Alaska Energy Authority - Bradley Lake Transmission Upgrade | **FY2014 Request: $13,700,000** | **Reference No: 56681**

AP/AL: Appropriation
Project Type: Energy
Category: Development
Location: Statewide
House District: Statewide (HD 1-40)
Impact House District: Statewide (HD 1-40)
Contact: Sara Fisher-Goad
Estimated Project Dates: 07/01/2013 - 06/30/2018
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Brief Summary and Statement of Need:
Funding will be used to design and engineering of intertie upgrades that will allow the hydroelectric resources of the Alaska Energy Authority (AEA) owned Bradley Lake power plant to operate unconstrained at its optimum capacity. The intertie project will also allow excess power from Kenai gas-fired generation to be supplied to Railbelt communities as far north as Fairbanks without restricting the use of Kenai hydroelectric resources.

Funding:	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	Total
Gen Fund	$13,700,000						$13,700,000
Total:	$13,700,000	$0	$0	$0	$0	$0	$13,700,000

☐ State Match Required ☐ One-Time Project ☑ Phased - new ☐ Phased - underway ☐ On-Going
0% = Minimum State Match % Required ☐ Amendment ☐ Mental Health Bill

Operating & Maintenance Costs:

	Amount	Staff
Project Development:	0	0
Ongoing Operating:	0	0
One-Time Startup:	0	
Totals:	0	0

Prior Funding History / Additional Information:

No prior funding. This is a multi-year project, however, state funding requests for this project will be developed in the future and at this time are indeterminate.

Project Description/Justification:

The Bradley Lake Hydroelectric Project has been constrained in its operation since its completion in 1991. To date, the Bradley Lake participants have successfully mitigated the constraints to the greatest extent possible by cooperative agreements and actions among the utilities. The changing atmosphere of the Cook Inlet gas situation and the evolving landscape of generation in the Railbelt will foreclose the avenues of mitigation that have been historically available to the Railbelt utilities to mitigate the constraints on the Bradley Lake project. As a result of the loss of the mitigation measures and the changing aspects of the generation and gas systems, without improvements to the electrical system between Anchorage and Kenai, the utilities will experience substantial cost increases in both electrical line losses, lost generation capacity and operating costs due to the constraints placed on the Bradley Lake project.

In addition to the near-term constraints identified above, the Anchorage-Kenai constraints severely inhibit the development of both large-scale renewable hydroelectric (hydro) projects in the Railbelt as well as the integration of additional variable resources such as wind energy. The constraints prevent the use of Kenai hydro as part of an overall hydro management or coordination strategy and could significantly increase the cost of hydro development in future projects. The lack of transmission

capacity also limits the amount of Kenai resources that can be used to mitigate the impacts of variable generation such as wind energy and will significantly increase the cost of integrating renewables into the Railbelt system.

The basic problem associated with the constraints of the Bradley Lake project is the lack of an adequate transmission system used to deliver the project's energy from Kachemak Bay to Anchorage and Fairbanks. The only transmission line between the Kenai and Anchorage is a 115 kilovolt (kV) transmission line constructed in 1961 to deliver approximately 16 megawatt (MW) of power from the Cooper Lake hydroelectric project to Anchorage and a similar 115 kV transmission line from Soldotna to the Cooper Lake area. These two lines have a combined length of 146 miles. Although the lines have been well maintained and improved by the utility owners, the lines were not originally designed to carry large amounts of power over long distances. For comparison, the line between Anchorage and Fairbanks is designed to carry slightly less power, but is constructed to a much higher voltage and uses two large conductors per phase instead of the one small conductor per phase used on this line.

The solution to the Bradley Lake constraints is an improved transmission system between Anchorage and Kenai. This can be accomplished by either adding an additional transmission path between the two regions, upgrading the existing transmission line to a larger capacity line or a combination of both.

An Alaska Energy Authority (AEA) commissioned study evaluated all three options. 1.) Adding a new transmission line between the regions greatly increases the reliability and relieves some constraints on Bradley Lake, but by itself does not unconstrain Bradley Lake. 2.) Upgrading the existing transmission system from Bradley Lake to Anchorage was studied, however it was not recommended due to higher costs, construction timing and constraints associated with continuing to operate a transmission system with a single transmission system between the Kenai and Anchorage. 3.) The recommended transmission system is composed of improvements to portions of the existing Anchorage – Kenai transmission system in conjunction with a new transmission line from the Southcentral area's 230 kV transmission system at Beluga Lake and the Kenai's 115 kV transmission system at Bernice Lake.

The individual benefits of each project cannot be easily derived however, the relative importance of the each of the projects in obtaining the identified potential cumulative benefits were utilized in determining the project priorities below. The individual projects are described below and listed in the order of prioritization:

1) Beluga-Bernice Lake HVDC Intertie:

This project includes the construction of a 100 MW high-voltage, direct current (HVDC) intertie between the Beluga power plant in Southcentral Alaska and the Bernice Lake Power Plant on the Kenai Peninsula. The interconnecting power line would consist of two undersea cables, each rated for 100 MW transfer capacity. The cables are approximately 36 miles in length and are estimated to be 300 kcm copper conductors rated at 80 kV DC. The converters are mono-pole HVDC converters with a transfer capacity of 100 MW. The actual voltage and submarine cable ratings will require optimization to provide the most economic selection for the project.

