Utah OnLaw: The Utah Law Review Online Supplement

Volume 2017 | Number 1 Article 3

4-11-2017

Growth and Legal Implications of Energy Storage Technologies

Chaunceton B. Bird
S.J. Quinney College of Law, University of Utah., chaunceton.bird@law.utah.edu

GROWTH AND LEGAL IMPLICATIONS OF ENERGY STORAGE TECHNOLOGIES

Chaunceton B. Bird*

INTRODUCTION

Energy storage is the harnessing of energy for use at a later time.[1] The term "energy storage" can refer to anything from the winding of a watch spring, to the damming of the Colorado River. In the context of this article, energy storage will refer to the technologies being developed and used to store electrical energy (potential, kinetic, chemical, or thermal energy). Large-scale, high-capacity storage of electricity is a pre-requisite to the wide-spread adoption of renewable energy sources like solar power and wind power.[2]

Methods of capturing renewable energy like wind and solar will become more dependable with reliable energy storage.[3] Without an ability to store large amounts of electricity, solar panels and windmills fail to meet energy demands on cloudy, windless days (or during the night).[4] Contemporary society demands electricity at fluctuating levels of consumption and the unpredictable conditions of nature make it near impossible to implement widespread renewable energy without an ability to deal with its intermittent power production.[5] Energy storage systems can be used to "smooth out variable power flows from wind and solar plants, reducing the need for large, centralized generation plants fired by fossil fuels."[6] Energy storage is a vital component to a resilient, reliable electric

---

* Student, University of Utah;

[1] *See Unleashing the Power of Energy Storage*, ENERGY STORAGE ASS'N, http://energystorage.org/energy-storage (last visited Nov. 7, 2016) (providing an overview of energy storage).

[2] *See U.S. Department of Energy, Grid Energy Storage* 4–6 (2013), https://energy.gov/sites/prod/files/2014/09/f18/Grid%20Energy%20Storage%20December%202013.pdf.

[3] *See Energy Storage*, DEP'T OF ENERGY, http://energy.gov/oe/services/technology-development/energy-storage (last visited Nov. 7, 2016) (discussing the need for reliable energy storage).

[4] *See* Rob Wile, *Solar Power Could Be A Total Game-changer — But They Still Need To Figure Out One Thing*, BUS. INSIDER (Nov. 18, 2013, 11:14 AM), http://www.businessinsider.com/renewable-energy-storage-problem-2013-11 (discussing renewable energy's need for high-capacity electricity storage).

[5] *See id.*

[6] Anna Hirtenstein, *Batteries Capable of Storing Power Seen as Big as Rooftop Solar*

grid based on renewable energy power generation.[7] "By eliminating the historical limitation of the grid . . . energy storage has the potential to drastically alter the way the electricity grid functions."[8]

Although growth in energy storage technologies is substantial, it is uneven and intermittent across the United States in part because of a lack of legal uniformity.[9] State governments are inconsistent and unpredictable in their renewable energy laws, and the federal government has been remiss to implement nationwide uniform regulations.[10] As a result, energy storage is booming in states like California and Texas,[11] yet crawling in states like Utah[12] and Virginia.[13] Short-term incentive programs only add to the market instability.[14] It is against this backdrop that this paper sets out to analyze how these inconsistencies and disparities can be replaced by polices that promote legal clarity and uniformity in energy storage markets.

This paper will discuss the modern methods of energy storage; then it will report on the tremendous growth—both occurring and planned—of energy storage technologies. The paper will then analyze and discuss the various forms of regulation, government funding, and legal framework that impact energy storage. Finally, this paper will make recommendations about how legislative bodies should respond to rapid growth in emerging energy storage markets.

Panels in 12 Years, 47 Env't Rep. (BNA) 1840, 1840 (June 17, 2016).

7 *Grid Energy Storage*, DEP'T OF ENERGY (Dec. 2013), http://energy.gov/sites/prod/files/2014/09/f18/Grid%20Energy%20Storage%20December%202013.pdf.

8 Amy L. Stein, *Distributed Reliability*, 87 U. COLO. L. REV. 887, 917 (2016).

9 *See* Michael J. Allen, *Energy Storage: The Emerging Legal Framework (And Why It Makes a Difference)*, 30 NAT. RESOURCES & ENV'T 20, 20–24 (Spring 2016) (analyzing the nation-wide inconsistencies in energy storage regulation and advocating for uniformity).

10 *Id.*

11 *See Issue Brief: A Survey of State Policies to Support Utility-Scale and Distributed-Energy Storage*, NAT. RENEWABLE ENERGY LABORATORY 2, 4 (Aug. 2014), http://www.nrel.gov/docs/fy14osti/62726.pdf (reporting on California and Texas's ambitious energy storage initiatives).

12 *See, e.g.*, Robert Gehrke, *Utah Senate Approves Bill Critics Say is a Gift to Rocky Mountain Power, Hurts Solar*, SALT LAKE TRIB. (Mar. 7, 2016, 2:16 PM), http://www.sltrib.com/home/3618367-155/utah-senate-approves-bill-critics-say (discussing one of Utah's recent bills that will eliminate a solar-power incentive program for residential and large-scale solar users).

13 *See* Ivy Main, *Your 2016 Guide to Virginia Wind and Solar Policy*, ENERGY COLLECTIVE (Sept. 15, 2016), http://www.theenergycollective.com/ivy-main/2388023/your-2016-guide-to-virginia-wind-and-solar-policy-2 (discussing the Virginia legislature's lethargy regarding renewable energy policy).

14 Allen, *supra* note 9, at 20–21.

I. ENERGY STORAGE TECHNOLOGIES

The Federal Energy Regulatory Commission's ("FERC") definition of an electric energy storage asset is:

> property that is interconnected to the electrical grid and is designed to receive electrical energy, to store such electrical energy as another energy form, and to convert such energy back to electricity and deliver such electricity for sale, or to use such energy to provide reliability or economic benefits to the grid.[15]

Or, put more succinctly, electric energy storage assets are "a set of technologies capable of storing previously generated electric energy and releasing that energy at a later time."[16] There are six main types of energy storage:

- **Solid State Batteries** - a range of electrochemical storage solutions, including advanced chemistry batteries and capacitors
- **Flow Batteries** - batteries where the energy is stored directly in the electrolyte solution for longer cycle life, and quick response times
- **Flywheels** - mechanical devices that harness rotational energy to deliver instantaneous electricity
- **Compressed Air Energy Storage** - utilizing compressed air to create a potent energy reserve
- **Thermal** - capturing heat and cold to create energy on demand
- **Pumped Hydro-Power** - creating large-scale reservoirs of energy with water[17]

[15] Third-Party Provision of Ancillary Services; Accounting & Financial Reporting for New Electric Storage Technologies, 144 F.E.R.C. ¶ 61056 (July 18, 2013) 2013 WL 5272814.

[16] Matthew Deal et al., *Electric Energy Storage: An Assessment of Potential Barriers and Opportunities*, CAL. PUB. UTIL. COMM'N 2–3 (July 9, 2010), https://www.jointventure.org/images/stories/pdf/cpuc.storagewhitepaper7910.pdf ("[Electric Energy Storage] technologies may store electrical energy as potential, kinetic, chemical, or thermal energy, and include various types of batteries, flywheels, electrochemical capacitors, compressed air storage, thermal storage devices and pumped hydroelectric power.").

[17] *Energy Storage Technologies*, ENERGY STORAGE ASS'N, http://energystorage.org/energy-storage/energy-storage-technologies (last visited Sept. 12, 2016).

Some of these storage systems store energy "behind-the-meter," meaning that consumers can generate and store electricity on-site.[18] However, the vast majority of energy storage happens on the other side of the meter.

The leading form of energy storage in the United States is currently hydropower pump storage.[19] Hydroelectric storage is the use of electricity to pump water to a higher elevation storage area where the energy can be stored in the form of gravitational potential energy of water.[20] Then, during periods of high-energy demand, the stored water is released to turbines to generate electric power [see figure 1[21]].[22]

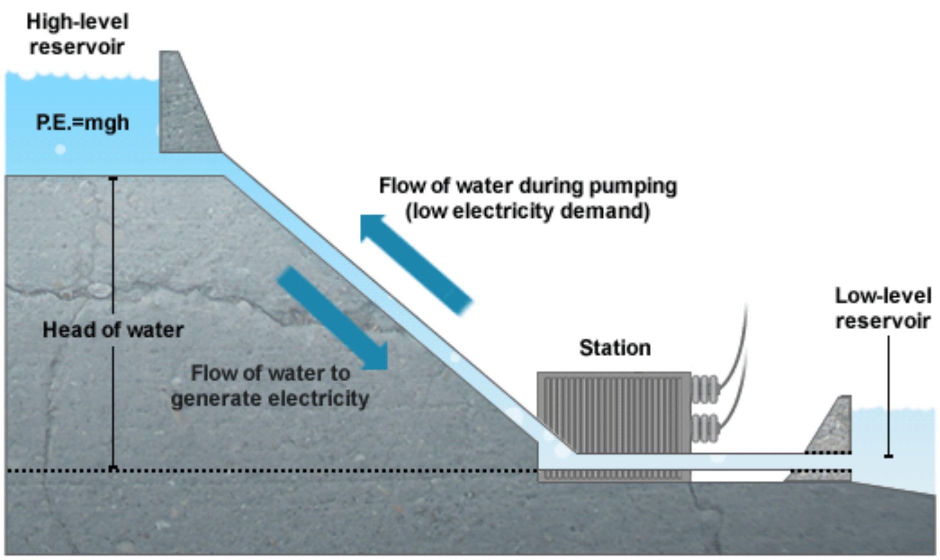

Figure 1: Basic Depiction of a Hydroelectric Storage System

---

[18] *See* J. Neubauer & M. Simpson, *Deployment of Behind-The-Meter Energy Storage for Demand Charge Reduction*, NAT. RENEWABLE ENERGY LABORATORY 9 (Jan. 2015), http://www.nrel.gov/docs/fy15osti/63162.pdf.

[19] K. K. DUVIVIER, THE RENEWABLE ENERGY READER 166 (2011).

[20] *Id.* at 165–67.

[21] *Generation of Electricity: Pumped Storage Hydroelectric Power Station*, BBC NEWS, http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/generation_of_electricity/revision/3/ (last visited Sept. 12, 2016).

