MICROGRIDS POLICY PROGRESS IN THE STATES

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What is NRRI? Who is Tom Stanton?

- The National Regulatory Research Institute (NRRI) was founded in 1976 by the National Association of Regulatory Utility Commissioners (NARUC). NRRI serves as a research arm to NARUC and its members, the utility commissions of the 50 US states and District of Columbia.

  NRRI's primary mission is to serve state utility regulators by producing and disseminating relevant, high-quality research that provides the analytical framework and practical tools necessary to improve their public interest decision-making.

  - **Ideas presented are my own; not necessarily those of NRRI Board of Directors or NRRI staff.**
  - **Companies and projects are identified only as examples. No endorsement by NRRI is intended.**

- Tom Stanton is Principal Researcher, Energy and Environment, at NRRI, where he has worked since fall 2010. Mr. Stanton's work for NRRI includes state public policy research papers and education about all kinds of distributed and renewable energy resources.

  A life-long Michigan resident, prior to NRRI Tom worked for 10 years at the Michigan Energy Office followed by over 22 years with the Michigan Public Service Commission Staff.

  Mr. Stanton earned a B.A. in Communications and M.A. in Journalism, both from Michigan State University, and an M.S. in Public Administration from Western Michigan University.

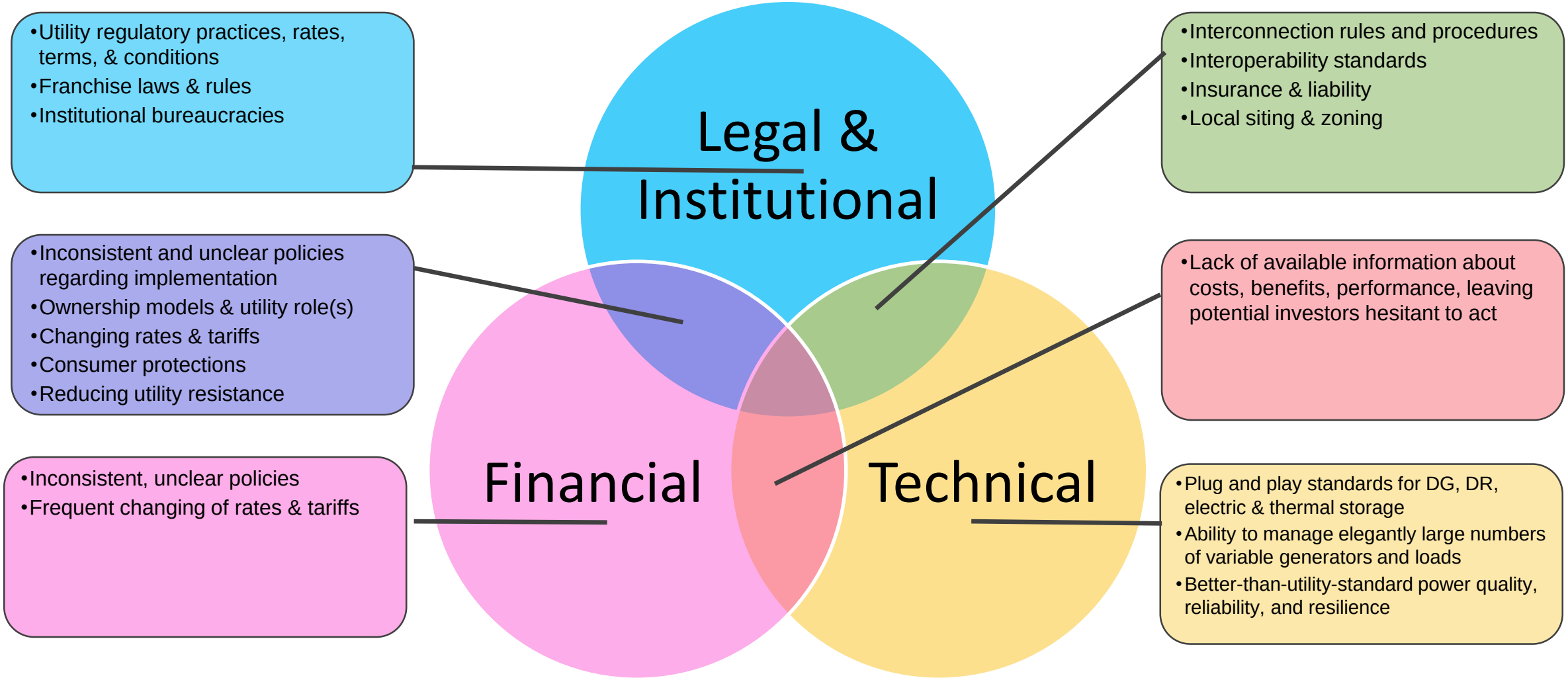
Today's microgrid policy progress topics

- Classifying microgrid progress by "degree of difficulty." Applying triage categories to market opportunities:
  1. **NOT blocked** by existing laws and regulations;
  2. **Minor blockages** that can be rooted out quickly and easily, using the public policy functional equivalents of angioplasty and stents; and,
  3. **Deep-rooted blockages** that are likely to require the public policy functional equivalent of triple by-pass surgery.
- Noting where progress is being made, and what types of progress?
- Asking, "How likely is meaningful forward motion during Post-COVID recovery and rebuilding?" Could post-COVID recovery efforts present a particularly important, teachable moment?

Speculating about microgrid types and degrees of difficulty

Not blocked at all	Minor blockages	Deep-rooted blockages
❶ Non-export self-service by device, circuit, or building ❷ DOD Bases & Major University Campuses	❸ Single-customer, with export ❹ Utility pilots, experiments ❺ Public purpose microgrids ❻ Remote microgrids	❼ Microgrid "anchors" for non-wire solutions ❽ Commercial, multi-customer microgrids open to all
➢ Variations on uninterruptible power supplies – multi-billion dollar markets already & poised for even more world-wide growth ➢ No known utility challenges to DOD bases nor major universities. Some utilities even *partner.*	➢ Often need some regulatory actions, but recent progress shows at least some promise in a handful of states ➢ Only a few states have systematically identified the existing obstacles and barriers	➢ Can need major legal and regulatory action, but success in a few states is making it look plausible
➢ Proliferate & go viral	***➢ Ready, fire, aim***	***➢ Prepare to engage***

What needs refitting? Where's the rub?



Source: Author's construct, based on original diagram presented by Mark Silberg, 2018, Rocky Mountain Institute eLab.

Why should we care? Beginnings of a list…

For the customers, the system, and society at large

- Reliability & resilience – for all critical needs services
- Decarbonizing energy systems – carbon neutral by 2050 or sooner?
- Relieving energy poverty, improving public health, achieving energy and environmental equity and justice
- Trillion-dollar opportunities for microgrid investing, but also risks of trillion-dollar strandable costs
- Are microgrid and grid-of-grids engineering and operations beyond the capabilities of today's monopoly utility companies?
- Are microgrid needs, and centralized utility system needs mutually exclusive?

❶ Non-export, self-service*

LEGAL & INSTITUTIONAL NEEDS

- Clarify: Does no export mean no utility role, no need for interconnect permission?
- Clarify regulations and utility roles for both grid-tied and remote, off-grid systems.

FINANCIAL NEEDS

- Inclusive financing & PAY-GO options for consumers
- Greenbank funding for developers

TECHNICAL NEEDS

- Bullet-proof, fail-safe, idiot-proof designs
- Plug & play standards
- Smart charge controller systems for all household and office equipment, cordless hand tools and appliances, electric vehicles (from bikes to buses, carts to semis)

- Examples: Every scale from a few Watts for single devices to many megawatts for large campuses.
- These can be "stealthy" projects, not in the utility or public eye.
- Home medical devices ready to "ride through" grid outages.

Note: Needs are nearly-identical for grid-tied and off-grid systems.

See: GOGLA Product Showcase; Mangoo catalog; Stanton and Sklar, 2020, *Utility Tariff On-Bill Financing: Provisions and Precautions for Equitable Programs*; Stanton and Nordman, 2017, *Regulating 'Energy Ladder' Products and Services; and,* United Nations Sustainable Development Goal #7: *By 2030, Ensure access to affordable, reliable, sustainable and modern energy for all*

*** a.k.a. behind-the-meter (BTM) or under-the-radar (UTR)**

❷ DOD bases & University Campuses

LEGAL & INSTITUTIONAL NEEDS

- Clearly articulated legal and regulatory permissions?
- Clearly defined roles for utilities, utility affiliates, and third-party developers

FINANCIAL NEEDS

- DOD funding and/or 3rd-Party Financing
- Can microgrids provide grid-services and be fairly compensated?

TECHNICAL NEEDS

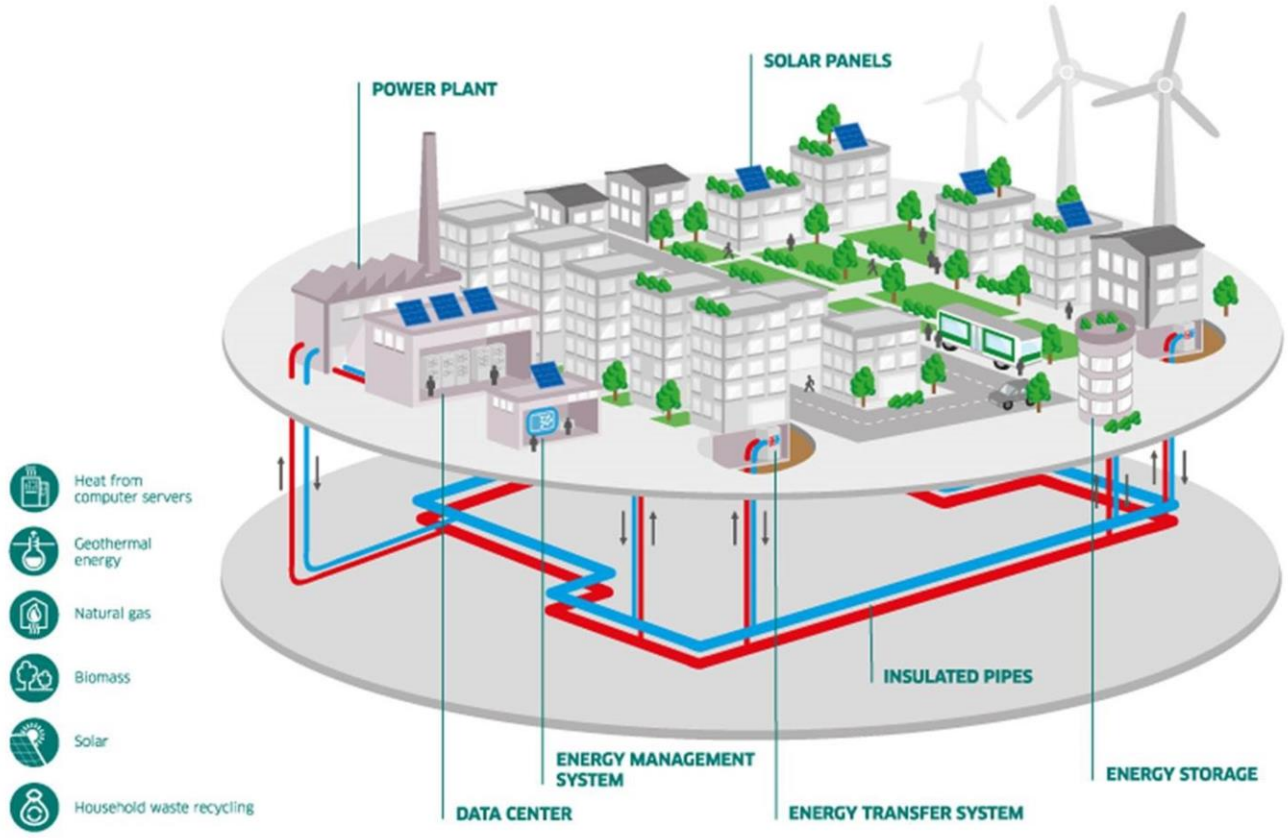
- ADMS, DERMS, and Smart substations
- Proofs of safe islanding under IEEE 1547-2018 and success with IEEE 2030 standards for communications and controls
- Smart rate designs including opportunities to monetize microgrid services value
- Eventually, transactive energy

