ENERGY TRANSITIONS INITIATIVE
U.S. Department of Energy

Partnership Project

Technical Assistance for CBS Utility Planning

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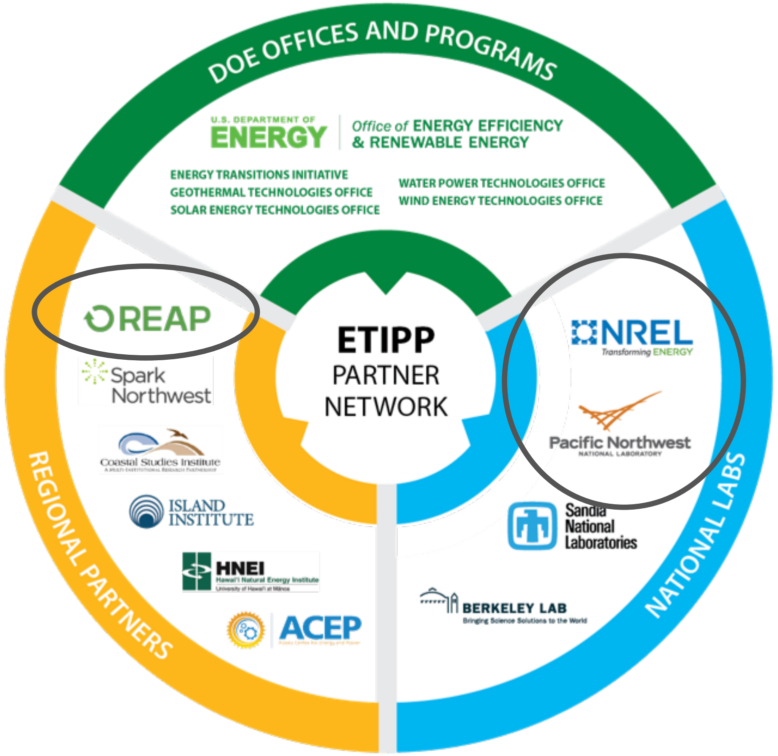
Energy Transitions Initiative Partnership Project

Energy Transitions Initiative Partnership Project Communities and Partners



ETIPP connects remote and island communities with regional and national energy experts who can provide strategic energy analysis and planning for local energy resilience projects.

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ETIPP Community: Sitka, Alaska

Project goals: Support a growing community with changing needs by providing:
- Long-term planning to address anticipated energy needs
- A strategy to minimize rate impacts on customers
- Solutions to bolster energy resilience and minimize climate impacts (e.g., avoid future reliance on diesel)
- Data to secure financing for energy investments

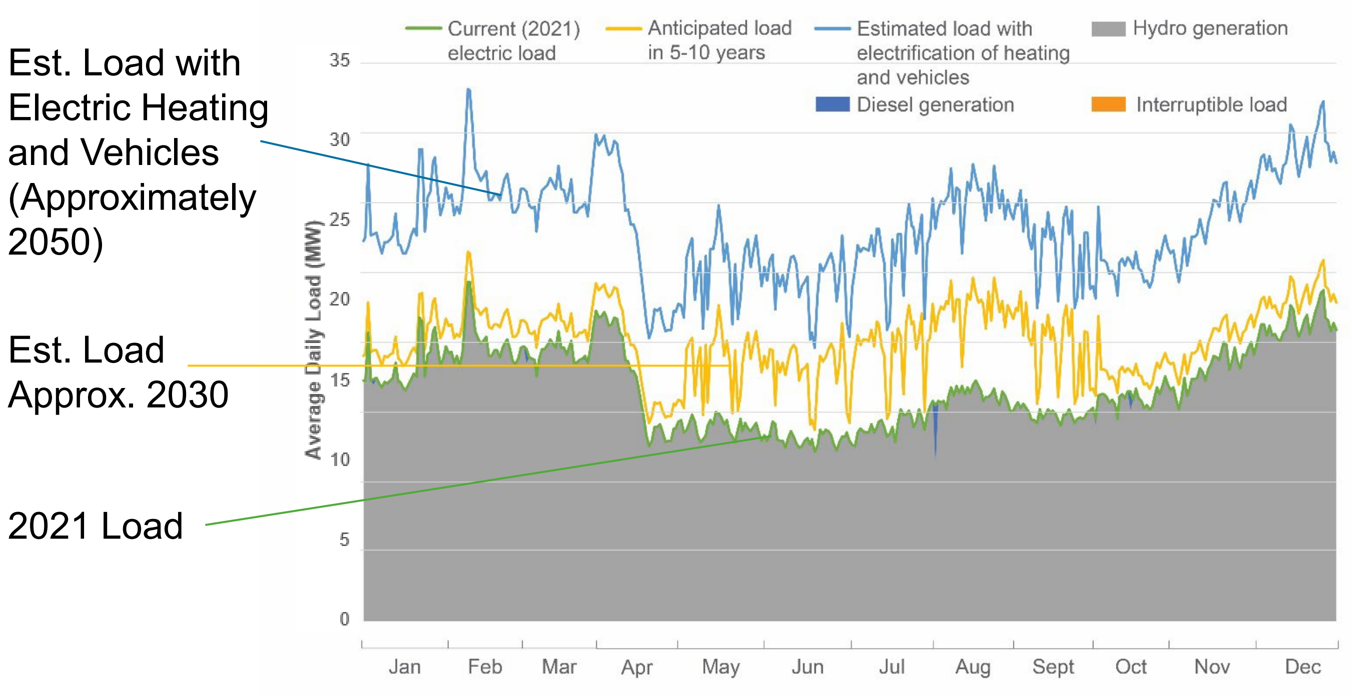
Scope: Assess available renewable resources in and around the community while planning for a more modern grid control system

