Request for Input

*Phase III HVDC Demonstration Project Selection Criteria and Location*

Polarconsult Alaska, Inc. is formally requesting the input of the Stakeholder Advisory Committee. The HVDC Development Program calls for the construction of a functional remote Alaskan HVDC intertie to demonstrate that the technology is commercially ready and appropriate for rural Alaska conditions and utilities. This demonstration project will be Phase III of the Development Program, commencing after the current Phase II effort is completed.

The location for the Phase III demonstration intertie is yet to be selected. Members of the Stakeholder Advisory Group are being asked to provide feedback, comment, and discussion on Phase III demonstration project selection criteria and candidate locations. Candidate interties will be analyzed by Polarconsult over the next several months, and the input of the SAG may be used to develop cost estimates and facilitate project partnerships for Phase III funding.

Please send your feedback and input on these questions to:

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Program Manager
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**Question 1: Demonstration Project Objectives**

This project is developing a number of new technologies and innovations in power transmission for remote Alaska applications, and a single demonstration project is unlikely to demonstrate all of them. Accordingly, the demonstration project should focus on the core technologies and innovations that have the greatest uncertainty or risk, or will address the most prevalent problems – these are the technologies that most need to be successfully demonstrated in Phase III. We request your input on defining the demonstration project objectives. We have identified the following:

- The HVDC converter technology and electrical hardware.
- Innovative transmission structures / materials / construction methods. This could include guyed fiberglass poles, overland cables, or other elements of the complete system.
- Single Wire Earth Return.

Please send us your thoughts on what the Phase III demonstration project most needs to demonstrate. This will help us select the right project to prove this technology in Alaska, paving the way to more economical rural interties and more affordable electricity in rural Alaska.
Question 2: Demonstration Project Candidates

Please send us your thoughts on potential intertie projects. Key criteria and some example projects are provided below. Polar Consult will use this feedback in determining next steps for project development, specifically to identify and apply for future funding for phase III.

Demonstration Project Criteria

So what makes a good demonstration project? Here are some of the criteria we will consider:

- **Intertie length.** The cost savings of HVDC relative to AC increase with distance, so longer interties are preferred. Our Phase I cost analysis indicated the breakeven point is at about ten miles so as a general rule, only interties longer than ten miles should be considered.

- **Intertie benefit.** There should be a public benefit from the intertie. The clearest example would be an intertie that connects a community with high-cost electricity to a community with excess low-cost electricity.

- **Constructability.** While the phase II HVDC development effort includes conceptual designs for construction in difficult terrain, it would be beneficial for the intertie route to be co-located with a road or trail to facilitate construction, monitoring, and maintenance. Similarly, communities with good airports and reliable barge service will help lower construction costs.

- **System Load.** The HVDC system under development will transmit up to one megawatt of power in a monopolar configuration or two megawatts in a bipolar configuration. In the future, the converter technology can be scaled up to at least 5 megawatts, allowing interties of at least 10 megawatts, but this will require additional converter development work beyond the scope of Phase II. Accordingly, interties of less than two megawatts are preferred for the Phase III demonstration project.

- **Project Readiness.** Our goal is to build the demonstration project as soon as is practical, so this HVDC technology can be commercially proven and deployed to help alleviate the energy crisis in remote Alaskan communities. Accordingly, demonstration projects with existing easements and that avoid significant environmental challenges are preferred.

- **Transmission Only.** This HVDC technology is suitable for transmission applications, not distribution applications. Potential small customers along the intertie route will not be able to get electricity from the HVDC line unless they purchase expensive converter equipment. Connecting intermediate villages or large industrial customers might be practical, but connections to lodges, fish camps, or individual houses will not be economical.

Some example intertie candidates are presented on the following pages.
Demonstration Project Examples
Below are some example candidate demonstration projects that have been suggested. A brief summary of the pros and cons of each intertie as an HVDC demonstration project is provided for each candidate.

**Barrow to Atqasuk**
This 75-mile overland intertie would connect Atqasuk, which uses high-cost diesel for electricity, to Barrow, which generates electricity from low-cost natural gas. This project could include conversion of Atqasuk to electric heating to achieve greater benefits.

**Nome to Teller and Brevig Mission**
This approximately 75-mile overland intertie would connect Teller and Brevig Mission - which both use high-cost diesel for electricity - to Nome, which generates electricity from diesel and some wind. AVEC is preparing for construction of an intertie between Teller and Brevig Mission. If the Pilgrim Hot Springs geothermal resource is developed and is large enough to supply Teller and Brevig Mission, it could significantly reduce electric costs in these villages.

