Power for a Resilient Fairchild Airport

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PORT of Port Angeles

CLALLAM COUNTY Washington

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Problem Statement

- The Fairchild International Airport in Port Angeles is attempting to increase its disaster resilience, and is specifically preparing for an earthquake along the Cascadia Subduction Zone that could produce 9.0 magnitude earthquakes.
- We were tasked with investigating the technical and economic feasibility and benefits of implementing a microgrid at the airport to enhance the resilience of the airport (Tier I/II) and to take advantage of the long term economic opportunities afforded by independent power generation (Tier III)
- The Port was also interested in the economic feasibility of a large solar power plant installation in the community to be sold to the local utility.

Site Assessment

- One of the concerns with placing solar panels near an airport is that the reflective surfaces could cause hazardous glare for pilots and airport personnel.
- Using ForgeSolar, we produced a FAA Glare Adherence Report the showed what location were permissible for the PV array (see picture below). 10 acres of ground space and 2 acres of rooftop space for the blue area.
- These location were also checked against the restricted zones near the runway.

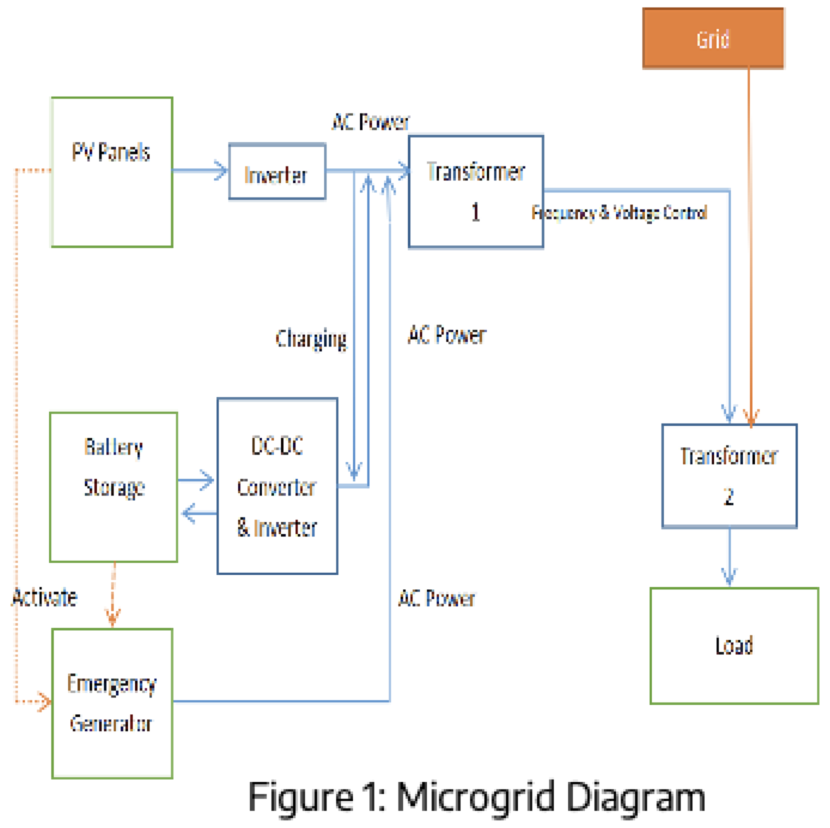

Figure 1: Microgrid Diagram

Figure 2: Airport PV Array Locations

Data Gathering

- Utility bills for normal operations and the emergency generator capacity for emergency operations were used in addition to site expert guidance to synthesize load profiles. Power outage operations were provided by FIA personnel during a site visit. The solar generation data was gathered by NREL PVWatts calculator at the FIA address.
- Financial assumptions include that the Tier I/II design would receive the Airport Improvement Program grant which covers 90 cents on the dollar of the capital cost. Additionally, the budget and costs from the Arlington Microgrid were used as a guide for costs.

Economics

- Below is a simplified cash flow of two possible scenarios for Fairchild Airport. A Tier I/II scenario with 195 kWdc of generation and 250 kWh of battery life is shown with NREL estimated values and the researched values used by the Arlington microgrid. These values assume that an Airport Improvement Grant will cover 90% of installation costs, and the remaining installation costs will be eligible for a federal Investment Tax Credit.

