Microgrids Policy: Forbidden Journey, Wizarding World, or Islands of Adventure?
The Puerto Rican power system was struggling before the storms

<table>
<thead>
<tr>
<th>Poor reliability</th>
<th>Minimal renewables</th>
<th>Expensive energy</th>
<th>Debt burden</th>
</tr>
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<tbody>
<tr>
<td>SAIFI, FY17</td>
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<tr>
<td>PREPA</td>
<td>14.4</td>
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### SAIFI, FY17
- **PREPA**: 4.8
- **NA Median**: 1.0

### RE generation (%)
- **2015 RPS**: 12%
- **2016 Actual**: 2%
- **2020 RPS**: 15%
- **2035 RPS**: 20%

### Average rates ($ / kWh)
- **Res**: 0.19
- **Com**: 0.23
- **Ind**: 0.19

### Debt burden
- **Total PREPA liabilities**: $11.4 B

Source: PREPA Fiscal Plan, January 2018; EIA
Renewable energy is cost-effective for Puerto Rico

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

- EcoElectrica Natural Gas PPA
- AES Coal PPA
- Aguirre Steam
- Palo Seco
- Mayagüez
- Caribbean wind
- Caribbean solar
- Costa Sur
- San Juan Steam
- San Juan CC
- Renewables (Existing PPAs)
- Cambalache

Estimated 2016 generation (MWh): 0 - 5,000 - 10,000 - 15,000 - 200

$/MWh: 0 - 50 - 100 - 150 - 200 - 250
Island systems are already operating at much higher renewable penetrations than Puerto Rico.

Current and potential renewable energy penetration rates without loss to reliability:

- Puerto Rico today
- Oahu, HI Today
- Maui, HI Today
- Hawaii, HI Today
- Jamaica, today
- Puerto Rico 2035 mandate
- Aruba, today
- Fiji, today
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

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

- Lack of interoperability standards and specifications
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

Puerto Rico Energy Resiliency Working Group
What’s next?

<table>
<thead>
<tr>
<th>Navigating partnerships and roles</th>
<th>Translating value into $</th>
<th>Distinguish the “what” from the “why”</th>
</tr>
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<tbody>
<tr>
<td>• Have you talked to the utility?</td>
<td>• Energy efficiency first</td>
<td>• Expanding our thinking from microgrid pilots to microgrids at scale</td>
</tr>
<tr>
<td>• 3rd Parties – who’s going to build this thing anyway?</td>
<td>• Putting a price tag on resilience, power quality, insurance, etc.</td>
<td>• Do you really need a microgrid?</td>
</tr>
<tr>
<td>• Do customers actually want it? If so, what do they want?</td>
<td>• What’s in the public good? Private good? What does that imply for cost allocation?</td>
<td>• Focus on services and value, not technologies</td>
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Please complete the session survey in the meeting app

Session A4

Look under the “polls” button