

3/22/12
Presentation by
Polarconsult
Alaska, Inc.:
Low Power HVDC
System for Rural
Alaska
Applications

<TARGET><BILL></BILL><SUBJECT>3-22-12 Presentation by
Polarconsult Alaska, Inc. Low Power HVDC System for Rural
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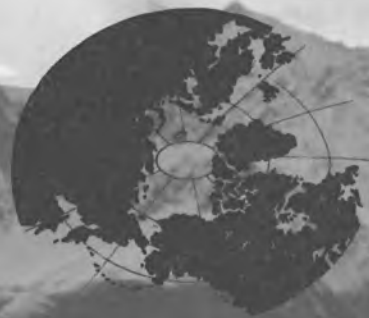
Low Power HVDC System for Rural Alaska Applications

Project Overview



ACEP
Alaska Center for Energy and Power

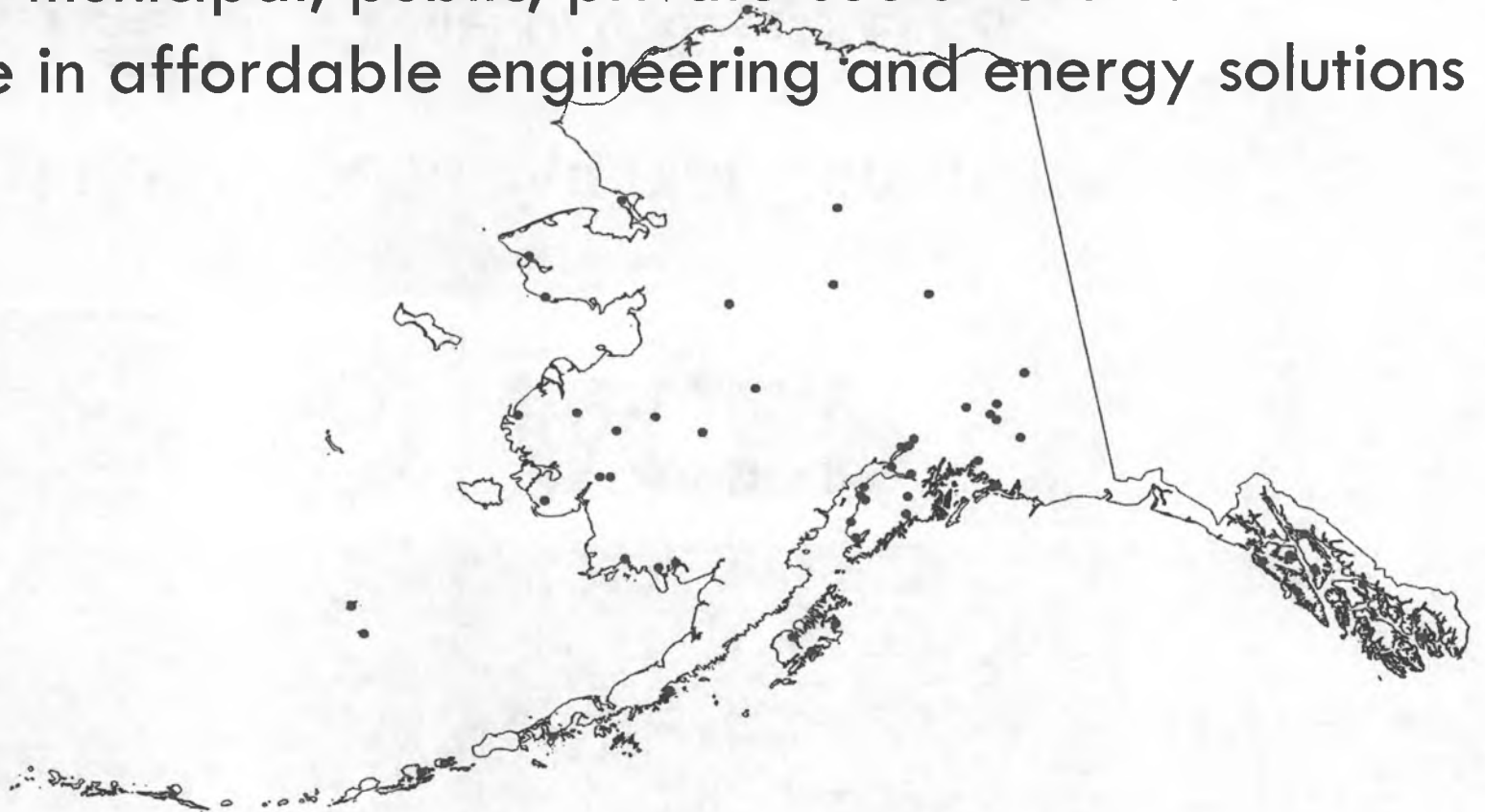
Testimony Before House Special Committee on Energy



