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Microgrids for Micro-Communities: Reducing the Energy Burden in Rural Areas

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NOTE

MICROGRIDS FOR MICRO-COMMUNITIES: REDUCING THE ENERGY BURDEN IN RURAL AREAS

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Rural communities currently face some of the highest energy costs and lowest reliability in the country, due in part to long transmission distances and low population densities. The North American Supergrid ("NAS") has been proposed as a solution for increased grid stability, resiliency, and renewable generation with decreased carbon emissions and energy cost across the lower 48 states. Although the NAS could help with these energy goals, it is likely that benefits of the NAS would bypass many rural or isolated communities outside of the transmission step-down points. As the NAS will not help rural communities, states can take regulatory action aimed at promoting microgrid systems of locally generated renewable energy. Remote communities in Alaska have already taken advantage of microgrid systems, and Alaska's microgrid policies could serve as a model for rural communities in the lower 48. This Note proposes regulatory changes to states' microgrid policies, based on Alaska's policies, to bolster renewable generation based microgrid system development for rural communities by (1) identifying and clearly defining important factors affecting microgrid implementation, (2) setting high renewable portfolio standards, (3) increasing financial investment, and (4) collaborating with other states and interest groups to share information. By considering Alaska's policies as a prototype, states across the country can increase rural residents' access to affordable energy.

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Introduction

On a warm day in America, the buzzing of transmission lines can be heard among the sounds of birds, crickets, and cicadas. Electric infrastructure, although considered an eyesore by some, has become part of the everyday landscape, moving energy from its birthplace to the homes of millions.

Despite the grid's visibility, few people in the U.S. consider the efforts necessary to keep the grid functioning: power has nearly always appeared instantly at the flip of a switch. Yet major blackouts occurred in 2003, 2011, and 2012,[1] and approximately 36.7 million people experienced power outages in 2017.[2] The grid is known to be vulnerable to electromagnetic and cyber threats,[3] and electricity costs are projected to continue rising.[4] On top of these issues is the recognition that greenhouse gas emissions from old electricity generation techniques contribute to global catastrophic climate change.[5] The current grid is facing challenges that its nineteenth century designers could not have anticipated. One suggestion to meet these challenges is the North American Supergrid ("NAS"), a proposed transcontinental update to our energy system designed to transmit abundant renewable energy from the windy center and sunny southwest of the country to the more populous, energy-hungry coasts, while keeping voltage stable across the system.[6]

The proposed NAS has the attractive goals of making our electricity infrastructure more resilient and cost-effective while reducing power sector carbon emissions.[7] Unsurprisingly, a system of this magnitude will encounter an abundance of legal issues, specifically the lack of backstop siting authority for the Federal Energy Regulatory Commission's ("FERC's") use of eminent domain, as well as dormant commerce clause considerations, among other challenges.[8] If the large legal hurdles involved in siting such a system can be overcome, the NAS would deliver cleaner, cheaper, and more reliable energy across the country. Despite these benefits, the NAS would

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1. *9 of the Worst Power Outages in United States History*, ELECTRIC CHOICE, https://www.electricchoice.com/blog/worst-power-outages-in-united-states-history/ (last visited Dec. 10, 2018).

2. Matt Kraus, *36.7 Million Affected by Power Outages in 2017, Per Eaton Study*, ELECTRICAL CONTRACTOR (March 2018), https://www.ecmag.com/section/systems/367-million-affected-power-outages-2017-eaton-study.

3. FED. ENERGY REG. COMM'N, ELECTROMAGNETIC PULSE: EFFECTS ON THE U.S. POWER GRID (2010), https://www.ferc.gov/industries/electric/indus-act/reliability/cybersecurity/ferc_executive_summary.pdf; ROBERT K. KNAKE, A CYBERATTACK ON THE U.S. POWER GRID: CONTINGENCY PLANNING MEMORANDUM NO. 31 (April 3, 2017), https://www.cfr.org/sites/default/files/pdf/2017/03/ContingencyPlanningMemo31_Knake.pdf.

4. Abhilash Kantamneni et al., *Emerging Economic Viability of Grid Defection in a Northern Climate Using Solar Hybrid Systems*, 95 ENERGY POL'Y 378, 379 (2016).

5. *See* Fiona Harvey, *Scientists Set Out How to Halve Greenhouse Gas Emissions by 2030*, THE GUARDIAN (Sept. 18, 2019 7:00 PM), https://www.theguardian.com/environment/2019/sep/19/power-halve-greenhouse-gas-emissions-2030-climate-scientists.

6. *See* Matthew L. Wald, *How to Build the Supergrid*, SCI. AM., Nov. 2010, at 56, 59.

7. Charles Bayless & Thomas Petri, *Upgrade America's 19th-Century Electric Grid*, WALL ST. J. (June 4, 2018, 6:52 PM), https://www.wsj.com/articles/upgrade-americas-19th-century-electric-grid-1528152728; CLIMATE INST., NORTH AMERICAN SUPERGRID: TRANSFORMING ELECTRICITY TRANSMISSION 5 (2017), http://cleanandsecuregrid.org/wp-content/uploads/2017/12/North-American-Supergrid.pdf.

8. A full discussion of these issues is outside the scope of this Note, but for a comprehensive overview, see Alexandra B. Klass, *The Electric Grid at a Crossroads: A Regional Approach to Siting Transmission Lines*, 48 U.C. DAVIS L. REV. 1895, 1914–16 (2015); CLIMATE INST., *supra* note 7, at 65–67.

fail to address energy costs in rural areas located outside the NAS's end-points or intermediate step-down feeder line locations.[9] These rural, often low-income areas experience some of the highest energy costs and lowest reliability in the country but would be unable to benefit from the NAS due to the continued cost of transmission to their remote locations.

One way to help these rural communities, with or without the implementation of the NAS, would be to increase the use of localized generation and microgrid systems. Of all the states, Alaska is most familiar with these systems due to its rugged terrain, remote communities, and complete grid isolation from the lower 48 states. If states were to follow Alaska's lead in adopting pro-microgrid policies, with an emphasis on renewables, rural communities would have access to benefits similar to those provided to NAS beneficiaries without the added cost of long-distance transmission.

The United States desperately needs to overhaul its energy systems,[10] and the NAS would help the United States reach goals of energy system resilience combined with cost and carbon reductions. Other than the overall carbon reduction, however, NAS benefits are unlikely to help those living in rural areas that face high energy burdens. This Note proposes that microgrids, rather than the NAS, provide a better solution for rural communities, and that regulatory changes to states' microgrid policies will assist in microgrid development. Part I provides an overview of the energy burden faced by rural communities and the current grid and regulatory system. Part II discusses the proposed NAS and microgrids and posits that microgrid systems are more beneficial to rural communities than the US's current system or the NAS. Part III considers Alaska's policies as a prototype for microgrid implementation in rural areas in the lower 48 states, and proposes that states can use their regulatory systems to reduce energy burden in these areas by (1) identifying and clearly defining important factors affecting microgrid implementation, (2) setting high renewable portfolio standards, (3) increasing financial investment, and (4) collaborating with other states and interest groups to share information.

I. The Need for Improvements

This Part I provides an overview of the U.S. grid system and regulation in Section A, followed by an examination of the high energy burden experienced by rural consumers in Section B, and concludes that the current sys-

9. The NAS would primarily be a transmission line with the purpose of moving energy long-distances; as a 52-node system, it is not designed to connect to step-down transformers to distribute energy at many points along its route. *See generally* Climate Inst., *supra* note 7. For a detailed explanation of how the grid functions refer to *How the Electricity Grid Works*, Union of Concerned Scientists, https://www.ucsusa.org/clean-energy/how-electricity-grid-works (last visited June 30, 2019).

10. Bayless & Petri, *supra* note 7.

tem fails to provide a method to address this burden. Part II explores two proposed solutions to ease the energy burden across the US, the North American Supergrid and microgrids, while changes to regulatory policy modeled after Alaska's policy is discussed in Part III.

A. *Overview of the Current Grid System*

1. The Grid

Unlike the U.S. highway system, the energy grid was developed slowly and piecemeal as local demand grew across the country.[11] What we now commonly call "the grid" is not one integrated system across the country, but a collection of systems, each containing three components: (1) generation facilities where power is created, (2) transmission lines carrying high-voltage electricity over long distances, and (3) local distribution where transformers "step-down" the power to a lower voltage to be carried through local distribution lines to buildings.[12] These three components combine to create local grids, which connect with a larger system of neighboring grids, forming large systems called "interconnections."[13]

Interconnections allow electricity to flow between smaller grids within the interconnection along multiple routes, creating redundancy that enables generators to supply electricity to various load centers (areas of electricity demand) even when more local systems are disabled or unavailable.[14] This networking and redundancy in the system helps prevent interruptions in service when a transmission line or power plant fails.[15]

In the US, three large interconnections connect smaller regional electricity grids: the Eastern Interconnection, Western Interconnection, and Electricity Reliability Council of Texas ("ERCOT") Interconnection.[16] These regional interconnections operate largely independent of one another.[17]

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11. *See* John Kemp, *The Fantasy of a U.S. Super-Grid*, REUTERS (Oct. 15, 2009), http://blogs.reuters.com/breakingviews/2009/10/15/the-fantasy-of-a-us-super-grid/.

