Low Power HVDC System for Rural Alaska Applications

Project Overview

ACEP
Alaska Center for Energy and Power

Testimony Before House Special Committee on Energy

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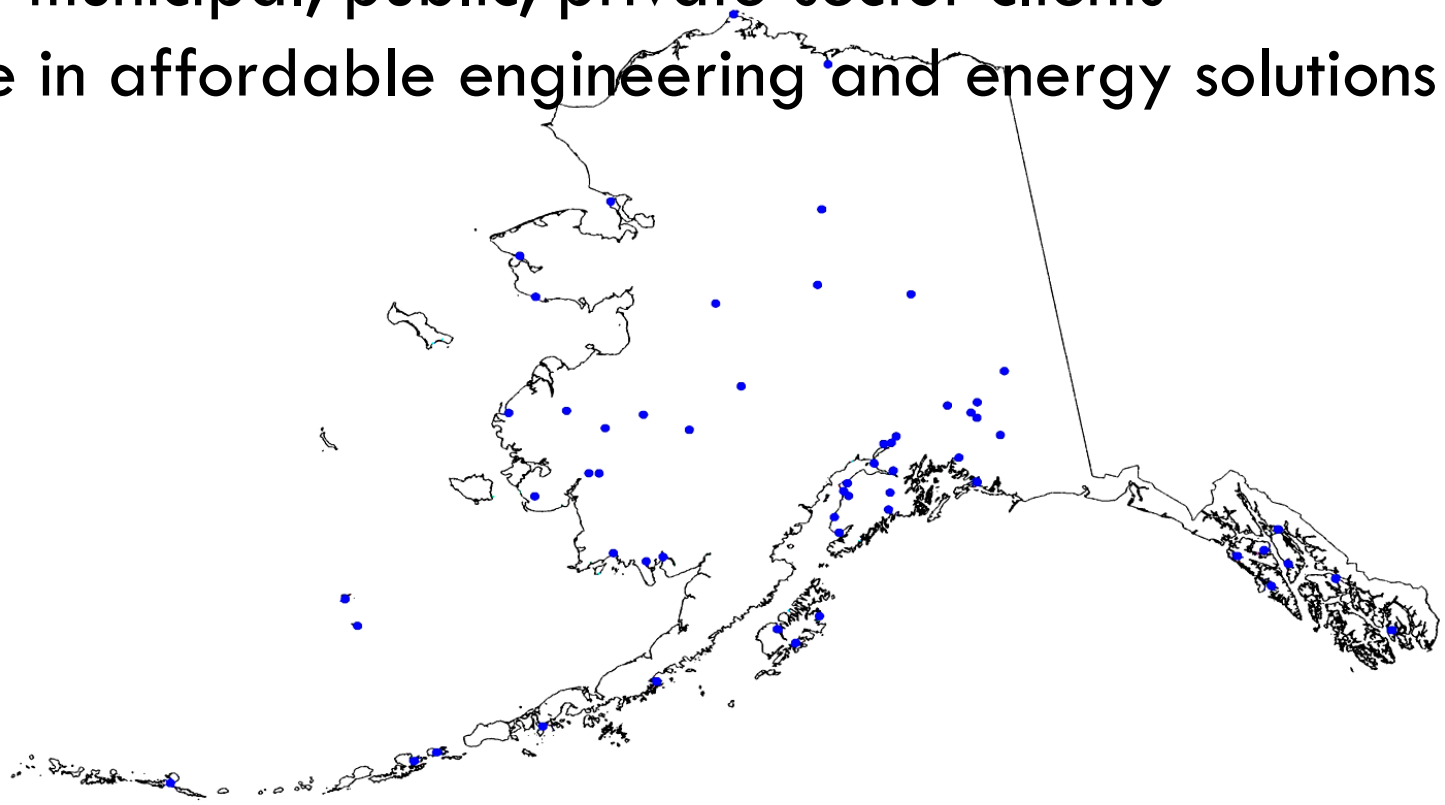
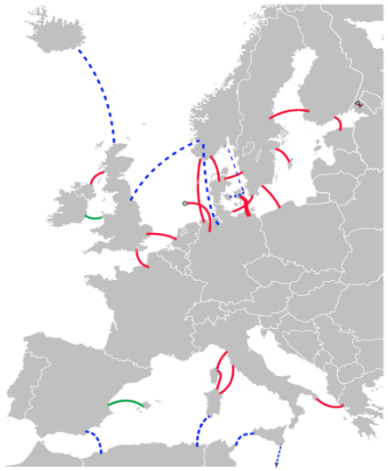
Polarconsult Background

