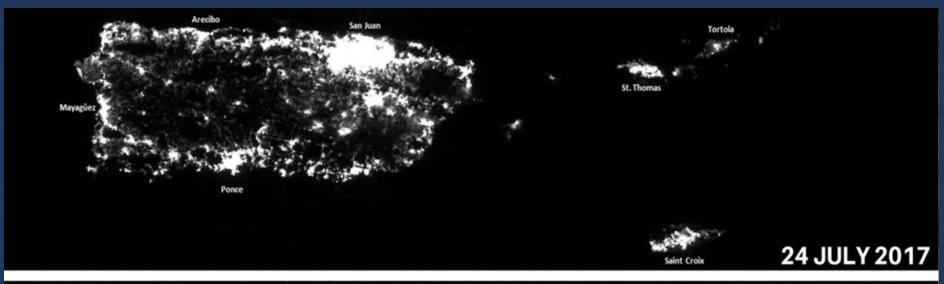
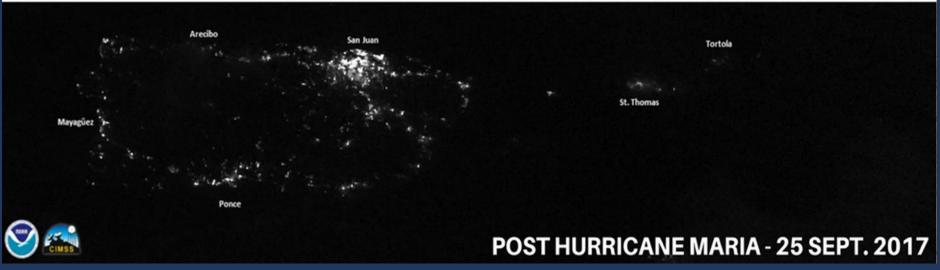
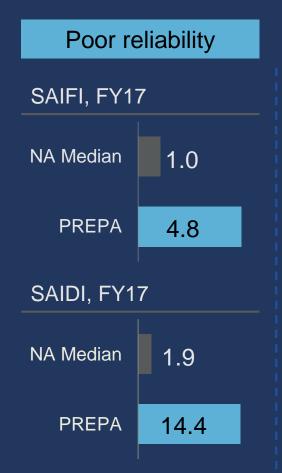
Microgrids Policy:
Forbidden Journey,
Wizarding World, or Islands of
Adventure?

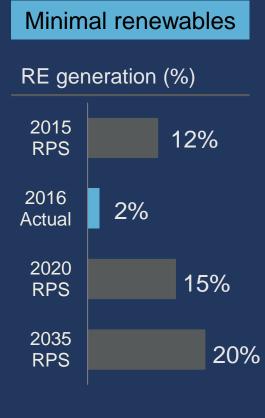


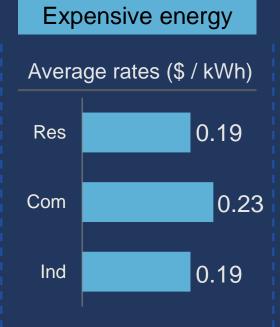




The Puerto Rican power system was struggling before the storms







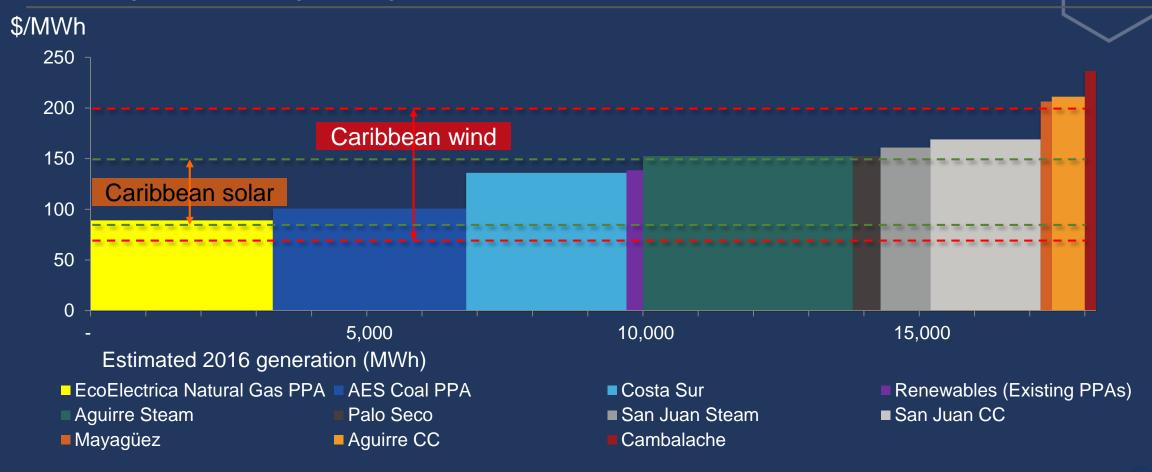
Debt burden

\$11.4 B

Total PREPA liabilities

Renewable energy is cost-effective for Puerto Rico

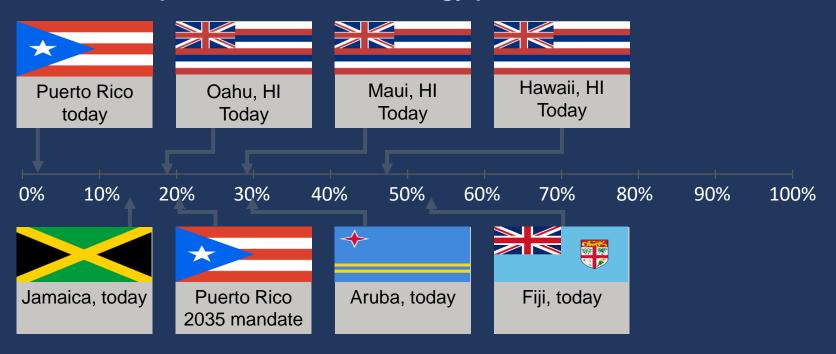
Operating cost of existing power generation in Puerto Rico, \$/MWh





