Connecting Remote Alaskan Villages Using an Energy Storage Ready Medium Voltage DC Intertie

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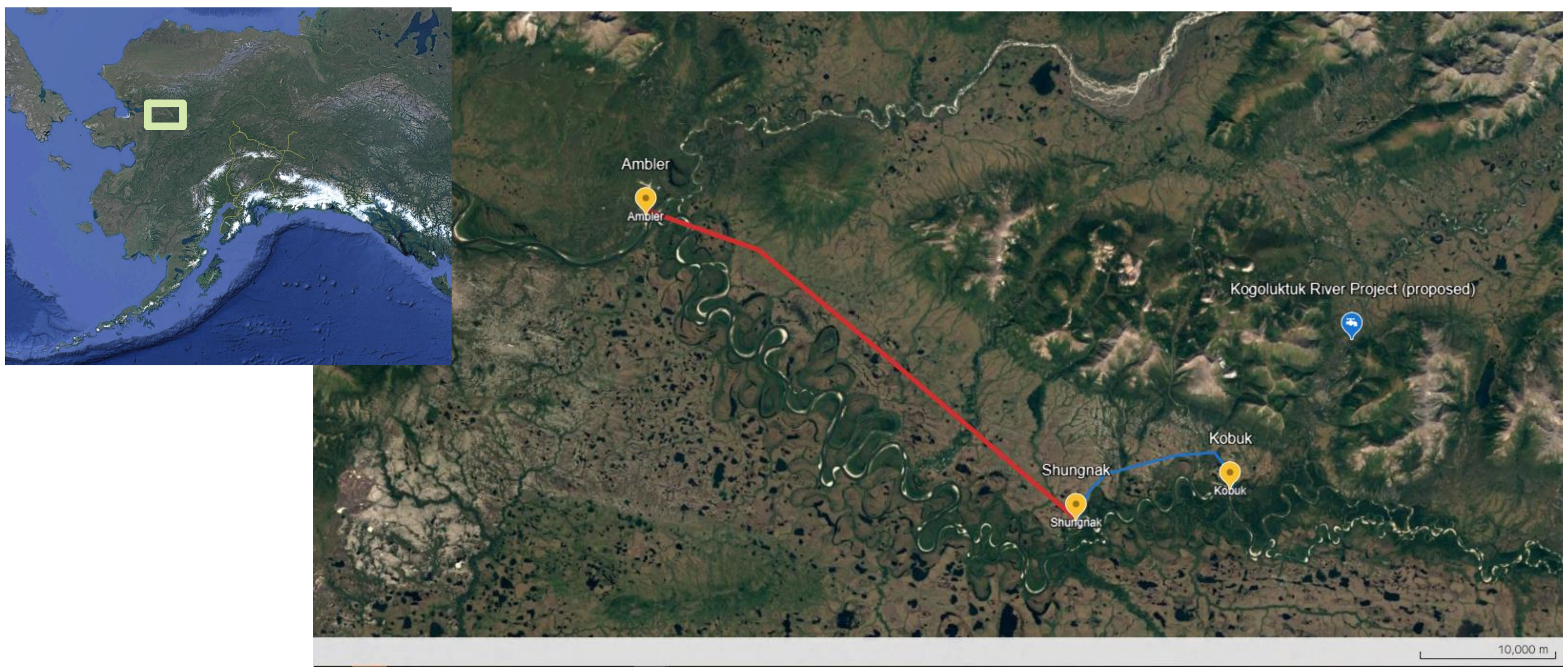

Fig. 1: Proposed ~25-mile intertie between Ambler and Shungnak (red) and existing intertie between Shungnak and Kobuk.

Case Studies:

- Ambler and Shungnak have some of highest power rates in the Alaska Village Electric Cooperative service area due to fuel delivery by plane. In Ambler it is required due to undersized fuel tank farm and in Shungnak due to changing river conditions prohibiting delivery by barge (by season).
- A 25-mile intertie between Ambler and Shungnak coupled with a tank farm upgrade in Ambler would allow barge-only fuel delivery to Ambler, reduced maintenance and operating costs, and facilitate DC-coupling of future battery energy storage systems
- The intertie will be critical for the integration of the Kogoluktuk River Hydro project.
- With today's costs, large scale seasonal storage does not make economic sense.

Evaluation of MVDC Electrical Interties Connecting Remote Communities: an Alaska Case Study

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Objectives and approach:

- Compare incurred cost of energy for Ambler, Shungnak, and Kobuk by comparing operation as:
  - Two standalone microgrids
  - Medium Voltage AC Intertie
  - Medium Voltage DC Intertie
- Identify most viable option from economic perspective using HOMER Pro
- Improve model accuracy to provide more well-grounded economic values and consider future developments

Results

- MVDC intertie scenario outperforms standalone configuration even with the inclusion of BESS required to increase system reliability.