1. *Generation planning*: Renewable energy assessment
2. *Microgrid planning*: Grid model development and training
3. *Optimization of resources for economic benefit*: Evaluation of green energy export options

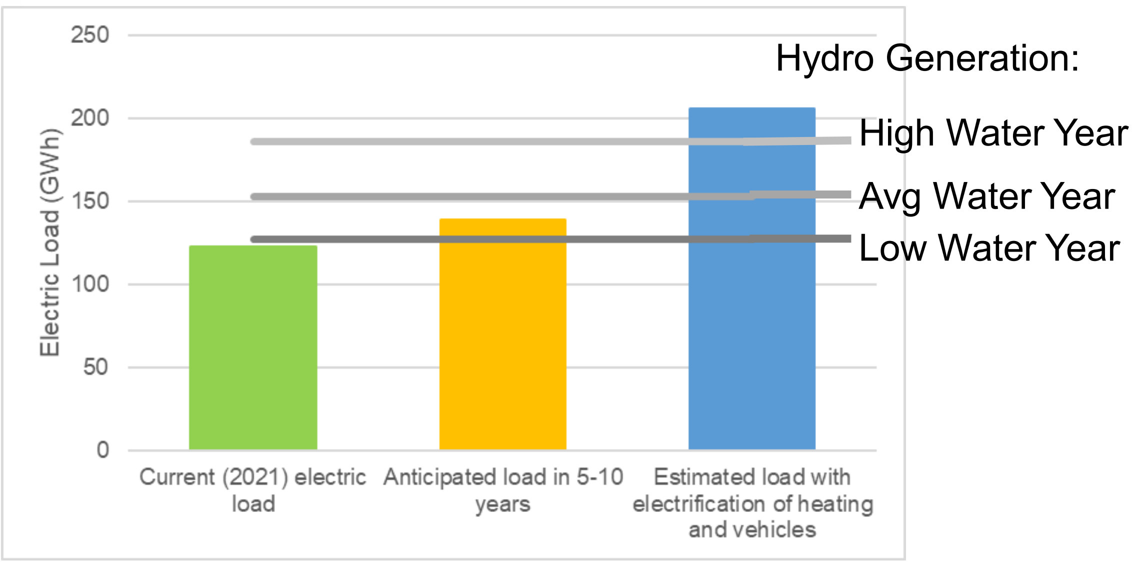

Photo by Grant Turner, City and Borough of Sitka

Sitka Electricity Generation vs. Current and Future Loads

Daily Generation vs. Load



Annual Hydro Generation vs. Load Scenarios



- **Clean renewable energy provides nearly 100% of Sitka's electricity**
- **Electric Department operates interruptible boilers and diesel generators to optimize hydropower generation**

- **Future load growth requires more reliance on diesel and interruptible generation**
- **This results in inefficient system operations**

