Financing at the Grid Edge

by C. Baird Brown

C. Baird Brown is Principal at eco(n)law LLC.

Summary

This Article, excerpted from Michael B. Gerrard & John C. Dernbach, eds., *Legal Pathways to Deep Decarbonization in the United States* (forthcoming in 2018 from ELI Press), discusses legal impediments and solutions for customer, community, and third-party financing of behind-the-meter and community-scale clean energy generation, storage, and energy efficiency. Current levels of investment by utilities and independent power producers fall well below levels needed to meet deep decarbonization goals. Investments at the "grid edge" driven by customers and communities not only contribute to clean energy goals, but also reduce energy prices and improve the resilience of the power supply. Legal reforms are needed to permit ownership of local energy resources and sales of energy and other services by customers, communities, and their local suppliers; to encourage utilities and regional transmission organizations to foster transparent markets for services from grid-edge resources; to provide better information on the usage of customers and the needs of the grid; and to adapt and reuse existing finance markets and create new institutions that support grid-edge finance.

I. Introduction

The Deep Decarbonization Pathways Project (DDPP) reports for the United States call for an annual decarbonization investment requirement ranging from "under $100 billion today to over $1 trillion in a span of about 20 years."[1] This includes more than $200 billion annually for each of commercial and residential building efficiency,[2] and more than $600 billion annually for low-carbon electric power-generating resources.[3] The DDPP reports do not attempt to address financing as a quantitative matter, but include a policy prescription to "anticipate investment needs and build a suitable investment environment,"[4] and note that this "requires stable policy and a predictable investment environment."[5] This Article explores those policy imperatives as they affect decarbonization investment at local levels.

Local actors—customers, campus managers, and communities—are increasingly investing in and attracting investment to clean energy, energy efficiency, and energy storage. New technologies support this movement, leading to an increasing democratization of electricity generation and energy management. The result is a new sector that is highly motivated by both energy savings and environmental goals. The participants in this sector are investing in highly efficient integration of thermal and electric energy generation and management at the "grid edge."

In this Article, references to the "grid edge" or "grid-edge resources" refer to facilities and resources owned or operated by or on behalf of customers or communities, either behind the meter or through various forms of aggregation of individual customer demand such as community choice aggregation (CCA) or community solar. The meter is typically where utility ownership ends and customer ownership begins, and so it is the legal edge of the grid.[6] Participants in this sector need support from the grid, but they are also providing services that support the grid.

Attracting new investors to decarbonization matters. The investment requirements contemplated by the DDPP reports are large compared to current levels and represent a substantial proportion of aggregate annual investment in the current U.S. economy as a whole. Annual average gross private domestic investment in the United States

Author's note: The author is extremely grateful for the research assistance of Emily Maus.

1. James H. Williams et al., Energy and Environmental Economics, Inc. et al., US 2050 Report, Volume 2: Policy Implications of Deep Decarbonization in the United States 12 (2015).
2. *Id.* at 41.
3. *Id.* at 42.
4. *Id.* at 12.
5. *Id.*
6. Recommendations made in the Article may apply equally to other distributed energy resources, but the focus is on investment decisions made by customers or communities or by their vendors and suppliers.

stood at $3.126 billion in the last quarter of 2016.[7] Moreover, that aggregate investment does not represent a vast pool of capital ready to flow in any direction where profits are available. Lending and equity investment take place within established product boundaries in specialized institutions and institutional departments. While credit analysis[8] across these investing silos shares some fundamentals, there are differences in culture and approach that provide differing opportunities for expansion of decarbonization investments, both by traditional investors such as utilities and by new grid-edge investors. We need to expand the pool of investors.

The electricity sector is among the most regulated in the nation. While building energy-efficiency measures are less regulated, the ability of buildings and their included storage and generation to respond to the requirements of the electric grid brings them increasingly into the regulated sphere. Four kinds of legal requirements directly affect the ability to invest in new energy technology:

- *Substantive regulation*. State laws limit who can own generating resources and distribution wires.
- *Laws affecting energy markets*. State and federal laws affect sales of energy and of "ancillary services" needed to serve customers and operate the grid.
- *Laws affecting specific forms of energy finance*. States regulate the abilities of utilities and governmental entities to borrow, and federal tax law governs aspects of the issuance of most governmental bonds.
- *State procurement laws*. State laws govern procurement of energy equipment and services by state and local governments and agencies.

In addition, state and local governments are forming "utilities" or "banks" to facilitate sustainable energy finance.

Part II of this Article makes the case for action at the grid edge. It then reviews the barriers and benefits to decarbonization investment at the grid edge arising from these four types of legal frameworks, and suggests paths forward. Those paths fall broadly into four categories:

- Enable ownership, operation, and sales of services by customers, communities, and local groups of customers (aggregations) and by private industry that supports them (Part III);
- Encourage utilities and regional transmission organizations to serve as transactional platforms that allow grid-edge resources to receive full value for the services they provide (Part IV);
- Collect and disseminate information about the grid and the performance of decarbonization projects that supports grid-edge project planning and credit analysis (Part V);
- Adapt and reuse existing finance markets to support deep decarbonization investment, and create new institutions that support identification, structuring, and finance of creditworthy grid-edge decarbonization projects (Part VI).

Part VII concludes with a further discussion of energy justice and a proposal for an energy bill of rights for customers and communities investing in decarbonization at the grid edge.

II. The Case for Action at the Edge

A quarter-century ago, a family moving into a house would sign up with monopoly suppliers of electricity, water (if they did not have a well), and phone service. They might also sign up with a monopoly natural gas supplier or choose between oil or propane delivery services. They bought gasoline from a local filling station supplied by one of a handful of major oil companies. (Previous revolutions in home heating and refrigeration had largely ended the coal and ice deliveries of 50 years earlier.) Switching the homeowner's name on accounts of the utility companies and arranging for transitional meter readings are well-oiled rituals of real estate closings and mortgage financings.

A. *The Energy Revolution at the Grid Edge*

New technologies are giving energy customers, large and small, individually and collectively, the power to manage their energy consumption and generate their own electricity. These technologies include:

- End-use energy reduction:
  - Building envelope improvements
  - Heating, ventilating, and air-conditioning systems
  - Industrial equipment (such as variable speed motors)
  - Advanced building and process controls
- New technologies to generate and store energy locally:
  - Cogeneration
  - Renewable energy
  - Batteries
  - Thermal storage

In addition, there is renewed interest in community energy solutions:

- District heating and cooling
- Community solar

7. U.S. Bureau of Economic Analysis, *Gross Private Domestic Investment (GPDI)*, *Retrieved From* FRED, Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org/series/GPDI (last visited May 25, 2018).
8. Throughout this Article, "credit" and "credit analysis" are broadly used to refer to the ability of a project (or pool of projects) to repay principal invested with an expected return, whether the investment is in the form of debt or equity or a hybrid, and includes returns from all sources including tax benefits and third-party payments. It does not refer to "investment analysis" in the sense of suitability for a particular investor.

- Multi-customer microgrids
- CCA

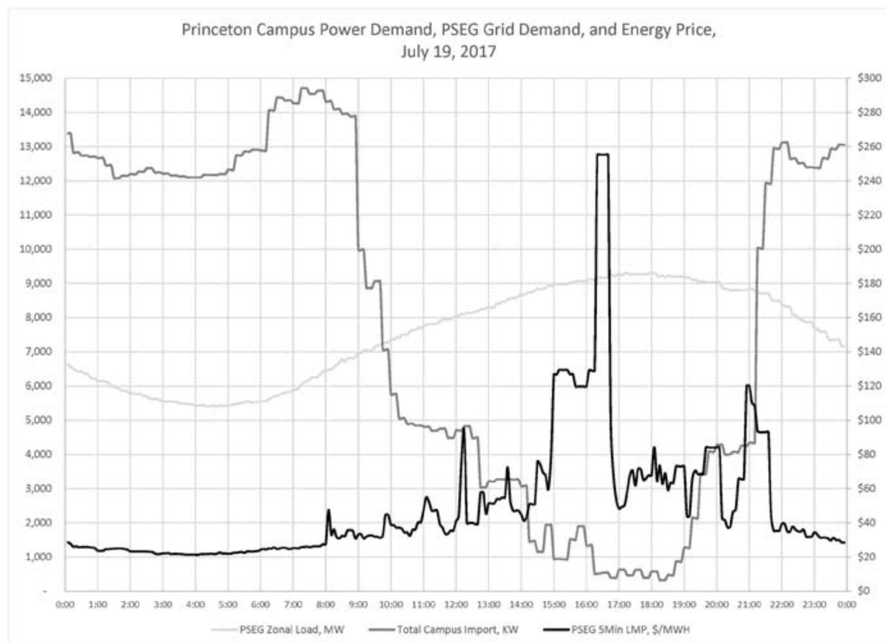
End-use customers can now combine these technologies to manage their aggregate energy needs. The revolution arises not from a single technology, but from integration of multiple technologies that support active management and production of energy at the grid edge. The balance of this Article treats the installation of any one or a combination of several of these technologies that will be financed collectively as an "energy project."

The revolution began as large customers—college campuses and industrial and research facilities—began to deploy cogeneration to meet their thermal energy requirements while also generating power. These installations can achieve greater than 80% efficiency in fuel use[9] as compared to around 35% current grid average[10] and less than 60% for modern combined-cycle gas turbine power plants.[11] By locating at the customer's site, they also avoid losses on the transmission and distribution system that may rise to an additional 10%.

Over time, these installations have been coupled with building and process efficiency improvement that reduce electric and thermal load, storage devices (both thermal and electric) that allow load to be shifted to different times of day, and active building energy management (which allows buildings themselves to act as thermal storage). Modern microgrids[12] combine all of these types of strategies to dramatically change the shape of their energy loads. Where appropriate regulatory frameworks exist, they can arbitrage against real-time energy prices and are able to sell services to the grid.

As an example, the Princeton University campus is served by a microgrid that includes 15 megawatts (MW) of gas cogeneration, 4.5 MW of solar generation, 40 megawatt hours (MWh) equivalent of thermal storage, advanced building controls, and an advanced interface with the grid. Figure 1 shows wholesale market energy consumption and price for the Public Service Electric and Gas (PSEG, the electric utility serving Princeton) service territory and the Princeton campus energy purchases from the grid, all plotted against the time of day. The data is for July 19, 2017, one of the days when the entire regional grid operated by PJM Interconnection, LLC (PJM) was near system peak capacity.

Figure 1: Princeton Campus Power Demand, PSEG Grid Demand, and Energy Price, July 19, 2017*



* Note that system load and campus imports use the same left margin scale, but system load is in MW and campus imports are in kilowatts (kW). LMP denotes the "Locational Marginal Price," which is the wholesale price specific to each utility service territory, in this case PSEG. Source: Edward T. Borer, Energy Plant Manager, Princeton University.

The chart shows that Princeton purchased a substantial amount of electric energy in the early morning to charge its thermal storage—chilled water in an insulated tank. It then purchased almost no electric power at the time of peak usage and peak pricing on the PJM system. This result at peak was achieved by 15 MW of cogeneration and 3.75 MW of solar. Campus potential peak load of around 27 MW was reduced to around 19 MW through use of steam chillers supplied by heat from the cogeneration plant and discharge of chilled water from the thermal storage tank.

9. U.S. Environmental Protection Agency Combined Heat and Power Partnership, *CHP Benefits*, https://www.epa.gov/chp/chp-benefits (last visited June 26, 2018); U.S. Environmental Protection Agency Combined Heat and Power Partnership, Efficiency Metrics for CHP Systems: Total System and Effective Electric Efficiencies, https://www.arb.ca.gov/cc/ccei/presentations/chpefficiencymetrics_epa.pdf.
10. U.S. Energy Information Administration, *Table 8.2. Average Tested Heat Rates by Prime Mover and Energy Source, 2007-2016*, https://www.eia.gov/electricity/annual/html/epa_08_02.html (last visited May 25, 2018).
11. *Gas Turbines Breaking the 60% Efficiency Barrier*, Decentralized Energy, Jan. 5, 2010, http://www.decentralized-energy.com/articles/print/volume-11/issue-3/features/gas-turbines-breaking.html.
12. A microgrid is a collection of controllable loads with substantial included generation that can separate electrically from the grid but can provide services to the grid when generating in parallel.

Princeton avoided purchasing high-priced power (the prices reached $255.00 per MWh), and reduced its obligation to pay transmission charges, which are allocated according to customer usage at system peak. Princeton paid a weighted average of $34.06 per MWh for power that day compared to a system average price of $50.17 per MWh. On more ordinary days, Princeton may dedicate a portion of its generating capacity to providing frequency regulation, an ancillary service that provides balancing energy (described more fully in Part II.B. below) to the PJM system in less than 10 seconds following a signal from the grid operator. Collective control of multiple grid-edge resources allows Princeton to manage for efficiency, price, and reduced carbon.[13]

The capabilities in use by large, campus-scale systems are rapidly becoming available to smaller systems including individual houses. Cogeneration through microturbines[14] is available at commercial building-scale, and rooftop solar for individual houses is rapidly expanding. Home hot water heaters are thermal storage systems,[15] and sophisticated biomass home furnaces use larger hot water storage capacities to support domestic heat and hot water usage for several days between firings.[16] Home battery storage is rapidly declining in price,[17] and home chilled water storage could take solar energy at noon to provide cooling at system peak at 5 p.m.[18]

All of these systems can be integrated using smart thermostats and smartphone apps.[19] With smart utility meters and Internet connections, individual residential customers can perform integrated thermal and electric energy management. Like campus-scale microgrids, they can reduce consumption, deploy low-carbon emission generation, reshape their load, and provide services to the grid. They can charge their electric vehicles with their own electricity or use their electric vehicles as a source of energy when their own generation is unavailable. This revolution is commencing with existing incentives and existing financing based on the personal and institutional goals of the customers at the grid edge. Decarbonization can harness and expand upon customer pathways.

B. *Where the Grid Meets the Edge*

The job of the grid operator is to manage its control area to meet all the energy requirements of grid customers (load) while maintaining the reliability of the system. This task, first and foremost, involves balancing the load with generation. Whenever a customer flips a light switch or starts a giant motor, the grid operator needs to meet the additional demand with additional generation. The operator cannot do that by simply turning on (or turning up) the next least expensive generator, because the existing power grid is a web of interlaced lines of different capabilities and the operator may need generation near a load to avoid overloading a line.

In addition to these physical delivery constraints, the grid operator must maintain voltage and frequency levels and other technical dimensions of grid performance and also maintain a group of generators (or other resources) standing by as "reserves" to come on (or turn up) at a moment's notice in the event that a transmission line or generator malfunctions and ceases to deliver power. The system is designed around the premise that it must meet peak customer demand whenever it occurs with little ability to manage demand in either the long or short term. Moreover, utilities often charge a flat rate per kilowatt hour (kWh) of energy purchased (sometimes in conjunction with a fixed demand charge) so that customers not only have little ability, but also have little incentive, to manage the timing of their power use.

It follows that customer generation and load management can have major benefits for the power grid. Locating generation near load reduces congestion and can avoid the need for costly upgrades to distribution and transmission systems. Smaller average generation size can reduce the contingencies for which reserves are required. Reducing demand—both in the long term and by shifting load away from peak—can have the same effects. To be beneficial, these capabilities at the edge must be visible and responsive to the needs of the grid operator.

Traditional distribution companies have little incentive to expand the contributions of grid-edge resources. In the 33 states where electricity sales are not otherwise subject to competitive supply,[20] grid-edge resources are direct competition. Even where distribution companies no longer own generation, they typically charge their customers by the kWh, so the more kWh they sell, the more money they make. Their regulated rate of return sets their profit at a fixed assumed level of sales, so if that level is exceeded, their profitability increases. Their regulated level of profit

13. Data on the Princeton system supplied by Edward T. Borer, energy plant manager, Princeton University.
14. Microturbines are natural gas-fired combustion turbines that typically have a capacity of less than one MW and are often in the 200 to 250 kilowatt range.
15. Ryan Hledik et al., Brattle Group, The Hidden Battery: Opportunities in Electric Water Heating (2016), http://www.electric.coop/wp-content/uploads/2016/07/The-Hidden-Battery-01-25-2016.pdf.
16. Cold Climate Housing Research Center, *Thermal Storage Technology Assessment*, http://www.cchrc.org/thermal-storage-technology-assessment (last visited May 25, 2018).
17. Lazard, Lazard's Levelized Cost of Storage—Version 2.0 (2016), https://www.lazard.com/media/438042/lazard-levelized-cost-of-storage-v20.pdf.
18. Wanyun Zhong, Chilled Water Storage for Effective Energy Management in Smart Buildings (2014) (M.S.E. thesis, Univ. of Toledo), http://utdr.utoledo.edu/cgi/viewcontent.cgi?article=2780&context=theses-dissertations.
19. Adam Zipperer et al., National Renewable Energy Laboratory, Electric Energy Management in the Smart Home: Perspectives on Enabling Technologies and Consumer Behavior (2013) (NREL/JA-5500-57586), *available at* https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/smart_home_electric_energy.pdf; Robert Lamoureux et al., Home Energy Management Systems (HEMS) Paths to Savings: On-Ramps and Dead Ends, Presentation at the 2016 American Council for an Energy-Efficient Economy Summer Study on Energy Efficiency in Buildings (Aug. 24, 2016), http://aceee.org/files/proceedings/2016/data/papers/12_630.pdf.
20. Electric Choice, *Map of Deregulated Energy States and Markets (Updated 2017)*, https://www.electricchoice.com/map-deregulated-energy-markets/ (last visited May 25, 2018).

is based in turn on their investment in the assets (wires and generators, meters and software) used in their business. They typically have no incentive to have their assets displaced by resources owned by customers or the customers' third-party service providers.

In large parts of the country, operation of the transmission system has been taken over by independent system operators (ISOs) and/or regional transmission operators[21] (RTOs[22]). PJM is one such RTO. In performing the RTO's job of balancing the grid over large regions, reduction in demand is equally as effective as increased generation. In wholesale power markets operated by RTOs, the Federal Energy Regulatory Commission (FERC) has urged RTOs to treat the ability of customer resources to provide demand response on the same basis as generation resources.[23] This has begun to open the door to inclusion and pricing of the services of grid-edge resources, but there is a long way to go.

Achieving grid efficiencies (and resulting carbon reductions) by expanding decarbonization investment at the grid edge requires resetting the relationship between the grid and the edge. Regulatory changes are required to compensate utilities for providing a supportive platform for grid-edge resources. Energy customers, in turn, will aggregate decarbonization strategies to provide smart, controllable resources such as microgrids when the value to the grid is recognized and compensated. Financing will follow the revenues and energy savings.

C. Decarbonization Investment Today

U.S. investment in renewable energy was $46.4 billion in 2016, down slightly from $51.4 billion in 2015, according to the report *Global Trends in Renewable Energy Investment 2017* (GTREI).[24] Total utility investment in all generation was $35 billion.[25] GTREI divides U.S. investment in renewable generation into $13.1 billion in "small distributed capacity" of 1 MW or less[26] and $29.8 billion of "asset finance,"[27] which includes larger assets using both project finance and balance sheet finance. Many grid-edge assets serving universities, hospitals, military bases, or warehouse complexes are substantially larger than one MW,[28] so it seems safe to assume that the grid-edge component of U.S. renewable energy investment is substantially larger than the $13.1 billion represented by small distributed capacity.