[22] *Id.*

In 2011, pumped storage accounted for 21 gigawatts of nameplate[23] capacity.[24] "All other forms of energy storage—including batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels, and miscellaneous technologies—accounted for only about 1 gigawatt of U.S. generator nameplate capacity in 2009."[25] As of 2015, roughly 98 percent of the U.S. electricity storage is pumped hydroelectric storage.[26] Although pumped storage is a reliable storage technology, the facilities are "very expensive to build, may have controversial environmental impacts, have extensive permitting procedures, and require sites with specific topologic and/or geologic characteristics."[27] For instance, the overnight cost[28] to construct a pumped hydroelectric plant is about $8,700/kW, compared to the $3,100/kW for a conventional hydroelectric plant.[29]

As a result, other forms of electrical storage are on the rise. In 2015, 220 megawatts of electrochemical and electromechanical storage capacity were installed in the U.S.[30] Compare this with the 61.9 megawatts in 2014, and the 44.2 megawatts in 2013.[31] And these numbers pale in comparison to the planned production of non-hydro energy storage. Bloomberg New Energy Finance predicts 4,500 megawatts of non-hydro storage will be installed globally by 2024.[32]

---

[23] "Generator nameplate capacity (installed): The maximum rated output of a generator, prime mover, or other electric power production equipment under specific conditions designated by the manufacturer." *Glossary: G*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/tools/glossary/index.cfm?id=G (last visited Sept. 12, 2016).

[24] DUVIVIER, *supra* note 19, at 166.

[25] *Id.*

[26] Cara Marcy, *Nonhydro Electricity Storage Increasing as New Policies Are Implemented*, U.S. ENERGY INFO. ADMIN. (Apr. 3, 2015), http://www.eia.gov/todayinenergy/detail.cfm?id=20652; *see also* Hirtenstein, *supra* note 6, at 1840 (finding similarly).

[27] *Electricity Storage: Location, Location, Location . . . and Cost*, U.S. ENERGY INFO. ADMIN. (June 29, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=6910#tabs_ElecStorage-1.

[28] "'Overnight cost' is an estimate of the cost at which a plant could be constructed assuming that the entire process from planning through completion could be accomplished in a single day." *Updated Capital Cost Estimates for Electricity Generation Plants*, U.S. ENERGY INFO. ADMIN. 2 (Nov. 2010), https://www.nrc.gov/docs/ML1034/ML103420319.pdf .

[29] *Electricity Storage*, *supra* note 27.

[30] *'Breakout Year' for Non-Hydro Energy Storage in U.S., Finds GTM Report*, PV MAG. (Mar. 5, 2015), https://www.pv-magazine.com/2015/03/05/breakout-year-for-non-hydro-energy-storage-in-u-s-finds-gtm-report_100018469/.

[31] *Id.*

[32] Jason Deign, *Study: Distributed Storage is Going to Take Over*, ENERGY STORAGE REP. (Sept. 7, 2016), http://energystoragereport.info/study-distributed-storage-going-take/ (predicting that 45 gigawatts of non-hydro energy storage will be installed by 2024).

Efforts to provide energy storage by way of lithium ion batteries has led Tesla Motors to build their "Gigafactory"—a 5.8 million square foot factory[33] costing between four and five billion dollars[34] that will produce "more lithium ion batteries annually than were produced worldwide in 2013."[35] The name Gigafactory comes from the factory's planned *annual* battery production capacity of 35 gigawatt-hours' worth of car batteries, and 50 gigawatt-hours' worth of residential and commercial battery packs.[36] This immense energy storage production is put into perspective in the following section.

II. GROWTH OF ENERGY STORAGE TECHNOLOGIES

Energy storage technologies are growing at tremendous rates.[37] "According to market research firm IHS [Information Handling Services], [global] energy storage growth will 'explode' from .34 GW in 2012–2013 to 6 GW by 2017 and over 40 GW by 2022."[38] As demand and supply of energy storage resources increase, lawmakers will need to keep pace by providing legal framework to protect consumers, facilitate growth, and encourage investment.

Most energy storage technologies are owned, and being developed by, private actors.[39] Growth in privately owned nonutility energy storage is driven by two primary factors.[40] The first is regulatory initiatives that incentivize nonutility ownership of storage.[41] The second is self-interest,

---

[33] Jack Stewart, *This is the Enormous Gigafactory Where Tesla Will Build its Future*, WIRED (July 27, 2016, 7:00 AM), https://www.wired.com/2016/07/tesla-gigafactory-elon-musk/.

[34] *Gigafactory Presentation*, TESLA, https://www.tesla.com/sites/default/files/blog_attachments/gigafactory.pdf (last visited Sept. 13, 2016).

[35] *Tesla Gigafactory*, TESLA, https://www.tesla.com/gigafactory (last visited Sept. 13, 2016).

[36] *Id.*; *Gigafactory Presentation*, *supra* note 34.

[37] *See* Katherine Hamilton, *Energy Storage: State of the Industry*, ENERGY STORAGE ASS'N 5 (2015), https://www.eia.gov/conference/2015/pdf/presentations/hamilton.pdf.

[38] *Id.* at 5 (referencing Sam Wilkinson, *The Grid-ConnectedEnergy Storage Market is Set to Explode, Reaching a Total of Over 40 GW of Installations by 2022*, IHS MARKIT [*sic*] TECH. (Jan. 15, 2014), https://technology.ihs.com/483008).

[39] *See* Stein, *supra* note 8, at 918 (noting that nearly 70% of energy storage resources are "owned by nonutility customers.").

[40] *Id.* at 919.

[41] *Id.*

i.e., profit from the development of energy storage technologies.[42] These factors have contributed to a surge in energy storage investments from both private and public entities, and the expansion shows no signs of slowing.

A. Regulatory Incentives

Regulatory initiatives, usually occurring at the state level, encourage (and sometimes mandate[43]) the development of energy storage by providing funding for energy storage projects.[44] "Since 2011, at least ten states have introduced a total of 14 bills related to energy storage, four of which passed."[45] What's more, funding and information-sharing projects like the "Energy Storage Technology Advancement Partnership" (ESTAP) exist "to accelerate the deployment of electrical energy storage technologies in the U.S." by acting as a brokers between private consumers and government entities.[46] These state funding programs allow consumers to implement alternative energy technology without bearing the brunt of the full cost.

California, for example, has a "Self-Generation Incentive Program" ("SGIP") which provides rebates for "qualifying distributed energy systems installed on the customer's side of the utility meter."[47] Such distributed energy systems include advanced energy storage systems.[48] California provides a step-by-step application process and will assist consumers in the state with the implementation of their alternative energy technology.[49] SGIP is a program created by the California legislature with the intent to "increase deployment of distributed generation and energy storage systems to facilitate the integration of those resources into the electrical grid, improve efficiency and reliability of the distribution and transmission system, and

---

42 *Id.* at 920.

43 A few states, namely California, Oregon, and tentatively Massachusetts, have passed storage target laws that mandate the installation of a certain amount (in California's case: 1.3 gigawatts by 2020) of energy storage. Julian Spector, *An Energy Storage Mandate Could Be Coming Soon to Massachusetts*, GREENTECH MEDIA (Aug. 2, 2016), http://www.greentechmedia.com/articles/read/an-energy-storage-mandate-could-be-coming-soon-to-massachusetts.

44 *See* Stein, *supra* note 8, at 919–20.

45 *Issue Brief*, *supra* note 11, at 1.

46 *Energy Storage Technology Advancement Partnership*, CLEAN ENERGY STATES ALLIANCE, http://www.cesa.org/projects/energy-storage-technology-advancement-partnership/ (last visited Sept. 6, 2016).

47 *Self-Generation Incentive Program*, CAL. PUB. UTIL. COMM'N (2017), http://www.cpuc.ca.gov/sgip/.

48 *See id.*

49 *See id.* (providing links to program administrators for their respective utilities).

reduce emissions of greenhouse gases, peak demand, and ratepayer costs."[50] These regulatory incentives often act as a catalyst for self-interested entities to invest in energy storage.[51]

B. Self-Interest

The second primary factor driving growth of nonutility energy storage technologies is self-interest.[52] A research study from MIT shows that investments in energy storage are becoming increasingly lucrative for private investors.[53] The study found although the economics of energy storage vary widely by location, energy storage projects in California and Texas are providing modest returns to their investors.[54] If there is any question as to whether profits can be made developing energy storage technologies for consumer products, one should consider the recent success of Tesla Motors[55]—a company founded to produce battery-operated electric cars.[56]

Tesla is perhaps the penultimate example of how investment in energy storage technologies can provide lucrative returns. Since the company's founding in 2003, Tesla has been focused on energy innovation.[57] Tesla's CTO, JB Straubel, has stated: "We are an energy innovation company as much as a car company."[58] And that statement is supported by the company's recent innovations and investment in Tesla Energy. "With Tesla Energy, Tesla is amplifying its efforts to accelerate the move away from fossil fuels to a sustainable energy future with Tesla

---

50 CAL. PUB. UTIL. CODE § 379.6 (West 2014).

51 *See, e.g.*, Kerin Cantwell, et. al., *Energy Storage: Clearing the Path for a Breakthrough*, 16 POWER INTELLIGENCE 9, 12 (Mar. 18, 2013) (providing an example of how California's Energy Policy Act of 2005 encouraged independent development of energy storage).

52 Stein, *supra* note 8, at 920.

53 *See* David L. Chandler, *Energy Storage for Renewables Can Be a Good Investment Today, Study Finds*, MIT NEWS (June 13, 2016), http://news.mit.edu/2016/energy-storage-renewables-good-investment-solar-wind-0613.

54 *See id.*

55 *See, e.g.*, *Tesla Inc.*, MSN MONEY, http://www.msn.com/en-us/money/stockdetails/history/fi-126.1.TSLA.NAS (last visited Sept. 7, 2016) (showing Tesla's per share stock price as around $30 in September of 2012 and over $200 in September of 2016).

56 *See About Tesla*, TESLA, https://www.tesla.com/about (last visited Sept. 13, 2016).

