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Energy Storage Policy Summaries for the Global Energy Storage Database

Will McNamara

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico
87185 and Livermore,
California 94550

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ABSTRACT

This report includes energy storage policy analysis from six states: Arizona, California, Massachusetts, Nevada, New Mexico, and New York. These summaries offer prototypes for summaries that will subsequently be prepared for all 50 states (and territories). There is presently a shortage of comprehensive energy storage policy analysis that public utility regulators can call upon to inform policymaking in their own jurisdictions. The state policy summaries that will be offered publicly on the Global Energy Storage Database (GESDB) will include analysis on the executive directives, legislation, regulations pertaining to energy storage that have been adopted by an individual state, along with perspective on the remaining policy issues pertaining to storage that a state will be likely to address in the future. It is anticipated that public utility regulators in particular will find the database to be a useful resource in benchmarking policy approaches critical to the continued development of an energy storage marketplace in the U.S., including policy approaches specific to storage and renewables procurement targets, interconnection standards, valuation of energy storage, rate reform and tariff design specific to energy storage, consideration of multiple uses for storage at the distribution level, and potential revisions to existing state net metering programs to accommodate an expected growth of energy storage technologies.

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ACRONYMS AND DEFINITIONS

Abbreviation	Definition
DERs	Distributed Energy Resources
ESS	Energy Storage System
PUC	Public Utility Commission

1. ARIZONA ENERGY STORAGE POLICY

1.1. Storage Policy Snapshot

Does Arizona have an renewables mandate?	YES; 15 percent by 2025
Does Arizona have a state mandate or target for storage?	NO
Does Arizona offer financial incentives for energy storage development?	NO
Does Arizona have a policy for the strategic deployment of Non-Wires Alternatives or Distributed Energy Resources to defer, mitigate, or obviate the need for certain T&D investments?	NO
Does Arizona have a policy addressing multiple use applications for storage?	NO
Does Arizona have a policy on utility ownership of storage assets?	NO
Does Arizona allow or mandate the inclusion of energy storage in utility IRPs?	YES
Has Arizona modified its permitting requirements specific to energy storage?	NO
Does Arizona allow customer-sited storage to be eligible for net metering compensation?	UNCLEAR
Has Arizona revised its rate structures to drive adoption of behind-the-meter storage?	NO
Approximate development of storage capacity in Arizona	?

1.2. Storage Policy Assessment

Arizona is an interesting state to follow given its unique approach toward both the tactical development of an energy storage marketplace and the creation of energy storage policies to drive and define such a marketplace. Among the group of approximately 15 states that have witnessed a significant growth in energy storage development and/or created energy storage policies at either the state legislature or public regulatory commission, Arizona remains unique in that its energy storage marketplace has been advanced primarily due to utility initiatives as opposed to policy directives. In all other states, it can be argued that policy has driven market development, either through outright mandates for energy storage (e.g., California, New York) or advantageous incentives that have subsidized the exploration of storage technologies. Not so in Arizona. The state's energy storage marketplace has continued to develop in spite of a near-total absence of policy guidelines; and despite this absence of policy directives, growth to date of energy storage initiatives in Arizona has been noteworthy and its potential for future growth is massive.

Storage technologies and utility-driven storage deployments continue to gain momentum in Arizona, while policymakers play "catch up" to develop appropriate rules and regulations. This approach has been thwarted at times due to conflicts among the state's policymakers and disagreements regarding which state agency (the governor's office, the legislature, or the Arizona Corporation Commission) should take the lead role in defining energy storage policy in the state.

Arizona's unorthodox approach is likely due to several distinguishing factors that simultaneously make the Grand Canyon State inherently unique and a benchmark for other states to be evaluated against. In other words, the factors that make Arizona unique also make it a testing ground for how to create an energy storage marketplace "from scratch." Consider the following dichotomies that exist within Arizona, which have caused the energy storage marketplace in the state to experience growth in a series of fits and starts.

- Arizona is one of the sunniest states in the country, with some areas of the state having 300+ days of sunshine in an average year. Thus, Arizona's potential for solar power is enormous.
    - ***AND YET,*** Arizona still gets only about 6 percent of its energy from solar power. More than 50 percent of Arizona's power continues to come from fossil fuels and fracked gas, most of which ends up being transported to other states like California. The state's low levels of overall usage of solar power relative to other states, particularly in its own region, means that even with their aggressive approach toward renewables development Arizona's utilities are still behind the curve when it comes to moving toward a carbon-free marketplace.

- Despite being an exporter of power to neighboring states, Arizona does not participate in any regional transmission organization (RTO). The oversight to run a central energy market, provide reliability services and assure operating reserves to prevent power blackouts is arguably a level of oversight that is beyond the capability of Arizona's state regulators.
    - ***AND YET,*** although Arizona continues to operate in a rather isolated manner, its dependence on access to outside markets moves it increasingly closer to participation in an RTO, which due to geographical local would likely be the California ISO. If it were to participate in an RTO, Arizona's energy market would increasingly fall under federal jurisdiction, which would create its own layers of complexity. The decision of RTO participation is further complicated by concerns about the available transmission lines that connect Arizona to neighboring states. A lack of transmission capacity would limit Arizona's ability to export and import power from other states, thereby deepening its need for resource self-sufficiency through renewables and energy storage.

- Arizona was the first U.S. state, in 2006, to require utilities to get a certain percentage of their power from renewable resources, specifically 15 percent by 2025.
    - ***AND YET,*** Arizona presently falls last among its neighbors in terms of renewables mandate. By comparison, Nevada and New Mexico have adopted a 50-percent requirement; Colorado has a 30-percent-by-2020 requirement; and California's RPS is 60 percent by 2030. Efforts to increase the state's renewables requirement (including public ballot initiatives such as 2018's Proposition 127) have failed, mostly due to concerns about how an increased renewables target would result in increased costs for end-use customers

- Arizona is in the midst of a contentious "turf war" between the state's executive and legislative branches regarding the policy oversight of its energy sector. Arizona's constitution uniquely establishes the ACC as a separate entity outside of the legislative and executive branches. The governor believes that the ACC's role should be limited to setting rates and its recent move into setting new renewables targets represents an inappropriate and unwanted "mission creep." The ACC says its responsibilities are unambiguous and include the oversight of the state's investor-owned utilities, including their generation mixes.
    - ***AND YET***, the conflict continues…which leaves Arizona in somewhat of a "policy paralysis" with regard to setting new renewables, energy storage, or clean energy policy. Having the Legislature — presumably with the governor in the driver seat— setting energy policy for the state would potentially create a conflict with the specific powers given to the ACC under the Arizona Constitution. The ACC believes it has the power to enact and enforce rules over its sphere of influence just as if it were acting as the Legislature. Whether or not a compromise can be reached remains unclear.

- Arizona continues to wrestle with the question of energy competition or "deregulation," which would open its generation market to independent providers.

    AND YET: If deregulation were to include a separation between transmission & distribution responsibilities from generation, the question of potential utility ownership of storage assets would be further complicated.

Despite all these systemic challenges, the largest utilities in Arizona—Arizona Public Service (APS), Tucson Electric Power (TEP) and Salt River Project (SRP)—have all pursued renewables and energy storage on their own. Unlike APS and TEP, SRP is not under the jurisdiction of the ACC, but despite this difference all three utilities have been aggressively pursuing renewables and storage development, as illustrated by the following: the

- APS has been viewed as an "early adopter" of battery storage technologies and publicly stated its intent in February 2019 to install over 850 MW of energy storage by 2025. APS' storage strategy is built upon three core initiatives:
    - The first initiative includes upgrading scale solar plants across the state with 200 MW of battery storage. APS has already selected Invenergy to install 141 megawatts of new battery systems at six solar sites, with the first expected to begin service by the summer of 2020.

    - The second initiative is APS' plan to build an additional 500 MW of battery storage and at least 100 MW of solar resources by 2025.
    - The third initiative has APS pursuing shorter term power purchase agreements with natural gas providers (e.g., a 7-year contract as opposed to the more typical 20-year contract). Shorter contracts are intended to provide APS flexibility to take advantage of clean energy technologies as they continue to mature.
- TEP added two 10-MW battery systems within the last year:
    - A lithium nickel-manganese-cobalt storage system at a TEP substation near Interstate 10 and West Grant Road, built by a subsidiary of NextEra Energy Resources
    - A 10-MW lithium titanate oxide storage facility linked to a 2-MW solar array at the UA Tech Park southeast of Tucson, built by E.ON Climate & Renewable
- SRP has started construction with AES Corporation for the SRP's first standalone battery-based energy storage project. The 10-MW, four-hour duration energy storage solution, to be supplied by Fluence, is intended to provide peaking capacity support. Under the 20-year agreement, AES will provide SRP with 10 MW, 40 MWh battery based energy storage system.

Meanwhile, Arizona is also home to what have been two widely publicized fires and explosions at battery-powered plants, highlighting the challenges and risks that can arise as utilities rely more heavily on battery storage. APS had installed a 2 MW battery system at a substation in Surprise, AZ, just outside of Phoenix, and another near the Festival Ranch development in nearby Buckeye. But an April fire and explosion sent eight firefighters and a police officer to the hospital. An investigation into the causes of the event is ongoing, but it appears that

In response to the fire and explosion, APS announced that would be temporarily delaying its investments in new battery storage, although it will still issue two requests for proposals to add up to 250 MW of wind generation to its portfolio no later than 2022 and 150 MW of solar power to its portfolio by 2021.

1.3. Executive Directives

When compared to neighboring states New Mexico and California, Arizona has not witnessed clear and consistently expressed support for energy storage through its executive leadership. The state's last energy plan was written in 1990, and since that time very little has been done through executive leadership to revise existing policies regarding Integrated Resource Planning, Renewable Energy Standards, or Net Metering Rules, all of which relate to energy storage but have not been addressed in a number of years and when addressed it was in separate proceedings. Further, there are no clean-energy rules that have been incorporated into the Arizona Constitution. In fact, directives issues by the state's executive leadership over the last decade has been largely geared toward limiting the development of renewable power rather than enabling or encouraging it.

For instance, former Arizona Governor Jan Brewer (R), who served from 2009 to 2015, was responsible for several initiatives that arguably complicated the development of a clean-energy market in the state, including repealing clean car emissions to lower emissions, opting out of the

Western Climate Initiative, and signing legislation that prohibited the Arizona Department of Environmental Quality from reducing greenhouse gas emissions unless authorized to do so by the Arizona Legislature. Furthermore, during Brewer's tenure as governor, the ACC pursued litigation in protest over the Clean Power Plan, issued by the Obama Administration, which would have required emission reductions from power plants across the country and enact restrictions regarding the use of coal-fired power. The Clean Power Plan was subsequently put on hold and its future prospects are doubtful under the Trump Administration.

In fairness, Gov. Brewer did issue in 2014 an Executive Order adopting the state's Master Energy Plan, officially known as "emPOWER Arizona: Executive Energy Assessment and Pathways," which was a collaborative effort by the Governor's Office of Energy Policy, Arizona Commerce Authority, Arizona Legislature, the ACC, and leading industry partners. The Plan identified five following executive-level goals:

1. Increase solar energy development through best practices and leading by example;
2. Educate the next generation of energy professionals;
3. Make Arizona a leader in energy-sector workforce development;
4. Foster statewide coordination to reduce energy consumption; and
5. Establish an energy advisory board.

Energy storage was included in the Plan, but since 2014 storage technologies have matured and prices have decreased, making many of the observations included in the Plan outdated. For instance, the Plan stated the largest challenge associated with energy storage to be as follows: "While there have been different attempts to establish energy storage to balance the system, these attempts have not been scalable due to costs and broad distribution of research funding. Currently, federal monetary resources are insufficient for meaningful research to create scalable energy storage technologies."

In addition, Brewer was responsible for awarding seven Arizona renewable energy companies more than $2.7 million in subsidies to advance their operations.

Arizona's current Governor Doug Ducey (R), who assumed office in 2015, has not issued any clear policy directives on renewables, energy storage, or broader clean energy initiatives. In fact, Ducey has declined to even sign a pledge to meet the Paris Climate Accord emissions reductions agreement, has supported the U.S. decision under President Trump to cease all participation in the 2015 Paris Agreement on climate change mitigation, and has opted not to participate in the alternative , U.S.-led Climate Alliance. In immediate response to President Trump's decision to withdraw from the Paris Agreement, the governors of California, New York, and Washington founded the United States Climate Alliance, pledging to uphold the Paris Agreement within their borders. Other states soon followed (e.g., Colorado, Connecticut, Hawaii, Oregon, Massachusetts, Rhode Island, Vermont and Virginia), but Arizona has opted not to join this Agreement.

Since taking office Gov. Ducey has been primarily focused on restraining the state regulators' efforts to regulate APS and TEC beyond rate design, which is the one clear responsibility assigned to the ACC under the state's constitution. Ironically, much of the efforts to expand the ACC's role (or simply execute what are believed to be its inherent responsibilities) have stemmed from former ACC commissioner Andy Tobin, whom Gov. Ducey appointed in 2015. (Note that ACC Commissioners are to be elected per Arizona law, but appointments can be made to fill a vacant spot with the intention that the appointed commissioner will subsequently have to win election to retain their seat on the ACC).

In 2018, Commissioner Tobin announced that he would be proposing a "series of reforms" contained within his Energy Modernization Plan (see the Regulations section below for more details). Although not captured in an official executive order, Gov. Doug Ducey (R) has publicly expressed concern that the ACC "has been getting into areas beyond its constitutional authority to set utility rates" and exhibiting a "bit of mission creep." Specifically, the governor has commented that the ACC may be overstepping its bounds in telling utilities in the state how much of their power has to originate from renewable energy. The ACC has pushed back by stating that it has rule-setting authority to establish rules that utilities in the state must follow. "We want to see the ACC doing what their constitutional charge is," Ducey said. But that, he said, does not mean the elected regulators should have the last word.

Against this "turf war" over energy policy, Arizona has not seen its executive leadership drive the development of clean energy reforms, as has been the case in most other Western states.

1.4. Legislation

As with an absence of executive directive, Arizona has also witnessed an absence of legislative policy that would clearly define its energy storage market. At this time, there is no single piece of legislation that has been introduced or enacted in Arizona that defines clear policy principles for energy storage in the state. The one piece of recent legislation that has touched upon policies related to energy storage resulted from, or developed out of, a utility-driven campaign to mitigate a public ballot initiative in 2018 that would have increased the state's renewable requirements placed upon utilities, and ultimately failed. The legislation must be viewed from the lens of what it was attempting to avert rather than direct.

In November 2018, an initiative known as Proposition 127 (official name was the Arizona Renewable Energy Standard Initiative" or "Clean Energy for Healthy Arizona") was included on the general election ballot. Proposition 127 was a proposed constitutional amendment that would have required investor-owned utilities and cooperatives to obtain 50 percent of their power from renewable resources (a significant increase from the existing renewables requirement put into place in 2006, requiring 15 percent by 2025). Most reports indicate that the state's IOUs already have met their renewables mandate.

Backed by APS, the opposition to Proposition 127 argued that the initiative would drive up utility bills, cause reliability problems, and force APS to close Palo Verde, the nation's largest nuclear plant. Further, the utility's parent company Pinnacle West publicly characterized the initiative as a reckless attempt to force unrealistic California-style renewable energy goals on utility customers in a desert climate where reliable electricity for air conditioning is a necessity.

In response to the ballot measure and the prospect that it might pass, Gov. Ducey signed House Bill 2005 in March 2018, which was intended to mitigate the impact that passage of Proposition 127 might have on the state's IOUs and cooperatives.

The key provisions of HB 2005 include:

- Would fine electric utilities that violate the new renewable energy standards (had they passed under Proposition 127).
- Fines would be between $100 and $5000.
- While imposing a fine for non-compliance on the state's utilities, in practice HB 2005 would have made violating the initiative, which again failed at the ballot, a low-risk prospect for utilities in the state due to the low-level fines.

There are presently no other pieces of legislation that address energy storage under consideration by the Arizona Legislature.

1.5. Regulations

Similar to the absence of executive directives and legislative policy pertaining to energy storage, Arizona has also witnessed a lack of regulatory policy on energy storage as well. While there has been some discussion of energy modernization plans by individual commissioners on the ACC, a formally adopted decision related to energy storage in the state has not occurred as of yet.

For context, the ACC was created by the Arizona Constitution and has jurisdiction over public service corporations, including investor-owned utilities such as APS and TEP as well as electric cooperatives. The primary responsibility of the ACC is to set electric rates of the state's regulated utilities. In addition, prior court proceedings in the state ruled that the ACC also has authority to decide what mix of energy sources utilities in the state are required to use. As previously noted, SRP is not regulated by the ACC.

The ACC is comprised of five commissioners who are elected to their positions; Arizona is one of only 12 states that have elected public utility commissioners; the other 38 states have appointed public utility commissioners.