U.S. investment in building efficiency is difficult to get a handle on. According to the International Energy Agency, U.S. investment in energy-efficiency retrofits was a meager $6.3 billion in 2015.[29] The U.S. Environmental Protection Agency (EPA) indicates that Energy Star® housing was 9.77% of new housing in 2016.[30] U.S. investment in new residential housing was $587 billion in 2016, which suggests that new investment in efficient residential housing was around $57 billion.[31] The Net-Zero Energy Coalition says that around 8,000 new housing units were built to their standards in 2016—a 33% increase from the prior year.[32]

D. Credit Quality

Dramatically expanding investment at the grid edge will require expanding the pool of energy projects that meet the credit criteria of traditional lending institutions and investors. From a lender's or investor's perspective, the key to the lending or investment decision is an assessment of the ability of the borrower or investment recipient to repay the loan or investment with the expected return. Certain lenders or investors will accept a higher level of risk for a higher promised or expected rate of return, but all within the framework that aggregate losses in an investment portfolio must be outweighed by aggregate returns. Lenders develop underwriting standards and due diligence processes specific to particular asset classes to streamline the process of establishing credit quality, but they also serve to segregate lending markets and raise potential barriers to novel investment.

The universals of analyzing credit quality (also known as underwriting) are deceptively simple to state. What follows discusses lending transactions, but for the most part is applicable across investment classes.

---

21. *See* Federal Energy Regulatory Commission (FERC), *Regional Transmission Organizations (RTO)/Independent System Operators (ISO)*, https://www.ferc.gov/industries/electric/indus-act/rto.asp (last updated Apr. 23, 2018).
22. While there are certain regulatory differences, those differences do not affect the discussion in this Article, and ISOs and RTOs will be referred to collectively as RTOs. FERC created the ISO status first and some RTOs (such as ISO New England (ISO-NE)) include ISO as a part of their corporate name.
23. *See* Part IV.A.1. (Current RTO Markets).
24. Frankfurt School-UNEP Collaborating Centre for Climate and Sustainable Energy Finance, Global Trends in Renewable Energy Investment 2017, at 13 (2017) [hereinafter GTREI], *available at* http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2017.pdf.
25. *See* Martin Rosenberg, *Utility Spending Rockets*, Energy Times, Aug. 29, 2016, http://www.theenergytimes.com/new-utility-business/utility-spending-rockets.
26. GTREI, *supra* note 24, at 58.
27. *Id.* at 52.
28. For example, university members of the Microgrid Resources Coalition operate microgrids ranging from 26 MW to 135 MW. Information courtesy of members of the Microgrid Resources Coalition, http://www.microgridresources.com/home (last visited May 25, 2018).
29. International Energy Agency, Energy Efficiency Market Report 2016, at 111 (2016), *available at* https://www.iea.org/eemr16/files/medium-term-energy-efficiency-2016_WEB.PDF.
30. ENERGY STAR, *2016 ENERGY STAR Certified New Homes Market Share*, https://www.energystar.gov/newhomes/2016_energy_star_certified_new_homes_market_share (last visited May 25, 2018).
31. National Association of Home Builders, *Housing's Contribution to GDP*, *available for download at* https://www.nahb.org/-/media/Sites/NAHB/Research/housing-economics/housings-economic-impact/housings-contribution-to-gdp/table2web_pe_20170831083944_77568.ashx?la=en&hash=3AA293E3BFC2CEAAC54559FEA000E4C9FAB88660 (last visited May 25, 2018).
32. Net-Zero Energy Coalition, To Zero and Beyond: Zero Energy Residential Buildings Study (2017), *available at* https://netzeroenergycoalition.com/wp-content/uploads/2017/06/2017-06-14_NetZeroEnergy17001_zero-energy-homes-booklet_a01_fnl_screen-1.pdf.

- The borrower must be legally enabled to engage in the transaction and must operate in compliance with law.
- The borrower must be financially sustainable—the borrower's revenues after expenses must be adequate to comfortably repay the loan.
- If the borrower is providing collateral to secure its repayment obligation, the value of the collateral must support the amount of the loan (or in any event must have the value that the lender assumes in its overall credit analysis).

1. Capacity and Compliance

As outlined in Part I, this Article treats the dimensions of each of these factors that are particular to energy-related finance. Laws that effectively prevent ownership of generating assets except by specifically authorized corporations (such as utilities) affect the essence of the borrower's ability to transact. Other laws may constrain a borrower's otherwise legal operation, such as air permitting requirements for combustion electric generation. A lender will require that all permits be issued and may require an expert engineer's opinion that a power plant can be operated in compliance with its permits.

2. Financial Sustainability

A borrower's ability to repay is typically evaluated by comparing revenues available for debt service with the amount to be paid on the loan. For a household, this is typically an evaluation of income from employment less major categories of household expenses. For a municipality, it is typically an evaluation of tax revenues less its budget for streetlights, police, schools, garbage collection, and similar functions. In addition to dollar amounts, lenders try to assess stability of revenues. Has an individual held a job steadily, and does he or she have marketable skills? Does a municipality have a strong tax base of assessable properties and is the level of taxes consistent with surrounding communities? Are the population and the commercial enterprises growing or declining?

Both the individual and municipal examples above represent "general obligations" of the borrower. All the revenues of the borrower are compared to all of its expenses. Many energy assets are financed using a technique called "project financing" in which a single asset or project is financed based on the net revenues attributable solely to that project.

As an example, a biomass power-generating project may be owned by a special-purpose entity that by itself has no financial strength. However, it enters into a construction contract to build the facility with an experienced, creditworthy contractor; it enters into a long-term contract to sell the power it generates to a creditworthy purchaser (known as an offtaker); it enters into supply contracts for the biomass fuel; and it hires an experienced operator who guarantees a level of performance of the facility. The contract for the sale of power (together with the design capacity of the facility) defines the project revenues, and the fuel and operating costs are also defined by contract. The capital cost of building the facility under the construction contract defines the amount to be borrowed. With all the components of the analysis fixed by contract (in this simplified example), the ability of the project to pay debt service (and a return to an equity investor once debt is paid) is easy to calculate. The credit of the project depends on the credit of the contracting parties and on the terms and enforceability of their contracts. This puts an extra focus on the legality of the contract obligations.

Project finance is often used in the context of "public-private partnerships," in which a governmental entity shifts technology and operating risks of a project to a private contractor.[33] The government enters into an "offtake contract," such as a power purchase agreement (PPA) or waste disposal services agreement with a minimum guaranteed offtake, which provides the strength of the governmental credit to the revenues of the project. The private contractor takes construction, operation, and performance risk. If the contractor retains ownership of the project, it can take advantage of tax benefits that are not available to non-taxpayers such as governments. This technique works for nonprofit institutions as well.

A variation on the offtake agreement is a "concession." A government or other body grants the right to use a particular asset or right-of-way, such as a toll bridge, or grants the exclusive right to provide community thermal energy services in a territory. In these instances, no specific level of revenues is guaranteed, and independent consultants are typically called on to evaluate the expected market for the services (and, like a municipal tax base, the likelihood of growth or shrinkage over time) to allow credit analysis and approval.

In any case, when thinking about debt service coverage, lenders try to assess not just the numbers, but also the borrower's ability to manage to achieve revenue objectives. In lending to individuals, credit score is typically used as a proxy for how the borrower has managed debts in the past. However, in a public offering of debt securities by a corporate entity, U.S. Securities and Exchange Commission (SEC) Regulation S-K requires an extensive discussion of the managers of the borrowing enterprise and their backgrounds as well as a description of the financial challenges they face.[34]

Finally, in evaluating the revenues or cost savings that a borrower will achieve through an energy project, the lender will want assurances that the technology involved in the project will perform as anticipated. In a utility-scale energy project, an independent engineering consultant is often engaged to review the design and equipment specifications of the project and provide a report that confirms the ability

33. Williams et al., *supra* note 1, at 13.
34. 17 C.F.R. §229.303.

of the project to perform. In smaller projects, this is typically too expensive to be practical. The lender must rely on the reputation, financial strength, and guarantees provided by equipment manufacturers and construction contractors. Information collected over enough installations in enough locations and operating over long enough periods to provide statistical validation of effective performance is extremely valuable in this regard. In many cases, it is simply critical for an individual lender to gain confidence over time through its own experience with particular types of transactions. As particular technologies and transactions gain momentum in the market, lenders who are not first movers can gain necessary expertise by hiring loan officers with prior experience.

3. Collateral

In addition to evaluating revenues, lenders often ask borrowers to grant them a right to foreclose on particular property of the borrower ahead of any other creditors to help pay off the loan if the borrower defaults. The most familiar example is the home or commercial mortgage, which secures payment of the loan to purchase a building. The lender will seek an appraisal of the property to assure that the value of the building is greater than the amount of the loan. This works effectively because: (1) the mechanisms for documenting, recording, and enforcing mortgages are well-established, and (2) there is typically a broad, transparent market for a wide range of properties, making it comparatively easy to realize value in a foreclosure.

A "security interest" under the Uniform Commercial Code (UCC)[35] serves the same purpose as a mortgage, except that the security interest is for personal property, bank and securities accounts, cash, and a variety of intangible property—in other words, almost anything that is not land or a permanent structure. Light-emitting diode (LED) streetlights, wind turbines, and transmission lines, even though they are bolted down, are severable "fixtures" subject to the UCC.[36] Fixtures and other personal property often constitute most of an energy-efficiency or distributed energy project.

Even where financing takes the form of a financing lease, where nominal title to the assets is in the lender, lenders often create a security interest in the project as a backstop. For project financings or concessions, where the revenues depend on the entire web of contracts, all of the contracts and technology rights are pledged to the lender along with the physical assets. This allows the lender to foreclose on the entire project and all its revenue-producing contracts, to use as originally intended if the project defaults due to poor management on the part of the borrower.

35. UCC §1-201.

36. *Id.* §2A-309. *But see* AUI Constr. Group, LLC v. Vaessen, 2016 Ill. App. 2d 160009 (Ill. App. Ct. 2016) (indicating a wind turbine was not a fixture: "UCC security interests simply do not exist 'in ordinary building materials incorporated into an improvement on land.' As AUI built the wind structure with concrete, rebar, electrical conduit, and other 'ordinary building materials,' the UCC does not apply.").

E. Legal Action on Grid-Edge Finance

It should now be apparent that the legal issues listed in Part I directly affect the ability to structure and finance creditworthy energy projects.

- Laws affecting permitted ownership and operation of energy projects go directly to issues of capacity and compliance. Laws affecting procurement and ability to incur debt by particular classes of customers also affect capacity to contract for projects or loans.
- Laws affecting sales and markets for energy and ancillary services directly affect project revenues and savings.
- Laws affecting the incentives and operation of utilities affect their ability and willingness to support projects contractually or through tariff structures to allow projects to operate as proposed.
- Utility regulation also directly affects utility provision of information about customer energy usage and the state of the utility system that allows structuring of projects and lenders' underwriting evaluation.
- Government action can establish institutions that reduce conventional barriers to decarbonization finance.

More broadly, legal action can help bend the arc of policy toward energy justice. Energy justice is not simply a subset of environmental justice, and it has broader concerns. Traditionally, environmental justice has focused on pollution sources, such as power plants, being sited in neighborhoods of the poor and powerless. But at the grid edge, we should all want a power plant in our backyard (or on our roof), just one that does not pollute our air. Being the source of our own energy literally empowers us. We all need access to energy to support health by cooking, heating, and bathing, but also to support our connection to the world's information and our fellow human beings. These are (and were over tens of thousands of years of home fires and campfires) critical supports for the "capabilities and functionings" that Amartya Sen describes as the essence of human freedom.[37] Moreover, using excessive carbon-based energy is not just a form of income inequality, it also devastates our common habitat.

It is a particular irony, then, that one thing the poor have least of is credit. Credit is the means to bootstrap the present to future prosperity. If we can end the need to subsidize fossil fuel use to assist low-income households by instead financing home retrofits that pay for themselves in reduced energy use for those households, we achieve a double victory. But the road to victory requires new financing mechanisms. New technologies permit energy customers and communities to play a lead role in decarbonization of the economy. Finance technology and practice need to catch up. Policies that take advantage of customer and

37. Amartya Sen, Development as Freedom (1999).

community incentives can greatly expand the required investment resources.

The balance of this Article explores legal barriers to (and the absence of legal support for) financing deep decarbonization at the grid edge. It proposes an energy bill of rights for customers and communities investing in decarbonization at the grid edge.

III. The Legal Authority to Generate, Distribute, and Sell Energy

The first element of credit quality essential for grid-edge resources, as described above,[38] is legal capacity to own and operate an energy project and the ability to operate in compliance with law. There are few arenas of productive economic activity that are regulated to the point of prohibition, but generation, delivery, or sale of electricity by persons that are not franchised public utilities is one of those areas. Traditional utility regulation grants to regulated public utilities the exclusive right to produce, deliver, and sell electricity. Different states make different exceptions, and some new exceptions have evolved over time. To have the legal capacity to operate, a grid-edge resource must generally fall into one of these exceptions. This part explores the nature of utility regulation, describes a number of exceptions and workarounds available under existing law, and makes recommendations for alternative policies more favorable to grid-edge resources.

A. The Utility Regulation Hurdle

All states have adopted some form of utility regulation. While the details vary widely, the basic form is the same: investor-owned utilities are granted exclusive service territories (or franchises) for retail sales of electricity. Having been granted a monopoly, utilities then are subjected to detailed regulation of their rates and investments to ensure that the rates they charge to customers are "just and reasonable." Under the Federal Power Act, regulation of local distribution and retail sale of electricity is left almost entirely to the states.[39]

At their inception, investor-owned utilities typically owned all the generation resources used to serve their customers.[40] Now, at least 15 states have adopted retail deregulation, in which competing retail electric suppliers can sell commodity electricity to retail customers over the incumbent electric utility's wires.[41] The utilities still have a monopoly on electric distribution (and customers pay them a "wires charge" for their service), but electric customers can choose their retail electric supplier. Most states adopting retail deregulation have also required utilities to divest their electric power-generating resources, either entirely or to unregulated affiliates of their parent utility holding companies. In those states, generating assets no longer figure in ratemaking proceedings.

Whether utilities solely act as "distribution companies" or remain "integrated utilities" that include generation assets, the heart of the regulatory statute defines the actors subject to regulation. These definitions are typically based on ownership of generating assets or distribution wires or on the activity of selling electricity. For example:

- The District of Columbia, as a retail choice jurisdiction, defines an "electric company" as any entity "physically transmitting or distributing electricity in the District of Columbia to retail electric customers."[42]
- California defines "electrical corporation" as including any entity "owning, controlling, operating, or managing any electric plant for compensation within this state, except where electricity is generated on or distributed by the producer through private property solely for its own use or the use of its tenants and not for sale or transmission to others"[43] and defines "electric plant" as including all property used for "production, generation, transmission, delivery, or furnishing of electricity for light, heat, or power."[44]
- New York defines an "electric corporation" as including any entity "owning, operating or managing any electric plant except where electricity is generated or distributed by the producer solely on or through private property for . . . its own use or the use of its tenants and not for sale to others," and defines an "electric plant" as including all property used for "the generation, transmission, distribution, sale or furnishing of electricity for light, heat or power."[45]

The consequence of falling within the defined target class is either to be subject to full regulation as a public utility or to simply be prohibited from acting as a utility if one does not have an assigned service territory. Either result effectively prevents ownership or operation of a generating resource by anyone other than a franchised utility.[46] Many of these statutes provide limited exceptions, as discussed below. Most permit a property owner to use or purchase

38. *See* Part II.D.1.
39. 16 U.S.C. §824 states:
> The Commission shall have jurisdiction over all facilities for such transmission or sale of electric energy, but shall not have jurisdiction, except as specifically provided in this subchapter and subchapter III of this chapter, over facilities used for the generation of electric energy or over facilities used in 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.

40. Except for customers that served their own needs.
41. Electric Choice, *supra* note 20. Certain states, such as California, have very limited retail choice.
42. D.C. Code §34-1501.
43. Cal. Pub. Util. Code §217.
44. *Id.* §218(a).
45. *Id.*
46. North Carolina Waste Awareness & Reduction Network v. North Carolina Utils. Comm'n, No. COA16-811, 2017 WL 4126385 (N.C. Ct. App. Sept. 19, 2017).

electricity generated on its own property by itself or a third party, but some, such as Kansas, do not allow for third-party ownership of generation.[47] You cannot finance what you cannot legally own and operate.

B. Statutory Exceptions and Workarounds

Most state utility definitions provide some exceptions. One of the most common is the landlord exception that allows the owner of a "building" or "property" to distribute and sell power to its tenants. Some of these are stated broadly and others are limited to resale at the landlord's cost.[48] In a new real estate development where a single developer controls an entire tract and leases to sub-developers, a landlord exception may serve to allow distribution through an entire development. In similar circumstances, an owners' association may be permitted to own distribution wires in common, allowing all distribution to be treated as self-distribution.

Many states have limited geographic exceptions. California permits sales to a customer on adjacent property (so long as wires do not cross a public road[49]).[50] New York, in enabling legislation for the federal Public Utility Regulatory Policies Act (PURPA), permitted qualified renewable energy and cogeneration facilities to sell to customers located "at or near the project site."[51] A review of all exceptions in a particular jurisdiction will often yield fortuitous paths forward.

Some jurisdictions have developed common-law exceptions. For example, case law in Pennsylvania exempts generator/sellers of power if they "do not hold themselves out as serving the public."[52] These judicial exceptions have permitted serving five to 10 customers through private contracts, but incumbent utilities have sometimes taken a dim view of these exceptions. If an energy project faces a challenge in court or before the state utility commission, the uncertainty will typically prevent financing from going forward.

C. Other Forms of Entities

In addition to public utilities, states often authorize certain other types of special-purpose entities to engage in the production, delivery, and sale of power. Some of these forms are flexible enough to be adapted to ownership of grid-edge assets and some are specifically designed to foster them.

1. Cooperative and Municipal Utilities

Most states permit two kinds of community-owned utilities: municipal utilities and electric cooperatives. Municipal utilities are owned directly or indirectly by one or more political jurisdictions. Cooperatives are owned by their customer members and may be for-profit or nonprofit. Municipal utilities can generally finance their facilities with tax-exempt bonds so long as they are not net exporters of electricity.[53] Cooperatives are eligible for financing through a special-purpose federal finance institution, CoBank.[54] Municipal finance terms can often be comparatively flexible. CoBank terms are more typical of traditional lenders.[55] Municipal utilities and co-ops are generally not subject to utility commission rate regulation for sales within their jurisdictions or to their members, respectively, and, accordingly, are freer to pursue community goals such as decarbonization even if it is not the immediate least-cost option.[56]

Existing cooperatives were mostly formed to provide rural electrification, and statutes were adopted in most states to facilitate their formation. Some states, such as New York, limit co-ops to rural locations,[57] but in California, the co-op statute would permit a group of adjacent customers in any area to establish their own generation and distribution system.[58]

---

47. Kan. Stat. Ann. §66-104.
48. For an example of limited cost recovery, see 66 Pa.Cons. Stat. Ann. §1313. For an exception with fewer limitations, see D.C. Code §34-1501.
49. The right to have wires or pipes in a public right-of-way is typically subject to local government jurisdiction, and needs to be considered as well.
50. Cal. Pub. Util. Code §218(b)(2).
51. N.Y. Energy Law §21-106 (Consol.).
52. 66 Pa. Cons. Stat. Ann. §102. *See also* Bethlehem Steel Corp. v. Pennsylvania Pub. Util. Comm'n, 680 A.2d 1203 (Pa. Commw. Ct. 1996) (holding that a company holding itself out as willing to provide utility services to the public is a public utility); Waltman v. Pennsylvania Pub. Util. Comm'n, 596 A.2d 1221, 142 Pa. Commw. 44 (Pa. Commw. Ct. 1992) (holding that the test for determining whether utility services are offered "for the public" is whether or a not a person holds himself as engaged in the business of supplying the product or service to the public); Commonwealth v. Lafferty, 233 A.2d 256, 426 Pa. 541 (Pa. 1967) (holding the distinction between a public entity and business entity is that the public utility holds itself out to the public generally and may not refuse any legitimate demand for service).
53. I.R.C. §142(a)(8); *see* Internal Revenue Service, Tax Exempt Bonds Training Materials, Phase II Training Information, Lesson 6—Exempt Facility Bonds, Facilities for the Local Furnishing of Electric Energy or Gas, at 6-72, https://www.irs.gov/pub/irs-tege/teb2_lesson6.pdf (last visited June 26, 2018); FERC Order No. 888-A states:

    > Congress has determined that certain entities in the bulk power market can use tax-exempt financing by issuing bonds that do not constitute "private activity bonds" or by financing facilities with "local furnishing" bonds . . . a facility shall not be treated as failing to meet the local furnishing requirement by reason of transmission services ordered by the Commission under section 211 of the FPA if "the portion of the cost of the facility financed with tax-exempt bonds is not greater than the portion of the cost of the facility which is allocable to the local furnishing of electric energy."