- U.S. utilities are cooperating with microgrid installations at U.S. Department of Defense, facilities – often with support from U.S. DOE
  - See DOD's *Strategic Environmental Research and Development Program* and *Environmental Security Technology Certification Program* project listings
- Some utilities are partnering with DOD bases (e.g., Hawaii, Michigan, Mississippi, Utah).
- Major university Microgrids: Illinois; Michigan State (since 1894!); Montclair (New Jersey); Ohio State; Princeton; and UC San Diego.

❷ DOD bases & University campuses

- Ameresco Navy Shipyard in Maine
- Kirtland Air Force Base DC Microgrid
- Sandia Laboratories combined DOE/DOD projects to enhance national security

- Colorado State University and City of Fort Collins *FortZED* project
- Illinois Institute of Technology Galvin Center Perfect Power Microgrid
- University of Pittsburgh Energy GRID Institute



Source: U of Pittsburgh, Energy GRID Institute, District Energy: The Grid of Microgrids

❸ Single customer, with export

LEGAL & INSTITUTIONAL NEEDS

- Definitions, e.g., customer, premise, facility
- Interconnection rules allow intelligent islanding
- Aggregating on single properties? On contiguous properties?
- Utility tariffs allow "export" to other customers

FINANCIAL NEEDS

- More and better inclusive financing
- Equitable NEM or DG rate designs
- Access to markets for the delivery of energy and ancillary services (FERC Order 2222 implementation?)

TECHNICAL NEEDS

- Load differentiation for critical needs
- Smart plugs, panels, circuits, wiring
- Thermal storage, battery storage, EV integration, set-it-and-forget-it HEMS and BEMS with simple user override controls
- Grid-interactive efficient buildings (GIEBs)

- March 2018 Colorado law affirms customers' rights to install, interconnect, and use energy storage systems, and directs PUC rulemaking
- Might FERC Order 2222 fundamentally change the rules?
- See Greenworks Lending C-PACE for microgrids

❹ Utility pilots, experiments

LEGAL & INSTITUTIONAL NEEDS

- Clarify conditions for utility project regulatory approval
- How, if at all, will microgrid operations affect non-participants?
- Establish clear utility financial incentives, and performance and evaluation criteria for all participating parties

FINANCIAL NEEDS

- What costs can be recovered from which ratepayers?
- How are utility RD&D expenditures treated in rates?
- Utility motivation, incentives?

TECHNICAL NEEDS

- What utility personnel have the technical know-how or the capability to oversee those who do? (Not to mention know-what, know-why, and know-who.)

- Many states are already supporting **regulated utility** company proposals for **microgrid pilots**, including Alabama, Arizona, California, Colorado, Georgia, Hawaii, Illinois, Indiana, Michigan, New Hampshire, North Carolina, and Utah
- Muni's and Cooperatives, too – e.g., in California, Colorado, Hawaii, Massachusetts, North Carolina (multiple projects), and Ohio

Illinois

- "Utility of the Future" working group 1 report: *Topic 10: What Are the Opportunities and Challenges of Microgrids?* (pp. 27-29)
- Legislature provides funding for Illinois Institute of Technology microgrid
- Ameren (Champaign, Illinois) and Commonwealth Edison (Chicago Bronzeville neighborhood) microgrid pilot project case studies

Source: Avendano, 2106, Utility-Owned Public Purpose Microgrids

❺ Public purpose microgrids*

LEGAL & INSTITUTIONAL NEEDS

- Utility standards for reliability & resilience?
- Permissions for service to multiple meters?
- Rights-of-way, franchise for infrastructure?
- Teach community leaders about reliability and resilience metrics and planning options

FINANCIAL NEEDS

- Public/private greenbank financing or utility investing

TECHNICAL NEEDS

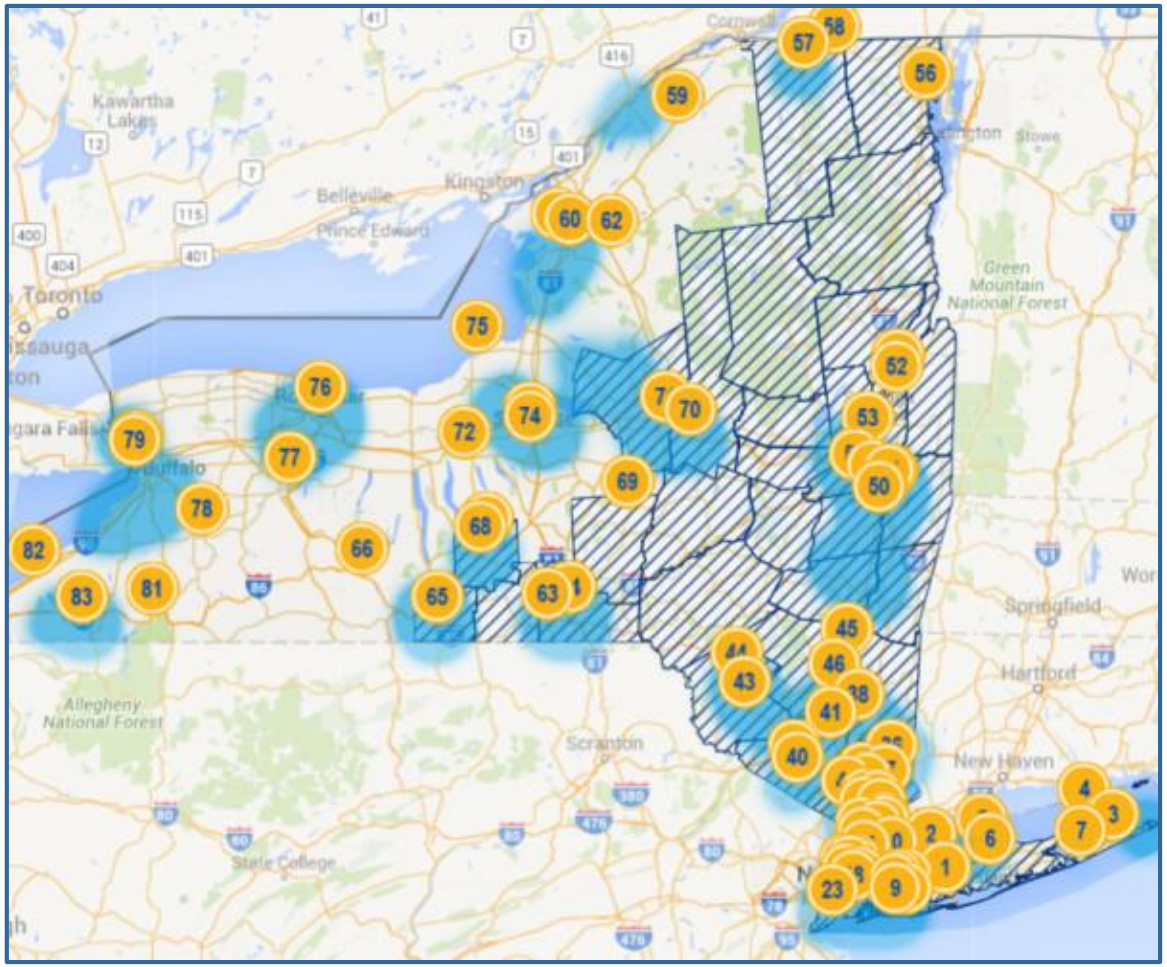
- Inventory and map all community critical needs

- These are for critical needs facilities, first responders (like public safety and fire stations, ambulance services, hospitals), and shelters.
- Montgomery County Maryland is a poster-child
- New York 2013 Legislation: NYSERDA shall develop recommendations for non-profit organizations "with a mission to assist in disaster relief" to collaborate on successful microgrids.
- See Sandia Laboratory work for New Orleans Community Resilience, Puerto Rico Community Resilience, and Resilient Communities Conference
- See Yale University, 2019, Community Microgrids – A Tool for Adaptation or Mitigation

*** a.k.a. or similar to *community microgrids***

❺ Public purpose microgrids

- States enabling **public purpose microgrids** include: Connecticut, Massachusetts, New Jersey, New York, Rhode Island
- Clean Coalition Community Microgrid Initiative
- See also **airport microgrid systems**, e.g., in California, Hawaii, and at Denver, Pittsburgh
- See Maryland *Resiliency through Microgrids Task Force Report* and Maryland PSC Docket No. 9416, including *Order No. 87669* rejecting Baltimore Gas & Electric's microgrid proposal but inviting the utility to present an improved proposal in the future.



New York PSC directed utilities to identify and map *Opportunity Zones,* "where microgrids may reduce utility system constraints, and defer expensive infrastructure investment costs." Source: NYSERDA, 2020.