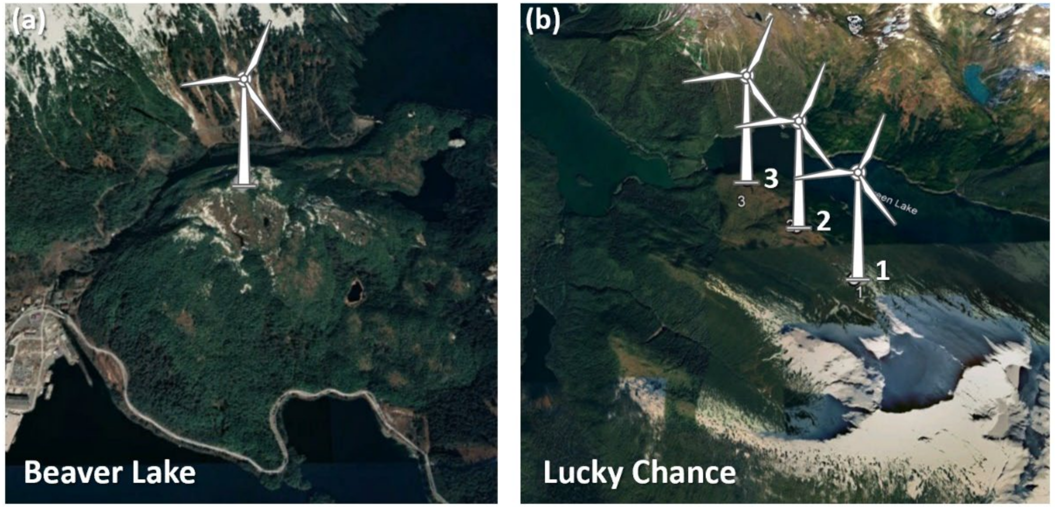
Renewable Energy Resource Comparison

Resource	Capital Cost	Operation and Maintenance	Development Timeline (years)	Power Generation	Other Considerations
Hydropower (Takatz)	$$$	$$$	~4-8	High, Baseload	Long transmission line required
Wind	$$	$$	~4	High, Intermittent	Vista alterations, access roads, wildlife impacts
Solar	$	$	~1	Low, Intermittent	Structural integrity of roofs
Geothermal	$$	$$	~2 + initial exploration	Unknown, Baseload	Permeability of rocks and flow rate need investigation
Tidal	$$$	$$	~10	Low, Baseload	More likely to have federal funding, requires underwater transmission
Wave	$$$$	TBD	~10	Low, Intermittent	More likely to have federal funding, potentially riskier technology

Most Beneficial			Most Challenging

Near-term Renewable Energy Options

1. **Wind resource is strong in the region**
   - Several locations are promising for development – up to 24 MW
   - Approximately 4 years to implement project
2. **Solar PV could be installed on rooftops for targeted generation**
   - Primarily summer output; approx. 130 kW
   - Approx. 1 year to implement project



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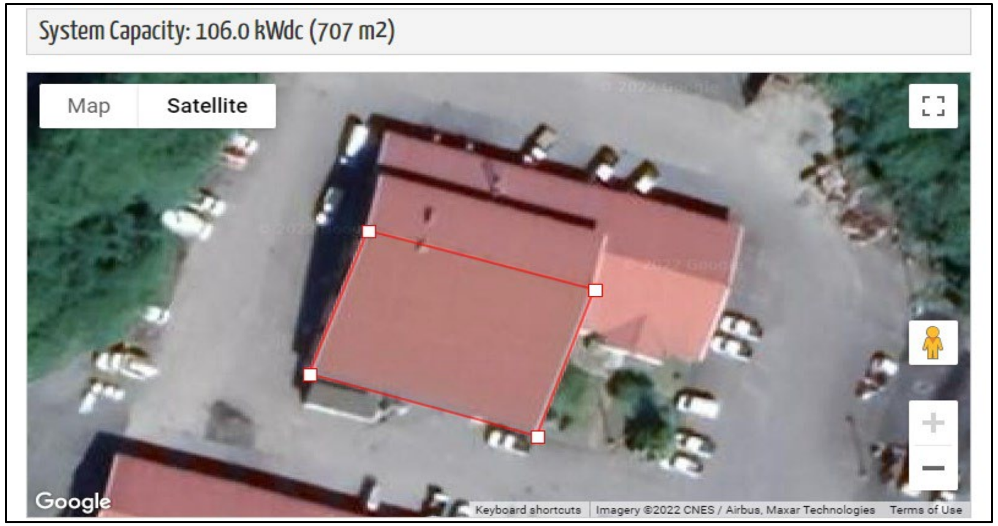