    FERC Order No. 888-A, 78 FERC ¶ 61220, at 311-15 (Mar. 4, 1997), 18 C.F.R. pt. 35.
54. CoBank, *About CoBank—Industries We Serve: Power*, https://www.cobank.com/About-CoBank/Industries-We-Serve/Power.aspx (last visited May 25, 2018); *see generally* Bloomberg, *Company Overview of CoBank, ACB*, https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=4727249 (last visited May 25, 2018).
55. *See, e.g.*, CoBank, *Products and Services: Capital Markets/Syndications*, http://www.cobank.com/Products-Services/Capital-Markets-and-Syndications.aspx (last visited May 25, 2018).
56. *See generally* American Public Power Association, Authority of State Commissions to Regulate Rates of Public Power Utilities (2014), https://www.publicpower.org/public-power/stats-and-facts/industry-statistics-and-reports.
57. N.Y. Rural Elec. Coop. Law §2.
58. Cal. Pub. Util. Code §2776; *id.* §2868.

Municipal utilities were often formed in the early days of electrification by towns and cities trying to advance economic progress. Many state laws allow formation of a new municipal utility through a process of condemnation or replacement of existing utility wires, but this is a very complex process and likely to be strongly resisted by the incumbent utility.[59] Boulder, Colorado, has spent more than five years attempting to form a municipal utility to meet its renewable energy goals. It met fierce opposition from its incumbent utility, and the process has not reached a conclusion.[60] Municipal utilities that currently exist have different incentives than investor-owned utilities and can, like green banks or sustainable energy utilities, take a strong role in promoting customer generation and efficiency.[61]

2. Thermal Utilities

Many states regulate thermal utilities, which pipe steam, hot water, or chilled water to their customers from central plants, on terms substantially similar to electric utilities. Many of these statutes were enacted long ago and have not kept pace with technology (e.g., steam utilities may be regulated, but not utilities distributing hot or chilled water).[62] Unlike electric power, thermal utilities are not ubiquitous; they typically exist in compact central areas of large cities and on institutional campuses.[63]

Installing district heating or cooling in new developments will rarely compete with an incumbent utility, and utility commissions will be open and flexible to new service. Legal compliance is important, but unlikely to be prohibitively difficult to achieve. Combined heat and power plants are popular grid-edge resources that make efficient use of fuel by creating both electricity and thermal energy from the same fuel source. They can provide both forms of energy to consumers and may, accordingly, be regulated (or require an exception) both as a power seller and as a seller of thermal energy if they serve multiple customers.

3. Customer Aggregations

Assembling multiple customers to support an energy project, whether a community microgrid or simply low-carbon generation, can be especially difficult in light of the limitations on retail sales. Several types of existing laws are designed for or can be adapted to this purpose.

- ❑ ***Retail electric suppliers*.** In states that have adopted retail electric competition,[64] becoming licensed as a retail electric supplier permits sale of commodity electricity at retail and allows the developer of an energy project a path to compliance. While the statutes generally envision retail electricity sellers competing statewide or in regional territories, there is typically no requirement to do so.[65] Sales from local generation to members of the local community or even a few buildings can legally be made by a retail electric supplier. Those sales can be made over the local distribution company wires and billed through the utility. This provides a framework for a utility-private partnership[66] without need for extensive contract negotiations.

Retail electric suppliers are often subject to a variety of consumer protection requirements. These can be extensive as in New York[67] or be as simple as requiring that customers be permitted to switch suppliers periodically.[68] Careful review of an individual state statute is required. Retail suppliers are also typically committed by statute to meet the entire load of their customers. An energy project developer would need to enter into a contract with a wholesale supplier to supply any power not provided by the energy project for its customers and perhaps to purchase excess power from customers as well. These are wholesale transactions not generally subject to state regulation.[69]

- ❑ *CCA*. Six states currently permit municipalities to act as aggregators of commercial and residential demand in their jurisdictions.[70] The municipality that elects to provide CCA acts much like a retail supplier, as discussed above. However, retail suppliers must market to and sign up their customers. A CCA automatically serves all properties in its jurisdiction unless they opt out.[71] The CCA can also purchase at wholesale from any generator within (or without) its boundaries and distribute power over the local utility wires.

---

59. Colo. Rev. Stat. §31-15-707.
60. Empower Our Future, *Boulder Municipalization: A History*, http://empowerourfuture.org/boulder-municipalization-a-history/ (last visited May 25, 2018); Robert Walton, *Five Years in, Boulder's Municipalization Fight Could Be Drawing to a Close*, Util. Dive, July 5, 2016, http://www.utilitydive.com/news/five-years-in-boulders-municipalization-fight-could-be-drawing-to-a-close/421709/.
61. *See* Part V.G. (Green Banks and Sustainable Energy Utilities).
62. *See, e.g.*, D.C. Code §34-213.
63. *See* Steve Tredinnick, *Why Is District Energy Not More Prevalent in the U.S.?*, HPAC Engineering, June 7, 2013, http://www.hpac.com/heating/why-district-energy-not-more-prevalent-us.
64. Those states currently are California (on a limited basis), Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, and Virginia, as well as the District of Columbia. *See* Electric Choice, *supra* note 20.
65. *See, e.g.*, D.C. Code §34-1501; 52 Pa. Code §54.2.
66. *See* Part IV.B.3. (Recommendation: Utility-Private Partnerships).
67. *See, e.g.*, N.Y. Pub. Serv. Law §65.
68. *See, e.g.*, 52 Pa. Code §§54.1 et seq.
69. 16 U.S.C. §824(b)(1).
70. Cal. Pub. Util. Code §366.2; 20 Ill. Comp. Stat. 3855/1-92; Mass. Gen. Laws ch. 164, §134(a); R.I. Gen. Laws §96-H 8124B; N.J. Stat. Ann. §§48:3-92-95. New York is operating a pilot program at the township level through the Reforming the Energy Vision (REV) process (Robert Walton, *New York Towns Wades Into Community Choice Aggregation, Taps Supplier*, Util. Dive, Apr. 15, 2016, http://www.utilitydive.com/news/new-york-towns-wades-into-community-choice-aggregation-taps-supplier-1/417510/).
71. California Public Utilities Code §366.2 requires that customers be provided the opportunity to "opt out"; New Jersey allows the local distribution utility to set up an aggregation as "opt-out," but also allows programs to be set up as "opt-in." New Jersey Board of Public Utilities, NJ Government Energy Aggregation—Program Summary, http://www.state.nj.us/bpu/pdf/energy/NJ_Gov_Energy_Aggregation_Summary.pdf.

In California, which sharply limited retail choice after its energy crisis in 2000, CCAs are becoming increasingly important. The California distribution companies, which are not generally permitted to own generation, do not have strong incentives to resist.[72]

- *Community solar*. Several states, by statute or regulation, have established legal mechanisms for ownership of solar projects that serve multiple customers in a community.[73] These statutes permit the multiple owners or beneficiaries of an energy project to be credited on their electric bills for their proportionate share of the output of a generating project located at some distance from their metered location. These laws and regulations were typically adopted to solve specific problems in specific ways. They may require that there be a single specific energy project rather than a portfolio of suppliers and may require joint ownership by the customers.[74] They have the advantage of providing net metering, so the developer of the project need not supply the entire amount of electricity for each customer as with the aggregation techniques described above. Many of the existing legal authorizations relate only to solar facilities.[75] They clearly permit long-term offtake arrangements that can support financing of an energy project.

D. *Recommendation: New Grid-Edge Regulatory Models*

At the heart of the various partial measures and workarounds described previously in this part are two simple policies:

- Empower local customers and communities to implement local generation and distribution
- Permit virtual metering (as discussed below) for grid-edge energy projects

Both, if more fully implemented, would enable structuring and financing of decarbonization energy projects. They permit revenues from multiple customers to support financing of projects, permit projects to achieve efficient scale, and allow participation by customers who could not singlehandedly develop their own project. They form the core of the customer and community bill of rights.

A third policy would support the other two: allow third-party developers, private or public-interest, to own and operate assets included in grid-edge projects for the benefit of the participating customers. Together, these policies empower customers to manage their own energy consumption and take action to decarbonize their energy use. Investment will follow their lead.

1. Local Generation and Distribution Projects

States that have not done so should create a new exemption from utility regulation that permits customers and their local suppliers to own and operate generation and distribution wires (and pipes). Customers should be permitted to contract on a long-term basis for services of a local energy project to support its financing. Such projects could integrate thermal load with electric load and optimize for its customers through fuel and time-of-day arbitrage. Such projects would generally require a "point of common coupling" with the grid and most likely would be capable of operating as an island isolated from the grid, though that need not be a requirement.

States through regulatory incentives or by legislation could also encourage utilities to partner with local generation aggregations that use utility-owned wires to serve a discrete electrical subarea within its system where the collaboration will also provide benefits to the utility's larger customer base.[76]

2. Combined Virtual Metering

States should enable customers who own a portion of a community energy project, or have a PPA for a portion of such a project, to reduce their billing for the property where they consume electricity by the amount of their entitlement in the project on a real-time basis.[77] This allows customers who cannot site generation on their own property the same advantages available to those who can, and enables customer decarbonization goals to attract more investment.

3. Carbon Conditions

Either of the policies described above can be made subject to policy qualification. States could require that a

72. Tyler Bonson & June Brashares, Center for Climate Protection, Community Choice Aggregation Expansion in California and Its Relation to Investor-Owned Utility Procurement (2017), https://climateprotection.org/wp-content/uploads/2017/07/Procurement-Report-June-21-2017.pdf.
73. *See generally* David Feldman et al., National Renewable Energy Laboratory, Shared Solar: Current Landscape, Market Potential, and the Impact of Federal Securities Regulation, https://www.nrel.gov/docs/fy15osti/63892.pdf.
74. New York Public Service Commission, Order Authorizing Framework for Community Choice Opt-Out Program (Apr. 21, 2016).
75. The Massachusetts program is specific to solar; the New York program is not. Cadmus Group, Inc., Community Shared Solar: Implementation Guidelines for Massachusetts Communities (2013), http://www.mass.gov/eea/docs/doer/renewables/solar/community-shared-solar-implementation-guidelines-with-contracts-032913.pdf; New York's pilot program at the township level through the REV process includes solar: New York Public Service Commission, Order Authorizing Framework for Community Choice Opt-Out Program (Apr. 21, 2016).
76. *See* Part IV.B.3. (Recommendation: Utility-Private Partnerships).
77. This is not a suggestion for net metering either virtual or otherwise. Net metering allows the owner or power purchaser of a self-sited generating resource to receive a credit at the retail rate for net exports of electricity made at a different time. Virtual net metering would allow the same treatment for a community generating asset. This controversial policy is discussed in more detail below at Part IV.B.1. (Utility Purchase Programs Are Rare). The suggestion of virtual metering is to allow a reduction of current consumption at another, local, metered location, not to allow an unpriced time-shifting of consumption.

project meet certain criteria to be eligible for the exemption. A likely limit is aggregate generation or load size. The point is to permit customer load co-management over areas that can be efficiently and effectively managed. As one example, New Jersey permits ownership of distribution wires by local suppliers to service customers to whom they also deliver thermal energy services.[78] Qualification to meet carbon objectives could also be implemented by requiring a local aggregation project to be: (1) a qualifying facility under PURPA,[79] (2) qualified to receive renewable energy credits (RECs) under the state's renewable portfolio standard, or (3) subject to an explicit carbon standard. A carbon standard could require that a new project improve on current statewide generation carbon levels by some percentage, creating a virtuous ratchet.

4. Federal Policy Directives to States

PURPA requires state utility commissions to consider adopting recommended federal policies and to report on their consideration.[80] The effect has been to encourage widespread adoption of various versions of the recommended policies. The U.S. Congress could amend PURPA to require state utility commissions to consider state implementation of policies outlined in this part as well as in other parts below.

IV. Services From and to the Grid Edge

The positive, reliable balance of revenues or savings over costs, as discussed above,[81] is critical to the credit quality of energy projects. Even where an energy user finances an energy project as its general obligation, its own decision to go forward with a project will depend on an accurate understanding of the revenues, savings, and costs. An end-user may elect to go forward with a project to achieve goals other than energy savings, including resilience and reduction of its carbon footprint. When it does so, however, it needs a clear understanding of the amount of its expenditure that will not be self-funding. Lenders, too, will want to understand the amount of debt burden that an end-user is shouldering that must be covered by other income or resources.

Federal and state energy regulation directly affects energy projects' revenues, savings, and costs. Federally regulated RTOs operate markets for energy, capacity, and ancillary services, and they price transmission services, in ways that are the principal available sources of revenues and savings for energy projects. State-regulated utilities may directly purchase energy from energy projects and in some cases run their own demand response programs. Some state regulators are urging them to look to third-party suppliers for additional resources.[82] At the same time, utility tariffs and procedures applied to self-generators (in addition to regular energy charges) can be major sources of costs and delays that are the enemy of creditworthy energy projects.

This part discusses the regulatory regimes affecting the ability of grid-edge resources to earn revenues or create savings for their hosts that support financing. It proposes policies in each regulatory arena that will improve the finance climate at the grid edge.

A. Sales to RTOs

1. Current RTO Markets

To operate the transmission system and to balance generation and load, RTOs create a "dispatch stack" that orders available generators from least cost to highest. They originally did this based on cost information submitted by generators, but they now conduct auctions based on generator-submitted bids, which may vary from hour to hour. They typically have a two-step settlement: a day-ahead settlement based on expected load, and a real-time settlement in which differences between expected and actual load are settled based on real-time bids.[83]

In addition to energy markets, RTOs have established markets for a variety of ancillary services, such as reserves and frequency regulation, to help them balance and manage the system. Finally, to assure an adequate forward supply of generation, several RTOs have established "capacity" markets in which generators are selected to be available and bidding into the market one to three years in advance in return for payments during that forward period.[84] The capacity market, which provides forward assurance of revenues, has been particularly important to financing new generation.

Initially, these markets were open only to utility-scale generation owned by utilities and independent power producers. FERC has issued a series of orders requiring RTOs to open their markets to demand response (the ability of customers to reduce load, either by shutting off energy-using equipment or by ramping up generation on their property that reduces their metered consumption). These

78. N.J. Rev. Stat. §48:3-77.1.
79. 18 C.F.R. §§292.203-.205.
80. 16 U.S.C. §2621.
81. *See* Part II.D.2.

82. *See*, *e.g.*, Constance Douris, Lexington Institute, California Aims to Incentivize Utilities to Adopt Third-Party Energy Resources (2017), http://www.lexingtoninstitute.org/wp-content/uploads/2017/03/CPUC-Incentivize-Third-Party-Resources.pdf; New York Public Service Commission, CASE 14-M-0101, Order Adopting a Ratemaking and Utility Revenue Model Policy Framework (May 19, 2016) (establishing a framework for a utility revenue model where utilities are distribution system platform providers who facilitate the deployment of distributed energy resources), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={D6EC8F0B-6141-4A82-A857-B79CF0A71BF0}.
83. PJM, *Energy Markets*, http://www.pjm.com/markets-and-operations/energy.aspx (last visited May 25, 2018).
84. PJM, *Capacity Market (RPM)*, http://www.pjm.com/markets-and-operations/rpm.aspx (last visited May 25, 2018); ISO-NE, *Forward Capacity Market*, https://www.iso-ne.com/markets-operations/markets/forward-capacity-market (last visited May 25, 2018).

include Order Nos. 745 (demand response), 755 (frequency regulation), 784 (regulation and frequency response), and 819 (frequency response).[85] Independent power producers challenged Order No. 745 on the alleged grounds that FERC impermissibly interfered with states' ability to set retail power prices. The U.S. Supreme Court firmly rejected these contentions in *Electric Power Supply Ass'n v. Federal Energy Regulatory Commission*,[86] making it clear that FERC has authority to continue expansion of market participation by grid-edge resources.

PJM, among the RTOs, has moved the farthest to integrate demand response resources,[87] but is still wrestling with the unique characteristics of highly flexible aggregations of capabilities such as microgrids. (The traditional view of a demand response resource is that it has a fixed baseline of "normal" use and it can reduce consumption from normal in response to grid operator requests. When a customer has as many options to manage its load as Princeton University does in the example above,[88] it is hard to describe it as having a baseline.) In 2017, PJM imposed new requirements for participation in its capacity markets,[89] which raised concerns that demand response might be pushed out. Yet, in the PJM capacity auction held later in 2017 for 2020 delivery, substantial amounts of demand response cleared.[90]

Other RTOs are playing catch-up. The New England Independent System Operator (ISO-NE) is working toward full market integration in 2018.[91] The California Independent System Operator (CAISO) has taken steps in the context of distributed resource aggregations to simply allow behind-the-meter resources to put in performance-based bids without reference to a baseline.[92]

2. Recommendation: Improved Market Participation Models

To advance grid-edge energy development, FERC must continue its movement to full integration of grid-edge resources in the RTO markets. It should accept the principle that grid-edge resources, individually or in the aggregate, can simply submit bids (and bear the tariff consequences if they fail to meet them). This eliminates the "baseline" issue described above by requiring a resource owner to reserve capacity to meet its bid, and only operate that portion of its capacity in response to RTO direction. FERC should continue to work toward "market participation models" that take account of the specific characteristics of grid-edge resources as it has articulated in its 2017 Proposed Rulemaking on Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators.[93]

On a larger stage, FERC could resume the transformation of the U.S. grid that it began with Order Nos. 888,[94] 1000,[95] and 2000[96] by requiring the establishment of RTOs throughout the country. Without RTO markets, grid-edge resources generally have no ability to receive revenues for the services they provide. PURPA requires utilities outside of RTOs to purchase energy from qualifying facilities at the utility's "avoided cost." In practice, this has typically meant that utilities hold auctions to determine who gets to enter into a PPA.[97] However, many if not most grid-edge resources do not export power on a net basis, but rather provide balancing services by reducing (or increasing) their net load to the grid.

