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Article

Curbing Energy Sprawl with Microgrids

SARA C. BRONIN

Energy sprawl—the phenomenon of ever-increasing consumption of land, particularly in rural areas, required to site energy generation facilities—is a real and growing problem. Over the next twenty years, at least sixty-seven million acres of land will have been developed for energy projects, destroying wildlife habitats and fragmenting landscapes. According to one influential report, even renewable energy projects—especially large-scale projects that require large-scale transmission and distribution infrastructure—contribute to energy sprawl.

This Article does not aim to stop large-scale renewable energy projects or even argue that policymakers should focus solely on land use in determining whether energy projects are allowed to proceed. Rather, it proposes that we advance the legal institutions necessary to facilitate one possible solution to energy sprawl: the alternative energy microgrid—that is, small-scale distributed generation between neighbors of energy derived from sources such as solar collectors, wind power systems, microturbines, geothermal wells, and fuel cells. Microgrids are attractive from a public policy perspective. They decentralize energy production, reducing the need for massive transmission lines and large centralized plants. They allow property owners to achieve economies of scale by spreading the costs and the risk of installation and maintenance among many parties. They provide cleaner alternatives to conventional energy methods of production. And they improve system efficiencies by reducing the amount of energy lost during transmission across long distances to end users.

Despite such benefits, regulatory, political, and economic barriers thwart microgrids. For example, state laws prohibit or severely limit their viability, while neighbors may object to living nearby. This Article offers three proposals to address such barriers. First, Congress should require states to consider a model standard for microgrids, just as it has required states to consider model standards in other areas of utility law. Second, states should provide guidance to localities with respect to siting and permitting microgrid projects. Third, states should develop and authorize legal institutions that would support microgrid projects, drawing from Professor Robert Ellickson's proposal for block improvement districts, which accommodate the public-private nature of shared energy. Together, these proposals would support small-scale energy sharing collectives whose emergence could transform the American landscape.

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Curbing Energy Sprawl with Microgrids

SARA C. BRONIN*

I. INTRODUCTION

Energy sprawl—the phenomenon of the ever-increasing consumption of land,[1] particularly in rural areas, required to site energy generation facilities—is a real and growing problem. Over the next ten years, significant investment in energy infrastructure will lead to widespread fragmentation and damage to natural ecosystems and wildlife and bird habitats.[2] Ten years after that, at least sixty-seven million acres of land will have been developed for energy projects.[3] By 2050, demand for electricity is expected to double, requiring the use of even more land.[4] Curbing energy sprawl exceeds the capabilities of local governments, and even states, as sprawl by definition presents complex cross-jurisdictional questions.

With demand for energy showing no signs of abating, slowing energy sprawl will require a multi-faceted approach by all levels of government. One key component of this approach must be alternative energy microgrids—that is, small-scale, low-voltage distributed generation[5]

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* Associate Professor of Law, University of Connecticut.

[1] This Article focuses on land, but energy infrastructure can extend to waters, too. In 2009, the Obama administration announced a new policy opening federal waters for alternative energy projects with potentially profound negative impacts on the environment. *See* President Barack Obama, Remarks by the President on Clean Energy (Apr. 22, 2009), *available at* http://www.whitehouse.gov/the_press_office/Remarks-by-the-President-in-Newton-IA/.

[2] Jessica B. Wilkinson & Robert Bendick, *The Next Generation of Mitigation: Advancing Conservation Through Landscape-Level Mitigation Planning*, 40 ENVTL. L. REP. NEWS & ANALYSIS 10,023, 10,023 (2010).

[3] Darci Palmquist, *Energy Production and Nature: What Will the Impacts Be?*, THE CONSERVATION BLOG OF THE NATURE CONSERVANCY (Aug. 26, 2009), http://blog.nature.org/2009/08/new-energy-production-nature-impacts-energy-sprawl-renewable-rob-mcdonald/.

[4] LITOS STRATEGIC COMMC'N, U.S. DEP'T OF ENERGY, THE SMART GRID: AN INTRODUCTION 18 (2008) [hereinafter THE SMART GRID], *available at* http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf.

[5] The term "distributed generation" refers to the production of electricity by a small-scale source located at or very near the end users it serves. *See* THE SMART GRID, *supra* note 4, at 12 (defining "[d]istributed generation" as "the use of small-scale power generation technologies located close to the load being served, capable of lowering costs, improving reliability, reducing emissions and expanding energy options"); MARK RAWSON, DISTRIBUTED GENERATION COSTS AND BENEFITS ISSUE PAPER 5 (2004), *available at* http://www.energy.ca.gov/papers/2004-08-30_RAWSON.PDF (stating that "[d]istributed [g]eneration is electricity production that is on-site or close to the load center and is interconnected to the distribution system"); U.S. ENERGY INFO. ADMIN., GLOSSARY, http://www.eia.doe.gov/glossary/index.cfm?id=D#dist_generator (last visited Oct. 26, 2010) (defining "[d]istributed generator" as a "generator that is located close to the particular load that it is intended to serve").

between neighbors for energy derived from sources such as solar collectors, wind power systems, microturbines, geothermal wells, and fuel cells, which have minimal negative impact on the environment.[6] Our current legal regime, and state laws in particular, prohibit or severely limit such arrangements, thereby facilitating energy sprawl while thwarting investment in alternative energy resources. As a result, only a handful of microgrid projects have been built across the country.[7] Several of these projects have been publicly called microgrids but only serve one customer, so they fall outside of the definition of microgrids used by this Article.

Consider, for example, a homeowner with a solar panel installation that produces more electricity than she uses. Currently, if she can do anything at all with the excess electricity, she can only "sell" it back to local electric utility companies under state rules governing such transactions, known as net metering.[8] This electricity will get redistributed

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[6] *See* ROBERT LASSETER ET AL., INTEGRATION OF DISTRIBUTED ENERGY RESOURCES: THE CERTS MICROGRID CONCEPT 26 (2002), *available at* http://certs.lbl.gov/pdf/50829.pdf (defining the microgrid as "a semiautonomous grouping of generating sources and enduse sinks that are placed and operated for the benefit of its member customer(s)"); Thomas E. Hoff et al., *Distributed Generation and Micro-Grids* (USAEE/IAEE Conference, 1997), *available at* http://www.clean-power.com/research/microgrids/MicroGrids.pdf (defining the microgrid as "an electrically isolated set of power generator that supply all of the demand of a group of customers"); F. Katiraei & M.R. Iravani, *Transients of a Micro-Grid System with Multiple Distributed Energy Resources* 1 (Int'l Conference on Power Sys. Transients, Paper No. IPST05-080, 2005), *available at* http://www.ipst.org/TechPapers/2005/IPST05_Paper080.pdf (defining the microgrid as "a portion of a power system which includes one or more DG [distributed generation] units capable of operating either in parallel with or independent from a large utility grid, while providing continuous power to multiple loads and end-users"); Douglas E. King, Electric Power Micro-grids: Opportunities and Challenges for an Emerging Distributed Energy Architecture 3 (May 2006) (unpublished Ph.D. dissertation, Carnegie Mellon University), [hereinafter King, Thesis] *available at* http://wpweb2.tepper.cmu.edu/ceic/pdfs_other/Doug_King_PhD_Thesis_2006.pdf (defining the microgrid as "a small group of customers, interconnected at low voltages on a local power grid with a single point of interconnection with the area electric power system").

[7] *See* Jesse Berst, *Macro Trends Point to Microgrids*, SMARTGRIDNEWS.COM (Nov. 28, 2006), http://www.smartgridnews.com/artman/publish/article_182.html (identifying a CERTS facility, a subsidiary of a Michigan-based utility offering to build microgrids for commercial and industrial customers, a prototype microgrid at a Vermont commercial/industrial park, two Wal-Mart microgrids, and a demonstration project at Sandia National Laboratories); Kerry A. Dolan, *Thinking Small About the Grid*, FORBES.COM (Mar. 10, 2009, 12:00 PM), http://www.forbes.com/2009/03/10/microgrid-electricity-cleantech-technology-breakthroughs-microgrid.html (noting two Wal-Mart microgrids in Colorado and Texas, a demonstration microgrid installed by the Sacramento Municipal Utility District, and a microgrid backup power system at the Santa Rita Jail); *Perfect Power at the Illinois Institute of Technology*, GALVIN ELECTRICITY INITIATIVE, http://galvinpower.org/projects/perfect-power-illinois-institute-technology (last visited Oct. 26, 2010) (describing the microgrid "that will not fail the end-user" at the Illinois Institute of Technology); Press Release, U.S. Dep't of Energy, Secretary Chu Announces More than $20.5 Million for Community Renewable Energy Deployment Projects (Jan. 21, 2010), *available at* http://www1.eere.energy.gov/recovery/news_detail.html?news_id=15759 (describing a microgrid project for the Forest County Potawatomi Tribe that includes a biogas digester, wind turbines, solar panels, a biomass combined heat and power facility, and a University of California at Davis project that includes biogas, a fuel cell, and a storage battery).

[8] Eight states have not allowed for net metering, prohibiting individuals from selling excess energy produced by their renewable energy technologies back to the local electric utility company. LAUREL VARNADO & MICHAEL SHEEHAN, NORTH CAROLINA SOLAR CENTER & INTERSTATE RENEWABLE ENERGY COUNCIL, CONNECTING TO THE GRID 11 (6th ed. 2009), *available at*

through the central transmission facility to other end users, becoming less efficient the farther it travels. Under the laws of many states, the homeowner cannot enter into an agreement with her neighbor wherein the neighbor buys the excess power, lest she be considered to be a public utility[9] and therefore be regulated more heavily than is warranted given the relatively small scale of her output.

Consider also the situation in which a group of neighbors engages in a debate as to whether to install a wind turbine in a vacant lot that the city has given to them for redevelopment. From the city's perspective, a turbine would lessen the load on the local utility, which would reduce the number of unsightly and environmentally disruptive distribution lines cutting through town. In many jurisdictions, these neighbors can divide the cost of installing the turbine but can neither centralize operational costs and pay for their later individual energy use nor connect the turbine to their individual parcels without violating public utility laws. The likelihood that either the neighbors invest in the turbine, or that the homeowner invests in a solar panel whose output exceeds her basic needs, is slim. The cost of alternative energy has decreased in recent years, but not enough to make recouping ongoing costs unnecessary for private parties.

Although current state laws prohibit or severely limit alternative energy microgrids, such arrangements are attractive from a public policy perspective. They decentralize energy production, reducing the need for nationwide transmission lines and large-scale centralized plants. They allow property owners to achieve economies of scale by spreading the costs and the risk of renewable energy installation and maintenance among many parties. They provide cleaner alternatives to conventional energy methods of production. And they improve system efficiencies by reducing the amount of energy lost during transmission across long distances to end-users. If we agree that alternative energy microgrids are a good idea, then we must determine how to construct legal regimes that facilitate them. In furtherance of that goal, this Article proceeds as follows.

Part II sets the stage for the rest of the Article. It begins by describing the phenomenon of energy sprawl, focusing on the role of the Nature Conservancy in framing the debate. It then identifies several points of contention with the concept of energy sprawl, as identified by environmentalists, politicians, and other advocates. It concludes by acknowledging that although the energy sprawl phenomenon may be difficult to accurately measure or predict, a problem exists. A uniform approach to microgrids would be part of a multi-faceted solution.

Part III articulates the alternative energy microgrid option. It first

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http://www.irecusa.org/fileadmin/user_upload/ConnectDocs/Connecting_to_the_Grid_Guide_6th_edition-1.pdf (identifying the forty-two states that currently authorize net metering).

[9] Note that the term "utility" or "public utility" in this Article encompasses only electric utilities.

defines the microgrid and several related concepts. It then analyzes how small-scale distributed generation advances national goals with respect to energy security, energy independence, and sustainable communities.

Part IV identifies barriers to the microgrid in both state and local law, focusing on the lack of coordination between various levels of government. Inconsistent, unclear, and outright hostile laws prevent users from implementing microgrids. Political considerations also serve as barriers—most significantly the opposition of public utilities that control most of our existing energy infrastructure, and neighbors who work through local governments to halt microgrid projects. Finally, economic factors, including subsidies of traditional energy infrastructure, work to promote energy sprawl, while thwarting the microgrid.

After concluding that the key barriers to microgrids relate to regulation, siting, and institutional development—all areas controlled by states—Part V recommends three possible paths forward. First, Congress should tackle energy sprawl by requiring states to consider model regulations for microgrids. The consideration requirement has encouraged states to modify their laws to provide nationally recognized interconnection standards, and I believe upon review states would find microgrids to be compelling means to meet their own alternative energy use goals. Second, states should provide guidance to localities with respect to siting and permitting microgrid projects. This guidance can be issued without infringing on localities' core autonomy in regulating land use. Third, states should authorize new legal institutions that would facilitate microgrid development. More specifically, states should draw from the work of Professor Robert Ellickson with respect to block improvement districts, to authorize block-level energy districts that recognize the renewable energy produced as a shared public/private resource.

