NREL values are based on national averages; actual savings in Washington State may be lower

RESILIENCY FOR TULALIP CRITICAL FACILITIES - COMMUNITY CONSIDERATIONS

CLEAN ENERGY INSTITUTE
UNIVERSITY of WASHINGTON

DESIGN GOALS

This project supports the Tulalip Tribes in designing a resilient and cost-effective microgrid for key community buildings.

- **Decarbonization**: Reduce greenhouse gas emissions by shifting from propane and diesel to renewable electricity.
- **Resiliency**: Ensure backup power for critical services during grid outages, with seasonal performance analysis, of up to one week.
- **Cost Savings**: Lower utility costs through smart use of BESS, PV, and rate structure optimization.

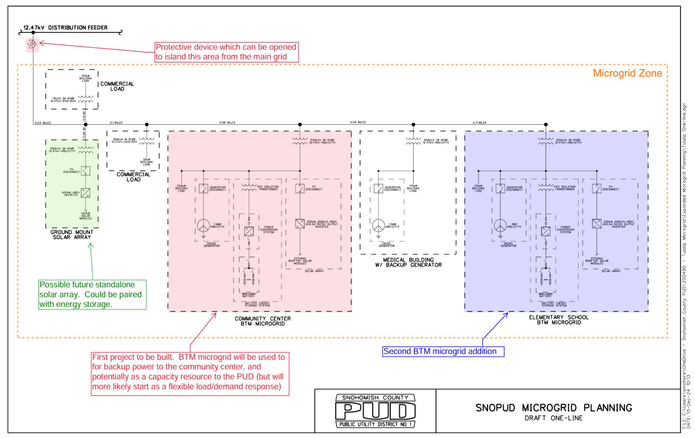
INTRODUCTION

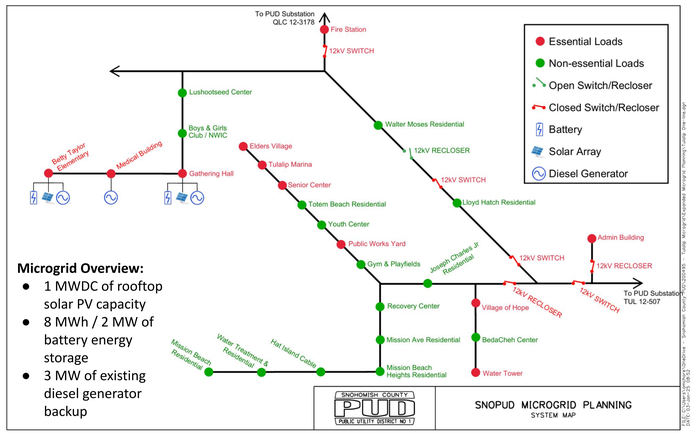
Gathering Hall:
- 600,640 kWh(2023)
- Energy varies on event schedule

Health Clinic:
- 775,500 kWh (2023)
- Utilizes propane tanks for backup power.

Early Learning Academy (ELA):
- 775,500 kWh (2022)
- Typical primary school operations.

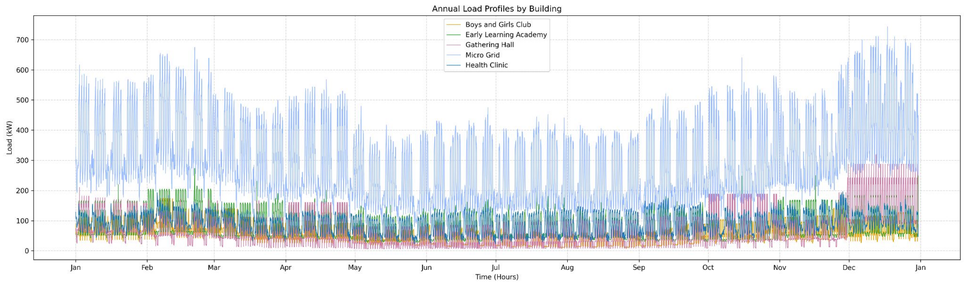
Boys and Girls Club:
- 492,364 kWh (2023)
- Offers youth programs.