Congress, as an alternative, could expand PURPA to require purchase of a wider range of services. This would be consistent with proposals to reform utilities, as discussed further below.[98]

B. Services for and From Distribution Companies

Distribution company purchase of services from grid-edge resources has the potential to serve as a strong basis for grid-edge finance. Distribution company non-energy charges raise grid-edge resources' costs and complicate finance. Under typical utility regulatory regimes, these payments and charges must be "just and reasonable" both to grid-

85. FERC Order No. 745, 134 FERC ¶ 61187 (Mar. 15, 2011), 18 C.F.R. pt. 35, https://www.ferc.gov/EventCalendar/Files/20110315105757-RM10-17-000.pdf; FERC Order No. 755, 137 FERC ¶ 61064 (Oct. 20, 2011), 18 C.F.R. pt. 35, https://www.ferc.gov/whats-new/comm-meet/2011/102011/E-28.pdf; FERC Order No.784, 144 FERC ¶ 61056 (July 18, 2013), 18 C.F.R. pts. 35, 101, 141, https://www.ferc.gov/whats-new/comm-meet/2013/071813/E-22.pdf; FERC Order No. 819, 153 FERC ¶ 61220 (Nov. 20, 2015), 18 C.F.R. pt. 35, https://www.ferc.gov/whats-new/comm-meet/2015/111915/E-1.pdf.
86. Electric Power Supply Ass'n v. Federal Energy Regulatory Comm'n,136 S. Ct. 760 (2016).
87. PJM Interconnection, Demand Response Strategy (2017), http://www.pjm.com/~/media/library/reports-notices/demand-response/20170628-pjm-demand-response-strategy.ashx.
88. *See* Part II.A. (The Energy Revolution at the Grid Edge).
89. PJM Interconnection, PJM Manual 18: PJM Capacity Market (2017), *available at* https://www.pjm.com/~/media/documents/manuals/m18.ashx.
90. A total of 119 MW of solar resources, 504.3 MW of wind resources, and 1,710 MW of energy-efficiency resources cleared the 2020/2021 auction. News Release, PJM, PJM Capacity Auction Sees Strong Response From Market Participants to Strict Performance Standards (May 23, 2017), http://www.pjm.com/~/media/about-pjm/newsroom/2017-releases/20170523-pjm-2020-21-rpm-results-news-release.ashx.
91. ISO-NE, Docket ER17-__-000: Revisions to Implement Full Integration of Demand Response (July 27, 2017), https://www.iso-ne.com/static-assets/documents/2017/07/prd_implement_full_integration.pdf.
92. FERC, Order Accepting Proposed Tariff Revisions Subject to Condition, 155 FERC ¶ 61229 (June 2, 2016), *available at* https://www.ferc.gov/CalendarFiles/20160602164336-ER16-1085-000.pdf.
93. FERC, Notice of Proposed Rulemaking: Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, 157 FERC ¶ 61121 (Nov. 17, 2016), 18 C.F.R. pt. 35, https://www.ferc.gov/whats-new/comm-meet/2016/111716/E-1.pdf. FERC has recently issued its final order in this docket: FERC Order No. 841, 162 FERC ¶ 61127 (Feb. 15, 2018), 18 C.F.R. pt. 35, https://www.ferc.gov/whats-new/comm-meet/2018/021518/E-1.pdf.
94. FERC Order No. 888, 75 FERC ¶ 61080 (Apr. 24, 1996), https://www.ferc.gov/legal/maj-ord-reg/land-docs/order888.asp.
95. FERC Order No. 1000, 136 FERC ¶ 61051 (July 21, 2011), 18 C.F.R. pt. 35, https://www.ferc.gov/whats-new/comm-meet/2011/072111/E-6.pdf.
96. FERC Order No. 2000, 89 FERC ¶ 61285 (Dec. 20, 1999), 18 C.F.R. pt. 35, https://www.ferc.gov/legal/maj-ord-reg/land-docs/RM99-2A.pdf.
97. *See generally* California Public Utilities Commission, *Procurement Processes*, http://www.cpuc.ca.gov/general.aspx?id=5131 (last visited May 25, 2018).
98. *See* Part IV.B.4. (Recommendation: Support the Utility of the Future).

edge resources and to other utility customers. Where payments can be determined in well-structured markets, as is the case with RTOs, there is some assurance of balance. Presently, most are determined in tariff proceedings before utility commissions.

1. Utility Purchase Programs Are Rare

Distribution companies have the potential to provide substantial markets for services from grid-edge resources, but currently do not. Utilities that own generation also often purchase power to augment their own generating fleet. Utilities that do not own generation often still act as power providers of last resort to customers that do not choose a different retail power provider, and those utilities purchase power to meet their obligation. Utilities outside of RTOs still operate their own transmission systems and need the ancillary services that RTOs purchase through their markets. Grid infrastructure is aging, and local provision of generation, storage, or demand response is often a cheaper solution to grid bottlenecks than utility-installed "wires solutions." Those purchases that distribution utilities make are typically purchases from wholesale market players such as other utilities, independent power producers, or federally licensed power marketers and only rarely are purchases from grid-edge resources.

- *States have subsidy programs, not purchase programs***.** Numerous states have adopted requirements that utilities promote adoption of energy-efficiency measures by their customers. These programs subsidize customer costs of energy-efficiency measures (which in some states may include solar generation), using money collected from ratepayers. A total of 29 states and the District of Columbia have adopted renewable portfolio standards that require that prescribed levels of energy used by the utility's customers be renewable or some other form of favored energy generation.

These programs generally result in the issuance of RECs to renewable energy generators, which they in turn can sell to utilities to allow the utilities to meet their portfolio obligation. Some renewable portfolio standard programs require actual purchase of the renewable energy, but for the most part, these are simply state-mandated subsidy programs for particular technologies rather than an effort to foster competitive markets. In some states, such as New Jersey, where the portfolio targets were high enough and utilities made long-term purchase arrangements, the solar RECs have served as a substantial basis for financing renewable energy.[99] In most states, the RECs have served as a kind of "kicker"—an added inducement to equity or tax equity investors in energy projects, rather than as a meaningful contribution to debt service coverage.

- *Utilities sometimes see grid-edge resources as a problem***.** The lack of programs to pay grid-edge resources for actual services rendered, as opposed to state-mandated subsidies, results primarily from the utility disincentives described in Part II.B. Those disincentives are institutionalized in the way utility commissions conduct their business. They also reflect utility views that grid-edge resources are a hindrance to operating their systems rather than a help. This view arises primarily from the increasing proliferation of intermittent solar and wind resources whose output cannot be controlled by the grid operator. At the grid edge, rooftop solar for homes, businesses, and smaller institutions are the primary source of concern.

In California, the annual solar contribution to total generation averaged 10% of in-state electricity generation in 2016, and it sometimes approaches 30%.[100] This has substantially reduced peak consumption at midday and requires a dramatic ramp-up of non-solar resources in the late afternoon when insolation decreases, resulting in the now famous "duck curve" shown in Figure 2.[101] Bringing on resources in a rush in late afternoon that would otherwise have already been serving the midday peak presents an operational challenge for the RTO.

In Arizona, the incumbent utility attempted to impose steep standby charges on residential solar, though a compromise was subsequently reached.[102] Similar regulatory efforts have been launched in a number of states.

- *Net metering***.** One widespread "purchase program" is net metering, in which small solar installations can sell excess power to the utility at flat retail rates. Adoption of net metering in many states substantially encouraged adoption of solar, but the policy has now come under attack, as it often results in the purchase of energy by utilities at prices well above the wholesale price at times when the system does not need additional power.[103] As the proportion of customers receiving this subsidy grows, the sense of injustice increases between the solar haves and have-nots. An alternative way to view net metering is that the utility is providing energy storage services. The utility's avoided cost to provide the service is the cost of providing a battery with the capacity to shift the customer's generation to its time of usage. The customer is not paying that price.

---

99. Lauren Miller, *The Shifting Solar Incentive Landscape*, Sol Systems, Sept. 27, 2017, http://www.solsystems.com/blog/2017/09/27/the-shifting-solar-incentive-landscape/.

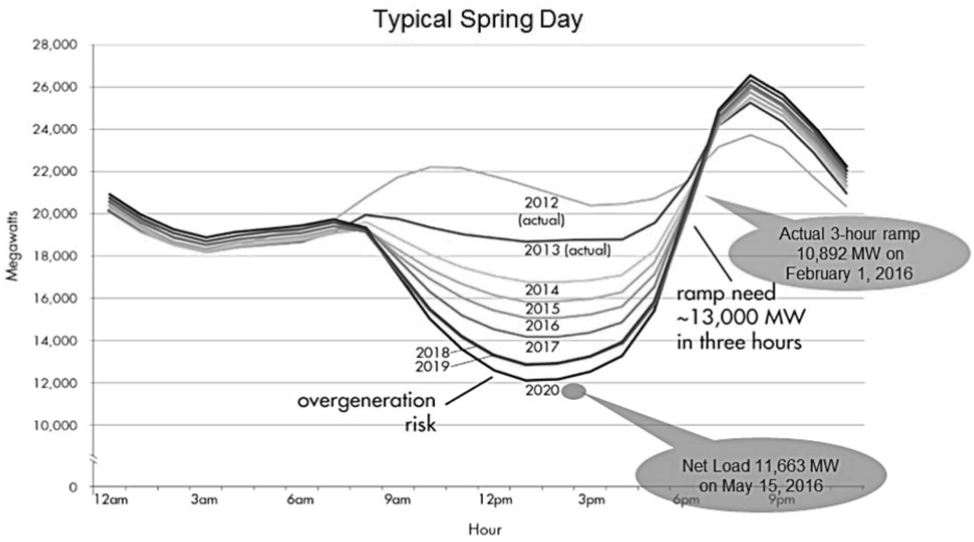
100. California Energy Commission, *Total System Electric Generation*, http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html (last updated June 23, 2017).

101. California ISO, Fast Facts: What the Duck Curve Tells Us About Managing a Green Grid (2016).

102. Herman K. Trabish, *Arizona Preserves Net Metering by Charging a Small Fee to Solar Owners*, Greentech Media, Nov. 15, 2013, https://www.greentechmedia.com/articles/read/charging-a-fee-to-solar-owners-preserves-net-metering-in-arizona#gs.OPraNOM.

103. *See, e.g.*, Annie Knox, *State Announces Solar Net-Metering Deal*, Desert News Utah, Aug. 28, 2017, http://www.deseretnews.com/article/865687684/State-announces-solar-net-metering-deal.html.

Figure 2: Electricity Duck Curve



Source: California ISO, Fast Facts: What the Duck Curve Tells Us About Managing a Green Grid (2016).

2. Recommendation: Getting the Tariffs Right

Planning and financing sustainable grid-edge resources requires reasonable assurances of long-term revenues or savings. Requiring one set of ratepayers to subsidize another set often means that the subsidized revenue stream is at political risk.[104] As matters stand, grid-edge resources often receive no compensation for the services they provide, while a few kinds of resources receive subsidized overcompensation. As a first step to expanding financing for low-carbon grid-edge resources, states should expand these resources' ability to receive predictable, fair compensation for the services they do provide.

Decarbonization technologies at the grid edge cover a vast range from "incommunicative" and unresponsive to smart and flexible. For example, today's typical rooftop solar installation does not communicate to the grid in real time and is unable to modulate production in response to signals from the grid or the installation's owner. At the other end of the spectrum, microgrids are typically smart and responsive—able to communicate with the grid operator and respond with finely tuned output. They bid into day-ahead and real-time markets not only for demand response, but also for frequency regulation and other ancillary services, and the existing markets in RTOs do not exhaust their capabilities. The ancillary services that are needed by the grid today may not be the ones needed tomorrow.

Owners of smart, flexible resources such as microgrids frequently invest in operational or switching capabilities to enhance resilience or reliability, such as black start and "islanding" capacity, especially for mission-critical load clusters such as healthcare or manufacturing facilities or research institutions, where costs of interruption can be economically and functionally damaging. The ability to maintain operations during severe weather events or extreme temperature conditions is obviously beneficial to the host facility, but also provides regional benefits. It alleviates distribution utilities' triage costs and the urgency for emergency response, enabling service restoration to occur more uniformly since mission-critical needs are already being met.

Microgrids' ability to adjust their generation and load to shape their aggregate load profiles permits them to provide more finely tuned services ("smart services") than traditional demand response or ancillary services. Microgrids moderate power prices and grid congestion by efficiently shifting load to times of lower demand and pricing, and by locating generation closer to loads. Smart services can be delivered in response to real-time dispatch or market signals but also pursuant to long-term contracts with utilities. (See next part.) Smart services can be unique, customizable solutions to localized planning and operational challenges. Microgrids employing multiple energy management technologies can simultaneously provide multiple services using multiple dynamic objective functions. This diversity of capabilities cannot be integrated into the grid through a one-size-fits-all, grid-edge resource tariff, but only through valuation of the particular services provided by a particular grid-edge resource.

Rooftop solar and other variable inflexible renewables will not dry up and go away. They will get smarter. Net metering tells them that it is fine to be incommunicative and nonresponsive. The right tariff will encourage future energy projects to integrate storage or take advantage of aggregated storage services to avoid grid charges. Battery prices are coming down, but thermal storage is already cheap and requires no rare materials or toxic chemicals. Peak solar generation can be used in electric chillers to make chilled water to use for air-conditioning in the late-day heat as the sun disappears. This kind of solution can effectively smooth the duck curve.

104. *See, e.g.*, Riley Snyder, *NV Energy Declares Contentious Net Metering Rate Plan "Dead on Arrival" as Deadline to Implement Rooftop Solar Bill Draws Closer*, Nev. Indep., Aug. 22, 2017, https://thenevadaindependent.com/article/nv-energy-declares-contentious-net-metering-rate-plan-dead-on-arrival-as-deadline-to-implement-rooftop-solar-bill-draws-closer; Robert Walton, *Nevada Regulators Approve Net Metering Draft Order for NV Energy*, Util. Dive, Sept. 5, 2017, http://www.utilitydive.com/news/nevada-regulators-approve-net-metering-draft-order-for-nv-energy/504161/.

The challenge of meeting the decarbonization goals is not simply a problem of installed MW of capacity. The challenge is to build a decarbonized system that works as a system to meet customer needs. Providing revenues to the resources that solve the problem will support the investment we need.

3. Recommendation: Utility-Private Partnerships

Beyond purchasing energy, capacity, and other services through markets and other tariff arrangements, utilities can take advantage of direct contractual "partnerships" with grid-edge resources. As discussed above, utility-private partnerships can be used by utilities to acquire long-term services that support the distribution system in lieu of wires solutions.[105] Utility credit behind a long-term contract for services from a grid-edge resource will provide a strong basis for project financing of the grid-edge resources.

California has taken the lead in this arena. The utility commission has required utilities to map their distribution systems, to identify places where new resources would resolve grid inadequacies, and to make those maps available to private developers.[106] The commission has required utilities to consider private ownership of grid-edge resources such as batteries, and it is exploring the level of return needed to make utilities indifferent between private contracts and their own wires investments.[107] State utility commissions should expand on California's lead. The following subsections outline linked regulatory proposals for utility commissions to support implementation of utility partnerships at the grid edge by: (1) encouraging distribution utilities to identify grid infrastructure that would benefit from partnership solutions and identifying possible grid-edge providers, (2) supporting long-term contracts for distribution support services, and (3) assuring that distribution utility incentives support creation of partnerships.

- ❑ ***Procurement of distribution system services*.** States should implement, on an integrated basis, actions similar to those in California, so that grid-edge ownership structures can be integrated with long-term utility planning to identify locations for grid-edge resources. The mapping process can be paired with technology-neutral utility requests for proposals (RFPs) seeking solutions to operational and planning needs. Private respondents to RFPs often have more information about local, integrated electric and thermal technical solutions than utilities. In addition, because grid-edge resource providers may themselves be major customers or have long-standing relationships with major customers, they may well have substantial information about the economics of solutions that depend on optimizing one or more customer systems to respond to utility planning and operational needs while also meeting customer needs.

In addition to RFPs, utility commissions should consider a process for unsolicited proposals from grid-edge resource providers to meet needs identified in a utility distribution system plan. Virginia's Public-Private Transportation Act,[108] which allows private developers to make unsolicited proposals to resolve transportation system issues identified in state and regional transportation plans, provides a useful model. This statute permits, but does not require, unsolicited projects to be bid out before they are awarded, in the discretion of the relevant public planning agency. The analogy here would be that the utility commission would either directly approve or give policy guidance on when to proceed with a noncompetitive procurement based on factors such as the quality of the proposal and the urgency of the need. This has been a successful model in Virginia for more than 20 years.

- ❑ ***Contracting for distribution support services*.** Whether a utility initiates an RFP or responds to an unsolicited proposal, the result will be negotiated contractual arrangements that form a "partnership" between the utility and the grid-edge resource provider. This "utility-private partnership" is analogous to public-private partnerships that are often used to provide crucial infrastructure for municipal services and transportation. These contractual arrangements spell out not only the infrastructure to be constructed, but also the terms of operation including the services to be provided by a grid-edge resource and the compensation for those services—essentially a negotiated tariff.

It will be important not to force such arrangements into a rigid set of service definitions. As discussed above, smart, flexible grid-edge resources provide tailored energy services that are at least as varied as can be provided by a generator. These services include rapid response, steady state operation, timed ramping, and providing frequency regulation around any agreed load or generation profile. These "distribution support services" can be designed to meet the particular needs of the distribution system in emergencies or in daily operation.

As an example, a utility could accept proposals from three microgrids to provide generation/load reduction to support a substation during critical periods as an alternative to distribution system reinforcement. The contracts could call for response in any local crisis (not just peak system demand) and require that maintenance schedules between the three resources be coordinated. Such contracts

105. *See* Part II.D.2. (Financial Sustainability).

106. Herman K. Trabish, *How California's Utilities Are Mapping Their Grids for Distributed Resources*, Util. Dive, Feb. 27, 2017, http://www.utilitydive.com/news/how-californias-utilities-are-mapping-their-grids-for-distributed-resource/436899/.

107. California Public Utilities Commission, Consumer and Retail Choice, the Role of the Utility, and an Evolving Regulatory Framework (2017), http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/Retail%20Choice%20White%20Paper%205%208%2017.pdf.

108. Va. Code §§33.2-1800 et seq.

can also specify specific liquidated damages for nonperformance, which can provide a much finer tuned response than permanent adjustment of demand charges.

More broadly, utility-private partnership contracts can allocate the risks and benefits of long-term investment appropriately among the parties. While the contract may provide specific payments for services that are guaranteed for the financing term of the project, the investment will also be supported by value provided to grid-edge energy users, and ratepayers bear less risk of stranded assets. Utility-private partnership projects can attract more risk-taking capital from third parties and more patient capital from motivated utility customers than utilities themselves can attract. As discussed below, payments by the utility for microgrid distribution support services would be fully recoverable from ratepayers.

- ❑ *Utility compensation for utility-private partnerships***.** As California has realized, it is desirable that utilities be made financially indifferent between physical upgrades to the distribution system and long-term contracts that avoid or reduce the cost of system upgrades. One way to accomplish this is to treat these contracts as capital assets on a similar basis to the treatment of physical upgrades for utility ratemaking purposes. The underlying physical asset may be producing value for particular customers as well (which is why the utility can get attractively priced services from the grid-edge resource provider), but there is no need to make any artificial allocation, as the utility values the regulatory asset based on its cost to acquire the services (the contract payments), not the underlying asset value.

The utility should be able to earn a return on an investment in such a contract. Utility commissions should require and approve tariffs that make the utility indifferent as to whether the solution is achieved by a utility-private partnership or a wires solution, without the utility commission attempting to balance incentive ratemaking payments against a direct return. Payments under such contracts should not be subject to reopening in subsequent ratemaking proceedings, or they will fail to serve as a basis for financing grid-edge resources.