12. *What Is the Grid? Explaining a Modern Engineering Marvel*, ENBRIDGE, https://www.enbridge.com/energy-matters/energy-school/grid-101 (last visited Dec. 10, 2018).

13. Sarah Hoff, *U.S. Electric System Is Made Up of Interconnections and Balancing Authorities*, U.S. ENERGY INFO. ADMIN. (July 20, 2016), https://www.eia.gov/todayinenergy/detail.php?id=27152.

14. *Id.*

15. *Id.*

16. IIYA CHERNYAKHOVSKIY ET AL., U.S. LAWS AND REGULATIONS FOR RENEWABLE ENERGY GRID INTERCONNECTIONS, NAT'L RENEWABLE ENERGY LABORATORY 2 (Sept. 2016), https://www.nrel.gov/docs/fy16osti/66724.pdf.

17. Hoff, *supra* note 13; OFFICE OF ELECTRICITY DELIVERY AND ENERGY RELIABILITY, U.S. DEP'T OF ENERGY, DOE/OE-0017, UNITED STATES ELECTRICITY INDUSTRY PRIMER 11 (July 2015), https://www.energy.gov/sites/prod/files/2015/12/f28/

Utilities are independent of, but operate within these interconnections. According to the U.S. Department of Energy, a utility is "a power company that generates, transmits, and distributes electricity for sale to customers."[18] Any one utility, however, does not need to provide all three functions.[19] Within the US, there are more than 3,200 utilities of varying types. Utilities can be investor-owned; not-for-profit public (sometimes called municipal utilities); cooperatives (not-for-profit entities owned by their members); federal power programs (e.g., the Tennessee Valley Authority), which are wholesale-only and provide electric service functions to other utilities; or independent power producers (non-utility generators), which are privately owned businesses.[20]

Sale and delivery of electricity takes one of two forms. Traditional state-regulated systems employ a vertically integrated model, where utilities are responsible for generation, transmission, and distribution in a specific geographical area.[21] Costs are monitored by a state's regulatory commission,[22] and utilities are granted a state-approved monopoly over their particular service areas.[23] This model is based on the idea that utilities are "natural monopolies" because of the interconnected nature of the system and the large amounts of capital investment required to build the system.[24] The second form treats electricity as a tradeable commodity,[25] including activity in wholesale and retail markets. In wholesale markets, electricity sales are regulated by FERC (with the exception of the ERCOT Interconnection). States regulate retail electricity rates.[26]

The Public Utility Regulation Policies Act ("PURPA"), enacted in 1978, was designed to encourage more efficient use of fuels by allowing non-utility generators to enter the wholesale power market. This disrupted the "natural monopoly" philosophy of utilities, and in 1992 Congress passed the Energy Policy Act ("EPACT"), which further supported a breakdown of vertically integrated models by opening access to interstate transmission

united-states-electricity-industry-primer.pdf [hereinafter U.S. ELECTRICITY INDUSTRY PRIMER]. A map of the interconnections is available from *Key Players*, N. AM. ELECTRIC RELIABILITY CORP., https://www.nerc.com/AboutNERC/keyplayers/Pages/default.aspx (last visited June 30, 2019).

18. U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 17, at 27.

19. *Id.*

20. *Id.* at 27–28.

21. *Id.* at 28.

22. *Id.* at 28.

23. Robert J. Michaels, *Electric Utility Regulation*, LIBR. OF ECON. & LIBERTY, http://www.econlib.org/library/Enc1/ElectricUtilityRegulation.html (last visited Dec. 16, 2018).

24. *Regulation Public vs. Private Power: From FDR to Today*, PBS FRONTLINE, https://www.pbs.org/wgbh/pages/frontline/shows/blackout/regulation/timeline.html (last visited Dec. 16, 2019).

25. U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 17, at 28.

26. *Id.* at 28–30.

networks to non-utility generators.[27] States began to consider whether the second, competitive approach to energy markets would lower costs to consumers, and in 1996 California and Rhode Island were the first states to pass deregulation legislation.[28] By November 2018, thirteen states and the District of Columbia had residential retail choice programs allowing customers to elect to purchase their electricity directly from their choice of energy suppliers, delivered by a local utility.[29]

2. Federal Regulatory Authority

Authority over interstate electricity transmission, as well as natural gas and hydropower projects, rests with FERC, an independent agency within the U.S. Department of Energy.[30] FERC uses regulatory and market means to obtain energy services at a reasonable cost to consumers, and promotes the development of energy infrastructure that serves the public interest.[31] FERC regulates the transmission and wholesale sales of electricity in interstate commerce; licenses and inspects private, municipal, and state hydroelectric projects; protects the reliability of the high-voltage interstate transmission system through mandatory reliability standards; monitors and investigates energy markets; enforces regulatory requirements; administers accounting and financial reporting regulations; and supervises the conduct of regulated companies, among other duties.[32]

However, FERC's authority was quite limited until The Energy Policy Act of 2005 expanded FERC's authority to enforce reliability regulations. After the Act, FERC designated the North American Electric Reliability Corporation ("NERC"), a nonprofit entity, to be the government's electrical reliability organization to oversee grid reliability and security.[33] NERC's role is to develop and enforce reliability standards, assess reliability, monitor the bulk power system, and educate industry personnel.[34] NERC audits power companies and levies fines for noncompliance under authority granted by FERC.[35]

27. *Regulation Public vs. Private Power: From FDR to Today*, *supra* note 24.
28. *Id.*
29. Kimberly Palacios, *Electricity Residential Retail Choice Participation Has Declined Since 2014 Peak*, U.S. ENERGY INFO. ADMIN. (Nov. 8, 2018), https://www.eia.gov/todayinenergy/detail.php?id=37452.
30. U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 17, at 24.
31. *Id.*
32. *Id.*
33. Alexandra B. Klass, *Expanding the U.S. Electric Transmission and Distribution Grid to Meet Deep Decarbonization Goals*, 47 ENVTL. L. REP. 10749, 10750 (2017); U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 17, at 25.
34. *About NERC*, N. AM. ELEC. RELIABILITY CORP., https://www.nerc.com/AboutNERC/Pages/default.aspx (last visited Dec. 14, 2018).
35. U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 17, at 25.

The US's bulk electric system consists of more than 360,000 miles of transmission lines connecting to about 7,000 power plants.[36] Individual utilities are responsible for coordinating and developing transmission plans, unless a territory is part of a regional transmission organization ("RTO") or an independent system operator ("ISO").[37] RTOs and ISOs are entities formed at the recommendation of FERC to operate the transmission system within a certain region.[38] Not all areas of the country are covered by RTOs or ISOs, and participation is optional.[39] Utilities that are not part of an RTO or ISO system are subject to FERC oversight, as are the RTOs and ISOs themselves. In areas that do participate, ISOs operate the electricity grid, administer the region's wholesale electricity markets, and provide reliability planning for the region's bulk electricity system.[40] RTOs perform these functions and also have greater responsibility for the transmission network, coordinating, controlling, and monitoring operation of the power system within their territory.[41] ISOs and RTOs gage their region's infrastructure needs and engage in region-wide planning. There are currently seven ISOs and four RTOs within North America.[42]

Despite FERC's significant regulatory power in interstate electricity markets and transmission, FERC does not control permitting, siting, or eminent domain authority.[43] FERC also does not regulate retail electricity sales, approve the construction of generation assets, regulate activities of nuclear power plants, or assess reliability problems related to distribution facilities.[44] These issues are left to the states.

3. State Regulatory Authority

State regulatory bodies assume a wide variety of roles, and numerous state agencies regulate the electric industry within each state. In general, states empower a Public Service Commission ("PSC") (also called a Public Utilities Commission or Public Corporation Commission, depending on the state) to regulate fair and reasonable rates for electric service.[45] PSCs also

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36. *Id.* at 13.

37. *Id.* at 25–26.

38. *Id.*

39. *See An In-Depth Look at Regional Transmission Organizations and Independent System Operators for Lawyers and Energy Professionals*, ENERGY BAR ASS'N, https://www.eba-net.org/assets/1/6/2012SpringSeminar.pdf (last visited June 30, 2019).

40. U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 17, at 25.

41. *Id.* at 25–26.

42. For a visual representation of the ISO/RTO areas, view *Regional Transmission Organizations (RTO)/Independent System Operators (ISO)*, FED. ENERGY REG. COMM'N, https://www.ferc.gov/industries/electric/indus-act/rto.asp (last updated Oct. 17, 2019).