In 2010, the ACC issued an order related to energy efficiency that tangentially related to energy storage, the development of which would begin to accelerate both nationally and regionally at around the mid-point of the decade Docket No. RE-00000C-09-0427 (Decision # 71819) established a established a goal of a 22-percent reduction in energy consumption among regulated utilities by 2020.

The ACC has also encouraged the adoption of energy storage technologies through requirements placed directly on individual utilities. For example, distinct from a statewide procurement mandate, the ACC ordered APS to develop a $6 million residential demand response / load management program to facilitate residential energy storage.

By far the most vocal member of the ACC over the last decade has been Andy Tobin, who was appointed to the ACC in 2015. Tobin publicly stated that the "lack of clear energy policy [in Arizona] has resulted in each utility using their own strategies as the guiding principles in developing their own integrated resource plans," which in Tobin's and other commissioner's opinions continued to rely too heavily on natural gas. This sentiment was manifested in the ACC's rejection of IRPs from both APS and TEP.

Key regulatory initiatives in Arizona that occurred during the Tobin era at the ACC included:

E-00000V-15-0094 (March 2018)

- The ACC decision established that a load serving entity may not procure by purchase, acquisition, or construction a generating facility of natural gas energy of 150 MW of capacity or more.
- The order effectively barred APS and TEP from buying or constructing new gas-fired plants with generating capacities of 150 megawatts or more.
- The order was subsequently extended to August 1, 2019.
- The ban also does not apply to contracts the utilities sign to buy power gas plants owned by independent power producers.
- The order also required the utilities to submit detailed studies of alternative energy storage options and petition for approval before mounting plans for any new gas plants.

Simultaneous to the March 2018 Order, it became publicly known that Commissioner Tobin intended to release his own "Energy Modernization Plan" that would seek to completely overhaul the ACC and place new requirements on regulated utilities for renewables procurement and energy storage development. Specifically, Tobin's Plan included the following provisions:

- Require utilities to source 80 percent of their electricity from zero-emissions sources (namely, renewables and nuclear) by 2050, referred to as a "Clean Peak Standard."
- Require a collective deployment of 3,000 MW of energy storage by 2030.
- Direct the ACC to begin reforming the utility IRP process, pushing utilities to add more targeted analysis of clean energy into their generation plans.
- Direct utility regulators to devise a new energy efficiency program within 120 days to meet the goal of the new energy standard
- Direct utilities to propose electric vehicle (EV) charging programs for new and existing homes, commercial and industrial customers, and on major freeways.
- Direct the procurement of 60 MW of biomass energy to aid in Arizona's efforts to thin forest underbrush.

Commissioner Tobin's tenure on the ACC ended in March 2019 with Tobin's resignation amid accusations from his fellow commissioners of a "definite breach of ethical standards" due to inappropriate contact that Tobin reportedly had with APS during a pending rate case. The vacancy on the ACC created by Tobin's departure was filled by Governor Ducey's appointment of Lea Marquez Peterson, who will have to seek election for a four-year term in order to retain her position.

Since Tobin's departure from the ACC, we have not seen any significant, storage-specific dockets or decisions coming out of the ACC, with the exception of policies that appear to be emerging under the leadership of ACC Commissioner Sandra Kennedy, who has called for a regulatory order requiring that 50 percent of all energy generated by regulated utilities come from renewable resources by 2028. Unlike Tobin's Plan, Kennedy's Plan would not include nuclear energy as a renewable resource. Further, Kennedy's Plan directly calls for an increase in the carve out for distributed energy from the current requirement of 30 percent to an updated 50 percent of all renewable generation. It is unclear whether Commissioner Kennedy's Plan will advance.

Docket No. RU-00000A-07-0609 (2019)

- The proposed rules regarding interconnection requirements are intended to make the installation of grid-connected renewable-energy and battery systems easier and cheaper, the Arizona Corporation Commission has preliminarily approved a long-awaited set of rules governing how such off-grid power sources connect to state-regulated utilities.
- The proposed rules offer a streamlined "super fast track" process for approval of systems with a maximum rated generating capacity of 20 kilowatts or less, a fast-track process for systems of less than 2 megawatts and a longer "study track" process including in-depth facility studies for projects greater than 2MW.
- The rules also include measures to make sure distributed generating systems don't adversely affect reliability or system and worker safety.
- While Arizona is late compared to other states with regard to the adoption of statewide interconnection standards, the rules do have the benefit of having considered new technologies, including battery storage, and how they will interconnect to the grid in Arizona. .
- APS and TEP have been connecting customer-owned rooftop solar and wind systems for years, but have been doing so based on independent renewable energy compliance plans
- The proposed rules will set statewide standards for interconnection of such distributed generating systems and include provisions for emerging home battery storage systems.

Moreover, as 2019 comes to a close, the ACC also is entertaining the idea of re-introducing the concept of electric competition (or "deregulation") in the state of Arizona. The state had explored the concept of deregulation in the 2000s but discontinued those discussions in the wake of the California energy crisis that occurred in 2002. The resurrected concept of deregulation in Arizona would allow new suppliers to complete with existing utilities for the generation of power, giving end-use customers a choice in their power supplier. If it were to follow a common model, deregulation in Arizona would likely allow utilities to maintain power lines and responsibility for delivering power to end-use customers. However, the utilities would also likely be required to divest of any generations assets they own and would call into question whether the utilities in Arizona would be allowed to own storage assets.

1.6. Interconnection Rules

To Be Added

1.7. The Future of Energy Storage in Arizona

While Arizona continues to vet broader energy regulation issues (e.g., role of the ACC, increased renewables requirements, deregulation), the absence of energy storage policy in the Grand Canyon State persists. There are a number of issues pertaining to energy storage that the ACC (and potentially the Arizona Legislature) will need to consider as utilities in the state continue to pursue their own storage initiatives.

There are several opportunities for developing supportive state policies:

1. Finalize interconnection policies to ensure that storage can connect to the grid
2. Consider whether a energy procurement mandate is appropriate for the state, similar to what has been enacted in neighboring states.
3. Introduce proceedings to evaluate the value of energy storage and consider multiple use applications (MUAs) for storage that would include varying value levels.
4. Determine whether Arizona's generation sector will be deregulated and, if so, how deregulation will impact storage deployments currently being initiated by utilities and opportunities for utility ownership of storage assets.
5. Consider whether the inclusion of energy storage alternatives should be mandated in regulated utilities' integrated resource plans.
6. Re-evaluate and extend financial incentives provided to energy storage initiatives.
7. Determine if Arizona will join the California ISO or another RTO and how that might provide opportunities for energy storage procured or developed by the state's utilities can be used in wholesale transactions at the RTO level.

2. CALIFORNIA ENERGY STORAGE POLICY

2.1. Storage Policy Snapshot

Does California have an renewables mandate?	YES. 50 percent renewables by 2026 and 60 percent renewables by 2030
Does California have a state mandate or target for storage?	YES. 1,325 MW by 2020
Does California offer financial incentives for energy storage development?	YES
Does California have a policy for the strategic deployment of Non-Wires Alternatives or Distributed Energy Resources to defer, mitigate, or obviate need for certain T&D investments?	YES
Does California have a policy addressing multiple use applications for storage?	YES
Does California have a policy on utility ownership of storage assets?	YES
Does California allow or mandate the inclusion of energy storage in utility IRPs?	YES
Has California modified its permitting or interconnection requirements specific to energy storage?	YES
Does California allow customer-sited storage to be eligible for net metering compensation?	YES
Has California revised its rate structures to drive adoption of behind-the-meter storage	YES
Approximate development of storage capacity in California	Approximately 4.2 GW

2.2. Storage Policy Assessment

With its innovative and ambitious policies, California is a global leader in the development and application of energy storage technologies. For the last decade, the state has been a frontrunner in both the development of storage technologies and the legislative and regulatory policies that are needed to enable the growth of a storage marketplace.

It is clear that California has set the course for developing a clean energy future, a course that other states continue to monitor and, in several cases, mirror in their own policies. The specifics of California's clean-energy infrastructure are impressive. As of 2018, California has generated about 29 percent of its power from renewables. Another 9 percent came from nuclear and 15 percent from large hydropower (both of those count as carbon-free, but the last remaining nuclear plant in the state is slated to retire by 2025). Natural gas provided 34 percent of California's electricity. Further, since 2010, California has procured 1,514 MW of new energy storage capacity to support grid operations. Also in 2010, California became the first U.S. state to mandate energy storage procurement with targets imposed on the state's three investor-owned utilities (Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric, formalized by the California Public Utilities Commission (CPUC).

California recently upped the ante on its clean-energy goals, with its newly established goal to generate 60 percent of its generation from renewable resources. In addition, California has adopted a 100 percent carbon-free electricity by 2045.

Energy storage factors prominently into California's clean energy goals, and in fact some market observers have concluded that California's goals are not achievable without a significant amount of new storage capacity being developed over the next two decades. Policymakers in the state appear to agree on the critical role that storage will play going forward, and in 2018 through legislative and regulatory policy the state formally adopted a new energy storage target of 1,325 MW by 2020. This mandate is the outcome of California's conclusion that energy storage will continue to be a main ingredient in the mix of strategies the state is using to balance supply and demand, support the California Independent System Operator (CA ISO) in maintaining grid stability; avoid voltage and frequency imbalances; and support the state's transition to a renewables-centric energy infrastructure.

With approximately 4.2 GW of energy storage capacity already in development, California has a large amount of installations that can be analyzed and used to inform related policy decisions. California also has been a pioneer in testing and utilizing large-scale lithium-ion battery deployments as a swift response to compromised grid conditions, and is the location for prominent demonstrations intended to evaluate storage technologies for various grid-scale applications, including PG&E's use of batteries to replace gas-powered plants that are shutting down. Moreover, due to the sheer volume of California's energy storage development and the fact that it has wrestled with what will ultimately be critical storage policy issues for other states, it is no surprise that California has become the benchmark against which policies and market development for storage across the U.S. are being evaluated.

California has used a mix of executive directives, legislation, and regulatory decisions to define energy storage policy, and has relied upon coordinated efforts among the Legislature, CA CPUC, California Energy Commission (CEC), and the CA ISO The policy initiatives related to storage that have been developed by California policymakers over the last decade have been focused in three key areas:

- Requiring utilities to procure significant amounts of new energy storage resources;

- Developing robust incentives through the Smart Grid Inventive Program) that provides consumer rebates to enable storage development (totaling about $450 million in 2019); and
- Evaluating the value of energy storage through consideration of multiple use applications (MUAs) (i.e., storage's many contributions to grid stability and reliability).

Through these efforts, California has addressed a number of complex technology and policy factors including storage's role in a clean-energy environment, how a storage market should be designed, barriers that prevent storage's participation in both retail and wholesale markets, and the various ways in which storage can and should be used. Given that the state's legislators opted not to define specifics paths for storage development but rather deferred to regulators and market drivers, California has experienced somewhat of a "learning by doing" process as it pertains to developing its storage market. Accordingly, California's efforts provide many "lessons learned" for other states across the country, many of which have taken very few steps toward developing their own policies for storage. Key storage issues that California has addressed over the last decade include:

- Determining an appropriate amount to be included in a storage mandate;
- Defining a realistic and achievable timetable for storage procurement;
- Allowing flexibility in types of storage projects that will be considered;
- Providing financial incentives that are offered appropriately and fairly;
- Evaluating various ownership models for storage; and
- Determining the value for storage across a suite of MUAs

California has almost single-handedly jump-started the advanced storage industry by setting statewide mandates for renewables, storage and carbon-free electricity, but the state is still in the early stages of this rollout. That means utilities are still testing how storage works on the grid, and how it performs after several years of service, both of which are crucial to planning a grid that is all renewables

The challenges for the state to achieve its vision are significant. For example, according to a study prepared by the National Renewable Energy Laboratory (NREL), even with optimal grid improvements, California would still need an estimated 15 GW of additional storage just to reach 50 percent solar by 2030. That's more than 11 times the amount of storage mandated currently in California, and 66 times the total megawatts deployed in the U.S. last year. For now, though, California has solidified its leadership role in building the future paradigm for clean energy and the grid. If it succeeds, others will learn from it. If it falls short, that expensive experiment will be instructive, too.

2.3. Executive Directives

California's commitment to a renewables-centric, clean energy infrastructure has been in place for almost two decades, building upon the policies enacted by Governors Arnold Schwarzenegger (R) (2003-2011) and Jerry Brown Jr. (D) (2011-2019) who pushed California toward becoming a global leader in decarbonization. California's current Governor Gavin Newsom (D) (2019-) campaigned with a pledge to issue a directive to put California on a path toward 100 percent renewables. While Newsom has not enacted any executive orders along these lines as of August 2019, it is anticipated that California will continue with its aggressive clean-energy objectives, which include a prominent place for energy.

The explicit support for green energy by the state's executive leadership has set the foundation for the number of legislative and regulatory policies enacted in recent years that have defined energy storage's role in California. It is important to view executive directives within the context of legislation and regulations that have followed and understand the role that executive leadership has played in jump-starting the energy storage market in California.

For instance, On June 1, 2005, Governor Schwarzenegger signed Executive Order S-3-05[1] which established greenhouse gas emissions targets for the state. The executive order required California to reduce its greenhouse gas emissions levels to 2000 levels by 2010, to 1990 levels by 2020, and to a level 80 percent below 1990 levels by 2050. However, to implement this measure, the California Air Resources Board (CARB) needed authority from the legislature. Consequently, Gov. Schwarzenegger was instrumental in the passage of California's signature clean energy legislation known as the Global Warming Solutions Act (AB 32) in 2006, which required the state to dramatically cut is greenhouse gas emissions. AB 32 also gave the CARB authority to implement the program.

Governor Brown continued executive support for clean-energy initiatives in California through his own executive orders. In his inaugural address in 2015, Governor Brown increased the state's target for renewable energy from 33 percent by 2020 to 50 percent by 2030, which subsequently codified with the passage of SB 350.

On April 29, 2015, Governor Brown issued Executive Order B-30-15, which established a new greenhouse gas emissions reduction target for the year 2030Governor Brown issued Executive Order B-55-18 in September 2018, just before he left office, which established California's goal of achieving statewide carbon neutrality by 2045. Governor Brown also signed two bills representing California's landmark legislation on energy storage: 1) SB 100, which establishes the state's goal of achieving zero-emission electricity by 2045, with 60 percent renewables to be achieved by 2030; and 2) SB 700, which provided expanded funding for energy storage and other emerging clean energy technologies, resulting in a total investment of $1.2 billion for customer sited energy storage.

Furthermore, Both Governor Schwarzenegger and Governor Brown supported the expansion of the state's Self-Generation Incentive Program (SGIP) established in 2001. The SGIP has been California's way of encouraging residential installations of solar and energy storage systems.

2.4. Legislation

As a leader among states regarding energy storage policy development, California policymakers have driven the development of policy through the state legislature and public utility commission. As is often the case, legislation passed in California has established high-level objectives and goals for clean energy in general and energy storage, to then be implemented with more granular-level regulations created at the CPUC.

Goal-defining legislation passed in the state over the last decade has not only created the energy storage market in California but has also set defined important precedents that other states have referred to as they define their own storage markets. Taken as a whole, the suite of storage policy that has emerged out of legislation has positioned California as the most mature energy storage market in the U.S.

The key pieces of storage-focused legislation in California include:

- ***AB 2514 ("Energy Storage Systems")*** (2010)
    - AB 2514 was the first state law in the U.S. establishing a mandate for energy storage systems.
    - AB 2514 directed the CPUC to require California's investor-owned utilities to procure 1.3 GW of storage capacity by 2020, split among the transmission, distribution, and customer domains.
    - The targeted goal of 1.3 GW of storage was intended to be split evenly among the three investor-owned utilities.
    - The target is divided in sub targets related to storage at the transmission level, distribution level and at the end-user level, behind the meter. Targets are defined in power capacity (MW) without defining technology, ramp-up time, amount of energy (MWh) or duration. It is left to the market to determine what kind of energy storage is the most cost effective and adds the most value to the electricity system.
    - The legislation aims specifically at stimulating new types of energy storage for electricity such as compressed-air energy storage (CAES), battery-based energy storage, thermal energy storage, fuel cells and other technologies. It rules out large pumped hydro storage.
    - AB 2514 also mandated the inclusion of storage technology considerations in each of the IOU's long-term Integrated Resource Planning (IRP).
    - AB 2514 mandated that utilities cannot own more than 50 percent of the storage projects they propose
    - According to AB 2514, an energy storage system must be "cost-effective and either reduce emissions of greenhouse gases; reduce demand for peak electrical generation; defer or substitute for an investment in generation, transmission, or distribution assets; or improve the reliable operation of the electrical transmission or distribution grid." In addition, the law requires the satisfaction of at least one of the following:
        - Use mechanical, chemical, or thermal processes to store energy that was generated at one time for use at a later time;
        - Store thermal energy for direct use for heating or cooling at a later time in a manner that avoids the need to use electricity at a later time;
        - Use mechanical, chemical, or thermal processes to store energy generated from renewable resources for use at a later time;
        - Use mechanical, chemical, or thermal processes to store energy generated from mechanical processes that would otherwise be wasted for delivery at a later time.
    - Public utilities are required to purchase a targeted energy storage capacity equivalent to 1 percent of peak load by 2020. These are essentially voluntary storage targets that must be reviewed every three years.
    - For investor-owned utilities the legislation requires the CPUC to set targets for the procurement of 'viable and cost-effective energy storage systems'. The IOUs

    received storage procurement targets based on their size. The IOUs are responsible for selecting and financing storage projects (as approved by the CPUC)
  - AB2514, through which utilities are mandated to procure over 1.3GW of behind-the-meter storage by the early 2020s and the addition of energy storage into utilities' long-term Integrated Resource Planning (IRP).