Joel D. Groves, P.E.
polarconsult alaska, inc.
March 22, 2012

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

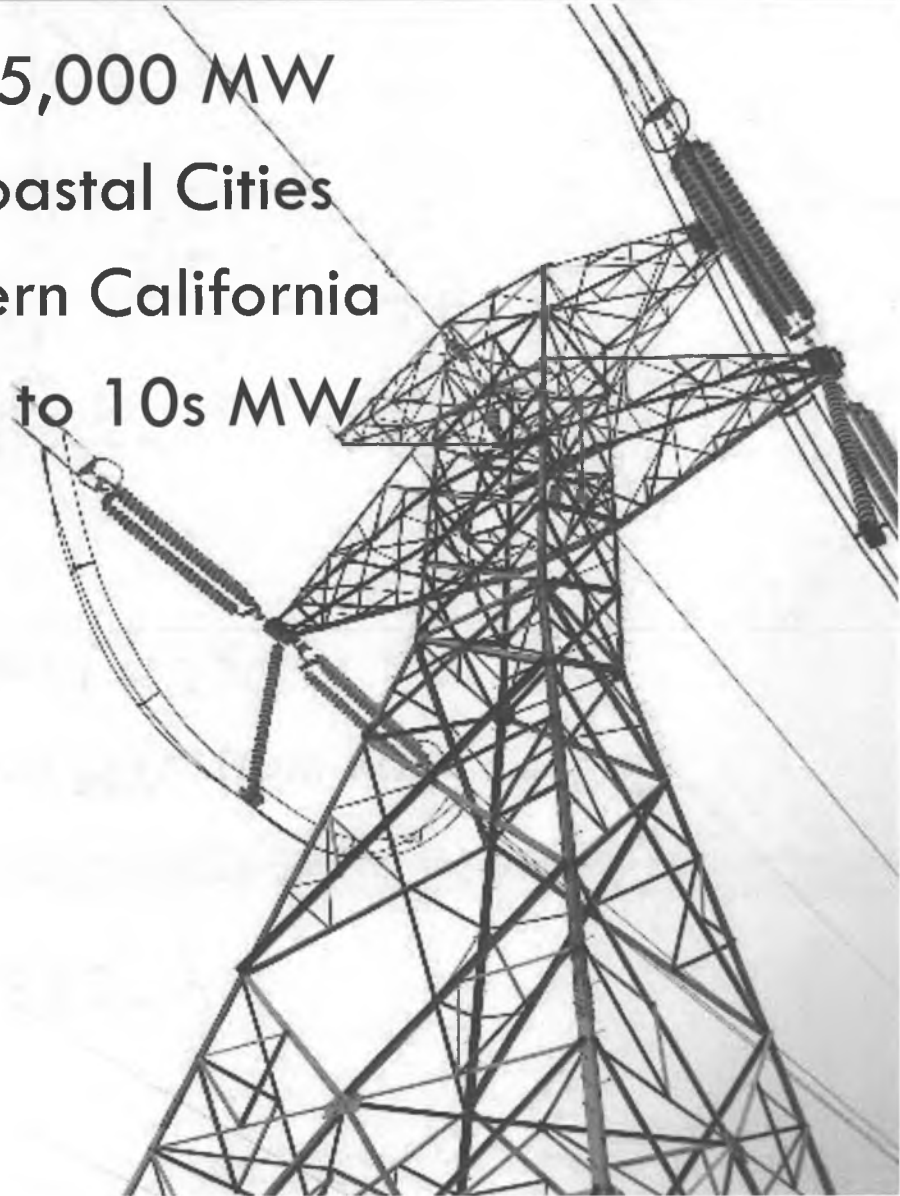
- ❖ 1880s – Edison’s Pearl Street Station NYC (low voltage DC)
- ❖ 1950s – 1st modern commercial use of HVDC
- ❖ Today
 - ❖ ~30 HVDC stations in North America
 - ❖ 100+ HVDC stations worldwide



