
MICROGRID
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May 16-17, 2023 | Anaheim, CA
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Employing Data to Achieve Microgrid Goals

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5/16/2023

Typical Microgrid Goals

Carbon Footprint Reduction

- Operating the DER's within the microgrid based on carbon production vs. utility carbon production.
- Employing microgrid DER assets and operation to improve overall carbon footprint of facility/ site
- Selection of Inverter based DER's in the development of the Microgrid.

Resiliency

- Operating the DER's in a utility outage situation based on carbon reduction goals and/ or run time needs of microgrid.
- Managing available energy supplies to ensure adequate outage support time is maintained (energy storage minimum SOC for example).
- Selection of grid forming asset(s) in the development of the Microgrid.

Economics

- Operating DER assets based on lowest cost of energy of each of the available energy sources.
- Participating in Utility revenue streams available through the utility provider (Coincident Peak Load Management, Real Time Pricing, Frequency Control, etc.).
- Site peak demand reduction.

Carbon Footprint as a Priority

Standard DER Operation (Utility source available)

- Maximum ESS discharge during highest utility carbon footprint hours.
- Minimize fossil fuel-based operation and ensure fossil fuel based assets are not needed to augment utility demand.
- Maximize solar output and low or no carbon renewable DER's.

Resiliency Mode DER Operation (Utility source unavailable)

- If capacity allows, operate facility as long as possible on BESS
- When operating reciprocating asset for long term outages, parallel low or no carbon DER's with recip to reduce fuel burn, emissions maintenance hours and maximize carbon reduction.
- Operate reciprocating engine asset with renewable fuel.
- Automated load shedding of non critical loads.

Supporting Data Points

1. Real time utility emissions footprint
2. Energy Storage SOC
3. Solar output tracking vs overall load demand
4. Site loads
5. On site load data to make shedding decisions.

Resiliency as a Priority

Standard DER Operation (Utility source available)

- Maximum ESS discharge during highest utility carbon footprint hours.
- Minimize fossil fuel-based operation and ensure fossil fuel based assets are not needed to augment utility demand.
- Maximize solar output and low or no carbon renewable DER's.

Resiliency Mode DER Operation (Utility source unavailable)

- Immediately place facility on reciprocating engine driven generator.
- When operating reciprocating asset for long term outages, parallel low or no carbon DER's with recip to reduce fuel burn, emissions maintenance hours and maximize carbon reduction.
- Discharge energy storage to increase overall run time of reciprocating asset..
- Automated load shedding of non critical loads.

Supporting Data Points

1. **Fuel/ DEF levels**
2. **Weather forecasting**
3. **Energy Storage SOC**
4. **Solar output tracking vs overall load demand**
5. **Site loads**
6. **On site load data to make shedding decisions.**

Economics as a Priority

Standard Mode DER Operation (Utility source unavailable)

- Maximum ESS discharge during highest utility cost hours.
- Minimize fossil fuel-based operation and ensure fossil fuel-based assets are not needed to augment utility demand.
- Operate DER's in accordance with associated grid support incentives to generate revenue from the assets.
- Maximize solar output and low or no carbon renewable DER's to reduce utility usage/ charges.

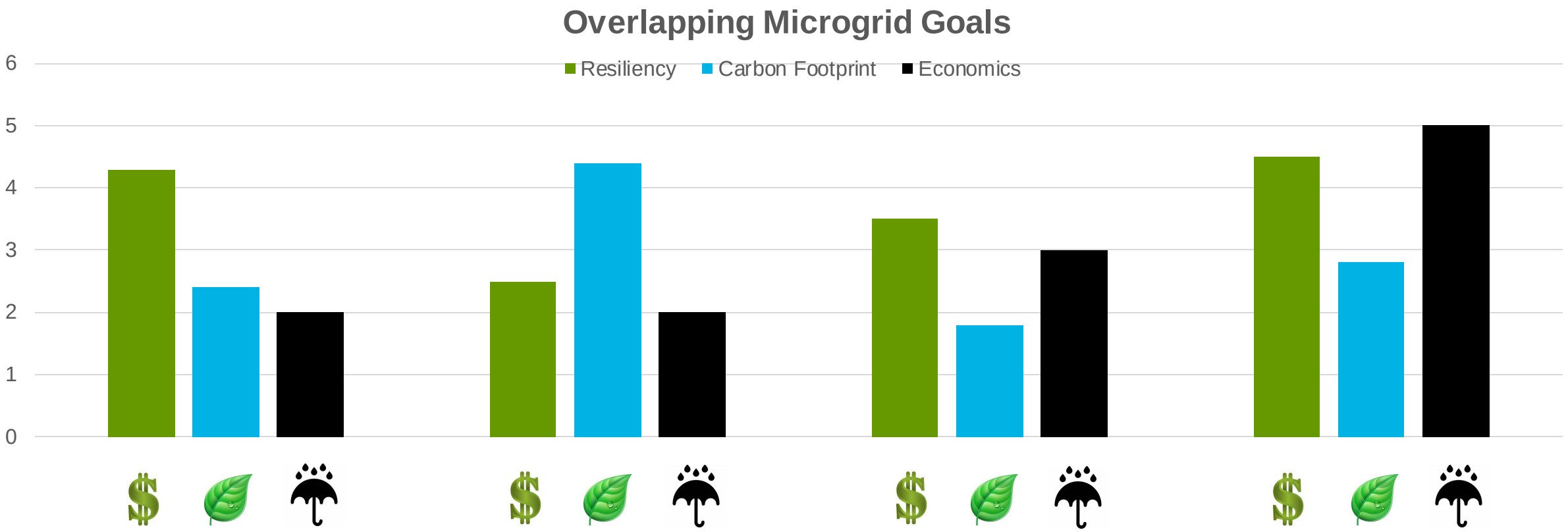
Resiliency Mode DER Operation (Utility source unavailable)

- Immediately place facility on reciprocating engine driven generator.
- When operating reciprocating asset for long term outages, parallel low or no carbon DER's with recip to reduce fuel burn, emissions maintenance hours thereby reducing operating costs.
- Discharge energy storage to increase overall run time of reciprocating asset to reduce fuel burn and operating costs.
- Automated load shedding of non-critical loads to reduce fuel burn and operating costs.

Supporting Data Points

1. **Fuel/ DEF levels**
2. **Weather forecasting**
3. **Energy Storage SOC**
4. **Price of energy markets**
5. **Time/ Day/ Month**
6. **On site load data to make shedding decisions.**
7. **Utility daily load peak data to support CP program participation.**
8. **Historical peak data.**

Overlapping Microgrid Goals are Typical



Weighting of priorities will dictate the makeup of the Microgrid DER assets and the application approach.

Summary

- Microgrids can contain one or more DER.
- The DER's contained within a Microgrid are selected based upon the customer goals.
- Customer goals for Microgrids are based on one or more of the following:

Questions?


SOLAR ENERGY
BIO ENERGY
WIND POWER
RENEWABLE ENERGY
GEOTHERMAL ENERGY
HEAT PUMP
HYDROPOWER
ENERGY STORAGE