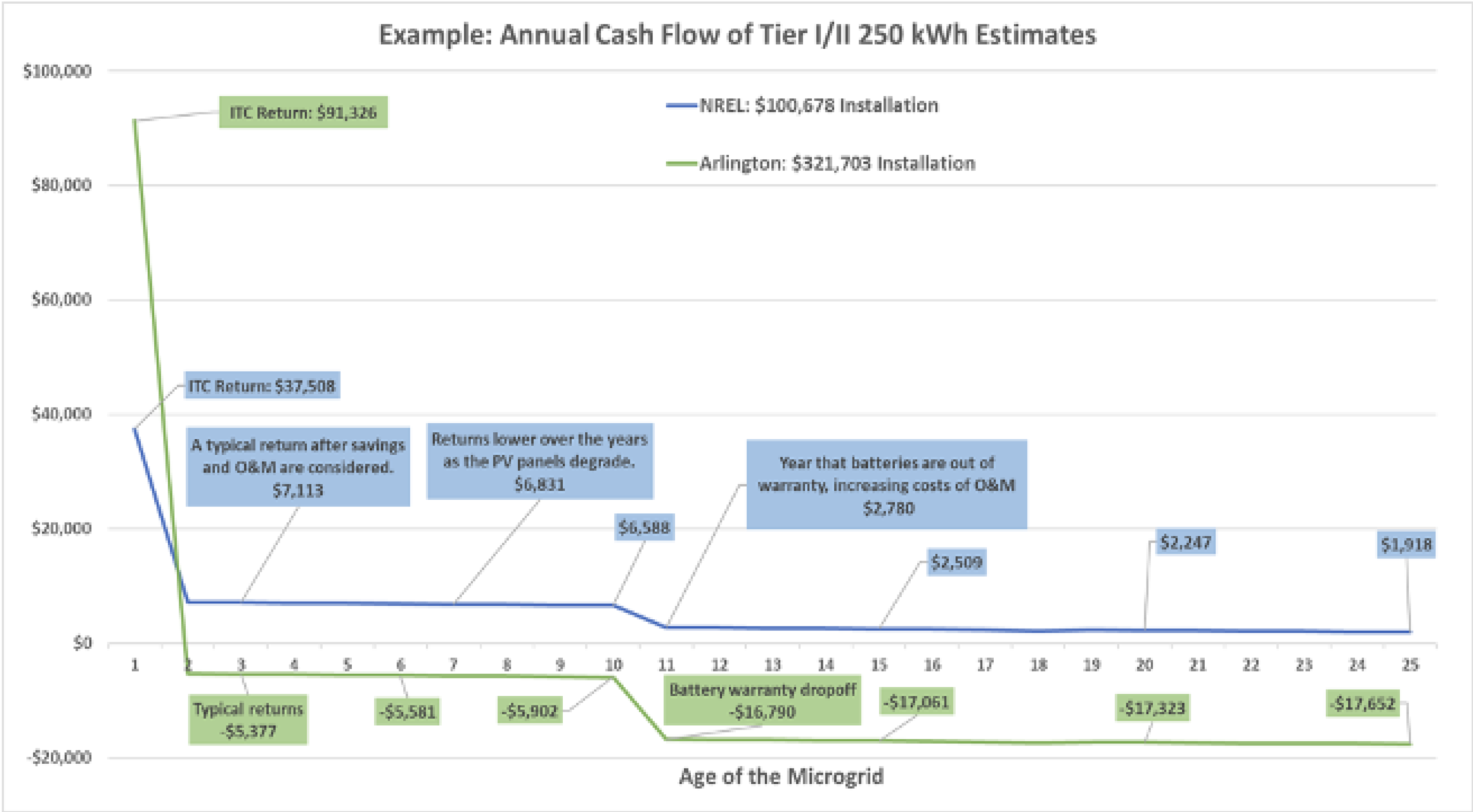

Figure 3: Annual Cash-Flow Diagram

Optimization

- HOMER and assumed emergency load data were used to determine the different possible combinations of PV array size, battery size, and fuel used.
- With a 200kW cap on PV arrays generation, we were left with the following possibilities of system sizes.