Microgrid Overview:
- 1 MWDC of rooftop solar PV capacity
- 8 MWh / 2 MW of battery energy storage
- 3 MW of existing diesel generator backup

HOURLY LOAD PROFILES



Hourly Load profiles were generated for each building and aggregated into a microgrid profile using the following data from Snohomish PUD Power Trend Analytics Reports (2020-2023):

- Heating and cooling system types
- Local weather conditions
- Building schedules and usage patterns
- Historical monthly utility billing data

Health Clinic
- Hospital DOE profile
- Simulated Heating Load with varied COP
- AC incorporation in the summer

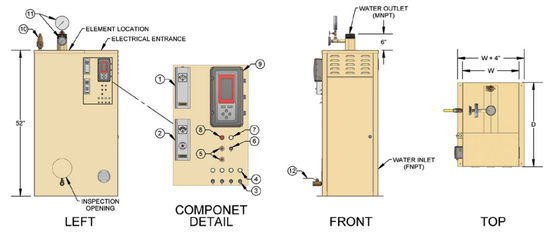
Boys and Girls Club
- Customized schedule based load

Early Learning Academy (ELA)
- Primary School DOE profile
- Edited to match billed demand peaks

Gathering Hall
- Simulated using preliminary data

DECARBONIZATION

Health Clinic Heating Upgrades:
- Changing heating system from propane to electric
- Compatible with solar power and battery energy store systems (BESS)
- Estimated annual savings of $9,384*
- Reduces carbon emissions by ~ 348,000 lbs of CO_2 per year
- Grant Opportunities:
  - DOE Tribal Energy Grant Programs
  - Washington Clean Energy Fund

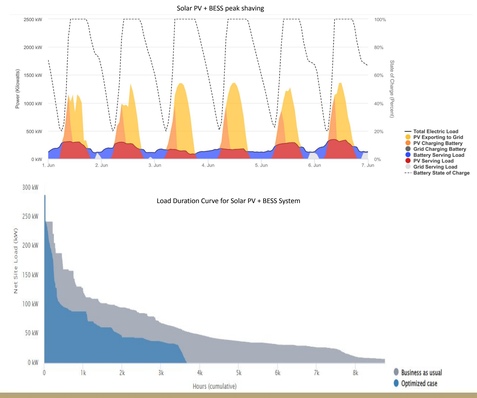


COST SAVINGS

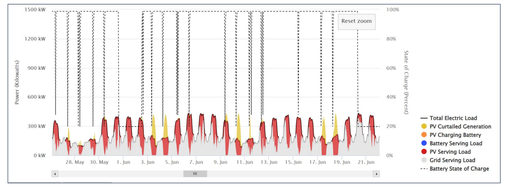
Peak Shaving:
- 2022: Tulalip Tribes paid $19,328 in demand charges
- Solar PV + Battery Energy Storage Systems shaves peaks during high-load periods

Rate Models:
- **Time-of-use :** Incentivises exporting during peak hours
- **No Exports:** All generated energy used on-site; no credit for excess.
- **Net Metering:** Credited the same rate for exports as grid electricity. (used for modeling only; not feasible at this scale)

*NREL values are based on national averages; actual savings in Washington State will be lower



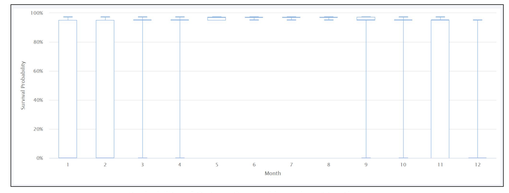
REOPT



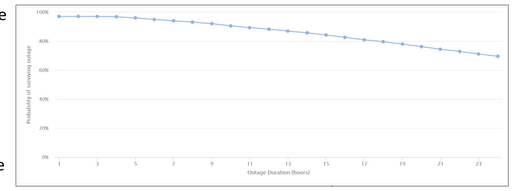
The REopt platform, run by NREL, evaluates the economic viability of distributed energy resources (DERs) for the microgrid, as well as strategies to mitigate the cost and achieve resiliency within the system. This simulation displays the potential load profile for the microgrid over 8760 hours, totaling one year in use.

OUTAGE ANALYSIS

PV/BESS vs Diesel Power:
- **Diesel Limitations:**
  - Fuel availability
  - High operating and maintenance cost
  - Greenhouse gas emissions
- **PV/BESS Gains:**
  - Operates independently during emergencies
  - Reduced dependence on generators
- **System Modeling:**
  - Ensures battery capacity supports essential loads
  - Optimizes size for reliable cost-effective backup



Probability of Outage Survival based on Month



Probability of Outage Survival vs Outage Hours

FUTURE INTEGRATION

- An updated hourly electric load model the across all buildings
- New Snohomish PUD rate schedule for net metered systems utilizing below 100 kW
- Automated building usage data analyzation for each of the four buildings to improve cost modeling
- Grant funding for implementing solar & BESS microgrid system

CONCLUSION

This study demonstrates how a solar and battery powered microgrid can support the Tulalip Tribes' goals through:
- **Decarbonization:** Replacing propane heating and adding solar could reduce annual emissions by over 122.22 metric tons of CO_2
- **Resiliency:** During a week-long outage, the system can supply 50% of critical loads
- **Cost Savings:** Optimized microgrid designs show potential 10-year net savings of $964,146* under realistic utility rate scenarios.

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