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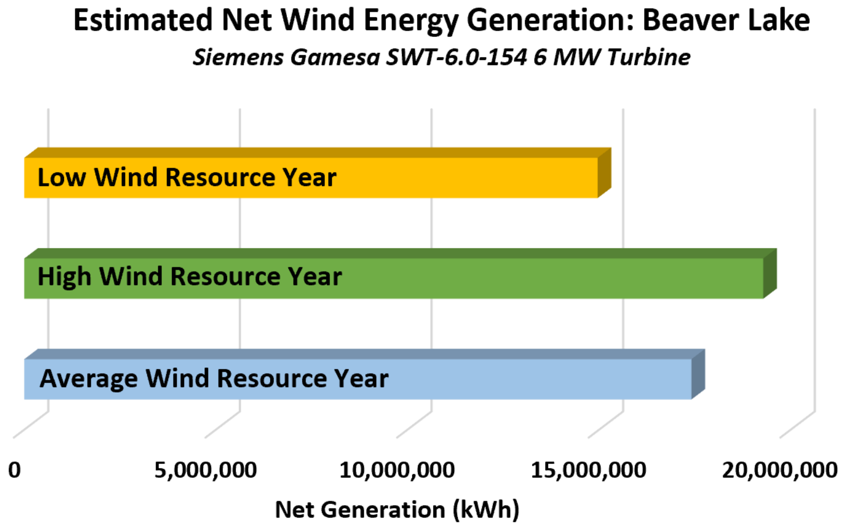
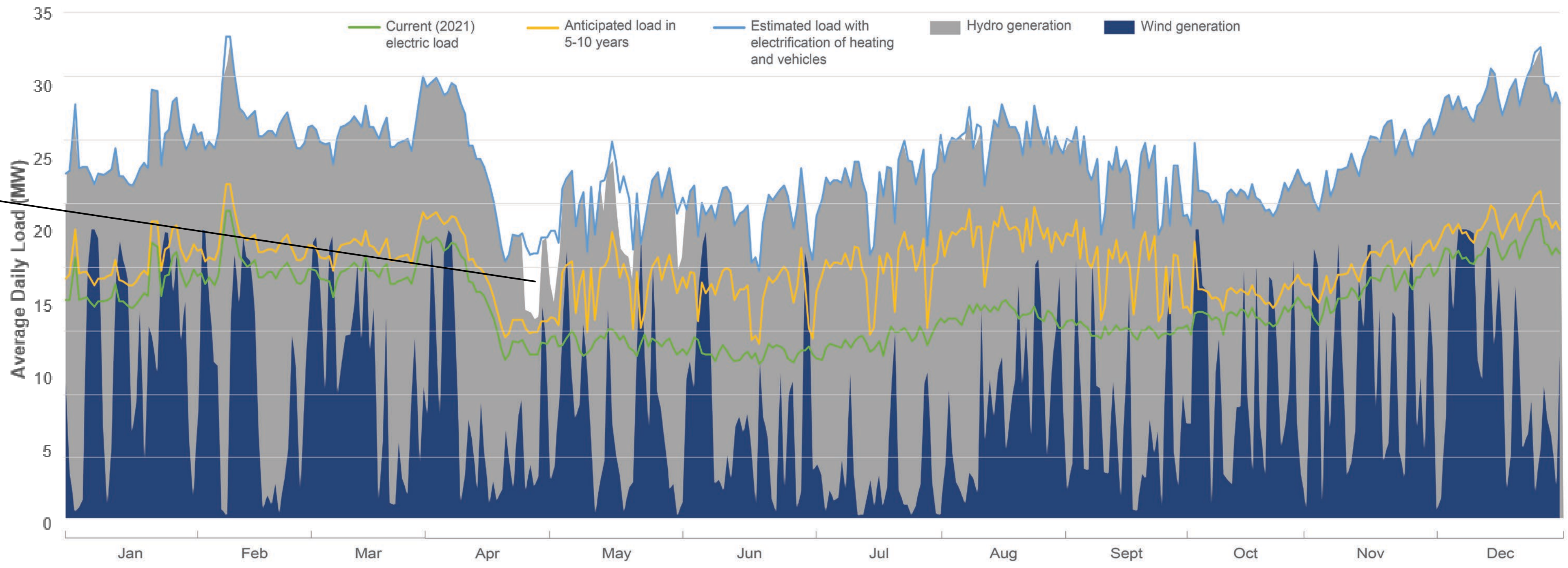


Potential Future Generation vs. Load

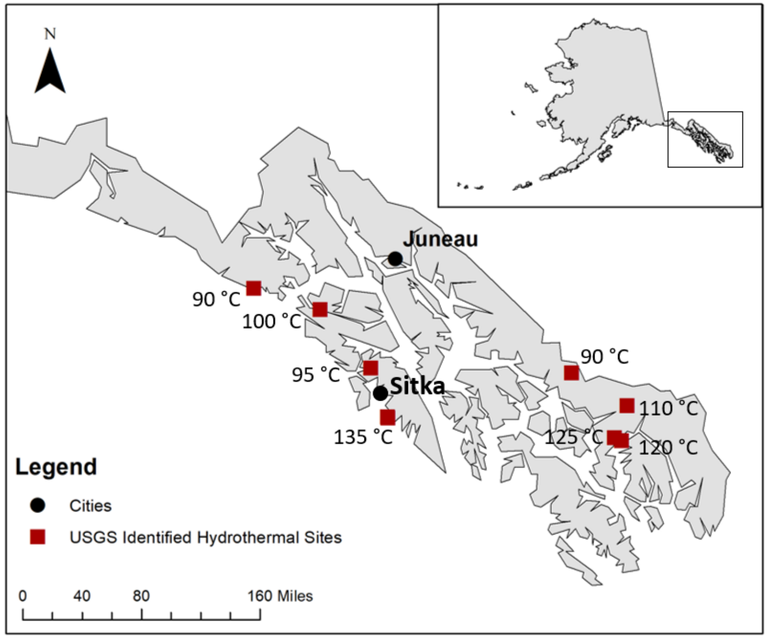
Electricity to fill these gaps is available from diesel, interruptible boilers, and hydro resource management