Connecticut – *Public Purpose Microgrids*

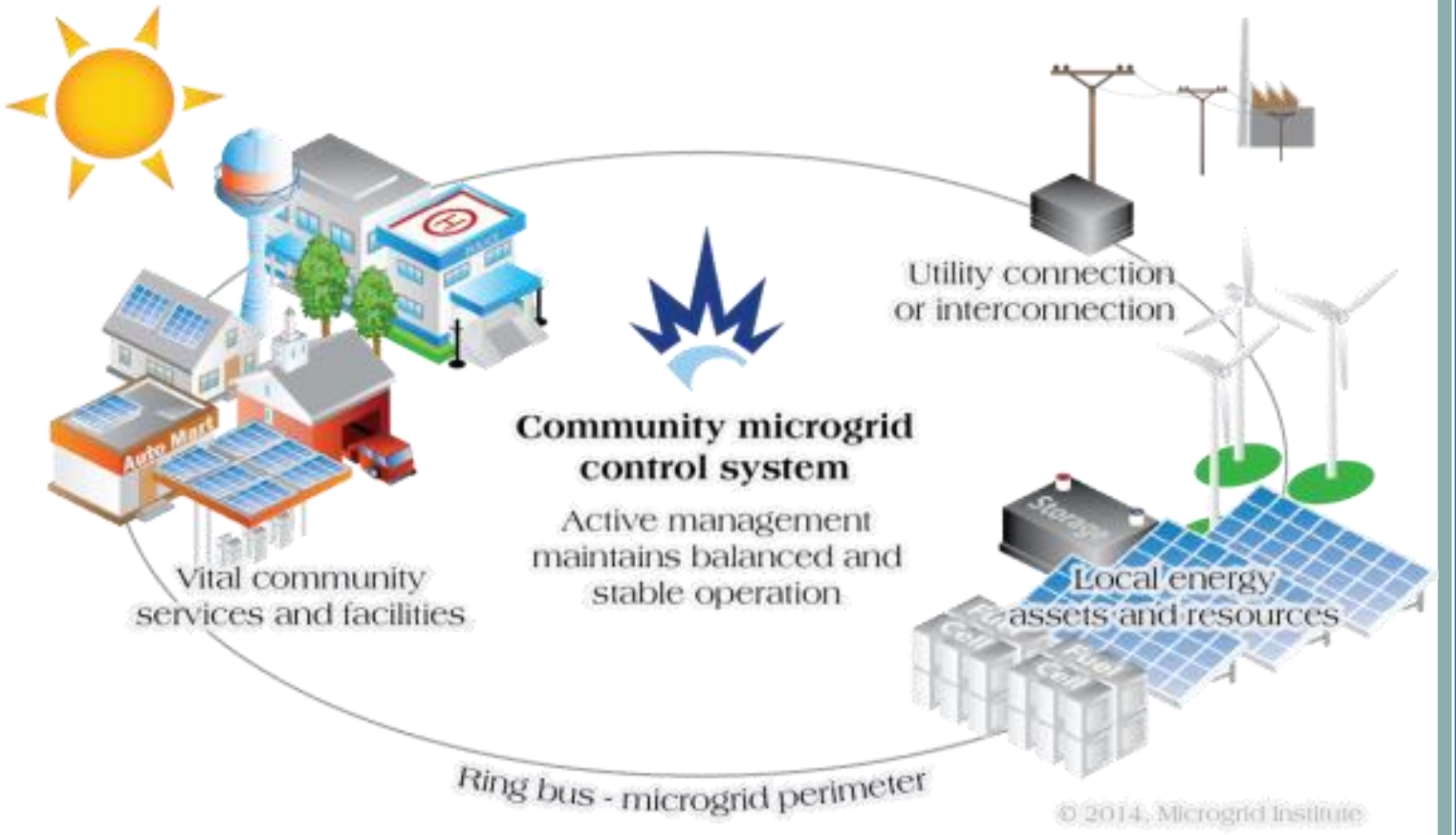
- Initial support from Governor, and enabling legislation in 2012: PA 12-148 §7, "…to ensure that critical buildings remain powered during electrical grid outages."
  - "Critical facility" means any hospital, police station, fire station, water treatment plant, sewage treatment plant, public shelter or correctional facility, any commercial area of a municipality, a municipal center, as identified by the chief elected official of any municipality, or any other facility or area identified by the Department [of Energy and Environment, DEEP]… as critical.
  - "Microgrid" means 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 and that connects and disconnects from such grid to enable it to operate in both grid-connected or island mode.
- 9 operational, 1 in construction, 3 in contract negotiation (late 2019)
- Connecticut Department of Energy and Environmental Protection (DEEP) *Microgrid Grant and Loan Program*

Connecticut – *Public Purpose Microgrids Pilot Grants, Round 1*

Project	Facilities	Generation	Grant Value
UConn Depot Campus/Storrs	Campus Buildings	400 kW fuel cell, 6.6 kW PV	$2,144,234
City of Bridgeport-City Hall/Bridgeport	City hall, Police Station, Senior Center	(3) 600 kW natural gas microturbines	$2,975,000
Wesleyan/Middletown	Campus, Athletic Center (Public Shelter)	(1) 2.4 MW and (1) 676 kW Natural Gas Combined Heat and Power Reciprocating Engine	$693,819
University of Hartford-St. Francis/Hartford	Dorms, Campus Center, Operation Building	(2) 1.9 MW diesel (existing), 250 kW diesel, 150 kW diesel	$2,270,333
SUBASE/Groton	Various Buildings and Piers	5 MW cogen turbine, 1.5 MW diesel	$3,000,000
Town of Windham/Windham	2 Schools (Various Public Purposes)	(2) 130 kW natural gas, 250 kW solar, 200 kWh battery; (2) kW diesel,	$639,950
Town of Woodbridge/Woodbridge	Police Stations, Fire Station, Department of Public Works, Town Hall, High School, Library	1.6 MW natural gas, 400 kW fuel cell	$3,000,000
City of Hartford- Parkville Cluster/Hartford	School, Senior Center, Library, Supermarket, Gas station	600 kW natural gas	$2,063,000
Town of Fairfield- Public Safety/Fairfield	Police Station, Emergency Operations Center, Cell Tower, Fire Headquarters, Shelter	50 kw natural gas recip engine, 250 kW natural gas recip engine, 27 kW PV, 20 kW PV	$1,167,659

Massachusetts

- Massachusetts 2018 Comprehensive Energy Plan supports strategies for grid modernization and advanced technologies, including microgrids
- Massachusetts Clean Energy Center Community Microgrids Program, including feasibility study grants
- *Massachusetts Microgrids: Overcoming Legal Obstacles*, Harvard Law School, September 2014
- Northeast Clean Energy Council (NECEC), *Multi-User Microgrids: Obstacles to Development and Recommendations for Advancement*, November 2018.



Source: Massachusetts Climate Action Network – *Microgrids* [Web page]

❻ Remote microgrids

LEGAL & INSTITUTIONAL NEEDS

- Clarify roles and responsibilities for regulated utilities, and for product and service providers
- Consumer protections
- Workable operations and maintenance protocols, spare parts

FINANCIAL NEEDS

- Inclusive financing, including PAY-GO
- Public/private greenbank financing or utility investing

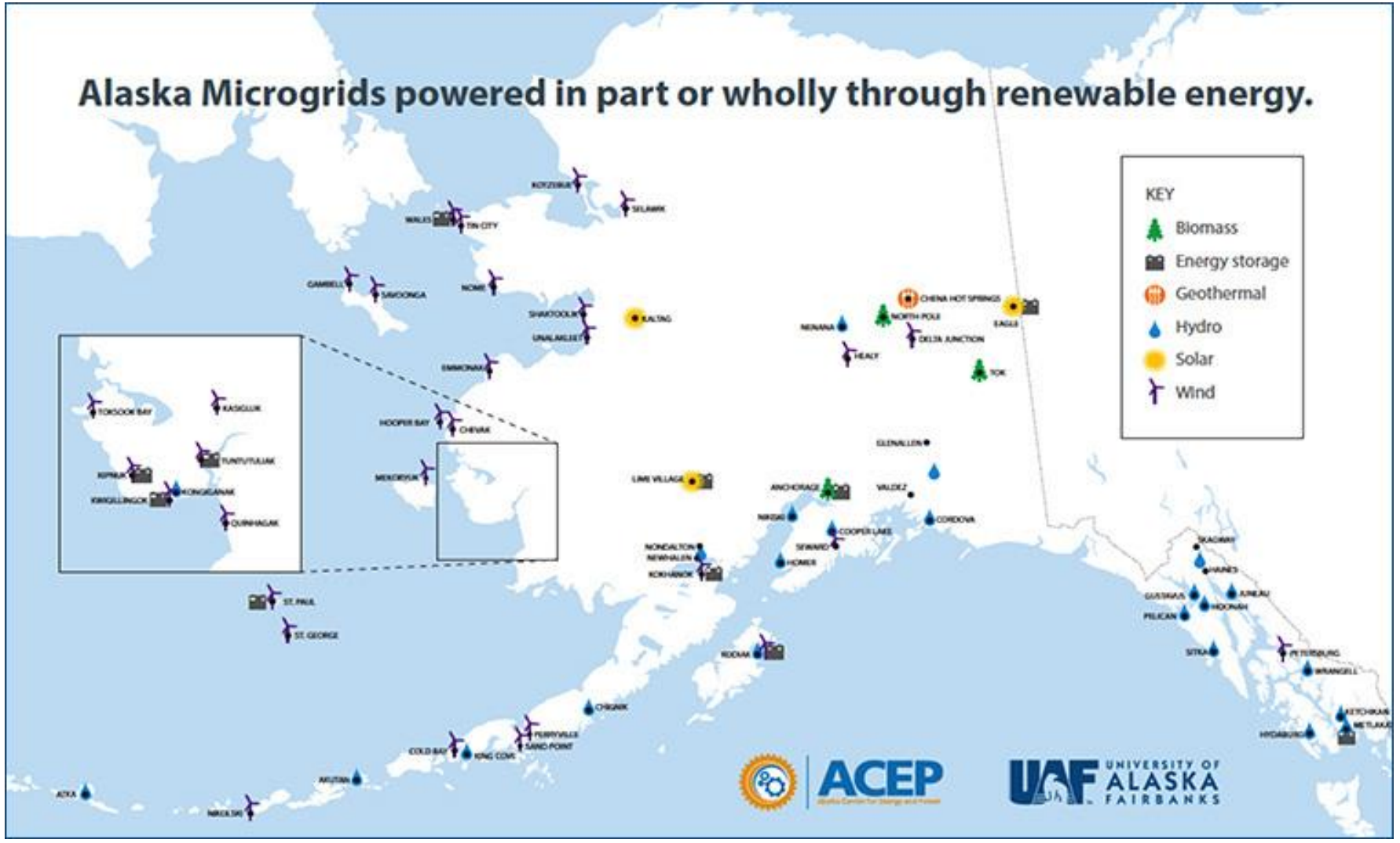
TECHNICAL NEEDS

- Standard grid architectures, modular, and at multiple scales
- Equipment & communications standards
- Smart plugs, panels, circuits, wiring
- Thermal storage, battery storage, EV integration, set-it-and-forget-it HEMS with simple user override controls