43. *See Chernyakhovskiy et al.*, *supra* note 16, at 5. This is true for interstate transmission lines as well as those wholly intrastate.

44. U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 17, at 24.

45. *Id.* at 27.

adopt and enforce regulations protecting public interests and safety related to electric service, consider economic and environmental impacts of utility operations, ensure electric system reliability, and mediate disputes between utilities and customers.[46]

Outside of the states' PSCs, state departments of environmental protection are integral to the power system, especially when it comes to siting. These environmental protection departments regulate air, land, and water resources and provide permits for construction, discharges, and emissions by facilities.[47]

B. *Energy Burden in Rural Communities*

> *"I just got my bill—$368 in a month where we were traveling and no one was home. My bill runs $500 to $700 in the wintertime. I know people who have to decide between medicine and food and electricity. I know one gentleman who says he can only afford to run his refrigerator and one light bulb at a time."*
>
> —Gary Talarico,
> resident of rural Germfask Township in
> Schoolcraft County, Michigan[48]

1. Choices Between Food, Medicine, and Electricity

Approximately 16% of U.S. households are rural, spreading across 72% of the nation's land area.[49] This large swath of the country faces unique energy-cost challenges: transmission lines run for miles over varied terrain with little population to share the overhead cost.[50] Ability to share these

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46. *Id.*
47. *Id.*
48. Keith Matheny, *Power Bills Are Whoppers for Some in Michigan's U.P.*, DETROIT FREE PRESS (Sept. 8, 2016, 3:49 PM), https://www.freep.com/story/news/local/michigan/2016/09/07/power-outrage-electric-bills-upper-peninsula/89593302/. The population of Germfask Township was 486 at the 2010 U.S. Census, spread over an area of 71.6 square miles. *Profile of General Population and Housing Characteristics: 2010*, U.S. CENSUS BUREAU, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_DP_DPDP1&prodType=table (last visited Oct. 28, 2019); *Germfask Township, Schoolcraft County*, MICH. TOWNSHIPS ASS'N, https://www.michigantownships.org/twp_details.asp?fips=31940 (last visited Dec. 14, 2018).
49. LAUREN ROSS ET AL., THE HIGH COST OF ENERGY IN RURAL AMERICA: HOUSEHOLD ENERGY BURDENS AND OPPORTUNITIES FOR ENERGY EFFICIENCY 2 (July 2018), https://aceee.org/sites/default/files/publications/researchreports/u1806.pdf.
50. *Id.* at 30–31; Matheny, *supra* note 48.

costs is important, as a typical new 69 kV line costs approximately $285,000 per mile.[51]

Michigan's remote Upper Peninsula is representative of this problem. In this area, one of the local power companies, Upper Peninsula Power Company ("UPPCO"), services 54,000 customers over 4,460 square miles—about 12 customers per square mile,[52] an area over four times the size of Rhode Island but with only 0.051% of the population. Energy costs in UPPCO's regions are 67% higher than the Michigan average.[53] In some areas of the Upper Peninsula, energy costs are so high that grid defection[54] is economically viable.[55]

Remoteness creates vulnerability. Outages can occur anywhere along the extensive transmission lines, and last longer and occur more frequently than in more populated areas.[56] Three factors contribute to the frequency and duration of outages in rural areas: (1) remote areas are often serviced radially by a single transmission supply line, (2) rural communities lack transmission backup connections and cannot build them because of geographical features or cost constraints, and (3) field crews have to travel the entire length of the supply line (which can be hundreds of miles) to find the problem.[57] Simply put, rural communities lack the networking and redundancy that ensures energy reliability in more populated areas.

The higher energy cost is further exacerbated by socioeconomic factors. 41% of households in rural areas have incomes below 200% of the federal poverty level ($49,200 for a family of four in 2017),[58] meaning that a great portion of a family's income is dedicated to energy bills. The percentage of household income spent on energy bills is called the energy burden.[59] Economists estimate that an energy burden of 6% is affordable,[60] but low-income rural residents shoulder a median energy burden of 9%—with some areas as

51. Frank Alonso & Carolyn A.E. Greenwell, *Underground vs. Overhead: Power Line Installation-Cost Comparison and Mitigation*, ELECTRIC LIGHT & POWER (Feb. 1, 2013), https://www.elp.com/articles/powergrid_international/print/volume-18/issue-2/features/underground-vs-overhead-power-line-installation-cost-comparison-.html.

52. *What We Do*, UPPER PENINSULA POWER COMPANY, (Oct. 15, 2019, 7:35 PM), https://www.uppco.com/did-you-know/what-we-do/.

53. Matheny, *supra* note 48.

54. Grid defection means completely disconnecting from the main power grid, usually to use a locally generated power source with storage (i.e. solar panels and battery system).

55. Kantamneni et al., *supra* note 4, at 379.

56. Huijuan Li et al., *National Grid Microgrid Feasibility Evaluation: Case Study of a Rural Distribution Feeder*, IEEE PES GENERAL MEETING (July 2014), https://ieeexplore.ieee.org/document/6939569.

57. *Id.*

58. ROSS ET AL., *supra* note 49, at 3.

59. *Id.* at 2.

60. Dan Boyce & Jordan Wirfs-Brock, High Utility Costs Force Hard Decisions for the Poor, INSIDE ENERGY (May 8, 2016), http://insideenergy.org/2016/05/08/high-utility-costs-force-hard-decisions-for-the-poor/.

high as 15%—among the highest energy burden in the country.[61] This burden means that nearly one-third of rural households face energy insecurity and are often forced to decide whether to pay for food, medicine, or electricity.[62]

High energy burdens and frequent power outages are clear signs that our current energy system is failing low-income rural residents. Accordingly, Part II describes two potential solutions to boost energy equity: the proposed North American Supergrid ("NAS") and microgrids.

II. Big Grids and Little Grids

Reducing the cost of energy generation, transmission, and distribution lowers the energy burden for consumers. Part II.A discusses a recently proposed, nationwide solution to reduce energy costs and increase the use of renewable energy, the NAS, but finds that the NAS will not reduce the energy burden for rural consumers. Part II.B considers the effect of microgrids on energy-burdened rural communities and ultimately concludes that microgrids could reduce the energy burden in rural areas, but that policy changes are needed for effective implementation. Part II.C discusses microgrid policy hurdles, and Part III delves into potential solutions modeled after Alaska's policies.

A. *The Proposed North American Supergrid Transmission System*

Generating cheap energy is one thing, but distributing it is another. Although wind and solar power generation have become affordable sources of energy,[63] such resources are concentrated outside of major demand areas on the coasts. For example, solar generation tends to be very strong in the Southwest and the wind consistently strong in the Great Plains. The current grid was created for local generation and distribution, and it is not designed for the type of long-distance transmission needed to move renewable energy thousands of miles. As a result, renewable energy resources remain underemployed.[64]

One way to use these resources more effectively is to link demand at the coasts with generation elsewhere through the NAS. The NAS[65] is a proposed high-voltage, direct-current, and largely underground transmission

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61. Ross et al., *supra* note 49, at 3. This figure does not include Alaska, whose figures will be discussed in Part III.

62. *Id.* at 6.

63. Irina Ivanova, *How Wind and Solar Became America's Cheapest Energy Source*, CBS News: MoneyWatch (Apr. 22, 2019, 5:00 AM), https://www.cbsnews.com/news/americas-cheapest-energy-source-wind-and-solar-power/.

64. Climate Inst., *supra* note 7, at 7.

65. The NAS concept described by the Climate Institute is based on research summarized in the MacDonald et al. publication released in 2016 in *Nature Climate Change*. *Id.* at 5.

network that would overlay the existing regional alternating current distribution system, extending across the lower 48 states.[66] The NAS would allow clean renewable energy to reach population centers, decrease electricity prices, and reduce blackouts.[67] It is estimated that the NAS would reduce power-sector carbon emissions by 80%—no small drop in the bucket, as the electric power sector is the US's largest source of carbon dioxide emissions[68]—and reduce power sector fresh water usage by 65%, while increasing system resiliency to natural disasters and electromagnetic disturbances.[69]

Because of its length, the NAS would reduce the effects of the inherent variability of renewable generation, which can be a serious problem for the grid. As one regulatory specialist noted, "Wind is a wild child. . . . Wind does as it pleases. You don't know when the wind is going to blow. You don't know how long it's going to blow. It's unpredictable, it's variable, it's all over the place."[70] By linking the three independent interconnections, however, the NAS would combine different types of variable generation over a very large geographic area, smoothing variability across the whole system.[71] This would also help with renewable generation mismatch between renewable supply and energy demand.[72] For instance, the NAS could make solar power from westerly sources available on the Eastern Seaboard during the evening peak, when the east's own solar generation is declining as the sun sets.[73]

Despite these benefits, implementing the NAS would require the United States to overcome serious obstacles. Interestingly, some of the most significant barriers of such a massive system are not technological but regulatory.[74] The NAS would require many unpopular adjustments to our current

66. *Id.*

67. Wald, *supra* note 6, at 57.

68. *See* U.S. EPA, EPA 430-R-16-002, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2014, at ES-10 fig.ES-6 (2016), https://19january2017snapshot.epa.gov/sites/production/files/2016-04/documents/us-ghg-inventory-2016-main-text.pdf.