57 *See id.*

58 Eric Wesoff, *Tesla CTO on Energy Storage: 'We Should All Be Thinking Bigger'*, GREENTECH MEDIA (May 27, 2014), http://www.greentechmedia.com/articles/read/Tesla-CTO-on-Energy-Storage-We-Should-All-Be-Thinking-Bigger; *see also Tesla Energy*, TESLA, https://www.tesla.com/presskit/teslaenergy (last visited Sept. 7, 2016) ("Tesla is not just an automotive company, it's an energy innovation company.").

batteries, enabling homes, business, and utilities to store sustainable and renewable energy to manage power demand, provide backup power and increase grid resilience."[59]

Figure 2: Tesla's Powerwall

The most recent innovation from Tesla is the Powerwall and Powerpack. The Powerwall [see figure 2] is "a rechargeable lithium-ion battery designed to store energy at a residential level for self-consumption of solar power generation, emergency backup power, load shifting and other applications."[60] The Powerpack [see figure 3] is a larger, scalable version of the Powerwall designed for businesses and utilities.[61] The Powerpack allows companies to build a localized grid that can eventually disconnect from the main power grid and operate independently from on-site power generation.[62] The Powerpack will also allow utilities to reduce the need for expensive facilities that only run during times of peak demand.[63] The ability to store large amounts of energy in the Powerwall and Powerpack allows corporations and individuals to "[s]mooth and firm the output of a renewable power generation source such as wind or solar."[64]

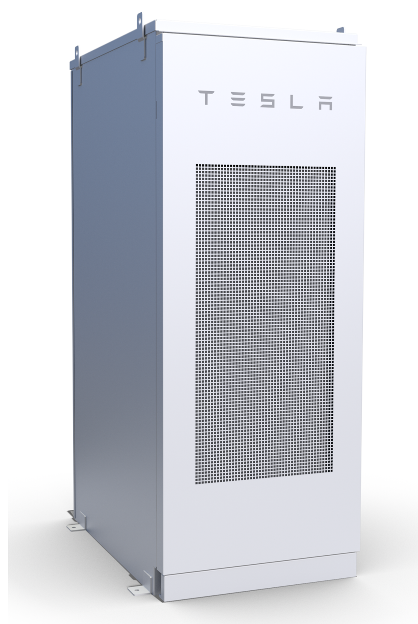

Figure 3: Tesla's Powerpack

On October 28, 2016, Tesla

---

[59] *Tesla Energy*, TESLA, https://www.tesla.com/presskit/teslaenergy (last visited Sept. 7, 2016).
[60] *Id.* ("Powerwall consists of Tesla's lithium-ion battery pack, liquid thermal control system and software that receives dispatch commands from a solar inverter. The unit mounts seamlessly on a wall and is integrated with the local grid to harness excess power and give customers the flexibility to draw energy from their own reserve.").
[61] *See Powerpack: Utility and Business Energy Storage*, TESLA, https://www.tesla.com/powerpack (last visited Sept. 8, 2016).
[62] *See id.*
[63] *SolarCity to Use Tesla's Batteries to Provide Electric Storage of 13 MW for Solar Panels*, 47 BLOOMBERG CLIMATE & ENERGY 534, 534 (Feb. 19, 2016).
[64] *Id.*

announced the release of the Powerwall 2.0 in an event unveiling Tesla's new "Solar Roof."[65] The Powerwall 2.0 is flatter, slightly heavier, and doubles the energy storage capacity (now up to 14 kilowatts) and adds a "fully integrated Tesla inverter."[66] Tesla expects the first Powerwall 2.0 units will ship in December of 2016 with installations beginning in January of 2017.[67] Tesla also announced version 2 of its Powerpack system.[68] Like the Powerwall 2.0, the Powerpack 2 achieves twice the energy storage capacity as its predecessor (storing over 200 kilowatts of electricity), and has a new integrated inverter.[69]

In the past, the high price of installation kept many potential consumers from installing these types of energy storage devices.[70] However, installation prices have been the target of state legislation that aims to aide consumers in their installation of energy storage. For example, in California, residents can take advantage of the "Self Generation Incentive Program," which provides a $2 per watt subsidy for installing energy storage devices.[71] More recently, the United States Senate is considering a bill that would extend renewable energy tax incentives to energy storage systems.[72] These incentives could reimburse as much as 30 percent of installation costs.[73] One of the bill's co-sponsors is Senator Dean Heller from Nevada, who cites Tesla's Gigafactory as a reason for backing the bill.[74]

---

[65] *See* Darrell Etherington & Greg Kumparak, *These are Tesla's Stunning New Solar Roof Tiles for Homes*, TECHCRUNCH (Oct. 28, 2016), https://techcrunch.com/2016/10/28/these-are-teslas-stunning-new-solar-roof-tiles-for-homes/.

[66] Fred Lambert, *Tesla Powerwall 2 is a Game Changer in Home Energy Storage: 14kWh w/ Inverter for $5,500*, ELECTREK (Oct. 28, 2016, 9:52 PM), https://electrek.co/2016/10/28/tesla-powerwall-2-game-changer-in-home-energy-storage-14-kwh-inverter-5500/.

[67] *Id.*

[68] *See* Tesla Team, *Gaining Momentum with Tesla Powerpack*, TESLA (Oct. 27, 2016), https://www.tesla.com/blog/gaining-momentum-tesla-powerpack.

[69] Darrell Etherington, *Tesla Powerpack 2 Has Twice the Energy Density, Began Shipping in September*, TECHCRUNCH (Oct. 27, 2016), https://techcrunch.com/2016/10/27/tesla-powerpack-2-has-twice-the-energy-density-began-shipping-in-september/.

[70] *See generally*, Eric Wesoff & Jeff St. John, *Lessons Learned from SolarCity's First Home Energy Storage Installs, Updated*, GREENTECH MEDIA (May 30, 2013), http://www.greentechmedia.com/articles/read/Lesson-Learned-From-SolarCitys-First-Home-Energy-Storage-Installs (noting that the cost to a homeowner for the installation of a SolarCity energy storage system in 2013 was around $6,000).

[71] *Id.*

[72] *See* Christopher Martin, *Energy Storage Would Draw Tax Credits Under Bipartisan Bill*, 47 Env't Rep. (BNA) 2111, 2111 (July 15, 2016).

[73] *Id.*

[74] *Id.*

Tesla has much to gain from developing and providing energy storage. "The battery division of Tesla Motors Co. turned a profit in its first quarter shipping Powerwall and Powerpack batteries from the company's Nevada Gigafactory."[75] And Tesla is not the only corporation interested in profiting from energy storage development. AT&T, Dow Chemical, General Motors, Google, HSBC, Procter & Gamble, Volkswagen, and Wal-Mart have made "public, voluntary renewable energy commitments" that will rely on dependable energy storage technology.[76]

For many of the world's largest corporations, the cost of energy is one of the largest operating costs.[77] Looking to reduce operating costs, many companies have begun investing in renewable energy to fuel their energy-intensive operations.[78] Apple and Pacific Gas & Electric, for instance, have entered into a purchasing agreement with First Solar to receive a combined 280 megawatts of solar energy from the California Flats Solar Project.[79] Google uses thermal energy storage to cool its $300 million fifteen hectare data center in Taiwan.[80] Wal-Mart is using Tesla Powerpacks at eleven of its California stores.[81] Whole Foods is planning to save money by retrofitting up to 100 of its stores with solar power generation.[82] Amazon

---

[75] Jeff McMahon, *Tesla's Battery Business Profits In Its First Quarter, Elon Musk Says*, FORBES (Feb. 10, 2016, 7:10 PM), http://www.forbes.com/sites/jeffmcmahon/2016/02/10/teslas-battery-business-profits-in-its-first-quarter-elon-musk-says/#473f44636ab4.

[76] David Gardiner, et. al., *Power Forward: Why the World's Largest Companies Are Investing in Renewable Energy*, CERES 2, https://www.ceres.org/resources/reports/power-forward-why-the-world2019s-largest-companies-are-investing-in-renewable-energy (last visited Sept. 8, 2016).

[77] Stein, *supra* note 8, at 922.

[78] *See id.*

[79] *California Flats Solar: Project Overview*, FIRST SOLAR, http://www.firstsolar.com/Resources/Projects/California%20Flats (last visited Apr. 10, 2017).

[80] *Compare* Adam Lesser, *Rethinking On Demand Energy Storage*, GIGAOM (Apr. 10, 2012, 10:06 AM), https://gigaom.com/2012/04/10/rethinking-on-demand-energy-storage/ (reporting on Google's plans for the data center) *with*, Yevgeniy Sverdlik, *Report: Google Plans $66M Taiwan Data Center Investment*, DATA CENTER KNOWLEDGE (Jan. 5, 2015), http://www.datacenterknowledge.com/archives/2015/01/05/google-data-center-in-taiwan-to-get-66m-in-additional-investment/ (discussing the finished data center with the operational thermal cooling and a planned $66 million dollar addition).

[81] Dana Hull, *Tesla Wants to Power Wal-Mart*, BLOOMBERG (Apr. 22, 2015, 2:33 PM), http://www.bloomberg.com/news/articles/2015-04-22/tesla-powered-wal-mart-stores-attest-to-musk-s-energy-ambitions.

[82] *SolarCity to Work with Whole Foods Market to Install Solar Power Systems Across the U.S.*, SOLARCITY (Mar. 8, 2016), http://www.solarcity.com/newsroom/press/solarcity-work-whole-foods-market-install-solar-power-systems-across-us.

Web Services uses Amazon Wind Farms to supply electricity to its cloud data centers and generates more than 2.6 million megawatts annually of additional energy for the grid.[83] In the summer of 2016, Advanced Microgrid Solutions and Stem raised $200 million and $100 million, respectively, for the financing of "solar-plus-storage systems."[84] The following September, "both Tabuchi Electric and Sharp announced new funding specifically for financing solar-plus-storage systems."[85] "VC [venture capital] funding for no-money-down distributed storage financing is approaching $700 million for this year, more than triple the last major wave of funding, which occurred in 2014."[86]

These are just a few examples of the growing investment in renewable energy and energy storage; growth that shows no signs of slowing.