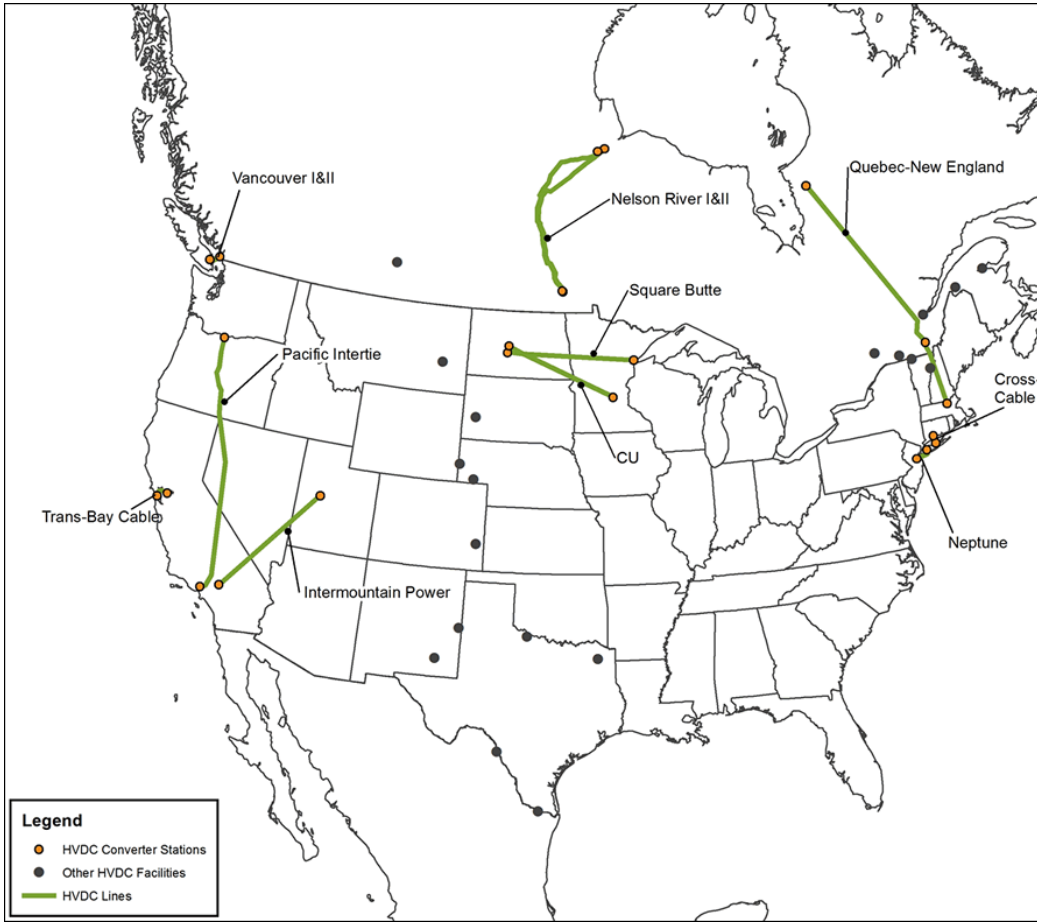
- Anchorage-based engineering consulting firm
- Serving Alaskans since 1978
- Over 200 municipal, public, private-sector clients
- Specialize in affordable engineering and energy solutions



HVDC History

- 1880s – Edison's Pearl Street Station NYC (low voltage DC)
- 1950s – 1st modern commercial use of HVDC
- Today
  - ~30 HVDC stations in North America
  - 100+ HVDC stations worldwide





Existing HVDC Applications

- Existing HVDC systems are 50 to 5,000 MW
  - Three Gorges Dam to China's Coastal Cities
  - Columbia River System to Southern California
- Rural Alaska Loads are 100s kW to 10s MW
- **Existing Technology**