- Arizona off-grid 340MW microgrid for remote data center
- Hawaii nanogrid for irrigating organic farm and nursery, and a neighborhood-housing microgrid for previously homeless families, with utility company backup
- Remote park facility projects in North Carolina, Vermont, and Wisconsin
- World Bank says ~210,000 remote minigrids are needed by 2030 to meet *United Nations Sustainability Goal #7: Sustainable energy for all* ("Ensure access to affordable, reliable, sustainable and modern energy for all")
  - An estimated $220 billion (USD) market opportunity between now and 2030
- See NARUC and US AID reports on *Regulatory Treatment* and Tariff Methodologies

❻ Remote microgrids

- Alaska already has no wide area grid – only a series of remote microgrids
- There are opportunities everywhere, including ~1 million populated islands
- Every utility can look for one or more excellent opportunities for experimental and pilot project microgrids and NWS (see reports about Maine Islands and RMI Islands Energy Program)



Source: https://www.slideshare.net/jameshamilton10/jeremy-kasperenergyresearchinalaska

❼ Microgrid "anchors" for non-wire solutions

LEGAL & INSTITUTIONAL NEEDS

- Systematic modeling of NWS opportunities with mechanisms to decide and act, as valid data confirms future needs
- Clearly articulated performance standards
- Standard contracts

FINANCIAL NEEDS

- Clearly articulated permissions
- Clearly defined roles for utilities and utility affiliates
- Mechanisms so that utilities will be indifferent to, if not predisposed towards, NWS

TECHNICAL NEEDS

- Load differentiation for critical needs
- Smart panels, circuits, wiring
- Thermal storage, battery storage, EV integration, set-it-and-forget-it HEMS with simple user override controls.

- The New York Brooklyn-Queens Demand Management Project is the poster-child: Roughly 1/5 the cost of the wires alternative
- New York is continuing to build more non-wire alternatives projects, including Long Island,
- Connecticut, Conn. Gen. Stat.§16-244w, and in January 24, 2018 Order in Docket No. 17-06-03, and Docket No. 17-12-03RE07
- Some utilities are inviting proposals, like NationalGrid (for opportunities in Massachusetts, New York, and Rhode Island)
- Note the same general types of opportunities exist for **non-pipe solutions** for natural gas, water, and wastewater

❼ Microgrid "anchors" for non-wire solutions

- Maine's Booth Bay Harbor, non-transmission alternative project
- Maine's 2019 law "to reduce electricity costs through nonwires alternatives"

See: Dyson, Prince, et al., 2018, *The Non-Wires Solutions Implementation Playbook – A Practical Guide for Regulators, Utilities, and Developers*, Rocky Mountain Institute; Pentland, 2016, "Infrastructure-As-A-Service Gets Real in Maine," *Forbes*; Shah and Gramlich, *UtilityDive Opinion*, 2020; and, Stanton, 2015, *Getting the Signals Straight: Modeling, Planning, and Implementing Non-Transmission Alternatives*, NRRI 15-02

Source: Convergent Energy & Power, 2019, Non-Wires Alternative Case Study

❽ Commercial, multi-customer microgrids

LEGAL & INSTITUTIONAL NEEDS

- Rates to govern "sales" during both grid-tied and islanding operations?
- Opt-in, opt-out provisions for customers
- Performance contracts

FINANCIAL NEEDS

- Public/private greenbank financing?
- Clear guidance, if not rules & regulations, about what roles utilities may play and what costs, if any, can be recovered through rates.

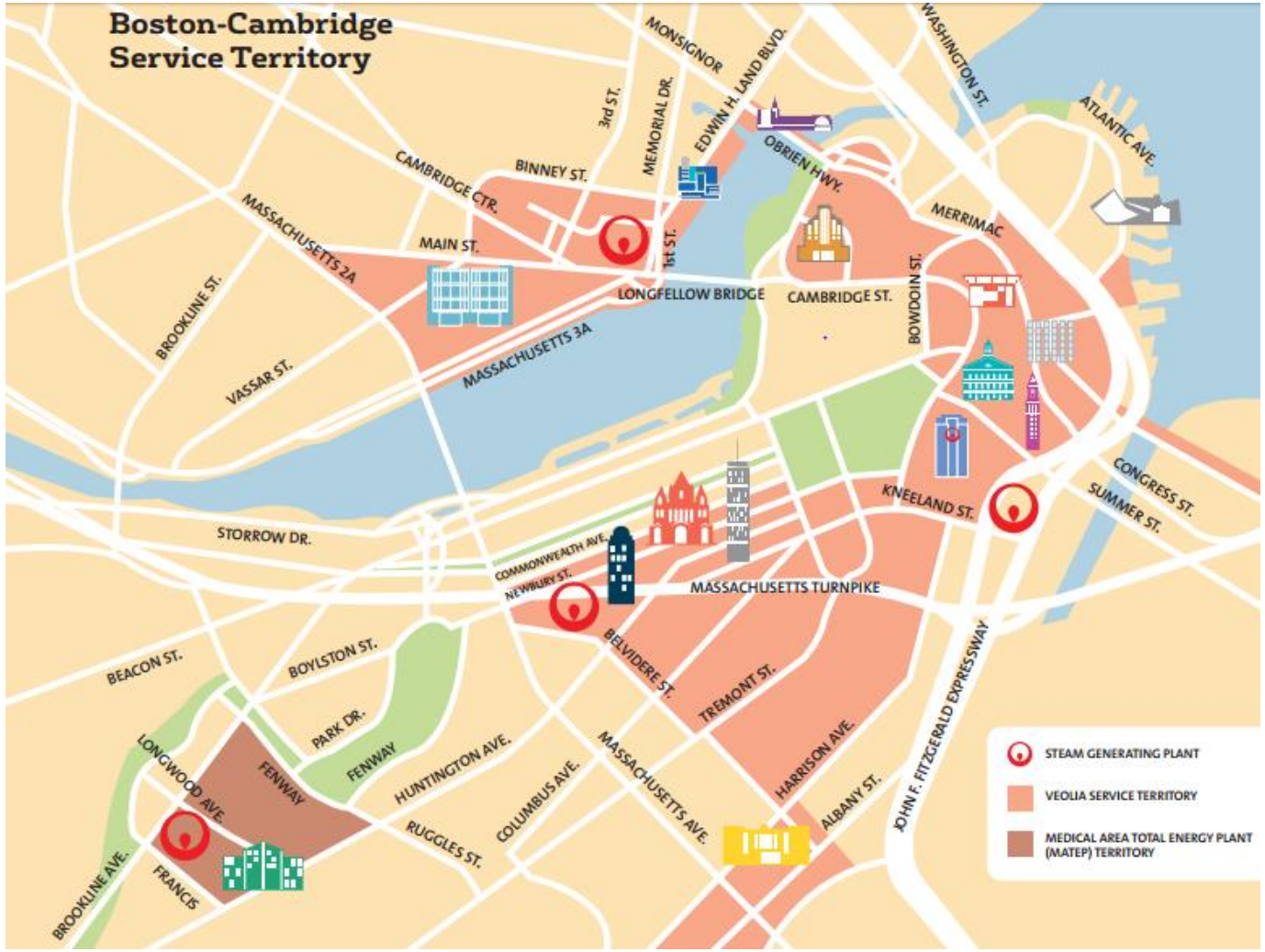
TECHNICAL NEEDS

- What's left to prove?
- What's left to specify for each unique power system design?
- What grid architectures will work for pre-wide-area-grid locations and for within wide-area-grid locations?
- What modeling capabilities are needed?

- Puerto Rico Rules are in place; IRP Order (August 2020) calls for major microgrid progress in "transmission, distribution, and resource planning exercises and all deployment actions" (Order, ¶956, p. 293).
- California Rules are TBD by December 1, 2020
- Hawaii's process (in Docket No. 2018-0163) began July 2018 and looks now to be nearing completion
- In DC, a July 2020 DC-PSC Order seeks public comment on a series of questions about a microgrids regulatory framework
- Will Arizona's updated competitive energy rules enable microgrids?
- Does every other state have laws and rules preventing commercial microgrids? Which states have completed systematic reviews of legal and regulatory barriers?
- Netherlands' energy regulatory innovations support framework, in 2015-2018, established temporary energy law waivers, so that microgrids could be tried.

❽ Commercial, multi-customer microgrids

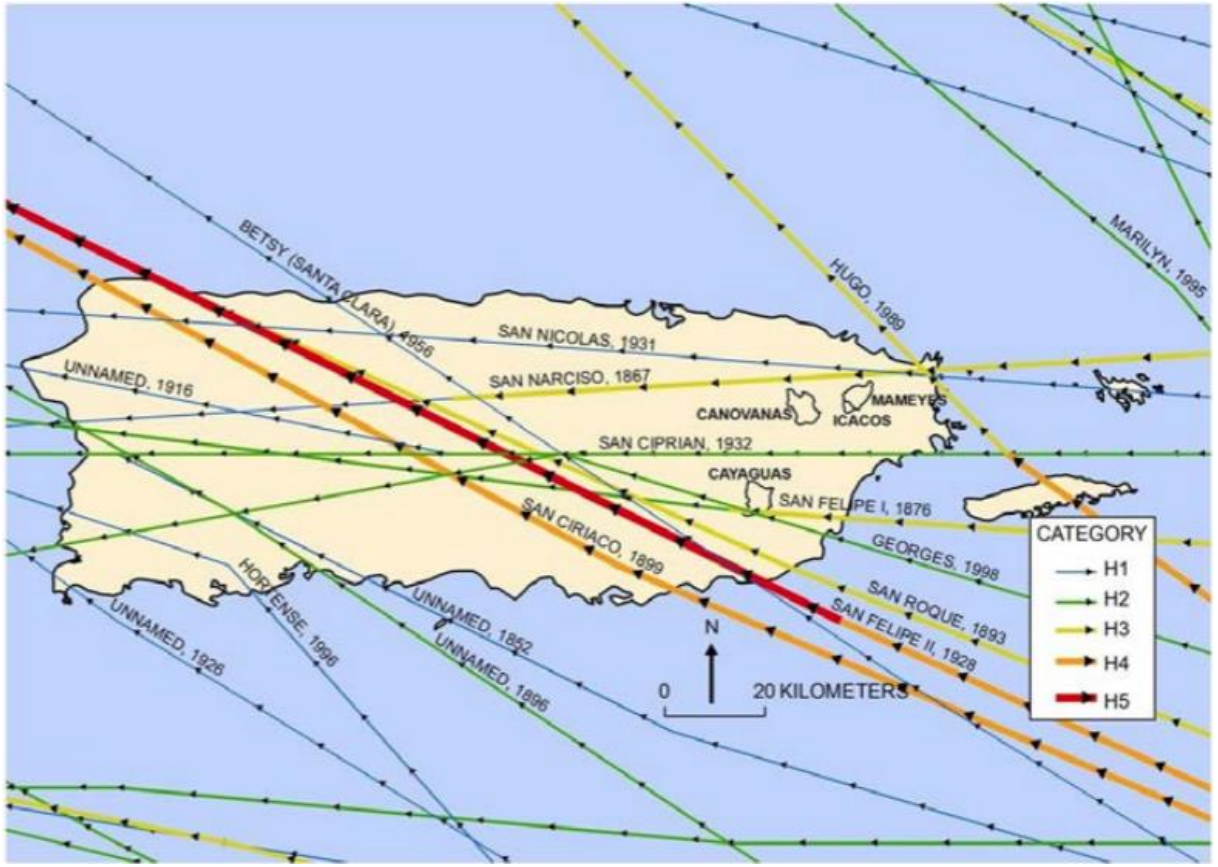
- Cambridge, Massachusetts, Veolia Energy Microgrid Project provides district heating, cooling, and electricity.
- See: Grimley and Farrell, 2016, *Mighty Microgrids*; and, NECEC and Boston University, 2018, Multi-User Microgrids: Obstacles to Development and Recommendations for Advancement
- Gonzales, California, microgrid provides higher reliability and resilience, at lower cost, to the City's agricultural-industrial park