C. Growth

"[I]n 2015 alone, the United States doubled the installed capacity of advanced energy storage to 500 megawatts (MW) and deployment of this key resource is projected to continue to expand."[87] The Whitehouse has announced "new executive actions and 33 state and private sector commitments that will accelerate the grid integration of renewable energy and storage."[88] These actions are expected to result in at least 1.3 gigawatts (or 1,300 megawatts) of additional storage procurement or deployment in the next five years.[89] The private sector commitments include "[s]ixteen developers and power companies in at least eight states announcing new storage procurement and deployment targets for the next five years."[90] Overall these new procurement, deployment, and investment commitments could lead to approximately $1 billion in investments in energy storage.[91]

[83] *AWS & Sustainability*, AMAZON WEB SERVICES, https://aws.amazon.com/about-aws/sustainability/ (last visited Sept. 8, 2016).
[84] Julian Spector, *Energy Storage Financing is Coming Into Its Own*, GREENTECH MEDIA (Oct. 5, 2016), https://www.greentechmedia.com/articles/read/energy-storage-financing-is-coming-into-its-own.
[85] *Id.*
[86] *Id.*
[87] *Fact Sheet: Obama Administration Announces Federal and Private Sector Actions on Scaling Renewable Energy and Storage with Smart Markets*, WHITEHOUSE (June 16, 2016), https://www.whitehouse.gov/the-press-office/2016/06/16/fact-sheet-obama-administration-announces-federal-and-private-sector.
[88] *Id.*
[89] *Id.*
[90] *Id.*
[91] *Id.*

To put these numbers into perspective, in 2008 the U.S. had about 80 megawatts of non-hydro energy storage installed.[92] 80 megawatts is enough to power roughly 13,120 homes for one year.[93] Now, in 2016, there are about 580 megawatts (enough power for nearly 100,000 homes).[94] "The 112 megawatts deployed in the fourth quarter 2015 represented more than the total of all storage deployments in 2013 and 2014 combined. Propelled by that historic quarter, the U.S. energy storage market grew 243 percent over 2014's 65 megawatts (86 megawatt-hours)."[95] "[R]esearch forecasts that the annual U.S. energy storage market will cross the 1-gigawatt mark in 2019, and by 2020 it will be a 1.7-gigawatt [or 1,700 megawatts] market valued at $2.5 billion."[96] By 2040, grid-level energy storage could be discharging around 750 gigawatt-hours of electricity.[97]

One potential obstacle to this explosive growth could be the recent drop in oil prices. Low oil prices make electric vehicles less appealing for consumers whose cost-benefit analysis will see a lower cost in continuing to use gasoline and diesel powered vehicles.[98] However, oil is used in only a fraction of power generation in the United States[99]—in 2015, although 67 percent of power generation came from fossil fuels like coal and natural gas, only one percent of the country's electricity was generated using petroleum products.[100] When it comes to industrial power generation, short-term oil and gas prices will likely have no—or very little—effect on the

---

[92] Joe Ryan, *Big Batteries, Elusive Key to Clean Energy Storage, Boomed in 2015*, 47 Env't Rep. (BNA) 685, 685 (Mar. 4, 2016).
[93] *See What's in a Megawatt?: Calculating the Number of Homes Powered by Solar Energy*, SOLAR ENERGY INDUSTRIES ASS'N, http://www.seia.org/policy/solar-technology/photovoltaic-solar-electric/whats-megawatt (last visited Sept. 10, 2016) (stating that the current national average of homes powered by a megawatt is 164).
[94] *See id.*
[95] Mike Munsell, *US Energy Storage Market Grew 243% in 2015, Largest Year on Record*, GREENTECH MEDIA (Mar. 3, 2016), http://www.greentechmedia.com/articles/read/us-energy-storage-market-grew-243-in-2015-largest-year-on-record.
[96] *Id.*
[97] *See* Hirtenstein, *supra* note 6 at 1840.
[98] *See* Reed Landberg, *Electric Cars to Be Affected Most In Renewables Industry by Oil Slump*, 46 Env't Rep. (BNA) 23, 23 (Jan. 2, 2015) ("Electric vehicles are likely to be the clearest victim of cheaper oil, since they're less competitive with gasoline-powered cars when oil is cheaper.").
[99] Geoffrey Heal & Karoline Hallmeyer, *How Lower Oil Prices Impact the Competitiveness of Oil with Renewable Fuels*, COLUM. | SIPA CTR. ON GLOB. ENERGY POL'Y 1, 12 (Oct. 2015).
[100] *Frequently Asked Questions: What is U.S. Electricity Generation by Energy Source?*, U.S. ENERGY INFO. ADMIN. (Apr. 1, 2016), https://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3.

growth of renewable energy development.[101]

> [A] comparison of costs shows that even at current lower levels, oil will not compete with renewable energy sources in the generation of electric power. For oil-fired power stations to be competitive, oil prices would have to fall to unsustainably low levels—around $15 per barrel, a price level at which the majority of oil producers would be losing money.[102]

Low oil prices still have potential to slow growth in the short-term by deterring the inevitable demise of oil dependence in markets that sell and rely on the commodity.[103] But oil and gas do not have a monopoly on plummeting prices. "Since 2010, the average electric vehicle . . . battery pack price has fallen from $1,000 per kWh [kilowatt], to $350 per kWh."[104] With falling prices and environmentally minded consumers on the rise,[105] the future of renewable energy is bright. By 2040 researchers estimate that 35 percent of all light vehicles sold will be electric—that is about 90 times the figure in 2015.[106]

As evidence of this continued expansion, the U.S. Department of Energy recently announced plans to fund six new integrated solar power and energy storage systems as part of its Grid Modernization Initiative.[107] The investment will provide $18 million in funding for "the development and demonstration of integrated, scalable, and cost-effective solar technologies that incorporate energy storage to power American homes after the sun sets or when clouds are overhead."[108] And that is just one example.

---

[101] *See* Heal & Hallmeyer, *supra* note 100, at 12.
[102] *Id.* at 3.
[103] *See* Landberg, *supra* note 99, at 23.
[104] FRANKFURT SCHOOL, GLOBAL TRENDS IN RENEWABLE ENERGY INVESTMENT 2016 36 (2016).
[105] *See* Aliza Edelstein, *More Consumers Are Opening Their Wallets for Eco-Friendly Products*, SURVEYMONKEY (May 11, 2015), https://www.surveymonkey.com/blog/2015/05/11/more-consumers-are-opening-their-wallets-for-eco-friendly-products/ ("Our most recent Trends Tracker Report reveals that consumer spending on eco-friendly products, from transportation to diet, is on the rise.").
[106] Hirtenstein, *supra* note 6 at 1840.
[107] *Energy Department Announces $18 Million to Develop Solar Energy Storage Solutions, Boost Grid Resiliency*, DEP'T OF ENERGY (Jan. 19, 2016, 11:33 AM), http://energy.gov/articles/energy-department-announces-18-million-develop-solar-energy-storage-solutions-boost-grid-0.
[108] *Id.*

Globally, the Department of Energy reports that as of November of 2016, there are 1,619 energy storage projects in the works, with an expected cumulative storage capacity of over 193,000 megawatts of power.[109] "According to market research firm IHS, the energy storage market is set to 'explode' to an annual installation size of 6 gigawatts . . . in 2017 and over 40 [gigawatts] by 2022 — from an initial base of only 0.34 [gigawatts] installed in 2012 and 2013."[110] As mentioned above in Section I *supra,* Bloomberg predicts 45 gigawatts of non-hydro storage will be installed globally by 2024[111] (which does not seem to account for Tesla's plan of producing 85 gigawatts of battery storage annually by 2020[112]).

Such rapid expansion of a market comes with its fair share of bureaucratic oversight. In the next section, the legal implications and legislative initiatives regarding the rapidly expanding energy storage industry will be analyzed.

III. REGULATION OF ENERGY STORAGE

The electric sector is regulated at both the federal and the state levels. But before the 1970s the Federal government played a limited role in energy regulation.[113] Then, when the energy crisis of the mid-1970s throttled America's energy supply, the executive and legislative branches of the Federal government stepped in.[114] In 1977, in the face of a nonrenewable energy famine, Congress found that:

> [the] energy shortage and our increasing dependence on foreign energy supplies present a serious threat to the national security of the United States and . . . a strong

---

[109] *See DOE Global Energy Storage Database*, DEP'T OF ENERGY, http://www.energystorageexchange.org/projects (last visited Nov. 7, 2016) (providing a regularly-updated database of world-wide energy storage projects).
[110] *Facts & Figures*, ENERGY STORAGE ASS'N (2016), http://energystorage.org/energy-storage/facts-figures.
[111] Deign, *supra* note 32.
[112] *Gigafactory Presentation*, *supra* note 34.
[113] *See A Brief History of the Department of Energy*, DEP'T OF ENERGY, http://energy.gov/management/office-management/operational-management/history/brief-history-department-energy (last visited Sept. 15, 2016).
[114] *See id.* ("[T]he energy crisis of the mid-1970s hastened a series of government reorganizations as both the executive and legislative branches sought to better coordinate Federal energy policy and programs."); *see also* 42 U.S.C.A. § 7111 (West 2012) (citing the same reasons for the creation of the Department of Energy).

> national energy program is needed to meet the present and future energy needs of the Nation consistent with overall national economic, environmental and social goals.[115]

This national energy program integrated the major Federal energy functions into the Department of Energy ("DOE").[116]

Within the DOE is the licensing and enforcement agency called the Federal Energy Regulatory Commission, or "FERC."[117] FERC says it exists to "[a]ssist consumers in obtaining reliable, efficient and sustainable energy services at a reasonable cost through appropriate regulatory and market means."[118] The U.S. Code says the FERC exists to investigate, issue, renew, revoke, and enforce licenses and permits for the construction and operation of dams, water conduits, reservoirs, powerhouses, and transmission lines.[119] FERC also establishes, reviews, and enforces wholesale "rates and charges for the transmission or sale of electric energy."[120] Whether FERC's broad authority also sweeps into energy storage resources is still a developing issue.[121] Experts agree, however, that "[r]egulation of energy storage rightly is the domain of Congress and the [FERC] to promote nationwide uniformity through new and existing legislation and regulation."[122]

FERC works in conjunction with the Federal Trade Commission ("FTC") to influence both public and private energy storage markets.[123] In short, the FTC exists to "prevent business practices that are anticompetitive or deceptive or unfair to consumers; to enhance informed consumer choice

---

[115] 42 U.S.C.A. § 7111 (West 2012).
[116] *See id.*; 42 U.S.C.A. § 7112 (West 2012).
[117] *See* 42 U.S.C.A. § 7172 (West 2012).
[118] *About FERC*, FED. ENERGY REG. COMMISSION, http://www.ferc.gov/about/about.asp (last visited Sept. 15, 2016).
[119] 42 U.S.C.A. § 7172 (West 2012).
[120] *Id.*; *see also* Allen, *supra* note 9, at 21 (noting that FERC has jurisdiction to regulate "rates and charges made by any public utility in connection with the transmission or sale of electric energy subject to FERC jurisdiction.").
[121] *See* Dennis L. Arfmann et al., *The Regulatory Future of Clean, Reliable Energy: Increasing Distributed Generation*, 40 COLO. LAW. 31, 36 (Oct. 2011) (describing FERC's slow but undefined entry into energy storage markets).
[122] Allen, *supra* note 9, at 20 (analyzing the nation-wide inconsistencies in energy storage regulation and advocating for uniformity).
[123] *See Comment of the Federal Trade Commission: Integration of Variable Energy Resources*, U.S. FED. ENERGY REG. COMMISSION 1–5 (Apr. 8, 2010), https://www.ftc.gov/sites/default/files/documents/advocacy_documents/ftc-comment-federalenergy-regulatory-commissionconcerning-integration-variable-energy-resources-vers.rm10-11-000/v100009ferccomment.pdf.