- ***SB 350 ("The Clean Energy and Pollution Reduction Act")*** *(October* 2015)
  - SB 350 established the requirement that retail sellers and publicly owned utilities must procure 50 percent of their electricity from eligible renewable energy resources by 2030.
  - SB 350 increased the state's Renewable Portfolio Standard to 50 percent by 2030 and specifies storage as a means to help achieve the state's goals.
  - The law established clean energy, clean air, and greenhouse gas (GHG) reduction goals, including reducing GHG to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050.
  - SB 350 also requires the state to double statewide energy efficiency savings in electricity and natural gas end uses by 2030. To help meet these goals and reduce greenhouse gas (GHG) emissions, large utilities will be required to develop and submit integrated resource plans (IRPs). These plans detail how utilities will meet their customers' resource needs, reduce GHG emissions, and ramp up the use of clean energy resources.
- ***AB 338 ("Integrated Resource Plan; Peak Demand")*** (2017)
  - Signed in October 2017 by Gov. Jerry Brown, it required the California utilities to rely on energy efficiency, demand management, energy storage, and other strategies to meet peak electricity needs.
  - AB 338 requires the CPUC and the governing boards of local publicly owned electric utilities to consider, as a part of the integrated resource plan process, the role of distributed energy resources and other specified energy- and efficiency-related tools, in helping to ensure that each load-serving entity or local publicly owned electric utility, as applicable, meets energy needs and reliability needs while reducing the need for new electricity generation and new transmission in achieving the state's energy goals at the least cost to ratepayers.
- ***AB 2868 ("California's Additional 500 MW Energy Storage Procurement Requirement")*** (2016)
  - Under AB 2868, California legislators added a new storage target that calls for 500 MW of behind-the-meter storage, or 166.6 MW for each IOU.
  - AB 2868 required PG&E, SCE, and SDG&E to propose programs and investments for up to 500 MW of distributed energy storage systems (defined as distribution-connected or behind-the-meter energy storage resources with a useful life of at least 10 years).
  - Transmission-connected storage resources are not included in the 500 MW target, to further emphasize the call for the development of distribution-connected storage resources.
  - The CPUC has emphasized that the 500 MW of storage required under AB 2868 in 2016 is separate from, and does not raise the targets set by, AB 2514. But in

practice it will result in another 500 MW of storage being deployed by the three IOUs.

- ***AB 33 ("Energy Storage Systems; Long Duration Bulk Energy Storage Resources")** (2016)*
    - Directed the CPUC to consider large-scale storage, specifically pumped hydro to "assess the potential costs and benefits of all types of long duration bulk energy storage resources, including impacts to the transmission and distribution systems of location-specific long duration bulk energy storage resources."
    - Required the CPUC to determine the role of large scale energy storage as part of the state's overall strategy to procure a diverse portfolio of resources.
    - The law developed in response to the CA ISO's call for fast-ramping, flexible resources to balance the grid and mitigate the potential impacts of over-generation from renewables.
    - Declared the legislature's wish that the CPUC give particular consideration to long-duration storage for the grid, in recognition that to date storage installations have largely been dominated by lithium-ion batteries, which work better for short-term use.
- ***AB 1637 ("Energy: Greenhouse Gas Reductions**") (2016)*
    - Authorized the CPUC to double the budget for the Self-Generation Incentive Program through 2019
    - This legislation reportedly added $249 million to the funding that is available to small-scale distributed energy resources, including storage.
- ***AB 2861 ("Distribution Grid Interconnection Dispute Resolution Process")** (2016)*
    - Authorized the CPUC to create an objective, expedited dispute-resolution process for distributed, behind-the-meter energy resources attempting to establish an interconnection to an IOU's electricity distribution network.
    - The resolution panel is to be staffed by electrical systems experts.
    - The responsibility of the panel is to evaluate a disputed interconnection fee, gathering input from both sides and ruling on the case within 60 days.
    - The law sets a goal of resolving disputes within 60 days, and would require the commission to appoint a "qualified electrical systems engineer with substantial interconnection expertise to advise the director of the energy division and to provide adequate commission staff to assist in resolving interconnection disputes."
- ***AB 546 ("Local Ordinances; Energy Systems")*** (September 2017)
    - Requires all local governments to make available online all permitting applications for BTM advanced storage systems, and to accept such applications electronically. The law is meant to reduce the burden and costs on residential customers and prompt greater deployment of customer-sited energy storage systems.
- ***SB 801 (Aliso Canyon natural gas storage facility: electrical grid data: electricity demand reduction and response: energy storage solutions)*** (October 2017).
    - Requires the local publicly owned electric utility that provides electric service to 250,000 or more customers within the Los Angeles basin (i.e., LADWP) to do three things:

- ▪ LADWP must share electrical grid data with any persons interested in the greater deployment of DERs;
  - ▪ LADWP must undertake load reduction measures by favoring demand response, renewable energy resources, and energy efficiency strategies over simply meeting demand with increased gas-fired generation; and
  - ▪ LADWP must determine the cost-effectiveness and feasibility of deploying 100 MW of energy storage in the Los Angeles Basis. SB 801 also requires any private utility serving the Los Angeles Basis (e.g., SCE) to deploy at least 20 MW of energy storage "to the extent that doing so is cost-effective and feasible and necessary to meet reliability requirements."

- ***SB 100 ("California Renewables Portfolio Standard Program") (2018):***
  - o Mandates 100 percent zero-emission electricity by 2045, with 60 percent renewables to be achieved by 2030.
  - o Positions California as the largest U.S. state to set such an aggressive zero-emission electricity target
  - o The law is viewed as an update to **SB 350**, which had established the requirement that retail sellers and publicly owned utilities must procure 50 percent of their electricity from eligible renewable energy resources by 2030.
  - o SB 100 is not the first legislation requiring a reduction in overall greenhouse gas emissions; what makes this legislation different is that aims to eliminate greenhouse gas emissions entirely in the state.
  - o This legislation positioned California as the second state to make a 100-percent clean energy commitment after Hawaii, which made that commitment in 2015.
- ***SB 700 ("Self Generation Incentive Program")*** (2018)
  - o Extends and continues to fund the state's Self Generation Incentive Program (SGIP), extending rebates for customers who install behind-the-meter storage solutions through 2026.
  - o Supplies roughly $166 million per year in incentives for qualifying behind-the-meter technologies, or $830 million total.
  - o Available data indicates that the SGIP has contributed to about 318 MW of behind-the-meter energy storage procured in California.
- ***SB 1369 (Energy: Green Electrolytic Hydrogen***) (2018)
  - o Positions green electrolytic hydrogen, as defined, as one of these energy storage technologies to be targeted for increased use.
  - o Requires the CPUC, State Air Resources Board, and the California Energy Commission to consider green electrolytic hydrogen an eligible form of energy storage, and to consider other potential uses of green electrolytic hydrogen

Pending Legislation

- ***AB 1144*** (passed the Assembly on April 25, 2019; currently in Senate):
  - o Would require the CPUC to allocate 10 percent of the annual collection for the self-generation incentive program in 2020 for community energy storage and other distributed energy resources for customers that provide critical infrastructure to communities in high fire threat districts to support resiliency during a de-energizing event.

- ***AB 1503*** (introduced in the Assembly April 12, 2019; currently in Senate):
    - Would require the CPUC beginning in 2022 to show how distributed energy and microgrids create jobs in its annual report to the Governor and Legislature on recommendations and plans for a smart grid.

- ***SB 1347*** *(introduced in the Senate; currently in the Assembly)*
    - Would require the PUC, direct electrical corporations, community choice aggregators, electric service providers and certain electrical cooperatives to procure their proportionate share of a total of 2,000 MW of energy storage systems by Jan. 1, 2020.
    - Would authorize electric utilities to own and operate a certain percentage of those energy storage systems. The bill would require the CPUC to develop and make available to all load-serving entities a cost recovery mechanism for energy storage investments.

- ***SB 772*** *(introduced in the Senate in February 2019)*
    - Would require the ISO to initiate a competitive solicitation process for 2-4 GW of long-duration bulk energy storage by June 30, 2022.
    - To be eligible, a storage project must have at least 400 MW of capacity, an eight-hour minimum discharge capability, and a useful life of at least 40 years.
    - The competitive solicitation process would provide for cost recovery from load-serving entities within the CA ISO territory.

2.5. Regulations

The CPUC regulates investor-owned electric and natural gas utilities operating in California. Among its many responsibilities, the CPUC oversees energy related functions such as determine electric costs; electric power procurement and generation; infrastructure; customer energy resources; energy efficiency; and electric rates and tariffs. Through its oversight over utilities, the CPUC has played a key role in developing the energy storage market in the state and issuing precedent-setting rules that other states have increasingly referred to as the presence of energy storage accelerates in various markets.

Here is a list of the most significant regulatory proceedings in California pertaining to energy storage that have transpired over the last decade, including key provisions
:

R.10-12-007 (implementation of SB 2514) (opened in December 2010)

- SB 2514, signed into law in September 2010, required the CPUC to open a proceeding to determine appropriate utility procurement targets, if any, for energy storage systems that are commercially available and cost-effective. In response, the CPUC opened rulemaking R.10-12-007 on December 19, 2010.
- The high-level purpose of R.10-12-007 was to set policy for California utilities and load-serving entities (LSEs) to consider the procurement of viable and cost-effective energy storage systems and consider the appropriate utility procurement targets.
- R-10-12-007 consisted of several phases of workshops, modeling of energy systems, staff reports, proposed decisions, and stakeholder input.

- The process of establishing the procurement targets took the commission about three years. During this time, the CPUC held a series of workshops to evaluate cost and benefits of energy storage, use cases, modeling of energy systems, and procurement options.
- On October 17, 2013 meeting, the CPUC formally adopted a 1,325 MW procurement target for energy storage by 2020, with biannual targets increasing every two years from 2016-2020.
    - The targets were broken up by "use case buckets" (transmission-connected, distribution-connected, and behind-the-meter) and by each of California's three IOUs
    - The CPUC established an energy storage target of 1,325 MW for PG&E, Edison, and SDG&E by 2020, with installations required no later than the end of 2024.
    - According to the CPUC the reasons for the energy storage mandate:
        - Increase energy storage at the grid level will optimize the grid, including peak reduction, contribution to reliability needs, or deferment of transmission and distribution upgrade investments
        - Integrate renewable energy
        - Reduction of greenhouse gas emissions to 80 percent below 1990 levels by 2050, per California's goals
    - The CPUC also reinforced important characteristics of the targets:
        - The targets were defined in power capacity (MW) without defining any specific technology, ramp-up time, amount of energy (MWh), or expected duration.
        - The legislation from which the targets were mandated aimed to stimulate new types of energy storage such as compressed air energy storage (CAES), battery-based energy storage, thermal energy storage, fuel cells and other technologies.
        - Large pumped hydro storage was not included.
        - The mandate specified that utilities cannot own more than 50 percent of the storage projects they propose.
    - To foster emerging technologies (such as thermal or flywheel storage), smaller scale projects and disruptive suppliers, hydroelectric storage projects larger than 50 MW are not eligible under the CPUC's mandate.
- In this rulemaking, the CPUC determined that appropriate interconnection policies are one of the major barriers toward the deployment of storage.

D.13-10-040 (October 2013)

- The decision established:
    - Storage targets for each of the investor-owned utilities and Electric Service Providers (ESPs)/Community Choice Aggregators
    - Mechanisms to procure storage and means to adjust targets for storage procurements in various grid domains (Transmission, Distribution and Customer-sited); and
    - Program evaluation criteria.

- D.13-10-040 set procurement targets for 2014 to 2020, adopted the Energy Storage Procurement Framework and Design Program, and directed the state's three IOUs to file four biennial storage procurement applications starting in March 2014.
- D.10-13-040 required IOUs to provide proposed procurement details, including Power Purchase Agreements (PPAs), bid evaluation protocols, request for cost-recovery authorizations, and to report on storage procurement to date.
- D.13-10-040 also directed that a comprehensive evaluation of the Energy Storage Framework and Design Program be conducted no later than 2016 and once every three years thereafter.
- With the issuance of this Decision, R.10-12-007 was closed.

D.14-10-045

In this decision, the CPUC:

- Evaluated and approved the utilities' energy storage procurement plans for the 2014 biennial period, with some modifications.
- Approved eligible energy storage technologies and approved the Power Charge Indifference Adjustment (PCIA) mechanism to allow recovery of potential above-market costs associated with departing load for market/"bundled" energy storage projects.
- In compliance with Decision D.13-10-040, this decision approved the three IOUs' Energy Storage Framework and Program Applications for the 2014-2016 Biennial Procurement Period with some important modifications as follows:
    - Approved proposed energy storage procurement proposals of SDG&E (16 MW), SCE (16.3 MW), and modified the storage proposal of PG&E to 80.5 MW;
    - Clarified "eligible" technologies *including* V2G electric vehicle technologies, eligible storage component of biogas, eligible storage component of solar thermal (CSP-TES), eligible storage component of hybrid thermal generation (Hybrid-TES), but *excluding* V1G and biogas (without eligible storage component);
    - Denied request for extension of the PCIA mechanism for market/"bundled" energy storage contracts beyond 10 years;
    - Directed SCE and PG&E to provide a more detailed explanation of the type of storage resources and the associated MW quantities the IOU intends to procure, categorized by grid domains, use cases, and locations.

R.15-03-011 (implementation of AB 2868) (opened in March 2015)

- This proceeding, opened as a result of AB 2514, was intended to refine and evaluate California's energy storage framework and policies. The proceeding was broken into two tracks.
    - Track One (now complete) focused on issues that would impact 2016 procurement such as new technologies, flexibility between grid domains, and cost recovery.
    - Track Two focused on refining the CPUC's storage framework and policy.
- A key component of this rulemaking was that the CPUC approved rules for energy storage resources that can provide multiple services in January 2018.
- The CPUC reasoned that since contemporary market rules fail to compensate energy storage resources for all of the values that they could provide to the grid, utilities must account for

those uncompensated values in their planning to ensure that the full economic value of energy storage is reflected in resource decisions.

- Prior CPUC rules did not allow an energy resource to “stack” more than one service, which mean that a resource could not be paid for the incremental values it brought to the wholesale market, distribution grid, transmission system, resource adequacy, or end-use customers.
- Under the rulemaking, energy storage resources can now provide services to either the domain in which they are interconnected or “higher” domains (but not “lower” domains). For example, an energy storage resource interconnected at the distribution level could also provide services at the higher transmission, wholesale market, and resource adequacy levels, but not at the lower customer level. The rules prioritize reliability services over non-reliability services and seek to ensure that multiple reliability service obligations do not conflict with one another. The rules also aim to enhance transparency and avoid double compensation.
- Recognizing the unique operating characteristics of energy storage (e.g., it can serve as both load or supply), the CPUC adopted 11 rules outlining how multiple use applications (MUAs) should be evaluated, enabling the resources to stack incremental value and revenue streams through the delivery of multiple services.
- The CPUC’s 11 rules pertaining to MUAs for storage are:
    1. Resources interconnected in the customer domain may provide services in any domain.
    2. Resources interconnected in the distribution domain may provide services in all domains except the customer domain, with the possible exception of community storage resources.
    3. Resources interconnected in the transmission domain may provide services in all domains except the customer or distribution domains.
    4. Resources interconnected in any grid domain may provide resource adequacy, transmission and wholesale market services.
    5. If one of the services provided by a storage resource is a reliability service, then that service must have priority.
    6. Priority means that a single storage resource must not enter into two or more reliability service obligation(s) such that the performance of one obligation renders the resource from being unable to perform the other obligation(s). New agreements for such obligations, including contracts and tariffs, must specify terms to ensure resource availability, which may include, but should not be limited to, financial penalties.
    7. If using different portions of capacity to perform services, storage providers must clearly demonstrate, when contracting for services, the total capacity of the resource, with a guarantee that a certain, distinct capacity be dedicated and available to the capacity-differentiated reliability services.
    8. For each service, the program rules, contract or tariff relevant to the domain in which the service is provided, must specify enforcement of these rules, including any penalties for non-performance.
    9. In response to a utility request for offer, the storage provider is required to list any additional services it currently provides outside of the solicitation. In the event that a

storage resource is enlisted to provide additional services at a later date, the storage provider is required to provide an updated list of all services provided by that resource to the entities that receive service from that resource. The intent of this Rule is to provide transparency in the energy storage market.