69. CLIMATE INST., *supra* note 7, at 5–6.

70. Rachel Waldholz, *Kodiak Has Almost 100 Percent Renewable Power. It Took Some Sci-fi Tech to Get There.*, KTOO PUB. MEDIA (Sept. 15, 2017) (quoting regulatory specialist Jennifer Richcreek), https://www.ktoo.org/2017/09/15/kodiak-almost-100-percent-renewable-power-took-sci-fi-tech-get/.

71. *See Continental Power: Operating the Super Grid*, POWER TECH. (Feb. 23, 2015), https://www.power-technology.com/features/featurecontinental-power-operating-the-super-grid-4512977/.

72. *See* Earl Ritchie, *Managing Wind and Solar Intermittency in Current and Future Systems*, FORBES (Feb. 27, 2017, 6:14 PM), https://www.forbes.com/sites/uhenergy/2017/02/27/managing-wind-and-solar-intermittency-in-current-and-future-systems/#60a9b36d3c5d.

73. For a description of energy periods throughout the day, see *Demand for Electricity Changes Through the Day*, U.S. ENERGY INFO. ADMIN. (April 6, 2011), https://www.eia.gov/todayinenergy/detail.php?id=830.

74. Christopher Gillespie & Emmanuel Taylor, *State Regulatory and Policy Considerations for Increased Microgrid Deployment*, NAT'L ELECTRICAL MANUFACTURERS ASS'N

system. Issues including environmental siting concerns, eminent-domain authority for siting, project oversight, market structure, and cost allocation must be resolved for effective implementation of the NAS.[75] If the NAS were able to overcome these barriers, it would provide cheaper, cleaner energy to the most populous areas of the country.[76]

While the NAS promises great improvements for populated areas, it offers little help for most rural communities.[77] Although energy generation would likely be cleaner and cheaper, the problems of transmission costs, single service line reliability issues, and low population density for cost-sharing would remain. In contrast, microgrids offer solutions to these problems that would reduce the energy burden on rural communities.

B. *Microgrids*

1. Overview of Microgrids

The U.S. Department of Energy defines microgrids as "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid."[78] In short, microgrids are small grids. Microgrids can either act as part of a larger macrogrid, with the ability to disconnect as needed to operate autonomously in "island mode," or operate fully independent of the macrogrid as "islanded" units.[79]

Microgrids are reminiscent of the US's early power system: small and localized systems of power generation and distribution, essentially the opposite of the proposed NAS. While the NAS would move renewables long distances, microgrids can generate and distribute energy locally. Municipal utilities, originally stand-alone systems, did not begin forming the macrogrid until interconnection became less expensive and more reliable than local generation and distribution.[80] With the advent of localized, *renewable* generation, however, microgrids may provide a better solution for rural communities facing high transmission costs and low reliability.

(Jan. 2018), https://www.nema.org/Standards/ComplimentaryDocuments/MGRD%20R2-2018%20contents%20and%20scope.pdf.

75. Klass, *supra* note 8, at 1916.

76. CLIMATE INST., *supra* note 7, at 47.

77. The current proposed NAS is set to have 52 nodes, where local grids can connect into the larger system, and those nodes may not be placed in a way that could benefit these communities, even if the NAS is running through their backyard. *See* CLIMATE INST., *supra* note 7, at 8.

78. Dan T. Ton & Merrill A. Smith, *The U.S. Department of Energy's Microgrid Initiative*, ELECTRICITY J., Oct. 2012, at 84, https://www.energy.gov/sites/prod/files/2016/06/f32/The%20US%20Department%20of%20Energy's%20Microgrid%20Initiative.pdf.

79. Li et al., *supra* note 56, at 1.

80. Kennedy Maize, *Microgrids: An Old Concept Could Be New Again*, POWER (Aug. 1, 2017), https://www.powermag.com/microgrids-an-old-concept-could-be-new-again/.

2. Usefulness for Rural Communities

Outages in rural areas tied to the larger grid occur more frequently and last longer than outages in densely populated areas for several reasons. First, many remote areas are fed radially by a single transmission supply line.[81] If that line is damaged, the community becomes stranded. Second, remote communities are often situated in locations that make access to backup transmission resources cost-prohibitive due to distance or some physical barrier, such as a mountain.[82] Third, field crews must travel to the remote location and patrol the entire supply line—which can be hundreds of miles—to find the cause of the interruption.[83] A solution to these transmission-related problems, and to the high cost of long-distance transmission, is to operate microgrids with locally produced (generated) energy.

Local energy can be created with fossil fuels, but pairing renewable-energy generation with microgrids reduces or eliminates fuel costs while also reducing greenhouse gas and particulate emissions. Moreover, rapidly advancing energy storage technology provides a solution to the intermittency issues caused by renewable generation,[84] and many rural communities are already implementing a variety of creative renewable generation strategies in an effort to reduce costs. These strategies include: (1) traditional hydro, wind, and solar generation, (2) combination systems like combined heat and solar,[85] and (3) new technologies like geothermal generation using abandoned mine water.[86]

Due to modern technological advancements, renewable energy generation is no longer confined to areas of greatest productivity. Researchers are now pushing the perceived boundaries of renewable generation in places like Alaska, where consumers rely on power from wind, solar, biomass, geothermal, hydroelectric, and hydrokinetic generation.[87]

Microgrids can be a useful way for rural communities to improve reliability and manage the costs of transmission and fuel, whether or not the NAS comes to fruition, because microgrids solve the problem of a single, long-distance supply line. But legal regulatory hurdles remain, limiting implementation and keeping the rural energy burden high.

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81. Li et al., *supra* note 56, at 1.
82. *Id.*
83. *Id.*
84. Maize, *supra* note 80.
85. *See, e.g.*, Kantamneni et al., *supra* note 4, at 397.
86. *See* Allison Mills, *Tapping into Mine Water for Geothermal Energy*, MICH. TECH NEWS (Apr. 2, 2015, 11:56 AM), https://www.mtu.edu/news/stories/2015/march/tapping-into-mine-water-for-geothermal-energy.html.
87. *See* E. Whitney, *Alaska Microgrids Offer Energy Resilience and Independence*, AIP PUB., (Dec. 21, 2017), https://publishing.aip.org/publishing/journal-highlights/alaskan-microgrids-offer-energy-resilience-and-independence; ALASKA ENERGY AUTHORITY, RENEWABLE ENERGY ATLAS OF ALASKA 6–17 (Apr. 2016) [hereinafter RENEWABLE ENERGY ALASKA PROJECT].

C. *Microgrid Policies*

1. Federal Policies

As far back as 2001, NERC informed Congress that the US's grid was not designed to carry large blocks of power from one region to another in the manner used today.[88] Yet it took six years before Congress enacted the Energy Independence and Security Act of 2007 ("EISA").[89] EISA recognized a need to update the power grid system, and, though microgrids are not specifically mentioned, the statute included policy goals tied to microgrid development:

> It is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of the following, which together characterize a Smart Grid:
>
> (1) Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid.
>
> (2) Dynamic *optimization of grid operations and resources*, with full cyber-security.
>
> (3) *Deployment and integration of distributed resources and generation, including renewable resources*. . . .
>
> (7) *Deployment and integration of advanced electricity storage and peak-shaving technologies*, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning. . . .
>
> (9) Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, *including the infrastructure serving the grid*.

88. *See Hearing Before the S. Comm. on Energy and Natural Resources*, 108th Cong. 6 (May 15, 2001), (statement of David N. Cook, Gen. Counsel, N. Am. Elec. Reliability Council).