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

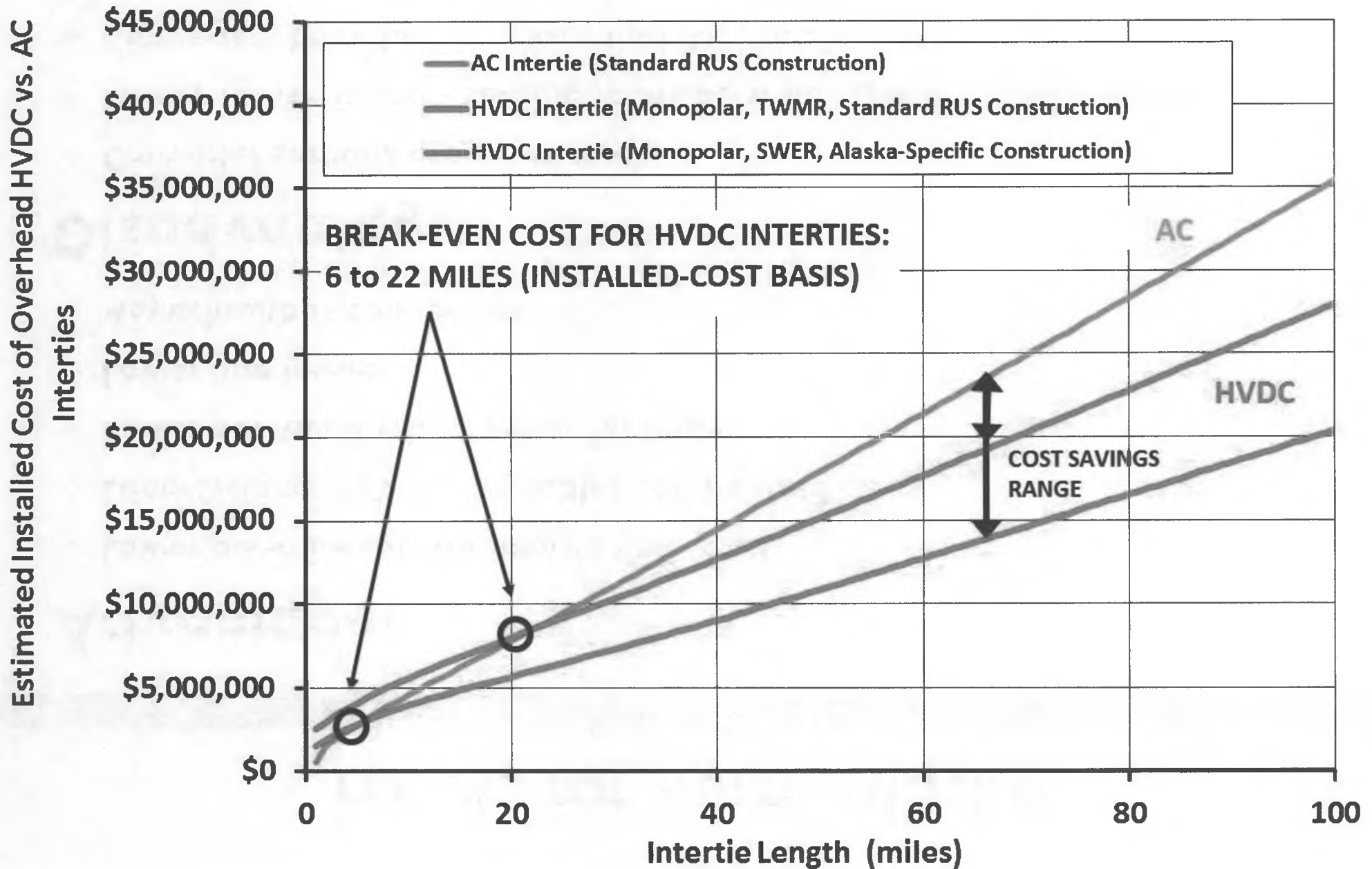
❖ **Advantages**

- ❖ **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**

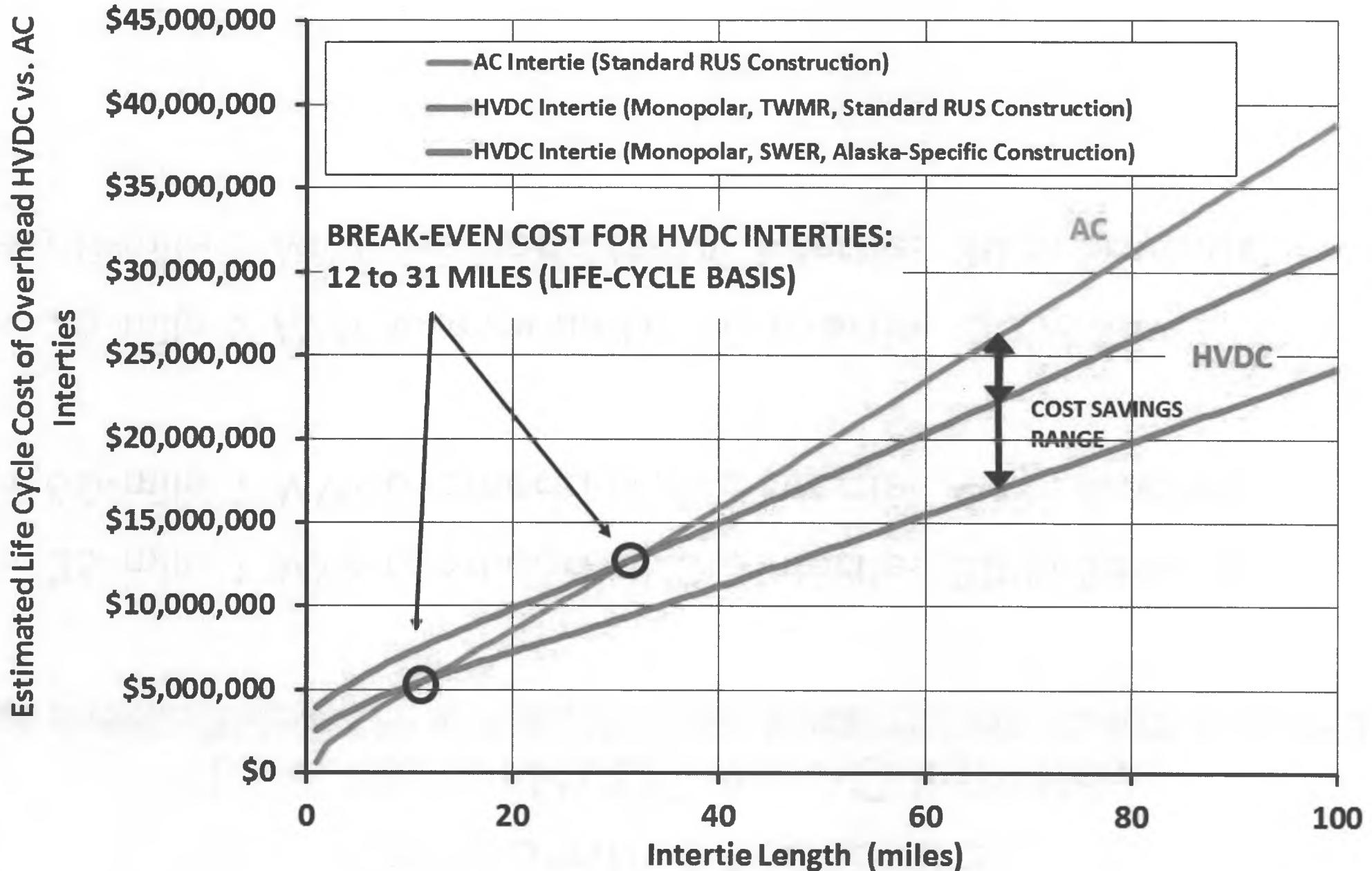
❖ **Disadvantages**

- ❖ **Converter stations are more costly**
- ❖ **Strictly transmission - serving loads between villages is expensive**
- ❖ **Converters have higher losses than AC transformers**
- ❖ **New technology – limited suppliers, lacks performance record**

