Analysis of Diesel Generation and Energy Storage Integration Benefits

A case study for the Levelock Village of Alaska

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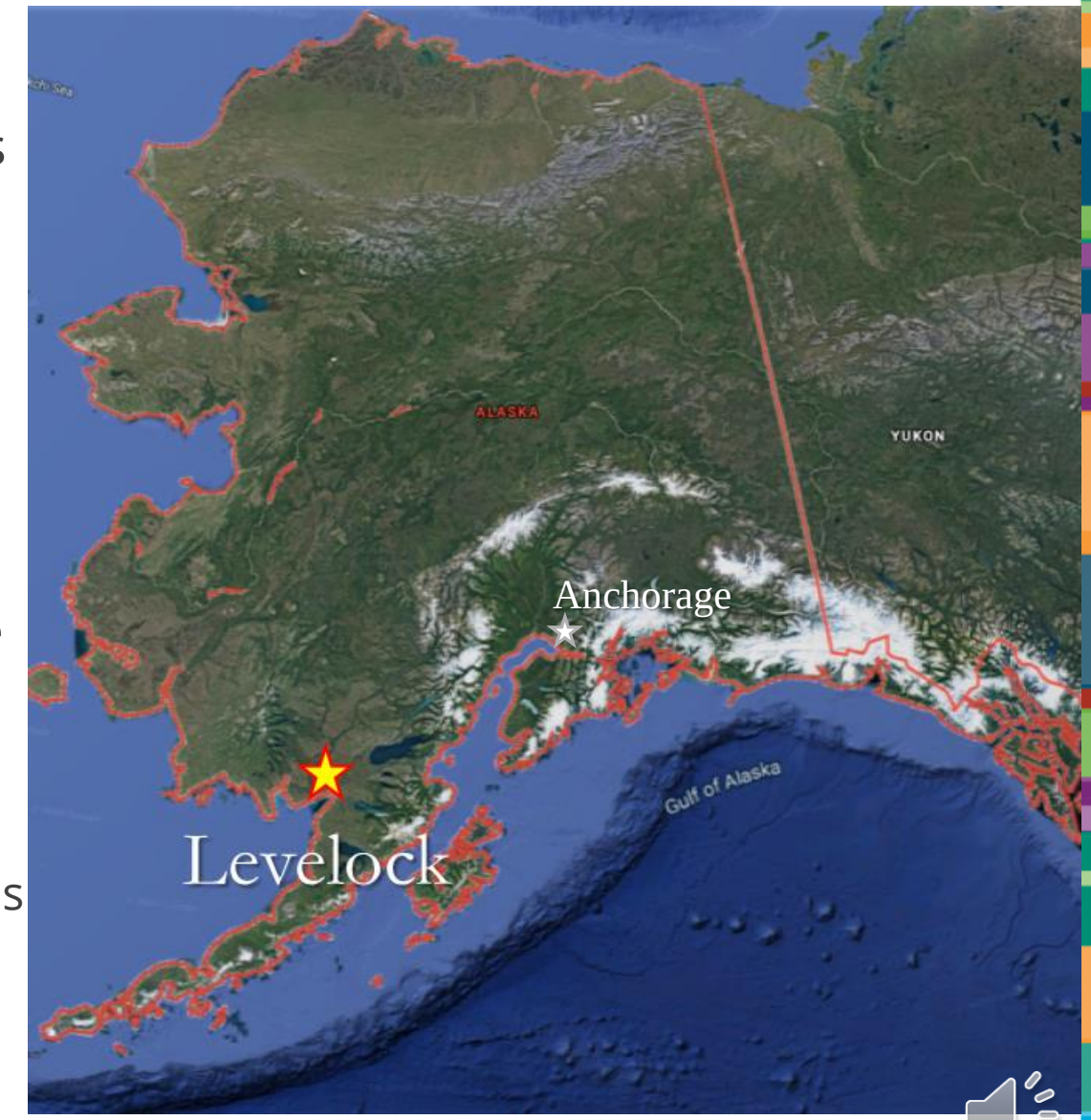
Background – Levelock Village of Alaska

- Tribal community of 49 residents, 300 members
- Commercial fishing
- Isolated power system
- Powered by 3 diesel generators (DGs)
- Diesel costs 20% more than national average
- Diesel generation system is aged and unreliable
- Average of 3 to 4 outages / month
- Investigate benefits of hybrid energy system
  - Battery energy storage system (BESS) paired DGs



Source: Google, TerraMetrics, SK telecom, INEGI.