Ultimately, this Article does not aim to halt alternative energy; nor does it advocate that policymakers focus solely on land use in determining whether energy projects should proceed. Rather, it attempts to introduce one solution to curbing energy sprawl via small-scale distributed generation.

II. ENERGY SPRAWL

Although the Nature Conservancy popularized the term "energy sprawl" in 2009, the phenomenon has an intuitive explanation. Simply put, energy sprawl refers to the land required to produce and move energy, measured in acres per total quantity of energy production. This Part defines energy sprawl, including jurisdictional issues that affect it. It also assesses the recent debate over the Nature Conservancy's report.[10]

A. *The Phenomenon*

When Americans think of sprawl, they typically think of urban sprawl: the unplanned, and often unsightly, expansion of human development into previously undeveloped rural areas. Urban sprawl, as its name suggests, develops in roughly concentric circles around cities. In some cases, urban sprawl is contained within city limits. In other cases, it crosses urban growth boundaries, into other counties, or even into unincorporated areas. When urban sprawl warrants government attention, interested jurisdictions often include a city and a county government or neighboring city governments. At times, state legislatures weigh in to influence land use policies, but by and large regulating urban sprawl is a local government function.

Like urban sprawl, energy sprawl involves expansion into undeveloped areas. Energy sprawl, however, is linear, not concentric. Traditional energy infrastructure, which takes the form of generating facilities and distribution centers connected by transmission lines, looks like a web in maps.[11] Another difference from urban sprawl is that energy sprawl does not necessarily follow existing settlement patterns. In fact, some of the largest energy generating facilities may be found in some of the most underpopulated places in the country.[12] Builders of such facilities no doubt find it easier to locate in places far outside urban boundaries, where fewer people object and where natural resources like sunlight and wind are easier to capture. In such areas, only counties or states, or the Bureau of Land Management if federal land is involved, have jurisdiction over siting.

While extra-urban siting may be attractive for the problems it avoids, it has significant negative long-term impacts. In 2009, the Nature Conservancy's *Energy Sprawl or Energy Efficiency* report focused on one of these negative impacts: the reach, in purely spatial terms, of different methods of production. The environmental nonprofit estimated that at least 206,000 square kilometers—an area larger than the state of Nebraska—will be impacted by energy development over the next twenty years if Americans do not substantially increase energy efficiency.[13] It predicted that energy will shift from fossil fuels to methods that may

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[10] Robert I. McDonald et al., *Energy Sprawl or Energy Efficiency: Climate Policy Impacts on Natural Habitat for the United States of America*, 4 PLOS ONE 1, 1 (2009).

[11] *See Visualizing the U.S. Electric Grid*, NAT'L PUB. RADIO (May 1, 2009), http://www.npr.org/templates/story/story.php?storyId=110997398 (offering a comprehensive, interactive map showing energy infrastructure across the country).

[12] *See* Elizabeth Souder, *World's Largest Wind Farm Opens in West Texas*, DALL. MORNING NEWS (Oct. 1, 2009), http://www.dallasnews.com/sharedcontent/dws/bus/stories/DN-wind_01bus.State.Edition1.ddb4af.html.

[13] McDonald et al., *supra* note 10, at 1.

require greater amounts of land than fossil fuels require.[14]

According to the calculations of the Nature Conservancy, among the least land-intensive methods of production are nuclear power, using about two square kilometers to produce a terawatt-hour annually and geothermal, using an average of seven and a half square kilometers to produce the same amount of energy.[15] Biofuels and biomass, at around 350 and 550 square kilometers respectively, are among the most land-intensive.[16] Somewhere in the middle are coal, at ten; solar thermal, at fifteen; natural gas, at nineteen; solar photovoltaic, at thirty-seven; petroleum at forty-five; hydropower at fifty-four; and wind at seventy-two square kilometers per annual terawatt-hour.[17] The report estimates that the land use figures for geothermal, natural gas, and wind production can be divided into direct disturbance of land of about five percent and indirect disturbance, involving disruptions of larger ecosystems, habitats, and wildlife activity, for the remaining ninety-five percent.[18]

To put this analysis in more concrete terms, take an example of one project using a somewhat land-intensive energy production method, wind farming. The largest wind farm in the world opened in October 2009, occupying almost 100,000 acres (or 405 square kilometers) in sparsely populated West Texas.[19] The farm has 627 turbines, with each turbine taking up, on average, about 160 acres.[20] It generates 781.5 megawatts (or 6.8 terawatt-hours, using a conversion of 114 megawatts per terawatt-hour) and powers 265,000 homes.[21] For every megawatt generated, the farm uses about 128 acres of land (100,000 divided by 781.5 megawatts). Interestingly, this figure represents more than double the estimated acreage required to produce a megawatt—60 acres—by the American Wind Energy Association.[22] Converted into the units of measurement used by

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[14] *Id*. at 6.

[15] *Id*. at 3.

[16] *Id*.

[17] *Id*. at 4. Note that the figures in the text are rounded to the nearest integer. It may also be important to note that the report does not appear to have included area used in transporting—via rail, pipelines, or similar means—the fossil fuels. *Id*. at 8–9.

[18] *Id*. at 4 ("[P]roduction techniques that involve wells like geothermal, natural gas, and petroleum have about 5% of their impact area affected by direct clearing while 95% of their impact area is from fragmenting habitats and species avoidance behavior. Wind turbines have a similar figure of about 3–5% of their impact area affected by direct clearing while 95–97% of their impact area is from fragmenting habitats, species avoidance behavior, and issues of bird and bat mortality."). The American Wind Energy Association has confirmed that for every megawatt of power, sixty acres of land are needed, although only five percent of needed land area is occupied by the actual turbine. *Resources*, AM. WIND ENERGY ASS'N, http://www.awea.org/faq/wwt_environment.html#What%20are%20wind%20powers%20other%20environmental%20impacts [hereinafter *Resources*] (last visited Oct. 26, 2010).

[19] Souder, *supra* note 12.

[20] *Id*.

[21] *Id*.

[22] *See Resources*, *supra* note 18.

the Nature Conservancy report, in order to produce one terawatt-hour of energy, the farm requires approximately 60 square kilometers of land (405 square kilometers divided by 6.8 terawatt-hours). Although the number of acres used by this particular wind farm, 60, is fewer than the 72 square kilometers estimated by the authors of the Nature Conservancy report, the report estimate seems reasonable, given this farm's exceptional size.

Taking this example further reveals how this wind farm contributes to energy sprawl. To be sure, the turbines occupy a significant amount of land themselves. Using the industry standard estimate that five percent of the land in a wind farm is actually used for equipment,[23] 5,000 acres of land of the Texas wind farm is likely directly occupied and thus disturbed by the generating equipment—in this case, turbines. It is unclear whether this five percent estimate includes the blasting, bulldozing, and digging required to locate the deep concrete foundations needed to support the massive steel turbines, or if it includes the roads, substations, and other facilities that support the turbines. Assuming that it does, the surface of the remaining 95,000 acres of the wind farm remains open. This open land may suffer from indirect effects from the construction, operation, and maintenance of the turbines. Such activities also alter delicate ecologies, underground and aboveground, as well as landscape vistas.[24] Giving new meaning to the term "climate change," studies have shown that wind farms hinder not only weather forecasting,[25] but also the natural patterns of weather itself.[26]

Birds and other wildlife may be as directly threatened as their habitat. In California, one wind farm killed so many birds—tens of thousands, including more than a thousand protected golden eagles—that citizens brought its owners to court.[27] Responding to the alleged facts behind the

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[23] *Id*.

[24] *See, e.g.*, Adam M. Dinnell & Adam J. Russ, *The Legal Hurdles to Developing Wind Power as an Alternative Energy Source in the United States: Creative and Comparative Solutions*, 27 NW. J. INT'L L. & BUS. 535, 537 (2007) (stating that critics "view this supposed environmental savior as a man-made plague on local landscapes and communities, fragmenting habitats, and causing irreparable ecological damage").

[25] *See* William Kates, *Wind Farms Interfering with Weather Radar in N.Y.*, USA TODAY, Oct. 13, 2009, *available at* http://www.usatoday.com/weather/research/2009-10-13-wind-farms-weather-radar_N.htm ("Wind farms in upstate New York are interfering with National Weather Service Doppler radars, making it more difficult to detect and assess approaching lake-effect snowstorms.").

[26] *See* D.B. Barrie & D.B. Kirk-Davidoff, *Weather Response to a Large Wind Turbine Array*, 10 ATMOSPHERIC CHEMISTRY & PHYSICS 769, 774 (2010) (testing the effects of an extremely large wind farm and observing that "[a]tmospheric anomalies initially develop at the wind farm site due to a slowing of the obstructed wind" and "[t]he anomalies propagate downstream . . . quickly . . . [suggesting] that predictable influences on weather may be possible").

[27] Ctr. for Biological Diversity, Inc. v. FPL Group, Inc., 83 Cal. Rptr. 3d 588, 591–92 (Cal Ct. App. 2008). The court ruled that wildlife and birds are protected by public trust principles, explaining, "whatever its historical derivation, it is clear that the public trust doctrine encompasses the protection of undomesticated birds and wildlife." *Id.* at 599. The court declined to apply those principles to the conflict at hand because the plaintiffs had not followed proper protocol in getting the case to court. *Id.* at 591, 607.

California case, the American Wind Energy Association stated that "[d]etailed studies, and monitoring following construction, at other wind development areas indicate that this is a site-specific issue that will not be a problem at most potential wind sites."[28] Even if birds and other wildlife are only minimally threatened by newer wind technologies, critics of wind energy believe that large-scale wind developments have a devastating effect on the immediate environment.

Beyond the 100,000 acres, large transmission lines must be built to get power to the 265,000 homes to be served by the wind farm. These lines take years to create, given the need to coordinate with private landowners, and are extremely expensive. Moreover, power lost in transmission is roughly ten percent.[29] Accordingly, energy sprawl costs space, money, and energy itself.

Despite the many troubling effects of large, out-of-the-way developments, government continues to direct significant support to projects with many hundreds or thousands of end users. The Department of Energy has completed studies showing that the United States could obtain as much as twenty percent of its electricity from alternative energy sources such as wind power alone by 2030, much of it to be produced in large-scale facilities.[30] As the government pushes for greater use of alternative energy, demand by large-scale alternative energy producers for land also grows. As one measure, the Bureau of Land Management has received four hundred applications for large solar and wind plants covering more than two million rural acres.[31] The question now is not whether energy sprawl will occur, but to what extent it may be contained.

B. *The Debate*

Reaction to the Nature Conservancy's report has been mixed. Some have questioned the methods of the report. Others have attempted to use the report's findings for political gain. Still others have simply ignored it.

Perhaps the most vehement criticism of the methodology of the report so far has come from Matthew Wasson, an ecologist and the director of programs for an environmental nonprofit called Appalachian Voices. He criticized the report's reliance on "reports, fact sheets and brochures" to estimate the number of acres per unit of energy for each method of

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[28] *Resources*, *supra* note 18.

[29] Anya Kamenetz, *Why the Microgrid Could Be the Answer to Our Energy Crisis*, FASTCOMPANY.COM (July 1, 2009), http://www.fastcompany.com/magazine/137/beyond-the-grid.html?page=0%2C0#self.

[30] *See* U.S. DEP'T OF ENERGY, ENERGY EFFICIENCY & RENEWABLE ENERGY, 20% WIND ENERGY BY 2030 1–2 (2008), *available at* http://www.20percentwind.org/20percent_wind_energy_report_revOct08.pdf ("A 20% Wind Scenario in 2030, while ambitious, could be feasible if the significant challenges identified in this report are overcome.").