Rural Alaska HVDC Economics (Cap. Cost)



Rural Alaska HVDC Economics (Life Cycle)



Comparative Economics

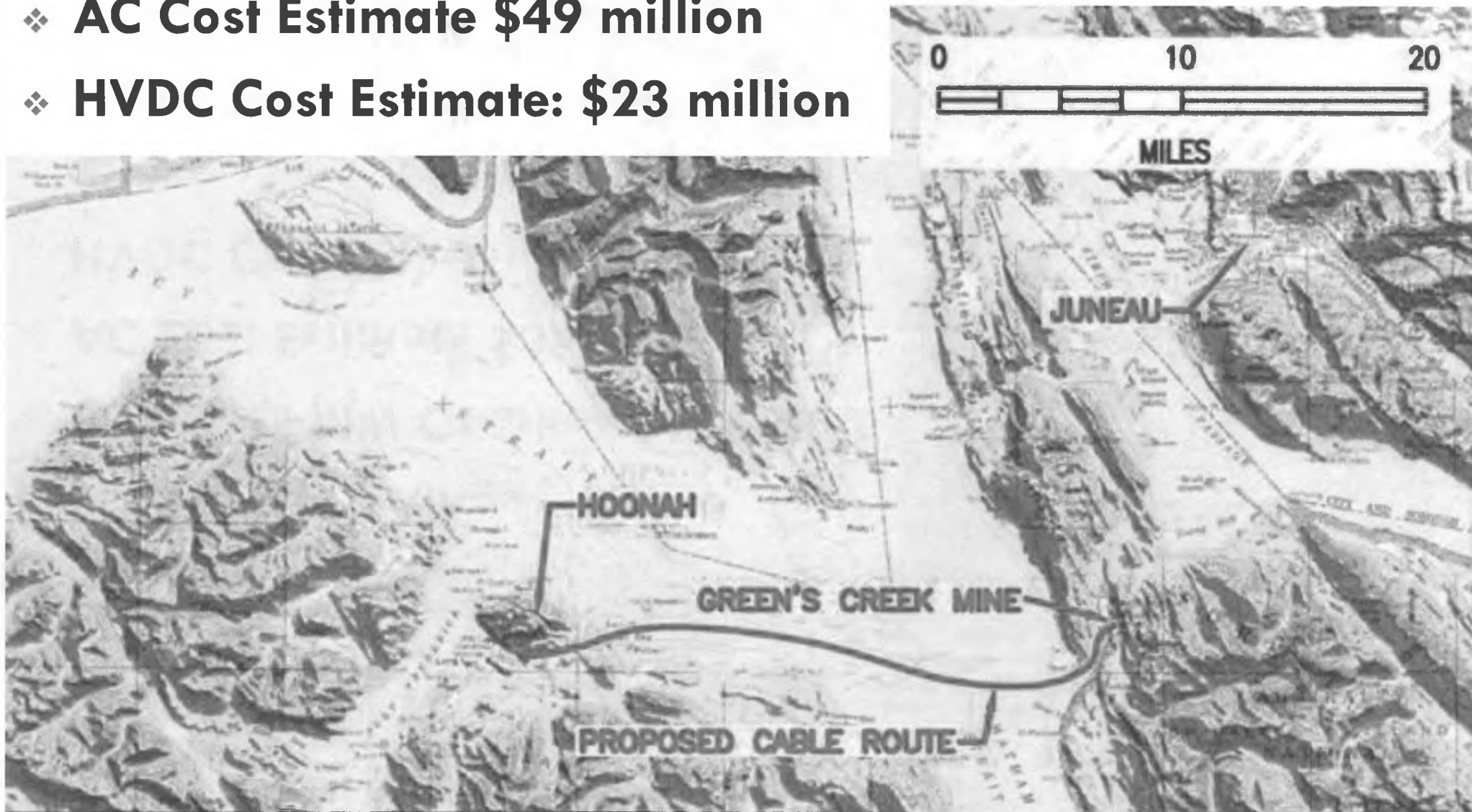
Low-Power HVDC vs. AC Interties

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

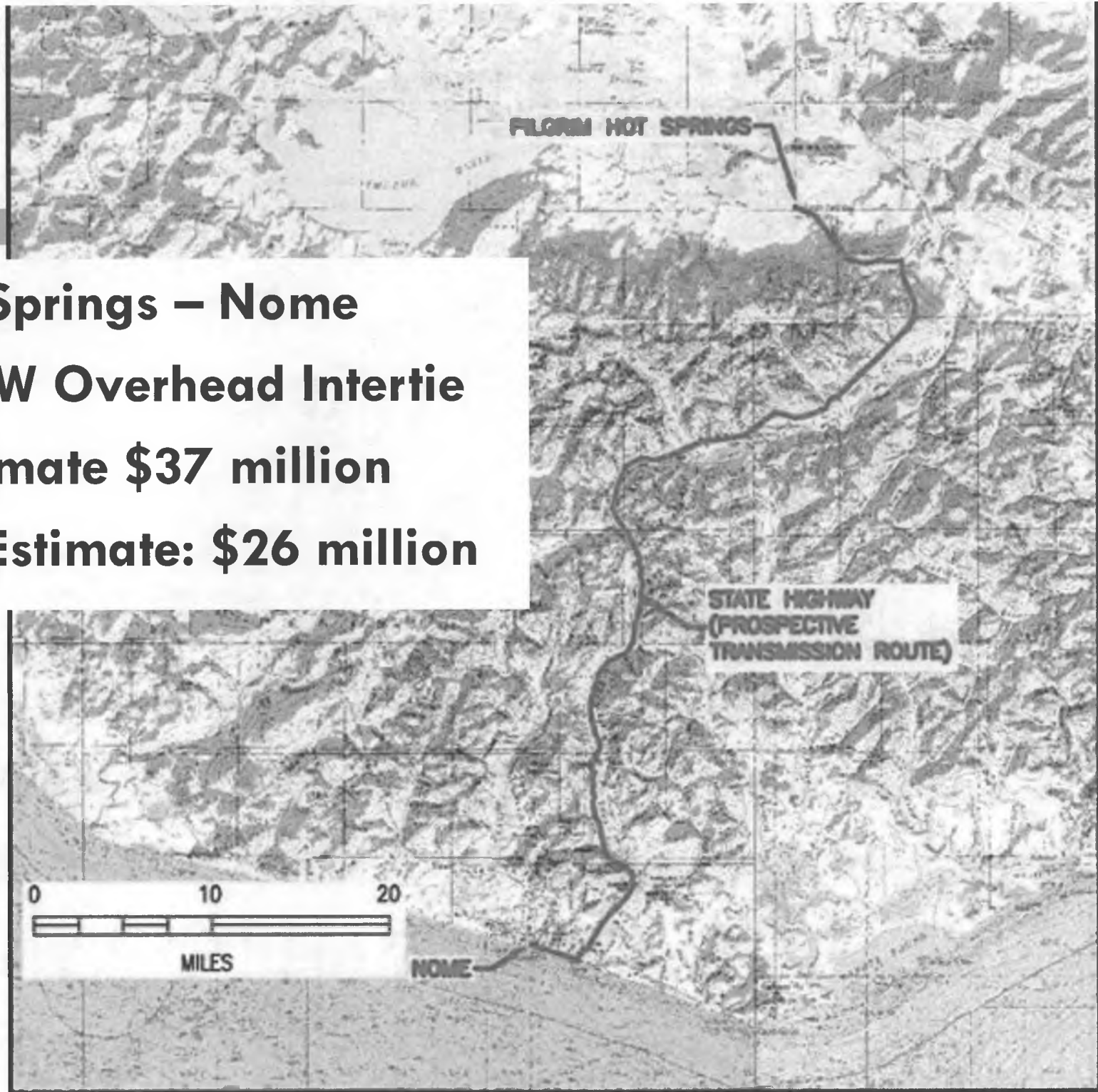
- ❖ 25-mile 2 MW submarine HVDC intertie: **50% Savings**
- ❖ 60-mile 5 MW overhead HVDC intertie: **30% Savings**