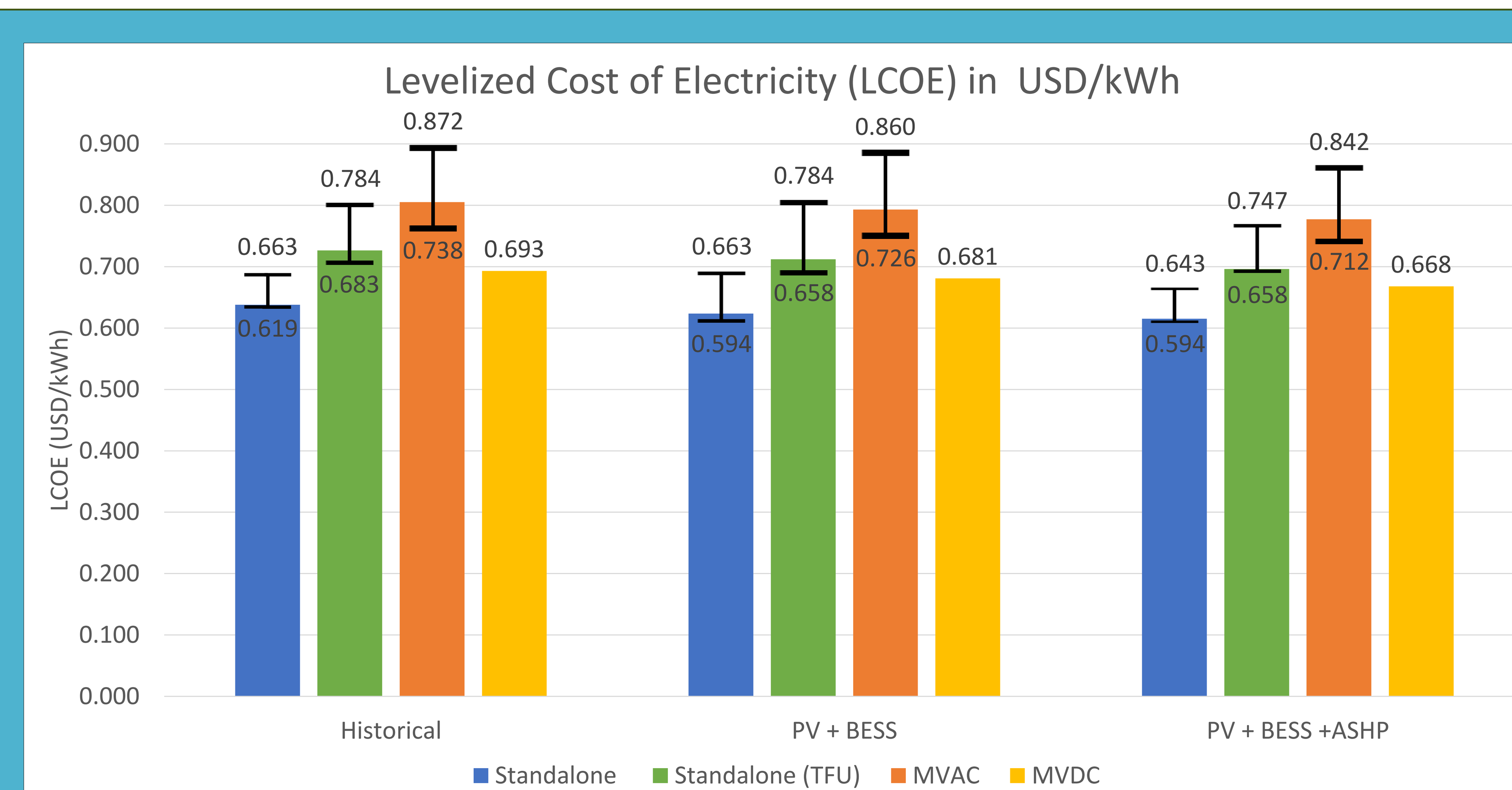

Figure 2: Standalone and Standalone TFU (Tank Farm Upgrade) represent the weighted average of the communities. The range presented for medium-voltage AC (MVAC) results from uncertainty in required capital investments. PV + BESS and ASHP refer to existing solar PV, battery storage, and air-source heat pump installations in Ambler and Shungnak.