**Pilgrim Hot Springs to Nome**
The geothermal resource at Pilgrim Hot Springs could provide electricity for Nome. One of the challenges with this renewable energy concept is the cost of the approximately 50-mile transmission line between Pilgrim Hot Springs and Nome. Using this HVDC technology could reduce the costs of this intertie, improving project economics. One potential hurdle for this demonstration project candidate is that the Pilgrim Hot Springs resource may be larger than the two megawatt target capacity for the demonstration project. If the Pilgrim geothermal resource is greater than 2 MW, some additional development work will be needed to increase the HVDC converter capacity. ACEP is currently conducting an assessment of the geothermal resource at Pilgrim Hot Springs, which will help determine how much power can be derived from the resource.

**St. Mary’s to Mountain Village**
This 26-mile overland intertie would connect these two Yukon River villages, allowing AVEC to economize by consolidating bulk fuel and generation assets and operations at one village. There is good access to both villages, and an existing road between them would facilitate construction of the overhead intertie.

**Dillingham to Manokotak**
This 20-mile intertie would connect Manokotak to Dillingham. This intertie would allow the Dillingham and Manokotak electric utilities to consolidate operations, lowering costs in Manokotak and improving the economies of scale for both utilities. Also, Dillingham is currently studying two hydroelectric resources, Lake Grant and Lake Elva, that would provide stable, low-cost electricity. If these projects are built, Manokotak would enjoy significantly lower electric rates with this intertie. An intertie between Manokotak and Dillingham has been studied in the past, but has not been constructed. This HVDC technology could reduce costs for the intertie, improving project economics.
**Gustavus to Glacier Bay National Park**

With the completion of the 800-kilowatt Falls Creek Hydroelectric Project in 2009, Gustavus now has excess hydropower. The headquarters of Glacier Bay National Park, located approximately five to ten miles from Gustavus, continues to rely on diesel gensets for electricity. Connecting the park headquarters with Gustavus would allow the Park to reduce fuel consumption and operating costs and would allow Gustavus to increase its rate base and power sales, lowering overall rates. A buried HVDC cable would be preferable to overhead AC lines in the park, where aesthetics are a major factor. Due to the relatively short length, an HVDC intertie may not be cost-effective compared to an AC intertie.

**Green’s Creek to Hoonah**

This 26-mile submarine intertie would connect Hoonah to AEL&P’s Juneau power grid, providing lower-cost power to Hoonah. The intertie is a good length for HVDC, and would provide a clear benefit to Hoonah. The intertie has been under consideration for several years, and significant engineering studies have already been completed. The intertie is uneconomic using AC transmission or existing HVDC technology. This HVDC technology could reduce costs for the intertie, improving project economics.

**Petersburg to Kake**

This approximately 60-mile submarine and overland intertie would connect Kake with the Petersburg-Ketchikan grid. The intertie would allow Kake to convert from high-cost diesel electricity to low-cost hydro electricity, and would be part of the proposed southeast intertie grid. Using HVDC could reduce costs by allowing longer spans, buried cable, or increased use of submarine cable. While a one megawatt monopolar HVDC intertie would be sufficient to serve Kake, future extension of the southeast intertie to Sitka or development of nearby hydropower resources could increase the load on this intertie to 10s of megawatts.
BARROW – ATQASUK
INTERTIE MAP
(EXISTING WINTER TRAILS ARE SHOWN IN RED)
PILGRIM HOT SPRINGS – NOME
AND
NOME – TELLER
INTERTIE MAPS
(EXISTING ROADS ARE SHOWN IN RED)
ST. MARY’S - MOUNTAIN VILLAGE INTERTIE MAP
(PREVIOUSLY PROPOSED ROUTE FOR AN INTERTIE IS SHOWN IN RED)

DILLINGHAM – MANOKOTAK INTERTIE MAP
GREEN’S CREEK – HOONAH AND
GUSTAVUS – GLACIER BAY NATIONAL PARK
INTERTIE MAPS
(PREVIOUSLY PROPOSED ROUTES FOR AN AC INTERTIE ARE SHOWN IN RED)

PETERSBURG – KAKE INTERTIE MAP
(PREVIOUSLY PROPOSED ROUTES FOR AN AC INTERTIE ARE SHOWN IN RED)