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

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**

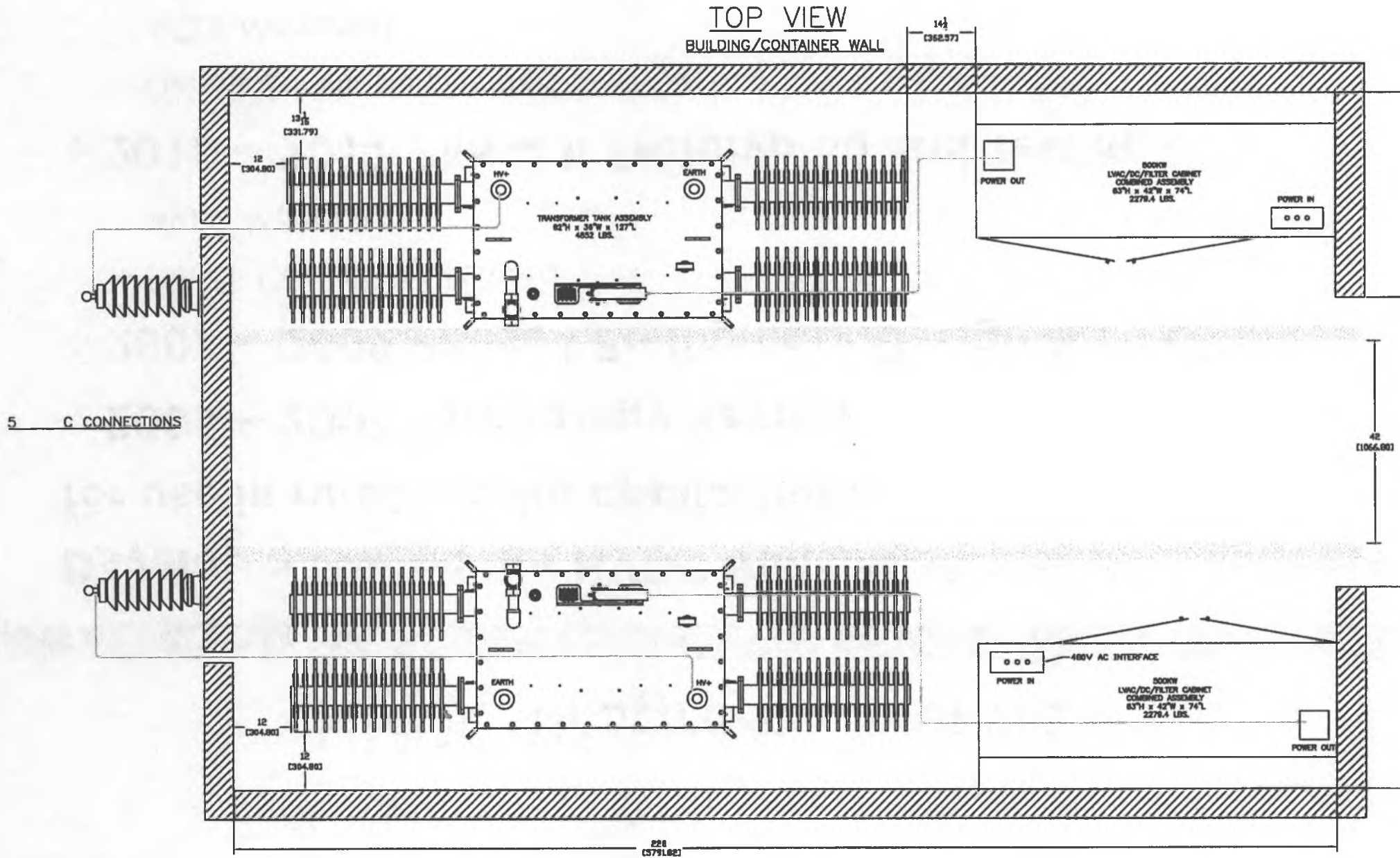