10. For all services, the storage resource must comply with availability and performance requirements specified in its contract with the relevant authority.
11. In paying for performance of services, compensation and credit may only be permitted for those services which are incremental and distinct. Services provided must be measurable, and the same service only counted and compensated once to avoid double compensation.

- Also in this rulemaking, the CPUC ordered the IOUs to incorporate proposals for programs and investments for the full 500 MW of distributed energy storage systems (166.66 MW for each of PG&E, SCE, and SDG&E)
- This proceeding was a successor of R. 10-12-007

D.19-01-03: (2018)

- Allows customers with energy storage systems to receive credits for storage energy that is sent back to the grid, as long as the storage system charges entirely from solar.
- In the past, customers were only allowed to receive credits from the excess energy produced by a solar system exported to the grid, but now, with some stipulations, energy exports from a battery with receive full NEM credit.

D.14-05-033 (2019)

- On January 31, 2019, the CPUC issued a final decision granting a petition to modify Decision 14-05-033, which governs net metering in California.
- The modification allows certain DC-coupled energy storage systems that adopt UL-verified firmware to benefit from net energy metering (NEM).
- In practice, this means that going forward in California, solar-plus-storage asset owners can export battery power onto the grid and receive NEM credits on all solar and storage exports, including those with aggregate (NEM-A) and virtual (NEM-V) tariffs.
- Before the January 2019 decision, DC-coupled solar-plus-storage projects installed behind-the-meter could not be interconnected under NEM, out of a concern formally expressed by the state's utilities that solar-plus-storage owners would charge their batteries from the electric grid at an inexpensive nighttime rate and later profit by selling the stored grid power back to the utility at higher NEM daytime rates.

Other relevant regulatory proceedings pertaining to energy storage policy that have been conducted at the CPUC include:

- ***D.17-04-017:*** Approved 85 percent of funds authorized by AB 1637 (another $196 million) to be made available in the Self-Generation Incentive Program (SGIP) for commercial, industrial, and residential behind-the-meter energy storage systems.

- ***D.16-06-055***: Approved a 75 percent budget allocation for storage in the Self-Generation Incentive Program, along with other reforms including changes to support long-duration storage.
- ***D.16-06-052:*** Improved treatment of behind-the-meter energy storage load in Rule 21 and an expedited review process for standardized non-export storage
- ***D.12-08-016:*** Adopted proposed targets and framework for analyzing energy storage needs pursuant to AB 2514
- ***D.11-09-015:*** Modified SGIP eligibility to include energy storage technologies

Revisions to Rule 21

Another regulatory initiative in California that had direct implications for energy storage were the changes that the CPUC made to Rule 21, the tariff that describes the interconnection, operating and metering requirements for certain generating and storage facilities seeking to connect to the electric distribution[1] system.

For background, Rule 21 describes the interconnection, operating and metering requirements for generation facilities to be connected to a utility's distribution system, over which the CPUC has jurisdiction. This jurisdiction includes the interconnection of all net energy metering (NEM) facilities, "Non-Export"[2] facilities, and qualifying facilities intending to sell power at avoided cost to the host utility.

Rule 21 does not apply to the interconnection of generating or storage facilities intending to participate in wholesale markets overseen by the Federal Energy Regulatory Commission (FERC). Each of California's large investor owned utilities (IOUs) has its own Rule 21 tariff as part of its electric rules; however, they are largely equal in content.
Rule 21 contains provisions governing many aspects of interconnection, including:

- Procedures and timeframes for reviewing applications
- Fee schedules to process applications and perform impact studies
- Pro forma application and agreement forms
- Allocation of interconnection costs
- Provisions specific to net energy metered facilities
- Technical operating parameters
- Certification and testing criteria
- Technical requirements for inverters
- Metering and monitoring requirements
- Procedures for dispute resolution

3. MASSACHUSETTS ENERGY STORAGE POLICY

3.1. Storage Policy Snapshot

Does Massachusetts have a renewables mandate?	YES. The current RPS is 13 percent but new legislation increases the standard by 2 percent a year beginning 1/1/2020. On 1/1/2030, the yearly increase will be reduced back to 1 percent unless further legislation revises this plan. By 2030, the RPS in Massachusetts is anticipated to be about 35 percent.
Does Massachusetts have a state mandate or target for storage?	YES 1,000 MWh by 2025
Does Massachusetts offer financial incentives for energy storage development?	YES
Does Massachusetts have a policy addressing multiple use applications for storage?	NO
Does Massachusetts have a policy that allows utility ownership of storage assets?	YES
Does Massachusetts allow or mandate the inclusion of energy storage in utility IRPs?	NO
Has Massachusetts modified its permitting or interconnection requirements specific to energy storage?	NO
Does Massachusetts allow customer-sited storage to be eligible for net metering compensation?	YES
Has Massachusetts revised its rate structures to drive adoption of behind-the-meter storage	UNCLEAR
Approximate development of storage capacity in Massachusetts	Including projects that are in a queue for state incentive funding and projects that are already operating, Massachusetts has approximately 190 MW of energy storage capacity

3.2. Storage Policy Assessment

Massachusetts is among a handful of U.S. states that is currently on the forefront of establishing energy storage policies through legislation and regulatory directives. Like California, Hawaii, and

New York, Massachusetts has created policy on critical energy storage issues that now serve as reference points and/or precedents for developing storage policy in other states. In fact, Massachusetts has been a front-runner in developing energy storage policy since 2015 with the creation of an Energy Storage Initiative (ESI) for the Commonwealth, which included comprehensive studies about the capabilities of energy storage, funding for storage demonstration projects, and the Commonwealth's authorization to establish a statewide energy storage target.

Some of the unique decisions that have framed Massachusetts' precedent-setting energy storage policy include:

- Massachusetts is one of the first states to provide comprehensive guidance focused on parting energy storage with solar panels;
- Massachusetts became the first state to allow behind-the-meter (BTM) energy storage to qualify for energy efficiency incentives;
- Massachusetts was one of the first states to adopt a target for storage and has ratcheted up the target to its current level of 1,000 MWh by 2025;
- Massachusetts includes storage as an eligible resource for the state's solar incentive program, the Solar Massachusetts Renewable Target (SMART); and
- Along with the SMART program, Massachusetts has several incentive funding mechanisms that are aimed at unlocking the full potential of energy storage, either as a stand-alone resource or as a hybrid resource with renewables (e.g., solar + storage).

With regard to incentive funding, Massachusetts has awarded approximately $20 million in grants to 26 energy storage projects, doubling the state's original $10 million commitment. The grants were awarded under the state's Advancing Commonwealth Energy Storage (ACES) program that is part of the ESI funded by the Massachusetts Department of Energy Resources (MA DOER).

Massachusetts is part of the New England Independent System Operator (ISO-NE), which over the last several years has experienced a number of challenges including the retirement of traditional power plants, diminished capacity of available resource<s and restrictions against building new transmission lines that would enable the development of power-generating resources. Energy factor factors prominently into the region's efforts to address these challenges at the wholesale level. To date, energy storage in Massachusetts has been primarily limited to pumped hydro storage in Northwest Massachusetts that is provided as bulk energy to the ISO-NE. State-level incentive offerings are intended to spur storage deployment and enable broader opportunities for storage to participate in residential, commercial, and wholesale energy markets.

3.3. Executive Directives

Support for energy storage in Massachusetts has been clearly articulated by the Commonwealth's governor and executive state agencies. Again, Massachusetts has earned its place as a state that has taken the lead on developing energy storage policy.

The Energy Storage Initiative

In May 2015, Governor Charlie Baker (R) introduced a conceptual Energy Storage Initiative (ESI) in Massachusetts to incentivize energy storage companies to do business in the state, accelerate early-stage commercial energy storage technologies, expand the market for these technologies, and develop policy recommendations to advance these goals. In response to the governor's directive, the Massachusetts Department of Energy Resources (MA DOER) and the Massachusetts Clean Energy Center (MA CEC) officially launched the ESI in 2015, which included a comprehensive study and funding for demonstration projects, to analyze opportunities to deploy electric energy storage on the Massachusetts grid and support the growth of storage companies in the Commonwealth.

The stated goals of the ESI include:

- Attracting, supporting and promoting storage companies in Massachusetts;
- Accelerating the development of early commercial storage technologies;
- Expanding markets for storage technologies, and valuing storage benefits to clean energy integration, grid reliability, system wide efficiency, and peak demand reduction; and
- Recommending and developing policies, regulations and programs that help achieve those objectives.

The SMART Incentive Program

- The MA DOER created the Solar Massachusetts Renewable Target (SMART) Program in 2017 to create a long-term sustainable solar incentive program that promotes cost-effective solar development in the Commonwealth.
- The SMART program has been called the first in the nation to offer incentives to solar projects that are paired with storage.
- The SMART program will provide payments to residential solar users based on a fixed rate per kilowatt-hour (kWh).
- The SMART incentive pays solar customers for each kilowatt-hour produced and adds a premium for storage-paired production
- The SMART interconnection queue already includes more than 130 megawatts of storage.

The ACES Program

- In 2017, DOER and the MA CEC teamed up to launch the Advancing Commonwealth Energy Storage (ACES) initiative, the goal of the program is to identify valuable, replicable combinations of value streams to drive further energy storage deployment in the state.
- Through the ACES Program, Massachusetts has provided $20 million in grants to about 25 energy storage projects that test various, multi-use business cases for energy storage.
- ACES projects encompass a wide range of use cases, from merchant solar-plus-storage and utility dispatched residential storage to resiliency/microgrids and transit applications.
- The technologies, while mostly calling for lithium-ion batteries, also include a flywheel, a vanadium redox flow battery and a zinc iron flow battery.
- In all, the ACES projects represent 32 MW and 85 MWh of energy storage capacity, of which 16 MW and 45 MWh are within electric distribution company territory. At year end, Massachusetts had 4 MW and 7 MWh of advanced energy storage installed.

3.4. Legislation

Like other states that are leading the energy storage policy development effort, the Massachusetts Legislature has been a primary vehicle for defining high-level goals and guidelines.

***H. 4568 ("An Act Relative to Energy Diversity")* (August 2016)**

- The primary purpose of H. 4568 was to require utilities to competitively solicit and contract for approximately 1,200 MW of clean energy generation.
- Specific to storage, H 4568 directed the MA DOER to set a storage target for 2020 if deemed to be necessary.
- Established that any procurement target established by the MA DOER would need to be adopted by July 2017, and then electric companies would have to comply by the start of 2020. The law established that any storage targets established by the MA DOER would need to be re-evaluated no less than every three years.
- To qualify as energy storage, a system must reduce greenhouse gas emissions, cut demand for peak electrical generation, avoid new investment in generation, transmission or distribution assets, or improve the reliability of the grid.
- Significantly, the legislation also specified that electric distribution companies may own energy storage, which represented a significant policy change as previously storage had been defined more narrowly as generation for the purpose of bidding into wholesale markets. This previous definition thus prohibited distribution companies from owning storage in Massachusetts' deregulated power market, where generation and distribution companies must be separate.
- Distribution companies in the state were successful in getting the prohibition against utility ownership of storage removed based on the argument that they would have to pay for T&D system upgrades, and thus they have an interest in procuring storage to defer more expensive infrastructure updates. The new law would allow them to install and own storage directly, simplifying the process.
- Following extensive public input, the MA DOER concluded that Massachusetts should set targets for energy storage systems, and an initial storage targeted was established (1,000 MWh by 2025)

H. 4857 ("An Act to Advance Clean Energy") (August 2018)

- Established an increased energy storage deployment target for utility, third-party, and customer-owned systems of 1,000 MWh of by 2025. The law also empowered the MA DOER to consider a variety of policies to help achieve this target.
- Expanded Massachusetts' **Renewable Portfolio Standard** by increasing the annual RPS growth rate from the previous 1 percent annually to 2 percent from 2020 to 2029, dropping back down to 1 percent thereafter.
- The law created the Clean Peak Standard for the state (the first of its kind in the nation), which requires retail suppliers to provide a minimum percentage of retail sales during seasonal peak periods from eligible renewable, energy storage, and demand response resources.

  - The legislation defines a clean peak resource as "a qualified RPS resource, a qualified energy storage system or a demand response resource that generates, dispatches or discharges energy to the electric distribution system during seasonal peak periods, or alternatively, reduces load on said system."
  - The MA DOER was charged with setting the baseline for compliance and promulgating regulations to implement the new program.
- Established that distribution companies are allowed to consider and solicit for non-wire alternatives for the resiliency of their distribution systems;
- Requires the MA DOER to study the feasibility of mobile battery storage systems.
- H. 4857 also established policy for solar, offshore wind, grid modernization & resiliency, and energy efficiency, all of which are closely related to storage policy.
  - **Solar**– Addresses the unfair and inefficient mandatory residential demand charge approved in Eversource's recent rate case, requiring Eversource to refile with the Department of Public Utilities (DPU) a modified Monthly Minimum Reliability Contribution (MMRC) proposal to meet new criteria that protect customers.
  - **Offshore Wind**— Allows the DOER, after studying needs, benefits, and costs, to conduct additional offshore wind procurements of up to 1,600 additional MW by 2035 (doubling the original 1,600 MW authorization enacted in 2016).
  - **Grid Modernization & Resiliency** – Requires utilities to file annual resiliency reports with the DPU and authorizes the utilities to hold competitive solicitations for non-wires alternatives to distribution grid investments from third party developers. These project proposals will be evaluated for their ability to reduce greenhouse gas emissions, replace aging infrastructure, and provide benefits to stressed, congested, or severe weather-prone areas of the electric grid.
  - **Energy Efficiency** – Promotes energy efficiency by enabling more advanced technologies, such as renewable resources, energy storage, strategic electrification, and other clean energy technologies to qualify under Massachusetts' energy efficiency programs. Also requires cost-effectiveness evaluation to be conducted at the sector level (e.g., "commercial retrofits") rather than measure level, and allows for the consideration of other benefits beyond "system benefits."

Pending Legislation

As of August 2019, pending legislation in Massachusetts Legislature could result in a 100-percent renewables goal for the state.

- **S 2545** (2019) ("An Act to Promote a Clean Energy Future") (approved by the Senate in June 2019), still under review in the House: This bill would increase existing Renewable Portfolio Standard requirements in Massachusetts from a current level of 13 percent n 2018 to procuring 49 percent of their electricity from renewables in 2030, 79 percent in 2040 and 100 percent in 2047. If SB 2545 is passed by the Massachusetts House and signed by the governor, Massachusetts would join Hawaii as the only U.S. states with 100 percent renewable energy targets.

H 4318 (March 2018): Gov Baker proposed this legislation that encourages electricity and natural gas distribution companies to consider energy storage as part of their join electric and natural gas efficiency plans. H 4318 does not propose to require that the LDCs include energy storage in their analyses, instead suggesting that the LDCs include energy storage as part of their efficiency and load management programs. The bill remains pending in the Massachusetts House of Representatives.

3.5. Regulations

Along with the legislative activity summarized above, regulatory policy set at the Massachusetts Department of Public Utilities also has created precedent-setting policy for energy storage in Massachusetts.

D.P.U. 17-146: Energy Storage Paired with Net Metering Facilities; Net Metering Participation in the Forward Capacity Market

On October 3, 2017, the Massachusetts DPU opened the docket D.P.U. 17-146 to investigate two issues: whether energy storage systems paired with net metering facilities are eligible for net metering and what should be done to clarify the rights of net metering facilities to participate in the Forward Capacity Market ("FCM"), in which a regional grid manager (ISO New England in this case) pay electricity generation resources simply for staying available, even if they happen not to be used.