Source: Massachusetts Climate Action Network, *Microgrids*

Puerto Rico – August 2020 Order Sets the Stage

- Territory goal for 100% Renewable Energy by 2050, for all "retail electricity suppliers" ACT 17-2019:
  - "Section 1.5(8)(c) and Section 1.12 promote the development of microgrids, particularly in essential service facilities as these are defined in Act 57-2014, and in remote areas, as a mechanism to promote the resilience and modernization of the distribution networks."
- Regulation 9028 is microgrids regulation.
- August 20, 2020 Final Order on PREPA Integrated Resource Plan sets the stage for microgrids progress (¶ 956, 959, 960, pp. 293-94)
  - "The Energy Bureau FINDS that **microgrids form a critical part of… resiliency solutions…** [and] ORDERS PREPA to **directly incorporate promotion of microgrid resources into all of its transmission, distribution, and resource planning exercises and all deployment actions…**"
  - The Energy Bureau further ORDERS PREPA to include the ability of small-scale distributed resources that include **solar PV and battery storage serving a portion of critical load** to be part of its solution for ensuring a more resilient electric power system.
- New mini-grids docket just getting underway. MiniGrid Optimization proceeding (Optimization Proceeding)
- Sandia Report SAND2018-11145 maps 159 potential microgrids for Puerto Rico.



Sampling of historic hurricanes to hit Puerto Rico, from U.S. DOE, 2018, *Energy Resilience Solutions for the Puerto Rico Grid*.

District of Columbia

- Systematic review of *Barriers to Realizing the Full Potential of Microgrids in the District*
- *DCPSC Seeks Public Comment in Microgrid Proceeding* (July 2020)
- DCPSC *Power Path DC Order* (Jan 2020) directs staff to open Docket No. 1163, *Investigation into the Regulatory Framework of Microgrids in the District of Columbia*. (*July 2020 Order*)

Source: DC MEDSIS Staff Report, Part 2. Image Credit LBNL.

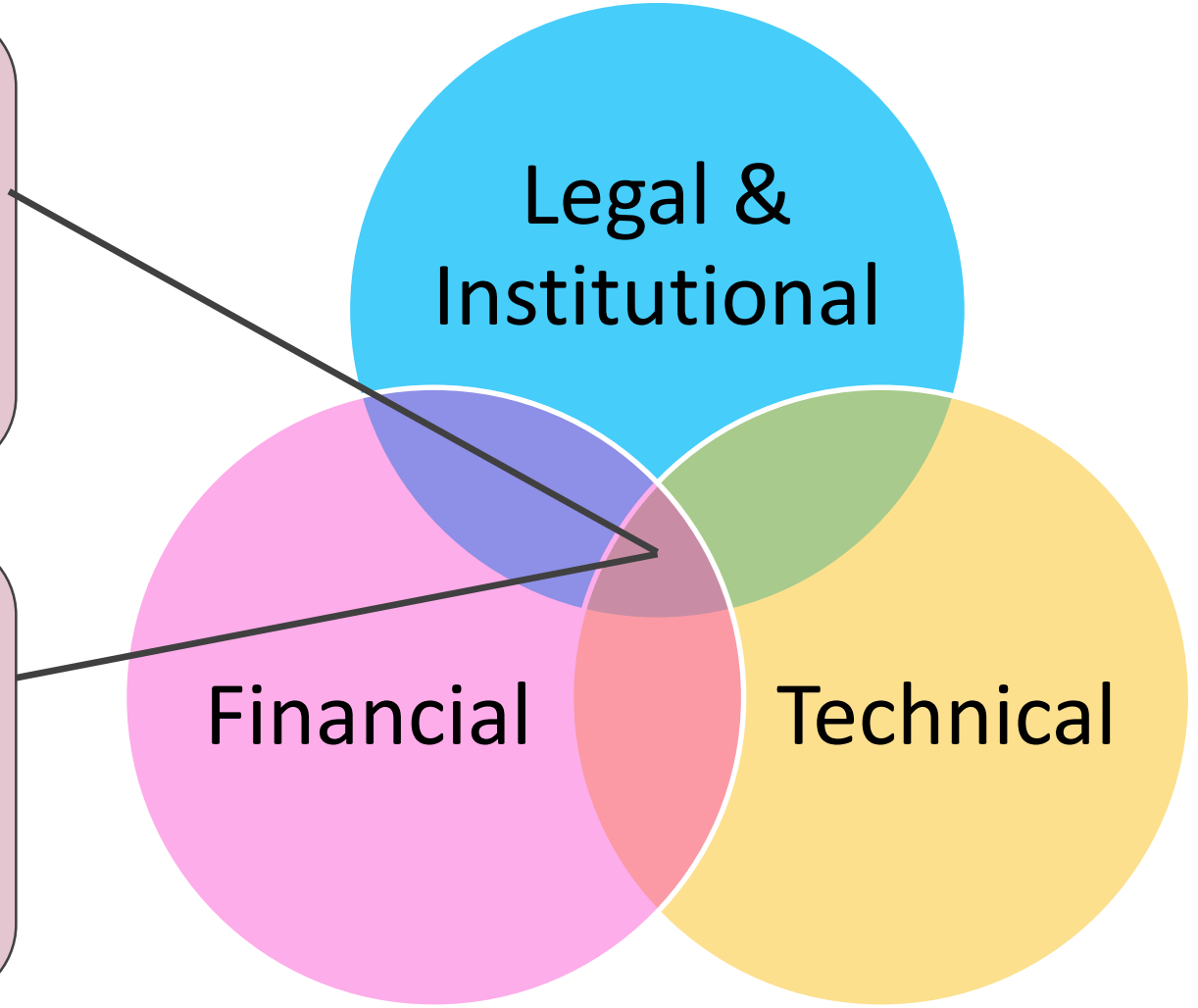
Conclusions: What's in the sweet spot? (1)

For utilities:

- New business models with financial incentives for best practices
- Grid Modernization investments that assuredly enable full microgrid communications & controls
- Market transparency that reveals utility system costs and benefits by time and location

For Customers:

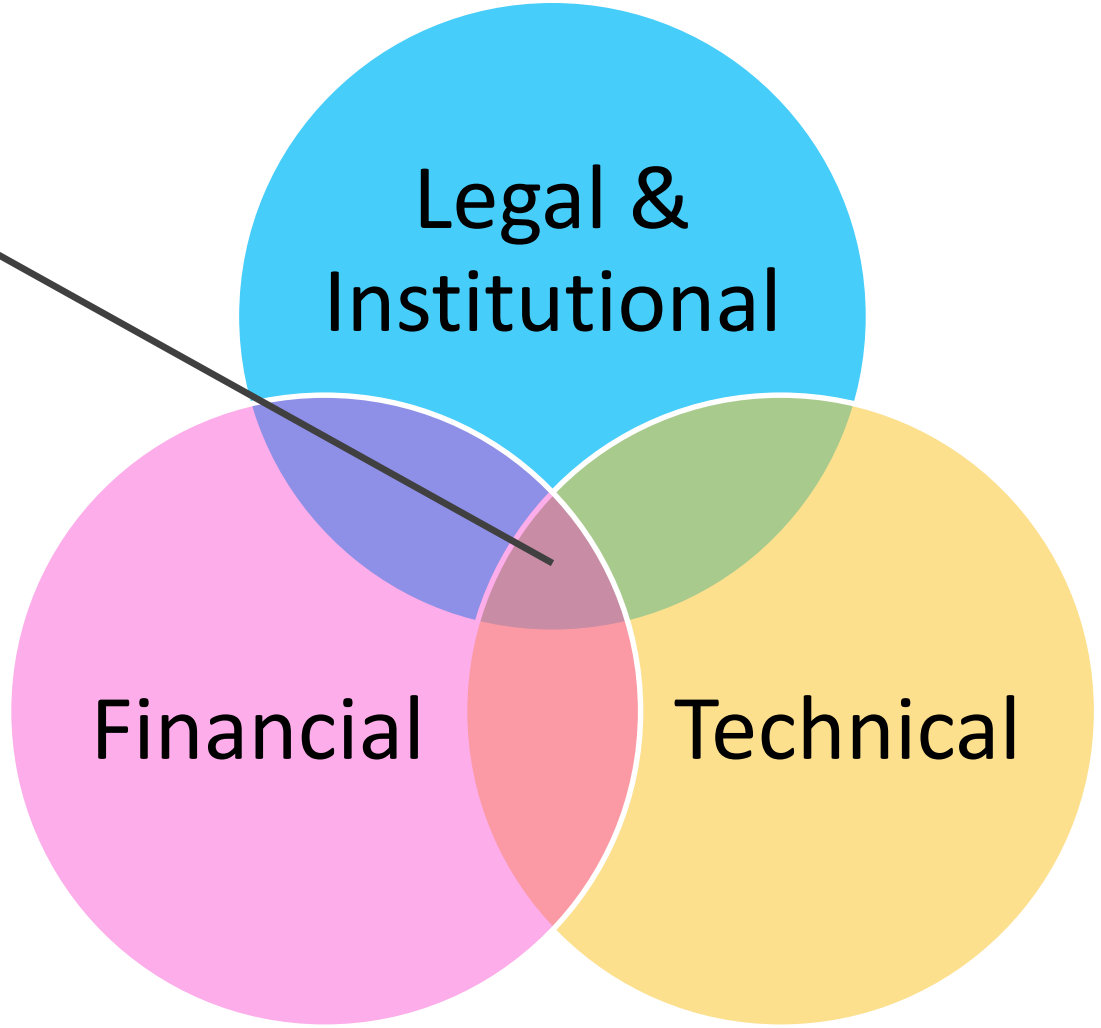
- Educated consumers who know their options for reliability and resilience
- Critical loads are identified for every customer and community
- Inclusive financing with strong consumer protections will make success inevitable