❖ Denali Commission Funded

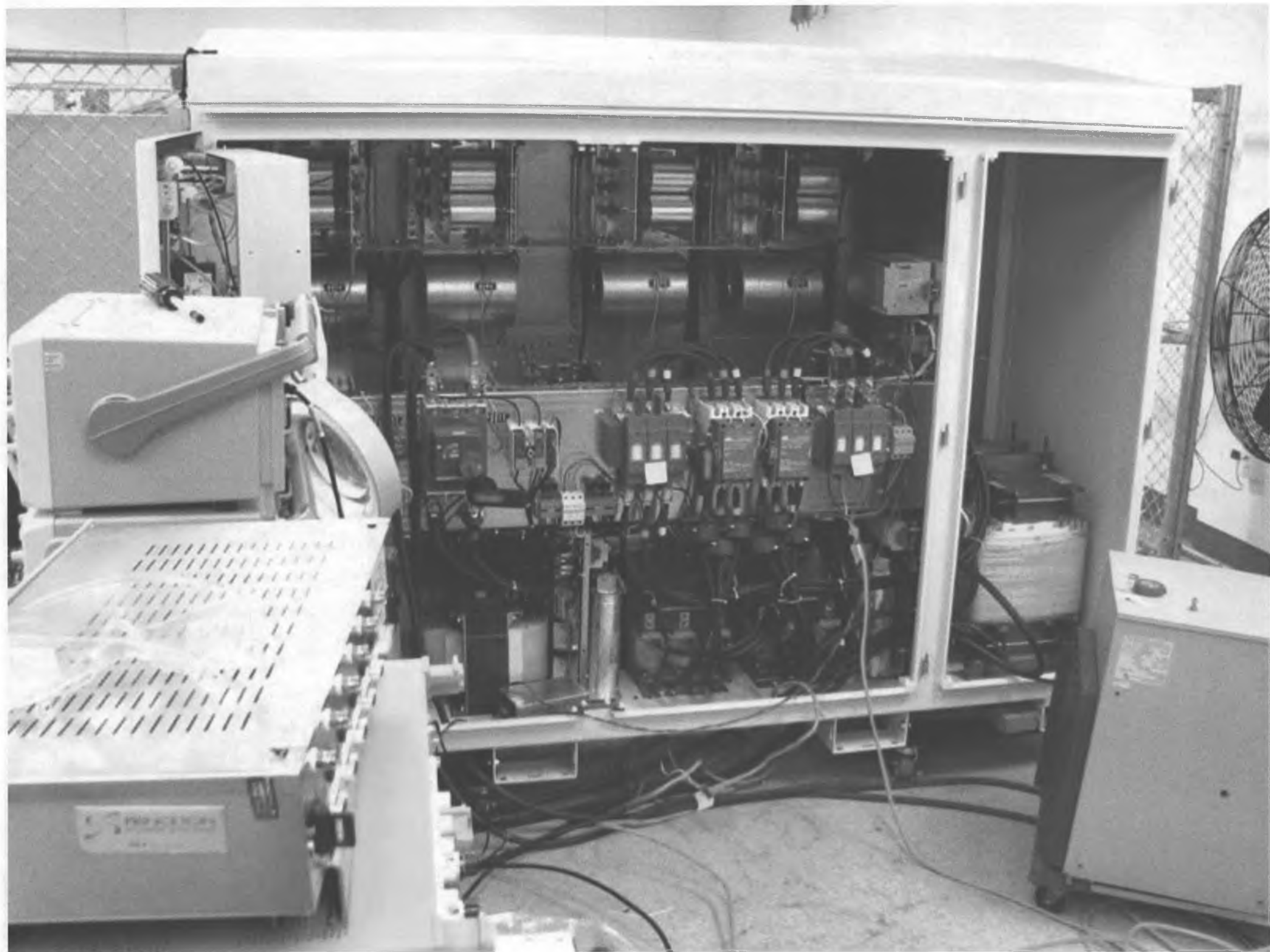
❖ ACEP Managed

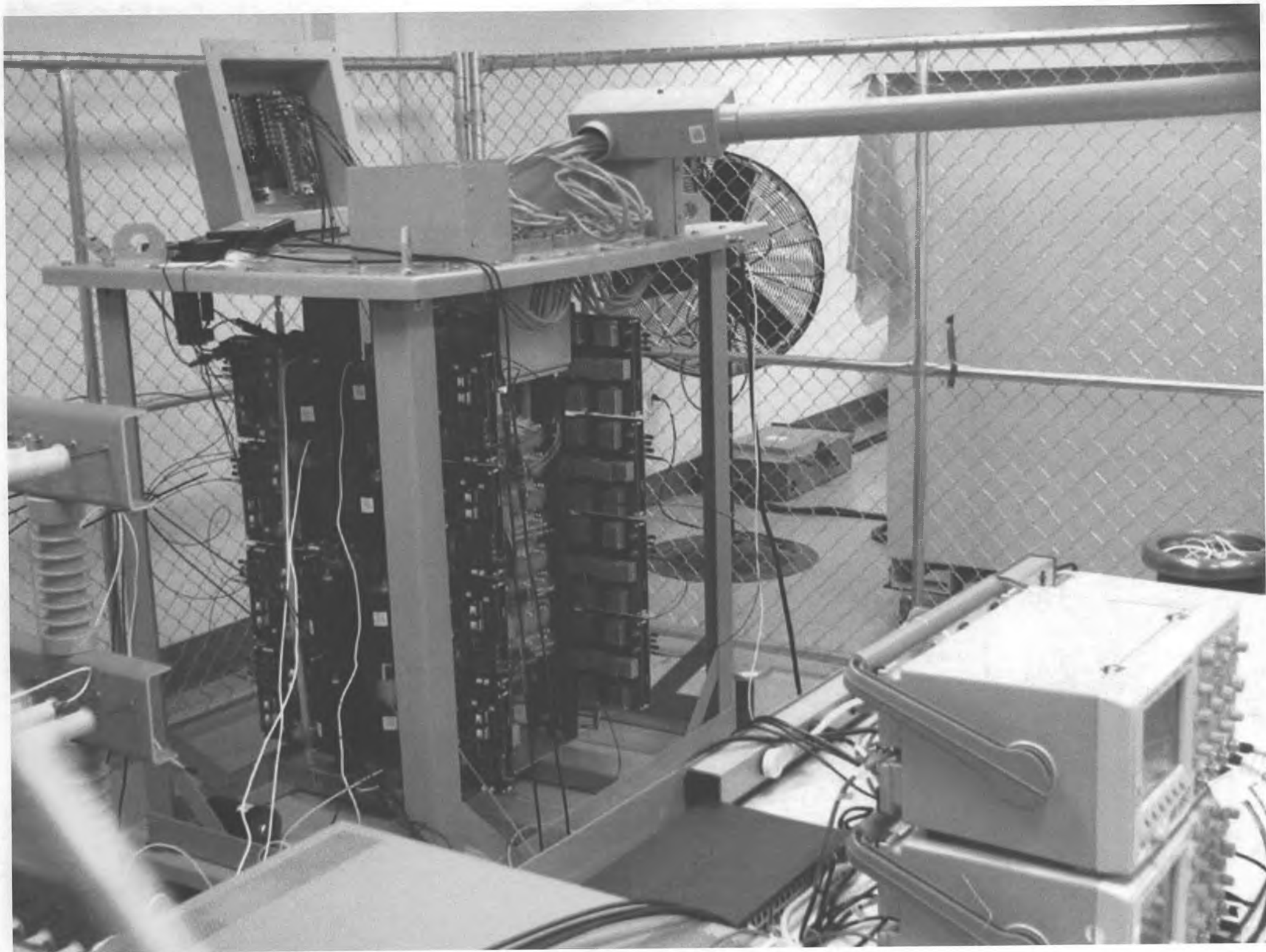