- These two issues have been under investigation for a number of years in Massachusetts, stemming from filings made by storage market participants seeking clarity on state and wholesale market policies. Consider the following:
    - In June 2015, SolarCity filed a petition for an advisory ruling on whether a project that combined solar generation and energy storage was eligible to net meter as a Class II net metering facility. SolarCity resolved the issue underlying its petition outside of the DPU process and withdrew its petition before further proceedings took place.
    - National Grid proposed ratemaking treatment for the costs and proceeds associated with bidding the capacity of net metering facilities into the FCM.
    - In July 2016, Genbright petitioned the DPU for a declaratory order regarding net metering facilities' rights to participate in the FCM and for clarification on the applicability of net metering regulations to energy storage projects.
    - In May 2019 In May of this year, Tesla filed a petition for declaratory relief and an advisory ruling with respect to the eligibility of energy storage and solar facilities to net meter where (1) the solar net metering facility has a capacity of less than 60kW, (2) the battery storage charges only from the solar net metering facility, and (3) the battery storage does not export power to the grid. The DPU issued a narrow ruling specific to Tesla only, that such facilities "should be eligible to net meter," but reserved broader policy issues for this new docket.
- On February 1, 2019, the Massachusetts DPU issued two orders within the context of D.P.U. 17-146:
    - *D.P.U. 17-146 (A)*

- The order defined "energy storage system" for net metering purposes ('ESS') as: a commercially available technology that is capable of absorbing energy, storing it for a period of time and thereafter dispatching electricity; provided, however, that an energy storage system shall not be any technology with the ability to produce or generate energy."
- The order also allowed net metering facilities to be paired with ESS but limited the permissible configurations. It allowed configurations in which:
  - The energy storage system (ESS) is charged only from the net metering facility and cannot export to the electrical grid;
  - The ESS is charged only from the net metering facility but is programmed to allow exports to the electrical grid; and
  - The ESS is charged from both the net metering facility and the electrical grid, but cannot export to the electrical grid.
  - The Department did not allow configurations where the ESS is unrestricted as to charging source and can export to the electrical grid.

- *D.P.U. 17-146 (B)*
  - The DPU further addressed capacity market issues in D.P.U. 17-146 (B), in which the MA DPU accepted a compromise proposal from stakeholders.
  - Under the compromise proposal, Distribution Companies are required to monetize the capacity of DG Facilities in one of two ways:
    - Directly monetize the capacity by qualifying and bidding that capacity into the FCM to obtain a capacity supply obligation (CSO) commitment ("Option 1"); or
    - Register the DG Facility in the FCM to passively earn performance incentive payments under ISO-NE's PFP rule ("Option 2")
  - The Order also determined the conditions under which energy storage can participated in FCMs, as follows:
    - For Class I net metering facilities, which are 60 kW or less, capacity rights stay with the facility owner.
    - For ESS paired with net metering or SMART facilities, the capacity associated with the ESS (distinct from the capacity of the associated net metering or SMART facility) will also stay with the facility owner.
    - For Class II (more than 60 kW but less than or equal to 1 MW) and Class III net metering facilities (more than 1 MW but less than or equal to 2 MW), and for SMART facilities using the alternative-on-bill crediting mechanism, capacity rights will automatically transfer to the electric distribution company, which will then be required to

participate in the forward capacity market either by obtaining a capacity supply obligation, or registering to passively earn performance incentive payments.

- For an existing Class II or Class III net metering facility, the capacity rights remain with the facility owner if a distribution company has not previously asserted title to the capacity rights and a host customer has either qualified the facility in a Forward Capacity Auction or submitted a qualification package in the most recent a Forward Capacity Auction prior to the date of the Order.
- Facilities that are behind the meter or that are paired with ESS will have an option to buyout the capacity rights from the EDC according to a set formula. Although commenters had suggested broader buyout options, the Department believed that limiting the buyout mechanism to these circumstances was the appropriate balance for returning value to ratepayers at this time.

▪ The Department deferred a decision on the capacity rights of Qualifying Facilities, an issue of relevance to SMART participants, suggesting that the matter will be decided in connection with an ongoing review of its QF regulations in D.P.U. 17-54.

- ***D.P.U. 19-55 ("Interconnection of Distributed Generation")*** **(2019)**
    - The MA DPU opened this docket on May 22, 2019, to investigate the interconnection of distributed generation ("DG") in Massachusetts.
    - The MA DPU has expressed its intention that energy storage interconnection be included in the definition of DG in this docket despite defining DG as "technologies that generate electricity".)
    - Orders from this docket proceeding are still pending.

3.6. Interconnection Rules

Does Massachusetts have interconnection rules and requirements?	YES. They require utilities to have interconnection tariffs.
Does it explicitly include energy storage in the definition of eligible projects for interconnection?	No
What standard is	UL 1741

<table>
<tr><td>referenced for setting technical requirements?</td><td colspan="5">IEEE 1547
IEEE 1453 for Voltage fluctuation limits</td></tr>
<tr><td>Is there any System Capacity Limit?</td><td colspan="5">No Limit specified</td></tr>
<tr><td>Is there a “Fast Track” option for application?</td><td colspan="5">YES! (the simplified process)</td></tr>
<tr><td>What are the eligible Technologies that can be Interconnected</td><td colspan="5">Solar, Wind, Hydro, Diesel, Natural gas, Fuel Oil</td></tr>
<tr><td>What sectors are eligible to participate</td><td colspan="5">Commercial, Industrial, Local Government, Nonprofit, Residential, Schools, State Government, Federal Government, Agricultural, Multifamily Residential</td></tr>
<tr><td>Is net metering required for interconnection?</td><td colspan="5">Net metering is available but not required.</td></tr>
<tr><td rowspan="2">What are the associated fees with interconnection in Massachusetts?</td><td></td><td>Simplified</td><td>Expedited</td><td>Standard</td><td>Simplified Spot & Area Network</td></tr>
<tr><td>Application Fee (Covers Screens)</td><td>0</td><td>$4.50/kW, minimum $300 Maximum $7,500 For Supplemental Review: Up to 30 engineering hours at $150/hr ($4,500 maximum</td><td>$4.50/kW, minimum $300 Maximum $7,500</td><td>≤3kW $100, >3kW $300</td></tr>
<tr><td>Is an external disconnect switch required for interconnected technologies?</td><td colspan="5">At the discretion of the Utilities</td></tr>
<tr><td>Is liability insurance required for homes and/or small business seeking to interconnect?</td><td colspan="5">YES. General Liability insurance is required.</td></tr>
<tr><td>Is there an Export limits from an energy storage technology</td><td colspan="5">No limits specified</td></tr>
<tr><td></td><td colspan="5"></td></tr>
</table>

URLs	https://www9.nationalgridus.com/non_html/Interconnect_stds_MA.pdf

- The Massachusetts Department of Public utilities (DPU) regulates the interconnection process in the state and requires utilities to have interconnection Tariffs.
- In August 2011, the Department of Energy Resources (DEOR) submitted the Massachusetts Distributed Generation Interconnection Report to the DPU outlining its recommendations for improved interconnection policies and processes.
- The DPU opened an investigation into the interconnection of distributed generation in MA,
- On January 23, 2012, the Massachusetts Distributed Generation Interconnection Working group was initiated at the request of the DPU through Order 11-75
- The Working Group was tasked with determining what issues should be resolved regarding the interconnection standard and application procedure to ensure an effective and efficient interconnection process.
- The participants of the Working Group were
  - UTILITIES:
    - National Grid
    - NSTAR
    - WMECO
    - Unitill
  - DG PROVIDERS
    - DG Solar
      - Borrego Solar
      - Blue Wave Capital
      - Spire Solar Systems
      - DG Cleanpower
      - SEBANE/SEIA
      - Exelon/Constellation Energy
      - My Generation Energy
    - DG CHP
      - Source One/Veolia Energy
      - Northeast Clean Heat and Power Initiative
      - US Clean Heat & Power Association,
      - The E-Cubed Company,
      - Prime Solutions,
      - Havard
  - STATE AGENCIES
    - Dept. of Energy resources
    - MA Clean Energy center
  - Customers/Cities
    - CLC/CVEC

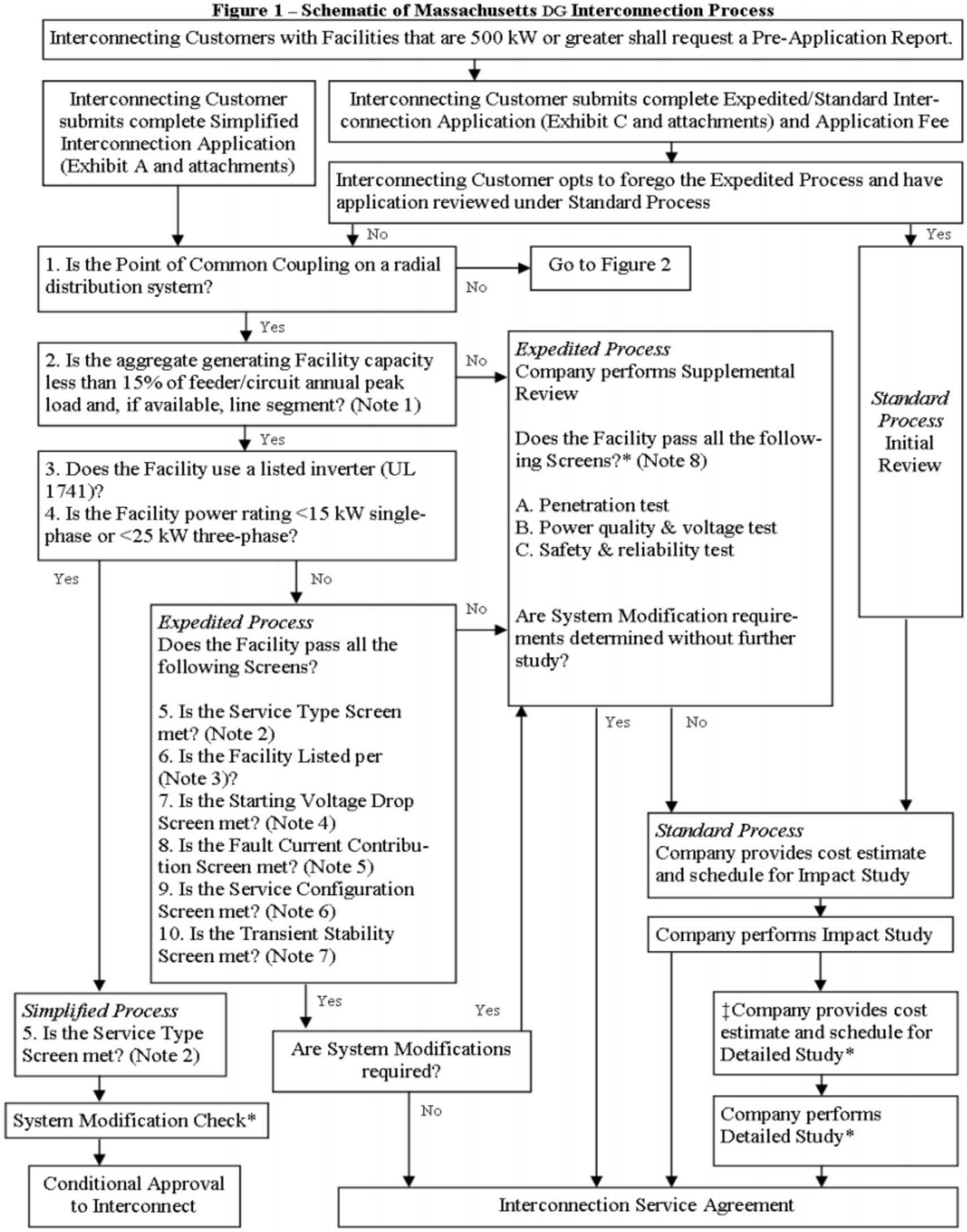
- On September 14, 2012, the working group issued its final report, and the DPU adopted the report in March 2013.

INTERCONNECTION PROCESS SUMMARY

- Prior to connecting, the distributed generation system owner must obtain written approval from the local utility in the form of an Interconnection Service Agreement and subsequent Authorization to Connect.
- There are three (3) basic path to Interconnection
    - Simplified Process (fastest and least costly path)
    - Expedited Process
    - Standard process (longest time period and highest potential cost)
- **Simplified Process:** for interconnecting customers using
    - listed single-phase inverter-based facilities with power rating of 15 kW or less OR
    - listed three-phase inverter-based facilities with power rating of 25 kW and requesting an interconnection on radial EPS where the capacity is less than 15% of feeder annual peak load.
- **Expedited Process:** for customers that pass certain pre-specified screens on a radial EPS (See Figure 1)
- **Standard Process:** for all facilities not qualifying for either the simplified or expedited interconnection processes on radial and spot network EPS, and for all facilities on area network EPS.

3.7. Schematic of Massachusetts DG Interconnection Process

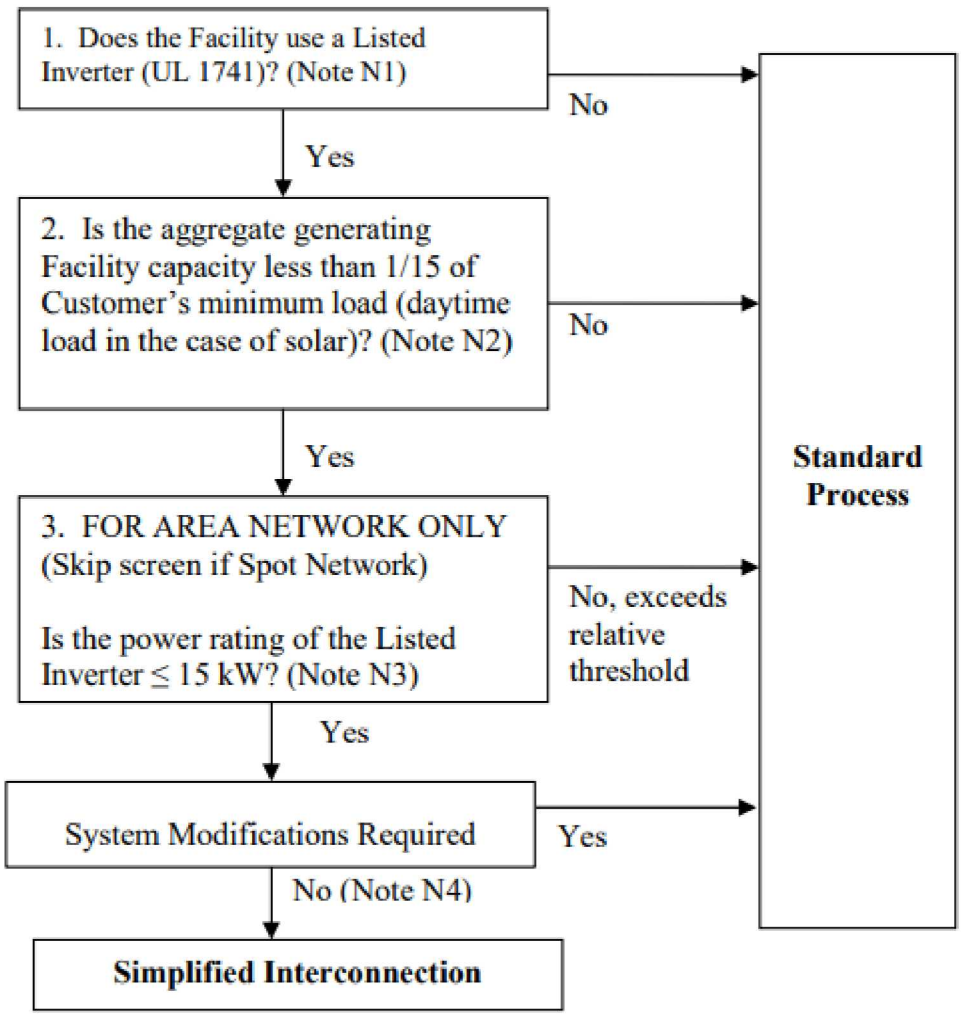
Figure 1 – Schematic of Massachusetts DG Interconnection Process



*Only if required

3.8. Simplified Interconnection to Networks

Figure 2 – Simplified Interconnection to Networks



3.9. The Future of Energy Storage in Massachusetts

It is clear that Massachusetts has made great strides in developing energy storage policy and other states continue to look at the Bay State for insights as to how to approach complex policy issues in their own states. However, there are number of storage policy issues that remain "top of mind" for policymakers in Massachusetts and as of August 2019 remain unsettled. These issues include:

- Storage's eligibility to participate in the state's net metering program;
- Which entity will have capacity value of storage that participates in ISO-NE's forward capacity market;
- Restrictions against "gaming the system" at the distribution level should all forms of energy storage be allowed to participate in the state's net metering program;
- Revision to existing tariffs and rate design in the state to further accommodate the participation of storage

4. NEVADA ENERGY STORAGE POLICY

4.1. Storage Policy Snapshot

Does Nevada have an renewables mandate?	YES; 50 percent by 2030
Does Nevada have a state mandate or target for storage?	NO, although the Nevada PUC appears to be in the process of evaluating.
Does Nevada offer financial incentives for energy storage development?	YES
Does Nevada have a policy for the strategic deployment of Non-Wires Alternatives or Distributed Energy Resources to defer, mitigate, or obviate need for certain T&D investments?	NO
Does Nevada have a policy addressing multiple use applications for storage?	NO
Does Nevada have a policy on utility ownership of storage assets?	NO
Does Nevada allow or mandate the inclusion of energy storage in utility IRPs?	YES, mandated
Has Nevada modified its permitting or interconnection requirements specific to energy storage?	YES
Does Nevada allow customer-sited storage to be eligible for net metering compensation?	YES
Has Nevada revised its rate structures to drive adoption of behind-the-meter storage	UNCLEAR
Approximate development of storage capacity in Nevada	?