and public understanding of the competitive process; and to accomplish this without unduly burdening legitimate business activity."[124] In addition to enforcing antitrust and consumer protection laws, the FTC also "analyzes regulatory or legislative proposals that may affect competition or allocative efficiency in the electric power industry."[125] The FTC also reviews proposed mergers in the electricity storage markets.[126]

An example of how these agencies' responsibilities overlap is the recent energy storage proposals in New York. The New York State Public Service Commission ("NY PSC") recently proposed the establishment of "Distributed System Platform" operators which "would be responsible for balancing electricity supply and demand on local, lower-voltage distribution lines."[127] This proposal is a part of New York's "Reforming the Energy Vision" or, "REV" strategy,[128] which aims to reduce greenhouse emissions and encourage development of renewables.[129] Essentially, the plan is to foster the development of customer-owned solar arrays and energy storage units.[130] Before the plan went into effect, the FTC submitted comments and recommendations on the initiative.[131] All the while, the FERC has the authority, in some circumstances, to assert jurisdiction and regulate where it deems necessary.[132]

By contrast, FERC generally does not have jurisdiction over "facilities used for the generation of electric energy or over facilities used in

---

[124] *About the FTC*, FED. TRADE COMMISSION, https://www.ftc.gov/about-ftc (last visited Sept. 13, 2016).
[125] *Comment*, *supra* note 124, at 3.
[126] *See id.*
[127] *FTC Staff Advises New York State Public Service Commission to Increase Competition in Proposal to Transform Electric Distribution System*, FED. TRADE COMMISSION (Oct. 24, 2014), https://www.ftc.gov/news-events/press-releases/2014/10/ftc-staff-advises-new-york-state-public-service-commission.
[128] *See* David Labrador, *New York REV's Distributed System Platform Breaks New Ground*, ROCKY MOUNTAIN INST. (Aug. 27, 2015), http://blog.rmi.org/blog_2015_08_27_new_york_REV_distributed_platform_breaks_new_ground.
[129] *See About the Initiative*, N.Y. ST. (Jan. 28, 2016), http://www3.dps.ny.gov/W/PSCWeb.nsf/All/CC4F2EFA3A23551585257DEA007DCFE2?OpenDocument.
[130] *Id.*
[131] *Id.*
[132] *See* NYS Department of Public Service, REFORMING THE ENERGY VISION 43 (Apr. 24, 2014), http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/26be8a93967e604785257cc40066b91a/$FILE/ATTK0J3L.pdf/Reforming%20The%20Energy%20Vision%20(REV)%20REPORT%204.25.%2014.pdf.

local distribution or only for the transmission of electric energy in intrastate commerce, or over facilities for the transmission of electric energy consumed wholly by the transmitter."[133] Jurisdiction over these matters is typically reserved to the states.[134]

States enjoy a great deal of autonomy when it comes to energy storage regulation.[135] As a result, there is an enormous amount of variation in how the states are developing policy and regulations regarding energy storage.[136] "At one end of the spectrum is California, which is aggressively promoting storage. At the other end are many states that have not yet addressed energy storage to any significant degree with [legislative action]."[137] In the latter states, fundamental questions like who can own and operate energy storage are yet to be resolved (or, in many cases, the questions have yet to be asked).[138] The problems caused by these inconsistencies are discussed further in Section V.E, *infra*. But before those complexities are examined, it is important to understand how the federal and state governments operate under their legislative schemes. Then, after examining how the government shapes energy storage both as an actor and a funder, the full depth of multifarious legal framework can be examined in context.

IV. GOVERNMENT ACTORS IN ENERGY STORAGE

In addition to regulating markets and resources, state and federal governments are the nation's biggest users of energy. The Department of Defense ("DoD"), for example, uses more energy than any other entity in the United States.[139] This section analyzes how government entities are utilizing energy storage, and how governments are operating under the legal framework they have created.

The DoD is the oldest and largest government department in the United States.[140] In 2013, the DoD used over 200,000 gigawatts of

[133] 16 U.S.C.A. § 824 (b)(1) (West 2015).
[134] *See* Allen, *supra* note 9, at 20.
[135] *See generally*, Hari M Osofsky & Hannah J. Wiseman, *Dynamic Energy Federalism*, 72 MD. L. REV. 773, 775–79 (2013) (analyzing the federalism that exists in the energy sector).
[136] *See* Allen, *supra* note 9, at 23.
[137] *Id.*
[138] *Id.*
[139] *Fact Sheet: DoD's Energy Efficiency and Renewable Energy Initiatives*, ENV'T & ENERGY STUDY INST. (July 2011), http://www.eesi.org/files/dod_eere_factsheet_072711.pdf.
[140] *About the Department of Defense (DoD)*, U.S. DEP'T OF DEFENSE (August 27, 2015), http://www.defense.gov/About-DoD.

power[141]—or, measured differently, almost 900 *trillion* British Thermal Units ("BTU") of energy.[142] Compare that with the next highest government energy consumer, the United States Postal Service ("USPS"), who used 44.4 trillion BTUs of power in 2011.[143] For perspective, the total U.S. energy consumption in 2013 was 97 quadrillion BTUs, and the global total was 543 quadrillion BTUs.[144] The vast majority of the DoD's energy use, nearly 90 percent, is in the form of fossil fuels,[145] which creates vulnerability to volatile oil prices.[146] The DoD's clean energy goals aren't just motivated by a desire to protect the environment;[147] a shift to renewable energy also makes good business and economic sense.[148]

The DoD works closely with the National Renewable Energy Laboratory ("NREL") to "demonstrate and validate energy efficiency and renewable energy technologies, with approaches that can be replicated for broad impact across DOD."[149] For example, the DoD is working with NREL and the U.S. Army Corp of Engineers to develop a "microgrid" system that integrates energy storage technologies with photovoltaics, electric vehicles, and a load management unit.[150] If the project is successful, it will improve energy security, cut costs, add reliability, and ultimately be implemented to other DoD projects.[151]

---

[141] *See Defense Department Energy Use Falls to Lowest Level Since at Least 1975*, U.S. ENERGY INFO. ADMIN. (Feb. 5, 2015), http://www.eia.gov/todayinenergy/detail.cfm?id=19871 (stating that the DoD used 0.75 quadrillion British thermal units of energy in fiscal year 2013).

[142] *See Total Energy*, U.S. ENERGY INFO. ADMIN. (Sept. 27, 2012), https://www.eia.gov/totalenergy/data/annual/showtext.cfm?t=ptb0113 (showing that the Department of Defense used 890.3 trillion BTUs of power in 2011).

[143] *Id.*

[144] *Frequently Asked Questions: What is the United States' Share of World Energy Consumption?*, U.S. ENERGY INFO. ADMIN. (May 6, 2016), https://www.eia.gov/tools/faqs/faq.cfm?id=87&t=1.

[145] *See Total Energy*, *supra* note 143 (showing that about 800 trillion BTUs of energy come from fossil fuels).

[146] *See* MOSHE SCHWARTZ ET AL., CONG. RES. SERV., R42558, DEP'T OF DEFENSE ENERGY INITIATIVES: BACKGROUND AND ISSUES FOR CONGRESS 13–14 (Dec. 10, 2012) (discussing the vulnerabilities inherent in a dependence on fossil fuels).

[147] *See id.* (discussing the DoD's efforts to reduce energy consumption and development of alternative fuel sources).

[148] *See* Memorandum from the Department of Defense on Installation of Energy Management 9 (Dec. 11, 2009), http://www.dtic.mil/whs/directives/corres/pdf/417011p.pdf ("Reducing energy consumption and investing in energy reduction measures makes good business sense . . . .").

[149] *Department of Defense Energy Programs*, NAT. RENEWABLE ENERGY LABORATORY (Jan. 6, 2016), http://www.nrel.gov/defense/projects.html.

[150] *See id.*

[151] *See id.*

Another substantial government consumer of energy (third to the DoD and USPS), is the United States Department of Energy ("DOE").[152] The DOE "ensure[s] America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions."[153] The DOE's primary expenditure of energy occurs through its management of the county's nuclear infrastructure, administration of energy policy, and research and development in the energy sector.[154]

An office within the DOE named the Office of Electricity Delivery & Energy Reliability develops storage technologies and collaborates with utilities and state energy organizations to "design, procure, install, and commission major pioneering storage installations that are up to several megawatts in size."[155] Another office within the DOE named the Federal Energy Management Program ("FEMP") "plays a critical role in reducing energy use and increasing the use of renewable energy at federal agencies."[156] Thanks in part to FEMP, the energy intensity of federal facilities has decreased by roughly 40% since 1975.[157]

In addition to purchasing and managing its own energy, the government provides funding for renewable energy and energy storage projects. The breadth and depth of this funding is examined in the next section.

V. GOVERNMENT FUNDING OF ENERGY STORAGE

The United States DOE provides grants, loans, and financing for renewable energy and energy storage technologies.[158] Many state governments also fund energy storage projects. This section looks to the

---

[152] *See Total Energy*, *supra* note 143 (showing the DOE used 33.4 trillion BTUs of energy in 2011).
[153] *About Us*, DEP'T OF ENERGY, http://energy.gov/about-us (last visited Sept. 13, 2016).
[154] *See Department of Energy*, USA.GOV, https://www.usa.gov/federal-agencies/u-s-department-of-energy (last visited Apr. 6, 2017) (summarizing the DOE's primary functions).
[155] *Energy Storage*, *supra* note 3.
[156] *Government Energy Management*, DEP'T OF ENERGY, http://energy.gov/eere/efficiency/government-energy-management (last visited Apr. 6, 2017).
[157] *Id.*
[158] *Funding & Financing*, DEP'T OF ENERGY, http://energy.gov/public-services/funding-financing (last visited Oct. 17, 2016).

nuts and bolts of government funding and provides examples of how money is being spent on energy storage development.