Study – Benefits of BESS

Reliability improvements

- Automation of backup power
- Extended time for repairs
- BESS reserve must be sized to cover typical outages

Fuel savings

- Operating DGs at most efficient point (close to full load)
- Charge BESS to shift the point of operation of DGs

Generator replacement deferral

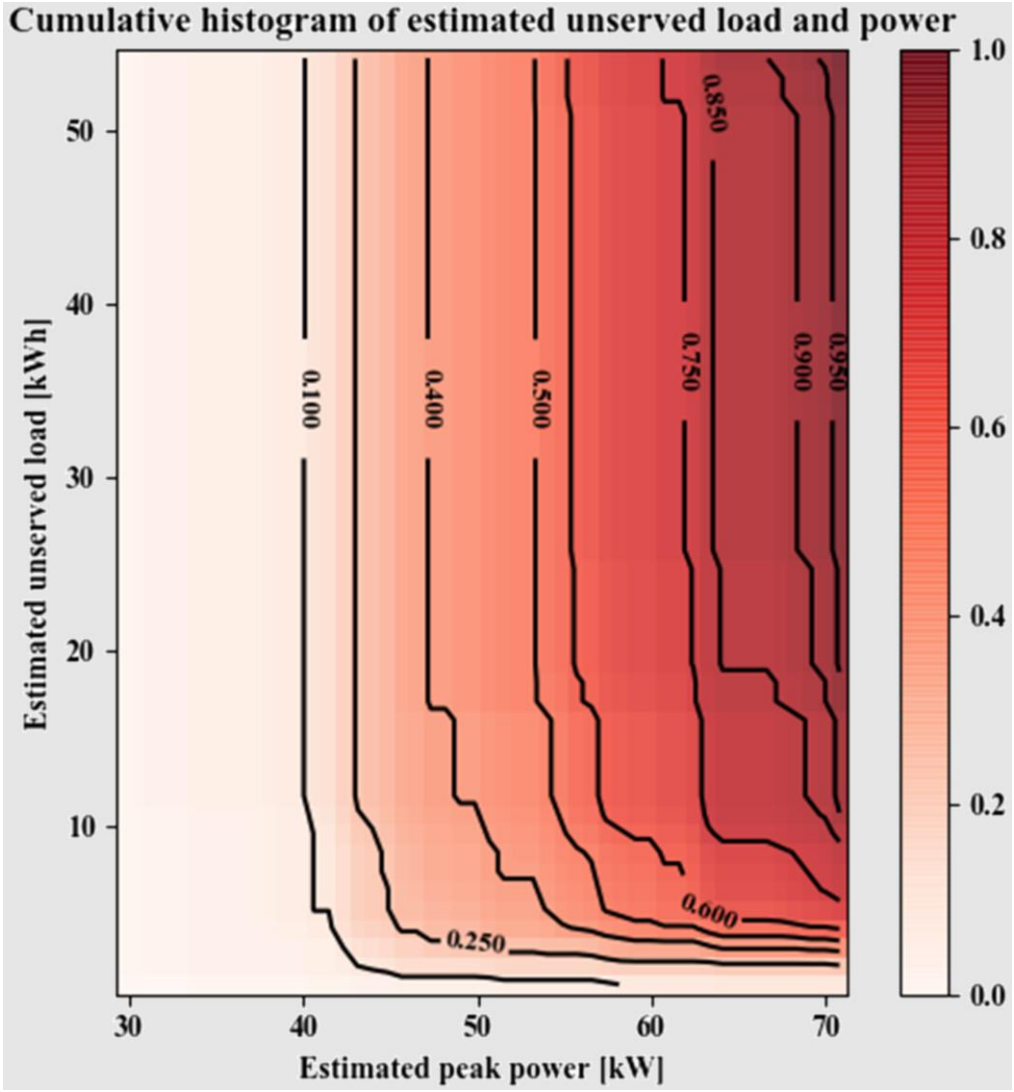
- Reducing run-hours

Potential value changes with load and DG characteristics

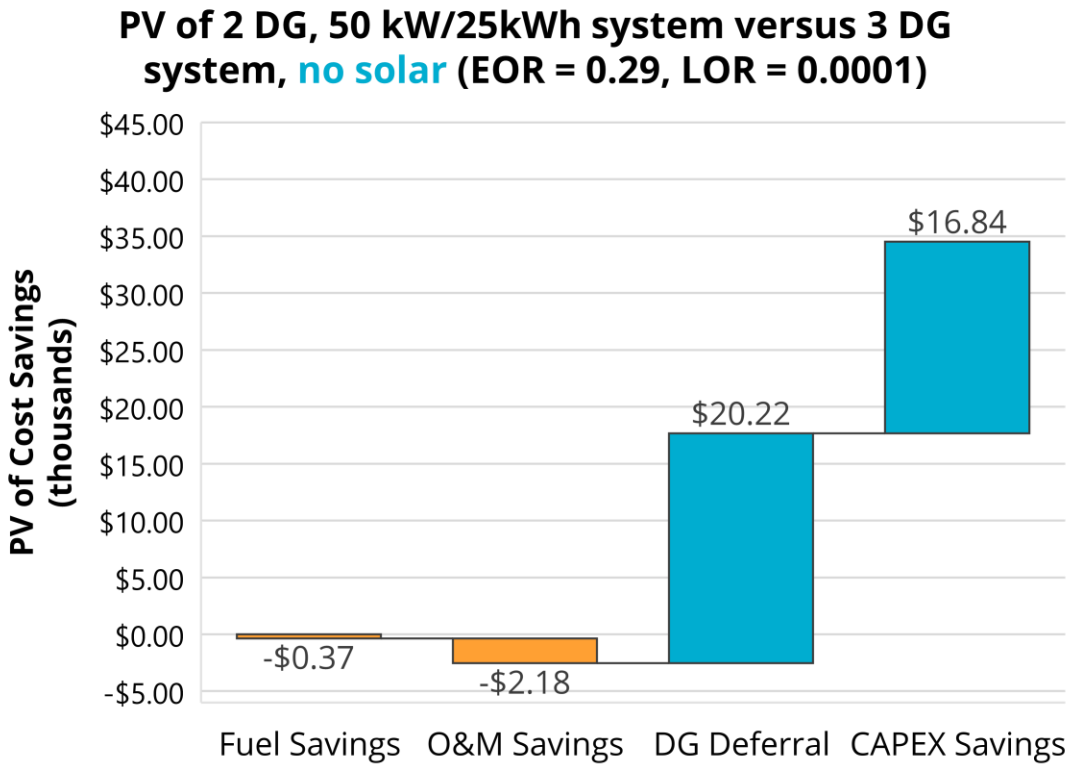
- Energy Opportunity Ratio (EOR)
- Portion of energy supplied away from peak DG efficiency