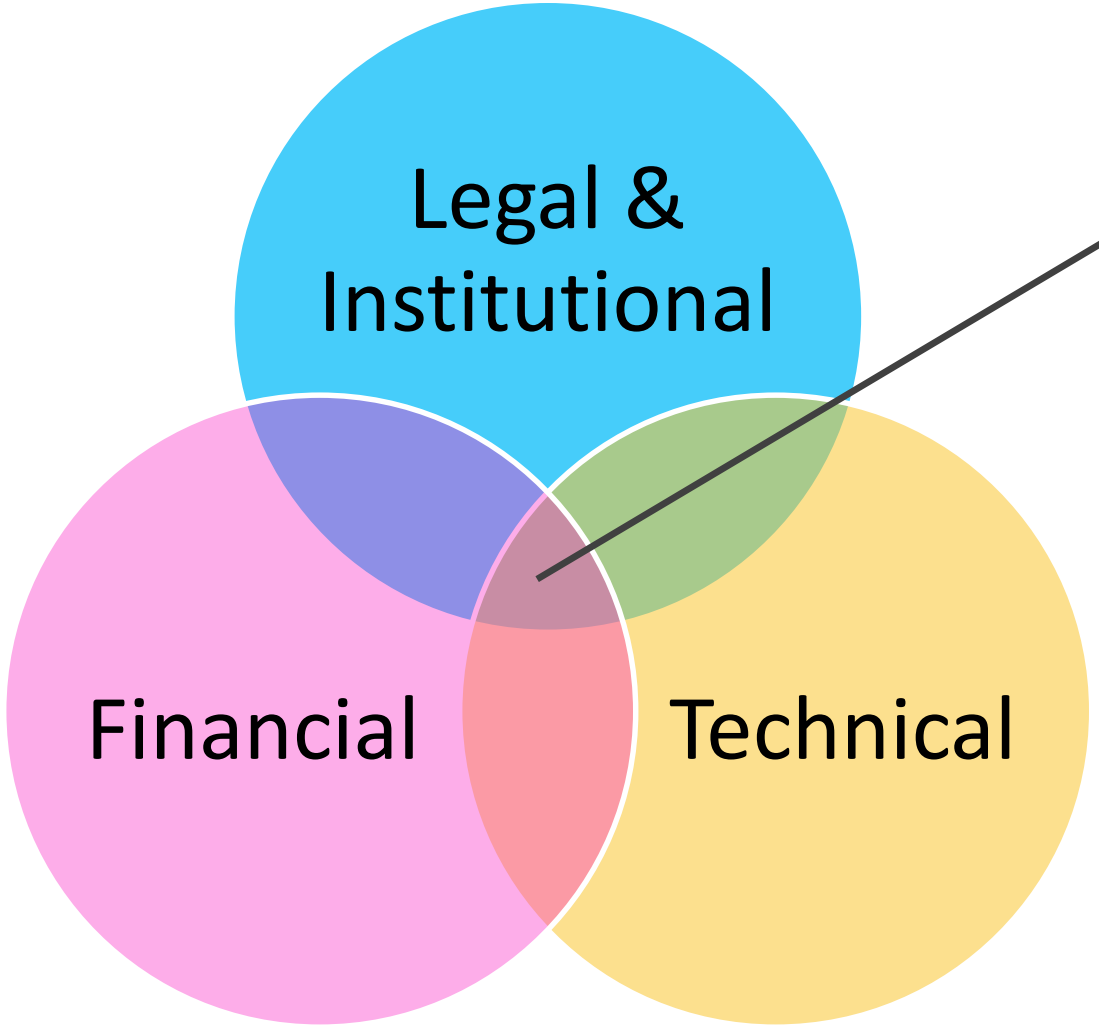
Conclusions: What's in the sweet spot? (2)

For project developers:

- Financing mechanisms, e.g., PACE, PPAs, utility on-bill financing or tariffs, bonds, vendor financing, state infrastructure banks or greenbanks
- Reliable and valid microgrid modeling and simulation capabilities, including interactions with wide-area grids
- Regulatory certainty over microgrid options, or rule-bending or waivers for pilot or experimental microgrids



Conclusions: What's in the sweet spot? (3)



For policymakers, regulators:

- Policies are clearly defined and explained
- Clarifying goals and objectives for Grid Modernization and Performance Based Regulation
- Consider taking one or more of the five steps for policy progress from Stanton 2012 microgrids report
- Regulatory innovations support frameworks
- Support for post-COVID rebuilding and revitalizing programming that works towards solving all of society's major, interrelated crises
- Question: How does the historical *state regulatory compact* and utility role change when new technologies change the century-old thinking about public utility economies of scale and scope?

Microgrids Regulatory and Policy Issues

(Source: Stanton, NRRI Report No. 12-15, pp. 15-26, 28; Table adapted from Hyams et al., 2010, pp. 22-67)

Step 1: Review and clarify existing policies. Inventory laws and rules implicated in microgrid operations

Step 2: Review rate structures for both full- and partial-requirements customers.

Step 3: Open Business Model 1 for proposed fixes (single customer intentional islanding).

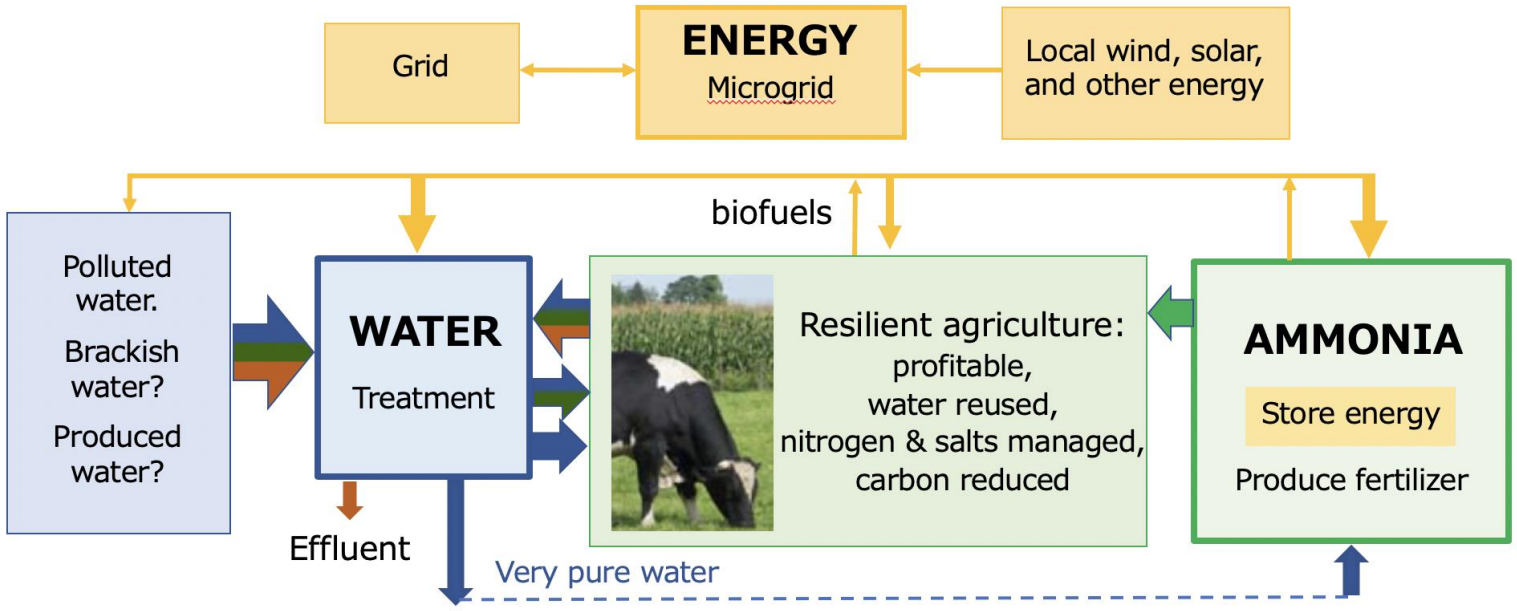
Step 4: Open any Business Models 2 (microgrids as premium fee for service), 3 (critical needs facilities), or 4 (specific load pockets).

Step 5: Open Business Model 5 (microgrids for all).

Microgrid Components and Functions	Ownership and Operations Options	Regulatory and Policy Issues and Concerns
Distribution wires up to and at the point of common coupling	Utility, except for off-grid, private systems, which could be owned by customer, landlord, or third-party	• Interconnection standards & procedures • Will off-grid private systems be regulated as public utilities? • What is a private system's obligation to serve, if any?
Distribution wires (and pipes?) inside the microgrid	• Utility • Customer • Landlord or third-party	• Does the microgrid serve a single customer or campus owned by a single entity, or multiple customers on multiple land parcels? • Are any private wires allowed? • Does the installation of wires (or pipes) need any public right-of-way, franchise, or CPCN?
Individual meters or submeters inside the microgrid	• Utility • Customer • Landlord or third-party	• Do master-metering or sales-for-resale policies apply? • Are separate meters required for DG? For storage?
Distributed generation and electricity storage	• Utility • Customer • Landlord or third-party	• What rates, wholesale and retail, apply to generation and storage for (a) self service power; (b) net metering; and (c) some, mostly, or entirely wholesale delivery? • Are rules and ownership options the same for electricity and thermal-energy distribution? • Are the thermal-energy-distribution rules the same for steam, hot and chilled water, and air? • Is multiple ownership allowed?
Microgrid controls and communications systems	• Utility • Customer • Landlord or third-party	• Who is authorized to own the switchgear at the PCC, and how are costs allocated between the microgrid customer(s) and utility? • What entities can offer load management and demand-response programming? • Who determines the operating protocols for the microgrid? • Under what circumstances, if any, shall microgrid operations be governed by the utility (or independent system operator)?