❖ **2012 – 2014 Phase III Testing and Demonstration**

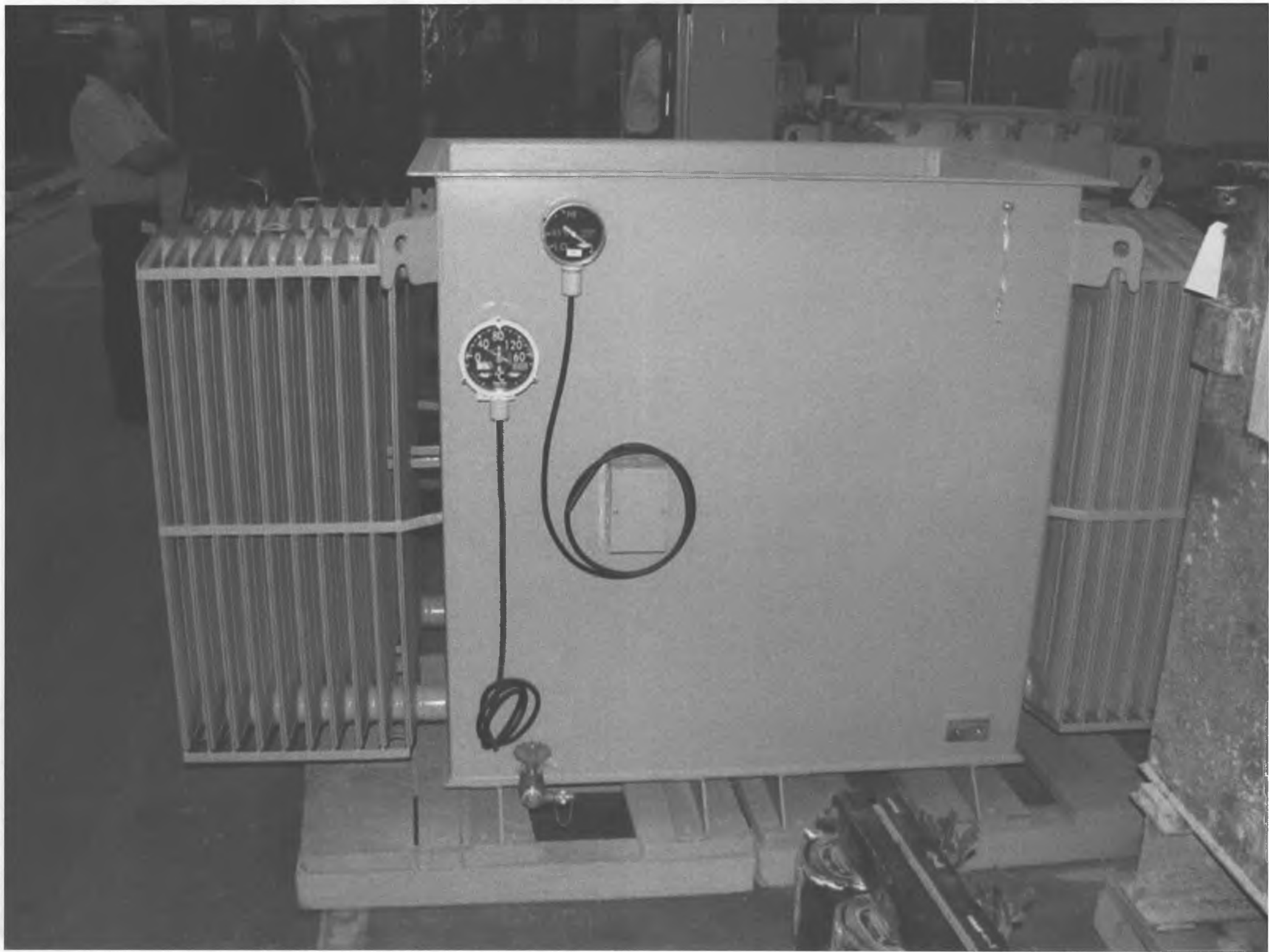
❖ **2015 – 2016 Ready for Commercial Deployment**