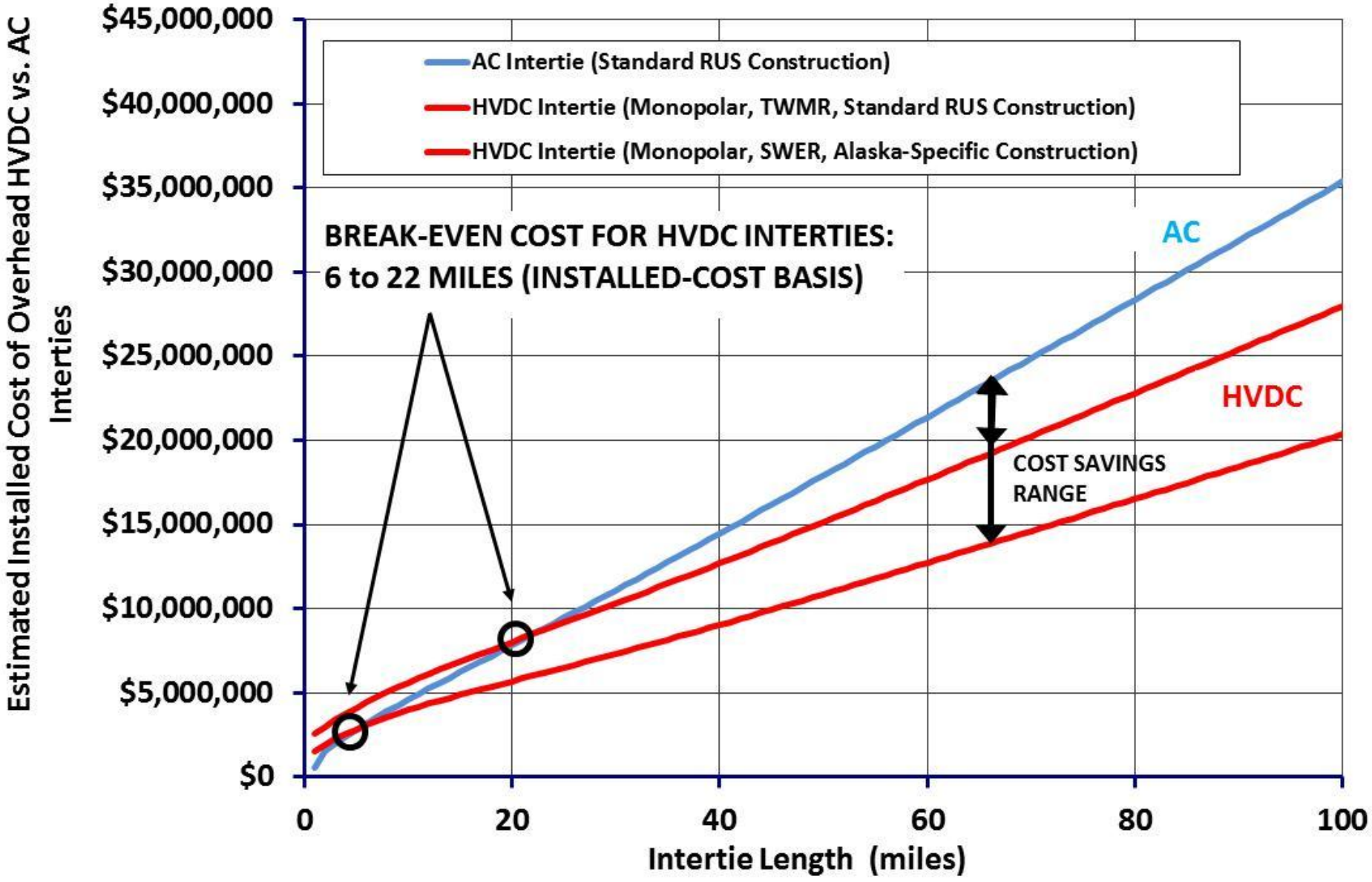
  Does Not Meet

  Rural Alaska's Needs

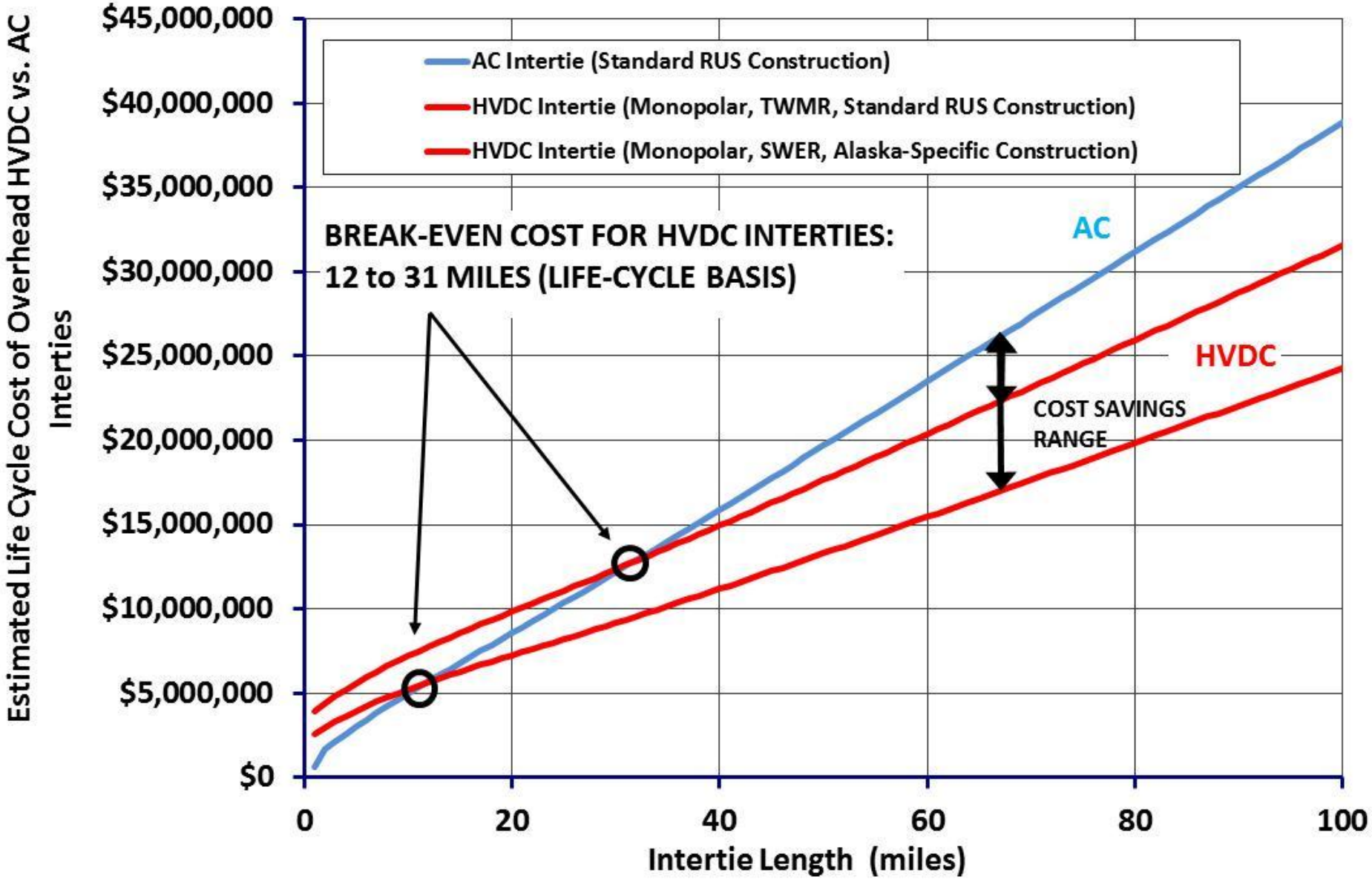
HVDC for Rural Alaska

- **Advantages**
  - Lower per-mile cost for intertie line
  - Long-distance submarine cables can be used
  - Fewer overhead wires, better for birds
  - Lower line losses
  - Asynchronous connection
- **Disadvantages**
  - Converter stations are more costly
  - Strictly transmission - serving loads between villages is expensive
  - Converters have higher losses that AC transformers
  - New technology – limited suppliers, lacks performance record

Rural Alaska HVDC Economics (Cap. Cost)



Rural Alaska HVDC Economics (Life Cycle)



Comparative Economics
Low-Power HVDC vs. AC Interties

- 25-mile 1 MW overhead HVDC intertie: **30% Savings**
- 60-mile 1 MW overhead HVDC intertie: **40% Savings**