4. Recommendation: Support the Utility of the Future

The recommendations in this Article are intended to promote the proliferation of low-carbon, grid-edge resources. The final step to support financing and assure sustainability for grid-edge resources is to revise the mission and incentives of utilities. Both utility commissions and industry executives are beginning to articulate a vision of utilities that act as a supportive platform for smart, flexible grid-edge resources.[109] Physically, they will convert the grid from a hub-and-spoke configuration both for delivery of power and for management of the grid, to a web that supports and draws services from embedded microgrids and other smart, controllable grid-edge resources. Utilities will deploy regional and subregional semiautonomous control systems that integrate services from grid-edge resources and allow grid-edge resources to cluster and support each other in emergencies. These abilities, in turn, will allow the grid operator to reconfigure the system to reduce or eliminate the effects of disruptions.

The utility business model must also evolve to align utility incentives with the new physical mission. Utility ratemaking, in which utility commissions oversee utility expenditures and determine their profit incentives, is a two-step process. Utilities first develop a "revenue requirement" that covers their anticipated costs of service, debt service, and a return on shareholders' investment in utility assets. They then translate the revenue requirement into tariffs for each class of customer that, based on expected energy consumption by each class, will in aggregate result in rate collections from customers that meet the revenue requirement. The utility commission must approve both, determining that expenditures are "prudent" and rates are "just and reasonable." This process, as currently in effect in most jurisdictions, leads to the misincentives described above and constrains the willingness of utilities to support grid-edge resources.[110]

Moving toward the grid of the future will require utility commissions to promote a utility business model that provides new sources of revenue and profit consistent with encouraging the growth of grid-edge resources. The business model will require: (1) rethinking the utility revenue requirement to be consistent with acting as a platform for third-party services, (2) "decoupling" utility revenues from the actual payments for energy by customers, and (3) making utility profits above minimum levels dependent on earning incentive payments for meeting goals established by state legislators and utility commissions. The following list provides an example of the kind of utility revenue requirement approach that should be implemented by utility commissions to promote the evolution of the grid:

- Debt service should be included as a direct pass-through to ratepayers.
- Operating costs (including administrative overhead, but not profit) should also be treated as a direct pass-through, subject to prudence review. There should be some incentives for reduced costs, but also incentives

109. David J. Unger, *"Platform" Model Will Be Key for Illinois' Future Power Grid*, Energy News Network, Oct. 5, 2017, https://midwestenergynews.com/2017/10/05/platform-model-will-be-key-for-illinois-future-power-grid/; Public Service Commission of the District of Colombia, Staff Report: Formal Case No. 1130, Modernizing the Energy Delivery System for Increased Sustainability (2017), https://www.dcpsc.org/getmedia/6048d517-1d9d-4094-b0f4-384f19a11587/MEDSISStaffReport.aspx; New York Public Service Commission, Case 15-E-0751, Order on Net Energy Metering Transition, Phase One Value of Distributed Energy Resources, and Related Matters (Mar. 9, 2017), https://s3.amazonaws.com/dive_static/paychek/15-E-0751_VDER_Order___final_1.pdf.

110. *See* Part II.B. (Where the Grid Meets the Edge).

for meeting standards established by the North American Electric Reliability Corporation (NERC)[111] and overall reliability performance so that cost reduction does not compromise reliability. As discussed above, distribution system services contracts should be as attractive as wires solutions.

- Purchased power costs should be passed through subject to utility commission supervision of procurement. Procurement can be made subject to carbon reduction goals.
- A base return on equity should be provided at a level that is not significantly higher on an after-tax basis than interest on debt.
- Significant incentives should be given for reducing aggregate peak demand, reducing aggregate load, increasing load factor, signing up flexible load, and reliable performance. Utility commissions should give the same credit for reliable performance and energy efficiency achieved through embedded grid-edge resources as they do for new distribution assets. There should be incentives for prompt action on interconnection and islanding capability requests. Incentives can be devised for optimizing the capital requirement (including generating equipment) per MW served and for reducing carbon emissions. These incentives would, in part, be offset by reduced costs that result from the incentivized behavior and, in part, would permit the rate of return on equity to rise to more traditional levels.
- Assets should not be permitted in rate base that can be effectively made subject to competition by, for example, eliminating barriers to competitive investment, or using RFPs.

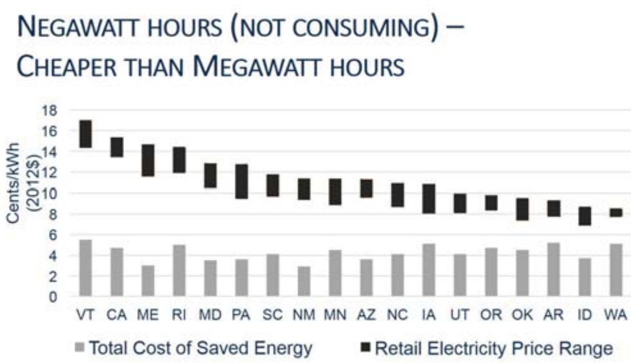
To complement this type of approach to utility revenue requirements, utility commissions should adopt decoupling mechanisms so that utilities do not receive income in excess of their revenue requirement plus earned incentives, with the result that MWh of sales do not drive profits.[112] Implementation of this approach would mean that a utility could not substantially increase its equity returns by adding capital in rate base unless that capital allows it to meet performance goals. The value of utility stock will not depend on expectations of growth in either rate base as such or MWh sold or distributed. Instead, shareholder value will largely depend on creating customer value consistent with the state policy framework—which in many cases will consist of enabling customers to create their own value and value for the grid through grid-edge resources. Creating value by creating satisfied customers through resilient, low-cost, low-carbon energy supply is the essence of advancing decarbonization investment.[113]

C. Recommendation: Subsidies Should Not Interfere With Markets

This Article focuses deliberately on matters affecting project credit to the general exclusion of subsidies. Exceptions are made for long-running subsidies such as investment tax credits (ITCs) and tax-exempt bonds that substantially affect the structure of financing and cause further specialization in finance markets. For the most part, however, the effect of direct subsidies on financing is straightforward—they reduce capital cost (and hence reduce debt service) or they increase revenues, and, in either case, fall straight to the bottom line of credit analysis. The risk of subsidies is that they interfere with the operation of markets that should support grid-edge resources and create pushback against decarbonization goals from those who are disadvantaged by market distortions. A simple price on carbon—established by a market for carbon credits or a resource extraction tax—is the least market-intrusive option for creating clean energy incentives.

Several trends drive customers and communities at the grid edge to decarbonizing investment. First, the cost is low and falling. Energy-efficiency investments typically more than pay for themselves. Figure 3 compares the cost of a "negawatt" of avoided consumption through implementation of energy conservation measures to the price of electricity in selected states.

Figure 3: Cost of Negawatt Hours Versus MWh



Source: The figure is reproduced courtesy of Dr. John Byrne, president, Foundation for Renewable Energy and Environment. It is based on analysis in *Estimating the Cost of Saving Electricity Through U.S. Utility Customer Funded Energy Efficiency Program* by Ian M. Hoffman et al., and data from the U.S. Energy Information Administration.

111. *See* North American Electric Reliability Corporation, *Home Page*, http://www.nerc.com/Pages/default.aspx (last visited May 25, 2018).

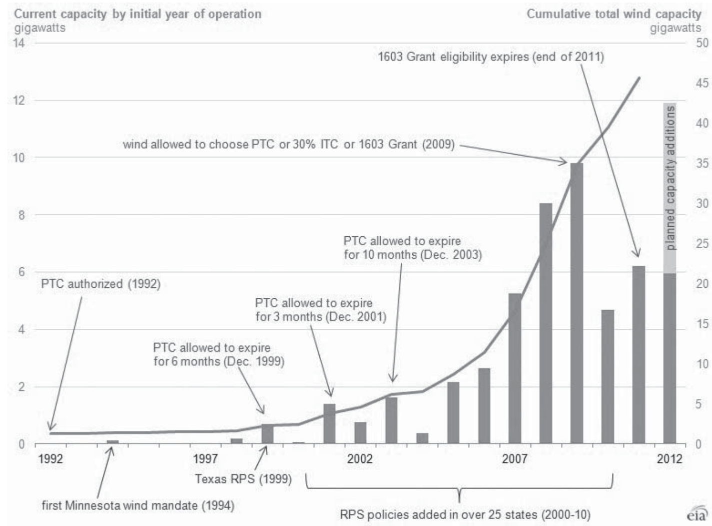
112. National Renewable Energy Laboratory, Decoupling Policies: Options to Encourage Energy Efficiency Policies for Utilities (2009), *available at* https://www.nrel.gov/docs/fy10osti/46606.pdf.

113. The state of Hawaii has recently enacted legislation that gives the Hawaii Public Utilities Commission the power to implement most of these recommended reforms. *See* Hawaii Ratepayer Protection Act, S.B. No. 2939, http://www.capitol.hawaii.gov/session2018/bills/SB2939_SD2_.HTM; *see also* H.B. No. 2110, https://www.capitol.hawaii.gov/session2018/bills/HB2110_.HTM.

The cost of renewable energy storage and smart controls has also reached or come close to grid parity.[114] Moreover, many customers and communities are highly motivated to pursue decarbonization for its own sake. Clearing barriers to undertaking and financing energy projects will often be enough to allow dramatic expansion.

Subsidies, nevertheless, can undoubtedly promote decarbonization investments. Feed-in tariffs in Germany[115] and strong renewable portfolio standards in some states have dramatically expanded investment. The graph shown in Figure 4 of MW of wind capacity installed compared to the on-again off-again status of the production tax credit (PTC) over many years demonstrates this dramatically.[116]

Figure 4: Wind Capacity Installed Compared to PTC Availability



Source: U.S. Energy Information Administration, *Wind Energy Tax Credit Set to Expire at the End of 2012*, Today in Energy, Nov. 21, 2012, https://www.eia.gov/todayinenergy/detail.php?id=8870.

Two kinds of issues arise with subsidies. As discussed above,[117] in connection with net metering, subsidies can often simply seem unfair as between different classes of customers. (By contrast, as discussed below, subsidies that allow low-income or otherwise disadvantaged customers to participate in energy-efficiency or renewable energy programs can counteract unfairness and support financing.) However, subsidies do not reflect either the market price of services or the utility's avoided cost of services, so they can, if poorly deployed, disrupt the legal regime that utility commissions are otherwise bound to implement. This becomes increasingly problematic where the conflicting market and subsidy regimes arise from different jurisdictions.

In *Talen v. Hughes*,[118] the Supreme Court invalidated Maryland and New Jersey statutes that sought to subsidize new electric power-generating plants in their jurisdictions. Each state offered a "contract for differences" that promised to pay proposed new generators selected in an auction process an amount necessary to bring their payments for capacity to a promised level if the RTO auction price was lower. The Court ruled that this was an impermissible interference with federal regulation of the wholesale market price for capacity. However, the Court ruled narrowly, leaving the door open for subsidies that did not directly impose on the federal market pricing mechanism.[119]

In subsequent cases in Connecticut,[120] New York,[121] and Illinois,[122] federal courts have ruled that RECs and zero emissions credits (ZECs, designed to help struggling nuclear plants, which have zero carbon emissions at the plant) are permissible state subsidies because they operate independently of federally regulated markets. While independent, they nevertheless affect market outcomes, supporting lower bids from subsidized resources. While these cases may yet be appealed, they have already given rise to efforts to restructure RTO capacity markets. PJM has proposed a two-tiered settlement in its capacity market, in which it would first set the price for capacity by running an auction that excludes resources that receive RECs or ZECs and then running a second settlement (based on the same bids) to determine which resources are selected, assuring a higher capacity price.[123]

ISO-NE, the RTO that operates the grid in the six New England states, is considering an auction in which carbon is directly priced. All six states are members of the Regional Greenhouse Gas Initiative,[124] which already prices carbon from generating plants as a state policy and may make this more feasible. New York has commissioned a report on implementing a carbon price in the markets run by the New York Independent System Operator (the

114. Rocky Mountain Institute et al., The Economics of Grid Defection (2014), https://www.rmi.org/wp-content/uploads/2017/04/RMIGridDefectionFull_2014-05-1-1.pdf.
115. Kerstine Appunn, *EEG Reform 2016—Switching to Auctions for Renewables*, Clean Energy Wire, July 8, 2016, https://www.cleanenergywire.org/factsheets/eeg-reform-2016-switching-auctions-renewables.
116. U.S. Energy Information Administration, *Wind Energy Tax Credit Set to Expire at the End of 2012*, Today in Energy, Nov. 21, 2012, https://www.eia.gov/todayinenergy/detail.php?id=8870.
117. *See* Part IV.B.1. (Utility Purchase Programs Are Rare).
118. Hughes v. Talen Energy Mktg., LLC, 136 S. Ct. 1288, 46 ELR 20078 (2016).
119. *Id*. at 1299.
120. Allco Fin. Ltd. v. Klee, No. 3:15-cv-608 (CSH), 2016 U.S. Dist. LEXIS 109786 (D. Conn. Aug. 18, 2016) (subsequently upheld in *Allco Fin. Ltd. v. Klee*, 861 F.3d 82 (2d Cir. 2017)).
121. Coalition for Competitive Elec. v. Zibelman, No. 16-CV-8164 (VEC), 2017 U.S. Dist. LEXIS 116140, 47 ELR 20092 (S.D.N.Y. July 25, 2017).
122. Village of Old Mill Creek v. Star, No. 17 CV 1163, 2017 U.S. Dist. LEXIS 109368 (N.D. Ill. July 14, 2017).
123. 16 U.S.C. §2642.
124. *See generally* Regional Greenhouse Gas Initiative, *Home Page*, https://www.rggi.org/ (last visited May 25, 2018).

New York RTO), and it is moving toward taking action on the report.[125]

In an (economically) perfect world, Congress would impose a uniform carbon price on all energy suppliers, whether through federal carbon offset markets or a carbon tax imposed at extraction. This would operate separately from the energy markets and would not be dependent on legislative selection of technologies. It would relieve utility commissions of choices between conflicting legislative policies and avoid conflict between federal and state energy regulation. It would give decarbonization investments at the grid edge a competitive advantage without distorting markets.

V. Grid-Edge Finance

Well-structured energy projects—ones that are legally permissible and make economic sense in the context of existing regulation of energy markets—face a compartmentalized finance market. Some aspects of those markets are subject to direct legal strictures, such as state and federal regulation of municipal finance and state regulation of utility finance. Many of them have also developed specialized forms of contracting and project structuring that are adapted to assuring creditworthy projects for particular technology and borrower niches.

This part first explores the state of play in credit markets for energy efficiency in new and existing buildings and for grid-edge energy resources and makes a few suggestions for possible legal and practice improvements. It next explores and makes recommendations on a group of topics that cut across market niches and are crucial for expanding financing for grid-edge resources, including: (1) pooled finance and securitization, which allows lenders to reduce transaction costs and expand their lending capacity, (2) the many roles of information in structuring creditworthy projects and facilitating lending, (3) the use of performance contracting as a foundation for decarbonization projects, (4) sustainability finance organizations (SFOs, as further defined in Part V.G.), which can facilitate improvements in the first three areas as well as build decarbonization markets, and (5) advancing market participation by low-income customers.

A. *New Building Efficiency*

New buildings are everywhere financed with mortgage financing. Both residential and commercial mortgage financing are ubiquitous through a combination of banks, financial institutions such as savings and loan associations, and specialized players. There are robust secondary markets that allow mortgage originators to sell their portfolios or interests in them to third parties to replenish their liquidity and make more loans. Mobilizing finance in the sector, as such, does not create a barrier to decarbonization, but several ancillary features of the market deserve consideration.

1. Legal Performance Requirements

Lenders will not lend against buildings that are not legally compliant. Accordingly, building codes are a substantial tool for decarbonizing the building stock. Also, zoning codes sometimes prevent or limit rooftop solar, backyard wind, or battery storage.

2. Private Requirements

In addition to governmental codes, several organizations promote voluntary standards for partial or complete decarbonization. They include the U.S. Green Building Council (which promulgates the Leadership in Energy and Environmental Design (LEED) standard),[126] Passive House Institute US (which operates several certification programs),[127] and the New Buildings Institute (which promulgates the Zero Net Energy standard).[128] It is important for the construction contract for a particular building to specify where these standards should be applied.[129]

Many new developments are organized as condominiums or with owners' associations or the properties are otherwise made subject to restrictive covenants of various types. The author has assisted with the structuring of a mixed-use redevelopment of a former army facility in which owners' association members: (1) are required to purchase their electric and thermal energy requirements from a microgrid serving the entire development, and (2) through the owners' association, can enforce the contract with the microgrid developer.

3. Lending Market Process

Although they are not matters of statute or regulation, two aspects of the credit approval process have a major impact on the expansion of decarbonization lending: property appraisal and evaluation of the revenue effects of energy efficiency.

- ❑ *Appraisal*. Mortgage lending depends critically on the value of the property as collateral to secure the loan. Lenders will require as a condition of their loans, and mortgage purchasers (including Fannie Mae and Freddie Mac[130]) will also require, an appraisal

125. Marie J. French, *New York's Energy Leaders Lay Out an Early Blueprint for Carbon Pricing*, Politico, Aug. 11, 2017, http://www.politico.com/states/new-york/albany/story/2017/08/11/new-york-utility-regulator-grid-operator-agree-to-study-carbon-pricing-in-electricity-market-113884.

126. *See generally* U.S. Green Building Council, *Home Page*, https://new.usgbc.org/ (last visited May 25, 2018).

127. *See generally* Passive House Institute US, *Home Page*, http://www.phius.org/home-page (last visited May 25, 2018).

128. *See generally* New Buildings Institute, *Zero Net Energy*, https://newbuildings.org/hubs/zero-net-energy/ (last visited May 25, 2018).

129. *See* Part V.F. (Performance Contracting).

130. *See generally* Fannie Mae, Selling Guide: Fannie Mae Single Family (2017), *available at* https://www.fanniemae.com/content/guide/sel082917.pdf; Freddie Mac, Single-Family Seller/Servicer Guide (2016), *available at* http://www.freddiemac.com/singlefamily/guide/bulletins/

of the property indicating a market value in excess of the value of the loan. For residential properties, the required excess is typically 20% (although this rule was bent substantially in the lead up to the 2008 mortgage lending meltdown).[131] For commercial properties, 25% to 35% is often required.[132]

The appraisal process seeks to determine how the market values the property, not the value in energy savings of the energy-efficiency features as such. Accordingly, market acceptance of energy-efficient features affects valuation as much as building performance. Moving forward, higher demand for energy-efficient homes requires evolution in customer education and values as well as changing the mindset of appraisers.[133] The Institute for Market Transformation, among others, promotes these goals.[134]

Failure to attribute value to energy use reduction is less of a problem in commercial contexts such as for owner-occupied buildings and commercial rental uses. These customers are accustomed to careful business planning calculations, though they may be reluctant to embrace new technology. On the other hand, where developers are building new residential rental property, the calculus becomes even more diffuse. The appraiser must determine the rental rates that tenants will be willing to pay.

- *Energy savings underwriting*. Beyond the appraisal, the mortgage lender makes its own assessment of revenue available for debt service. Traditionally, that assessment looks at principal, interest, taxes, and insurance (PITI) as costs of the building and lumps energy costs in with other household costs.[135] Including energy cost along with the traditional four cost categories (PITIE) would call more attention to the energy category and help level the analytic playing field. Under current analysis, home purchasers at the margin would be disqualified from financing a higher cost home with lower energy costs, where a PITIE analysis would rank the two homes equally in affordability. Of course, this requires good information on new home energy costs.[136]

4. Tax-Exempt Bonds

State and local governments and §501(c)(3) nonprofit organizations can finance new construction through tax-exempt bonds.[137] This group of borrowers is often referred to as the "MUSH" sector (for municipalities, universities, schools, and hospitals), but consists more generally of state and local governments and government agencies and nonprofit organizations, including arts and social services organizations and museums as well as health and education institutions. Because interest on these bonds is exempt from federal taxation to the bondholder, the bonds typically carry an interest rate well below the rate for taxable debt for an equivalent credit.

