MicroGrid & ENERGY AGGREGATOR MODEL

**MicroGrid:** We are developing an electrical model for the development and determining its effects on the exiting grid. We are also looking at developing protection schemes for the model so that any faults in the grid are able to be isolated.

**Energy Aggregator:** We are also developing a model to simulate the flow of energy within the development and take advantage of sources of electrical generation and storage within the development to create a mechanism for load management.

**Goals:**

- **MicroGrid:** Show that the electrical grid within Palamanui can actually help the health of the overall grid rather than harm it. Adapt a protection scheme for Palamanui that clears various kinds of faults.
- **Energy Aggregator:** Demonstrate the usefulness of active load management within Palamanui and the profitability of a business that provides these capabilities.

**Strategies:** We are using tools such as MATLAB and PowerWorld to simulate hypothetical situations occurring within the development and then see how we can adjust our models to optimize the results.

### MicroGrid

- Distributed generation
  - Reliability
  - Flatter load curve is achievable
- MicroGrid concept
  - Beneficial to customers as well as the utility
  - Beneficial to the grid
  - Mesh network employed for more reliability
  - Distributed generation enhances the voltage profile of the whole system
- The Palamanui model should show the proposed benefits
- Protection
  - Challenges:
    - Overcurrent protection is ineffective
    - Various kinds of faults are cleared by different kinds of protection schemes
    - The nuances of applying these schemes to small-scale distribution (mesh) networks are not fully developed
- We’re still working on adapting these schemes to the Palamanui model

### Energy Aggregator

- Regulates power flow from electricity provider and on-site generation sources to loads and storage units
- Actively manages load to capitalize on price differentials
- Load shedding capabilities available through individual contracts

**Benefits:**

- Reduced electricity rates within development
- Profit stream for private company
- Reduction in infrastructure needed for Big Island’s electrical grid
- Increased reliability within Palamanui’s MicroGrid

**Future Work:**

- Assign economic and reliability value to adjusting load curve
- Optimize degree of storage/generation used to maximize revenue

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**The Goal:**

Make this ...  

<table>
<thead>
<tr>
<th>Palamanui Electrical Load</th>
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<tbody>
<tr>
<td>![Load Curve Image]</td>
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... look like this ...

<table>
<thead>
<tr>
<th>Palamanui's Perceived Load #1</th>
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<tr>
<td>![Perceived Load #1]</td>
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... or like this ...

<table>
<thead>
<tr>
<th>Palamanui's Perceived Load #2</th>
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<td>![Perceived Load #2]</td>
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... for HELCO using technologies such as photovoltaic panels, battery banks, and load shedding.