Kansas

- S.B. 69, effective April 2019, directs a broad study about "developing electric policy that includes regionally competitive rates and reliable electric service."
- The legislation calls for an omnibus study, including "whether Kansas consumers could benefit from improved access to advanced energy solutions, including micro grids, electric vehicles, charging stations, customer generation, battery storage and transactive energy"
- The study, in two parts, was presented in 2020. Part 2 findings include:
  - "Nearly all stakeholders largely supported improved access to multiple advanced energy solutions, noting the opportunities for… improved reliability, grid resilience, public health, and comfort."
  - "[M]icrogrid solutions could improve grid resiliency, especially for customers in wildfire prone areas or on a utility's worst performing feeder, and would thus benefit Kansas ratepayers."



Kansas State University reports, "To maintain local economic vitality and food security for a growing population, and to build a resilient society, pathways to resilient agricultural communities are critical. Yet delayed action is reducing possible alternatives and increasing the eventual cost of adaptation."

Post-COVID pathways

- *Wanted:* Post-pandemic recovery plans that will achieve prolific economic and employment gains, leading to a more equitable, sustainable, and resilient future. Positive redirecting is needed to achieve major, rapid improvements in climate action, social needs and equity, public health, rebuilding our economies, and increasing resilience.
- International Energy Agency proposes global investment of $1 trillion per year for 2021-22-23: "an energy sector roadmap to spur economic growth, create millions of jobs and put global emissions into structural decline… integrating energy policies… accelerat[ing] the deployment of modern, reliable and clean energy technologies and infrastructure."
- World Resources Institute proposes "rebooting" the U.S. economy using strategic investments in energy efficiency, public transit and transportation infrastructure, grid modernization, and low-income energy assistance programs.
- See *Green Recovery from COVID-19: Perspectives from Across the Globe* [Columbia Univ. Center on Global Energy Policy, Climate Week 2020 YouTube Video (90 minutes)]

Supplemental Slides

MICROGRIDS POLICY PROGRESS IN THE STATES

8th Annual HOMER International Microgrid Conference

October 14, 2020

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References & Links (1)

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- Fox-Penner, 2020, *Power after Carbon: Building a Clean, Resilient Grid*
- National Energy Screening Project, 2020, *National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources*
- Lovins, et al. & Rocky Mountain Institute, 2002, *Small is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size*
- Microgrid Institute *Reports, Presentations, and Videos*; Microgrid Knowledge *Resources*; and, Microgrid Resources Council *Resources*.
- National Association of Regulatory Utility Commissioners (NARUC) and National Association of State Energy Officials (NASEO) Microgrids State Working Group
  - *Private Sector, State, and Federal Funding and Financing Options to Enable Resilient, Affordable, and Clean Microgrids* (forthcoming)
  - *User Objectives and Design Options for Microgrids* (forthcoming)
- NARUC and US Agency for International Development, 2020, *Exploring Africa's Mini-Grid Tariff Methodologies*

References & Links (2)

- NARUC and US Agency for International Development, 2017, *Practical Guide to the Regulatory Treatment of Mini-Grids*
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- Stanton, 2019, *Policy Pathways for Public Purpose Microgrids – Opportunities Everywhere?*, Presentation for Decentralized Energy Association of Canada. (Available from author)
- Stanton, 2015, *Getting the Signals Straight: Modeling, Planning, and Implementing Non-Transmission Alternatives*, NRRI 15-02
- Stanton, 2012, *Are Smart Microgrids in Your Future? Exploring Challenges and Opportunities for State Public Utility Regulators*, NRRI 12-15
- Stanton, 2012, *Consultant Report for Maine PUC Docket 2010-267: Smart Grid Coordinator*, NRRI 12-02
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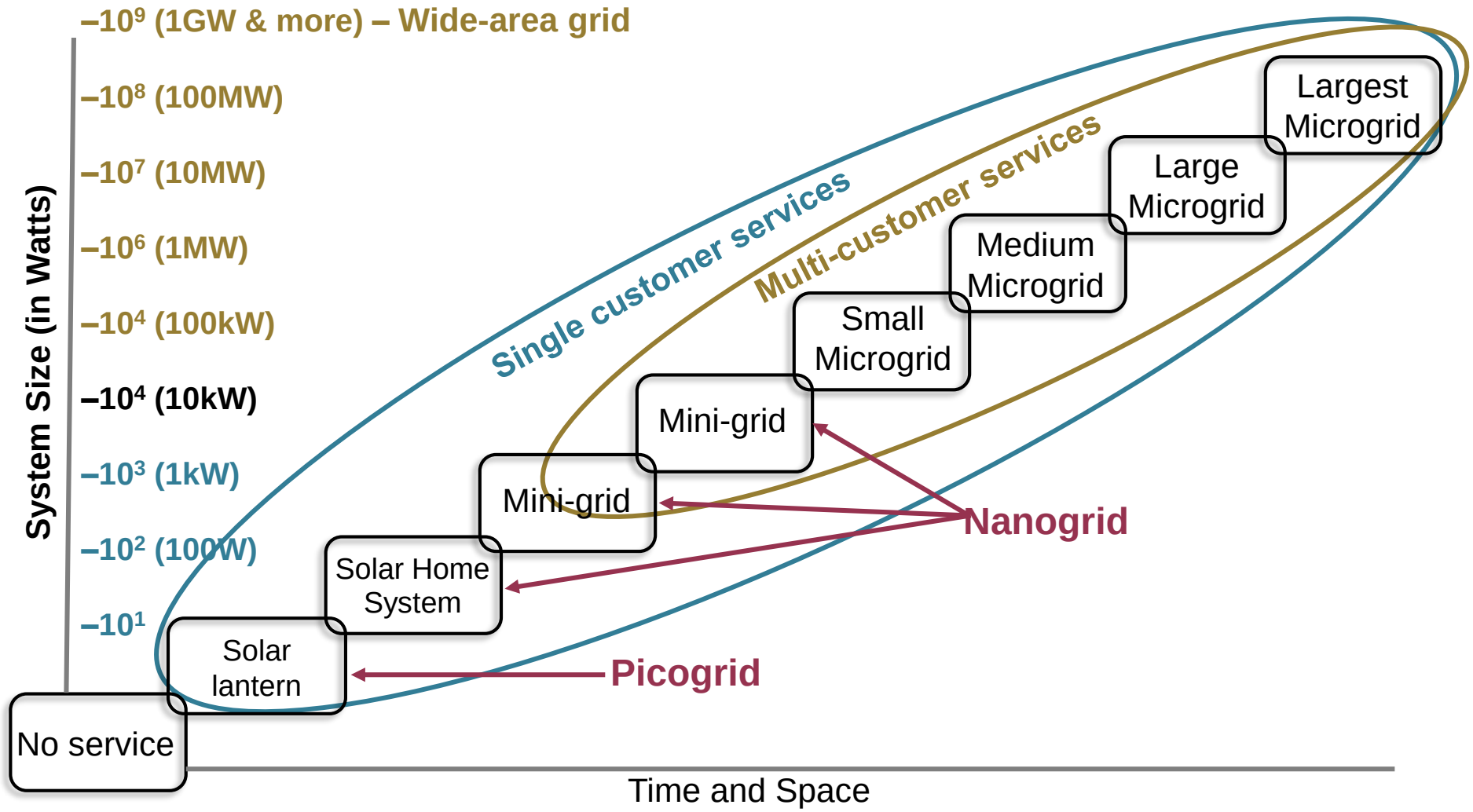
Heading up or down the "energy ladder"…

Possible steps to a more energizing future

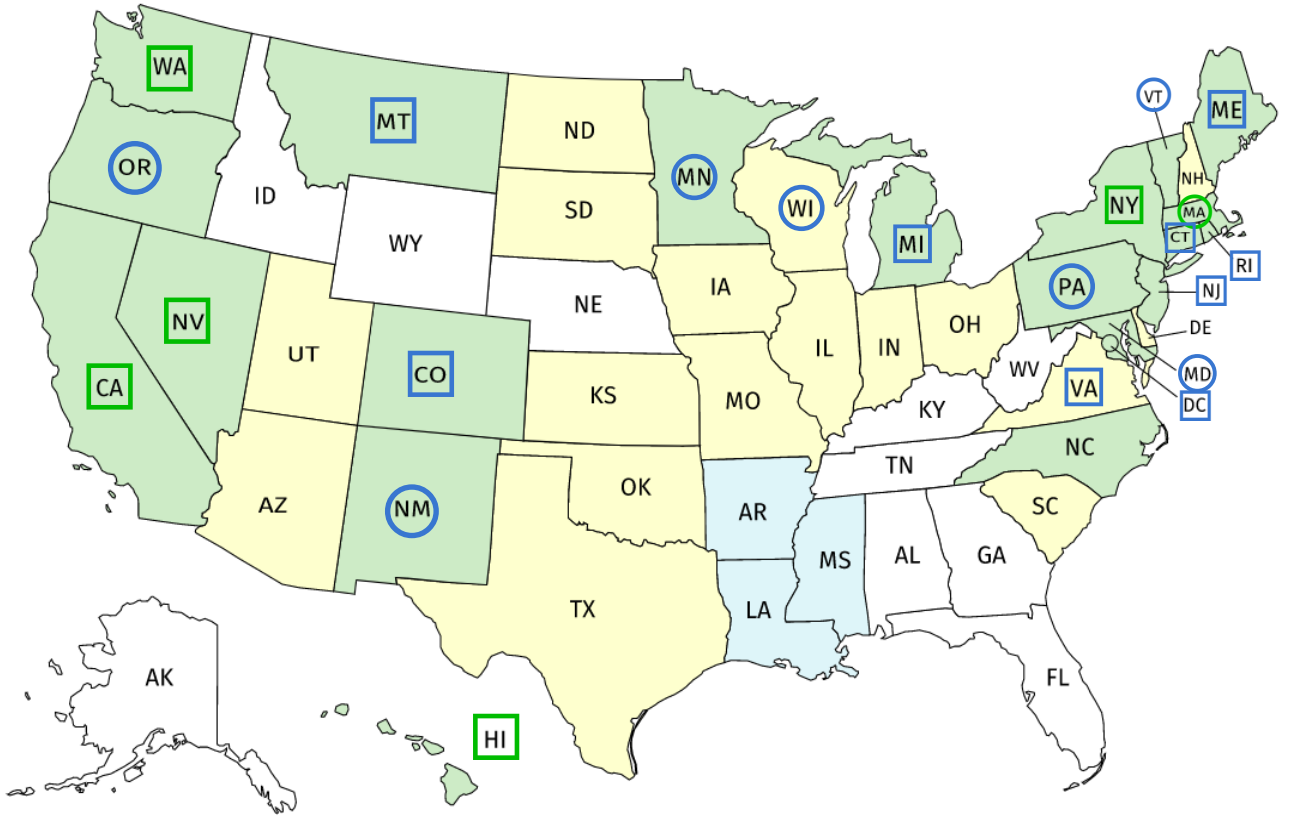
- *"Single customers" range from users of stand-alone solar appliances, all the way to the biggest campuses and military bases*
- *Utility laws and regulations are implicated, for both single, "partial requirements customers," and for service to more than one customer*