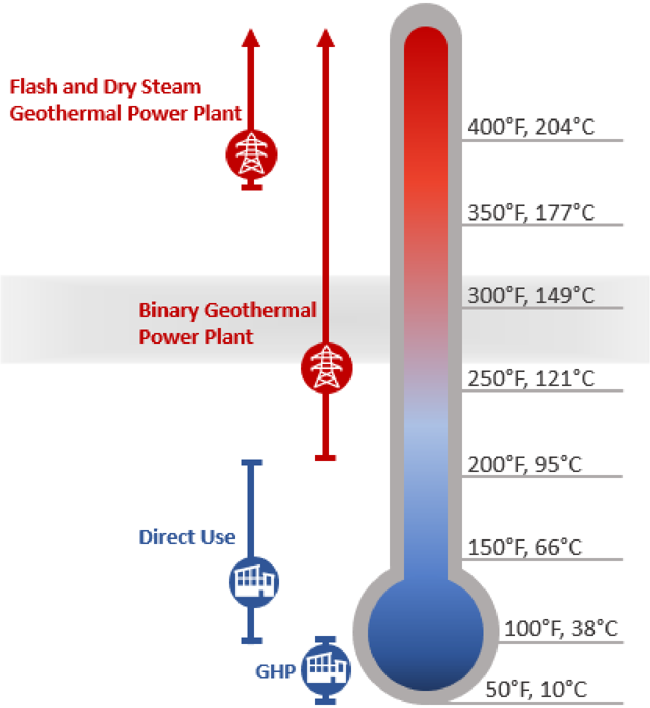
- **Wind generation could support hydro in supplying potential future load**
- **Additional (non-diesel) generation options are also needed for surety of power supply**

Long-term Renewable Energy Options (5+ years)

- **Geothermal at Goddard Hot Springs**
  - Resource appears to have good potential but has not been investigated since the 1980s
  - Need more detailed assessment to characterize the potential capacity and feasibility
    - Ensure industry interest
    - Determine whether investment in drilling test well is worthwhile



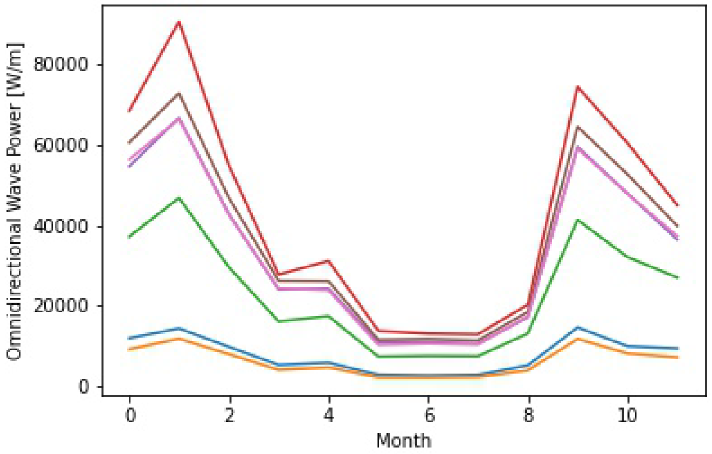
Data from Williams et al 2008



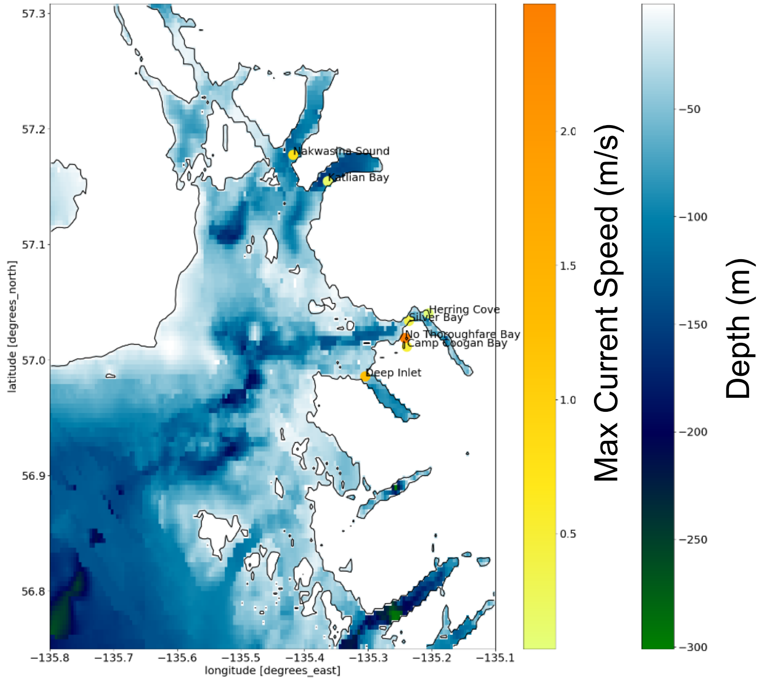
Long-term Renewable Energy Options (5+ years)

- **Wave Resource (approx. 100 kW/unit, 10+ years)**
  - Wave resource is highest in winter, so may be a good match for lower hydropower in winter
  - Next steps: Identify type of wave energy converter to use and most promising site; take measurements