4.2. Storage Policy Assessment

The energy sector in Nevada has experienced a rather tumultuous evolution over the last few years. While seeking to make systemic changes to its regulatory structure and its approach toward grid planning and operations, the state has experienced some very public setbacks with regard to its market and policy initiatives for clean energy. However, despite these setbacks, Nevada now appears to be back on track toward assuming a leading position in developing innovative energy storage policies while simultaneously supporting what is clearly a rapidly growing sector for clean energy development. Within these broader initiatives Nevada has also assumed its current position as a market leader for energy storage. What makes Nevada an important case study today is the extent to which voluntary, business-driven decisions to expand renewables and energy storage solutions has been spearheaded by the primary utilities in the state. This is in contrast to how the development of renewables and energy storage has evolved in other states, which has typically been driven through policy directives.

While Nevada is currently considered a leader in both the clean energy space generally and in renewables and energy storage specifically, its path within these sectors has not been a straight line toward success. Further, while the inherent characteristics that define Nevada's energy sector also make it fundamentally unique, the state still provides an important experience that in a number of ways may foreshadow the development of energy storage policy that is still yet to be developed in other states.

Let's first remind ourselves of the key characteristics that make Nevada and its energy sector unique. These factors include:

- The population concentration of the state. Almost three-fourths of Nevada's residents live in Clark County, which includes the city of Las Vegas.
- Nevada is one of the fastest-growing states in the U.S.
- Nevada is a net importer of energy (in 2016, about 87 percent of the energy consumed in the state came from outside sources).

There has been a rapid increase of solar development in the state. Hydro remains the prominent source for renewables-based generation, but the use of solar has been steadily increasing and recently moved past geothermal as the second-largest contributor to renewables generation in the state behind hydro.

In addition, Nevada is also rather unique in the sense that it does not produce much of its own energy (the state ranks in the bottom ten in terms of states that produce their own energy). Compared to neighboring states, Nevada has very little generation capacity in-state, and reportedly nine-tenths of Nevada's power comes from outside of the state. Moreover, Nevada has no significant fossil fuel reserves. Rather, natural gas is the primary fuel for power generation in the state, with the majority of the state's remaining power plants primarily relying on this fuel source. In 2017, about 72 percent of Nevada's generation mix came from natural gas; and only about 7 percent came from coal.

This fossil-fuel base still overshadows renewables, which in 2017 accounted for approximately 18 percent of the energy mix. In Nevada, renewables have mostly meant hydro, solar, and geothermal. Even though it is one of the driest states in the nation, historically most (over 80 percent) of Nevada's renewable resources have come from hydroelectric power plants, primarily the Hoover Dam. This unique energy mix, particularly the need to import power, has made the state dependent on transmission capacity that can deliver power from other regions. Further, the lack of its own power resources or long-term commitments to traditional forms of generation arguably has positioned Nevada as state that can move to a completely clean energy mix more seamlessly than others.

The move toward a clean energy environment in Nevada has its roots in economic analysis, and thus even in the absence of stringent requirements the main utilities in the state have been moving away from carbon-intense energy sources for a number of years. Perhaps illustrating this point best is the recent announcement from NV Energy, the primarily utility in Nevada, which stated it will no longer own any coal generation plants moving forward.

The future of renewables in Nevada is now pointed toward the sun. Solar continues to develop rather rapidly in Nevada and is expected to supply an increasing share of Nevada's net generation. About one-four of Nevada's utility-scale electricity is now generated from renewable resources, and about half of those renewables are now coming from utility-scale solar resources. In fact, according to most rankings, Nevada leads other states in terms of solar power potential, and has generally ranked within the top five states for installed solar capacity.

NV Energy (which operates through its two regulated utilities, NV Power and Sierra Pacific Power), provides about 81 percent of the state's electricity and is clearly the dominant utility operation in the state. NV Energy has publicized aggressive, voluntary plans for solar + storage development through its integrated resource plans, placing it in a lead position among utilities that are pursuing hybrid solutions. NV Energy is owned by Warren Buffett's Berkshire Hathaway Companies (which also owns PacifiCorp in the Northwest and MidAmerican Energy in Iowa). Berkshire Hathaway has established an over-arching strategy across its utility subsidiaries to strategically move away from coal-fired generation into a renewable-centric generation portfolio.

The new plan is part of the company's long-term goal, as outlined in its Integrated Resource Plan approved by the PUCN in December 2018, of serving its customers with 100-percent renewable energy. Again, in the absence of an enforced mandate via the legislature or PUCN, NV Energy is opting to pursue this increase of renewables and storage on its own accord.

In the near term, NV Energy announced the addition of nearly 1,200 MW of new solar PV generation to be built in the state, along with 590 MW of battery storage. The renewable energy will come from three projects, all expected to enter commercial operations by 2023 (still pending approval from the PUCN):

- Arrow Canyon Solar: 200 MW solar PV project with a 75-MW, five-hour battery storage system. (Developed by EDF Renewables North America.)
- Gemini Solar + Battery Storage: 690 MW of solar energy coupled with a 380-MW battery storage system. If completed, this project could earn status as the largest solar plant in the United States. (Quinbrook Infrastructure in collaboration with Arevia Power will develop and manage the project.)
- Southern Bighorn Solar & Storage Center: 300 MW of generating capacity including a 135-MW, four-hour Li-Ion battery storage system. (Built by 8minute Solar Energy).

This utility activity preceded but was ultimately validated by increases to the state's renewables target. Nevada's initial renewable portfolio standard (RPS), set in 2009, required that annually increasing percentages of the electricity sold to retail customers in the state come from renewable resources, reaching 25 percent of retail electricity sales by 2025. Additionally, the RPS originally required that 6 percent of the renewable requirement, 1.5 percent of the state's total net generation, had to come from solar power by 2016. That requirement was exceeded and almost half of the utility-scale and distributed renewable generation in Nevada—11 percent of the total state net generation—was solar-powered in 2017.

However, it is the solar industry in the state that has been the focus of what has arguably been the greatest setback to the development of clean energy initiatives in Nevada. In December 2015, the PUCN voted in favor of a new tariff structure that reduced net metering rates — the rates NV Energy pays to buy back excess energy generated by those with rooftop solar. It also increased the monthly service charge for those solar customers.

The PUCN ruling was considered a major setback for the industry. It caused a number of solar companies (most notably Sunrun and SolarCity) to leave the state entirely, leading to the loss of hundreds of jobs. In 2017, Nevada fell from the No. 4 state for overall solar jobs to No. 10, according to The Solar Foundation. The net metering program was reinstated in late 2017, but in many respects the damage to the solar sector in the state was already done.

Public support for more renewables in Nevada was confirmed in November 2018 when a ballot initiative was approved that would require electric utilities to acquire at least 50 percent of their electricity from renewable sources by 2030. However, because it amends the Nevada Constitution, the ballot measure must be approved by voters twice in order for the requirement to go into effect. Nevada voters will vote on the measure again in 2020. Subsequent legislation (SB 358) enacted this increase into law.

A key part of Nevada's renewables law, which positions the state as an innovative leader in the energy storage realm, is that every kilowatt-hour of energy delivered by a qualified storage device will count double for the purpose of meeting the RPS requirement. This is a very innovative approach; Nevada may in fact be the only state to have enacted such a provision allowing energy storage to be eligible for a renewables requirement in such a significant way. There are two ways in which storage can meet the renewables requirement in Nevada: 1) if the energy storage system charges from renewable generation and discharges during a peak load period or 2) if the energy storage system performs ancillary grid services that enable the integration of renewable generation.

This policy alone positions Nevada among the ranks of other important storage markets (e.g., California, New York, Massachusetts) as in practice it will position storage devices as renewable energy assets that can delivery energy. It should be noted that the law caps the role of energy storage at 10 percent of the electricity eligible for RPS compliance, meaning that the majority of energy eligible for RPS compliance will still be generation.

Nevertheless, without a statewide storage mandate in place, this legislation in Nevada (SB 358) should be viewed as the leading policy measure that is now driving storage development in the state. In the absence of a statewide procurement mandate for energy storage (as of September 2019 the Public Utilities Commission of Nevada (PUCN), directed by state legislation under the enacted SB 205 in June 2017, is still evaluating the appropriateness of a mandate), this increased mandate for renewables is still viewed as a much-needed jolt for the solar + storage market in Nevada.

Nevada policymakers continue to vet the question of whether or not mandates for energy storage should be adopted statewide. It is expected that a decision along these lines should be make in early 2020. Meanwhile, behind the scenes, Nevada lawmakers, regulators, utilities and environmental and consumer stakeholders have also been putting together a plan to integrate distributed energy resource (DERs) into the state's grid planning and operations. The PUCN has called NV Energy to evaluate hosting capacity, grid needs, and potential DER impact and values of each circuit and feeder line across its 1.3 million-customer territory. If approved, the distribution planning plan (DRP) requirements would put Nevada in a small club of states — California, New York and Hawaii — that are actively asking their investor-owned utilities to bring DERs into their grid plans on a number of levels.

4.3. Executive Directives

Over the last decade Nevada has seen two leaders at the executive level: Brian Sandoval (R) who served as governor from 2011 until 2019 and Stephen Sisolak (D), who assumed office on January 7, 2019. While both publicly supportive of clean energy initiatives, albeit for different reasons, the Sandoval administration is generally viewed as not having made the level of gains toward clean energy, renewables and energy storage expansion in the state as his successor has pledged to achieve. Sisolak's campaign that found him elected governor in Nevada 2018included the pledge to be the "governor that wants Nevada to lead the nation on clean energy."

Under the Sandoval administration, the rooftop solar / net metering debacle certainly was a blemish on the clean energy scorecard. Sandoval had been publicly supportive of clean energy initiatives based primarily on economic analyses concluding that building out renewables infrastructure would be good for the Nevada economy. As noted, Nevada does not have significant generation resources within the state; in order to pursue energy development, renewables would likely be the most economically feasible strategy. Unlike many other Western states, Nevada does not have a thriving coal or petroleum industry. So, put another way, if Nevada wanted to get into energy development, it had to look toward renewables.

Sandoval supported the effort to expand renewables in Nevada primarily through financial subsidies that his administration endorsed. For example, under the Sandoval administration, the state saw $7.8 billion in total investment, including capital, payroll and taxes, for new renewable projects. At the same time, the state issued about $861 million in tax abatements to help get renewable energy projects off their feet.

However, from a policy perspective, the Sandoval administration was criticized for not sending clear messages to the public and for blocking legislation that would have accelerated renewables development. To illustrate this, the other perceived failure of the Sandoval administration was a veto of efforts to increase the state's renewables requirement. As noted, Nevada's Renewable Portfolio Standard was originally established in 2009 with a goal of 25-percent renewables by 2025. Efforts to increase the RPS via legislation to 40 percent by 2030 was vetoed by Gov. Brian Sandoval after the 2017 legislative session. The Sandoval veto, which also nixed a provision to include a community solar program, was driven by concerns about a 2018 ballot question that would have turned Nevada into a competitive electric retail market and removed NV Energy's monopoly (which ultimately failed). The dismantling of the net metering program, along with his veto of the legislation to increase the renewables requirement in the state, left many observers to conclude that Gov. Sandoval had not gone far enough to help create a clean energy market in Nevada.

In contrast, Gov. Sisolak fulfilled his campaign promises early in his tenure when, in April 2019, he signed legislation (SB 348), which increased the requirement to at least 50 percent renewable energy by 2030. The bill signing came more than a month after Sisolak signed the state onto a multi-state agreement to fulfill greenhouse gas reduction goals set in the Paris Climate Agreement, which President Donald Trump announced the U.S. would begin to withdraw from in 2017. Joining the "U.S. Climate Alliance" commits Nevada to an effort to reduce greenhouse gases by at least 26 to 28 percent from 2005 levels by 2025, monitoring and reporting progress on emission reduction efforts and committing to speeding up efforts to cut emissions and expand clean energy adoption.

4.4. Legislation

Nevada has a comparatively short legislative session of 120 days and fairly long interim periods between legislative sessions. Nevertheless there have been a handful of important pieces of legislation that have helped to define the energy storage marketplace in the state.

SB 145 (May 2017):

- Provided funding for storage, electric vehicles, and solar.
- Restructures an incentive fund to support clean energy battery projects. The law also ensures some of the funds support clean-energy projects for lower-income customers.
- Combined the amounts of allocations for the Wind, Solar, and Waterpower Programs and allowed funding for new programs as follows:
    - The Energy Storage Program includes funding for the Electric Vehicle Demonstration Program and other energy storage systems, for a total of $15 million.
    - The Low-Income Solar Program for $1 million per year until 2023.
- The PUCN regulations directed by this legislation are intended to increase access to residential and commercial-scale energy storage systems; develop an electric vehicle infrastructure program; and provide broader access to energy storage systems for low-income customers.

SB 204: (May 2017)

- Required the PUCN to study whether it should establish a program mandating that the state's electric utilities procure energy storage systems.
- Requires the PUCN to study whether or not utilities companies should have energy storage targets to increase storage of solar energy and, if so, what that target should be.

SB 65 (June 2017)

- Revised utility integrated resource planning processes to require information related to customer exposure to the potential costs of carbon.
- Requires that the PUCN give preference to utility plans that includes supply sources that reduce customer exposure to the potential costs of carbon.

- Requires the PUCN to prioritize energy decisions that provide the greatest economic and environmental benefits to the state, diversify the electric supply, and reduce exposure to the volatile prices of fossil fuels.

AB 405 (June 2017):

- Establishes right for customers to interconnection storage systems
- Modified the net metering rate structure effective June 15, 2017.
- Allows utility customers who choose to net meter to fall under a rate structure codified in the law.
- The rate structure applies to renewable energy systems of 25 kW or less.
- The new net metering rate structure is tiered and will decrease over time as the amount of electricity produced by net metering reaches a 80 MW benchmark.
- The first tier offers a net metering rate that is 95 percent of the retail rate. As of April 26, 2018, nearly 20 MW of installed capacity had been applied toward the first 80-MW tier. The net metering rate for the second tier is 88 percent of the retail rate, with tiers three and four crediting 81 percent and 75 percent, respectively.

SB 146: (June 2017):

- Calls on IRPs to include distribution planning process and DER integration.
- Mandates that Nevada Power Company and Sierra Pacific Power Company (both subsidiaries of NV Energy) file a joint Integrated Resource Plan.
- Required that before April 1, 2019, an IRP or IRP amendment include a distribution resource plan, defined as a plan for "distributed generation systems, energy efficiency, energy storage, electric vehicles, and demand-response technologies."
- Requires IOUs to submit a plan that identifies the costs, benefits, and barriers to adopting technologies like rooftop solar and other small-scale DG.

SB 358 (April 2019)

- Senate Bill 358 was fast-tracked through the Democrat-dominated Legislature as an "emergency measure," allowing Gov. Sisolak to sign it on Earth Day.
- Enacted into law the increase in the state's RPS that was approved in a public ballot initiative in November 2018.
- Requires state electric producers to buy or generate 50 percent of their power from solar, wind and other renewable power sources by 2030. It goes on to set a goal of zero carbon emissions from energy producers by 2050.
- The bill also requires electric cooperatives and public power districts to meet the higher renewable standards once they reach a 1 million MW threshold.
- In another major change, the bill will also count electricity generated from hydroelectric sources — including the Hoover Dam — to count toward the RPS (that source of power was previously excluded from the RPS formula), while excluding any potential new hydropower generation or plants.

In his signing address, Governor Sisolak pointed out that Nevada now ranks among the states with the highest RPS in the country, a move that is seen to help it cut its greenhouse gas emissions and create new jobs.

4.5. Regulations

In early 2015, the PUCN opened an Investigation Regarding Energy Storage Technologies to investigate battery storage technologies. The ongoing investigation involves a series of stakeholder meetings and workshops to discuss such storage-related issues as interconnection, valuation and integration into utility planning.

Other significant regulatory initiatives include the fact that Nevada is considering changing its interconnection standard (Rule 15) to include storage in the definition of generation resources for purposes of interconnecting to the distribution grid.

Docket No. 17-08022 (July 2018)

- Opened to address the implementation of SB 146
- Includes an order requiring NV Energy to incorporate Distributed Energy Resources (DERs), such as solar and energy storage, into its three-year system plan.
- Requires NV Energy to submit a Distributed Resources Plan (DRP) as part of its triennial integrated resource plan. Requirements of the DRP include the following components:
    - Forecast of net distribution system load and DER penetration (both energy and nameplate capacity) at the system, substation, and feeder levels.
    - Hosting Capacity Analysis, to determine the amount of DERs that can be accommodated on each feeder section without adverse impacts.
    - Locational Net Benefits Analysis that supports a location-specific cost-benefit analysis of DER projects, which will serve as the basis for comparison between Non-Wires Alternatives (NWAs) and traditional solutions
    - Grid Needs Assessment (GNA) that will combine the three components above for analysis of NWAs; the GNA will identify constraints on the electric grid and infrastructure upgrades and/or DER projects that may provide solutions to those constraints
- The regulation does not prescribe what utilities will do with DER, but lists all the information and analyses the utilities need to include in their distributed resources plans filed with the commission.
- NV Energy was expected to file its initial DRP in April 2019.
- This Order puts Nevada alongside leading states, such as California, Hawaii, and New York, in requiring that utilities take DERs into consideration as part of their system planning processes.

