The MICROGRID 2021 National Conference

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Summary

What is a Microgrid? - *The combination of one or more systems for generating electricity (solar, wind, tidal), storing electricity (batteries, flywheel, hydro) and distributing electricity locally or selling it to the main electric grid.* (Nearby examples are PSE's microgrid in Glacier, Washington and OPALCO's microgrid on Decatur Island.)

Microgrids add resiliency to existing utility grids. They provide back up power during unexpected outages and they replace expensive power from the grid during periods of peak demand.

We attended the Microgrid 2021 Conference to learn about how a microgrid could both add resiliency and generate additional power to supplement what we receive on Lummi Island through PSE's submarine cable from the mainland. Wintertime peak demands for power already are pushing the cable towards its maximum capacity of about 3 megawatts (Mw).

Normal population growth on Lummi Island, a rapidly growing fleet of electric vehicles, and the prospect of charging an all-electric ferry at the Lummi Island terminal in future years have motivated us to look for alternative solutions to the supply shortage we will soon be facing. Although the submarine cable is rated for three times the voltage it currently carries, achieving that voltage would require a new line from the nearest PSE substation at I-5 and Slater, or upgrading all the transformers along the existing 12,500 volt line – either one an expensive proposition.

A Microgrid could be part of the solution. The microgrids at Glacier (0.5 acre) and Decatur Island (3.25 acres) show that resiliency - backup power and peak power substitution - can be provided from small footprints.

We have appended our notes from the Microgrid 2021 Conference in May- June this year. Panels addressed the design, funding, operations and technology choices of microgrids already in service elsewhere in the U.S. and abroad. The notes highlight general points to keep in mind when looking at microgrid solutions . Please see Microgrid Knowledge at https://microgridknowledge.com for more. A student at Bellingham Technical College has done a class project on generic options he identified for MGs on Lummi Island. You can access his report here.

Microgrid Basics

1.World Bank estimates that 200,000 Microgrids (MGs) will be needed by 2030 worldwide, especially in isolated areas and in low income countries. This follows telephone, internet development. Worldwide, 2.7 billion people have unreliable or no power.

2. Need to train all stakeholders, esp. banks, in MG advantages—cost, resiliency, safety, reducing climate pollution.
3. A solar+battery+diesel microgrid system allows the operators to operate the diesel in its zone of greatest efficiency, 80%, rather than at its maximum, and less efficient, output.
4. Texas has about 200 MGs. Some went into 'island mode' during the Texas winter ice storm; others (143) continued to feed the grid; kept water supplies, assisted care, grocery stores running;
5. Utilities have to be a part of the solution. Utilities and private microgrid operators need to work together to increase electricity supply and reliability. Utilities can facilitate the adoption of microgrids by supporting the same rules for private microgrid energy suppliers at policy level.
6. Awareness of the term "microgrid" is low. But once explained, enthusiasm is high.
7. Feasibility and pre-construction phase is the most difficult and costly. But Maryland has experience in vetting and guiding these projects and supplying grants to the most viable. State level needs to be willing to help projects get off the ground and let communities articulate what is needed.

Resilience

1. As the grid becomes less reliable with climate change, MGs can provide resiliency, otherwise private diesel (or propane) generators will pop up everywhere. Need to beat the price of diesel.
2. MGs need to be part of the solution but policy is still lacking.
3. Reliability is paramount to owners/customers, whether a large system or a MG. Answer: switch systems to island mode when severe storms approach. But islanding is an additional cost. We know resilience is the greatest value, but in terms of quantifying it, we don't do it.
4. Reliability vs. resilience? In many circles, they mean the same. But at smaller scale, above the meter, resiliency is the dominant word customer doesn't mind a 10-minute outage, which is the kind of outage you have with a resilient system.
5. Electric vehicles are now straining the network. Microgrids provide resiliency to end customers.
6. Microgrids that complement and backup the utility grid can save lives, as was demonstrated with the Blue Lake Rancheria microgrid in N. California. The San Benito Health Foundation Microgrid also provides critical health services seamlessly during utility outages. It is hard to put a $ value on the peace of mind and life-saving benefit of having seamless backup for essential services.

Planning & Design

1. Each MG use for the military, a big box store, etc. tends to require a specific, unique design which makes standard/modular solutions at scale difficult.
2. The bigger the inverter to convert DC to AC the more reliable it will tend to be.
3. Load management sets the stage for operating successful island grids. On line reserve capacity and switching between grids are important. Flexibility leads to cost savings.
4. Outcomes: (Planning, selling, design decisions) Understanding incentives and leveraging sources of revenue, limits of selling your power back to the grid, Smart controllers for opening your MG. Communication within the grid at the micro level for 'blink switching' in and out. These are all important considerations.
5. Starting small and scaling up is the best way to keep overall cost down.
6. What size MG is the upper limit on size before getting into big engineering projects (one of a kind)? 4Mw is threshold (ABB). 1Mw is close to off the shelf now or plug and play. MGs can use modular designs that allow them to phase in additional power supply, to increase the load capacity over time.

1. Microgrids for essential service applications don't require large land area. The Blue Lake Rancheria microgrid in N. California combines solar panels with battery storage and a diesel generator on less than 2.25 acres.

Storage

1. Batteries coming down below $200/kW, which makes many projects financially viable.
2. Tesla batteries switch in within a few cycles of an outage—i.e. instantaneously, whereas generators will have a 10 sec. delay.
3 Iron flow batteries are a financially competitive technology for long-term storage applications of more than 4 hours. Systems with 25 year operating lives are available that provide 400kWh of storage capacity in a container that has a footprint of only 320 square feet. Response times of less than 1 second beat generators and have less environmental impact than diesel generation or lithium battery storage.
4. What battery chemistries are prevalent today? L-Ion is predominant now, but Lead Acid still pencils out better on small systems in rural areas and are more available.
5. Look at life cycle costs for operations and payback.

Controls

1. Microgrid controllers are the "brains" of the microgrid, managing the MG's power resources, often integrating power with a utility grid, and maximizing the efficiency of the system
2. Need to plan for EV charging, demand for which will be climbing very fast. Outages greater than 2-4 hours will require back up generation.
3. MG helps you use your energy more effectively. Renewable natural gas (from organic waste stock) and hydrogen power sources are coming.

Financial

1. *What is the typical rate of return on investment (ROI)?* Panel concluded 5-15% was average.
2. Local utility rates drive investment. Areas that experience outages more than once a year are a good place to start..
3. State and local incentives really drive which projects move forward.
4. Utility agreements of selling power come into play. (WA has 4% limit system-wide on selling power back to PSE per WA Utilities Commission)
5. Rate payers are also important and want to reduce carbon, to do the right thing, while getting a payback for their investment. Having credible numbers is key. Don't overlook what the value of resilience is; the avoided cost of power outages.
6. Times are changing rapidly. Good news is events in TX and CA have made ancillary benefits a component of real value. Use it.
7. Grant funders will require detailed project engineering documents, not just best guesses.
MG's are probably going to be self-sustaining by 2025, absent grant funding from lenders.
8. Find the Win-Win formula for all the players you are dealing with. Everyone wants something different in addition to payback.
9. *How do you value resilience?* Using outages is difficult because they are rare in most cases and business isn't tracking how much the outage cost them. That's changing. Some things you can't put a price on, such as maintaining public safety, emergency health care, and shelters.

This summary was presented at Whatcom County's – Lummi Island Ferry Advisory Committee meeting of July 14th , 2021, by Mike Skehan

Link: Matthew Weaver https://ourlummiisland.org/DOC/MicroGrid/Microgrid-Final-Project.pdf?b1b523&b1b523