Average Monthly Wave Power at 6 Sites Near Sitka

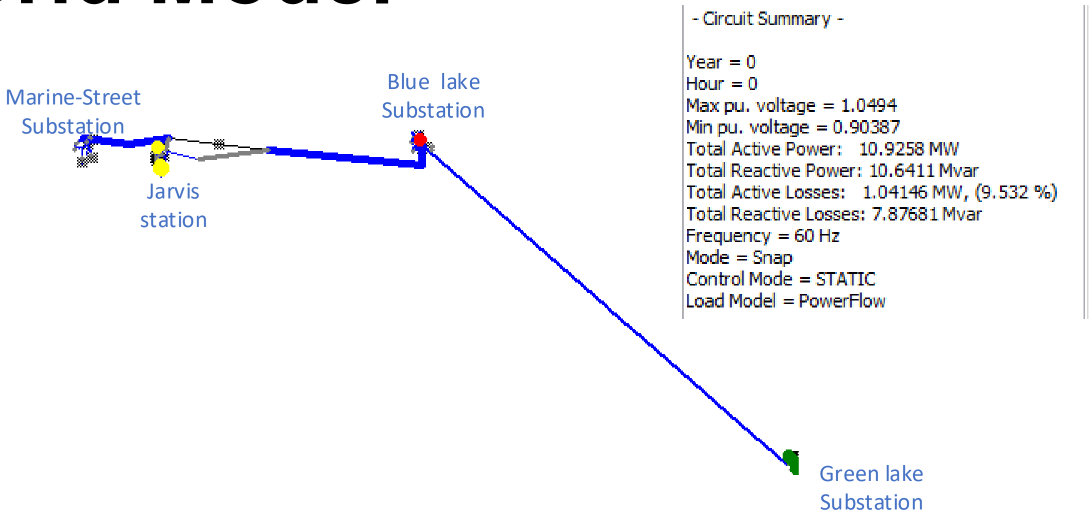


- **Tidal Resource (approx. 500 kW, 5+ years)**
  - Tidal velocities in No Thorofare Bay are appropriate and near existing transmission, but may not be wide or deep enough for >500 kW devices

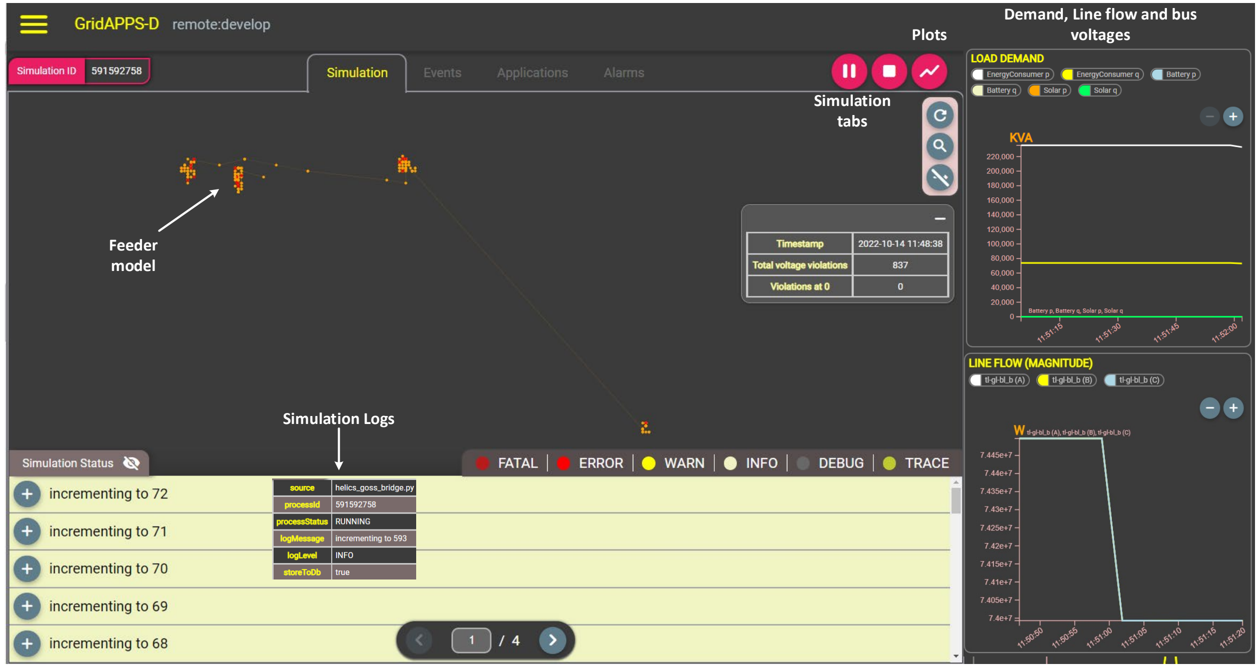


Steady-State Grid Model

- **Steady-state model of electric grid**
  - Leveraged existing data from City and Borough of Sitka (CBS)
  - Built model in an open-source tool for planning and designing distribution systems