Docket 17-07013 / 17-07026 (2017/2018)

- Opened to implement AB 405
- On March 14, 2018, the PUCN approved numerous new time-variant rates pursuant to AB 405. The rates are designed to incentivize the use of battery storage at residential and small commercial sites.

- Under the new structure, utility customers with battery storage are allowed to shift their grid usage to times when energy is less costly. The result is a reduced load on the system during peak times coupled with energy savings for the customer.

Docket No. 17-07014 (December 2018)

- Opened to implement SB 204; Evaluation of Storage Targets
- The PUCN is considering establishing an energy storage target, in response to the legislative directive to undergo such a consideration that was enacted under SB 204.
- Subsequent to the passage of SB 204 in 2017, the Brattle Group prepared a report for the PUCN and the Nevada Governor's Office of Energy in October 2018. Brattle's conclusion / recommendation was that a statewide deployment of up to 175 MW of utility-scale storage could be cost effective in 2020, based on an analysis that identified four key energy storage benefits and utilizing lithium-ion batteries with 4-hour storage capacity, costing less than $1,800/kW in 2020 and dropping to less than $1,300/kW in 2030. With declining battery costs, by 2030 Brattle projected that a deployment of between 700 MW-1,000 MW could also be cost-effective.
- The four benefits of energy storage that Brattle identified were:
    - Avoided distribution outages;
    - Delayed T&D investments;
    - Production cost savings; and
    - Avoided capacity investments
- PUCN held a workshop on May 1, 2019, to discuss target implementation that the PUCN recommended despite staff's recommendation that a target was not necessary because the electric companies are already planning to install significant amounts of storage.
- Whether or not the PUCN ultimately opts to impose a statewide energy storage procurement mandate will likely be conditioned on the PUCN determining that the benefits of energy storage exceed the costs. It is expected that the PUCN will consider such potential benefits as a reduction in peak generation, T&D infrastructure deferral, reduced greenhouse gas emissions, and consideration of multiple use applications for storage and their own unique values.
- If, after this evaluation, the PUCN determines that storage will provide a net benefit to the state, concurring with the Brattle report, then it is likely that a regulatory procurement target will follow.

Docket No. 19-06050 (June 2019):

- Opened to implement SB 145 and the associated fees for non-compliance with the legislation.
- The PUCN had ruled that NV Energy had "failed to comply with a Commission order" implementing SB 145 creating and mandating incentive payments aimed at spurring development in residential and large-scale energy storage systems.
- In the order, members of the commission wrote that NV Energy had agreed but then failed to set aside $10 million in funding from the utility's existing incentive funding pool to use toward energy storage incentive programs. Despite the utility agreeing to the order in a

docket implementing SB 145 and in its 2018 annual plan (including signing a stipulation), the utility ultimately never set aside the funds for the nascent program.
- The PUCN ordered all remaining program funds be dedicated to the energy storage program (save $1 million for a low-income solar program and a separate electric vehicle plan exempted from the $295 million limit), but it's unclear how long or whether incentive funds for the energy storage systems will continue to last.

4.6. Interconnection Rules

To Be Added

4.7. The Future of Energy Storage in Nevada

Along with the current ongoing dockets to address energy storage targets, the PUCN is likely to consider the following issues related to energy storage policy through 2020:

- Revision of interconnection standards for distributed generation (e.g., adoption of IEEE 1547 standards).

- Along with including energy storage in utility integrated resource plans, the PUCN will also likely consider more stringent requirements to have utilities evaluate the cost effectiveness of storage along specific locations on the distribution grid where it would offer the greatest value.

- Consideration of multiple use applications for storage and how those multiple uses should be valued differently.

- Continue to develop financial incentives for energy storage.

- Finalization of utility distribution resource plans (DRPs), including how utilities will gather data on how much DERs different circuits can support.

- Continued consideration of opening up retail competition in the state.

- Continued coordination with regional wholesale markets to determine the role that energy storage can play in RTOs/ISOs.

5. NEW MEXICO ENERGY STORAGE POLICY

5.1. Storage Policy Snapshot

Does New Mexico have a renewables mandate?	YES; 20 percent by 2020 for IOUs; 10 percent by 2020 for co-ops
Does New Mexico have a state mandate or target for storage?	NO
Does New Mexico offer financial incentives for energy storage development?	NO
Does New Mexico have a policy for the strategic deployment of Non-Wires Alternatives or Distributed Energy Resources to defer, mitigate, or obviate need for certain T&D investments?	NO
Does New Mexico have a policy addressing multiple use applications for storage?	NO
Does New Mexico have a policy on utility ownership of storage assets?	NO
Does New Mexico allow or mandate the inclusion of energy storage in utility IRPs?	YES (mandate)
Has New Mexico modified its permitting or interconnection requirements specific to energy storage?	NO
Does New Mexico allow customer-sited storage to be eligible for net metering compensation?	UNCLEAR
Has New Mexico revised its rate structures to drive adoption of behind-the-meter storage	UNCLEAR
Approximate development of storage capacity in New Mexico	TO BE CONFIRMED

5.2. Storage Policy Assessment

New Mexico for the most part operates outside of a competitive, regional market (the eastern part of the state participates in the Southwest Power Pool, but the largest market in the state served by the Public Service Company of New Mexico (PNM) does not belong to an RTO). Therefore, policies that are specific to storage are being developed primarily through state legislative and regulatory directives. The primary focus of New Mexico's storage policy development has been placed on removing or reducing barriers for storage and including new opportunities for storage to participate on a more level playing field with other resource alternatives.

Put another way, to date New Mexico has focused on policy revisions that are intended to broaden the competitive access for energy storage in the state. Broad policy initiatives that involve storage include the state's commitment to being "carbon free" by 2045. A primary example of New Mexico's efforts is the mandated inclusion of energy storage in utility integrated resource plans. With executive directives setting baseline expectations for storage, the New Mexico Public Regulation Commission (NMPRC) now takes the lead position in developing state-level policies that are intended to lay the foundation for a robust market for energy storage going forward. It is anticipated that future regulatory proceedings in New Mexico that are relevant to energy storage will include considerations of:

- Revised interconnection standards
- Asset classification for storage technologies
- Potential revision of net metering policies to include energy storage
- Consideration of multiple use applications for storage
- Cost-benefit analysis / valuation proceedings for energy storage
- Potential increases to the state's existing Renewables Portfolio Standard

In 2019, the state of New Mexico began to officially define an energy transition plan that emphasizes renewables and storage objectives as a pre-requisite for an envisioned carbon-free future in the state. Under the leadership of newly elected Democratic Governor Michelle Lujan Grisham, New Mexico has emerged among a handful of states that within the last year have publicly established a commitment to clean energy by directing power generators within its borders to produce more electricity from renewables, storage, and other non-polluting sources. In fact, New Mexico is among an elite group of states (California, Hawaii and, more recently, Washington and Nevada) that have publicly vowed to become carbon-free and receive most, if not all, of its power from renewable energy in the future. In New Mexico, the goal is to achieve zero-carbon electricity from public utilities by 2045 with 80-percent renewables by 2040.

It is an aggressive goal, given that presently New Mexico has achieved about 20 percent of its electric generation from renewables (in response to the previous renewable energy standard that was originally created in 2004). The Public Service Company of New Mexico (PNM) is currently the only utility in the state with existing storage capability due to its Prosperity Energy Storage project that includes a 500 kV solar PV facility with a 250 kW, 1 MWh battery storage system).

As has been well documented, the state of New Mexico has tremendous wind and solar resources that for the most part have been untapped to date, with reportedly some of the highest rates of solar irradiance and best wind conditions in the United States. It is clearly anticipated by the state's policymakers that energy storage will play a vital role in renewables development and achieving the carbon-free mandate established by new legislation. Consequently, New Mexico has the opportunity to become a national leader in grid modernization and energy innovations specific to storage development due to the local presence and expertise of the Sandia National Laboratories and the number of storage pilot projects and storage experiments being conducted at the Labs.

Storage policy development that is currently taking place at the New Mexico Legislature and the state's Public Regulation Commission (PRC) is currently defining the specific role that energy storage will play. High-level and long-range objectives for storage have been outlined by new legislation, and the PRC should be watched closely for more granular-level regulations ***specific*** to storage interconnection standards, valuation initiatives, and potentially mandated storage targets that will be addressed in the near term.

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5.3. Executive Directives

Throughout her gubernatorial campaign, election in 2018 and first year as New Mexico's executive leader, Governor Michelle Lujan Grisham (D) has publicly committed to building a state economy that is by powered renewable generation. Shortly after taking office, Governor Lujan Grisham appointed a new Energy, Minerals and Natural Resources Department secretary-designate, Sarah Cottrell Propst, who is now working to turn the governor's campaign promises into concrete action through legislative and administrative initiatives that could make New Mexico a national leader in clean energy development.

The governor's executive administration has been publicly supportive of having the state enact comprehensive energy legislation early in her term. This directive manifested in the state's newly enacted "Energy Transition Act," which the governor has presented as "a promise to future generations of New Mexicans. In the passage of the law, Lujan Grisham said, "When we were presented the chance to move toward cleaner sources of energy, we took it, boldly charting a course to a carbon-free future, permanently centering our commitment to lower emissions and setting an example for other states."

5.4. Legislation

Acting on the governor's policy directives, the most significant piece of legislation pertaining to energy storage, directly or indirectly, in New Mexico is the Energy Transition Act (SB 489) signed by Governor Lujan Grisham in March 2019. The legislation sets important baseline precedents for storage, including how it will be defined in the state. As per the law, "energy storage" means batteries or other means by which energy can be retained and delivered as electricity for use at a later time. An "energy storage system" is more broadly defined as methods and technologies used to store electricity, presumably intended to take an inclusive approach toward the consideration of storage technologies that may be developed in the future beyond battery-based technologies. However, the law is primarily concerned with creating the vision for New Mexico's carbon-free and renewables-focused energy future, for which storage will be needed to be achieved.

Specifically, the Energy Transition Act includes the following provisions:

- Codifies that utilities in the state must supply 20 percent of their retail energy sales with renewable energy by 2020 and must procure at least 50 percent of their electricity from renewable sources by 2030 and 80 percent by 2040 (electric cooperatives have until 2050 for the 80-percent requirement). For perspective, the prior renewables requirement had been 20 percent by 2030.

- Mandates renewable energy standards for utility companies and cooperatives with a goal of achieving 100-percent carbon-free use by 2045 (for investor-owned utilities) and 2050 (for cooperatives).
- Enables utilities to issue securitized bonds paid for by customer rates (with PRC approval) to pay for the early retirement of coal-fired generating plants and accelerate the transition to clean energy, including energy storage technologies. The bond payments would be supported by a non-bypassable energy transition charge appearing as a separate line item on customer bills.
- SB 489 also requires the New Mexico PRC, in granting a certificate of public convenience and necessity for energy storage systems, to ensure that energy storage replaces or defers generation, transmission, or distribution investment; provides ancillary services; provides renewables integration and T&D reliability; reduces demand for fossil fuels in peak load and greenhouse gas emissions.
- The law also enables the electric company to operate, maintain, and control energy storage to ensure reliable and efficient service.
- Utility responses, as illustrated by comments made by PNM, suggest that energy storage will be considered within a near-term and long-term resource mix depending on the economics of proposals received in response to an energy storage solicitations currently being pursued.

The legislation positions New Mexico among other leading states (California and Hawaii, for example) that have committed to eliminating carbon emissions from their grids through the increased use of renewables and storage technologies.

5.5. Regulations

With the passage of the vision-setting legislation, attention has now turned to the regulatory policy being developed at the New Mexico Public Regulation Commission (PRC) that will either create opportunities or barriers for storage technologies in practical application. As of August 2019, the most significant regulatory policy pertaining to energy storage in New Mexico is the unanimous decision by the PRC to revise its rules governing utility Integrated Resource Plans. A summary of those changes is provided below.

- *CASE 17-00198-UT Integrated Resource Planning*
  - Power-generating utilities in the state of New Mexico are required to produce and file an Integrated Resource Plan (IRP) with the PRC every three years. Within an IRP, a power-generating utility is required to evaluate existing and potential options for energy resources over a 20-year period to determine the most cost-effective mix that will enable the utility to meet resource and reliability requirements.
  - The PRC's prior rules governing utilities' IRPs were last updated in 2007. Those rules crafted in 2007 required investor-owned utilities to engage in a resource planning process that evaluates all feasible supply-side and demand-side resources on a "comparable and consistent basis." Specifically, the prior rules asked utilities to consider renewable energy, energy efficiency, load management, distributed generation and conventional supply-side resources.
  - However, in 2017 the PRC acknowledged that in 2007 energy storage was not available as a commercially feasible resource or alternative to supply-side or demand-

side resources (i.e., not mature or inexpensive enough) and thus was not identified in any explicit way. In August 2017, the PRC concluded that energy storage "has become a viable technology shown to improve the overall use and economics of the electric grid."

- Revisions to the IRP governing rules that became effective in August 2017 now allow utilities in New Mexico to include energy storage in their IRPs by comparing existing electric supply-side, energy storage and demand-side resources. It is noteworthy that the amendment to the IRP rules created a new listing for storage, distinguishing it from demand response solutions because storage resources are "at times demand-response resources and at times supply-side resources."

While utilities in New Mexico are still required to file new IRPs every three years, from now on, those IRPs will include "existing electric supply-side, energy storage and demand-side resources."

5.6. Interconnection Rules

To Be Added

5.7. The Future of Energy Storage in New Mexico

While high-level policies in New Mexico are laying the foundation for energy storage to play a significant role in the carbon-free future envisioned by the state, there will likely be a number of initiatives before the New Mexico PRC that will address the more granular-level requirements and tactical considerations associated with an expanded role for storage. Two issues that have been identified but have yet to be introduced with a formal policy proceeding are the desire / need for mandates for storage procurement and a reliable approach for determining the value of energy storage across multiple use applications. Both of these issues are common considerations as energy policy is determined at the state level.

The Energy Storage Association (ESA) filed a position paper in response to the PRC's rule change regarding IRPs and storage and recommended that New Mexico should set targets for energy storage procurement by utilities, as has been seen in California (1.3 MW target) and to a lesser extent Massachusetts (200 MWh target) and some other states. However, at this point, the PRC has declined to set storage targets for New Mexico on the basis that there is presently only one utility-owned storage system in the entire state (PNM's Prosperity Energy Storage project) and there is no adequate framework for comparing storage targets for deployment. That could certainly change as more utility-driven storage projects are developed in New Mexico.

PRC staff also have mentioned the need for a cost/benefit analysis of energy storage. This is a similar need that other states (e.g., Minnesota) have expressed and is reminiscent of similar "value of solar" proceedings that have occurred in various states in recent years. An interesting aspect in New Mexico is that the PRC staff specifically referred to how energy storage options are considered and possibly rejected by regulated utilities and, in the absence of a reliable cost/benefit methodology, how those projects were evaluated.

Other issues related to storage that regulators in New Mexico are likely to address in the near term include:

- Revised interconnection standards
- Asset classification for storage technologies
- Potential revision of net metering policies to include energy storage
- Consideration of multiple use applications for storage
- Potential increases to the state's existing Renewables Portfolio Standard

6. NEW YORK ENERGY STORAGE POLICY

6.1. Storage Policy Snapshot

Does New York have a renewables mandate?	YES; 50 percent by 2030
Does New York have a state mandate or target for storage?	YES, 1,500 MW by 2025
Does New York offer financial incentives for energy storage development?	YES
Does New York have a policy for the strategic deployment of Non-Wires Alternatives or Distributed Energy Resources to defer, mitigate, or obviate need for certain T&D investments?	YES
Does New York have a policy addressing multiple use applications for storage?	NO
Does New York have a policy on utility ownership of storage assets?	NO
Does New York allow or mandate the inclusion of energy storage in utility IRPs?	YES
Has New York modified its permitting or interconnection requirements specific to energy storage?	NO
Does New York allow customer-sited storage to be eligible for net metering compensation?	YES (Energy storage projects paired with eligible DER are eligible)
Has New York revised its rate structures to drive adoption of behind-the-meter storage	PENDING
Approximate development of storage capacity in New York	Approximately 1,460 MW of storage deployed

6.2. Storage Policy Assessment

Supported by a clear vision articulated by the state's governor, actions by the New York Legislature and New York Public Service Commission (NY PSC) have solidified the role of energy storage as an important foundation of the state's transition to a clean energy-powered future. In fact, New York has established one of the most aggressive procurement targets for energy storage in the country with its pledge to meet a target of 1,500 MW of storage deployed by 2025. By comparison, California has a 1,300 MW by 2020 target; Massachusetts is pursuing a target of 2,00 MW by 2025, and New Jersey recently adopted a 2,000 MW by 2030 target.