Issuance of bonds for a governmental entity involves engaging an underwriter (for a public offering) or a placement agent (for a private offering) and providing disclosure to potential bondholders that complies with federal securities laws.[138] Tax-exempt bonds are generally exempt from securities registration requirements[139] but are subject to the antifraud provisions of federal securities law. For publicly issued bonds, underwriters must arrange a contractual obligation by the borrower or another obligated person to provide continuing disclosure.[140] The process for nonprofit borrowers is similar but bonds are typically issued by a special-purpose governmental agency (a conduit issuer) that in turn lends the proceeds to the ultimate borrower. Due to the legal complexities, issuance of bonds incurs fairly high transaction costs and as a rule of thumb, an issuance below $15-$20 million may not make economic sense. Bond issuance will generally yield the lowest interest rate of any form of borrowing.

Tax-exempt bonds can be issued with a variety of maturities, secured or unsecured, and with additional features, as discussed below, in various contexts. In connection with long-lived new buildings, they are typically issued as general obligations of creditworthy entities such as local governments or colleges. Local governments typically cannot legally mortgage their property,[141] and colleges may find it unwise or may be prohibited by the terms of a bequest from granting a mortgage on a piece of their campus. MUSH-sector owners, accordingly, typically are not constrained by the issues affecting the mortgage market.

Tax-exempt bonds provide an inherently inefficient subsidy. The loss in revenue to the U.S. Treasury from the tax exemption of interest on bonds is greater than the interest rate reduction to the borrower. The tax-exemption has a history in the reluctance of the federal government to

pdf/121516Guide.pdf. *See also* Kenneth R. Harney, *For Fannie and Freddie, Appraisals Are Not Always Necessary*, Wash. Post, June 21, 2017, https://www.washingtonpost.com/realestate/for-fannie-and-freddie-appraisals-are-not-always-necessary/2017/06/19/18032bfc-54fc-11e7-ba90-f5875b7d1876_story.html?utm_term=.04ef8fb124d1.

131. Financial Crisis Inquiry Commission, The Financial Crisis Inquiry Report 109 (2011), https://www.gpo.gov/fdsys/pkg/GPO-FCIC/pdf/GPO-FCIC.pdf.

132. Loans.com, *Loan-to-Value Ratio and Commercial Loans*, http://www.c-loans.com/knowledge-base/loan-to-value-ratio-for-commercial-loans (last visited May 25, 2018).

133. Kevin Ireton, *Why Don't We Build Better Houses?*, Fine Homebuilding, Summer 2017, *available at* http://www.finehomebuilding.com/2017/04/26/dont-build-better-houses; Julie Caracino, *Appraised Value and Energy Efficiency: Getting It Right*, Home Performance Coalition, Mar. 7, 2017, http://www.homeperformance.org/news-and-resources/news/appraised-value-and-energy-efficiency-getting-it-right.

134. *See generally* Institute for Market Transformation, *About IMT*, http://www.imt.org/about (last visited May 25, 2018).

135. *See* Part II.D.2. (Financial Sustainability).

136. *See* Part V.E. (Information, Credit, and Carbon).

137. 26 U.S.C. §§141 et seq.; *see generally* Internal Revenue Service, Publication 4079: Tax-Exempt Governmental Bonds (2016), *available at* https://www.irs.gov/pub/irs-pdf/p4079.pdf.

138. 17 C.F.R. §240.15c2-12.

139. 15 U.S.C. §77c.

140. 17 C.F.R. §240.15c2-12.

141. The ability to purchase, convey, and encumber real estate may vary by jurisdiction. *See generally* John Kelly, *Municipalities and Conveyances of Real Estate*, Casenotes & Underwriters' Bull., Vol. 27, *available at* https://www.atgf.com/tools-publications/pubs/municipalties-and-conveyances-real-estate.

encroach on state and local finance when the income tax was first authorized by the Sixteenth Amendment. However, the municipal bond market is a large and effective finance sector, and policies relating to the interest rate exemption are not specific to the energy sector.

5. Recommendation: Change Construction and Lending Industry Culture

Interested nongovernmental organizations and building and lending industry trade groups should work together to: (1) promote verifiable standards for new building energy efficiency, (2) ensure that construction and real estate sales contracts for new buildings require testing and verification of energy performance, and (3) require building appraisals and mortgage credit evaluations to reflect building energy consumption. State and local governments should support this effort by adopting building codes that reflect best energy-efficiency practices and by requiring disclosure of expected building energy consumption to buyers. The federal government should adopt minimum energy-efficiency standards for new buildings as it does for new cars.

B. Energy-Efficiency Retrofits

As a general rule, energy-efficiency retrofits can improve by 30% to 50% the efficiency of any existing building that was not built to a high efficiency standard in the recent past.[142] A 2011-2014 retrofit of the Empire State Building was designed to achieve 38% efficiency gains and has substantially exceeded its guarantees.[143] But, the statistics cited at the beginning of Part II suggest that building owners are taking limited advantage of these opportunities. Most current energy-efficiency projects retrofit commercial, institutional, and governmental buildings.[144] These projects are often done by energy service companies (ESCOs), which perform retrofits pursuant to guaranteed energy savings agreements (GESAs). GESAs share much in common with ordinary construction contracts,[145] but they provide a guarantee of energy savings that typically extends over the life of the financing and in amounts that equal or exceed the financing payments.

1. Guaranteed Energy Savings Contracting

Owners of existing buildings or other facilities enter into GESAs through a process that is substantially different than the equivalent process for a new building. Typically, an ESCO (or sometimes more than one) will do a preliminary audit of the facility to give the owner a listing of the kinds of efficiency measures that will make economic sense. Sometimes, preliminary audits are performed separately, often with grant funding as part of programs to encourage energy efficiency, but in the author's experience, these audits often sit on the shelf for want of a further process or funding to enable the owner to move forward. In either case, an owner may have specific objectives to replace certain equipment or systems that have exceeded their useful life and function poorly or require high maintenance.

When a facility owner has reason to believe, based on a preliminary audit or otherwise, that a retrofit project makes economic sense, it enters into a contract with an ESCO to perform an "investment grade audit" (IGA). In the IGA, the ESCO creates several critical schedules that will be a part of the GESA: a detailed scope of work; a fixed, all-in construction price; a savings guarantee; a project baseline documenting facility energy use prior to undertaking the energy retrofit; and a measurement and verification (M&V) plan by which the guarantee will be evaluated. If the owner approves the IGA (often after some negotiation of the final schedules), the owner and ESCO enter into a GESA incorporating the final schedules.

This process contrasts with a typical construction contract in which a third-party architect or engineer designs a project, and a construction contractor (often chosen based on lowest bid) builds to the third-party design. The ESCO bases its savings guarantee on its design and construction experience. It cannot guarantee the success of a third-party design. In this respect, it is similar to engineering, procurement, and construction (EPC) contracts widely used to support project financings for other kinds of energy projects.[146] Laws in most states permit governmental entities to procure GESAs through a flexible process that does not require ESCOs to bid to a fixed design.[147]

Energy savings contracts for homeowners and small businesses are often, in the author's experience, pale imitations of fully developed GESAs. These customers, who have less experience and less negotiating power, often receive contracts that include only an estimate of savings or perhaps a comparison of the owner's current energy use with comparable properties in the vicinity. They do typically provide for installation of identified energy savings measures at an agreed price, though the price may be subject to reopening on poorly specified terms. This kind of "savings contract lite" is also typical, in the author's experience, in many state-mandated utility energy-efficiency programs. Improved contracting practice should help increase participation by small businesses and residential customers.

142. Krysti Shallenberger, *Clock Starts on Integrating Carbon Pricing in New York Market*, Util. Dive, Aug. 11, 2017, http://www.utilitydive.com/news/clock-starts-on-integrating-carbon-pricing-in-new-york-market/449170/.

143. *Four Reasons Why the Empire State Building Retrofit Model Works*, Clinton Found., Aug. 12, 2014, https://www.clintonfoundation.org/blog/2014/08/12/four-reasons-why-empire-state-building-retrofit-model-works.

144. Residential homes account for 9.77% of Energy Star® homes. *See* ENERGY STAR, *supra* note 30.

145. *See* Part V.F. (Performance Contracting).

146. *See* Parts V.C. (Generation, Storage, and Private Activity Bonds) and V.F. (Performance Contracting).

147. *See* Jocelyn Durkay, *State Energy Savings Performance Contracting*, Nat'l Conf. St. Legislatures, Nov. 15, 2013, http://www.ncsl.org/research/energy/state-energy-savings-performance-contracting.aspx.

2. Financing Retrofits

Because savings are not revenues, which can be pledged and captured easily by a lender, energy-efficiency retrofits are often financed as general obligations. When they are, however, lenders can rely on the guarantee by the ESCO for assurance that the energy project improves rather than decreases revenues available for debt service. Certain factors can weaken the value of the guarantee as a credit support:

- Many ESCOs are national or international companies whose guarantees provide strong credit support, but smaller companies, who are more likely to be willing to undertake smaller projects, are less likely to inspire lender confidence.
- The guarantee is only as good as the M&V protocol for energy savings contained in the GESA. In the past, ESCOs have sometimes used a variety of methods to weaken the value of the guarantee, including taking credit for high subsequent energy price escalation or providing for "deemed savings" (that are simply assumed to occur) in inappropriate situations.[148]
- Most of the technologies that are deployed in energy retrofits have successfully operated in different contexts over substantial periods. However, new technologies may be treated skeptically by lenders, and the performance of even proven technologies in existing buildings, which may involve idiosyncrasies beyond the ESCO's scope of work to resolve, can be hard to predict.
- The history of ESCO contracting over the past quarter-century has not always inspired confidence.[149]

In the author's experience, however, sophisticated lenders understand the retrofit value proposition and are prepared to lend for projects involving ESCOs with a good track record and owners with acceptable credit. Anecdotally, rating agencies often see undertaking energy savings initiatives as evidence of good management practices that reflect favorably in ratings. Potential customers, when considering an undertaking that is outside their ordinary scope and may disrupt normal activities, are more prone to be skeptical than lenders.

Homeowners and small businesses face all of the foregoing credit questions, and those questions are exacerbated by the rudimentary nature of some of their energy savings contracts. Notwithstanding these limitations, the Keystone Home Energy Loan Program (Keystone HELP) provided unsecured loans of up to $15,000 for 14,000 homeowners to complete a range of residential energy-efficiency improvements and experienced low default rates.[150] This program was eventually discontinued following a change in the ownership of the originating lender.

3. Other Financing Approaches

Lenders and lending programs have deployed a wide variety of additional structuring solutions for energy-efficiency loans.

- ❑ *Homeowners*. Homeowners can make use of traditional home improvement loans, often provided in the form of second mortgages. They can also roll home improvements into their first mortgages in connection with a refinancing. These loans face the same issues as loans for new energy-efficient homes discussed above and may also face questions about the ability of the energy-efficiency improvements to deliver actual savings that support underwriting.
- ❑ *Small businesses***.** To the extent they do not simply pay directly through business credit cards, small businesses can take advantage of loans from a small group of specialized lenders that make loans secured by the energy-efficiency improvements, often at rates reflecting a comparatively high degree of perceived risk and limited alternative sources of credit. In the author's experience, the terms of these loans often reflect the lack of bargaining power of the borrowers.
- ❑ *MUSH-sector borrowers*. As an alternative to the issuance of bonds, governments and nonprofits can borrow from banks[151] (for aggregate borrowings less than $10 million[152]) or special-purpose leasing organizations under tax-exempt leases.[153] These financing leases generally bear a somewhat higher interest rate than tax-exempt bonds but are still attractive compared to taxable borrowing. The documentation is similar to any bank leasing transaction, but the transaction must meet federal rules for tax-exempt finance including delivery of a bond counsel opinion. For small individual transactions, this may be the only tax-exempt alternative. The lease is a financing lease—title to the financed improvements remains with the lender until all payments are made and then reverts to the borrower.
- ❑ *Property-assessed clean energy programs*. In jurisdictions that have adopted property-assessed clean

148. *See* Part V.E. (Information, Credit, and Carbon).

149. Katherine McIntire Peters, *Energy Savings Performance Contracts Don't Measure Up, IG Finds*, Gov't Executive, Sept. 11, 2009, http://www.govexec.com/oversight/2009/09/energy-savings-performance-contracts-dont-measure-up-ig-finds/29932/.

150. Press Release, Renew Financial, Popular Keystone HELP Program Re-Launches (May 12, 2016), https://renewfinancial.com/resources/popular-keystonehelp-program-re-launches. Default rates under HELP averaged 1.7%, compared to 3% average for credit cards. John D. Oravecz, *Program Expected to Expand Home Energy-Improvement Loans*, Trib Live, Apr. 9, 2014, http://triblive.com/business/headlines/5917060-74/loans-energy-state.

151. Lisa Lambert, *As Municipalities Turn More to Bank Loans, Market Races to Catch Up*, Reuters, May 1, 2013, http://www.reuters.com/article/us-municipals-bankloans/as-municipalities-turn-more-to-bank-loans-market-races-to-catch-up-idUSBRE94014X20130501.

152. *See* I.R.C. §265(b)(3)(C)(i).

153. *See generally* Association for Governmental Leasing and Finance, An Introduction to Municipal Lease Financing: Answers to Frequently Asked Questions (2000), https://aglf.memberclicks.net/assets/docs/municipal_lease_financing.pdf.

> energy (PACE) legislation, commercial borrowers (and in some jurisdictions, homeowners) can finance energy-efficiency retrofits with this specialized form of secured lending.[154] Typically, a state adopts authorizing legislation and a local taxing jurisdiction adopts an implementing ordinance under the state legislation. The ordinance allows a borrower to voluntarily accept placement of an assessment on its property that has the same status and priority as the local jurisdiction's tax assessment (or immediately junior to it). If the borrower defaults on its PACE loan, the delinquent installment (rather than the entire amount of the loan) becomes a lien on the property, which can ultimately be enforced through a tax sale.

The PACE lien, with priority equivalent to a tax lien, takes precedence over an existing mortgage. The Federal Housing Finance Agency, the regulator of Fannie Mae and Freddie Mac, originally limited PACE programs for residential energy projects by making mortgages subject to PACE liens ineligible for purchase by Fannie Mae and Freddie Mac. The agency argued that PACE funding improperly subordinated the lien priority of the primary lender.[155]

Guidance released by the U.S. Department of Housing and Urban Development (HUD) in July 2016 allowed refinancing or purchase of PACE loans with Federal Housing Administration (FHA) mortgage products, but HUD has now withdrawn that guidance.[156] Some state programs, such as California's, have taken additional measures to mitigate lender risk.[157] Because the PACE lien is only for the amount in default, a senior lender could typically defend its mortgage by buying the property at foreclosure without large exposure.

The PACE mechanism is complex and may not be a significant improvement over second mortgages or secured lending on the collateral of the energy project. In addition to lenders' concerns, consumer advocates have raised questions about PACE loans, which do not enjoy the same level of consumer protection as typical mortgages. And, the *Wall Street Journal* reports that increasing numbers of borrowers are defaulting on PACE loans.[158] Congress should extend consumer mortgage loan protections to PACE loans.

The PACE mechanism does provide a means of credit enhancement for energy-efficiency retrofits, and may permit the loan to stay with the property, which can help support longer lived improvements. In any event, the PACE mechanism is spreading. Thirty-three states have passed PACE-enabling legislation and 20 states have active PACE programs.[159] Residential PACE loans have shown continuous growth, totaling more than $3 billion by January 2017, and were expected to double by 2018.[160]

4. Recommendation: Help Retrofit Markets Grow

The discussion in this part suggests that there are many ways in which retrofit markets can mature and improve. However, it is the author's view that the barriers are not so much legal, or even institutional, but lie more in the reluctance of property owners to take on these unfamiliar and invasive transactions. On paper, retrofits should be irresistible—no money down and start saving money immediately. Nonetheless, the resistance is often substantial. The recommendations below relating to information, performance contracting, and SFOs are intended to help address these concerns.

C. Generation, Storage, and Private Activity Bonds

Financing of generation and storage at the grid edge typically follows one of two ownership models. The first involves the end-use customer owning the generating or storage equipment and operating the equipment for its own benefit, perhaps with either operating or maintenance assistance from the installer. The second involves ownership (and typically operation and maintenance (O&M)) of the equipment by a third-party developer who enters into a PPA with the end-use customer. Various hybrid arrangements are also possible, especially where sales of services to the grid will be involved.

Solar power-generating equipment and batteries charged by solar facilities along with geothermal electric generation and large-scale wind are currently eligible for federal ITCs and wind power-generating equipment is eligible for PTCs.[161] As of 2018, the value of the ITC is 30% of the

---

154. *See, e.g.*, Roy L. Hales, *How California First Helped Bring PACE Home*, CleanTechnica, Oct. 6, 2014, https://cleantechnica.com/2014/10/06/how-california-first-helped-bring-pace-home/; Press Release, D.C. Department of Energy and Environment, District First in the U.S. to Use Property Assessed Clean Energy Financing for Energy Efficiency Project in Affordable Housing (June 20, 2013), https://doee.dc.gov/release/district-first-us-use-property-assessed-clean-energy-financing-energy-efficiency-project.

155. Laurie Goodman, Urban Institute, FHA Clarifies Financing on Properties With PACE Loans (2016), https://www.urban.org/sites/default/files/publication/82756/2000865-FHA-Clarifies-Financing-on-Properties-with-PACE-Loans.pdf.

156. *See* HUD, Mortgagee Letter 2017-18 (Dec. 7, 2017), https://www.hud.gov/sites/dfiles/OCHCO/documents/17-18ml.pdf.

157. *See generally* California State Treasurer, *Property Assessed Clean Energy (PACE) Loss Reserve Program: Background and History*, http://www.treasurer.ca.gov/caeatfa/pace/background.asp (last visited May 25, 2018). *See also Keeping Up With PACE: A Joint Oversight Hearing on Residential Property Assessed Clean Energy (PACE) Programs Before the Assembly Banking and Finance Committee & Assembly Local Government Committee*, 2015/2016 Sess. (Cal. 2016) (statement of Alfred M. Pollard, General Counsel, Federal Housing Finance Agency), https://www.fhfa.gov/Media/PublicAffairs/Pages/Pollard-Statement-before-California-Legislature-Keeping-Up-with-PACE.aspx.

158. *See* Kirsten Grind, *More Borrowers Are Defaulting on Their "Green" PACE Loans*, Wall St. J., Aug. 15, 2017, https://www.wsj.com/articles/more-borrowers-are-defaulting-on-their-green-pace-loans-1502789401.

159. PACENation, *PACE Programs Near You*, http://pacenation.us/pace-programs/ (last visited May 25, 2018).

160. Stuart Kaplow, *California Is a Model for PACE Loan Reform*, Green Building L. Update, Jan. 29, 2017, http://www.greenbuildinglawupdate.com/2017/01/articles/codes-and-regulations/local-government/california-is-a-model-for-pace-loan-reform/.

161. Database of State Incentives for Renewable Energy (DSIRE), *Business Energy Investment Tax Credit (ITC)*, http://programs.dsireusa.org/system/program/detail/658 (last updated Mar. 1, 2018); DSIRE, *Renewable Electricity Production Tax Credit (PTC)*, http://programs.dsireusa.org/system/program/detail/734 (last updated Feb. 28, 2018).

cost of the project, and wind generators rarely elect to use the ITC because the value of the PTC to a generation project over time is typically greater than the ITC. Almost all eligible generating projects are structured to take advantage of these subsidies.