Source: Stanton and Nordman, 2017. http://icer-regulators.net/download/icer-chronicle-edition-7/

GHGs affect the global environmental commons – states are responding

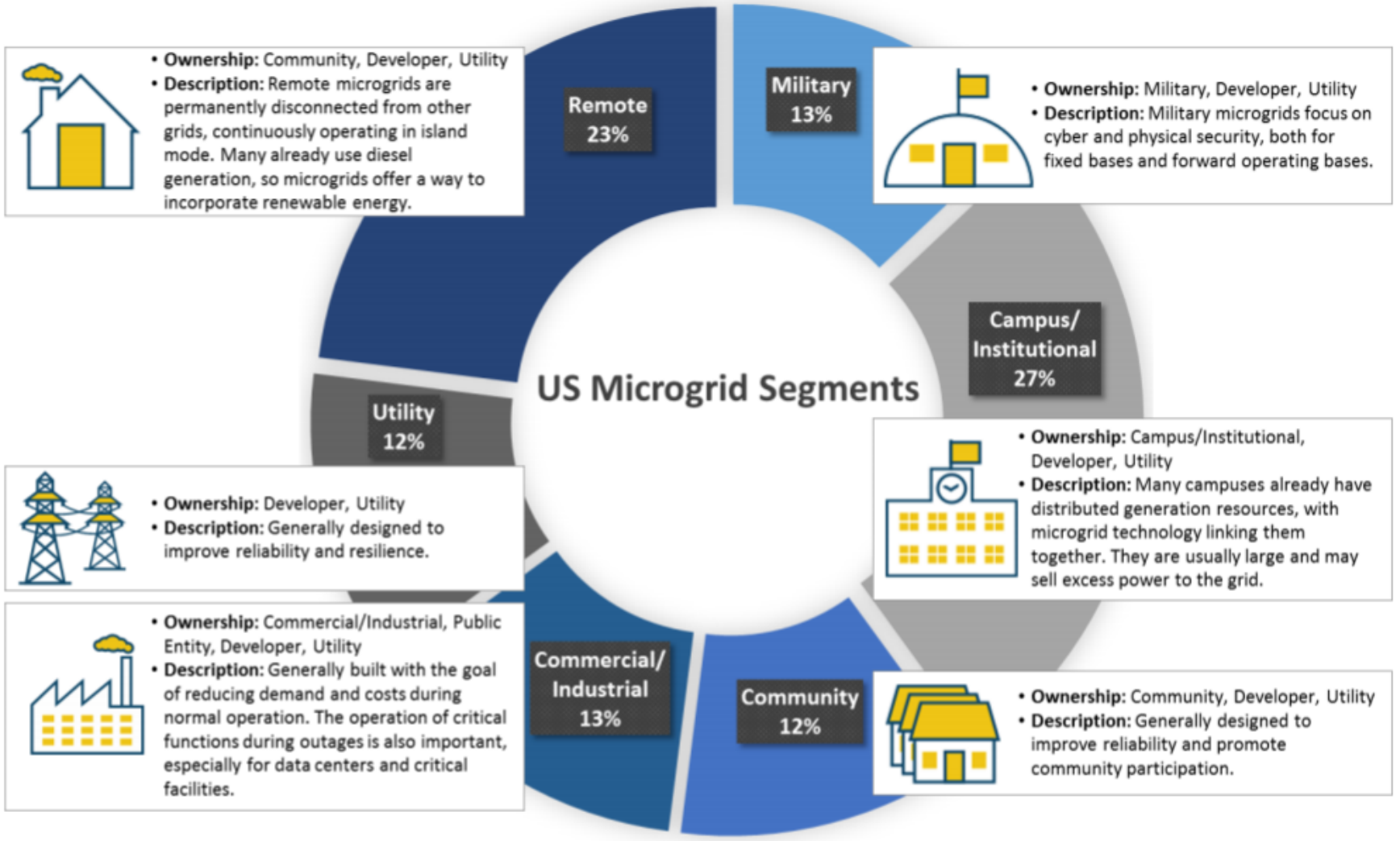
- Most jurisdictions are implementing policies to reduce greenhouse gases
- Many state goals include heating fuels, transportation fuels, and electricity
- 19 jurisdictions are reducing GHG by at least 75% by not later than 2050; 16 jurisdictions have goals for 80% or more clean electricity production by not later than 2050
- In addition, hundreds of cities and dozens of the world's largest corporations, including fossil fuel companies and major U.S. utility companies, have made similar GHG and renewable energy commitments.



Sources for map: Climate commitments data from United States Climate Alliance, *Inventory of Climate and Clean Energy Policies—Policies by State* [Web page, reporting 2019 status of states]. District of Columbia data from: DC Department of Energy & Environment, *Climate Action Planning* [Web page], and Code of the District of Columbia, §34–1432 – Renewable energy portfolio standard. EE goals or standards from American Council for an Energy Efficient Economy, Energy Efficiency Resource Standards [Web page]. RPS/CEPS data from North Carolina Clean Energy Technology Center, Database of State Incentives for Renewables & Efficiency, *Renewable Portfolio Standards and Clean Energy Standards* [Map, Updated September 2020]. All sources retrieved September 15, 2020.

Distinguishing microgrids by ownership

- Sizes range from single devices <10W to ~100 MW
- What loads are critical, for each owner and customer-participant?
- What are existing regulatory barriers, and how might they constrain technical capabilities?
- What are the potential sources of microgrid savings & revenues?



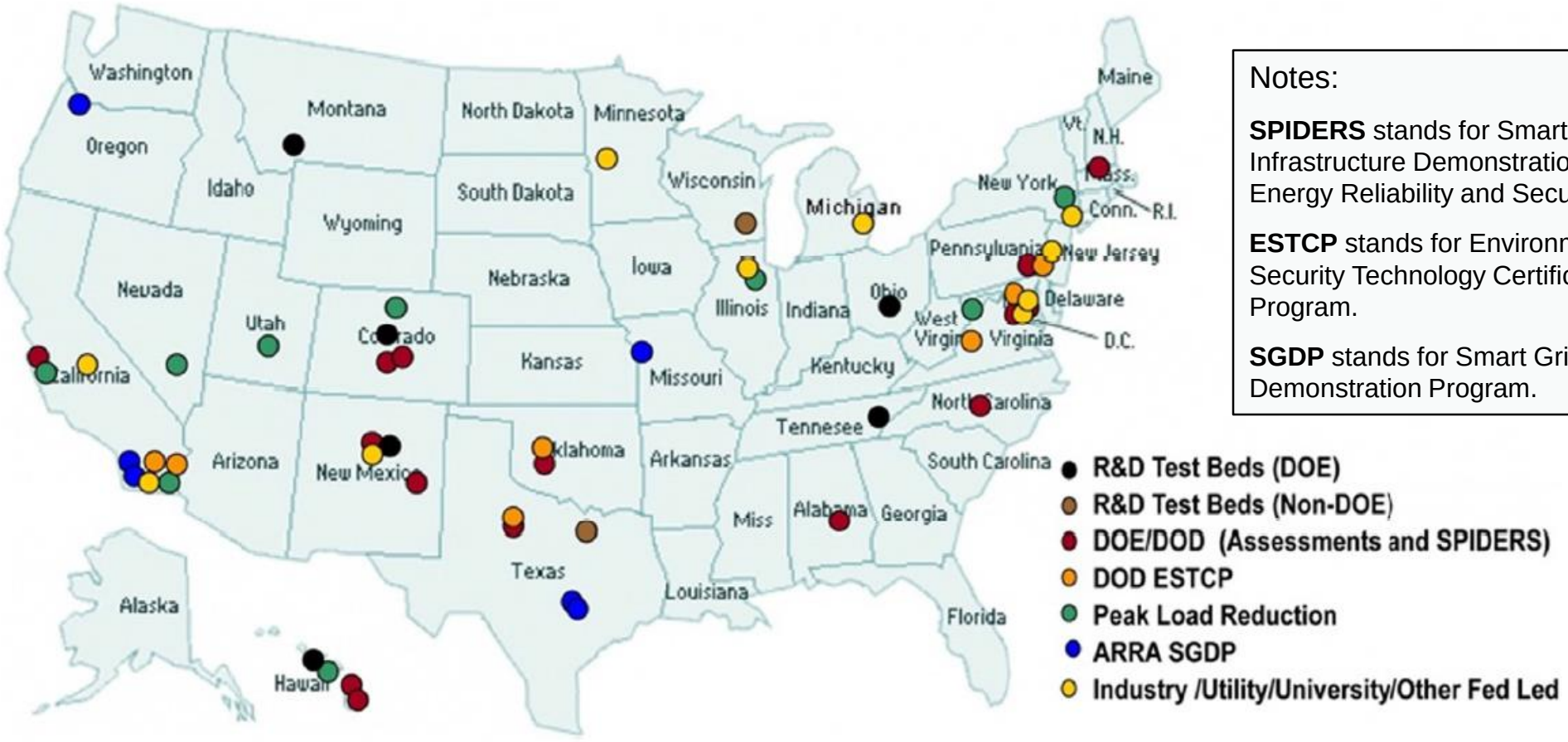
Source: Oueid, 2019, *Microgrid Guide for Publicly Owned Critical Infrastructure*, p. 22.

Test beds, pilots, & more are proliferating…

W. Feng et al.

Applied Energy 228 (2018) 1656–1668

doi 10.1016/j.apenergy.2018.06.096



Notes:

SPIDERS stands for Smart Power Infrastructure Demonstration for Energy Reliability and Security.

ESTCP stands for Environmental Security Technology Certification Program.

SGDP stands for Smart Grid Demonstration Program.

Select U.S. federal microgrid assessment and demonstration projects, U.S. DOE, Office of Electricity, Microgrid Portfolio of Activities
https://www.energy.gov/oe/services/technology-development/smart-grid/role-microgrids-helping-advance-nation-s-energy-syst-0