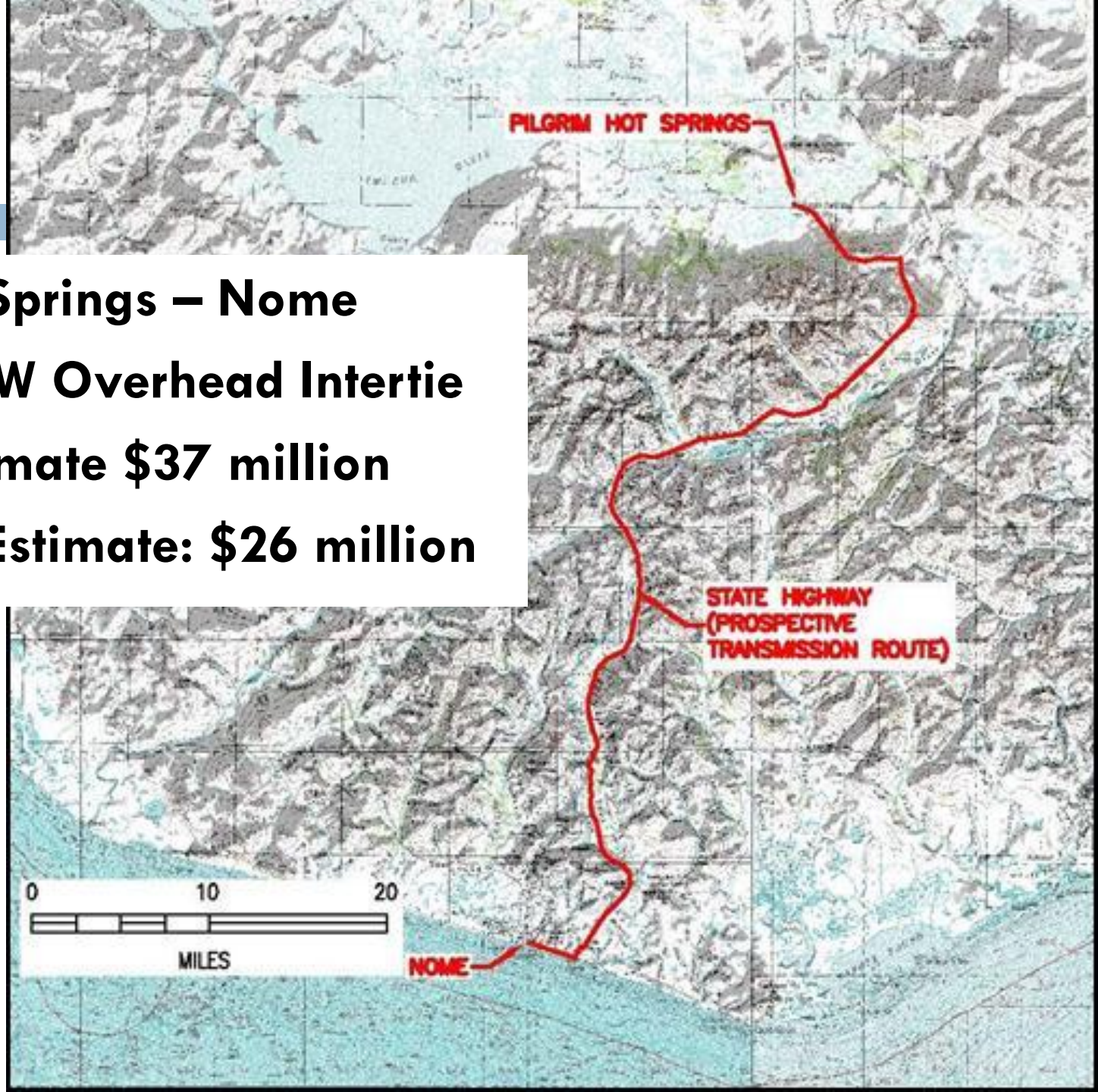
- 25-mile 2 MW submarine HVDC intertie: **50% Savings**
- 60-mile 5 MW overhead HVDC intertie: **30% Savings**