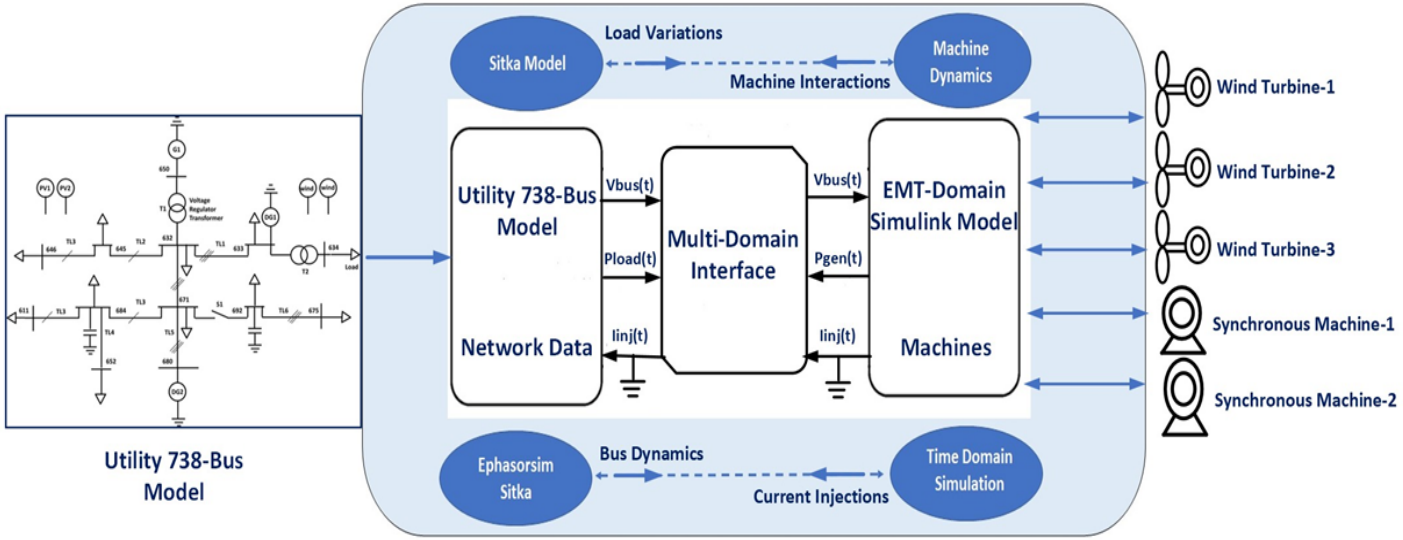


- **Planning tool for CBS**
  - Simulate distribution system power flows
  - Test various scenarios (operational, added generation resources, changing loads)
  - Evaluate value of new controls before investment
  - Sync with other commercial tools