89. Energy Independence and Security Act of 2007, 42 U.S.C. §§ 17381–17386 (2018).

> (10) Identification and *lowering of unreasonable or unnecessary barriers* to adoption of smart grid technologies, practices, and services.[90]

Emphasis added. EISA's goals align with the use of microgrids as a type of renewable, distributed generation infrastructure. Eleven years later, however, microgrids still face federal and state regulatory barriers. As of the date of this Note, comprehensive energy policy changes for microgrids were most recently introduced in Senate Bill S.1460 - Energy and Natural Resources Act of 2017, but the bill died in the Senate.[91]

Microgrids, especially islanded microgrids, fall under state authority unless they are in some way connected to interstate commerce. Nevertheless, federal policies can still influence and assist microgrid deployment. First, for microgrids under FERC's jurisdiction, FERC could consider policies enhancing integration and communication between the larger grid and state-centered microgrids. For instance, former FERC Chairman Jon Wellinghoff has championed the creation of "independent distribution systems operators ("IDSOs")" as a way to streamline FERCs policy regarding microgrids.[92] Under the IDSO model, and similar to ISO functions for transmission, utilities would continue to own the distribution poles and wires but surrender the actual planning and operation of the system to the IDSO. The IDSO model could allow utilities to grow revenue through partnerships with distributed energy resources ("DERs"), potentially increasing the utilities' acceptance of distributed generation.[93]

Second, the federal government could provide tax incentives to encourage microgrid development. For instance, extending the deduction of the Business Energy Investment Tax Credit ("ITC"), which is currently 30% but reduces to 10% after 2021, would continue an incentive for commercial, industrial, utility, and agricultural sectors to invest in renewable energy equipment.[94] The Modified Accelerated Cost-Recovery System ("MACRS"), a system allowing businesses to recover investments in equipment for renewable generation through enhanced depreciation deductions (currently at 50% bonus depreciation), expires in 2019 but could be extended.[95] Additionally, the Rural Energy for America Program ("REAP") provides small businesses with grants and loan guarantees for energy effi-

90. *Id.* § 17381 (emphasis added).
91. *See* S. 1460, 115th Cong. (2017).
92. Klass, *supra* note 33, at 10763.
93. *See* Gavin Bade, *Who Should Operate the Distribution Grid?*, UTILITY DIVE (Mar. 19, 2015), https://www.utilitydive.com/news/who-should-operate-the-distribution-grid/376950/.
94. *Business Energy Investment Tax Credit (ITC)*, DSIRE (Mar. 1, 2018), http://programs.dsireusa.org/system/program/detail/658.
95. *Modified Accelerated Cost-Recovery System (MACRS)*, DSIRE (Aug. 21, 2018), http://programs.dsireusa.org/system/program/detail/676.

ciency improvements and renewable energy systems.[96] Expanding REAP eligibility to include nonprofits, like municipal or cooperative utilities, could help these entities invest in microgrid development.

Third, imposing carbon taxes, or removing subsidies from fossil fuel production, could level the price-playing field, making microgrids with renewable generation more attractive. In 2014, the International Energy Agency estimated that fossil fuel consumption subsidies totaled $493 billion, with oil product subsidies accounting for about half of that total. These fossil fuel subsidies are four times the value of the subsidies to renewable energy.[97]

Fourth, the federal government could also fund additional research and development on microgrids, including research on adapting the US's current system to more localized generation and islanding capabilities for rural areas. Federal officials have already taken some steps in this direction. In 2017, the U.S. Department of Energy announced $32 million in funding to the Grid Modernization Laboratory Consortium for the purposes of advancing resilient distribution systems and developing clean DERs, such as microgrids.[98]

Finally, a strong national renewable energy mandate that sets high goals for the proportion of renewables in the country's fuel mix could also provide an incentive for microgrid development. Without active state participation, however, this will only take the United States so far—especially in cases of islanded microgrids that are completely outside of FERC's jurisdiction.[99]

2. State Policies

Most states lack a clear set of regulations and incentives for microgrid development, and most do not have a legal definition for microgrids.[100] Additionally, laws on siting, right-of-ways, ownership structures and taxes vary considerably among the states.[101] In some cases, archaic existing laws intended to protect consumers may unintentionally hinder microgrid development. For example, in 2016 the Maryland Public Service Commission

96. *USDA – Rural Energy for American Program (REAP) Grants*, DSIRE (Aug. 21, 2018), http://programs.dsireusa.org/system/program/detail/917.

97. RENEWABLE ENERGY ALASKA PROJECT, *supra* note 87, at 22.

98. *Resilient Distribution Systems Lab Call Awards*, U.S. DEP'T OF ENERGY, https://www.energy.gov/grid-modernization-initiative-0/resilient-distribution-systems-lab-call-awards (last visited Dec. 17, 2019).

99. An argument could be made that FERC's jurisdiction extends to fully islanded microgrids because, in the aggregate, such microgrids would certain have an effect on interstate commerce.

100. Doug Vine et al., *Microgrid Momentum: Building Efficient, Resilient Power*, CTR. FOR CLIMATE & ENERGY SOLS. 2 (Mar. 2017), https://www.c2es.org/site/assets/uploads/2017/03/microgrid-momentum-building-efficient-resilient-power.pdf.

101. *Id.* at 2–14.

("PSC") rejected a proposal to build two microgrids. The PSC's reasoning was based in part on Maryland's 1999 Electric Customer Choice and Competition Act.[102] Although that statute was enacted to "provide economic benefits for all customer classes,"[103] the commission found that microgrids restrained a consumer's right to exercise retail choice when the microgrids were in island mode, thus violating the consumer choice provision of the Act.[104] When drafted two decades ago, the Act did not anticipate the unique market position of microgrids. As a result, Maryland's potential for microgrid implementation is now severely limited.

Despite varying state laws, all U.S. state jurisdictions have three main policy areas that can limit microgrid deployment and create issues for rural areas hoping to take advantage of microgrids: (1) low or non-existent renewable portfolio standards ("RPSs");[105] (2) failure of states to define, promote, incentivize, or mandate microgrids;[106] and (3) insecurity among developers unsure of volatile regulatory and incentive structures.[107] Although several states are leaders in removing certain barriers—California, for example, has a very high renewable portfolio standard—no state has been as successful as Alaska in developing microgrids. In fact, Alaska tackles all three problem areas, and its policies can be adapted to work for rural communities in the lower 48 states.

III. Prototype and Application

Part III considers Alaska as an experienced player in the microgrid regulatory space and suggests that other states can follow Alaska's example to reduce their own rural residents' energy burdens. Part III.A discusses Alaska's regulations and how the state's rugged terrain led to policies that naturally supported a microgrid-friendly regulatory environment. Part III.B explores the key aspects of Alaska's policies, which can be used by other states to improve microgrid usage and reduce the energy burden on their own rural residents.

102. *In re* Baltimore Gas & Elec. Co.'s Request for Approval of Its Pub. Purpose Microgrid Proposal, Order 87669, No. 9416, 2016 WL 3941469, at *9 (Md. P.S.C. July 19, 2016).

103. Electric Customer Choice and Competition Act, Md. Code Ann., Pub. Util. § 7-504 (West 2018).

104. *In re* Baltimore Gas & Elec. Co.'s Request, 2016 WL 3941469, at *9.

105. *State Regulatory and Policy Considerations for Increased Microgrid Deployment*, Nat'l Elec. Manufacturers Ass'n (Jan. 2018), https://www.nema.org/Standards/ComplimentaryDocuments/MGRD%20R2-2018%20contents%20and%20scope.pdf [hereinafter NEMA State Policy Primer]; *State Renewable Portfolio Standards and Goals*, Nat'l Conf. of St. Legislatures (Feb. 1, 2019), http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx.

106. NEMA State Policy Primer, *supra* note 105; *Microgrids*, Ctr. for Climate & Energy Sols., https://www.c2es.org/content/microgrids/ (last visited July 1, 2019).

107. NEMA State Policy Primer, *supra* note 105, at iv.

A. *Alaska as a Microgrid Leader*

Alaska is home to 12% of the world's microgrids and 40% of the world's rural integrated system microgrids, making it the global leader in microgrid deployment.[108] With around 250 independent microgrids,[109] Alaska's microgrids have an 800-megawatt capacity, also the largest in the world.[110] It is a state of extremes, as one reporter put it: "[b]ig state, big energy costs, and big consumption—Alaska has it all! Small population, small microgrids, and small barriers to market access—these, too, Alaska has."[111]

Although most of these microgrids are fueled by diesel,[112] Alaska is working on renewable implementation, with around half of the communities in Alaska incorporating renewables in their diesel-based generation capacity.[113] The state has an economic reason for investing in renewables: energy prices in Alaska's rural areas can run $1.00/kWh, compared to the $0.12/kWh median in the lower 48 states, and renewables lower the bill substantially.[114]

Even though Alaska is still working to add more renewables overall, there is no question that the state has been successful with microgrid deployment. Alaska's success is a product of several factors, including: clear, microgrid-friendly policies; thoughtful addition of renewables with high renewable portfolio goals; significant financial investment; and collaboration between government and private party stakeholders, universities, and researchers.

1. Clear Policies

Many of Alaska's rural communities are not accessible by road, only by water or air. Some are so remote that they can only have fuel delivered once or twice a year, when the ice melts enough to allow a barge to move up riv-

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108. Elisa Wood, *Could Alaska's Microgrids Seed the Globe?*, MICROGRID KNOWLEDGE (Oct. 10, 2017), https://microgridknowledge.com/alaska-microgrid/; *REAP Accomplishments*; RENEWABLE ENERGY ALASKA PROJECT, http://alaskarenewableenergy.org/index.php/focusareas/accomplishments/ (last visited Dec. 17, 2018).

109. Michael Houlihan & Bonnie Harvey, *Alaska Is Offering Entrepreneurs a Huge Renewable Energy Opportunity*, ENTREPRENEUR (July 29, 2018), https://www.entrepreneur.com/article/317081.