At this time, energy storage is still in the early stages of development in New York (as is the case with other states). Approximately 1,460 MW of storage have been deployed in New York, of which approximately 1,400 MW of pumped hydro at two New York Power Authority facilities. The largest non-hydro storage facility in the state is a 20-MW flywheel used for frequency regulation, operated by Beacon Power in Stephenstown, N.Y. Beyond that, another 100 MW of storage is in various states of development, mostly in constrained downstate regions, and about six other battery storage projects that in aggregate total 430 MW.

New York is defining energy storage policy within the broader efforts contained in the Reforming the Energy Vision (REV) initiative, which has been in place since 2015 and aims to make a number of systemic changes to the state's regulatory model and operational requirements. REV's clean energy goals for 2030 include:

- 40 percent reduction in greenhouse gas emissions from 1990 levels;
- 50 percent of New York's electricity must come from renewables; and
- 23 percent reduction in energy consumption from 2012 levels

Provisions of the REV proceedings include moving New York utilities from a cost-of-service business model to a market-based model. Specifically, utilities will maintain their former status as energy distributors, but will also assume the role of "market operators," facilitating transactions between those who provide energy and those who use it. Utilities will be incentivized to use DER in their grid planning efforts. In this new role, utilities will own the distributed service platform that DER sellers and retail customers use to buy and sell electricity. REV envisions that current utilities in New York state will become a sort of "mini-ISO" as it relates to DERs. Utilities will be incentivized to use DER in their grid planning efforts.

The REV policy is being executed in two tracks. Both tracks seek to meet the same three goals: Track One described in an order released on February 26, 2015, focuses on shaping the new utility vision and DER ownership challenges. Track Two described in an order released on May 16, 2016, focuses on the necessary changes in the current regulatory, tariff, market, and incentive structures.

With regard to the development of energy storage specifically, New York is in the midst of developing an energy storage policy framework that can support what is anticipated to be a robust market in both the state's distribution system and wholesale market managed by the New York Independent System Operator (NY ISO). To date, New York's energy storage policy framework has utilized procurement targets, financial incentives and demonstration projects to jumpstart the energy storage marketplace in the state. Two specific areas that have been the core tenets of New York's storage policy are: 1) financial incentives provided by the state that are geared toward enabling the unique system benefits storage can provide; and 2) changes in rate design that would enable a shift toward energy storage, which are being assessed as part of the broader REV initiative.

6.3. Executive Directives

In February 2018, Governor Andrew Cuomo's State of the State address included a clean energy agenda, in which energy storage (and energy efficiency) targets were promised by executive directive (to be subsequently implemented by the New York PSC). The energy storage initiative set New

York on the trajectory to achieve 1,500 MW of storage by 2025 and up to 3,000 MW by 2030. (The energy efficiency target for investor-owned utilities aims to more than double utility energy efficiency progress by 2025). Governor Cuomo added another goal, pledging to make New York's electricity supplies 100 percent free of carbon dioxide emissions by 2040. Both announcements were made as part of the governor's wider REV initiatives that includes a Clean Energy Standard to generate 50 percent of the state's electricity from renewable energy sources by 2030.

Other state-level agencies are directly involved in the development of energy storage policy in New York. Perhaps most directly involved is the New York State Energy Research & Development Authority (NYSERDA) conducts energy analyses, provides financial aid for energy-related projects, and arbitrates programs related to energy efficiency and renewable energy. In response to the governor's State of the State address, NYSERDA, in collaboration with the New York Department of Public Service, developed the New York State Energy Storage Roadmap to identify key policies, regulations and initiatives instrumental to achieving what would become the formally adopted goal aiming for 3,000 MW of energy storage capacity by 2030.

The Roadmap offers an approach and a series of recommended actions that are intended to achieve the Governor's 1,500 MW target for energy storage. Key provisions of New York's Energy Storage Roadmap include:

- Providing $35 million in incentive funding for energy storage projects;
- Providing a $200 million fund to provide loans for energy storage project developers;
- Reviewing utility rates and carbon policies, creating new business opportunities for energy storage systems; and
- Reducing soft costs for energy storage.

As outlined in the Roadmap, the New York State Energy Research and Development Authority (NYSERDA) established, as part of its Clean Energy Fund, a $15.5 million funding program for energy storage projects. Through the funding program, NYSERDA is seeking proposals for early stage product development (up to $200,000 per award), product development (no award limit) and product field testing (up to $1 million per award). The bridging incentive is intended to jumpstart the energy storage market in the state of New York.

6.4. Legislation

AB A6571 ("Establishing the Energy Storage Program") (November 2017)

- The law directs the NY PSC to "establish a target for the installation of qualified energy storage systems to be achieved through 2030 and programs that will enable the state to meet such target," with goals/targets established in conjunction with programs administered by other state agencies.
- A6571 also specifically calls out for an aggressive build-out of "commercially available technology" which is cost-effective and can assist in lowering greenhouse gas (GHG) emissions, reducing peak demand, reducing the need for expensive infrastructure upgrades and otherwise improving the reliability of the electrical network, all cornerstones of the NY REV program. These commercially available technologies could include mechanical, chemical or thermal energy storage.

AB 8921A ("Establishing an energy storage deployment strategy")

- The law required that by December 31, 2018, the NYC PSC finalize a statewide energy storage goal.
- The law also formally adopted the storage goal referenced by Gov. Cuomo in his executive directive, namely that the NY PSC adopt an energy storage goal of installing up to 3,000 MW of qualified storage energy systems by 2030, with an interim objective of deploying 1,500 MW of energy storage systems by 2025.
- This law also described and adopted a suite of energy storage deployment policies and actions to help eliminate barriers inhibiting deployment and support the State's achievement of that goal.
    - 8 PSL §74(1) defines a "qualified energy storage system" as a "commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy using mechanical, chemical, or thermal processes to store energy that was generated at one time for use at a later time."

6.5. Regulations

Docket 14-M-0101 (The "Reforming the Energy Vision" (REV) proceeding) **(2015)**

- This massive regulatory proceeding touches many different areas of New York's energy market, including but not limited to energy storage.
- Under the REV proceeding, New York has been attempting to transform its electricity system into one that is cleaner and smarter, as well as more resilient and affordable.
- Energy storage technologies will play an increasingly important role in this REV transformation. Specific regulatory changes under the REV initiative are intended to promote more efficient use of energy, deeper penetration of renewable energy resources such as wind and solar, wider deployment of "distributed" energy resources, such as micro grids, rooftop solar and other on-site power supplies, and storage. It is also promoting markets to achieve greater use of advanced energy management products to enhance demand elasticity and efficiencies.
- Specific goals of the REV proceeding include:
    - Requires 50 percent of the state's electricity needs from renewable energy by 2030.
    - Requires a reduction of statewide greenhouse gas emissions by 40 percent by 2030 and the internationally recognized target of reducing emissions 80 percent by 2050.
- In the REV model, the state acts as a facilitator between developers and utilities. Through the REV Demo program, the state maintains an open call for demonstration project proposals that will test new technologies and business models for energy storage and other distributed energy resources.

CASE 15-E-0302 / CASE 16-E-270 (Order Adopting a Clean Energy Standard) **(2016)**

- The adoption of the Clean Energy Standard in New York in 2016 was arguably the first piece of regulatory policy in New York that served as a catalyst for energy storage development in the modern era.

- While the regulatory order was primarily focused on creating a renewables goal for the state, it did make important references to storage that set the stage for how storage would factor into the broader energy initiatives unfolding in the state. Specifically, the 2016 Clean Energy Standard set a goal that 50 percent of the electricity consumed in New York by 2030 would be generated from renewable energy sources (i.e., the "50-by-30 goal).

CASE 15-E-0751: Value of Distributed Energy Resources (VDER) (March 2017)

- CASE 15-E-0751 is an ongoing proceeding to develop accurate pricing for distributed energy resources that reflects the actual value DERs create.
- The goal of this proceeding is therefore to enable an increase in both overall DER penetration and the benefits that DER installations, individually and collectively, provide to the system by making compensation accurately match those benefits.

CASE 14-M-0101 (Development of Energy Storage Projects) (March 2017)

- This order emerged out of a broader NY PSC order advancing utility planning of Distributed System Implementation Platforms (DSIP).
- The order was intended to direct the state's utilities to "significantly increase the scope and speed of their energy storage endeavors."
- Specifically, under this case the NY PSC directed the state's investor-owned utilities to deploy at least two energy-storage projects by the end of 2018.
- The order requires that by the deadline of December 31, 2018, an individual utility must have energy storage projects deployed and operating at no fewer than two separate distribution substations or feeders."
- In addition, the order states that utilities will strive to have these energy-storage systems perform at least two types of grid functions, such as increasing the generating capacity of a substation ("hosting capacity") or help reduce the power needed when energy demand is at its highest ("peak load").

CASE 18-E-0130 (The "Energy Storage Roadmap") (June 2018)

- o On June 21, 2018, the NY PSC and the New York State Energy Research and Development Authority (NYSERDA) filed the "New York State Energy Storage Roadmap and DPS/NYSERDA Staff Recommendations" to the New York PSC in order to provide the NY PSC with a range of options to satisfy the newly enacted legislation directing the NY PSC's to establish a statewide energy storage goal for 2030, and a deployment policy to support that goal.
- o The Roadmap identifies near-term policies, regulations, and initiatives needed to realize the governor's 2025 target in anticipation of a 2030 target to be established later this year by the state's Public Service Commission.
- o The Roadmap describes a long-term (2026-2030) vision for energy storage deployment, though its primary focus is to identify opportunities, use cases, and implementable actions to support deployment of various energy storage applications in the near-to-medium term (2019-2025).
- o The Roadmap is technology-neutral and acknowledges that a range of energy storage solutions will be deployed to best meet customer and system needs.

- The Roadmap includes a host of recommendations to address barriers that impede energy storage from reaching its full potential, with an emphasis on near-term bridging mechanisms and reforms. The Roadmap recommendations fall into seven general categories with associated policy goals, including:
    1. *Retail rate actions and utility programs*: Improve customer delivery rates and programs like dynamic load management (DLM) programs to send more accurate price signals.
    2. *Utility roles and business models:* Incentivize utilities to manage the full customer bill, leveraging assets such as Non-Wires Alternatives (NWA) and unused real estate to reduce ratepayer costs.
    3. *Direct procurement:* Use direct procurement approaches through utility NWAs, the Renewable Energy Standard (RES), and the State's "Lead by Example" initiatives to expand the market for energy storage.
    4. *Market acceleration incentives:* Utilize "bridge incentives" to accelerate soft and hard cost reductions.
    5. *Soft-cost reductions*: Reduce soft costs by, for example, expanding access to more granular system load data and increasing access to a skilled workforce.
    6. *"Clean peak" actions:* Develop approaches to CO_2 reduction compensation that varies with time, and integrate the DEC's draft combustion turbine peaking unit regulations into energy storage policy.
    7. *Wholesale market actions*: Reform wholesale and retail market rules to better enable and coordinate energy storage services when technically and economically feasible

***Docket 18-00516/18-e-0130. ("Storage Targets")* (December 2018)**

- On December 13, 2018, pursuant to Governor Andrew Cuomo's call for a long-term energy storage target and in accordance with the Storage Roadmap, the NY PSC formally adopted a target of 1,500 MW of storage capability by 2025 and an aspirational target of 3,000 MW by 2030.
- The goal of the Order was to "accelerate the market learning curve and drive down costs, thus speeding the deployment of energy storage at scale through the highest-value applications."
- The Order also required that NYSERDA establish and administer a "bridge" incentive in order to accelerate the energy storage learning curve, drive down costs, and facilitate new research into energy storage as a non-wires alternative and replacement for peaker plants.
- Each utility is required to procure a minimum amount of storage to be operational by December 31, 2022, with Consolidated Edison required to procure at least 300 MW and each of the other electric IOUs required to procure at least 10 MW each, provided that bids do not exceed a utility-specific defined ceiling.
- Utilities shall amortize and recover the contract costs over the term of the contract. These costs shall be recovered from all delivery customers in the same manner that NWA program

costs are recovered at each utility. The IOUs shall account for their actual wholesale revenues earned from the asset as a benefit for ratepayers in recovering contract costs. To provide an incentive for the utilities to maximize the wholesale revenues of the storage asset, when revenues exceed contract costs on an annual basis, the Commission authorizes revenue sharing of 30% to utility shareholders and 70% to ratepayers.

***CASE 18-E-0130 ("Incentive Funds to Leverage Market Acceleration")* (March 2019)**

- One of the key parts of this broad case (see summary of the Energy Storage Roadmap that was also included in this case), the NY PSC ordered a $310 million "bridge fund" to kick start the energy storage market in the state.
- The bridge fund is intended to be administered by the New York State Energy Research and Development Authority (NYSERDA).
- The NY PSC directed the state's six major electric utilities to hold competitive procurements for 350 megawatts of bulk-sited energy storage systems.
- The bridge fund will use previously collected but uncommitted renewable portfolio standard ratepayer funds to finance energy storage projects.

The funds are slated to be allocated among three market segments —customer-sited storage, distribution-sited storage, and bulk market storage —but the order did not spell out those allocations.

6.6. Interconnection Rules

To Be Added

6.7. The Future of Energy Storage in New York

Even against the backdrop of the massive REV proceedings in New York, there are still a number of policy issues related to energy storage that are still being vetted by the state's stakeholders. Three significant policy issues that still require resolution in New York include:

- Utility ownership of storage assets
- Inconsistencies between New York's Energy Storage Roadmap and NYISO standards
- Siting challenges within New York City

A summary of these issues currently under discussion in New York is provided below.

Utility Ownership

From the utilities' perspective, questions remain regarding the ownership models and applications for storage that will emerge from REV initiatives.
Achieving a full array of utility and customer benefits through the development of energy storage may require a variety of storage scale, ownership, and control scenarios. However, in general the New York PSC has made clear through various REV orders and proceedings that utility ownership of Distributed Energy Resources (DERs) would be prohibited, barring a few specific exceptions. DERs in this case is considered to be distributed generation, storage used for economic purposes,

and customer-side demand management. However, the exceptions outlined by the New York PSC could prove to be favorable to utility-owned energy storage as a DER.
Exceptions for utility ownership of energy storage assets currently include the following circumstances:

- Procurement of DER has been solicited to meet a system need, and a utility has demonstrated that competitive alternatives proposed by non-utility parties are clearly inadequate or more costly than a traditional utility infrastructure alternative
- A project consists of energy storage integrated into distribution system architecture
- A project will enable low- or moderate-income residential customers to benefit from DER where markets are not likely to satisfy the need
- A project is being sponsored for demonstration purposes

There are stakeholders in New York, including utilities, that continue to make the argument that storage deployment at a scale optimal to the power system, which could include utility ownership given that utilities historically have been most informed of grid needs and positioned to deploy resources throughout their territories. As energy storage technologies and opportunities continue to mature, it is likely that utilities will continue to challenge the prohibition against ownership.

Inconsistencies with NYISO Standards
One of the key elements in New York's Energy Storage Roadmap is creating the potential for energy storage to draw revenues from both the retail market and wholesale markets. This is consistent with policy objectives established by FERC's Order 841, and was viewed positively by storage developers as it opens the possibility for storage technologies to pursue multiple revenue streams based on multiple-use applications. However, based on the New York ISO's (NY ISO's) filing response to FERC's Order 841, this is still likely unsettled policy and a potential conflict.

Here's how: Order 841 directs ISOs and RTOs to develop revisions to existing tariffs to open up their wholesale energy, capacity and ancillary services markets to energy storage resources on a nondiscriminatory basis. Grid operators had to submit their compliance filings by Dec. 3. However, in its filing NY ISO does not accommodate dual participation in both retail and wholesale markets. The NY ISO also requested an extension from FERC on the implementation of its new rules for energy storage in the wholesale market to May 2020.
This potential policy inconsistency may take some time to resolve, with strong arguments on both sides of the issue. Being able to participate in the ISO is going to be key to the full implementation of energy storage in New York. However, because the NY ISO is not under the jurisdiction of state agencies the goals outlined within New York's Energy Storage Roadmap may be difficult to achieve unless participation in the wholesale markets is approved.

6.7.1. Siting Challenges in New York City

Siting storage projects in highly congested areas, such as New York City, has remained a challenge as building and fire codes have not evolved sufficiently to address siting restrictions that impact storage development. One specific problem has been delays resulting from the Fire Department of New York's permitting processes and concerns about safety and the risk of fire associated with battery storage. The lack of clarity around standards pertaining to the indoor siting of lithium-ion battery storage systems has limited energy storage projects in the city. This lack of clarity is impacting storage development and thus the potential to meet targets the state has established.

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