[31] Kamenetz, *supra* note 29.

production.[32] Wasson also argued that focusing on acreage unacceptably minimized the environmental impact of coal mining, in particular.[33] Coal mining often involves shearing off mountain tops, disrupting ecosystems, and polluting waterways, among other negative impacts not included in a direct land disturbance, or acreage, measure.[34] Finally, in Wasson's analysis, the term "energy sprawl" armed those who oppose alternative energy with a catchphrase to frame their opposition. He suggested that environmentalists "strike that buzzword from their lexicons and literature entirely."[35]

Unfortunately for Wasson, at least one politician quickly took up the energy sprawl mantle to make a political point. A month after the Nature Conservancy report was released, U.S. Senator Lamar Alexander wrote an opinion piece for the *Wall Street Journal*.[36] Drawing from the report's statistics regarding the land-intensivity of wind power generation, Senator Alexander criticized plans of the Obama administration to generate twenty percent of the nation's electricity from wind, stating that doing so would require setting aside a land area the size of West Virginia and constructing nineteen thousand miles of high-voltage transmission lines.[37] In the piece, Senator Alexander also argued that the country should look more seriously at nuclear energy, the kind of energy the report identified as being among the least land-intensive.[38]

Similarly, advocates of nuclear energy in Iowa believe that the report supported their push for a second nuclear reactor in the state.[39] Other residents of Iowa, the state with the second highest level of wind energy production,[40] reportedly ignored or rejected the Nature Conservancy's assessment.[41] The Cedar Rapids-based *Gazette* interviewed the executive

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[32] Matt Wasson, *Misleading "Energy Sprawl" Study Pollutes Climate Debate*, HUFFINGTON POST (Oct. 1, 2009, 9:22 AM), http://www.huffingtonpost.com/matt-wasson/misleading-energy-sprawl_b_306051.html. *But see* McDonald et al., *supra* note 10, at 6–7 (identifying the source of most data as the Energy Information Administration's National Energy Modeling System, "a comprehensive econometric model of U.S. energy production, imports, and consumption").

[33] Wasson, *supra* note 32.

[34] *See, e.g.*, SIERRA CLUB, THE DIRTY TRUTH ABOUT COAL (June 2007), *available at* http://www.sierraclub.org/coal/downloads/coalreport.pdf.

[35] *Id*.

[36] Lamar Alexander, *Energy "Sprawl" and the Green Economy*, WALL ST. J., Sept. 17, 2009, at A21.

[37] *Id*.

[38] *Id*. ("Before we find ourselves engulfed in energy sprawl, it's imperative we take a closer look at nuclear power.").

[39] *See* David DeWitte, *Iowans Not Buying into "Energy Sprawl" Argument*, GAZETTE ONLINE (Jan. 19, 2010), http://gazetteonline.com/local-news/2010/01/19/iowans-not-buying-into-'energy-sprawl'-argument (interviewing a nuclear energy advocate).

[40] AM. WIND ENERGY ASSOC., ANNUAL WIND INDUSTRY REPORT 8 (2008), *available at* http://www.awea.org/publications/reports/AWEA-Annual-Wind-Report-2009.pdf (identifying Iowa as having 1,560 megawatts of wind power capacity, behind Texas with 2,671 megawatts of capacity).

[41] *See* DeWitte, *supra* note 39 (observing that the Nature Conservatory's report has drawn little attention in Iowa).

director of the Iowa Renewable Fuels Association, a group that supports biofuels. He claimed that the report failed to take into account the fact that grains for biofuels were being grown as efficiently as ever because of better seed genetics and agricultural practices.[42] In other words, the report's focus on land utilized by energy production is deceptive: While the full environmental impact of activities like coal mining is not taken into account, the full impact of biofuel production, which can easily be measured by the number of farms growing crops, is taken into account.

In light of these and other criticisms, the lead author of the report, Robert McDonald, has explained that the scope of his report was limited. On behalf of the Nature Conservancy, McDonald said he intended simply to ensure that land use issues were being considered—along with other measures such as energy security, cost effectiveness, job creation, energy independence, and economic issues—as legislation relating to alternative energy is drafted and implemented.[43] He neither intended to provide an endorsement of nuclear energy nor a critique of renewable energy.[44] Rather, he intended to promote "Energy By Design": avoiding development when possible, minimizing impacts if development is necessary, and compensating for unavoidable negative impacts.[45] Unlike Senator Alexander, McDonald praised the Obama administration's efforts to permit certain renewable energy projects after thorough environmental reviews, stating that such a process exemplified the kind of proper management the report hoped to support.[46]

From my perspective, the importance of the Nature Conservancy report did not lie in its specific findings relative to each method of production, but rather in its identification of an intriguing measure of the impact of methods of energy production. Intuitively, the findings make sense: Producing energy impacts land. The lesson is not that alternative energy should be avoided, but that careful attention must be paid to its scale and siting.

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[42] *Id.*

[43] *See* Rob McDonald, *Energy Sprawl and the Importance of Fact*, THE CONSERVATION BLOG OF THE NATURE CONSERVANCY (Aug. 26, 2009), http://blog.nature.org/2009/08/energy-sprawl-ethanol-rob-mcdonald/; Rob McDonald, *The Lessons I've Learned from "Energy Sprawl,"* THE CONSERVATION BLOG OF THE NATURE CONSERVANCY (Sept. 17, 2009), http://blog.nature.org/2009/09/energy-sprawl-rob-mcdonald-nature-conservancy/ [hereinafter McDonald, *Lessons I've Learned*] (arguing that land-use impacts are just one of many factors to consider when crafting climate change legislation).

[44] *See* McDonald, *Lessons I've Learned*, *supra* note 43. Nuclear energy requires large capital outlays and raises safety concerns, among other problems not captured by the concept of energy sprawl.

[45] *Id*.

[46] *See id.* ("U.S. Secretary of the Interior Ken Salazar's recent efforts to permit some renewable energy development in appropriate places after thorough environmental review . . . show that energy sprawl is a challenge that can be overcome through proper management.").

III. MICROGRIDS

Some people believe that we must choose between large facilities that generate alternative energy but destroy the environment, or the status quo.[47] If that were the case, the problem of energy sprawl would seem insurmountable. A third option, however, exists: the alternative energy microgrid, which deploys distributed generation technologies on a small scale. Although the concept of the microgrid has been used in engineering circles for a decade, it is relatively new in legal academia, so it warrants further explanation.[48] After clarifying the concept, this Part explains why the microgrid—and alternative energy microgrids, in particular—can help reduce the spread of energy sprawl.

A. *The Definition*

To understand the microgrid, one must first understand the concept of distributed generation. Distributed generation, also known as on-site generation or distributed energy, refers to the production of electricity by a small-scale source located at or very near the end users it serves.[49] Energy production thus occurs in distributed, or decentralized locations, rather than at one central point. A distributed generation system often contains generating equipment, controls for fluctuations in loads, storage devices, and monitoring equipment.[50] Distributed generation may either co-exist with and link to one of the three primary interconnections in this country,[51] loosely referred to in this Article as the "grid," or exist off the grid.

Microgrids organize distributed generation technology into a closed, low-voltage system that may address the needs of multiple users using multiple kinds of technologies.[52] A microgrid might, for example, utilize two kinds of distributed generation—a fuel cell, stored underground, and a photovoltaic solar array, located on multiple existing roofs—and storage equipment to serve an entire block of homeowners.[53] During the day,

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[47] *See, e.g.*, Dinnell & Russ, *supra* note 24, at 538 (presenting these two options in the wind farm context as a "Hobson's choice," though the options really present a false dilemma, since there are more than two alternatives).

[48] The term "microgrid" or "micro-grid" appeared in just sixteen scholarly or professional articles in the Journal and Law Review database of Westlaw, searched by the author on Oct. 15, 2010. This Article, however, is not the first to advocate for the use of microgrids. *See, e.g.*, Robert DeLay, *Solar Power & NYC Schools: Good Government and Electric Sparkplug*, 19 FORDHAM ENVTL. L. REV. 161, 170 n.62, 171 n.76 (2009) (citing the suggestion from the Center for Sustainable Energy at Bronx Community College to make microgrids legal in New York state).

[49] *See supra* note 5.

[50] LASSETER ET AL., *supra* note 6, at 1–2.

[51] These interconnections are the Eastern Interconnection, the Western Interconnection, and the Texas Interconnection. Within the Eastern and Western Interconnections, multiple regional transmissions organizations also play an important role.

[52] *See supra* note 6.

[53] Experts agree that while no technology is perfect (microturbines and fuel cells, for example, run on natural gas), such technologies are far cleaner than conventional combustion engines. *See, e.g.*,

when the sun shines, the neighbors might use the energy produced by the photovoltaic array, storing the energy produced by the fuel cell until nighttime. Meanwhile, excess heat from the fuel cell might be channeled into a heat recovery system that heats water and/or spaces within the homes.

Microgrids also present the opportunity for real-time management of aggregate production and loads. A Dutch company has developed technologies that allow end users to manage microgrids through an accessible central control system.[54] These products, which include an energy modem, software, and user interface, help end users (and managers) manage local energy networks.[55] Homes could be connected to this monitoring system through individual meters, and neighbors could work out a tariff—that is, a schedule of rates determining the price of energy—that reflects the cost of installing and maintaining the infrastructure.

Like individual distributed generation facilities, microgrids could either tie to the grid or exist apart from it. If interconnected with the grid, microgrids could connect as a "single self-controlled entity," like any other end user.[56] As day-to-day needs fluctuate, grid-connected microgrids could either draw power from the central grid or sell excess power to the local utility under applicable state net metering rules. In systemic emergencies, the microgrid could be disconnected from the central grid altogether, both protecting energy needs of the users of the microgrid and protecting the central grid from unexpected electrical surges.

Potential users of microgrids must review many variables to determine the best design of the microgrid from the outset.[57] Flexibility to respond over time to changes in demand and other circumstances, however, is also important. Ideally, a microgrid would function as a peer-to-peer system—a system without a critical master controller essential to its operation. It would also be a plug-and-play system—a system in which a new technology might be added at any point without undue disruption, like home appliances are placed in a home.[58] With these two characteristics,

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LASSETER ET AL., *supra* note 6, at preface, 1–3 (representing the premiere nationwide research group investigating alternative energy microgrids).

[54] *Products*, QURRENT: THE COMMUNITY ENERGY COMPANY, http://www.qurrent.com/eng/products.html (last visited Oct. 26, 2010).

[55] *Id*.

[56] *See* LASSETER ET AL., *supra* note 6, at 1, 9–10 (describing the concept of the CERTS MicroGrid, which has such a feature and is now the standard model for microgrid connectivity).

[57] *See, e.g.*, Hoff et al., *supra* note 6 (identifying six variables for determining microgrid characteristics: customer type, number of customers, types of distributed generation technologies, generation unit size, number of generation units, and level of system reliability). Of course, the availability of favorable financing through incentives, rebates, loan programs, renewable energy credits, net metering, and other means would also dictate the scale of the project.

[58] *See* R.H. Lasseter, *Microgrids and Distributed Generation*, 133 J. ENERGY ENG'G 144, 146–47 (2007) [hereinafter Lasseter, *Distributed Generation*] (explaining the peer-to-peer concept of micogrids).

microgrids can respond quickly and efficiently to user needs.

Researchers across the country have ensured that the system described above, and variations thereof, is feasible from a technical standpoint.[59] For at least a decade, the Consortium for Electric Reliability Technology Solutions ("CERTS") has taken the lead on research on the optimization of microgrid performance. CERTS includes four national research labs, nine universities, and eight industry groups,[60] which aim to transform the electric grid into something more reliable, responsive, and transparent.[61] Research from CERTS participants and others has revealed that microgrids stand ready to be deployed.

B. *Why Microgrids?*

With this understanding of microgrids, their prospective role in mitigating energy sprawl becomes clear. Microgrids can provide energy in real time to small groups of end users from a location in and around existing development. They are flexible and adaptable, and match the scale of demand, which for three-quarters of the users in this country is exceptionally small.[62]

Microgrids present a compelling alternative to the current mode of generating power in the United States, which primarily occurs through a network of large-scale centralized facilities. Microgrids reduce energy sprawl because they increase capacity without relying on massive, land-intensive transmission lines that large-scale facilities need to transport power to customers.[63] Nor do they usually require new parallel infrastructure for other utilities—such as water for solar panels, or natural gas for fuel cells and microturbines—because they are typically located in

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[59] *See Publications*, CONSORTIUM FOR ELEC. RELIABILITY TECH. SOLUTIONS, http://certs.lbl.gov/certs-pubs.html (last visited Oct. 26, 2010) (listing eighteen technical publications on microgrids alone); *see also* Hassan Nikkhajoei & Robert H. Lasseter, *Distributed Generation Interface to the CERTS Microgrid*, 24 I.E.E.E. TRANSACTIONS ON POWER DELIVERY 1598, 1598 (2009) (articulating a framework by which the resources of a distributed generation system can be channeled into special kind of microgrid, the CERTS MicroGrid, which can be separated and reconnected from the central grid seamlessly).

[60] *Research Performers*, CONSORTIUM FOR ELEC. RELIABILITY TECH. SOLUTIONS, http://certs.lbl.gov/certs-org-rp.html (last visited Oct. 26, 2010) (listing Berkeley, Oak Ridge, Pacific Northwest, and Sandia among the national labs, as well as listing the universities and industry groups involved).