110. Erica Martinson, *Alaska's Rural Energy Microgrids Offer a Prototype for Powering the World*, ANCHORAGE DAILY NEWS (Feb. 15, 2016), https://www.adn.com/energy/article/alaskas-microgrids-offer-prototypye-powering-world/2016/02/15/.

111. Houlihan & Harvey, *supra* note 109.

112. Diesel generates 90% of electricity in the rural community. Martinson, *supra* note 110.

113. *Id.*

114. Koty Neelis, *Alaska Offers Renewable Energy Opportunities in an Unlikely Place,* GREEN MATTERS (July 2018), https://www.greenmatters.com/renewables/2018/08/02/Z2AYGL/alaska-entrepreneurs-renewable-energy-opportunity-.

er.[115] Given that long-distance transmission lines were (and still are) out of the question for these communities, microgrids offered the only power solution.[116] Perhaps because Alaska's microgrids and energy policy developed simultaneously, the state does not explicitly define microgrids as a separate item; rather, the inclusive language in Alaska's administrative code simply encompasses microgrids.[117] In that sense, Alaska's energy regulations were born with—and grew up with—microgrids.

These microgrids are largely operated by Alaska's sixteen electric cooperatives; only four of the sixteen are part of Alaska's single macrogrid, known as the "Railbelt."[118] The rest of the cooperatives are spread among Alaska's rural areas. Importantly, electric cooperatives must receive at least 85% of their income from their members to maintain their federal tax-exempt status.[119] Thus, it can be problematic for cooperatives in deregulated states to maintain their tax-exempt status because they must compete with other power providers for customers, relying more heavily on grants and loans—which are classified as non-member income—to fill income gaps.[120] Alaska, which remains regulated and where cooperatives service isolated areas, avoids this competition.[121]

Under the Alaska Public Utilities Regulatory Act, the definition of "utility" is expansive and includes a variety of electricity ownership models:

> 'public utility' or 'utility' includes every corporation whether public, cooperative, or otherwise, company, individual, or association of individuals, their lessees, trustees, or receivers appointed by a court, that owns, operates, manages, or controls any plant, pipeline, or system for

115. *Alaskan Microgrids Offer Energy Resilience and Independence*, *supra* note 87 ("Some communities are so remote that they can only get fuel delivered once or twice a year when the ice melts and a barge can move up the river.") (quoting Erin Whitney, a researcher at the Alaska Center for Energy and Power).

116. Cathy Cash, *The Transforming Grid: Microgrids on the Rise, from AVEC to Ocracoke to Innovation Pointe*, NAT'L RURAL ELECTRIC COOPERATIVE (Feb. 27, 2018) ("The local microgrid is the only option we have to serve these communities.") (quoting Meera Kohler, CEO of Alaska Village Electric Cooperative), https://www.cooperative.com/remagazine/articles/Pages/electric-co-op-transforming-microgrid.aspx.

117. *See, e.g.*, ALASKA ADMIN. CODE tit. 3, § 52.500 (West 2018).

118. Derrill Holly, *Are Microgrids the Wave of the Future?*, AM.'S ELECTRIC COOPERATIVES (June 29, 2017), https://www.electric.coop/microgrids-potential-for-alaska-power/.

119. 26 U.S.C. § 501 (2012).

120. *See* Erin Kelly, *Bipartisan Bill Would Protect Co-ops from Losing Tax-Exempt Status*, AM.'S ELECTRIC COOPERATIVES (Apr. 4, 2019), https://www.electric.coop/bipartisan-bill-would-protect-co-ops-from-losing-tax-exempt-status/.

121. *See* Alaska Public Utilities Regulatory Act, ALASKA STAT. ANN. §§ 42.05.141-42.05.995 (West 2018).

> (A) furnishing, by generation, transmission, or distribution, electrical service to the public for compensation[.][122]

Alaska's regulatory commission "may exempt a utility, a class of utilities, or a utility service from all or a portion of [the Alaska Public Utilities Regulatory Act] if the commission finds that the exemption is in the public interest."[123] In addition, electric cooperatives may *elect* to be exempt from of portions of the Act.[124] With so many of Alaska's microgrids administered by cooperatives, this is a useful provision to reduce costs of microgrid implementation, management, and development.

Additionally, Alaska has devoted an entire chapter of its code to rural and statewide energy programs.[125] This chapter establishes a rural electrification revolving loan fund to extend new electric service into an area served by a utility under a certificate of public convenience and necessity.[126] It also provides power cost equalization to both regulated utilities and non-regulated utilities (generally cooperatives),[127] grant funding for utility improvements,[128] and grant funding for renewable energy projects.[129]

Alaska may have developed a microgrid policy early on out of necessity, but these policies allow investors and developers, whether public or private, to anticipate the costs and impacts of their projects without the fear that policy ambiguity will upset their efforts. This regulatory framework provided the support needed to allow microgrids to develop.

2. Adding In Renewables

Most of Alaska's microgrids run on diesel fuel, but with uncertain diesel prices and the energy burden of some rural communities at a whopping 47%, Alaska is now actively developing and promoting the integration of renewables into its microgrids.[130] Alaska's declaration of state energy policy "encourage[s] economic development by promoting the development of renewable and alternative energy resources, including geothermal, wind, solar, hydroelectric, hydrokinetic, tidal, and biomass energy, for use by Alaskans."[131]

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122. *Id.* § 42.05.990(6)(A).
123. *Id.* § 42.05.711(d).
124. *Id.* § 42.05.711(h).
125. *Id.* § 42.45.010-.990.
126. *Id.* § 42.45.020(b).
127. *Id.* § 42.45.170.
128. *Id.* § 42.45.180.
129. *Id.* § 42.45.045.
130. Will Swagel, *Lowering the Cost of Rural Energy*, ALASKA BUS., Sept. 2014, at 8, 8; Derek Minemyer, *Why Gas Prices Are So High in the Last Frontier*, KTUU-TV (Dec. 30, 2018). https://www.ktuu.com/content/news/Remembering-why-gas-prices-are-so-high-in-the-Last-Frontier-503690871.html.
131. ALASKA STAT. ANN. § 44.99.115(2)(A) (West 2018).

In 2008, Alaska passed House Bill 152, establishing the Renewable Energy Fund, administered through the Alaska Energy Authority and discussed more fully below. In 2017, Alaska also passed a joint resolution "[u]rging the Alaska delegation in Congress to implement a renewable energy testing program in the state; supporting the development and testing of renewable energy resources in the state; and encouraging entrepreneurs to develop renewable energy projects in the state."[132] The resolution cites high energy prices, Alaska's "hundreds of isolated, remote microgrids that provide a unique opportunity to test integration of renewable and nonrenewable generation resources," and the legislature "encourages entrepreneurs to develop renewable energy projects in the state."[133]

With this background support, some Alaskan communities are now hitting high renewable generation targets. For example, Kodiak—the nation's second-largest fishing port—is at nearly 100% renewable generation.[134] Faced with rising diesel costs, the local electric cooperative implemented a target of 100% renewable energy in 2007 and hit the mark within the decade. Kodiak now employs an impressive combination of hydro, wind, and flywheel generation combined with batteries to power its islanded microgrid.[135]

3. High Renewable Portfolio Standards

Alaska passed House Bill 306 in 2010, establishing a large renewable portfolio goal: 50% by 2025.[136] Admittedly, Alaska's goal is non-binding, and 24.9% of its energy portfolio is already composed of renewable energy from hydroelectric sources. Still, the goal is double Alaska's current renewable generation, demonstrating the state's commitment to increasing its use of renewables throughout its energy system and further paving the way for clean microgrid investment.