A. Federal Loan Program

The DOE's robust reference guide, "Federal Financing Programs for Clean Energy" outlines the funds available for private, corporate, and legislative actors.[159] The DOE's Loan Programs Office "has supported a large, diverse portfolio of more than $30 billion in loans, loan guarantees, and commitments covering more than 30 projects across the United States."[160] In all, "these projects have generated more than $50 billion in total project investment."[161] The DOE also has more than $40 billion in remaining loan and loan guarantee authority to finance clean energy and energy storage projects.[162] Of that, about $24 billion is dedicated to the "Title XVII Innovative Clean Energy Loan Guarantee Program."[163] Although Title XVII applies to a wide range of energy technologies, this is the one place in the reference guide that energy storage is specifically mentioned.[164]

Private and state actors can receive federal loan money directly through the DOE's Loan Programs Office.[165] According to the DOE, this loan money created or saved 56,000 American jobs, produced enough clean energy to power more than 1,000,000 homes, and prevented 14 million metric tons of carbon emissions.[166] The DOE's loan program, as of September of 2014, earned more than $810 million on interest from its loans. [167]

B. Federal Grants

In addition to loans, the federal government offers millions of dollars in grant money to energy storage developers. The "United States

---

[159] *See* DEP'T OF ENERGY, FED. FIN. PROGRAMS FOR CLEAN ENERGY 3 (2016).
[160] *Id.* at 13.
[161] *Id.*
[162] *Id.*
[163] *See id.* at 14.
[164] *Id.*
[165] *See Loan Programs Office*, DEP'T OF ENERGY, http://energy.gov/lpo/loan-programs-office (last visited Oct. 18, 2016) (providing links to loan programs on the far right column of the page).
[166] DEP'T OF ENERGY, LPO FIN. PERFORMANCE 3 (Nov.. 2014).
[167] *Id.* at 3.

Energy Storage Competitiveness Act of 2007" authorizes $295 million dollars to be appropriated to energy storage development in six categories:

> (1) the basic research program . . . $50,000,000 for each of fiscal years 2009 through 2018;
>
> (2) the applied research program . . . $80,000,000 for each of fiscal years 2009 through 2018; and;
>
> (3) the energy storage research center program . . . $100,000,000 for each of fiscal years 2009 through 2018;
>
> (4) the energy storage systems demonstration program . . . $30,000,000 for each of fiscal years 2009 through 2018;
>
> (5) the vehicle energy storage demonstration program . . . $30,000,000 for each of fiscal years 2009 through 2018; and
>
> (6) the secondary applications and disposal of electric drive vehicle batteries program . . . $5,000,000 for each of fiscal years 2009 through 2018.[168]

As an example of how these funds are allotted, one federal project has committed $18 million to enable the "development and demonstration of integrated, scalable, and cost-effective solar technologies that incorporate energy storage to power American homes."[169] This plan provides funding for six projects across the United States that are developing smart inverters[170] for solar PV and battery storage systems.[171] For one such project, Austin Energy was awarded $4.3 million in federal funding specifically for energy storage development.[172] In another of the six projects, Commonwealth Edison Company of Chicago "will receive $4 million to utilize smart inverters for solar PV and battery storage systems, working synergistically with other components within a microgrid community."[173]

---

[168] United States Energy Storage Competitiveness Act of 2007, 42 U.S.C.A § 17231(p) (West 2007).

[169] *Energy Department Announces*, *supra* note 108.

[170] "Advanced inverters, or smart inverters, are sophisticated versions of the devices long used to convert the direct current output of solar panels into the alternating current used by consumers across the electrical grid." David J. Unger, *How an Obscure Piece of Technology Will Help Put More Solar on the Grid*, MIDWEST ENERGY NEWS (Aug. 9, 2016), http://midwestenergynews.com/2016/08/09/how-an-obscure-piece-of-technology-will-help-put-more-solar-on-the-grid/.

[171] *Energy Department Announces*, *supra* note 108.

[172] *See Austin Energy Awarded $4.3 Million of Federal Funding to Drive Energy Storage and Renewable Power Innovation*, AUSTIN ENERGY (Jan. 19, 2016), http://austinenergy.com/wps/portal/ae/about/news/press-releases/2016/ae-awarded-43m (URL truncated for practical reasons, see author for full link).

[173] *Energy Department Announces*, *supra* note 108.

As another example, the DOE has recently announced $37 million in funding for 16 new energy storage projects as part of its Advanced Research Projects Agency-Energy project: "Integration and Optimization of Novel Ion-Conducting Solids ("IONICS").[174] The IONICS projects will "work to improve energy storage and conversion technologies in three categories: transportation batteries, grid-level storage, and fuel cells."[175] The core purpose of the IONICS projects will be to overcome the physical and chemical barriers that have "stifled further innovation" in battery technology.[176] The director of the project, Dr. Ellen D. Williams, stated that "[s]olid ion conductors made of affordable, easily produced materials could replace today's mostly liquid electrolytes and expensive fuel cell parts, helping create a next generation of batteries and fuel cells that are low-cost, durable, and more efficient."[177]

In 2015 the DOE announced nearly $55 million worth of new projects aimed at developing and deploying new forms of energy storage for vehicles.[178] "Specifically, in the area of advanced batteries, 10 projects totaling $26.1 million were awarded in the areas of advances in existing and next-generation battery material manufacturing processes, advances in electrode and cell fabrication manufacturing, and electric drive vehicular battery modeling for commercially available software."[179]

The government also funds its own energy storage projects. In 2015 the DOE allocated 12 million discretionary dollars to energy storage.[180] Its allocation increased to $20.5 million in 2016, and the DOE's budget request for fiscal year 2017 is $44.5 million.[181] This increased investment in energy storage reflects the DOE's commitment to the new technology. Although the DOE's "Total Electricity Delivery and Energy Reliability"[182] budget has

---

[174] *DOE Announces 16 New Projects to Transform Energy Storage and Conversion*, TRANSMISSION & DISTRIBUTION WORLD (Sept. 14, 2016), http://tdworld.com/generation-renewables/doe-announces-16-new-projects-transform-energy-storage-and-conversion.
[175] *Id.*
[176] *Id.*
[177] *Id.*
[178] *See* VEHICLE TECH. OFF., DEP'T OF ENERGY, ENERGY STORAGE 2015 ANNUAL REPORT 8 (2015).
[179] *Id.*
[180] *Budget*, DEP'T OF ENERGY, http://energy.gov/oe/about-us/budget (last visited Oct. 29, 2016).
[181] *Id.*
[182] "Total Electricity Delivery and Energy Reliability" reflects the DOE's total energy budget. *See id.*

nearly doubled from 2015 to 2017's requested amount,[183] energy storage spending has nearly quadrupled.[184]

The National Renewable Energy Laboratory's ("NREL") total funding appropriation from Congress in 2015 was $357 million.[185] Although down from past years, this is a substantial increase in funding from the early years of the NREL.[186] This money will be spent researching and developing clean energy solutions including more advanced energy storage technologies.[187] NREL will use most of the funding allotment to pay for salaries and facilities.[188] NREL spends a small portion of its funding allotment directly on energy storage research; with projects like Integrated Network Testbed for Energy Grid Research and Technology Experimentation ("INTEGRATE") receiving $6.5 million to develop energy storage technologies.[189]

C. State Funding

Investment and funding of energy storage projects also occurs at the state level. Several states, particularly those with high energy costs, are investing in storage technologies to supplement their growing use of renewables. For instance, New Jersey responded to the impacts of Hurricane Sandy in their 2014 budget by allocating $2.5 million a year to the development of energy storage.[190] The program is to last for four years

---

[183] In 2015, the DOE's total budget was $146,975,000, and the 2017 requested budget is $262,300,000. *Id.*
[184] *See id.*
[185] *Recent Funding*, NAT. RENEWABLE ENERGY LABORATORY, http://www.nrel.gov/about/funding-history.html (last visited Nov. 7, 2016).
[186] In both 2009 and 2010, the NREL received over $500 million in funding; but from 2002 to 2006, the NREL received just over $200 million dollars a year. *Id.*
[187] *See Missions and Programs*, NAT. RENEWABLE ENERGY LABORATORY, http://www.nrel.gov/about/mission-programs.html#rd (last visited Oct. 17, 2016) (outlining the fourteen renewable energy research and development projects, including energy storage technologies).
[188] For example, in 2014, NREL spent about $184 million on employee salaries, and $113 million in construction expenditures. *See* RICHARD WOBBEKIND & BRIAN LEWANDOWSKI, NATIONAL RENEWABLE ENERGY LABORATORY: ECONOMIC CONTRIBUTION OF OPERATIONS AND CAPITAL INVESTMENTS ON THE REGION, THE STATE OF COLORADO, AND THE NATION FY 2012–FY 2014 10–16 (May 2015) (providing the total construction expenditure figure, and stating that NREL employed 1,509 full-time workers with an average salary of $122,000).
[189] *See NREL Partnerships to Help the Grid Accommodate More Renewable Energy*, NAT. RENEWABLE ENERGY LABORATORY (June 15, 2015), http://www.nrel.gov/news/press/2015/18515.
[190] *Issue Brief*, *supra* note 11, at 3.

at a total cost of $10 million.[191] Washington State granted $14.3 million in their 2014 budget to three battery storage projects aimed at improving renewable energy integration into the grid.[192] The Oregon Department of Energy has awarded $295,000 for a pilot project to develop energy storage and microgrid technologies.[193] Massachusetts is offering $10 to $20 million in energy storage grants.[194] This is part of Massachusetts' plan to attract 600 megawatts of energy storage projects, which it calculates will save its citizens $800 million in electricity bills.[195] This is an ambitious plan for a state that ranks 23rd in energy storage development in the United States.[196]

The state that ranks number one in energy storage, California,[197] has an "Electric Program Investment Charge Fund."[198] It provides funds for projects that "will benefit electricity ratepayers and lead to technological advancement . . . in a portfolio of projects . . . that shall include, but not be limited to, energy storage, renewable energy, [etc.]."[199] Instead of setting up strict parameters by which the fund collects and disburses funds, the code allows the California's Public Utilities Commission to administer the fund.[200] In 2014, the Commission budgeted over $1.7 billion for energy efficiency programs in the state.[201] Although most of this is spent on developing wind and solar technologies, a portion will also be invested in energy storage development.[202] For example, in 2014, $21 million was