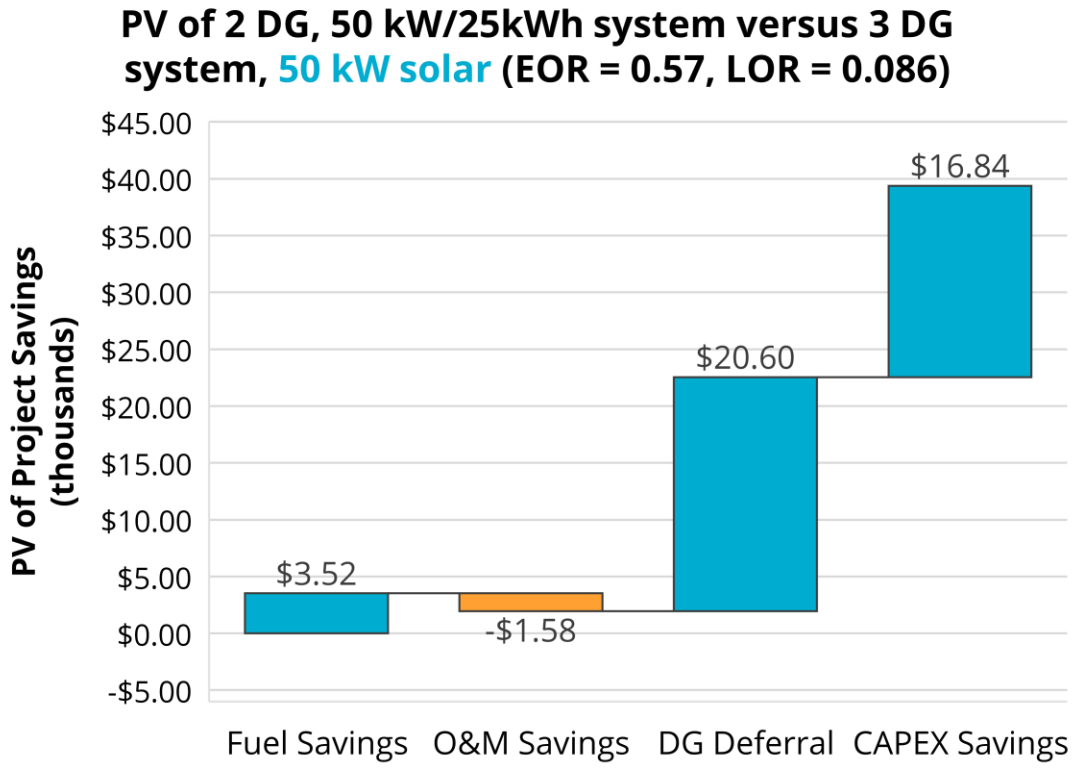
Low-Power Opportunity Ratio (LOR)

- Energy needing to supplied below wet stacking limit



Results – Case Study for Levelock





Major findings

- Larger BESS more viable at EOR > 0.45 (potentially from solar integration)
- Biggest financial benefit from DG deferral and reliability improvements

Conclusion

- BESS can significantly increase reliability indices by providing fast-responding automatic power backup
- Operation of BESS in tandem with DG can reduce generator runtime, deferring DG replacement or overhaul
- Larger benefits can be obtained if solar photovoltaic generation is added
- Analysis can help tribal leadership to take informed decisions about energy investments
- By deploying renewables plus storage on tribal lands, the tribe can secure **greater tribal and economic sovereignty** through energy independence and economic development

Project Deliverables

- R.D. Trevizan, A.J. Headley, R. Geer, S. Atcitty, I. Gyuk "Integration of Energy Storage with Diesel Generation in Remote Communities" in *MRS Energy and Sustainability*, 2021, DOI : 10.1557/s43581-021-00013-9, *accepted for publication*.

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