Read the report: DOI://10.5281/zenodo.8274639

Using Long-Term Energy Storage Systems to Capture Seasonal Imbalances of Renewable Production in Remote Alaskan Villages

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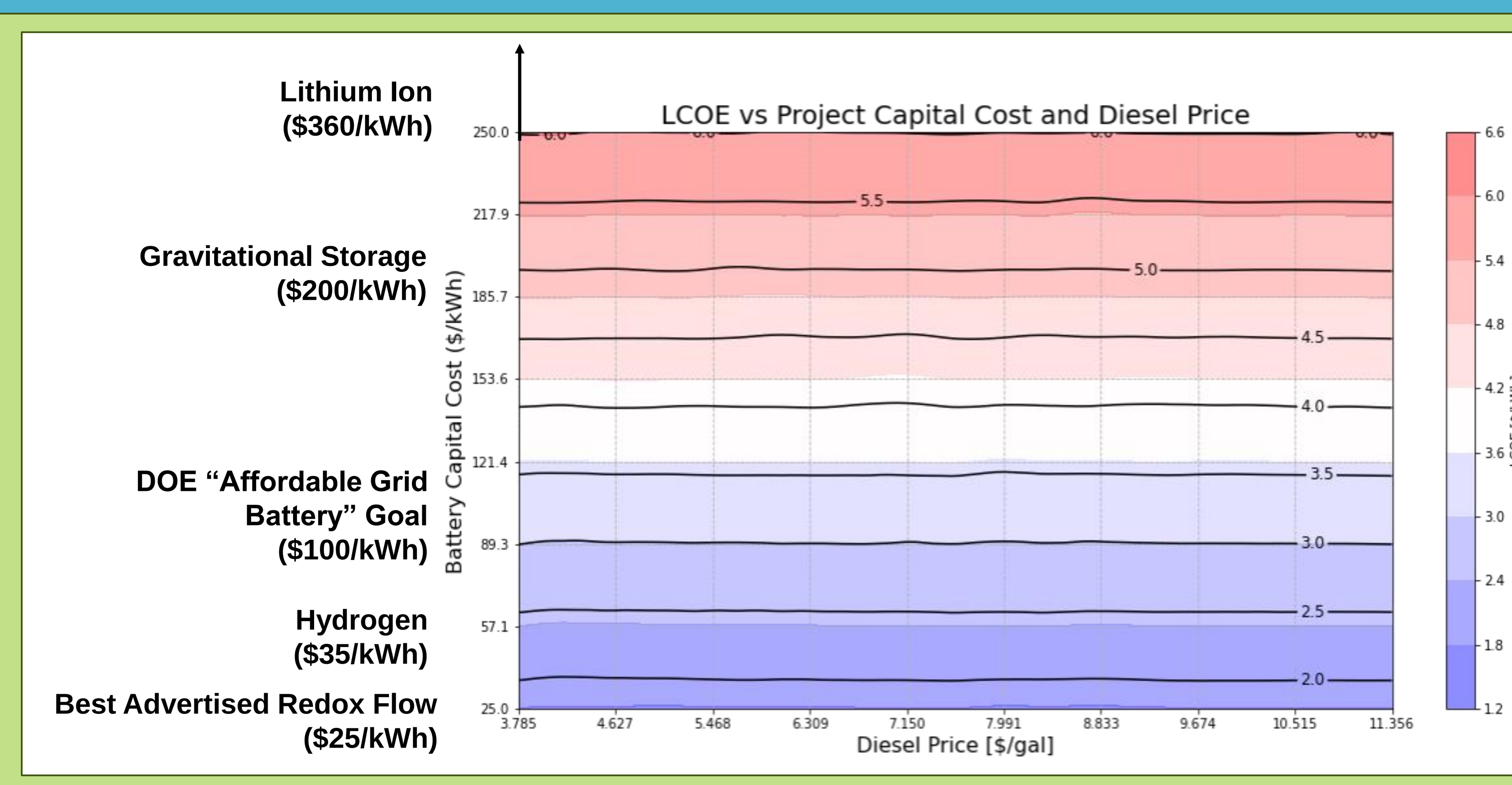
Objectives and approach:

- Identify and simulate 2 different energy storage sizing cases using Python:
  - No Storage
  - Storage sized to cover winter electric load (350 MWh)
- Analyze project's sensitivity to changing diesel and storage prices to determine pricing point at which seasonal storage becomes viable.
- Identify if electrifying residential space heat is a viable use for excess hydro power

Results

- Electrifying the heating load without long-term storage will not be sufficient to store excess renewables (results in recorded presentation – see adjacent QR code).
- With the current technology and the need for at least 350 MWh of energy storage, the price of fuel is insignificant when considering the total capital cost.
- Large scale seasonal storage does not make economic sense when compared to the base case of the Kogoluktuk River Hydro project.



Watch the presentation about viability of electrifying heat storage:

Figure 3: Levelized Cost of Energy (LCOE) sensitivity to diesel prices and capital costs for various energy storage technologies. On the left, reference technologies are shown to give context for capital cost per kWh. Notice that diesel price has little effect on the LCOE in this case study due to the need for a large seasonal battery which dominates the capital costs in the LCOE equation.

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Period of Performance:

- August 22nd, 2018 – September 30th, 2023

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Possible deployments

- AVEC is pursuing OCED funding to convert the existing intertie between Shungnak and Kobuk MVDC. Other funding avenues being explored for Shungnak to Ambler intertie.

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