---

191 *Id.*
192 *Id.* at 4.
193 *Oregon to Fund Solar, Energy Storage Microgrid Demonstration Project*, RENEWABLE ENERGY WORLD (Dec. 18, 2015), http://www.renewableenergyworld.com/articles/2015/12/oregon-to-fund-solar-energy-storage-microgrid-demonstration-project.html.
194 Elisa Wood, *Massachusetts to Offer $10–$20M in Energy Storage Grants this Fall*, MICROGRID KNOWLEDGE (Sept. 19, 2016), https://microgridknowledge.com/energy-storage-grants-massachusetts/.
195 *Id.*
196 *See id.*
197 "California leads all states in clean tech leadership for the seventh consecutive year, according to annual rankings released in May 2016 by Clean Edge, a leading clean tech research and advisory firm." Clint Wilder, *States that are Leading the Transition to a Clean Energy Economy*, GREENMONEY (2016), http://www.greenmoneyjournal.com/july-august-2016/california-massachusetts-vermont-lead-transition-to-clean-energy-economy/.
198 *See* CAL. PUB. RES. CODE §§ 25710–25712 (West 2012).
199 *Id.* § 25711.5.
200 *Id.* § 25711.
201 *See Energy Incentive Programs, California*, DEP'T OF ENERGY (Mar. 2015), http://energy.gov/eere/femp/energy-incentive-programs-california.
202 *See id.* (discussing the programs the $1.7 billion will be spent on).

granted to energy storage, biofuel, energy efficiency research, and energy efficient transportation programs.[203]

The federal government also provides funds to state governments for the states to fund energy storage projects.[204] The DOE has provided over $50 million each year from 2010 to 2013 for "competitively awarded financial assistance to U.S. states and territories to advance polices, programs, and market strategies that accelerate job creation and reduce energy bills while achieving energy and climate security for the union."[205] This program, the "State Energy Program Competitive Financial Assistance Program," is one of four state funding opportunities provided by the DOE.[206]

One way for states to learn about and receive available funding is through the Clean Energy States Alliance's Energy Storage Technology Advancement Partnership ("ESTAP").[207] ESTAP is a federal-state funding and information sharing project created to provide technical assistance and co-funding partnerships between states and the DOE.[208] ESTAP encourages states, municipalities, and other interested parties to contact the project director to get started.[209]

D. Utility Investment

Many utilities across the United States are also investing in energy storage technologies. Whether utilities are investor-owned utilities ("IOU"), cooperatives, or privately owned, most utilities are subject to state

---

203 *See Energy Commission Approves Grants for Energy Storage, Biofuel, Efficiency and Transportation Programs*, CAL. ENERGY COMMISSION (Mar. 11, 2015), http://www.energy.ca.gov/releases/2015_releases/2015-03-11_approved_grants_nr.html.

204 *See Federal Funding for State and Local Clean Energy Programs*, DEP'T OF ENERGY, http://energy.gov/eere/wipo/federal-funding-state-and-local-clean-energy-programs (last visited Oct. 22, 2016) (providing links for state and local governments to become involved in federal funding opportunities).

205 *State Energy Program Competitive Financial Assistance Program*, DEP'T OF ENERGY, http://energy.gov/eere/wipo/state-energy-program-competitive-financial-assistance-program (last visited Oct. 22, 2016).

206 *See Federal Funding*, *supra* note 205 (providing links for state and local governments to become involved in federal funding opportunities). The other three programs are the "DOE Office of Energy Efficiency and Renewable Energy Financial Opportunities," the "Environmental Protection Agency Local Climate and Energy Program," and the "U.S. Department of Agriculture Rural Development Energy Programs." *Id.*

207 *Energy Storage*, *supra* note 46.

208 *Id.*

209 *See id.*

regulation in the states where they operate.[210] In some states utilities are required to invest in energy storage.[211] New York, Hawaii, and California have ambitious regulatory schemes to encourage investment in renewable energy because they have high electricity costs. California's energy-storage mandate (described by some as "ground-breaking"[212]) requires its largest utilities—PG&E Corp., Southern California Edison, and Sempra Energy's San Diego Gas & Electric—to establish energy storage procurement targets of 1.3 gigawatts of storage capacity by the end of 2020, with installation required no later than the end of 2024.[213] And some utilities are investing in energy storage on their own accord. One of Hawaii's largest utilities, Kaua'i Island Utility Cooperative, has contracted with SolarCity to purchase solar generated electricity at 14.5 cents per kilowatt hour.[214] In addition to the solar power, SolarCity will be providing enough Tesla batteries to store 13 megawatts of electric energy.[215]

With government funding comes government legislation, as discussed in Section III, *supra*. However, "[b]ecause energy storage facilities have attributes of generation, transmission, and distribution assets, regulation does not rest solely within one federal jurisdiction or state jurisdiction, let alone fit neatly into traditional ratemaking categories."[216] It is against this backdrop that this paper next analyzes the legal issues in energy storage.

E. Current Legal Issues in Energy Storage

The addition of energy storage to the grid creates a host of legal issues. As previously mentioned, jurisdiction to regulate energy storage

---

[210] *See, e.g.*, CAL. PUB. UTIL. CODE §§ 201–3260 (West 2016) (providing for the regulation of utilities operating within the state); N.Y. PUB. SERV. LAW § 110 (McKinney 2016) (same); TEX. UTIL. CODE ANN. §§ 11.001–66.017 (West 2016) (same); UTAH CODE ANN. §§ 54-1-1 through 54-20-107 (West 2016) (same).
[211] *E.g.*, CAL. PUB. UTIL. CODE § 399.15 (West 2016) (establishing renewable portfolio standards for all retail utility providers).
[212] *See SolarCity to Use Tesla's Batteries to Provide Electric Storage of 13 MW for Solar Panels*, 47 BLOOMBERG CLIMATE & ENERGY 534, 534 (Feb. 19, 2016) (discussing California's "ground-breaking" energy-storage mandate in the context of Hawaii's investment in SolarCity and Tesla renewable energy and energy storage technologies).
[213] *See* Melicia Charles, *California's Energy Storage Mandate: Electricity Advisory Committee Meeting*, CAL. PUB. UTIL. COMMISSION (June 17, 2014), http://energy.gov/sites/prod/files/2014/06/f17/EACJune2014-3Charles.pdf.
[214] *SolarCity to Use Tesla's Batteries to Provide Electric Storage of 13 MW for Solar Panels*, 47 BLOOMBERG CLIMATE & ENERGY 534, 534 (Feb. 19, 2016).
[215] *Id.*
[216] Allen, *supra* note 9, at 21.

technologies does not clearly fall within any particular government authority. Legal issues arise when consumers install energy storage devices on their homes and are no longer reliant on public utilities. Grid-independent customers create headaches for the legislature-supported public utilities. As households become energy independent, revenues that formerly fueled utilities decrease and threaten the utility's viability. "This phenomenon, coined 'load defection' by the Rocky Mountain Institute, is antithetical to traditional utility business models where increased electricity sales drive revenue growth."[217] While some load defection is not a bad thing, large numbers of consumers disconnecting from the grid would eliminate the presently enjoyed benefits of resource sharing, "resulting in an unnecessarily expensive and inequitable electricity system."[218]

Legislators at local, state, and federal levels are confronted with decisions of whether and to what amount subsidies for energy storage should be offered. There is also the question of whether utilities should own the storage. "If utilities were allowed to own storage . . . they would gain a versatile new tool to help optimize the distribution system, increasing flexibility and enabling other cost-effective customer-sited resources."[219] The California legislature has already mandated the procurement of energy storage from its three Investor Owned Utilities.[220] Even states like Utah (a state without aggressive renewable energy legislation) have bills proposing the authorization of large-scale utilities to invest, analyze, and implement "a battery storage or electric grid related project."[221] Other states, however, are still grappling with whether investment in energy storage is a good use of taxpayer's money, let alone whether utilities should be publicly owned.[222]

From a consumer's standpoint, this uncertainty discourages investment and delays development.[223] Take, for example, consumers of Tesla's Powerwall discussed in Section II.B, *supra*. In California, a consumer can receive a 60 percent rebate on the purchase price of the

---

[217] Michael O'Boyle & Sonia Aggarwal, *Should Utilities Own Distributed Battery Storage?*, GREENTECH MEDIA (June 29, 2015), http://www.greentechmedia.com/articles/read/should-utilities-own-distributed-battery-storage.
[218] *Id.*
[219] *Id.*
[220] *See Energy Storage: Current Proceeding*, CAL. PUB. UTIL. COMMISSION, http://www.cpuc.ca.gov/General.aspx?id=3462 (last visited Oct. 22, 2016).
[221] S.B. 115, 2016 Gen. Sess. (Utah 2016).
[222] *See* Allen, *supra* note 9, at 23 (examining the disparity between states' approach to energy storage).
[223] *See id.* at 21–22.

battery,[224] and a $1.31 per watt rebate from the state for installation and use of their Powerwall.[225] A similar consumer in neighboring New Mexico would be able to receive a 30 percent rebate on the purchase price from the federal government,[226] but would not be eligible for any rebates from the state—either for the purchase of the energy storage device, or through per watt rebates.[227] Consumers in New Mexico may then find it prudent to abstain from investment until their state adopts incentive packages as inviting as California's.

Job creators and technology developers face the same uncertainty.[228] When Tesla wanted to build its $5 billion Gigafactory, Arizona, California, Nevada, New Mexico, and Texas were on a shortlist to become the host state for Tesla's largest investment to date.[229] Each state had different regulatory schemes, and two of them—Texas and Arizona—even prohibited Tesla from selling their cars at its company-owned stores.[230] But that did not stop each of the five states from bending over backwards to offer Tesla generous incentives programs.[231] When Tesla decided on Nevada, it was because of location, the site's low-cost green power, and politics.[232] Elon Musk, co-founder and CEO of Tesla, said that while Nevada did not offer

---

[224] Bill Howard, *What the Tesla Powerwall Home Battery Means: Inexpensive Time-Shifting for Solar Energy*, EXTREME TECH (May 1, 2015, 12:41 PM), http://www.extremetech.com/extreme/204702-what-the-tesla-powerwall-home-battery-means-inexpensive-time-shifting-for-solar-energy.

[225] *See Self-Generation Incentive Program*, CAL. PUB. UTIL. COMMISSION, http://www.cpuc.ca.gov/sgip/ (last visited Oct. 18, 2016) (incentive amounts can be accessed by clicking on the "2016 SGIP Incentive Levels" link); *see also* CAL. PUB. UTIL. CODE § 379.6 (West 2016) (providing the Public Utilities Commission the authority to delegate rebates).

[226] *See* Howard, *supra* note 225.

[227] *See Renewable Energy Storage*, ENERGY CONSERVATION AND MGMT. DIVISION OF N.M., http://www.emnrd.state.nm.us/ECMD/RenewableEnergy/RenewableEnergyStorage.html (last visited Oct. 22, 2016) (providing links to tax rebate and energy storage information, but not providing or listing any rebates or incentives specifically for energy storage).

[228] *See* Allen, *supra* note 9, at 20–21 (discussing the difficulty developers face in the short-sighted regulatory schemes that dominate state and local governments).