4. Financial Investment

Over the past ten years, Alaska has invested nearly a billion dollars in microgrid technology.[137] Alaska itself has provided $250 million during that time for microgrid development, more than any other state government.[138] In 2008, the Alaska Legislature created the Renewable Energy Fund, appropri-

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132. H.R. J. Res. 18, 30th Leg., 1st Sess. (Alaska 2017).
133. *Id.*
134. Rachel Waldholz, *How the Second-Busiest U.S. Fishing Port Is Powered by Wind and Water*, PBS NEWSHOUR (Nov. 1, 2017), https://www.pbs.org/newshour/show/how-the-second-busiest-u-s-fishing-port-is-powered-by-wind-and-water.
135. *Id.*
136. H.B. 306, 26th Leg. (Alaska 2010); Laws Martinson, *supra* note 110; RENEWABLE ENERGY ALASKA PROJECT, *supra* note 87, at 10, 25.
137. Martinson, *supra* note 110.
138. Whitney, *supra* note 87; Wood, *supra* note 108.

ating $50 million a year for five years to develop renewable energy projects, with a focus on areas with the highest energy costs.[139] The Fund was extended through 2023 and has provided assistance on 287 projects, displacing 30 million gallons of diesel fuel and reducing energy prices.[140]

The benefit-cost ratio of Alaska's renewable energy projects is 2.5, affording the state a great return on its investment.[141] This investment, combined with high renewable portfolio standards, provides an attractive, stable atmosphere for renewable-based microgrid development.[142] Moreover, Alaska recently secured another $6.2 million in funding from the U.S. Department of Energy for a microgrid resilience project, termed Resilient Alaskan Distribution System Improvements using Automation, Network Analysis, Control, and Energy Storage ("RADIANCE").[143] These investments demonstrate that microgrids are clearly a priority for Alaska. As one Alaskan puts it: "It seems ironic that Alaska, known in the lower 48 for its oil pipeline, would now be promoting alternative energy. We like to say, 'If you want to make a change, put a buck on it!'"[144]

5. Collaboration

Collaboration among the various public and private sectors is also an important part of Alaska's success with microgrids, and Alaska is involved in several key partnerships that place renewable energy and microgrids at the forefront of state policy. The Renewable Energy Alaska Project ("REAP"), for example, is "a coalition of large and small Alaska utilities, businesses, conservation and consumer groups, Alaska Native organizations, and municipal, state and federal entities with an interest in developing Alaska's vast renewable energy resources."[145] REAP works to promote Alaska as a world leader in remote, renewable microgrids, and helped craft Alaska House Bill 306 (setting renewable energy goals at 50% by 2025).[146] Working in conjunction with the Island Institute in Maine, REAP is a

139. RENEWABLE ENERGY ALASKA PROJECT, *supra* note 87, at 18.
140. *Id.* (figures as of 2016).
141. *Id.* at 18.
142. *See id.* at 23.
143. Naomi Klouda, *Energy Dept. Grant Aims to Harden Microgrids*, ALASKA J. COM. (Oct. 4, 2017, 12:15 PM), http://www.alaskajournal.com/2017-10-04/energy-dept-grant-aims-harden-microgrids#.XBfNfGhKg2w.
144. Michael Houlihan & Bonnie Harvey, *Alaska Is Offering Entrepreneurs a Huge Renewable Energy Opportunity*, ENTREPRENEUR (July 29, 2018), https://www.entrepreneur.com/article/317081.
145. *About Renewable Energy Alaska Project (REAP)*, RENEWABLE ENERGY ALASKA PROJECT, http://alaskarenewableenergy.org/index.php/about-reap/ (last visited Dec. 17, 2018).
146. H.B. 306, 26th Leg. (Alaska 2010); RENEWABLE ENERGY ALASKA PROJECT, *supra* note 108.

founder of the Islanded Grid Resource Center, which connects islanded microgrid communities with valuable information and resources.[147]

In addition, the state has invested in Launch Alaska, a non-profit, startup incubator with a focus on energy. Launch Alaska receives funding from the U.S. Department of Defense, the U.S. Air Force, and the city of Anchorage, among others.[148] The incubator expects microgrid technology to be the focus of at least half of the thirty energy-related companies it plans to foster over a two-year period.[149]

Alaska is also working with the U.S. Department of Energy on the Alaska Microgrid Partnership, which has received $1.8 million in funding "to reduce diesel fuel consumption by 50% in Alaska's remote microgrids without increasing system lifecycle costs, while improving overall system reliability, security, and resilience."[150] This partnership brings in heavy hitters from the research world, including the National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, University of Alaska Fairbanks, REAP, Intelligent Energy Systems, and the Institute for Social & Economic Research.[151] These collaboration projects form an integral part of Alaska's overall energy policy, signaling Alaska's commitment to continued development of its microgrid system.

B. *Application for the Lower-48 States*

> *"Some of the most significant barriers to microgrid deployment are created by policy and regulatory environments that were not designed to enable microgrids."*
>
> —National Electrical Manufacturers Association[152]

1. Definitive Microgrid Policy Considerations

With a few exceptions, most states lack definitive microgrid policies. Regulations that fail to anticipate the interaction of microgrids with the larger macrogrid can affect microgrid ownership, operation, and design. Such failures also create unintended barriers to microgrid deployment, impose additional costs, and prevent microgrids from operating in the most

147. H.B. 306, 26th Leg. (Alaska 2010); RENEWABLE ENERGY ALASKA PROJECT, *supra* note 108.

148. Wood, *supra* note 108.

149. *Id.*

150. *GMLC 1.3.21 – Alaska Microgrid Partnership*, OFF. OF ENERGY EFFICIENCY & RENEWABLE /ENERGY, https://www.energy.gov/eere/buildings/downloads/gmlc-1321-alaska-microgrid-partnership (last visited Dec. 17, 2018).

151. *Id.*

152. Gillespie & Taylor, *supra* note 74, at iii.

economically efficient way.[153] Uncertainty about how to address these issues inhibits investment in microgrid technologies.[154] By considering Alaska's policies as a prototype, states can take advantage of the benefits microgrids offer and ultimately reduce energy burdens on their rural communities.

First, states must comprehensively define microgrids, associated components, and their place in the state's energy landscape. This means not only defining microgrids themselves, but also detailing how microgrids will function within the larger system while considering factors favorable to microgrids inherent in the Alaskan system. These inherent factors include: (1) public utility regulation, including utility rate and market structures, production incentives, net metering, interconnections of microgrids with the macrogrid, permanent or temporary islanding capabilities and requirements, regulatory and technological barriers to islanding, energy storage and classification of storage, advanced utility metering and billing infrastructure, and ownership structures (including utility franchises and free-market structures with restrictions on generation and transmission/distribution assets); (2) locally available renewable energy generation resources, including wind, solar, geothermal, hydroelectric, hydrokinetic, biomass, and combined systems; (3) stakeholder incentives, including resource allocation, cost allocation with consideration of initial capital costs and financing, private financing, and alternatives to traditional financing (e.g., Green Banks[155]); (4) land use, including rights of way, permitting requirements, cultural issues, building codes, zoning ordinances, land constraints, and eminent domain authority; (5) data sharing, grid congestion, and grid layout; (6) consumer awareness; (7) overlapping jurisdictions; (8) skilled workforce development; and (9) public–private partnerships.

States that refuse to undergo the process of defining their microgrid systems will lag behind states with clear policy. States with ambiguous regulatory environments will also continue to have trouble attracting developers, or convincing utilities, to invest in technologies and capital improvements. This is especially true in deregulated states because utilities there are unlikely to make risky investments up front, even though these investments are needed to overcome barriers to utility ownership of microgrids or to take steps that would encourage private ownership of microgrids.[156]

To illustrate the complexity of the issue, consider energy storage. In some deregulated states, utilities are limited to owning and operating trans-

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153. *Id.*

154. *Id.*

155. *What is a Green Bank?*, GREEN BANK NETWORK, https://greenbanknetwork.org/what-is-a-green-bank-2/ (last visited Oct. 13, 2019) ("A Green Bank is a publicly capitalized entity established specifically to facilitate private investment into domestic low carbon, climate resilient (LCR) infrastructure and other green sectors such as water and waste management.").

156. Gillespie & Taylor, *supra* note 74, at iv.

mission and distribution infrastructure while nonutility parties are limited to owning and operating generation assets.[157] But energy storage, an essential element for microgrids running on renewables, shares common features with both transmission/distribution assets and generation facilities. This means that utilities in deregulated states are prohibited from (or severely limited in) owning energy storage systems if storage is classified as generation, rather than transmission/distribution.

On the other hand, thoughtful integration of microgrids can overcome the foreseeable barriers of a deregulated system. For example, New York's PSC barred utility ownership of DERs in 2015 as part of its overhaul of the electric industry with the intention of *more* reliance on DERs.[158] But New York did this as part of a larger plan to develop markets for DERs, not as a side effect of market deregulation.[159] Thus, it is imperative that states set clear definitions designed with modern technology in mind to avoid ambiguity and resulting unintended consequences.

Alaska developed its energy rules to work with small cooperatives and widely islanded microgrids, making microgrids part of the utilities' purview. In many states, however, rules exist to protect incumbent utilities and their exclusive territories. As a result, microgrids in these states exist on the customer side of the meter, serving just one, or a few, directly connected customers.[160] In such situations, the states can put into place certain policies—discussed below—that will allow microgrid development to move forward.

All of Alaska's sixteen cooperatives are generation-and-distribution cooperatives, producing all or most of their own power.[161] Cooperatives are not as common in other states, which should consider integrating a cooperative-type model with their investor-owned utility environments. Regulations designed for utilities can create problems for microgrid integration from which Alaskan cooperatives are exempt. One workaround for free-market states, where utilities are often prohibited from owning any generation assets, would be to allow utilities to own microgrids with renewable generation. Alternatively, free-market states could incentivize microgrid generation development with guaranteed utility connections.