[61] *See Vision*, CONSORTIUM FOR ELECTRIC RELIABILITY TECH. SOLUTIONS, http://certs.lbl.gov/certs-vision.html (last visited Oct. 26, 2010) (expressing a fourfold vision, including the transformation of the electric grid into an intelligent network; the enhancement of reliability management through market mechanisms; the empowerment of customers to manage their energy use; and the seamless integration of distributed technologies).

[62] *See* AMORY B. LOVINS ET AL., SMALL IS PROFITABLE: THE HIDDEN ECONOMIC BENEFITS OF MAKING ELECTRICAL RESOURCES THE RIGHT SIZE 2 (2009) (noting that "[t]hree-fourths of U.S. residential and commercial customers use electricity at an average rate that does not exceed 1.5 and 12 kilowatts respectively, whereas a single conventional power plant produces about a million kilowatts").

[63] *See* RAWSON, *supra* note 5, at 6 (indicating the "value of reducing 'foot-print' or space needed by generation, transmission and distribution infrastructure" as a benefit of distributed generation).

areas already served by such utilities. Such areas include central cities, which many argue could greatly benefit from a concentration of so-called "green jobs" related to the proliferation of renewable technology.[64] If effectively deployed across the country, microgrids could reduce demand on the grid itself, which would reduce the need for additional transmission and distribution capacity, and thereby reduce the amount of land and habitat occupied or affected by energy infrastructure.

Significant up-front outlays of capital for physical infrastructure are not the only expense of a large facility. Currently, approximately one-third to one-half of consumers' electric bills go toward the maintenance of existing large-scale infrastructure.[65] In addition, sunk costs cannot be recovered if populations shift; our existing energy infrastructure is extremely difficult to move or modify. Microgrids that incorporate plug-and-play technology provide great flexibility for users, who can move equipment and modify systems as circumstances require.[66] As Amory Lovins of the Rocky Mountain Institute has argued, while utilities have focused "on a few genuine economies of scale (the bigger, the less investment per kW)," they have "overlooked larger *dis*economies of scale in the power stations, the grid, the way both are run, and the architecture of the entire system."[67]

Microgrids present an opportunity to re-configure these "diseconomies" of scale and make the country's overall energy infrastructure more reliable and efficient. Currently, electric power interruptions—including noise, distortions, high voltage spikes, and instable frequencies—cost industrial, commercial, and residential consumers eighty billion dollars annually.[68] Disruptions to the grid can have a domino effect, with the Department of Energy warning of "a

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[64] *See, e.g.*, Alice Kaswan, *Greening the Grid and Climate Justice*, 39 ENVTL. L. 1143, 1153 (2009) (arguing persuasively that inner cities could benefit from "the integrated environmental and economic opportunities presented by new green-collar jobs").

[65] THE SMART GRID, *supra* note 4, at 18.

[66] *See supra* text accompanying note 58.

[67] *See* LOVINS ET AL., *supra* note 62 (documenting two hundred benefits of distributed generation).

[68] KRISTINA HAMACHI LACOMMARE & JOSEPH H. ETO, ERNEST ORLANDO LAWRENCE BERKELEY NAT'L LAB., UNDERSTANDING THE COST OF POWER INTERRUPTIONS TO U.S. ELECTRICITY CONSUMERS xi (2004), *available at* http://certs.lbl.gov/pdf/55718.pdf; *see also* R. BRENT ALDERFER ET AL., U.S. DEP'T OF ENERGY DISTRIBUTED POWER PROGRAM, NAT'L RENEWABLE ENERGY LAB., MAKING CONNECTIONS: CASE STUDIES OF INTERCONNECTION BARRIERS AND THEIR IMPACT ON DISTRIBUTED POWER PROJECTS 1 (2000), *available at* http://www.nrel.gov/docs/fy00osti/28053.pdf (arguing that distributed generation could improve reliability and save consumers billions of dollars annually); ROBERT GALVIN ET AL., PERFECT POWER: HOW THE MICROGRID REVOLUTION WILL UNLEASH CLEANER, GREENER, AND MORE ABUNDANT ENERGY 15–18 (2009) (describing the inefficiencies of the numerous regional power failures from 2006 to 2008); THE SMART GRID, *supra* note 4, at 8 (noting that the 2003 blackout in the northeast resulted in a six billion dollar economic loss, while a one-hour outage at the Chicago Board of Trade in 2002 resulted in twenty trillion dollars in delayed trades).

cascading series of failures that could bring our nation's banking, communications, traffic, and security systems among others to a complete standstill."[69] Decentralization of power sources provides greater reliability, because if one power source goes down, other power sources can remain fully functional.[70] For these reasons, decentralization via the microgrid could help address concerns of terrorist attacks on American energy infrastructure. Decentralized microgrids can serve very remote sites, where development is necessary. Finally, microgrids could help with transmission congestion issues prevalent in urban areas, particularly in the northeast, which in turn could drive down energy costs for consumers.

Microgrids also provide a financially and operationally efficient alternative to individual distributed generation. Studies have shown that microgrids can save users twenty to twenty-five percent in energy costs over the cost of individual distributed generation.[71] Individual distributed generation can be very expensive for individual users and may be difficult to finance because of its small scale.[72] Larger-scale microgrids, however, may be easier to finance and, as discussed elsewhere, spread risk and costs among multiple users.

From an operational standpoint, with individual distributed generation, a single user must rely on a single technology to meet all energy needs. With microgrids, a variety of configurations and sources enables different energy needs to be met at different times by different equipment.[73] Wind or solar power, which can be used when the weather conditions allow, could be combined with steady-stream energy generators, such as geothermal wells, to meet varying demands.[74] In microgrids that serve multiple users, users' different needs at different times of the day help to smooth out demand. In other words, there are fewer spikes and troughs in use than in a system with one user; with fewer fluctuations in demand, the microgrid's power can be more steadily utilized.

Moreover, microgrids can use waste heat more efficiently than

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[69] THE SMART GRID, *supra* note 4, at 9.

[70] *See* Lasseter, *Distributed Generation*, *supra* note 58, at 146.

[71] King, Thesis, *supra* note 6, at 47 tbl.19 (analyzing system net present value savings from distributed generation and microgrids for hospital, office, mall, "urban mix," and other users).

[72] *But see* Garrick B. Pursley & Hannah J. Wiseman, *Local Energy*, 60 EMORY L.J. (forthcoming Mar.–Apr. 2011) (describing the creation of energy financing districts in cities in California, Colorado, and New York, which use local government powers, such as tax overlay districts, to help private parties finance renewable energy).

[73] Lasseter, *Distributed Generation*, *supra* note 58, at 144 ("Indiscriminant application of individual distributed generators can cause as many problems as it may solve. A better way to realize the emerging potential of distributed generation is to take a system approach which views generation and associated loads as a subsystem or a 'microgrid.'").

[74] Note that it may be especially important to ensure that fuel cells are paired with a technology that can help smooth demand. Because fuel cells produce a steady stream of energy, they must be built to the peak capacity. If connected to a grid, fuel cells feed electricity into the grid in off-peak hours and pull from the grid during peak hours. Managing fuel cell input and output is an important consideration in microgrid situations.

individual distributed generation systems can, because one technology that produces waste heat can be combined with another technology that captures it.[75] This phenomenon, called cogeneration or combined heat and power, improves dramatically on traditional, centralized systems, because the production of heat is closer to the point of use and because heat production can be better matched to heat demand.[76] In traditional, centralized systems, half to three-quarters of such heat dissipates without being used, because energy production usually occurs very far away from end users.[77] Using heat at the site of its creation can more than double the overall efficiencies of the microgrid,[78] adding yet another benefit of microgrids over our current method of siting and utilizing energy infrastructure.

Lower infrastructure costs, flexible configurations, and the ability to use waste heat result in big savings to microgrid users. It may be important to conclude this section with some thoughts about the feasibility of small-scale energy sharing among neighbors. Some may doubt the ability of neighbors to cooperate enough to conceive, execute, and maintain something as complicated as a microgrid. Reviewing the American experience with district energy systems may assuage these doubts. District energy systems are small-scale systems that offer institutions, groups of individuals, or certain economies of scale to heat and/or cool several buildings at once through a small- or mid-sized facility.[79] Note that heating and cooling are not as regulated as electricity and other energy production.[80] As one example of a successful district energy system, a condominium community in New Hampshire uses a central pellet boiler plant which uses locally produced biomass fuel for heat and hot water.[81] The twenty-nine units range in size, and some are

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[75] *See* King, Thesis, *supra* note 6, at 3 (stating that "the development and adoption of interconnected micro-grids with combined heat-and-power applications" are the only way for microgrids to reach their full potential).

[76] *See* LASSETER ET AL., *supra* note 6, at 5.

[77] *See id.* at 4.

[78] *See* Robert H. Lasseter & Paolo Piagi, *Microgrid: A Conceptual Solution*, June 2004, *available at* http://certs.lbl.gov/pdf/mg-pesc04.pdf (stating that "[t]he size of emerging generation technologies permits generators to be placed optimally in relation to heat loads" and that the small scale of heat production "offers greater flexibility in matching to heat requirements").

[79] Ideally, the users of district energy, like the users of future microgrids, have different energy needs that vary throughout the day, a circumstance that flattens demand. An institution like a university, with different use profiles for different spaces, such as dormitories, laboratories, classrooms, auditoriums, and gyms, can take full advantage of a district energy system.

[80] *See, e.g.*, OR. REV. STAT. § 757.005(1)(a)(E)–(F) (2009) (exempting from public utility regulation "[a]ny person furnishing heat, but not delivering electricity or natural gas to its customers" and entities "furnishing heat to a single thermal end user from an electric generating facility, plant or equipment that is physically interconnected with the single thermal end user").

[81] *Green Features*, NUBANUSIT NEIGHBORHOOD & FARM, http://www.peterborough cohousing.org/green_features.htm (last visited Oct. 26, 2010).

freestanding buildings.[82] The central plant has helped the community to obtain the highest rank in the widely-recognized certification system administered by the U.S. Green Building Council.[83] Concerns about the safety, utility, or effectiveness of district energy systems, which like microgrids serve multiple distinct physical spaces, have been greatly reduced as such systems have become more common.

Moreover, various groups around the country are building networks that rely on the mutual support of neighbors to achieve alternative energy goals. In the nation's capitol, for example, several solar cooperatives have been established to share information, ideas, and labor.[84] In Maryland, a chamber of commerce has worked with a local clean energy broker to negotiate bulk rates for the purchase of wind power.[85] In New Hampshire, neighbors install alternative energy equipment for neighbors, in "energy rais[ing]" events not unlike the barn raising events of yesteryear.[86] These efforts reveal a growing grassroots initiative among neighbors to mobilize for alternative energy. The time to capitalize on this movement by facilitating the proliferation of microgrids is now.

IV. THWARTING MICROGRIDS, FACILITATING SPRAWL

Despite their possible benefits, only a few microgrid projects have been attempted in this country, mostly as prototypes or demonstrations.[87] Many regulatory, political, and economic barriers hinder the creation of microgrids and thus facilitate energy sprawl. Although an exhaustive treatment of these barriers goes beyond the scope of this Article, a brief survey reveals why the reforms described in Part V are so necessary.

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[82] *Id.* (describing the homes as having an energy efficient design).

[83] *Id.* (describing the platinum certification obtained through the LEED program).

[84] *See, e.g.*, *About*, MOUNT PLEASANT SOLAR COOPERATIVE, http://www.mtpleasantsolarcoop.org/about.htm (last visited Oct. 26, 2010) (describing the network of seventy-plus households that negotiate bulk purchase discounts and exchange information); *Our Plans*, COMMON CENTS SOLAR COOP., http://www.commoncentssolar.org/about.html (last visited Oct. 26, 2010) (citing its mission not only to educate potential solar users but also to make the cost of solar cheaper through collective bargaining); *Solar Roof Project*, CAPITOL HILL ENERGY COOPERATIVE, http://sites.google.com/site/capitolhillenergycoop/solarroofproject (last visited Oct. 26, 2010) (describing the process by which D.C. property owners can install solar panels on their homes and indicating that over one hundred individuals were participating in the information exchange).

[85] *Rockville Chamber of Commerce Teams up with Clean Currents for First Ever Green Energy Buying Group*, CLEAN CURRENTS, (Nov. 10, 2009), http://www.cleancurrents.com/index.php/Rockville-Chamber-of-Commerce-Teams-up-with-Clean-Currents-for-First-Ever-Green-Energy-Buying-Group (announcing the partnership which creates a green power buying group).

