MIGHTY MICROGRIDS

HOW SMALL GRIDS COULD BECOME A BIG DEAL

MIGHTY MICROGRIDS

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How much do Americans spend on electricity each year?
A(N) (INEFFICIENT) MARVEL
PORTION OF ELECTRIC GENERATION LOST AS HEAT

67%
Electric outage rate

2005

Photo: SULA-CH via Flickr

2015
UNPRECEDENTED OPTIONS
INSTALL EVERY 60 SECONDS
PERSONALIZED CONTROL

Software allows many iterations
A SMALL START

0.1%

Microgrid % of total U.S. electricity generation
UP AGAINST A MONOPOLY PROBLEM
DISTRIBUTION GRID INVESTMENT LAGGING

“America will see an investment gap in distribution infrastructure of $57 billion by 2020”

American Society of Civil Engineers
SLOW TO ITERATE
"MIGHTY" MICROGRIDS
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.
MICROGRID

- Distributed Energy Resources
- Substation Energy Storage
- Customer Energy Management
- Microgrid Controller
- Feeder Automation System Technology
- Home Energy Storage
- Community Energy Storage
MICROGRID

• Likes to act alone
• Capable of making its own decisions
• May benefit from remaining grid connected
• Lots of possibility

Photo: tifotter via Flickr
A QUESTION

Where is one of the first 100% renewable microgrids larger than 1 megawatt?
A FEW SAMPLES
STAFFORD HILL

Photo: Green Mountain Power

Stafford Hill
in Rutland, Vermont

100%
Renewable
2.5 Megawatt (MW) Solar
2 MW/ 1 MWh Lithium-ion Storage
2 MW/ 2.4 MWh Lead-acid Storage

97%
Utility Funded
Costs $10.77 Million

Economic Benefit
Cost 17.1 ¢/kWh
Value of 18.7 ¢/kWh
AUSTIN

Photo: clickykbd via Flickr

UT: Austin in Austin, Texas

0%

Renewable

135 megawatt Combined Heat & Power provides power, heat, and cooling for a 20 million square foot campus

Economic Benefit

Annual savings of $4.8M (compared to buying energy from the market).
LONG ISLAND

Photo: Clean Coalition

Long Island
in New York City, New York

50% 50%

Fossil Fuel vs Renewable

50% of power will come from 15 MW of local solar and 25 MWh of energy storage

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Economic Benefit
Will defer $300 million in transmission and distribution costs from the utility
MACRO BARRIERS
5 Reasons Why Microgrids Face Macro-Problems

1. A microgrid is undefined in most state laws
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4. Lack of a plug-and-play control solution

5. Who pays for it? Who benefits?
SMALL RULES FOR BIG RESULTS
STATE FUNDING?

New York: NY Prize provides funding for municipal feasibility studies

Minnesota: No microgrid financing

Credit: Microgrid Resources Coalition
EXEMPT FROM REGULATION?

New York

Exempt if:
1. solely on private property OR
2. uses cogeneration, small hydro, or alternative energy

Minnesota

Exempt if:
1. muni or co-op OR
2. only serves tenants of single building OR
3. serves < 25 persons

Credit: Microgrid Resources Coalition
New York does not designate monopoly service territories

Only if they serve fewer than 25 persons

Credit: Microgrid Resources Coalition
EASY INTERCONNECTION?

New York

Minnesota

REPORT CARD B

REPORT CARD C

Credit: Microgrid Resources Coalition
RETAIL OR WHOLESALE MARKET COMPENSATION?

**New York**

Wholesale, yes. Retail may be coming with Reforming the Energy Vision process.

**Minnesota**

Wholesale, no. Retail limited to net metering for 1 MW or smaller.

Credit: Microgrid Resources Coalition
Distribution utilities may be limited in ownership of microgrids. Vertically integrated utilities will likely fight any laws enabling microgrids.

Credit: Microgrid Resources Coalition
ROOFTOP SOLAR AND BATTERY STORAGE PRICES KEEP FALLING

- **Battery: cost per kilowatt-hour**
  - $0
  - $450
  - $900
  - $1,350
  - $1,800

- **Solar: Cost per installed Watt**
  - $0
  - $3
  - $6
  - $9
  - $12

- Median solar installed cost
- Lithium ion battery cost

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**Graph details**:
- X-axis: Years (2000 to 2020)
- Y-axis left: Solar: Cost per installed Watt ($0 to $12)
- Y-axis right: Battery: cost per kilowatt-hour ($0 to $1,800)

**Sources**:
- IISERs
- ENERGY DEMOCRACY INITIATIVE
Communities all over the country are finding ways to break the macro barriers to microgrids. As we flip from a top-down to bottom-up grid management structure, major policy barriers must be lifted in order to expand energy democracy to customers and producers.

Matt Grimley and John Farrell
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