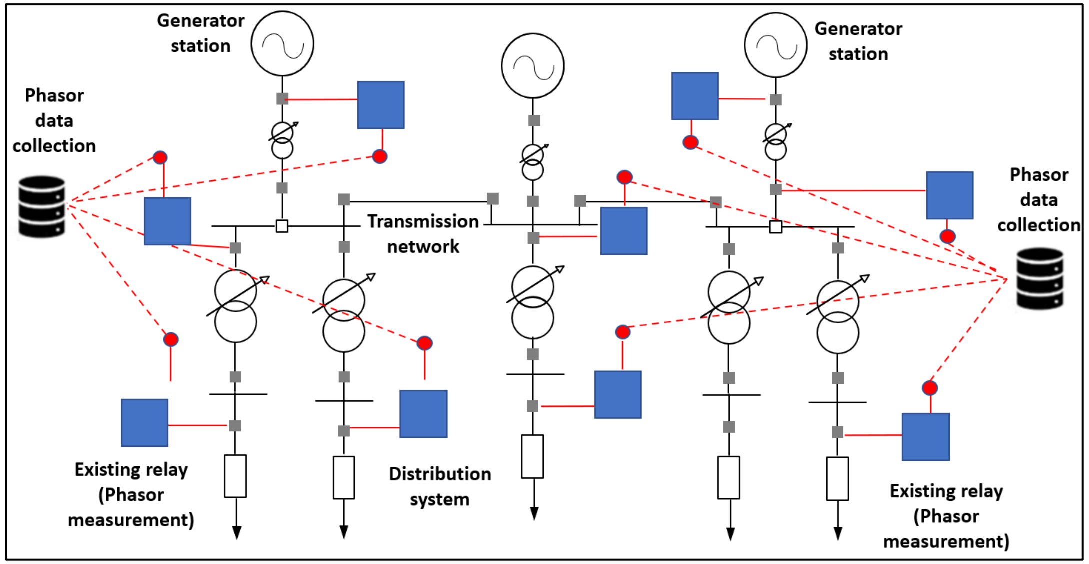
Dynamic Grid Model

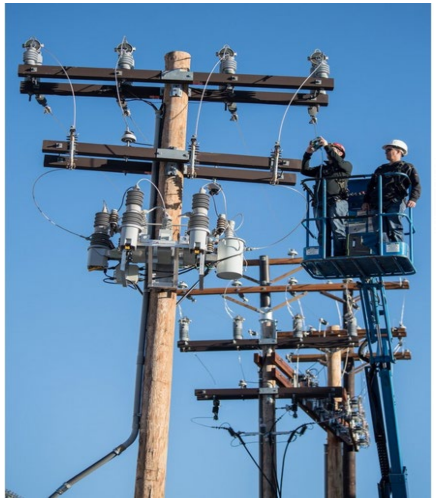
- **Built dynamic grid model based on steady-state model**
  - Evaluates grid stability and control impacts with addition of renewable energy generation
- **Existing hydro and load control can support up to 9 MW of intermittent renewable energy (i.e., wind) integration**
- **For higher levels of wind/solar integration, microgrid controls, upgrades to existing hydro/load control, and/or battery storage is needed**



Electric Grid Infrastructure Assessment

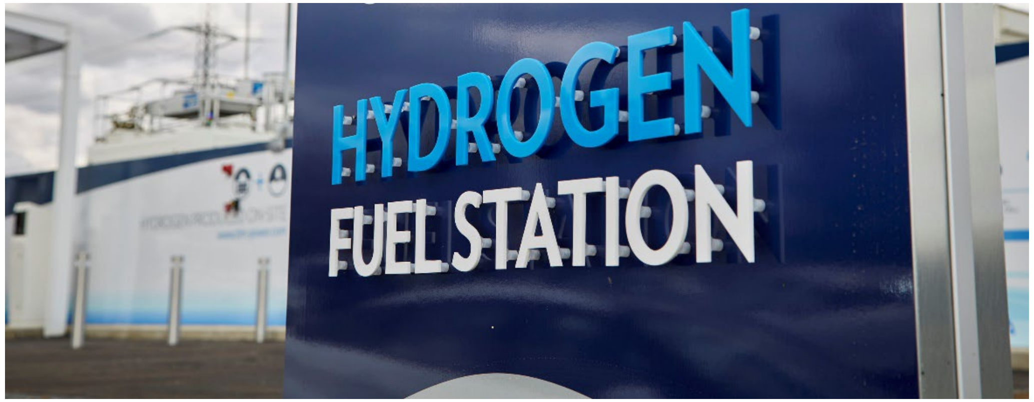
- **Assessed existing infrastructure for ability to operate microgrid**
  - Advanced sensors, measurement system, and microgrid controls are needed to support integration of variable renewable energy output
- **Existing infrastructure can be leveraged, with some adjustments, for enhanced monitoring and control**
- **Opportunities for further improvements in the future (more data storage, better visualization capabilities, etc.)**





Green Fuels Production Potential

- **Dams currently have 25–50 GWh/year of unutilized potential during periods of low load**
- **60–80 GWh/year could be available in future (with development of Lucky Chance wind and assuming 5–10-year load growth)**



Source: Creative Commons

If used to produce green fuel (hydrogen or ammonia), could replace diesel used by:

	Currently	With Wind Power
Diesel generators	100%+	100%+
Fishing fleets	50%	73%
All diesel use (incl. fishing vessels, cars, heavy machinery, etc.)	21%	31%

Note: Production would likely start out as less and ramp up to these numbers over time

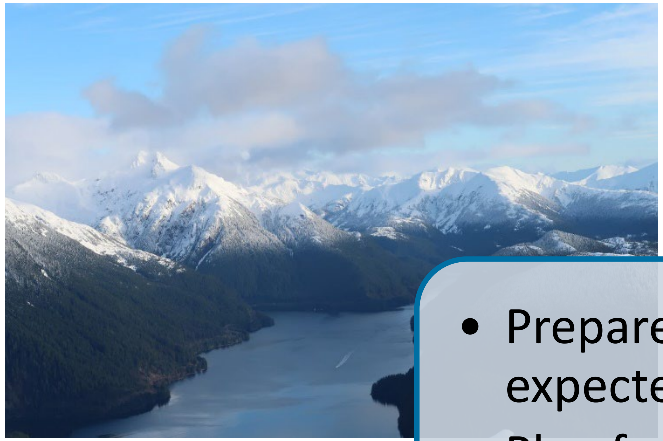


Photo by Kord Christianson, City and Borough of Sitka

Plan

- Prepare to meet expected growth
- Plan for future scenarios with reduced precipitation

Invest

- Diversify with clean energy sources
- Leverage excess clean power for economic benefit

Benefit

- Avoid sudden rate increases
- Provide resilience in a changing climate

Photo by Scott Elder, City and Borough of Sitka

Thank You

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