[86] The Plymouth Area Renewable Energy Initiative ("PAREI"), for example, has convened at least one hundred and fifty "energy rais[ing]" events to help individuals reduce the cost of solar installation. *See* Sarah Schweitzer, *Many Hands Make Light Work of Saving Energy; Neighbors Gather to Install Solar Power*, BOS. GLOBE, May 8, 2008, at A1 (describing PAREI's efforts on a house in Sandwich, New Hampshire); *Energy Raisers*, PLYMOUTH AREA RENEWABLE ENERGY INITIATIVE, http://www.plymouthenergy.org/about.html (last visited Oct. 26, 2010).

[87] *See supra* note 7.

A. *Regulatory Barriers*

By far the biggest barrier to the creation of microgrids is contradictory, unclear, or hostile law. State legislatures and state public utility commissions have made it difficult to determine whether a microgrid project can be built. One critical question is whether a microgrid should be considered a public utility. State laws often define "public utility" to include any person or entity furnishing power to another, without regard to the number of recipients of such power and without exceptions for alternative energy or microgrids.[88] Such broad definitions would subject even a microgrid with two users to burdensome regulation, because public utilities must abide by very strict rules that determine allowable technologies, tariffs, technical requirements, and other parameters.

No state laws squarely address microgrids, and no comprehensive, publicly-available analysis of possible means to allow microgrids within current state law appears to exist. Two studies, however, have shed some light on current law and regulators' perceptions. In 2002, researchers at Carnegie Mellon University interviewed utility regulators in eight states to determine how their states treated microgrids.[89] They presented the regulators with several scenarios, including one in which a for-profit commercial firm served twenty customers in an industrial park, as well as a cooperative operated by its customers.[90] Of the eight regulators, three indicated that microgrids in at least one presented scenario could be built, but only one of the three, the representative from Minnesota, indicated that small microgrids might be exempt from public utility classification and regulation.[91] None of the other states had an exemption for small numbers of customers.[92] Similar findings were obtained by a Carnegie Mellon Ph.D candidate in 2006. He surveyed twenty-seven state public utility commissions, asking each whether a microgrid is legal. Of those, seventeen said that the microgrid was "probably" or "definitely" legal, but

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[88] *See, e.g.*, IDAHO CODE ANN. § 61-129 (2002) (defining "public utility" to mean "every common carrier, pipe line corporation, gas corporation, electrical corporation, telephone corporation, water corporation, and wharfinger"); KAN. STAT. ANN. § 66-104(a) (2002) (defining "public utility" to mean "every corporation, company, individual, association of persons, their trustees, lessees or receivers, that now or hereafter may own, control, operate or manage, except for private use, any equipment, plant or generating machinery, or any part thereof"); NEV. REV. STAT. § 704.020(2)(a) (2009) (defining "public utility" to include "[a]ny plant or equipment, or any part of a plant or equipment, within this State for the production, delivery or furnishing for or to other persons, including private or municipal corporations, heat, gas, coal slurry, light, power in any form").

[89] M. Granger Morgan & Hisham Zerriffi, *The Regulatory Environment for Small Independent Micro-Grid Companies*, ELECTRICITY J., Nov. 2002, at 52, 53 (noting that some of the eight representatives were current regulators, and some were former regulators).

[90] *Id*. at 53–54.

[91] *Id*. at 53.

[92] *Id*. at 54.

only under very specific circumstances.[93]

In addition to muddling the creation of microgrids, state laws also fail to specify how microgrids might be regulated.[94] The 2002 survey mentioned above, for example, included questions related to interconnection with the central grids. The answers reflected at best, confusion, and at worst, obstruction by utilities, public utility commissions, and state legislatures.[95] The 2006 study showed that only four states of the twenty-seven surveyed had laws for individual distributed generation, tariffs, and interconnection procedures which could apply to microgrids.[96] While both studies are several years old and had small sample sizes, the findings reflect current concerns across jurisdictions. More broadly, ambiguities in the law create fundamental uncertainties about the legality and treatment of microgrids, dampening investment even where microgrids might, with creative lawyering, be possible.[97]

A few states have passed laws that could open the door for the creation and operation of microgrids. Oregon, for example, defines "public utility" as an entity "that owns, operates, manages or controls all or a part of any plant or equipment in this state for the production, transmission, delivery or furnishing of heat, light, water or power, directly or indirectly to or for the public."[98] It excludes from public utility regulation any entity or person that provides heat, light, or power from: any energy resource to fewer than twenty residential customers; solar or wind resources to any number of customers; or biogas, waste heat or geothermal resources for nonelectric generation purposes to any number of customers.[99] This definition implies that microgrids with fewer than twenty customers may be legal, although no legislation specifically provides for their implementation. Across the country, meanwhile, Connecticut has authorized municipalities to create energy improvement districts that can own and operate distributed generation technologies and combined heat and power, have multiple customers, and charge customers fees for their energy use.[100] The

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[93] *See* Douglas E. King, *The Regulatory Environment for Interconnected Electric Power Micro-Grids: Insights from State Regulatory Officials* 1 (Dep't of Eng'g and Pub. Policy, Carnegie Mellon Univ., Working Paper CEIC-05-08, 2008) [hereinafter King, *Regulatory Environment*], *available at* https://wpweb2.tepper.cmu.edu/ceic/pdfs/CEIC_05_08.pdf.

[94] *See id.* ("No states have clear guidance for the regulatory oversight of micro-grid systems once they are installed, and most respondents indicated that such oversight would be conducted on a case-by-case basis.").

[95] Morgan & Zerriffi, *supra* note 89, at 54 (stating that "[n]one of the eight respondents gave a simple yes" as to whether terms and conditions would be "clear and predictable").

[96] *See* King, *Regulatory Environment*, *supra* note 93, at 1.

[97] *Id*. at 6.

[98] OR. REV. STAT. § 757.005(1)(a)(A) (2009).

[99] *Id.* § 757.005(1)(a)(C).

[100] *See* CONN. GEN. STAT. § 32-80a(a)(1) (2009) (defining "energy improvement district distributed resources"); *id.* § 32-80a(c) (allowing an energy improvement district to, among other things, "[f]ix [and collect] fees, rates, rentals or other charges for the purpose of all energy improvement district distributed resources owned by the energy improvement district board" and

Connecticut statute provides that such districts are neither electric distribution companies—a kind of public utility in the state—nor municipal electric utilities.[101] While the law on municipality-controlled energy improvement boards does not provide a similar capacity for private firms, it still represents a move in the right direction. That said, without comprehensive statutes fully describing the treatment of microgrids, removing barriers created by legal uncertainties is very unlikely.

B. *Political Barriers*

Any attempts to reform the law to facilitate microgrids will have to overcome objections from two politically active groups: utility companies and neighbors. This subsection outlines the impact of these groups on current laws and policies.

1. *Utility Companies*

Utility companies, which tend to object to distributed generation—and, by extension, microgrids—have a significant impact on state law and on the financial feasibility of distributed generation projects. The utilities fight to protect their monopolies over service areas granted by the federal and state governments.[102] The Department of Energy described this protective impulse and identified utility companies as major impediments to regulatory reform for distributed generation.[103] Although utilities view any customer generation as potentially detrimental, their opposition to microgrids is far greater than their opposition to individual distributed generation, because microgrids involve exchanges of power and payment between multiple users.[104] Such exchanges could infringe on the monopolies enjoyed by utility companies, and so are vigorously opposed.[105] Microgrids may impose other costs on utilities, such as: an increase in the per-user share of capital costs for infrastructure maintenance; the need to provide standby power over normal capacity;

"[o]perate and maintain all energy improvement district distributed resources owned or leased by the board and use the revenues from such resources for the corporate purposes of the board").

[101] *Id.* § 32-80a(d)(1)–(2).

[102] Only in rare instances are service areas open to competition. *See* King, *Regulatory Environment*, *supra* note 93, at 6.

[103] ALDERFER ET AL., *supra* note 68, at iv (observing that "regulatory incentives drive the distribution utility to defend the monopoly against market entry by distributed power technologies" and that barriers faced by distributed generation "grow out of long-standing regulatory policies and incentives designed to support monopoly supply and average system costs for all ratepayers").

[104] King, Thesis, *supra* note 6, at 3 ("Unlike conventional DER applications, micro-grids pose a perceived market threat to regulated electric utilities because electric power is exchanged from one customer to another within the micro-grid—a service that is currently restricted only to regulated utilities."); *see also id.* at 83 ("Electric utilities have historically viewed customer-generators—those who have their own on-site generation—as financial, technical, and safety risks.").

[105] *See* Morgan & Zerriffi, *supra* note 89, at 1, 5 (interviewing eight state public utility commissioners, all of whom indicated that utilities would oppose microgrid legislation vigorously).

system upgrades; the cost of safety and maintenance issues related to interconnection of the microgrids; and the cost of uncertainties in planning for infrastructure expansion or modification.[106] If microgrids create too much uncertainty, a utility company may refrain from either entering into long term contracts for power or investing in long-term capital upgrades. Ultimately, utilities argue, these costs would be passed on to the consumer.

One way utilities slow adoption of distributed generation laws is by raising false concerns about technical feasibility and safety. For example, they often claim that distributed generation will supply power to the utility-run central grid when the grid is down, causing fires or endangering workers who believe they are fixing de-energized lines.[107] While these fears may have once been reasonable, technology to prevent this effect, known as "islanding," exists and has been used successfully for over two decades.[108] In addition, national safety standards, most prominently a standard issued by a well-respected international electrical engineering association, have been developed for the interconnection of distributed generation to the central grid.[109] The majority of the states have begun to adopt model safety standards,[110] although such adoption has not resulted in a clear legal framework for microgrids. Utility companies have also argued that distributed generation equipment threatens power quality.[111] Here, too, new technologies have emerged that protect against negative effects on power quality.[112] Other technological issues have been carefully analyzed and resolved by CERTS and other research and industry groups.[113]

By raising unfounded concerns through public hearings, lobbying, and other activities, utility companies worry lawmakers already confused about the technical aspects of distributed generation. This impact is particularly significant because utilities are often the most prominent group involved in drafting energy rules at the state level. Nonprofits, individually affected parties, and manufacturers of distributed generation and microgrid

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[106] Douglas King & M. Granger Morgan, *Guidance for Drafting State Legislation to Facilitate the Growth of Independent Electric Power Micro-Grids* 2 (Carnegie Mellon Elec. Indus. Ctr., Working Paper CEIC-03-17, 2003), *available at* https://wpweb2.tepper.cmu.edu/ceic/pdfs/CEIC_03_17.pdf.

[107] *See* ALDERFER ET AL., *supra* note 68, at 9; VARNADO & SHEEHAN, *supra* note 8, at 29–30.

[108] ALDERFER ET AL., *supra* note 68, at 9; VARNADO & SHEEHAN, *supra* note 8, at 30–32.

[109] *See, e.g.*, INST. OF ELEC. & ELECTRONICS ENG'RS, STANDARD 1547, IEEE STANDARD FOR INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS (2003).

[110] *See* VARNADO & SHEEHAN, *supra* note 8, at 19 (indicating that thirty-one states had to date considered or adopted new interconnectivity safety standards).

[111] ALDERFER ET AL., *supra* note 68, at 10; VARNADO & SHEEHAN, *supra* note 8, at 32–34 ("Power quality is important because electronic devices and appliances are designed to receive power within a designated range of voltage and frequency parameters, and deviations outside those ranges can cause appliance malfunction or damage.").

[112] ALDERFER ET AL., *supra* note 68, at 10.

[113] *See supra* notes 59–61 and accompanying text (reflecting research on voltage, generator configuration, monitoring equipment, and the like).

equipment have been active, but as the previous subsection reveals, they have not proven to be as well-organized, or as effective, in getting their initiatives passed into law.

Beyond lawmaking, utilities have a profound impact on the financial feasibility of distributed generation. This impact arises from utilities' ability to set tariffs and policies on end users within their jurisdiction. The Department of Energy has documented numerous examples of utilities charging unfair and outsized backup tariffs—supplemental, backup, and standby tariffs that distributed generators are required to pay to ensure access to the grid.[114] Sometimes, the proposed tariffs have even exceeded the equivalent cost of the energy produced by the distributed generator.[115] In addition, utilities, which enjoy monopolies over buying back excess energy, have tended to offer very low buyback rates.[116] Low buyback rates mean that power produced during off-peak periods which is not used by the microgrid cannot necessarily be fed back into the central grid, and sold back to the utility, at rates that would help offset the costs of investing in distributed generation. Finally, utilities sometimes refuse to serve users of distributed generation, by refusing to connect them to the grid. Backup generators that would alleviate worries of being without power—that is, protect microgrid users in a worst-case scenario—tend to add so many costs that entire projects are abandoned. The negative impact of these practices on the financial feasibility of distributed generation, and by extension microgrids, is clear. If past behavior is any indication, utility companies will continue to obstruct any reform that would facilitate microgrids.