Rural Alaska HVDC Case Studies

- **AC Cost Estimate $49 million**
- **HVDC Cost Estimate: $23 million**

Rural Alaska HVDC Case Studies

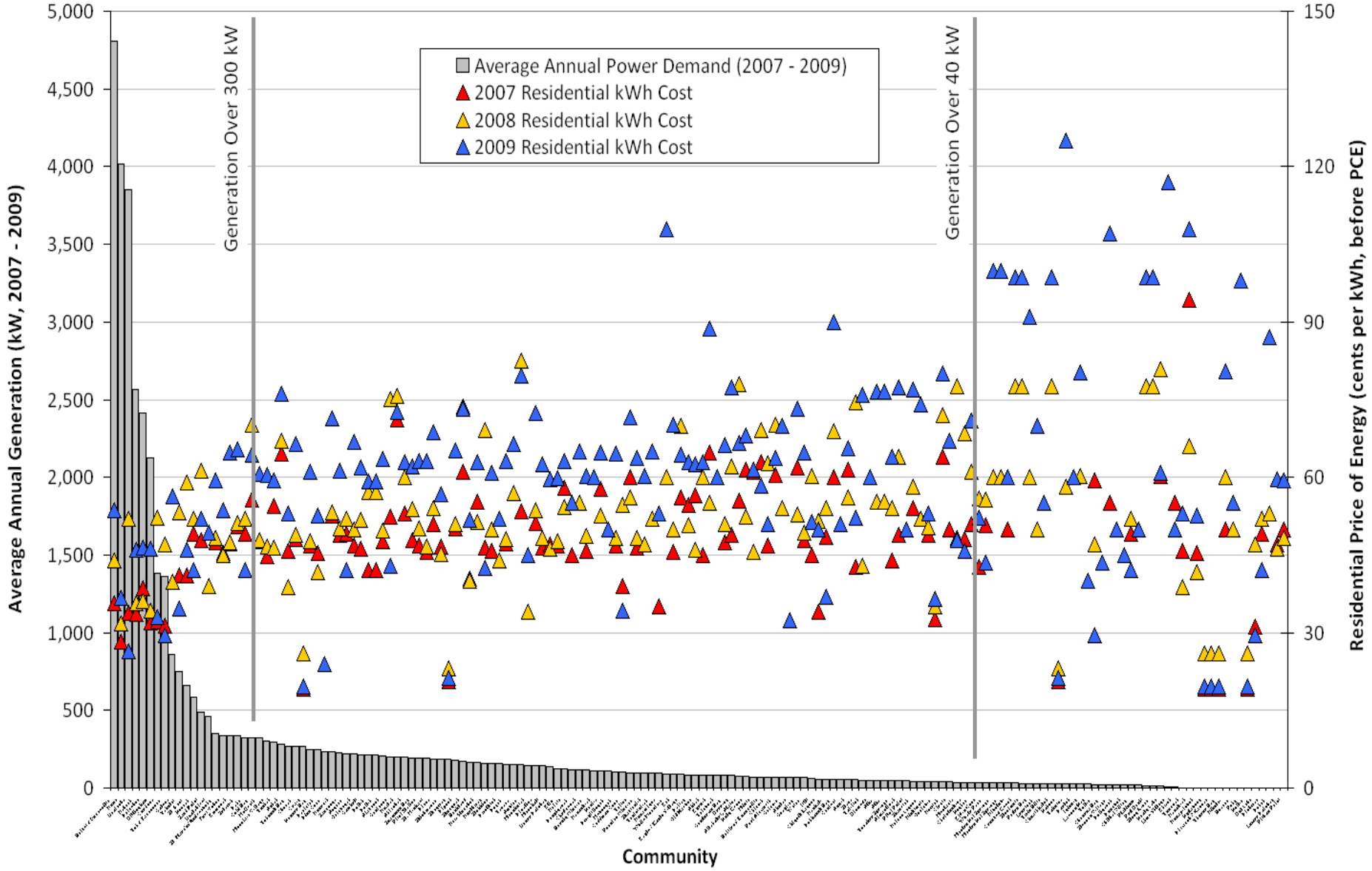
- **Pilgrim Hot Springs – Nome**
- **60-mile 5 MW Overhead Intertie**
- **AC Cost Estimate $37 million**
- **HVDC Cost Estimate: $26 million**



How does HVDC help?

- Reduce intertie costs to Interconnect Villages
  - AC interties are costing $400,000 per mile +/- 50%
  - HVDC interties can cut costs by up to 40 or 50%
- Interconnect Villages to Build Economy of Scale
  - Consolidate bulk fuel storage
  - Eliminate power plants
  - Boost plant efficiencies and operations
  - Combined loads that allow cost-effective development of local energy resources

Where do Economies of Scale Begin?