1. Customer Ownership

Customer ownership looks and operates much like the energy retrofit model. Generating equipment is typically directly metered, so the kWh energy savings can be read directly from the meter. The customer's dollar savings are the metered kWh multiplied by the customer's cost per kWh to purchase energy from the grid. However, as with energy retrofits, the installer makes no guarantees about grid pricing. For solar, the installer generally guarantees a specific quantity of kWh of output per hour of measured incoming solar energy, and so the guarantee varies over the course of the day or year. For gas cogeneration, the installer guarantees the "heat curve" of the generator—the kWh of electricity out for the British thermal units of gas energy in—which varies with how much of the generator's capacity is utilized at a given time, and how much is used as steam. A battery can store a limited amount of total energy; it loses energy in the charging/discharging process; and it is also typically limited in the amount of power it can deliver in a fixed time period.

Absent sales to the grid, the kWh generated represent reductions in cost, not revenues that can be pledged. Accordingly, the financing structures applicable to energy retrofits are generally applicable to customer-owned generators. A GESA can be adapted to treat generation as an energy conservation measure, although M&V can be simplified to eliminate the need for an energy baseline (the baseline is zero generation) and other adjustments that may be needed when whole buildings are the subject of a guarantee. A microgrid consisting of cogeneration to serve electric and thermal load, coupled with active building management controls (and with passive energy savings measures as well, if desired), can be financed as a guaranteed energy savings project.

Commercial customers can install renewable generation eligible for tax credits and simply claim the credits for themselves. Residential customers are entitled to a separate residential tax credit,[162] which they can claim if they are the system owner. MUSH-sector customers, however, cannot take advantage of tax credits because they pay no taxes. Other structuring options for non-taxpayers are discussed below.

2. Third-Party Ownership

Third-party ownership serves three purposes. The project owner is entitled by law to the ITC and can be allocated the PTC; it is typically allocated ownership of RECs and other environmental attributes; and it arranges and is the obligor on the financing. For tax benefits to have value, the owner/operator must have taxable income to shelter. Thus, for non-taxpayers such as MUSH-sector entities, a third-party ownership structure is usually preferable. Homeowners and smaller businesses may have limited income that is eligible to be offset with tax credits, and may also prefer not to manage the registration, ownership, and sale of RECs. Finally, through the mechanisms described below, the credit structure continues to rest in part on the project host.

- *PPAs.* PPAs serve as the centerpiece of the third-party ownership model. In the prototypical PPA, a host (the owner or lessor of a property) gives a third-party project owner the right to install generating equipment on its property and agrees to purchase the entire output of the generator at prices established in the PPA. The developer agrees to install equipment meeting general specifications as to output and footprint and to keep the generator in working order over the life of the contract. The payments for power by the host support the financing by the developer in a classic project financing structure. This structure has been a primary driver of rooftop solar expansion.[163]
- *Tax structuring.* As with many project financings, the project owner is often a special-purpose entity. With renewable generation eligible for tax credits, that entity is typically structured to manage the flow of tax benefits to a "tax investor"—a bank or other corporation with large tax liabilities that can be offset with the ITC or PTC and accelerated depreciation on the generating equipment.[164]

Project developers use two principal structures to allocate tax benefits in connection with PPA projects. In a "partnership flip," the project owner is an entity taxed as a partnership with one partner—the tax investor—who initially owns a 99% interest in the entity, and the second—the developer—who owns 1%. Five or six years after the project is completed and placed in service, when the recapture period for both the ITC and depreciation have passed (and often also after the tax investor has achieved a specified return, including cash revenues as well as tax benefits), the ownership of the entity "flips," and the developer owns 95% of the entity and the tax investor owns 5% thereafter.[165]

162. DSIRE, *Residential Renewable Energy Tax Credit*, http://programs.dsireusa.org/system/program/detail/1235 (last updated Mar. 23, 2018).

163. *See, e.g.*, Cameron Walker, *Power Purchase Agreements Expand Solar Development*, St. & Loc. Energy Rep., Nov. 7, 2012, http://stateenergyreport.com/2012/11/07/power-purchase-agreements-expand-solar-development/; Jon Guice, *Solar Power Services: How PPAs Are Changing the PV Value Chain*, Greentech Media, Feb. 2008, https://www.greentechmedia.com/research/report/solar-power-services-how-ppas-are-changing-the-pv-value-chain.

164. *See generally* DSIRE, *Modified Accelerated Cost-Recovery System (MACRS)*, http://programs.dsireusa.org/system/program/detail/676 (last updated Jan. 11, 2016).

165. Rev. Proc. 2007-65, 2007-3 I.R.B. 278. Rev. Proc. 2007-65 was revised in part by Announcement 2009-69, which clarifies that the parties may set a fixed option exercise price at the outset of the transaction so long as the fixed

In an "inverted lease" structure, by contrast, the developer has a wholly owned affiliate that owns the project and leases it to a project entity in which the tax investor is the principal owner, and the project entity, in turn, enters into a PPA with the host. The developer can pass down the entitlement to the ITC with the lease while the depreciation remains with the developer affiliate. The lease payments to the developer-affiliate deliver an agreed-upon proportion of actual cash flows to the developer.

A default under a PPA can result in foreclosure on a project prior to the full vesting of tax benefits. PPAs typically contain early termination payment provisions that require the host to pay for the loss of tax benefits as well as the value of financing.

A third tax structuring mechanism is a sale-leaseback. A host customer contracts for the installation of generating equipment and at completion sells the equipment to a tax investor who leases it back on an operating lease (sometimes called a true lease) in which it retains at least 20% of the value of the equipment at the end of the lease. In addition, the host has no option to purchase the equipment unless for fair market value (or a specified early termination value if higher). This structure has no PPA because the host customer directly leases the generation and uses the power. This structure cannot be used by non-taxpayers. A variation on this structure is a leveraged lease in which a special-purpose entity—often a trust—acts as lessor and borrows money from a third party as well as investing tax equity to fund the purchase of the equipment. The lease payments made by the host lessee cover the lessor's debt payments as well as its return to equity.

These structures are costly and complex. Were it not for the tax benefits, they would generally not be used. PPAs continue to make sense for host customers who do not want to take the risks of ownership or to take on additional debt. The value of tax benefits as an incentive (above the monetary value itself) is that they are self-executing. So long as they are in effect, the energy project is entitled to the benefit and can finance against it. No grant application or discretion is involved.

3. Private Activity Bonds

In addition to its role in the MUSH sector, tax-exempt finance is available to private, for-profit parties constructing and operating certain qualified facilities. Bonds for these projects, called "private activity bonds," can be used to fund:

- Solid waste disposal facilities
- District heating and cooling facilities
- Wastewater treatment facilities[166]

Solid waste, for these purposes, includes municipal waste, food manufacturing and preparation waste, agricultural wastes (both manure and crop waste), and byproducts of timber harvesting and saw mill operations, and also includes waste-derived fuels such as landfill gas and biogas produced from any of the above. With the exclusion of purpose-grown biofuels, this covers more or less the entire range of biofuels. Electric power-generating facilities—the turbine generator as such—are not eligible for tax-exempt finance, but the entire chain of waste processing (including gas digesting), thermal destruction of waste (or derived fuel) in a boiler, and ancillary equipment such as cooling towers and ash disposal can all be financed.[167] In a typical project financing, with 20% to 40% equity investment in addition to debt, the equity portion of the financing more than covers the cost of the ineligible generating equipment, so the restriction on generating equipment finance does not limit the size of the debt financing.

District heating and cooling systems include infrastructure for the distribution of steam or hot or chilled water used by at least two customers.[168] However, the electric and thermal generating facilities are not included.[169] District heating and cooling systems, common in Europe (heat)[170] and increasingly common in the Middle East (cooling),[171] are far more efficient in compact service areas than individual building furnaces and chillers, and can be combined with cogeneration for increased efficiency.

Wastewater treatment is included here for two reasons. First, wastewater treatment plants themselves are large energy users and this provision allows them to take advantage of public-private partnerships in which a private partner owns or operates all or portions of a wastewater treatment facility under a long-term service contract to deliver energy-efficiency retrofits. Second, thermal combustion power plants, including biomass plants, are major users of water. They can often economize (and avoid depletion of natural waterways) by using treated sewer effluent as boiler makeup or cooling water. Tax-exempt bonds can finance some of the ancillary facilities involved.

D. *Pooled Financing and Securitization*

Legal structure is expensive. Spreading the costs of legal structure across multiple projects is one way to reduce financing costs and promote decarbonization. Pooled financing, in the form of mortgage-backed bonds and

price reflects a reasonable determination of fair market value at the time of exercise. Investors rarely exceed the limits set out in this ruling.

166. I.R.C. §142(a)(9).

167. *Id.* §142(g).

168. *Id.*

169. Staff of the Senate Committee on Ways and Means, 97th Congress, Report for S97-248 Tax Equity and Fiscal Responsibility Act of 1982 (Comm. Print 1982).

170. *See generally* European Commission, Efficient District Heating and Cooling Systems in the EU: Case Studies Analysis, Replicable Key Success Factors, and Potential Policy Implications (2016), https://www.euroheat.org/wp-content/uploads/2017/01/study-on-efficient-dhc-systems-in-the-eu-dec2016_final-public-report6.pdf.

171. *See* Shikha Sinha, *Middle East District Cooling Market to Hit $12bn by 2024*, Decentralized Energy, Aug. 29, 2017, http://www.decentralized-energy.com/articles/2017/08/middle-east-district-cooling-market-to-hit-12bn-by-2024.html.

other asset-backed securities, has developed over 50 years and is widespread in capital markets.[172] Pooled financing of decarbonization projects is in its infancy, but has emerged in the form of solar securitizations, and pooled bond issues (both taxable and tax-exempt). For developers or financiers who have built a portfolio of loans, it is a way to sell off all or a portion of their exposure to the loans and rebuild their liquidity. To pursue these strategies, the loans, leases, or other obligations must be sufficiently standardized to facilitate adequate disclosure to prospective purchasers of asset-backed securities. They need to be assets that investors feel they can understand and whose risks they can evaluate.

1. Securitization

Securitization involves transferring a pool of obligations to make payments over time (such as leases, loan agreements, or even PPAs) to a special-purpose entity (the issuer). The issuer issues new securities (often bonds or notes) secured by the pooled obligations and repaid by the collective payments due under the obligations. The underlying obligations of the borrowers to pay on their agreements remain unchanged, and they bear no risk for the other borrowers in the pool. However, the credit of the pooled obligation can be improved compared to the credit of the underlying borrowers. To do so, the originator of the obligations can either retain a subordinated tranche of the risk or "over-collateralize" the pool by including obligations with a cash flow greater than that required to service the debt on the bonds or notes.

Several major solar installers have securitized their customers' solar obligations in this fashion, and Moody's has issued a report on the issuances and its approach to the credit analysis of the securities.[173] Financing providers have undertaken successful securitization of PACE loans, with Renovate America alone totaling $1.35 billion in PACE bonds.[174] The Commonwealth of Pennsylvania and the National Association of State Energy Officials launched the Warehouse for Energy Efficiency Loans (WHEEL) in 2011, which purchased and bundled unsecured residential efficiency loans. These, in turn, were sold as bonds to institutional investors.[175] However, this effort has now gone dormant due to difficulties in assembling required volumes of loans.

2. Pooled Bonds

Securitization involves building a portfolio of project loans and, from that portfolio, selecting a pool of loans to be separately refinanced. Alternatively, a developer or program administrator can marshal a pool of projects to an initial collective financing where all projects are financed contemporaneously. Some PACE programs are intended to function through the issuance of pooled bonds.[176] The Delaware Sustainable Energy Utility (SEU) has pioneered the issuance of tax-exempt bonds to finance pooled MUSH-sector energy-efficiency retrofits,[177] and its initial $70 million bond issue delivered more than $38 million in savings in excess of debt service on the bonds during the life of the bonds.[178]

3. Recommendation: A Federal Alternative

In the residential mortgage space, Fannie Mae and Freddie Mac provide direct liquidity to mortgage lenders by purchasing loans and issuing mortgage-backed securities.[179] In many instances, they provide a guarantee of payments on securities. Congress should establish an agency that can provide the same service for residential and small business energy-efficiency and renewable energy loans.

E. Information, Credit, and Carbon

As the foregoing discussion makes clear, information is critical to credit analysis—both information about borrower performance and about project or technology performance. For individually rated borrowers, the information mostly relates to the borrower. However, a municipality's rating depends in turn on its taxpayers' aggregate performance. Similarly, a solar installer seeking corporate borrowings (or to pool customer obligations in a securitization) will depend for its credit strength on the aggregate credit performance of its customers. Indeed, a lender or rating agency will often look beyond the experience of a borrower's individual customers to experience with similar classes of customers elsewhere. Similarly, even though an individual borrower is not part of a pool, lenders will use aggregate information about similar borrowers undertaking similar projects in addition to credit scores and individual revenue-to-debt comparisons. Lenders' and rating agencies' analyses are as statistically rigorous as the data will permit, both in terms of the size of the sample of bor-

172. John J. McConnell & Stephen A. Buser, *The Origins and Evolution of the Market for Mortgage-Backed Securities*, 3 Ann. Rev. Fin. Econ. 173-92 (2011), *available at* http://www.krannert.purdue.edu/faculty/mcconnell/publications/The-Origins-and-Evolution-of-the-Market.pdf.
173. Press Release, Moody's Investors Service, Moody's Publishes Methodology on Green Bonds Assessment (Mar. 30, 2016), https://www.moodys.com/research/Moodys-publishes-methodology-on-Green-Bonds-Assessment--PR_346585.
174. Press Release, Renovate America, Largest PACE Bond Securitization Completed (June 6, 2016), http://www.prnewswire.com/news-releases/largest-pace-bond-securitization-completed-300280343.html.
175. Carol J. Clouse, *WHEEL: Aligning Energy Efficiency and Securitization*, Institutional Investor, May 27, 2014, http://www.institutionalinvestor.com/article/3345818/asset-management-fixed-income/wheel-aligning-energy-efficiency-and-securitization.html?ArticleId=3345818#.WbfVrckUmDs; *IFR: Citi Sells First Green ABS Bond of Consumer Loans*, Renew Fin., June 18, 2015, https://renewfinancial.com/news/ifr-citi-sells-first-green-abs-bond-consumer-loans.
176. *See, e.g.*, D.C. Code §8-1778.41, 57 D.C. Reg. 3406 (2010)).
177. Sustainable Energy Utility, Inc., Official Statement, Energy Efficiency Revenue Bonds, Series 2011 (2011), https://emma.msrb.org/EA466605-EA361618-EA757647.pdf.
178. Center for Energy and Environmental Policy, DESEU Energy Efficiency Revenue Bonds Series 2011: Project Savings Analysis (2015), https://evogov.s3.amazonaws.com/media/50/media/17699.pdf.
179. *See, e.g.*, Fannie Mae, Basics of Fannie Mae Single-Family MBS (2016), http://www.fanniemae.com/resources/file/mbs/pdf/basics-sf-mbs.pdf.

rowers and in terms of the length of the borrowing history. The same holds true for data about the performance of particular technologies in particular types of installations. The more data and the longer time covered, the better.

Information is also required to structure economically viable and hence creditworthy projects. An energy user must have accurate information about its past energy use to understand the savings it can achieve through self-generation and reduction of energy use. It also needs to face a clear tariff from its distribution company and wholesale markets, both as to the cost of purchased power and as to the value of services it can provide to the grid. Where customer projects have the ability to provide distribution support solutions, the customer, or developers serving the customer, needs to understand what services would be valuable at its location on the grid.

Finally, information about the carbon impact of energy projects must inform policy going forward. Meter readings and M&V reports must translate into carbon reductions to allow customers, utilities, utility commissions, and governments to assess actions and manage toward carbon reduction goals.

A critical policy objective, then, is to ensure that information is collected and is available to customers, developers, lenders, and rating agencies, on the one hand, and to regulators and legislators, on the other hand, in a useable format and at reasonable cost. The following policies can help achieve those goals.

1. Recommendation: Availability of Utility Customer Information

Utility commissions or, if their power is in doubt, state legislatures should establish that information about customer usage belongs to the customer. Customer information should be made available promptly and at little or no expense to the customer or other persons (such as developers) that the customer designates. While a distribution company may aggregate customer data for its own use and should be obligated to provide aggregate data to the utility commission and other state and local governmental bodies, it may not release individual customer data to other parties without the customer's permission.[180]

2. Recommendation: Utility Grid Mapping

Utility commissions should require distribution companies to compile and release information needed to enable utility-private partnerships and other sales of services to support the distribution grid. The California Public Utilities Commission has required distribution companies under its jurisdiction to provide system maps that identify constraints on their distribution system where additional local generation or storage resources would relieve congestion or improve reliability.[181] New York has also taken steps in this direction.[182] All utility commissions should adopt this policy.

When coupled with incentive compensation for non-wires solutions and rigorous valuation of services provided by grid-edge resources, as discussed above,[183] this policy will permit structuring of grid-edge solutions that both reduce ratepayer cost and improve system efficiency. Improvements in system efficiency provide carbon reductions over and above those provided by clean local resources.

3. Recommendation: Performance of Energy Projects and Energy Borrowers

Improvements should be made in the reporting of energy project performance. Wherever a government body or utility commission has jurisdiction over an energy project participant, it should use its authority to require reporting of carbon performance information on an ongoing basis. Jurisdiction will arise in many ways:

- Utility commissions have jurisdiction over utility energy-efficiency and REC purchase programs.
- Any governmental program providing a subsidy for clean energy projects can require reporting as a condition.
- SFOs can require reporting from direct borrowers and from projects for which they facilitate financing.
- Local jurisdictions and environmental regulators can potentially require reporting of information as a condition of construction permits.
- Smart metering of generation resources can permit collection of information directly by utilities and the information would be subject to utility commission jurisdiction.

The U.S. Department of Energy, U.S. Energy Information Administration, and EPA, as well as state agencies, would have jurisdiction to curate information on carbon reduction. Standardized reporting formats will be required to allow effective use of information.

The quality of reporting must also improve. While M&V for energy-efficiency projects generally follow the International Performance Measurement and Verification Protocol (IPMVP),[184] GESA M&V plans often resort to "deemed savings" (savings that are assumed from the capabilities of the equipment under Option A of the IPMVP) or other shortcuts. The cost of meters, sensors, and other

180. An exception should probably be made for credit reporting agencies on the grounds that it helps customers to have a more efficient credit market, but only if those agencies are subject to similar customer rights.

181. Trabish, *supra* note 106.

182. New York Public Service Commission, CASE 14-M-0101, Order Adopting a Ratemaking and Utility Revenue Model Policy Framework 18 (May 19, 2017).

183. *See* Part IV.B.2. (Recommendation: Getting the Tariffs Right).

184. Efficiency Valuation Organization, *International Performance Measurement and Verification Protocol (IPMVP)*, https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp (last visited May 25, 2018).

smart measuring equipment are falling fast.[185] The ability to model the performance of complex buildings is rapidly advancing.[186] For large-quantity, repetitive energy conservation measures, such as streetlights, installing enough sensors for a statistically valid sample can be an improvement over deemed savings. Jurisdictional agencies (such as utility commissions that oversee utility energy-efficiency programs and environmental agencies that monitor emissions) and SFOs should require M&V metering and supervisory control and data acquisition (SCADA)[187] devices that permit accurate measurement of energy savings and carbon performance.

Individual customer identification is not needed to accomplish the analytical purposes of this policy and should be protected. To the extent that information on the performance of proprietary technology is commercially sensitive, the federal Freedom of Information Act provides protections against public release,[188] as do equivalent state statutes. Public agencies can work to make meaningful performance ranges for different technologies available to the public without release of individual proprietary information.