2. *Neighbors*

Neighbors, like utility companies, also have significant influence on the future of microgrids, although neighbors influence local law and policy more than state law and policy. More specifically, neighbors have played and will play a big part in land use issues, which are traditionally local in nature.

I have written elsewhere about localities' role in siting alternative energy technology and will summarize my findings here.[117] Of nearly forty thousand local governments nationwide, less than a hundred have squarely addressed renewable energy technologies like the ones that could

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[114] ALDERFER ET AL., *supra* note 68, at 21.

[115] *Id.* at 23 (describing a utility's attempt to charge $144,000 annually for a backup tariff for a facility that would generate just $100,000 worth of electricity annually).

[116] *Id.* at 28 ("[M]ost current siting processes were designed for large power plants, thus posing barriers to distributed power analogous to those more fully discussed in this report.").

[117] *See* Sara C. Bronin, *The Quiet Revolution Revived: Sustainable Design, Land Use Regulation, and the States*, 93 MINN. L. REV. 231, 235–40 (2008) (describing the locality of land use laws).

be deployed in a microgrid.[118] Tens of thousands of localities have either barred or ignored such technologies, in the laws either as written or as applied.[119] Local laws that thwart alternative energy projects include zoning ordinances, aesthetic controls, and historic preservation rules.[120]

Examples of local groups using these laws to erect barriers to alternative energy equipment, particularly with respect to wind energy, abound.[121] For instance, a city in Oklahoma changed its ordinances to prevent a wind farm from locating there,[122] while a New York town enacted a moratorium on wind turbine towers.[123] Even outside of formal legal actions, neighbors have managed to wrangle informal agreements and concessions from wind energy generators fearful of formal protests.[124]

Wind turbines may be taller and bulkier than other alternative energy generating technologies, but each technology has physical features that may make its proximity undesirable to potential neighbors: Solar collectors can be unsightly; microturbines can create a disconcerting hum; fuel cells are essentially large, trailer-sized boxes that are hardly beautiful; geothermal wells must be drilled fifteen hundred feet underground with loud equipment. To be sure, technology is improving, and many old stereotypes no longer apply. But in too many communities, neighbor involvement in local decision-making processes can help to kill microgrid projects that the utilities, and unfavorable state laws, do not. The equipment that supports microgrids has to go somewhere. If too many

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[118] U.S. CENSUS BUREAU, U.S. DEP'T OF COMMERCE, GOVERNMENT ORGANIZATION: 2002 CENSUS OF GOVERNMENTS v (2002), *available at* http://www.census.gov/prod/2003pubs/gc021x1.pdf (indicating that 38,967 general-purpose local governments exist nationwide); Bronin, *supra* note 117, at 249–50 (indicating that seventy-five of these governments have squarely addressed green building but have not provided a separate figure for localities that have addressed alternative energy).

[119] *See* Bronin, *supra* note 117, at 250–55 (indicating how localities have barred or ignored green technologies).

[120] *Id.*

[121] *See* Patricia E. Salkin & Ashira Pelman Ostrow, *Cooperative Federalism and Wind: A New Framework for Achieving Sustainability*, 37 HOFSTRA L. REV. 1049, 1068–71 (2009) (providing a detailed account of neighbor opposition to wind energy siting, and arguing that "local opposition to wind turbines, often labeled NIMBYism, is common" and that "[i]n fact, some communities have adopted moratoria on siting wind turbines after project developers expressed interest in the areas" (footnotes omitted)).

[122] ALDERFER ET AL., *supra* note 68, at 20 (noting that since the wind farm owner in question had been grandfathered in, the farm could be sited in the town despite zoning ordinances).

[123] A prospective wind farm developer sued the town—but lost. *See* Ecogen, LLC v. Town of Italy, 438 F. Supp. 2d 149, 152 (W.D.N.Y. 2006). The moratorium stated that

> the installation of wind turbine facilities in the Town of Italy may have an adverse affect [sic] upon the scenic and aesthetic attributes of the Town of Italy and a correspondingly detrimental influence upon residential and recreational uses as well as real estate values in the Town of Italy, unless properly controlled through zoning regulations.

Id. at 153.

[124] *See, e.g.*, Jim Carlton, *Bay Area: Wind Turbines Leave Some in a Huff*, WALL ST. J., Jan. 14, 2010, at A13A (describing various tensions between property owners who install wind turbines and their neighbors, as well as informal arrangements among neighbors, such as a wind turbine owner's agreeing not to operate his turbine on weekends when his neighbor gardens).

neighbors object and the equipment cannot be located in previously developed locations, where the infrastructure to support it already exists, then energy sprawl will continue to spread.

As Parts II and III clarified, the need to facilitate alternative energy microgrids, and the distributed generation technologies that comprise them, is clear. In those communities that explicitly bar alternative energy technologies, concerted efforts must be made to reverse course. In those communities that ignore alternative energy technologies, ambiguities must be resolved through careful redrafting of local laws. For a variety of reasons, however, localities are unlikely to move forward with major reforms.[125] In this limited respect, given the extra-local nature of energy sprawl, states may have a role in encouraging localities to facilitate microgrids—without ignoring neighbor objections—through carefully written state enabling statutes.[126]

C. *Economic Barriers*

Uncertainties about the price of surmounting formidable regulations and the unsubsidized, high costs per user can deter investment in distributed generation and microgrid projects.[127] As noted above, utilities may set tariffs or engage in selective discount pricing.[128] Utilities' refusal to establish clear guidelines for microgrid users make basic budgeting, and predicting returns, extremely difficult. In addition, the relative cost per user of microgrids to other alternative energy infrastructure is very high. Microgrid physical infrastructure does not cost as much per unit of energy as large-scale, centralized facilities, because microgrids do not require extensive transmission and distribution systems.[129] The costs of microgrids, however, must be borne by a smaller number of users than the costs of central grid infrastructure. This denominator problem comes into play when dealing with administrative costs, such as costs related to environmental permitting and review, which may be the same for few-user projects as for many-user projects.[130] The per-user comparative costs look

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[125] *See* Bronin, *supra* note 117, at 249–50, 255–60 (describing how localities are unable to move forward with major reforms due to the unpopularity of mandates, minimal efforts to amend existing laws or create new laws, and the power of interest groups in preventing sustainable-design principles from being written into local laws).

[126] *See id.* at 266–72 (explaining how states can balance local autonomy and public policy goals of pursuing alternative energy).

[127] *See* THE CERTS MICROGRID CONCEPT, *supra* note 6, at 21 (observing that rapidly changing commodity prices may deter investment in microgrids and stating that "it appears that emerging restructured electricity markets will deliver volatile commodity electricity prices and an erratic investment program that results in unpredictable electricity supply reliability").

[128] ALDERFER ET AL., *supra* note 68, at 18.

[129] Hoff et al., *supra* note 6, at 2.

[130] ALDERFER ET AL., *supra* note 68, at 18. Note that some states are already beginning to reduce administrative costs for small-scale projects. The New York Public Service Commission, for example, has decided that utility companies cannot require interconnection studies for facilities that produce

even worse in light of the lack of public subsidies for microgrids.[131]

Public subsidies for both individual distributed generation and large alternative energy facilities, on the other hand, run into the billions. Massive subsidies from all levels of government support individual distributed generation with one end user.[132] These subsidies—grants, tax credits, property tax exemptions, renewable energy credits, loan guarantees, and low-interest loans—help individuals offset the up-front and ongoing costs of installing and operating alternative energy technologies.[133] These subsidies have encouraged many individuals to embrace single-source distributed generation, although the ability of the vast majority of Americans to spend the money needed to match the government subsidies is admittedly limited. Moreover, the receipt of these subsidies is tied to the on-site consumption of all of the energy produced by the subsidized technology. So individuals who share energy, like microgrid operators, become ineligible for the incentive programs that make alternative energy financially feasible.[134] Across-the-board revisions to subsidy rules are certainly in order.

Government support has also been directed toward projects with many hundreds or thousands of end users, such as the wind turbine farms in West Texas or the solar installations in the Mojave Desert —projects that, while better than traditional forms of energy generation, nonetheless create undesirable energy sprawl. State and local governments justify efforts to attract such projects to their jurisdictions not only on environmental grounds, but also on economic development and job creation grounds. The public utility lobby has also helped increase financial support for large-

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fewer than ten kilowatts. *See* N.Y. Pub. Serv. Comm'n, Opinion No. 99-13, Case No. 94-E-0952, *In re* Competitive Opportunities Regarding Electric Service, app. B (Dec. 31, 1999). The Texas Public Utility Commission, meanwhile, allows utilities to require an interconnection study for distributed generation facilities, but the utility cannot charge the generator if it does not export power to the utility system or if it is smaller than certain set criteria. Tex. Pub. Util. Comm'n, § 25.211, Interconnection of Distributed Generation, Dec. 1, 1999, http://www.puc.state.tx.us/rules/subrules/electric/25.211/25.211.pdf.

[131] *But see* Press Release, *supra* note 7 (announcing over ten million dollars in federal government investment in three projects that appear to be microgrids).

[132] Numerous governments, and states in particular, provide a wide variety of subsidies. *See, e.g.*, TEX. TAX CODE ANN. § 11.27(a) (West 2008) ("A person is entitled to an exemption from taxation of the amount of appraised value of his property that arises from the installation or construction of a solar or wind-powered energy device that is primarily for production and distribution of energy for on-site use.").

[133] *See* Mona Hymel, *The United States' Experience with Energy-Based Tax Incentives: The Evidence Supporting Tax Incentives for Renewable Energy*, 38 LOY. U. CHI. L.J. 43, 43–44 (2006) (arguing that the United States should have tax incentives for alternative energy, just as it does for conventional energy).

[134] King, Thesis, *supra* note 6, at 2–3 ("In order to be cost-effective, continuous-use applications require the DER customer to be interconnected with the utility grid so that the customer can sell excess power to the utility and purchase power from the utility during peak periods or on-site system failures.").

scale projects that they control and operate.[135] As these projects are being built, however, costs are being shifted to ratepayers and the general public. For one thing, large projects create energy sprawl, which itself imposes hidden costs. For another, more strain is placed on the existing grid. Experts suggest that modernizing the grid could cost up to one hundred billion dollars, a cost which will be borne by consumers—in other words, internalized by those given few options to opt out.[136] It makes a lot of sense to dedicate some of that investment to the financial support of microgrids, which would result in reduced demand on the centralized grid and reduced transmission and distribution costs.

Expanding public support would, of course, make microgrid projects more affordable to end users. Perhaps more importantly, it would make microgrids more attractive to third party investors, who, along with the utility companies, are important players in large renewable energy projects. Such investors would be attracted to a microgrid project if the project received direct public support to offset costs, tax credits which could be sold to the investor at a discount, and/or renewable energy credits or energy efficiency certificates which are growing increasingly valuable. A further articulation of public subsidies for microgrids would be in order, once the law sufficiently addresses their creation. For the purposes of this Article, however, political and economic concerns may be treated only briefly. Turning now to Part V, we return to the law, and three ideas for resolving some of the regulatory barriers described in Part IV.

V. THWARTING SPRAWL, FACILITATING MICROGRIDS

Slowing the spread of energy sprawl could be achieved in many ways.[137] The most effective option would be reducing consumption, which seems unlikely given Americans' unending appetite for energy.[138] Other

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[135] Kamenetz, *supra* note 29 ("Big utilities are pushing hard to do what they do best—getting the government to subsidize construction of multi-billion-dollar, far-flung, supersize solar and wind farms covering millions of acres, all connected via outside transmission lines.").

[136] LACOMMARE & ETO, *supra* note 68, at xi–ii.

[137] The Nature Conservancy recommends four ways to reduce energy sprawl: first, reducing the area impacted by new energy development (a recommendation that seems circular); second, encouraging end-use generation; third, making any cap and trade bills flexible enough to include offsets from carbon capture and storage; and fourth, engaging in site selection and planning efforts to mitigate impact. MCDONALD ET AL., *supra* note 10, at 6. The author of the report added in an interview that conservationists could advocate to maximize energy conservation and energy efficiency; build incentives for the use of abandoned or degraded land, rather than natural habitat; and site new energy projects away from sensitive species. Palmquist, *supra* note 3.

[138] Some scholars, like Alice Kaswan, argue that U.S. policy must address consumption, and that "the public's increasing recognition of the global peril posed by climate change could shift the political landscape and increase the political feasibility of consumption-reducing policies." Alice Kaswan, *Climate Change, Consumption, and Cities*, 36 FORDHAM URB. L.J. 253, 256 (2009). Elsewhere, I have addressed measures, such as green building mandates, which would curb consumption but remain skeptical of the possibility of immediate, large-scale reductions. Bronin, *supra* note 117, at 231.

extremes—banning new transmission lines or refusing to subsidize any large-scale extra-urban energy projects—are equally infeasible. In this situation, modest reforms would work best.