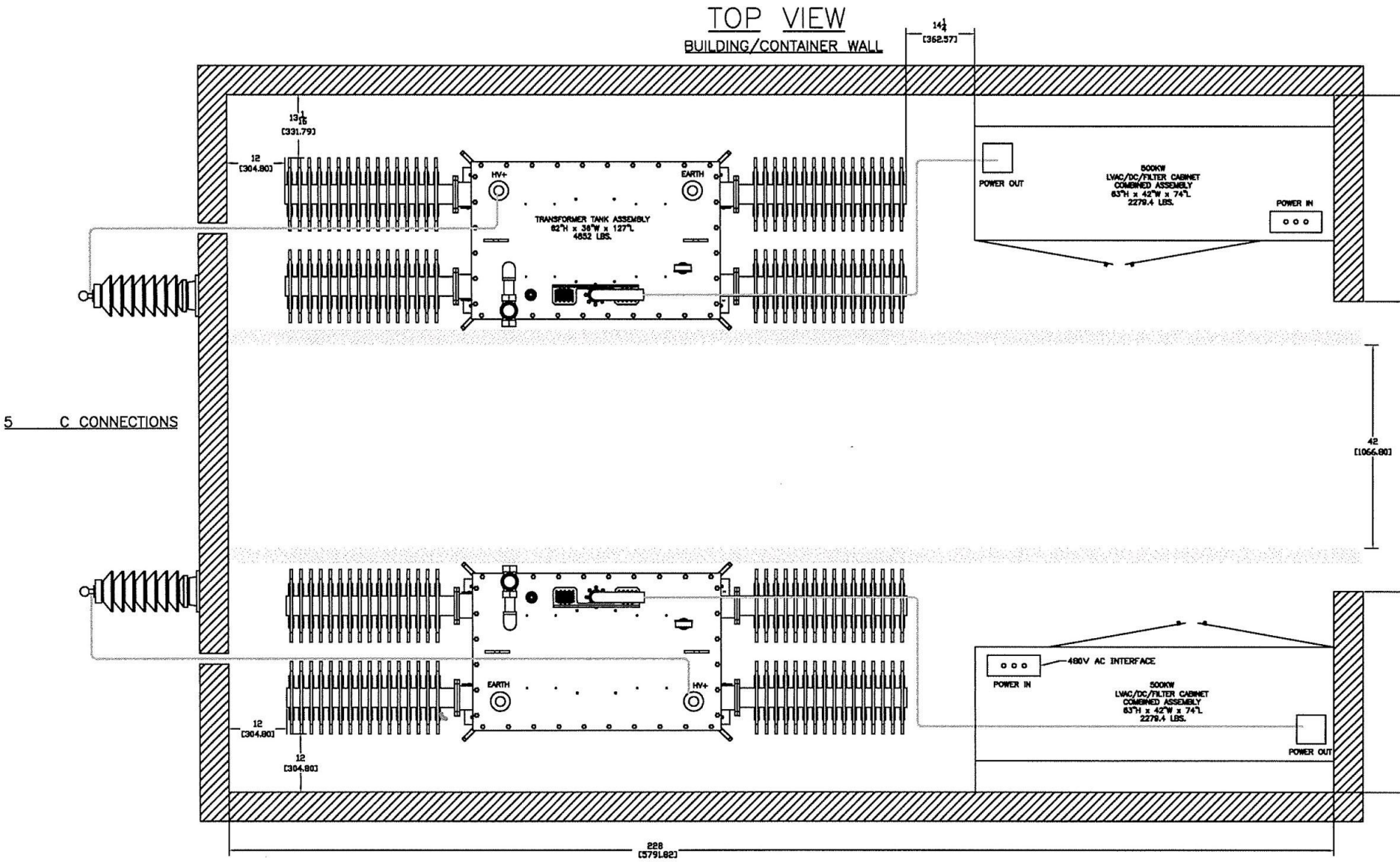


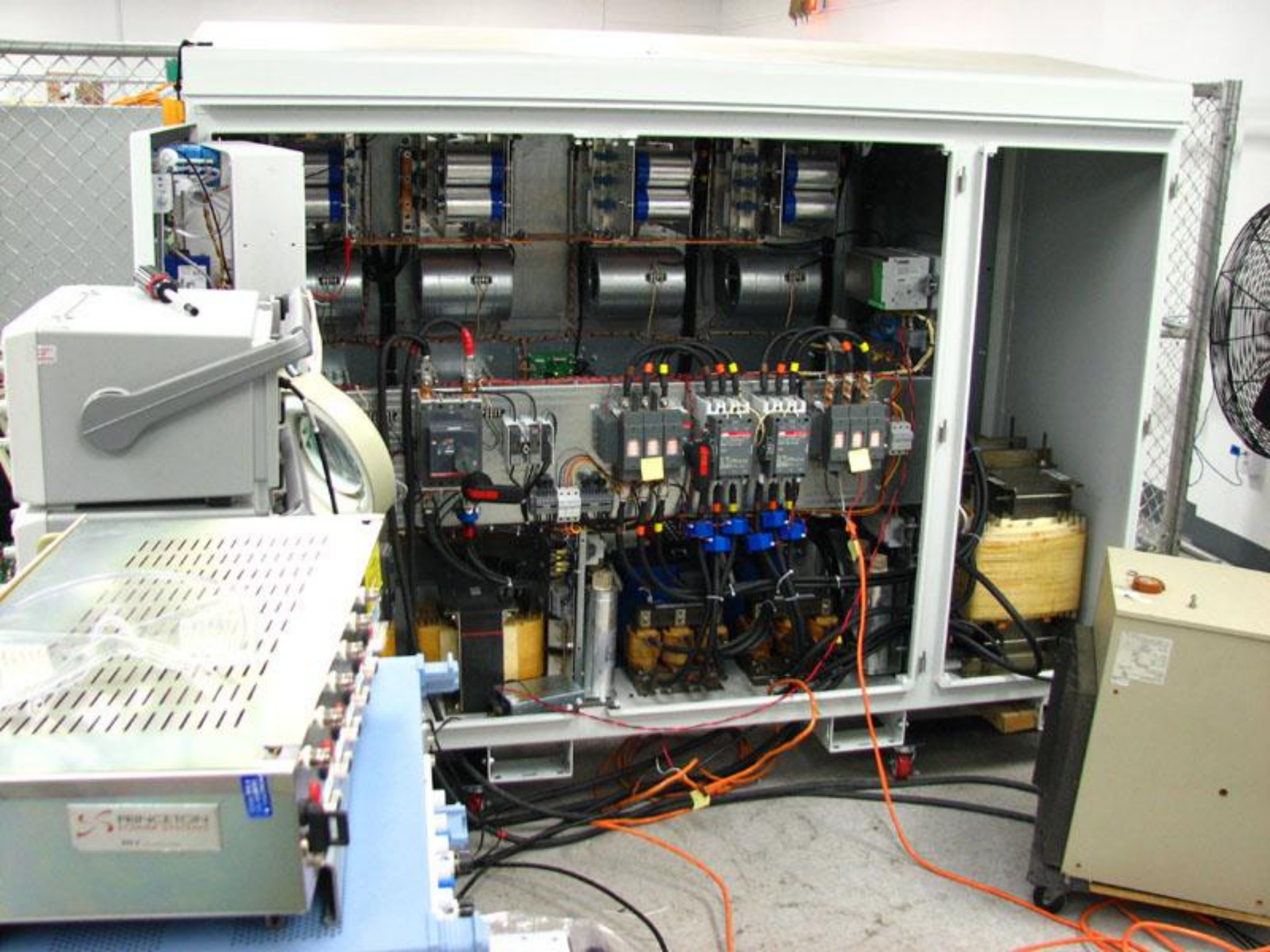
HVDC Program Overview

Develop a low-power HVDC transmission system suitable for use in rural Alaska applications.

- **2005 – 2007 Technology Review**
- **2007 – 2009 Phase I Preliminary Design & Feasibility**
  - Denali Commission Funded
  - AVEC Managed
- **2010 – 2011 Phase II Prototyping and Testing**
  - Denali Commission Funded
  - ACEP Managed
- **2012 – 2014 Phase III Testing and Demonstration**
- **2015 – 2016 Ready for Commercial Deployment**

1 MW Converter Enclosure






High Voltage Test
(HVT)
EXIT

INSTALLING MICRO-THERMOPILES AT THE FAIRBANKS TEST SITE


MICRO THERMOPILE
POLE FOUNDATION


MICRO THERMOPILE
POLE FOUNDATION


ASSEMBLING
FIBERGLASS POLE
SPLICE


60-FOOT TALL GUYED
FIBERGLASS POLE


60-FOOT TALL GUYED
FIBERGLASS POLE

Phase II Stakeholders Advisory Group

- Denali Commission
- Alaska Center for Energy & Power
- Polarconsult Alaska, Inc.
- Alaska Village Electric Cooperative
- Alaska Energy Authority
- North Slope Borough
- Naknek Electric Association
- Nome Joint Utilities
- Nome Chamber of Commerce
- Bering Straits Native Corporation
- Alaska Department of Labor
- IPEC
- AP&T
- CVEA
- MEA
- USDA-RUS
- GVEA
- Nuvista Light & Power

Key Team Members and Contributors

- Denali Commission (Funding Agency)
- ACEP (Grant Management, Economic Analysis, Strategy)
- Polarconsult (Project Management, Strategic Vision, Design)
- Princeton Power Systems (Converter Development)
- UAF/Dr. Wies (Technical Review / Alaska Integration / Practicality)
- AVEC (Alaska Integration / Practicality)
- SAG (Practicality / Industry Acceptance)
- Manitoba HVDC Research Centre (HVDC Expert)
- Cabletricity, Inc. (Submarine Cable Expert)
- Zarling Aero Engineering (Thermal Soils Analysis)
- Golder Associates (Geotechnical Expert)
- STG, Inc. (Rural Intertie Contractor)
- Arctic Foundations, Inc. (Foundation Supplier)
- Almita, Inc. (Foundation Supplier)

Questions