[229] Eric Wesoff, *Tesla's $5B Giga Battery Factory and Deep Politics in AZ, TX, NV and NM*, GREENTECH MEDIA (Mar. 1, 2014), http://www.greentechmedia.com/articles/read/Teslas-5B-Giga-Battery-Factory-and-Deep-Politics-in-AZ-TX-NV-and-NM.

[230] Mark Rogowsky, *Why Nevada Was Always the Best Bet To Land Tesla's Gigafacotry*, FORBES (Sept. 4, 2014, 7:35 AM), http://www.forbes.com/sites/markrogowsky/2014/09/04/why-nevada-was-always-the-best-bet-to-land-teslas-gigafactory/#51c67ac315b9.

[231] *See id.*

[232] *See id.*

the most incentive-heavy package, it proved in its presentation that it "can do things quickly" and "get things done."[233] Ultimately, then, Nevada was not chosen for its predictable energy storage legislation.[234] Instead, it was chosen because it could be the most flexible in catering to Tesla's needs.[235] This type of piecemeal policymaking only helps Tesla on a per-project basis, and leaves smaller companies guessing as to whether myopic state regulations will progress toward renewable-energy-friendly policies, or regress to fossil fuel protectionist policies.[236]

Although many large private sector investments may be faced with similar uncertainty, established industries benefit from stability gained through years of precedent.[237] The energy storage legal climate of incongruity, inconsistency, and unpredictability needs to change. Federal legislation that addresses energy storage can bring much-needed clarity to

---

[233] *Nevada Chosen for High-Tech Tesla Car Battery Factory*, BBC NEWS (Sept. 5, 2014), http://www.bbc.com/news/world-us-canada-29073329.

[234] In fact, Nevada may seem to be an ironic choice given the state's recent legislation to apply rate cuts and higher fixed charges to existing solar customers. *See* Jeff St. John, *Nevada's Solar Job Exodus Continues, Driven by Retroactive Net Metering Cuts*, GREENTECH MEDIA (Jan. 8, 2016), https://www.greentechmedia.com/articles/read/nevadas-solar-exodus-continues-driven-by-retroactive-net-metering-cuts. "No other state has applied net metering changes to existing solar customers, given that it could undercut the economic case for making the 10- to 20-year investment into rooftop PV." *Id.* This legislation was followed (the next day) by SolarCity, which leads the state in rooftop PV installations, announcing it would diminish its Nevada operations and cut 550 jobs in the state. *Id.* Other solar companies, Vivint Solar and Sunrun, are also closing their Nevada operations. *Id.* However, Tesla's goal with the Gigafactory is to build and export batteries to their factory in San Francisco. *See Tesla Gigafactory*, *supra* note 35. So although Nevada may not be a consumer friendly state for solar panel users, the state will be a business friendly state for Tesla to build its batteries.

[235] *See* Wesoff, *supra* note 230.

[236] *See* Allen, *supra* note 9 at 20–21 (discussing the difficulty developers face in the short-sighted regulatory schemes that dominate state and local governments).

[237] For example, when Boeing announces a new project and accepts state bids, both the states and Boeing have a long history of similar deals (both by Boeing and other Aerospace manufacturers) to compare with present bids. *See generally* Reid Wilson, *States Competing for Boeing 777X Jobs Project*, WASH. POST (Nov. 30, 2013), https://www.washingtonpost.com/politics/states-competing-for-boeing-777x-jobs-project/2013/11/30/6359a252-59dd-11e3-ba82-16ed03681809_story.html (discussing the competition among the states for Boeing's 777X contract). Further, regulations and statutes governing the Aerospace industry have been in place for decades, so private and state actors are provided with time-tested information regarding limitations and parameters of any such project. *Compare* Air Commerce and Safety Act, 49 U.S.C. §§ 40101–46507 (2012) (laying out the Air Commerce and Safety act passed in 1994) *with* Energy Storage Competitiveness, 42 U.S.C.A. § 17231 (West 2007) (providing legislation for energy storage and enacted in 2007).

governments, developers, and consumers. The solutions to the legal issues in energy storage start with the federal government.

F. Solutions to Legal Issues in Energy Storage

One way to achieve uniformity and predictability would be to enact broad federal energy legislation expressly providing for energy storage.[238] This would provide states a framework with which to build on, thereby achieving a greater degree of consistency in energy storage legislation from state to state. The authority for the federal government to enact such legislation has already been clarified by the Supreme Court. In *FERC v. Mississippi*,[239] the Court held "it is difficult to conceive of a more basic element of interstate commerce than electric energy, a product used in virtually every home and every commercial or manufacturing facility."[240] The Court in also provided instruction on existing regulations that bring energy storage within the purview of FERC.[241]

In *FERC v. Electric Power Supply Association*,[242] the Court held that the FERC had authority to implement rules that directly affect wholesale electricity rates.[243] The FERC action at issue required wholesale electricity market operators to compensate electricity users for their commitment to reduce their electricity use during peak periods at same rate as the operators compensate electricity generators.[244] Essentially, the operators accepted users' bids in auctions only if the bids would bring down wholesale rates by displacing higher-priced generation; the compensation rate was designed to increase users' participation and thus increase bids capable of displacing generation.[245] By upholding the FERC's authority to implement these rules, the Court held that the FERC's influence of the retail electricity market exists alongside states' power to regulate retail sales.[246]

---

[238] *See* Allen, *supra* note 9, at 24.
[239] 456 U.S. 742 (1982).
[240] *Id.* at 757. However, in the next sentence the Court notes that "[n]o State relies solely on its own resources in this respect." *Id.* This may become a point of confusion if energy storage gains a substantial foothold in states, and states do become solely reliant on its own resources.
[241] *See id.* at 746 (discussing the Public Utility Regulatory Policies Act of 1978).
[242] 136 S. Ct. 760 (2016) (analyzing the FERC's authority under the Federal Power Act, §§ 205(da), 206(a)).
[243] *Id.* at 774–75.
[244] *Id.* at 773–76.
[245] *See id.*
[246] *Id.* at 784.

Federalism would not suffer under uniform federal energy storage legislation. States would still have the ability to enact their own laws and could still act autonomously within the federal framework. For instance, in a recent attempt at federal legislation affecting energy storage, retail electric suppliers selling at least 500,000 megawatt hours of annual electric energy are compelled to have available energy storage devices with a power capacity rating equal to not less than one percent of the annual average system peak power demand by January 1, 2021.[247] However, in addition to not applying to retailers selling less than 500,000 megawatt hours a year, the bill's requirements do not "apply to rural cooperative or government-owned suppliers."[248] This leaves room for states to enact their own legislation while providing uniformity to large scale electric energy retailers.

For example, federal insurance regulations set the bar for state insurance regulations.[249] Historically, "the insurance industry has been regulated almost exclusively by the individual state governments."[250] As the various state governments each developed their own insurance legislation, insurance companies with multi-state business were hampered by the inconsistency of the various rules and regulations, as well as the localism by state regulators.[251] After a long history of states' struggle to maintain exclusive control over the industry,[252] federal regulation of the industry has

[247] Allen, *supra* note 9 at 24 (citing the Energy Storage Promotion and Deployment Act of 2015, S. 1434, 114th Cong. (2015–2016)).
[248] Energy Storage Promotion and Deployment Act of 2015, S. 1434, 114th Cong. (2015–2016).
[249] *See* Harold S. Bloomenthal & Samuel Wolff, *Insurance Regulation*, 3 SEC. & FED. CORP. L. § 1:282 (2nd ed.) (discussing one of the advantages of the Office of National Insurance as being "increased national uniformity through either a federal charter or effective action by the states"); *e.g.*, Plans of Insurance, 38 U.S.C. § 1904 (2012) (setting national standards for insurance plans).
[250] Van R. Mayhall, III, *A Brief Chronicle of Insurance Regulation in the United States, Part I*, INS. REG. L. (May 16, 2011), http://www.insreglaw.com/2011/05/brief-chronicle-of-insurance-regulation.html.
[251] *Id.*
[252] In *Paul v. Virginia*, 75 U.S. 168 (1868), the Supreme Court held that the federal government did not have power to regulate in the insurance industry because the issuance of insurance did not qualify as a transaction of commerce. Then, in 1944, the Court reversed *Paul v. Virginia* in *United States v. South-Eastern Underwriters Ass'n*, 322 U.S. 533 (1944), holding that the business of insurance qualified as commerce subject to federal regulation. The United States Congress responded with the McCarran-Ferguson Act, 15 U.S.C. §§ 1011–1015 (1945), which bolstered state control over the insurance industry, and curtailed federal control. Since then, Congress has passed several acts restoring power to regulate the insurance industry back in the federal government. *E.g.*, Gramm-Leach-Bliley Financial Modernization Act of 1999, 15 U.S.C. §6801 (setting out certain minimum

grown considerably; adding stability and uniformity throughout many aspects of the law. Insurance companies, states, and consumers can be confident that the insurance industry will have uniformity and consistency in the different state markets.[253]

By introducing federal energy storage regulations that set minimum standards for the states, the energy storage industry will enjoy greater consistency and accelerated growth. There is little justification for treating energy storage differently on a state-by-state basis. Energy storage facilities serve essentially the same function for consumers and the grid in each state.[254] The era of widely installed energy storage is in its infancy, and federal and state energy regulators "have a unique opportunity to get ahead of the potential value and avoid unnecessary balkanization of the grid."[255] By enacting broad federal energy legislation that expressly provides for energy storage, the United States can solve a great deal of the present issues in energy storage law.

CONCLUSION

The energy storage industry is growing at burgeoning rates. New technologies are lowering the cost and improving the efficiency of energy storage devices. But with widespread adoption comes a myriad of legal issues. When states are creating their own legal frameworks to encourage or discourage investment in energy storage, the industry is hampered by inconsistency and a lack of predictability. By implementing broad federal regulations, the federal government can remove uncertainty and encourage growth and development of energy storage technologies. Thanks to companies like Tesla who are making energy storage more appealing and affordable, demand for behind-the-meter energy storage is increasing. The world is at the cusp of an energy storage revolution, and the United States has an opportunity to lead in that revolution by passing legislation that spurs on the rapid growth of energy storage.

---

standards that state insurance laws and regulations were required to meet or else face preemption by federal law).

[253] *See Davenport v. Servicemen's Group Life Ins. Co.*, 168 S.E.2d 621, 624–25 (Ga. Ct. App. 1969) (holding that when a state insurance law conflicts with a federal statute, the state law must yield to the federal law).

[254] *See* Allen, *supra* note 9, at 26.

[255] *Id.*