Accordingly, this Article suggests three modest, but potentially very effective, means of facilitating microgrids, focusing on the primary role the states play in energy regulation and land use. First, Congress should require states to consider model standards for microgrid regulation. Second, states should provide guidance to local governments with respect to siting microgrid projects. Third, states should develop and authorize legal institutions that would support microgrid projects, drawing from Professor Robert Ellickson's proposal for block improvement districts.[139] If implemented together, these proposals would support small-scale energy sharing collectives whose emergence could transform the American landscape.

A. *Regulatory Reform: "Considering" Model Standards*

State legislatures and agencies must lead reforms for microgrid regulation. State public utility commissions regulate seventy-five percent of electricity in this country,[140] and they have more expertise with the creation and operation of distributed generation than other regulatory bodies, including the Federal Energy Regulatory Commission ("FERC").[141] Although states' treatment of microgrids to date has been anything but impressive, there is some hope that they would comply with federal rules to consider model standards.

In fact, states recently complied with federal mandates to review two other aspects of distributed generation regulation: net metering and interconnection standards. The Federal Energy Policy Act of 2005 required state public utility commissions to consider a model interconnection standard, based on the Institute of Electrical and Electronics Engineers Standard 1547,[142] as well as to consider a model net-metering standard by 2008.[143]

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[139] Robert C. Ellickson, *New Institutions for Old Neighborhoods*, 48 DUKE L.J. 75 (1998).

[140] JOSEPH H. ETO & KRISTINA HAMACHI LACOMMARE, ERNEST ORLANDO LAWRENCE BERKELEY NAT'L LAB., TRACKING THE RELIABILITY OF THE U.S. ELECTRIC POWER SYSTEM: AN ASSESSMENT OF PUBLICLY AVAILABLE INFORMATION REPORTED TO STATE PUBLIC UTILITY COMMISSIONS 3 (2008), *available at* http://certs.lbl.gov/pdf/lbnl1092e-puc-reliability-data.pdf.

[141] FERC does play a role in distributed generation projects. It controls all wholesale electricity transactions, including distributed generation. And in 2005, FERC adopted interconnection standards for transmission-level (not distribution-level) interconnections with public utilities (defined under the federal statute) for projects smaller than twenty megawatts. Standardization of Small Generator Interconnection Agreements and Procedures, Order No. 2006, 70 Fed. Reg. 34,190 (June 13, 2005), 111 F.E.R.C. Stats. & Regs ¶ 61,220 (2005).

[142] The full name of the standard is the Standard for Interconnecting Distributed Resources with Electric Power Systems. INST. OF ELECTRICAL & ELECTRONICS ENG'RS, *supra* note 109, at 1.

[143] 16 U.S.C. § 2622(b)(3)(A)–(B) (2006).

Congress passed this law after it recognized the need for implementation of technical standards with at least some common elements across jurisdictions, to spur distributed generation. Ten years ago, the Department of Energy blamed lags in the development of distributed generation on the lack of "a national consensus on technical standards for connecting equipment, necessary insurance, reasonable charges for activities related to connection, or agreement on appropriate charges or payments for distributed generation."[144] Also in 2000, the National Renewable Energy Laboratory called the "patchwork of rules and regulations which defeat the economies of mass production that are natural to these small modular technologies" the biggest barrier to distributed generation.[145] Ideally, as the Department of Energy and National Renewable Energy Laboratory recognized, manufacturers of distributed generation technology need national standards, lest they have to manufacture fifty different technologies to accommodate state preferences.

The Federal Energy Policy Act requirements appear to have succeeded in abating these concerns and prompting states to review, modify, and standardize their policies on interconnectivity and net metering. The states based their reviews in part on third-party model rules, perhaps most notably those drafted by the Interstate Renewable Energy Council.[146] The Interstate Renewable Energy Council is a nongovernmental, nonprofit organization that aims "to remove barriers to renewable energy use."[147] Interestingly, the net metering model rules require that the distributed generation system must meet, and not exceed, the generator's on-site demand, meaning that to take advantage of net metering, the generator must not serve neighbors; in other words, microgrids are banned.[148] Other model rules on interconnection standards have also formed the foundation for states' efforts. These include California's Rule 21 interconnection standard, adopted in 2000; FERC's Small Generator Interconnection Procedures, issued via Order No. 2006 in 2005; and the Mid-Atlantic Demand Resource Initiative Procedures.[149]

During the period of review provided by Congress, thirty-one states

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[144] ALDERFER ET AL., *supra* note 68, at 34.

[145] *Id*. at iv, 21–23.

[146] *See* INTERSTATE RENEWABLE ENERGY COUNCIL, MODEL INTERCONNECTION PROCEDURES (2009), *available at* http://irecusa.org/wp-content/uploads/2010/01/IREC-Interconnection-Procedures-2010final.pdf; INTERSTATE RENEWABLE ENERGY COUNCIL, NET METERING MODEL RULES (2009) *available at* http://www.irecusa.org/fileadmin/user_upload/ConnectDocs/IREC_NM_Model_October_2009-1.pdf.

[147] *About IREC*, INTERSTATE RENEWABLE ENERGY COUNCIL, http://irecusa.org/about-irec/ (last visited Oct. 26, 2010).

[148] INTERSTATE RENEWABLE ENERGY COUNCIL, NET METERING MODEL RULES, *supra* note 146, at 4 n.3.

[149] *See* VARNADO & SHEEHAN, *supra* note 8, at 20–21 (describing the history of each of these rules).

adopted or amended their interconnection standards.[150] Forty-two states have adopted net metering standards that allow distributed generators to sell excess energy back to the grid.[151] These rules vary among states, based on the types of technologies, system size, system capacity, timing of payments, and the ownership of renewable energy credits.[152] But we are no doubt better off today than we would have been without the "consideration" requirement of the Federal Energy Policy Act. Moreover, the variety reflects our federalist structure, as states have been allowed to experiment with different reforms.[153] States can continue to experiment, without federal interference, provided that they have considered the larger context for their decisions.

Finally, states (and public utilities) may be eager to consider microgrids once they understand how microgrids can help them meet their renewable portfolio standard goals.[154] Renewable portfolio standards,[155] adopted by state legislatures, require public utilities to incorporate a certain percentage of alternative energy in their productive capacity, within a certain time period. Not all states have adopted renewable portfolio standards, and those that do vary widely. Seventeen out of thirty states with renewable portfolio standards have targets of twenty percent or more, with each state assuming different benchmark and target years.[156] The most ambitious states are Hawaii and Maine, which have targeted forty percent of retail energy sales to come from renewables by 2030 and 2017, respectively.[157] Sixteen states have specific provisions setting goals for solar or distributed generation, the definition of which varies by state, in

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[150] *See id.* at 19 (noting, however, that it is hard to say that these changes necessarily resulted from the Federal Energy Policy Act and that "[a] number of these states may have simply recognized the value of distributed generation and would have set about to reform state policies regardless of encouragement from [the Act]").

[151] *Id.* at 11.

[152] *See* INTERSTATE RENEWABLE ENERGY COUNCIL, "CONNECTING TO THE GRID" PROJECT, STATE INTERCONNECTION STANDARDS FOR DISTRIBUTED GENERATION (2010), http://irecusa.org/wp-content/uploads/2010/02/February_2010_IC_Table.doc (presenting a comparison of states' rules on interconnection, including limits on system capacity, insurance requirements, eligible renewable technologies, applicable sectors, and more); INTERSTATE RENEWABLE ENERGY COUNCIL, "CONNECTING TO THE GRID" PROJECT, STATE AND UTILITY NET METERING RULES FOR DISTRIBUTED GENERATION (2010), http://irecusa.org/wp-content/uploads/2010/02/February_2010_NM_Table.doc (presenting a similar comparison).

[153] Kate Galbraith, *Renewable Energy's Odd Couple*, N.Y. TIMES, Oct. 18, 2009, at WK3 (observing that states' experimentation can be helpful and stating, "[i]n the absence of sustained federal action to support clean energy and fight climate change, Texas and California are serving as important policy laboratories").

[154] *See* RAWSON, *supra* note 5, at 5.

[155] For a full discussion of renewable portfolio standards, see generally Lincoln L. Davies, *Power Forward: The Argument for a National RPS*, 42 CONN. L. REV. 1339 (2010), and related commentary in *Connecticut Law Review*, Volume 42, Issue 5.

[156] FED. ENERGY REGULATORY COMM'N, RENEWABLE POWER & ENERGY EFFICIENCY 4 (2010), *available at* http://www.ferc.gov/market-oversight/othr-mkts/renew/2010/01-2010-othr-rnw-archive.pdf.

[157] *Id.* at 3.

their renewable portfolio standard.[158] Such variation reflects the different factors—energy policy, economic development, the environment—that states must consider in enacting reforms.

This Article does not propose model rules that Congress should require the states to consider, because others, including CERTS researchers and the Carnegie Mellon researchers mentioned above, have already articulated potential model legal frameworks.[159] Without delving too far into the details, I believe a model standard should have several components: (1) an articulation of the state policy promoting alternative energy; (2) a definition of the term "microgrid" based on the definition in this Article—a multi-user entity with one or more independent sources of electric power and generation;[160] (3) a limit on the size of unregulated microgrids, with respect to number of participants and energy output, to prevent overly large projects from evading public utility status;[161] (4) a description of an application and registration process which would be administered by the state public utility commissions; and (5) the articulation of certain rights for microgrid owners, such as the right to net meter, and certain prohibitions on utility behavior, such as prohibiting them from refusing to serve microgrid customers.[162] In addition, key to any reform is a clear, fair system of tariffs for microgrid operators and end users.[163] A bi-directional tariff that takes into account the needs and goals of the utility companies and the microgrid operators should be developed.[164]

If an acceptable model standard for microgrids emerges, Congress should adopt a rule that requires states to consider it. Federal legislation of this nature can both respect states' autonomy and build on states' expertise. More broadly, such legislation would reflect political trends that support

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[158] *Id.* at 7.

[159] *See, e.g.*, King & Morgan, *supra* note 106, at 1 (stating that states should pass legislation which would allow "development of independent micro-grids"); King, *Regulatory Environment*, *supra* note 94, at 11–13 (recommending specific regulatory changes).

[160] *See* King & Morgan, *supra* note 106, at 2 (suggesting that state laws include such a definition for microgrids).

[161] A reasonable size limit for an unregulated microgrid could be forty megawatts, which, as others have argued, would accommodate several users with different loads. *See id.* (noting that peak loads for residential homes are ten to thirty kilowatts, for shopping centers two to eight megawatts, and for office buildings six to twenty megawatts).

[162] Utilities have great flexibility in applying tariffs and can relatively easily refuse service or change rates for operators of distributed generation technology or microgrids. King, *Regulatory Environment*, *supra* note 4, at 7.

[163] As another commentator has summarized, public utility tariffs are set (or should be set) with seven goals in mind: attracting capital for the utility, encouraging efficient management practices, promoting socially optimal consumer choices (preventing over- or under-consumption), ensuring fairness to investors, providing a stable and predictable rate level, encouraging efficient management and use of customer-generated resources, and compensating customers for services rendered to the utility. King, Thesis, *supra* note 6, at 87–88.

[164] *See* Morgan & Zerriffi, *supra* note 89, at 6 (suggesting such a tariff and indicating that the tariffs "would depend on the size of the micro-grids, their number, and the nature of the distribution utility's system and loads").

the creation of so-called "green jobs" and the move toward energy independence.

B. *Siting Reform: Providing Guidance to Localities*

The suggestion that states become more involved in providing guidance to localities for siting microgrids may seem counterintuitive. On one hand, microgrids consolidate both generation and distribution in a finite area, and their most significant impacts are local, which might suggest local control. On the other hand, the development and standardization of renewable energy is a nationally important issue, which might suggest federal control.

State control, however, is preferable to local control because local decision-makers may not understand, or may be inclined to ignore, the impact of their actions on areas outside their jurisdiction. They may reject microgrid technologies, taking a "not-in-my-backyard" approach that drives distributed generation projects outward.[165] Such rejections would act to increase, not decrease, energy sprawl. Similarly, state control is preferable to federal control, because federal control of renewable energy siting must be reserved for issues with interstate implications. Microgrids have no such implications, as they can operate on the scale of the block or neighborhood and do not require interstate transmission lines.