Island systems are already operating at much higher renewable penetrations than Puerto Rico

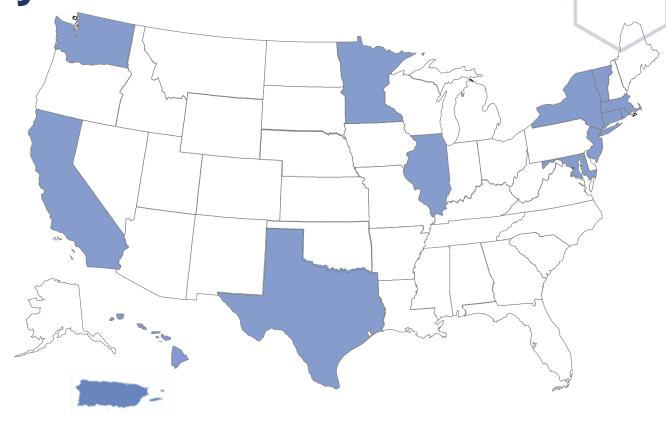
Current and potential renewable energy penetration rates without loss to reliability





Motivations for microgrids vary by region, customer, and utility

- Establish island-able shelters and critical loads during emergencies
- Reduce costs
- Integrate more DERs
- Provide grid services
- Catalyze experimentation and learning
- Economic development
- Respond to community and customer needs
- Decentralization
- Security
- Erosion of "natural" utility monopoly



States with microgrid policies or programs

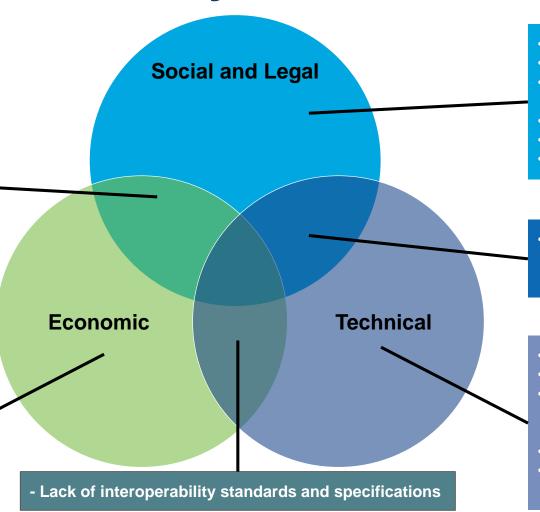
Source: Converge Strategies, NREL / MassCEC (2018)



The 'answers' are not easy or obvious

- Inconsistent and unclear policies for markets and market participation
- Limited ownership models
- Contractual uncertainty and lack of flexibility

- Inconsistent and unproven costs and benefits
- Lack of Financing
- Small inventory of existing and proven project creates risk and uncertainty for investors

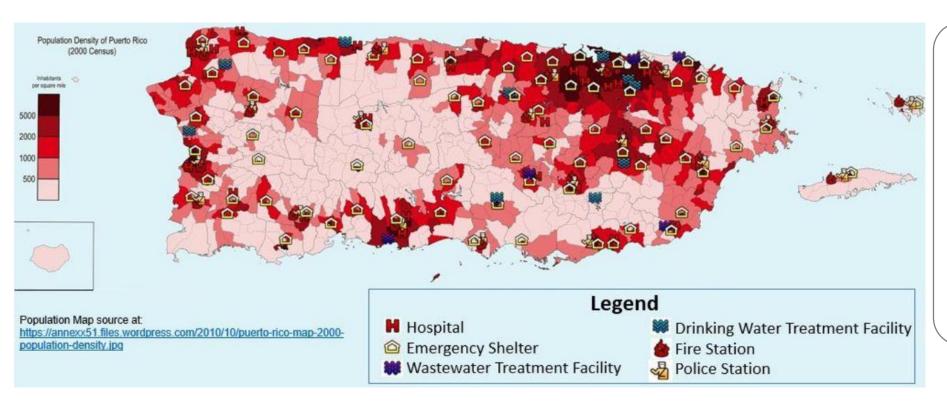


- Regulatory Policies
- Utility Franchise laws
- Lack of understanding and education
- Skills of Owner/Operators
- Underdeveloped work force
- Institutional Bureaucracy
- Inconsistent and unclear
 Interconnection Policies and
 Procedures
- Variability of renewables
- Evolving control capabilities
- Lack of visibility and forecasting for system operations
- Reliability
- Leveraging diversity of resources



Microgrids can cost-effectively improve resilience

Hypothetical islanding of critical infrastructure (NYPA)



Costs may be less than storm-hardening remote communities and carry additional benefits:

- Minimized lost economic activity during outage
- Minimized land use and transmission requirements for central generation
- Deferred or reduced need for new plants
- Reduced dependence on imported fossil fuels



What's next?

Navigating partnerships and roles	Translating value into \$	Distinguish the "what" from the "why
 Have you talked to the utility? 3rd Parties – who's going to build this thing anyway? Do customers actually want it? If so, what do they want? 	 Energy efficiency first Putting a price tag on resilience, power quality, insurance, etc. What's in the public good? Private good? What does that imply for cost allocation? 	 Expanding our thinking from microgrid pilots to microgrids at scale Do you really need a microgrid? Focus on services and value, not technologies



Microgrids Policy:
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Please complete the session survey in the meeting app

Session A4

Look under the "polls" button