In traditionally regulated states, utilities maintain monopolies over geographic service areas. Exempting microgrids from the utility's exclusive

157. Stuart Solsky et al., *Energy Storage: Ready for Takeoff*, LAW360 (Oct. 2, 2018), https://www.law360.com/california/articles/1087701.

158. William Opalka & Rich Heidorn Jr., *New York PSC Bars Utility Ownership of Distributed Energy Resources*, RTO INSIDER (Mar. 3, 2015), https://www.rtoinsider.com/new-york-rev-der-13376/.

159. *Id.*

160. Matt Grimley, *Breaking the Macro Barriers to Microgrids*, RENEWABLE ENERGY WORLD (Mar. 14, 2016), https://www.renewableenergyworld.com/ugc/articles/2016/03/breaking-the-macro-barriers-to-microgrids.html.

161. Holly, *supra* note 118.

service areas could allow microgrids to be placed where they would provide the most use. Moreover, easing regulatory burdens on small, non-utility microgrids could allow rural areas to develop more microgrids. Combining microgrid development with policies that do not prohibit interconnection could allow non-traditional ownership models, such as community solar programs, to integrate into the system.

Another regulatory problem is capacity limits on interconnections with existing utilities. While some rural areas may best benefit from islanded microgrids, they will likely take advantage of existing distribution infrastructure. This means that, even if the microgrid is completely islanded, its generation must connect with the current local distribution system (and sever longer transmission feeder lines if intending to be fully islanded). For this to happen, states must ease the capacity limits on distributed energy and create an easy process for interconnection and disconnection.

Unlike Alaska, most states' energy policies were not developed in conjunction with microgrids. Hence, definitions of "public utility" may hinder microgrid development, and, depending on the state's current statutory language complexity, it may be easier to just exempt microgrids from this definition while simultaneously providing a clear, separate definition of microgrids and their place in the state's energy system.[162]

2. Renewable Portfolio Standards

States with strong RPSs encourage development of DERs, which are the source of generation for microgrids.[163] Since 2000, approximately half of the growth in U.S. renewable-energy generation can be attributed to state renewable-energy requirements.[164] Solar photovoltaics are the most common microgrid generation technology in the US,[165] but states should focus on whatever renewable clean energy is most available to them. Illinois' RPS policy, for example, requires that 75% of renewable energy under the RPS come from wind.[166]

It is no coincidence that states with strong RPS policies, like New York and California, experience significant DER deployment. In contrast, Tennessee, a state with no RPS policy, has very few DERs and only one microgrid.[167] As Alaskan communities like Kodiak have shown, renewables

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162. *See* Elisa Wood, *Five Policies Blocking Microgrids (From a Veteran of Local Energy Wars)*, MICROGRID KNOWLEDGE (Apr. 1, 2016), https://microgridknowledge.com/policies-blocking-microgrids/.

163. Gillespie & Taylor, *supra* note 74, at v.

164. *State Renewable Portfolio Standards and Goals*, NAT'L CONF. STATE LEGISLATURES, (Oct. 23, 2019), http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx.

165. Gillespie & Taylor, *supra* note 74, at v.

166. *Id.*

167. *Id.*

offer a viable solution for energy generation in rural areas, and using clean renewable energy to power microgrids will lower fuel cost and further ease the energy burden on these communities.[168]

3. Financial Investment

After clarifying their microgrid policy, states should then consider financial investment options for renewably sourced microgrid development. This funding can include outright funding, like Alaska's Renewable Energy Fund, and should consider training for microgrid operation and maintenance along with development.

States can reduce reliance on subsidies by improving access to low-cost capital, such as revolving loan funds and "green bank" concepts that leverage public money to attract private investment.[169] Green banks are public or nonprofit entities designed to drive private capital into market gaps in order to accelerate investment in clean energy.[170] Specifically, green banks help by securing low-cost capital for clean energy projects,[171] focusing on commercially viable technologies, and using traditional finance tools—bonds, co-lending with banks, and insuring or credit-enhancing private loans—to fund projects.[172] Connecticut and New York, for example, both issue bonds leading to the sale of clean energy loan portfolios on the secondary market.[173] Florida, however, leverages private money into clean energy loans for people with low-to-moderate income.[174] Further, Connecticut, New York, California, Rhode Island, and Hawaii have already taken legislative measures to allow for the formation of green banks.[175] Other states could follow their example.

Working in conjunction with green banks, states could also modify their property assessed clean energy ("PACE") models to include a larger subset of the population. PACE, a financing mechanism for energy efficiency and renewable energy improvements on private property, allows a property

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168. This is not to say that initial investment in microgrids will be free, but rather that the overall costs to communities will be reduced with the renewably, locally generated power, reducing both fuel and transmission costs over the current long-distance transmission model currently in place.

169. Penny Gage, *Alaska's Microgrid Experience Applied Across Borders*, ATLANTIC COUNCIL: NEW ATLANTICIST (Oct. 19, 2016), https://www.atlanticcouncil.org/blogs/new-atlanticist/alaska-s-microgrid-experience-applied-across-borders.

170. *What Is a Green Bank?*, *supra* note 155.

171. *Green Banks*, NAT'L RENEWABLE ENERGY LAB., https://www.nrel.gov/state-local-tribal/basics-green-banks.html (last visited Dec. 17, 2018).

172. U.S. DEP'T OF ENERGY, ENERGY INVESTMENT PARTNERSHIPS: HOW STATE AND LOCAL GOVERNMENTS ARE ENGAGING PRIVATE CAPITAL TO DRIVE CLEAN ENERGY INVESTMENT 1 (2015), https://www.energy.gov/sites/prod/files/2016/01/f28/Energy%20Investment%20Partnerships.pdf.

173. *Id.*

174. *Id.*

175. *See generally id.*

owner to finance the up-front cost of property improvements and then repay the costs over time through a voluntary property tax assessment.[176] States have various forms of PACE financing, with some limiting use to particular geographic areas or only allowing commercial entities to take advantage of the program. Expanding the use of PACE to unserved constituents could help microgrid projects get off the ground.

4. Collaboration

Alaska has been largely successful with its collaborative approach, especially in its recent renewable-based microgrid efforts. Because of these efforts, much research is being done or is already accomplished on successful implementation of renewable microgrids in rural areas. States can take advantage of the available information through organizations like the Islanded Grid Resource Center. Deregulated states, in particular, can benefit by reviewing new legislation in other deregulated states like California and New York, both of which are in the process of expanding their microgrid systems in urban and rural areas.[177] California, for example, is collaborating with its Energy Commission, the California Public Utilities Commissions, and the California Independent System Operator to develop a "Roadmap" for commercializing microgrids in California.[178]

States can also consider Alaska as a prototype for their own systems. Alaska has no intention of hoarding its hard-earned information. Indeed, as Erin Whitney, a researcher at the Alaska Center for Energy and Power, University of Alaska Fairbanks, states, "We would love to share our expertise with microgrids and data from microgrid systems with communities whether they are in the Arctic or not, and we hope to learn from others experience as well."[179] There is no need for states to start from scratch.

Conclusion

The current energy policy in the United States is failing the country's rural residents, who continue to experience high energy burdens. The NAS, though helpful to the U.S. in terms of carbon reduction and costs in urban

176. *Property Assessed Clean Energy Programs*, OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs (last visited Dec. 17, 2018).

177. Sarah Rubenoff, *New York Paves the Way to Understanding Microgrid Utility Requirements,* MICROGRID KNOWLEDGE (June 29, 2018), https://microgridknowledge.com/microgrid-utility-requirements-new-york/; Elisa Wood, *California Bill Would Make It Easier to Develop Clean Energy Microgrids; Nixes Fossil Fuels*, MICROGRID KNOWLEDGE (July 9, 2018), https://microgridknowledge.com/clean-energy-microgrids-california-bill/.

178. *California Microgrid Roadmap*, CA. ENERGY COMM'N, https://www.energy.ca.gov/research/microgrid/ (last visited Dec. 17, 2018).

179. *Alaska Microgrids Offer Energy Resilience and Independence*, *supra* note 87 (alteration in original).

areas, is unlikely to help rural consumers face challenges associated with long-distance transmission lines. To ease the energy burden for rural citizens, states should make microgrid-friendly changes to their energy policies.

With so many remote, inaccessible communities, Alaska naturally developed microgrid-friendly regulations and policies. These policies can be adapted to support microgrid regulation in other rural areas of the country by (1) identifying and clearly defining important factors affecting microgrid implementation, (2) setting high renewable portfolio standards, (3) increasing financial investment, and (4) collaborating with other states and interest groups to share information.

Challenges remain, and existing laws designed to reduce consumer cost may inadvertently prevent such cost reductions, as in Maryland's case. Deregulated states face additional complexity when attempting to fit microgrids into statutory definitions of generation or distribution. Using renewables as fuel can also pose challenges for states without generation infrastructure already in place. But Alaska's experience and research in microgrid deployment is unparalleled, and states seeking to reduce their energy burden should take a good hard look at what is going on up north.