To clear a hurdle for potential microgrid operators, state legislatures should consider laws that provide special treatment for siting microgrid projects. State public utility laws, discussed in the previous subsection, may include provisions on siting, although not all states deal with siting. Only about thirty states have formal transmission line siting statutes; none of these directly address microgrids.[166] Even where siting statutes exist, scholars have criticized state legislatures for failing to clarify their siting authority.[167] Such criticism, however, focuses on problems related to the inability of states to coordinate interstate transmission lines that carry energy across state boundaries, not the intrastate distribution lines required by microgrids.

Land use regulation, an area of law in which states provide the framework within which localities make decisions, should also be used to advance the microgrid agenda.[168] At a minimum, state legislatures should modify their standard zoning enabling acts, which give localities power to

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[165] *See supra* text accompanying notes 119–24.

[166] Jim Rossi, *The Trojan Horse of Electric Power Transmission Line Siting Authority*, 39 ENVTL. L. 1015, 1019 (2009).

[167] *See, e.g.*, *id.* at 1024 (describing the inability of state siting rules to address interstate issues).

[168] *See* Bronin, *supra* note 117, at 249–55 ("[S]ome localities . . . fail to include any explicit reference to green technologies in their land use regulations. Although undoubtedly less problematic than an outright ban, failure to contemplate green technologies can itself hinder their utilization.").

create and administer land use laws, to say that zoning boards and local councils may not take any action that would unreasonably burden or halt microgrid projects, absent a compelling state interest in doing so. A few states have passed such laws to facilitate the siting of individual solar collectors, on the theory that localities may not necessarily consider the states' broader energy goals when making land use decisions.[169] Expanding this protection to microgrid projects more generally, while allowing localities to impose only reasonable restrictions on such projects, would be worthwhile.

In addition, states could encourage local land use offices to develop fast-track permitting processes and special building codes for projects that utilize specific distributed generation technologies. Here too, state regulation could be implemented in such a way that local autonomy is respected—for example, providing incentives for localities who revise their laws. Finally, states could require localities to include microgrid siting as a mandatory element of their comprehensive plans. Many states require localities to draft comprehensive plans that take into account considerations such as affordable housing or open space. It would be entirely appropriate to ask them to take microgrids into consideration when devising land use plans for their communities.

Localities may object to any intrusion by the state into their ability to site renewable energy projects. As Professor David Barron has written, however, localities do not and cannot enjoy full legal autonomy; rather, the state both grants and limits their powers.[170] In his article *Reclaiming Home Rule*, Barron persuasively argues for a break from the outdated notion that "home rule" requires complete local control. Siting this theoretical argument in the real-world example of urban sprawl, he argues that existing state laws that limit and grant localities' power facilitate sprawl.[171] Barron suggests that states could engage localities in the fight against sprawl by freeing localities to enact creative regulations, such as inclusionary zoning or antidiscrimination laws, changing annexation rules to favor city-suburb bargaining, and prohibiting localities from adopting exclusionary zoning measures.[172] Reconfiguring local power in the way that Barron suggests could be very helpful in reducing energy sprawl, which like urban sprawl is an extra-local problem.

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[169] *Id*. at 270–72 (describing state laws in California and Connecticut which take this approach).

[170] David J. Barron, *Reclaiming Home Rule*, 116 HARV. L. REV. 2255, 2263, 2373–74 (2003) ("[Localities] may operate within a legal structure that seems committed to securing their right to home rule, but that same structure subjects them to a variety of legal limitations—some clear, others less so. What now passes for home rule, therefore, is not local legal autonomy.").

[171] *Id*. at 2366 (stating that "current state constitutional grants of home rule initiative [do not] include matters of greater-than-local concern" and that current state laws lead to "isolation of individual localities").

[172] *Id*. at 2264–65.

Just as localities might reject state involvement in microgrid siting, federal officials may view state involvement as unwarranted or infeasible. In their article *Local Energy*, Garrick Pursley and Hannah Wiseman address the issue of siting renewable energy.[173] They advocate for "the federal government [to] first establish some . . . minimum standard—most likely a simple prohibition on regulations that impede renewables siting—for fostering the adoption of distributed renewable energy technologies and allocate *primary* authority for implementation and regulation, with substantial discretion, to local governments."[174] They then argue that state control on localities regarding renewable siting be altogether preempted by the federal government.[175] The authors contend that establishing a direct connection between federal and local governments is consistent with the theoretical underpinnings of federalism and, from a practical standpoint, can facilitate the spread of renewable energy more easily than action by states.[176] Another pair of scholars writing about wind energy, Patricia Salkin and Ashira Ostrow, take a similar approach, arguing that Congress should preempt certain state and local rules and offer a federal wind siting policy that constrains the ability of localities to make individualized zoning decisions.[177] These scholars' views may stem from the opinion that state political obstacles might be difficult to overcome. Eroding states' power to regulate siting of small-scale energy installations via federal preemption could hinder the ability of states to address other aspects of this important problem.

C. *New Legal Institutions*

Assuming that the first two reforms suggested by this Article are adopted by Congress and the states respectively, new legal institutions will be needed to facilitate the administration of microgrids. This Article proposes that states authorize the creation of block-level energy districts (BEDs) based on the block-level improvement districts (BLIDs) imagined by Professor Robert Ellickson.[178] Such districts are not currently authorized, at least explicitly, by any state.

Ellickson argues that BLIDs—micro-institutions that property owners in existing neighborhoods can vote to create and administer—could bring order to the inner city.[179] In his view, property owners should be able to organize into BLIDs that can levy assessments to pay for specific

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[173] *See* Pursley & Wiseman, *supra* note 72.
[174] *Id*. at 44.
[175] *Id*. (arguing that "in addition to a federal minimum standard, federal preemption of state power to interfere with local decisionmaking" is necessary).
[176] *Id*. at 43–48, 56–59.
[177] Salkin & Ostrow, *supra* note 121, at 1082–83.
[178] Ellickson, *supra* note 139, at 77–78.
[179] *Id*.

projects.[180] BLIDs, like the residential community associations common in new subdivision developments, could provide certain goods and services to small groups of people with common interests.[181] Such goods and services could include "maintaining sidewalk planters and tot-lots, removing litter and abandoned vehicles, conducting block-watch programs, and providing other highly localized benefits."[182] George Liebmann, who arguably began the discussion about formal block associations in the legal literature, believed that block-level districts could deal with matters ranging from day care to law enforcement to traffic regulation to elementary schools.[183] Others have considered their potential impact on environmental species protection[184] and trespass and zoning enforcement.[185]

Ellickson characterizes these and other BLID goods and services as local "public goods."[186] Public goods are available for consumption by anyone, and consumption of a public good by one person does not reduce the availability of that good to others. Truly public goods may not exist anywhere but in the minds of economists; often roads, the air, and police forces are cited as closest to the theoretical ideal. Ellickson's "public goods" fall outside of the traditional definition of public goods because, while they have benefits to the general public—crime deterrence, say, or aesthetic improvements leading to higher property values—they are

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[180] *Id*. at 77. Others have cited Ellickson's ideas as an inspiration for their policy proposals. *See, e.g.*, ROBERT H. NELSON ET AL., MERCATUS CTR., GEORGE MASON UNIV., FROM BIDS TO RIDS: CREATING RESIDENTIAL IMPROVEMENT DISTRICTS 2–3 (2008), http://mercatus.org/publication/bids-rids-creating-residential-improvement-districts?id=16056 ("Reflecting the spirit of Ellickson's earlier proposal, states and municipalities should now establish the legal authority for the creation of RIDs [Residential Improvement Districts] as well as BIDs."). Nelson has also advocated in *From BIDs to RIDs* and elsewhere for RIDs to draw from the example of business improvement districts, which exist in many cities across the United States. *See* Robert H. Nelson, *Privatizing the Neighborhood: A Proposal to Replace Zoning with Private Collective Property Rights to Existing Neighborhoods*, 7 GEO. MASON L. REV. 827, 867 & n.206 (1999) (citing Ellickson and focusing on the potential for block associations to regulate zoning).

[181] Ellickson, *supra* note 139, at 82. Ellickson identifies differences between BLIDs and residential community associations, stating that BLIDs are imposed on previously subdivided property, meaning that some BLID participants may not have "opted in," that BLIDs are more likely to include public properties within their boundaries, and that BLIDs are more heterogeneous. *Id*.

[182] *Id*. at 83, 97–98 (footnote omitted).

[183] George W. Liebmann, *Devolution of Power to Community and Block Associations*, 25 URB. LAW. 335, 351–83 (1993) (discussing the potential uses of neighborhood government).

[184] *See* Erin Morrow, Note, *The Environmental Front: Cultural Warfare in the West*, 25 J. LAND RESOURCES & ENVTL. L. 183, 244–45 (2005) (noting that block improvement districts are often supported by landowners and "almost universally allocate voting power based on an economic stake calculation," unlike "special nature districts," a proposal for which formed the basis of the article).

[185] *See, e.g.*, Peter M. Flanagan, Note, *Trespass-Zoning: Ensuring Neighborhoods a Safer Future by Excluding Those with a Criminal Past*, 79 NOTRE DAME L. REV. 327, 337–39 (2003) (citing the work of Ellickson, Nelson, and Liebmann as forming the basis for the argument that "[b]y allowing the residents of these preexisting neighborhoods to exercise the right to exclude [via privatized neighborhood districts], the municipalities simultaneously enable their police to protect, and ultimately revitalize, those neighborhoods by enforcing the property rights of those residents through criminal trespass law").

[186] Ellickson, *supra* note 139, at 78, 97–98.

primarily enacted to benefit private parties. Moreover, one person's consumption of certain potential BLID services, like the tot-lots, would necessarily exclude others.[187] At least some potential BLID services, then, appear to function more like semicommonses—that is, resources that at different times may be both publicly shared and privately captured—than public goods.[188] Indeed, like BLID services, microgrid-created renewable energy functions as a semicommons because the energy is publicly created and stored, and because renewable energy reduces the impact on the grid; it becomes private, however, once an individual reduces that energy to possession by consuming it.

The nature of the property protected requires special rules. Accordingly, this proposal for BEDs differs from Ellickson's proposal for BLIDs in two important respects. First, if energy is the shared good, more like a semicommons than a public good, states have to pass more specific enabling legislation than what exists for general BLIDs. Specific rules governing safety and interconnectivity will have to be articulated. Rules relating to how energy might be stored, sold, or returned to the grid would draw from public utility law and property law. Moreover, the rights of stakeholders and any constraints on their ability to enter into business arrangements with each other must be carefully conceived. Second, BEDs should not be mandatory. To reduce the problem of the free rider, Ellickson argues that all property owners within the BLID, whether they supported or opposed its initial creation, should be obligated to chip in.[189] Mandatory participation is inappropriate, however, in the microgrid context, where the sharing of energy occurs on both shared and private property and requires the installation of infrastructure on private property.[190] Requiring individuals to install piping, distribution lines, or monitoring equipment on their property could result in takings claims, something that both governments and microgrid operators would want to avoid.

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[187] It may be important to note that because microgrids by definition require extensive monitoring, tragedy of the commons problems do not exist in a microgrid. Individual users' consumption of the property (energy) would be monitored by meters that would allocate costs of energy use among users. Norms among neighbors would prevent abuses other than over-use, such as failures to report technical problems with equipment or siphoning energy without paying.

[188] Henry Smith has done more to advance semicommons theory than any other scholar. *See, e.g.*, Henry E. Smith, *Governing the Tele-Semicommons*, 22 YALE J. ON REG. 289, 290–91 (2005) (analyzing the mandatory sharing regime created by the Telecommunications Act of 1996 as a semicommons); Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 446 (2008) (applying an "information-cost theory of property to water law"); Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131, 131–34 (2000) (discussing the history of semicommon property rights and their importance today).

[189] Ellickson, *supra* note 139, at 77 ("I propose authorizing the owners of a supermajority of property to compel dissenting property owners to join a BLID . . . .").

[190] For further discussion of non-mandatory block improvement districts, *see generally* Liebmann, *supra* note 183.

The articulation of a model law for the creation of BEDs is beyond the scope of this Article. It is clear, however, that specific legal institutions must be created to address the unique problems posed by the microgrid. If enacted along with the other modest reforms proposed in this Part, it is possible that microgrids could begin to operate, with the full protection of the law, within the decade.

VI. CONCLUSION

Even alternative energy has costs. Energy sprawl, an unintended and harmful consequence of large-scale alternative energy projects, should concern policymakers around the country. As this Article has shown, microgrids provide decentralized, flexible energy infrastructure that can be easily deployed in places already touched by development. They can meet growing demand for energy without the negative consequences of larger (or, for that matter, smaller) energy projects. Congress should act quickly to require states to "consider" model microgrid standards, while the states should provide guidance to localities on siting microgrids and should allow private parties to enter into formal arrangements to share costs and risk. Removing some of the barriers to microgrid development, even in an incremental way, could radically transform future land use.