Battery Size (kWh)	Fuel Used /yr (gal)	Fuel Used / 90 days (gal)
84	9030	3402
167	8396	3290
251	7518	3089
279	7124	3024
557	5742	2812
836	5137	2693

Figure 4: System Sizes

Results

- Load profile (right) is modeled for each season. Max stress day occurs in winter
- PV output depends on solar Irradiance. Excess PV power charges the battery if applicable. If PV output is insufficient to support the load, battery is preferred to supply the insufficiency, while emergency generator only starts up when battery state-of-charge is low.

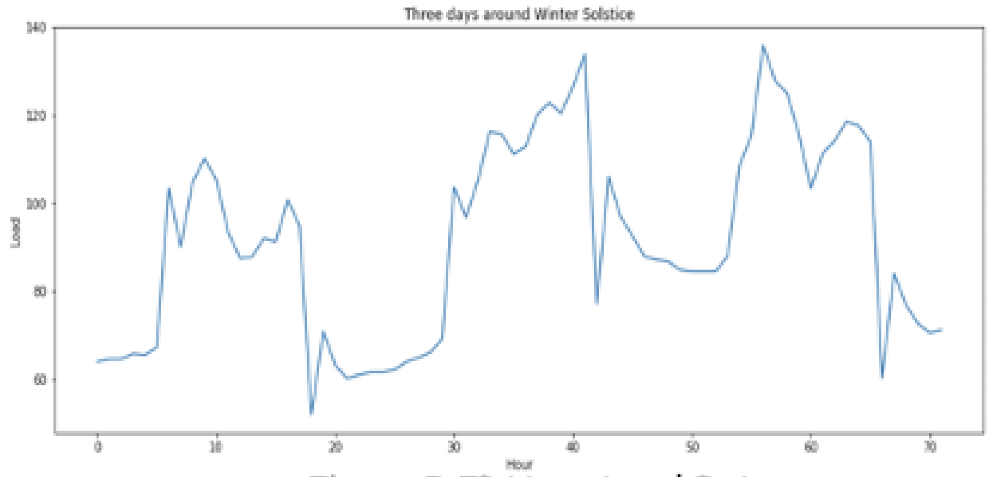

Figure 5: 72 Hour Load Data

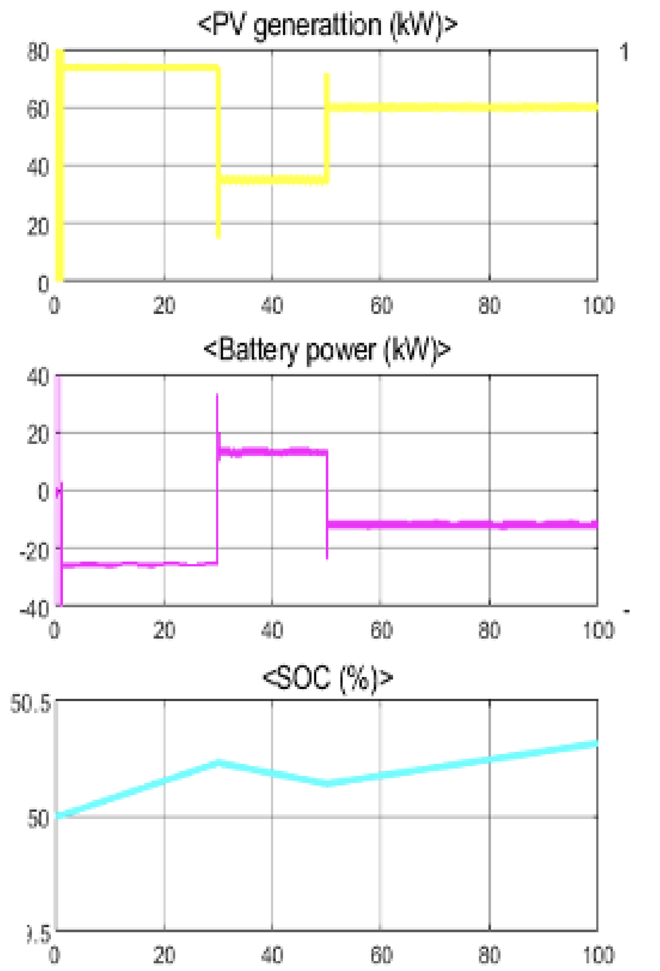

Figure 6: Power Results.

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