Information on carbon performance of existing grid generating assets is also necessary. RTOs and utility grid operators have resource dispatch records, but not necessarily fuel consumption records. New England Power Pool Generation Information System (NEPOOL GIS) has been legislatively enabled by the New England states to collect this information (and generators are required to provide it).[189] All states should adopt policies requiring reporting on the carbon performance of grid generating assets through legislation or regulation.

4. Recommendation: Green Investments

Several efforts are underway to adopt green bond standards that assure investors that the purchase of bonds supports carbon reduction or other "green" outcomes.[190] These standards are intended to make bonds more attractive to investors and expand the market for decarbonization investment. In 2016, California agencies issued more than $1.38 billion total in green bonds, and increased growth and involvement were expected for 2017.[191]

Most of these efforts are based on point systems similar to LEED for buildings. Points are available for performance reporting after project completion, but reporting is not required, and the standards are not explicit on the quality of the reporting.[192] Accrediting agencies such as Moody's and the International Capital Market Association should adopt improved standards more closely tied to carbon performance based on the M&V methods discussed above. Better standards should improve these markets.

To be clear, green bondholders do not own any environmental attributes generated by underlying energy projects[193] and are not concerned with the value of the attributes as such, but rather with the mission of the projects and with project viability in a market that may become subject to increasing environmental regulation. The Federal Trade Commission in its Green Guides has imposed standards on claims about ownership of environmental attributes,[194] and the SEC would have jurisdiction over claims of benefits to the extent that a prudent investor would care about the veracity of green claims. Otherwise, accreditation is voluntary.

F. Performance Contracting

1. Importance

Most energy projects rely on some form of performance contracting. Stripped to its essence, a performance contract requires the contractor to design, build, and/or operate a project that produces certain results. This contrasts with ordinary construction contracts that require the contractor to build something that conforms visually and structurally to an architect's or engineer's plans.

At a minimum, performance contracts require that an energy project meet guaranteed levels of performance through passage of acceptance tests prior to the owner making final construction payments. They often, either integrally or through a separate O&M agreement with the contractor or an affiliate, provide for ongoing guarantees of performance over an operating period at least as long as the term of the financing. If they are well-structured, such contracts provide for lost revenues or lost savings payments that begin at the scheduled completion date so that debt service is covered from the date anticipated when the project is financed. If a project is unable to achieve guaranteed levels, the contractor may have the option or requirement to pay off project debt to a level that can be met by the actual performance levels achieved.

In short, a performance contract is intended, with limited exclusions for circumstances beyond the contractor's

185. *Sensor Shipments Strengthen but Falling Prices Cut Sales Growth*, IC Insights, Apr. 8, 2015, http://www.icinsights.com/news/bulletins/Sensor-Shipments-Strengthen-But-Falling-Prices-Cut-Sales-Growth/.
186. *See generally* Drury B. Crawley et al., *Contrasting the Capabilities of Building Energy Performance Simulation Programs*, 43 Building & Env't 661-73 (2008).
187. SCADA devices and software are used to manage complex equipment such as electric power-generating resources.
188. 5 U.S.C. §552(b)(4).
189. NEPOOL GIS, *About the NEPOOL GIS*, http://www.nepoolgis.com/about/ (last visited May 25, 2018).
190. *See, e.g.*, Press Release, *supra* note 173.
191. *California Green Muni Bonds Top $1.3 Billion in 2016*, Cal. Green Fin., Jan. 6, 2017, http://www.calgreenfinance.com/2017/01/california-green-muni-bonds-top-13.html.
192. Arguably, the sustainability of the offeror of securities is strongly related to the sustainability of underlying energy projects.
193. This is in contrast to tax investors in renewable projects that generate ITC, who typically own all environmental attributes of a project.
194. Press Release, Federal Trade Commission, FTC Issues Revised "Green Guides" (Oct. 1, 2012), https://www.ftc.gov/news-events/press-releases/2012/10/ftc-issues-revised-green-guides; Guides for the Use of Environmental Marketing Claims, 16 C.F.R. pt. 260, *available at* https://www.ftc.gov/sites/default/files/attachments/press-releases/ftc-issues-revised-green-guides/greenguides.pdf.

control, to support the project credit analysis by assuring the capacity of the project to achieve required revenues or savings, and by replacing lost revenues or savings if the project does not perform. The contractor guarantees the technical performance of the equipment, not energy prices, and the contract must specify the forward prices that translate the guarantee to dollars if it does.

Across the range of energy projects, performance contracts take many forms, for example:

- Generation projects with a customer-owner (or where a third-party owner will provide services to a customer) are typically constructed under EPC contracts that guarantee generator efficiency. For wind turbines, the manufacturer will often provide an ongoing O&M agreement with performance guarantees. Solar panel manufacturers now typically provide 20 to 30-year warranties for their product, which allows solar installers to guarantee performance under an O&M agreement.
- GESAs typically guarantee savings for the life of the financing of an energy-efficiency project. State energy performance contracting statutes authorizing government bodies to enter into GESAs typically require the agreement to include such a guarantee.[195]
- Solar PPAs typically guarantee the output of the panels for the term of the agreement, although the guaranteed output typically declines over time as the panels age. If the installer fails to meet its guarantee upon installation, it may pay damages for occupying the host's real estate without delivering promised savings.

The examples above represent areas where, at least for commercial and institutional customers, performance contracting is reasonably well-developed. Even then, sophisticated customers dealing with unfamiliar contracts often accept inappropriate terms. The author has seen, for example, a contract for installation of a battery system for a major hospital system that purports to give the battery installer control over the entire hospital complex's electrical system without performance requirements or limitations with respect to the needs of hospital operation.

Certain portions of the decarbonization market have yet to see widespread adoption of adequate performance contracts. New building construction contracts, which are dominated by architectural and building function considerations, often substantially neglect the performance of energy systems other than the load specifications of individual equipment. Contracts for residential and small business energy efficiency often provide little or no guarantees, and, although less likely in the author's experience, this can also be true of residential solar PPAs.

195. *See*, *e.g.*, 62 Pa. Cons. Stat. §375; Del. Code tit. 29, §6972.

2. Recommendations

Energy project performance contracts are sufficiently complex, that it may be difficult and counterproductive to regulate them as a consumer protection matter. They can be regulated after the fact where practices amount to consumer fraud.[196] Numerous actors, however, can and should take steps to improve contracting practice. SFOs should use their leverage to assure appropriate forms of contract for customers that they assist.[197] Lenders generally will have an interest in assuring adequate underlying contracts, and banking organizations could assist in promulgating standards. If Congress establishes a national energy-efficiency and renewable energy loan repurchasing organization, equivalent to Fannie Mae or Freddie Mac,[198] such an organization, as a necessary step to improving liquidity in the energy finance market, should impose better forms of contract on the market.

G. Green Banks and Sustainable Energy Utilities

1. Growing Role

A number of states have established special-purpose organizations to lend directly or organize financing for decarbonization projects in their jurisdiction. The first of these was Efficiency Vermont, formed in 2000, which focused on energy-efficiency retrofits.[199] Delaware established its SEU in 2007,[200] and the District of Columbia SEU, formed in 2011, was modeled after Delaware.[201] Several states, beginning with Connecticut and including New York, California, Rhode Island, and Hawaii, have formed green banks that are now up and running.[202] Montgomery County, Maryland, has also established a green bank.[203] These

196. *See generally* Carolyn L. Carter, National Consumer Law Center Inc., Consumer Protection in the States (2009), *available at* http://www.nclc.org/images/pdf/udap/report_50_states.pdf.
197. *See* Part V.G. (Green Banks and Sustainable Energy Utilities).
198. *See id.*
199. *See generally* Efficiency Vermont, *Home Page*, https://www.efficiencyvermont.com/ (last visited May 25, 2018).
200. *See generally* Energize Delaware, *Home Page*, https://www.energizedelaware.org/Sustainable-Energy/ (last visited May 25, 2018).
201. *See generally* District of Columbia Sustainable Energy Utility, *Home Page*, https://www.dcseu.com/ (last visited May 25, 2018).
202. The Coalition for Green Capital works to drive the creation of green banks across the country, as well as internationally, through education, partnering with governments to launch green banks, and supporting innovations of existing green banks. *See*, *e.g.*, Coalition for Green Capital, *Home Page*, http://coalitionforgreencapital.com (last visited May 25, 2018); Green Bank Network, *Knowledge Center*, http://greenbanknetwork.org/knowledge-center/ (last visited May 25, 2018); Coalition for Green Capital, Green Bank Product and Activity Overview (2016), http://coalitionforgreencapital.com/wp-content/uploads/2016/06/CGC-Green-Bank-Product-Activity-Overview.pdf; Annie Gilleo et al., American Council for an Energy-Efficient Economy, Report No. F1602, Green Bank Accounting: Examining the Current Landscape and Tallying Progress on Energy Efficiency (2016), *available at* http://aceee.org/research-report/f1602.
203. *See* Montgomery County Green Bank, *Home Page*, https://mcgreenbank.org (last visited May 25, 2018).

variously named organizations are collectively referred to below as SFOs.

SFOs often receive some funding from their founding jurisdictions, and the Delaware SEU receives an ongoing share of state revenues from the annual Regional Greenhouse Gas Initiative auction without further appropriation. However, no amount of direct state funding will suffice to meet the goals of the DDPP reports, and the principal value of the SFOs is their ability to mobilize private capital to finance energy projects. To this end, they manage financing programs that can make use of all the financing techniques described above. These programs focus a substantial part of their effort on customer education and motivation—trying to get the market moving. For example, the Delaware SEU developed a procurement process to issue tax-exempt bonds for eligible government and nonprofit entities.[204] The New York State Energy Research and Development Authority has also established a financing program to issue tax-exempt bonds for energy projects.[205]

SFOs have worked to standardize documentation to bring clarity and protection to customers and to facilitate pooling and securitization. Because they represent a potentially large market, their negotiating leverage far exceeds that of their customers. SFOs can require reporting of project decarbonization performance for projects they facilitate. This permits them to build a database that allows them to predict future project performance and to support rating agency analysis. In this connection, SFOs have the opportunity to drive M&V standards and to provide green bond reporting at a much higher level of assurance than is contemplated by current green bond standards.[206] SFOs can also play a key role of trusted advisor to homeowners, businesses, and institutions, assisting them with procurement, contracting, and financing. Overcoming customer concerns with education and assistance can promote the advance of grid-edge resources.

2. Recommendations

States and local governments that have not done so should act to establish SFOs to carry out the functions described above. In addition, existing state agencies and authorities, ranging from water and sewer authorities, to municipal utilities, to state treasurers, can often take on the task of sponsoring financing programs and serving some or all of the functions of an SFO. The Pennsylvania treasurer originated the Keystone HELP and WHEEL programs described above and currently sponsors the Pennsylvania Sustainable Energy Finance (PennSEF) Program for pooled bond financing for energy-efficiency projects in the MUSH sector.[207]

H. Recommendation: Help Bring Low-Income Energy Users Into the Market

Federally funded programs assist low-income residents by providing subsidies for housing, energy-related repairs, or energy use.[208] However, these subsidies, which in fiscal year 2017 aggregated $3.6 billion for the principal federal programs and are due to shrink in 2018, cannot come close to alleviating energy poverty.[209] Just as with renewable energy and energy efficiency in the rest of the economy, we need to bring private capital to bear.

Low-income residents, as discussed above, typically have very limited access to credit and then often on very drastic terms. However, those who are able to own or rent homes often spend more than 35% of their income on energy use and in extreme cases more than 50%.[210] Low-income housing programs rely on tenant purchasing power combined with federal subsidies to provide the revenue and reduced costs that make financing possible. Federal and state energy subsidies could, in principle, also be used as credit enhancement to leverage the purchasing power of low-income residents for energy-efficiency improvements, and even community renewable energy facilities.

The existing energy subsidy programs are administered through different agencies, however, and it is often difficult to do the obvious—combine the various subsidies to permanently reduce energy use. As a first goal, the barriers to aggregating programs (so a dwelling's roof can, for example, not only be insulated, but also made waterproof) should be eliminated. Congress and state legislatures should act to allow subsidy funds to be combined with private finance to create low-income housing rehabilitation programs that require energy standards be met in the rehabilitation process.

Subsidies from governmental or nonprofit sources can also be deployed by a lending program to improve pooled credits from low-income projects. Subsidy funds can be used to provide a debt service reserve fund or to take ownership of a high-risk tranche of bonds. Congress or state legislatures could create or authorize federal or state agen-

204. Baird Brown, *Introducing the SFO*, Envtl. Fin. (Nov. 2011), *at* https://www.environmental-finance.com/content/analysis/introducing-the-sfo.html.

205. New York State Energy Research and Development Authority, *Bond Financing*, https://www.nyserda.ny.gov/About/Bond-Financing (last visited May 25, 2018).

206. See the description of green bonds in Part V.E.4. (Recommendation: Green Investments).

207. *See generally* Foundation for Renewable Energy and Environment, *PennSEF*, http://freefutures.org/pennsef/about/ (last visited May 25, 2018).

208. *See generally* U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *Where to Apply for Weatherization Assistance*, https://energy.gov/eere/wipo/where-apply-weatherization-assistance (last visited May 25, 2018); Benefits.gov, *Energy Assistance*, https://www.benefits.gov/benefits/browse-by-category/category/27 (last visited May 25, 2018).

209. LIHEAP Clearinghouse, *LIHEAP and WAP Funding*, https://liheapch.acf.hhs.gov/Funding/funding.htm (last visited May 25, 2018).

210. *See* Adam Chandler, *Where the Poor Spend More Than 10 Percent of Their Income on Energy*, Atlantic, June 8, 2016, https://www.theatlantic.com/business/archive/2016/06/energy-poverty-low-income-households/486197/; Ariel Drehobl & Lauren Ross, Energy Efficiency for All & American Council for an Energy-Efficient Economy, Lifting the High Energy Burden in America's Largest Cities (2016), *available at* http://energyefficiencyforall.org/sites/default/files/Lifting%20the%20High%20Energy%20Burden_0.pdf.

cies to provide reinsurance to private bond insurers for such pools. These avenues have been little explored and have the potential to greatly multiply the effect of the subsidy funds available.

Certain structuring options will not even require subsidies. One low-cost option is "on-bill recovery" of payments on loans for energy projects. A customer who borrows for an energy project makes debt repayment on one of the customer's utility bills.[211] The utility does not need to be the lender, just the back office, and failure to pay need not result in the electricity, gas, or water (as the case may be) being shut off. The lender could be an SFO working in conjunction with the utility. Because these bills rarely go unpaid, the mechanism firms up the repayment stream. Utilities such as National Grid have successfully experimented with these payment plans.[212] Utility commissioners should authorize or require them.

VI. Energy Rights

This Article begins with the urgent need to decarbonize the energy economy. It begins, in other words, in the middle of a discussion about energy justice, a discussion in which we have already decided what needs to be done. In an effort to provide some grounding for the legal and economic policies discussed above, this part returns to the topic of energy justice. With that as background, it also summarizes the spirit of the specific recommendations for energy policy above as a bill of rights for energy customers and communities relating to grid-edge investment in the context of the evolving electric energy regulatory system in the United States.

A. Energy Justice

The fundamental requirements of energy justice are that each person:

- Is entitled to access to energy to support life, health, and participation in the culture and economy
- Must be assured that the extraction, generation, distribution, and use of energy is consistent with preservation of a healthy ecosystem that supports a sustainable economy

The first principle seeks assurance that everyone has the energy means to participate meaningfully in modern society. The second follows Herman Daly's fundamental insight that the economy is a subset of the ecosystem.[213] It encompasses traditional ideas of environmental justice (my power plant cannot destroy your neighborhood), but also acknowledges the requirement to maintain the balance of the economy with the larger planetary ecosystem. Our rights as individual users of energy must be balanced with our rights as participants in the shared commons of the ecosystem. We must balance our need to invest in decarbonization with the ability of the ecosystem to support that material investment.

B. An Energy Bill of Rights

At a practical policy level, examples cited in this Article and the author's experience both strongly suggest that the investment balance just discussed can successfully be struck across a broad range of decarbonization measures. Our ability to achieve a balance will often depend on honoring the ability of customers and communities to incorporate local knowledge and integrate economic and environmental goals. That integration will lead to investment decisions that can substantially expand the collective effort to decarbonize the economy. Local actors should not be free of environmental policy constraints or the constraints of maintaining a reliable grid, but the constraints of existing energy regulation are preventing the healthy evolution of the system.

In that spirit, the various suggestions for grid-edge empowerment that are scattered through this Article can be summarized as an "energy bill of rights" for energy customers and communities:

Each customer:

- May generate and manage energy behind its meter and contract with third parties to assist them in doing so
- May purchase clean energy from local[214] providers through its own or the provider's distribution system
- May purchase energy through local group or community arrangements
- Is entitled to prompt, convenient access to all information gathered by public utilities regarding its own energy use and energy services it delivers
- Is entitled to grid access on a nondiscriminatory basis to provide wholesale energy and energy services through open, transparent markets or at just and reasonable rates to the local distribution company

Each community:

- May purchase or generate energy on behalf of its citizens directly or through contractual arrangements with third parties
- Is entitled to prompt, convenient access to aggregate information gathered by public utilities about their

211. This is similar to PACE from a collection point of view, but unlike PACE it does not impose a lien on the customer's property.

212. New York State Energy Research and Development Authority, *On-Bill Recovery Loan—How to Apply*, https://www.nyserda.ny.gov/All-Programs/Programs/Small-Business-Financing/Applicants/On-Bill-Recovery-Loan-How-to-Apply (last visited May 25, 2018).

213. Herman Daly, *Economics for a Full World*, Great Transition Initiative, June 2015, http://www.greattransition.org/publication/economics-for-a-full-world.

214. This term is deliberately undefined here to be defined in the context of particular state programs.

citizens' energy use and the energy services the citizens deliver

- Is entitled to act as an aggregator of energy and energy services provided by its citizens with the same rights to deliver wholesale energy and energy services as its citizens

Vindication of these rights would dramatically change the opportunities for customers and communities to reshape generation and use of energy at the grid edge. With the support of federal and state policies, it should unleash investment in decarbonization energy infrastructure by customers and communities.

VII. Conclusion

This Article takes as a premise that customers and communities are motivated to reinvent their energy use. Energy efficiency is cheaper than incremental energy (when financed over the useful life of improvements), and the cost of renewable energy at grid-edge scale has reached grid parity in many regions and is falling. Moreover, many customers and communities are motivated by a desire, and will take sensible actions, to reduce their carbon emissions if the path forward is sufficiently clear. These local motivations can mobilize substantial new investment in the effort to decarbonize the economy.

Customer and community action is often thwarted by outmoded regulatory structures. Action by Congress and state legislatures and by FERC and state utility commissions to implement the bill of rights outlined in the previous part can clear those impediments away. Utilities will be required to play new roles and need to transform themselves to serve as platforms that support customer and community action. Utility commissions, in turn, should transform utility ratemaking to support this new utility business model. The new business model goes hand-in-hand with a new operating model—which relies on flexible, dispatchable local resources that can be reconfigured to minimize disruptions—a model that is not only decarbonized, but also more resilient.

Governments and trade associations should work with lenders, rating agencies, appraisers, building inspectors, insurers, and other industry players to educate these finance stakeholders regarding underwriting standards and successful credit-structuring possibilities. They should work to simplify and strengthen contracts that underlie energy financings to support improved customer outcomes and pooled financing. Finally, state and local governments should establish SFOs to further the lending markets' stakeholder process described above, to facilitate both public and private investment, and to act as trusted advisors to customers and communities.