW) and cite cost information from recent projects in the region.
 - 3.3. Value Stacking – Explanation of “value stacking”—summing the value of the services a storage unit can provide—to determine its cost-effectiveness. Show examples of value stacks from other studies.
 - 3.4. Assessing the Value of Storage in a Policy Context – Discussion of how the value of storage differs by stakeholder (i.e., the grid operator, technology developer, end-user, or ratepayer) and by context, such as utility planning or state policymaking.
 - 3.5. Societal Benefits – Discussion of societal benefits that have little or no market value—i.e., reduced costs (of energy, peak capacity, ancillary services, ramping, GHG emissions compliance, T&D, and renewables integration); increased grid reliability and resiliency; and reduced health impacts (of carbon and criteria pollutants). Discuss ways to capture these benefits indirectly through mandates, including financial impacts on ratepayers, storage system owners, and utilities.
4. Status of Storage in Maryland and PJM
 - 4.1. Existing Incentives and Activities – Brief description of MEA’s Game Changers program, the State’s newly passed tax credit, UMD’s research hub, PC 44 effort, and any other efforts PRRP learns of during research phase.
 - 4.2. Current Storage Projects – Reasonably comprehensive list of utility-owned and private projects, with descriptions of the application(s) for which each project is designed.
 - 4.3. Oversight and Regulation – Description of which entity or entities (i.e., PJM, utilities, or owners) control the approval, interconnection, and operation of storage units, depending on their location and use.
 - 4.4. Access to Revenue – High-level overview of the ability of storage to participate in PJM markets and to receive compensation for distribution-level services (including *de facto* barriers to participation such as discriminatory market rules and prohibitions on participating in both wholesale and retail programs).

- 4.5. Inclusion in System Planning Processes – High-level description of how storage is (or is not) incorporated into PJM, PSC, and utility-planning processes.
- 4.6. Summary of Key Barriers for Storage to Overcome – High-level review of barriers such as storage system costs. Existing reports identify priorities that are universally applicable such as: expanding revenue opportunities, reducing the cost of connecting to the grid, and integrating storage into system planning. (The PC 44 Storage Group and/or PPRP may develop a MD-centric list of barriers.)
5. Policies in Other States – Supplement to foundational work in other reports to summarize other states’ activities using both (1) a comprehensive, table-format list of state programs that contains information on program type, start date, cost, and size; and (2) discussions of program characteristics, by type. Where possible, include discussion of the results of initiatives, as identified by participants or stakeholders (e.g., cost-effectiveness, promotion of diverse ownership models, challenges/successes providing multiple services, evaluation methods, implementation lessons-learned). This information could be organized by program type, as shown below, with states known to be active in each sphere noted.
 - 5.1. Grants and Loans – CA, OR, WA, MN
 - 5.2. Rebates and Incentives – NJ, NY, CA
 - 5.3. Procurement Authorizations – CA, AZ
 - 5.4. Mandates or Targets – CA, OR, MA
 - 5.5. System Planning – NY, CA, HI (The MD PSC will convene a PC 44 System Planning Working Group, if budget remains after the work of the current WGs in completed.)
6. Revisions to Existing State Regulatory Policies and Definitions
 - 6.1. Ownership / Cost Recovery – Discussion of possible revisions to COMAR XX.XX.XX, which largely prohibits utilities from owning generation. This section needs to include an overview of the relationship between utilities, unregulated affiliates, and non-affiliated companies, including potential conflicts of interest and ways to address these conflicts. (PC 44 Storage Working Group may take up this matter.)
 - 6.2. Interconnection Regulations – Discussion of PC 44 Interconnection Working Group considerations/actions regarding the interconnection procedures in COMAR 20.50.09 (e.g., types of grid and queue info to be provided to developers, thresholds for fast-track review,

elements of more substantial reviews, interconnection cost allocation, possible creation of a DER Generator Resource Market), and best practices in other states.

- 6.3. Storage Mandate – Discussion of how Maryland’s RPS could be expanded to include storage and/or how the State could institute a separate storage procurement standard.
- 6.4. Time-varying Rates – Summary of PC 44 Rate Design Working Group considerations/actions regarding creating additional incentives to shift energy use to lower-priced periods (e.g., greater price differentiation between TOU periods, distribution TOU rates, additional TOU rate periods, hourly rates using AMI, expanded demand charges, expanded EV program participation) and best practices in other states. Emphasis should be that rates need to reflect costs.
- 6.5. Net Metering, DSM Programs – Review of PSC technical Staff identified areas for tariff revisions: determining combined net metering and storage capacity (for generation limits), integration with peak load management programs, integration with utility load management or system restoration, islanding or backup power capability.
- 6.6. System Planning – Discussion of ways that the State/PSC could promote storage by establishing new requirements for long-term planning (e.g., distributed generation plans, hosting capacity analyses, locational value assessments, or DER forecasts), by expanding developer access to pertinent utility data, or by changing the utility business model to better align with storage deployment.
- 6.7. Safety and Power Quality Standards – Review of existing standards and metrics for energy storage system performance. (DOE-EPRI Electricity Storage Handbook includes sections on performance standards, safety issues, and interfacing with utility communications networks.)
- 6.8. TBD Additional Programs – During research, PPRP may learn of additional programs that could be expanded to promote energy storage, such as partnerships with federal entities or State-level programs focused on economic development, technological innovation, or sustainable cities.
- 6.9. Recommendations for State action – TBD based on research process.

7. Wholesale Market Factors

7.1. FERC-initiated activities

- 7.1.1. Order 755 (2011) – Review of order, which required pay-for-performance in ISO/RTO frequency regulation markets. PJM’s work to revise its rules often praised for spurring

energy storage market in the region. However, in April 2017, ESA filed a complaint with FERC that PJM's recent revisions discriminate unfairly against storage devices.

- 7.1.2. NOPR on Electric Storage Participation in RTO/ISO Markets (Nov. 2016) – Review of proposed rulemaking to require ISOs/RTOs to revise rules to allow 100+ kW storage and DER aggregators to participate in capacity, energy, and ancillary services markets. PJM says its rules governing market participation have already largely been revised to allow storage but it needs to revise its bidding parameters and its market engine (which I think means its dispatch algorithm).
- 7.1.3. Policy Statement on Utilization of Electric Storage Resources for Multiple Services When Receiving Cost-Based Rate Recovery (Jan. 2017) – Discussion of statement's recommendations for avoiding double-recovery of costs, minimizing adverse impacts on wholesale markets, and maintaining owner independence from ISO/RTO control

7.2. PJM-initiated activities

- 7.2.1. Energy Storage Pilot Projects and Studies – Summary of findings from/results of pilot projects and studies including: 2-MW lithium-ion battery; 105-gallon water heater; study of impact of 1 million EVs in Baltimore-DC area; Pepco/DOD/Joint Base Andrews pilot project to aggregate EVs as a grid resource.
 - 7.2.2. RTEP – TBD based on research and conversations with PJM regarding if/how the ISO includes storage during the RTEP process, beyond noting how much storage is in its interconnection queue.
 - 7.2.3. Collaboration with the MD PSC – Discussion of comments PJM submitted under PC 44 docket, in which PJM highlighted the desire to work with the PSC to: address possible conflicts between PJM and utility or state rules and tariffs; coordinate hosting capacity analyses of both transmission and distribution lines; and define standards for energy storage equipment (such as smart inverters)
 - 7.2.4. Recommendations for FERC/PJM action – TBD based on research process.
8. Conclusion – Summary of recommendations for State and ISO action. Discussion to include consideration of the ease/difficulty, cost, and likely impact of each action.