1 MW Converter Enclosure







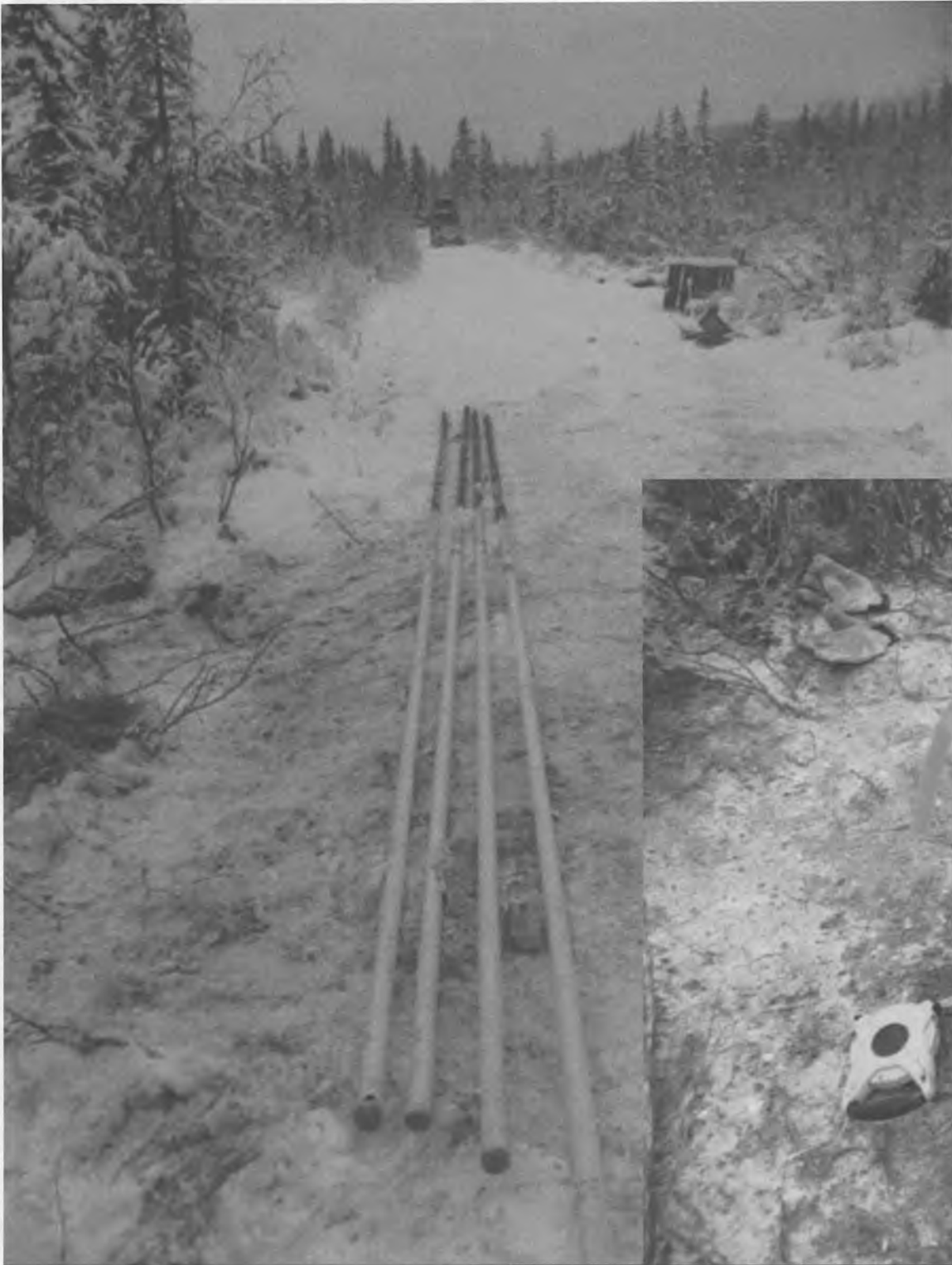


High Voltage Test
(HVT)





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