2) 25MW BESS - Anchorage Area

This project includes the installation of a 25 MW / 14 MWh Battery Energy Storage System (BESS) in the Anchorage area. The exact characteristics of the BESS technology should be evaluated in the design and procurement of the BESS.

3) Bradley Lake - Soldotna 115kV Transmission Line

This project includes the construction of a new 68 mile long, 115 kV transmission line from the Bradley Lake Power plant to a new substation near the Homer Electric Association (HEA) existing Soldotna substation. The transmission line includes modifications to the existing switchgear and 0.5 miles of 115 kV solid-dielectric cable at the Bradley Lake Power Plant. The northern end of the line would terminate in a new 115 kV substation connected to the existing HEA substation through the existing AEA static var compensator (SVC) bay. The line would utilize the same construction configuration and conductor size as the existing Bradley Lake – Soldotna transmission line.

4) Flexible Gas Storage - Anchorage Area

This project includes the installation of a 1.91 MCF (262 MWh) gas storage facility at an Anchorage/Matanuska-Susitna area power plant. The gas storage includes storage tanks for compressed natural gas, compressor, compressor building and delivery system. The need for this project should be evaluated as more stringent gas supply and delivery constraints are enacted in Southcentral Alaska.

5) University - Dave's Creek 230 kV Transmission Line Conversion

This project includes the conversion of 77 miles of existing 115 kV transmission line from 115 kV to 230 kV from Chugach's Dave's Creek Substation on the Kenai Peninsula to Chugach's University Substation in Anchorage. The project requires two separate phases, the conversion of the line to 230 kV followed by the conversion of the substations to 230 kV. The line conversion would include rebuilding the line across the avalanche areas along the existing route. This conversion would include the installation of avalanche deflection structures and the installation of more avalanche resistant structures. The line would be placed along the existing line's route.

5) University - Dave's Creek 230 kV Substations and Compensation

This project includes the installation of reactive compensation at Dave's Creek Substation and the conversion of substations at Dave's Creek, Hope, Summit Lake, Portage, Girdwood and Indian stations to 230 kV. The project also includes the completion of the 230 kV bus at Chugach's University substation. The project also includes the installation of sectionalizing switches at each of the stations to allow remote sectionalizing of the transmission line.

Summary

A summary of the costs and benefits of the proposed projects to unconstrain the Bradley Lake hydroelectric project are presented below. While the costs are estimated to be accurate budgetary figures, the benefits do not include benefits associated with unserved energy costs or hydro-hydro benefits to future projects and as such may underestimate the value of the projects to the Railbelt consumers and the state of Alaska.

Unconstrain Bradley Lake Projects			
Priority	**Project**	**Cost**	**Benefit**
1	Bernice Lake-Beluga HVDC	$165-$206M	
2	25 MW/14 MWh BESS	$30.2M	
3	Bradley Lake-Soldotna 115 kV Line	$67.5M	
3	262 MWh Flexible Gas Storage	$18.2M	
4	University-Dave's Creek 230 kV	$56.9M	
5	University-Dave's Substations	$32.2M	
	Energy Losses		$62.2M
	Excess Energy		$23.1M
	Hydro-thermal		$20.1M
	Reservoir Management		$7.9M
	Spinning Reserve		$109.6M

	Reduced Construction Cost		$19.0 M
	Reduced BESS		$65M
	Flexible Gas Storage Reduction		$59M
	Hydro-Hydro Coordination*		
	Unserved Energy**		
	Totals	$370-$411M	

*The benefits of hydro-hydro coordination are very large in terms of saving for the development of future large hydro projects. The ability to provide hydro regulation from the Kenai hydro resources have a tremendous benefit in the design and construction constraints of the future large hydro projects. The exact benefit is unknown, but is estimated that is could exceed the combined total of all other benefits

**Unserved energy is the value of energy that is unserved by the electrical system due to outages or the inability to serve the load of the electrical system. Unserved energy is generally expressed as a $/MWh value that is determined for the total expected MW hrs that can be avoided following the improvement to the transmission system. The value of unserved energy is a recognized basis for evaluating transmission improvements in the U.S. There are very few transmission projects completed in the U.S. within the past ten years or currently underway that are reported as justified by economic benefit associated with true commerce. The majority of projects undertaken in the US are justified as reliability based projects, with the benefit of unserved energy and other intangibles being used as the primary justification for the improvement.

Project Cash Flow Requirements ($ millions)

Fiscal Year	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Bernice Lake-Beluga HVDC	7.0	64.5	64.0	50.0		185.5
Bradley Lake-Soldotna 115 kV Line	1.1	1.4	32.0	33.0		67.5
University-Daves Creek 230kV	1.1	14.9	17.0	14.0	9.9	56.9
University-Daves Substations	1.0	23.6	7.6			32.2
25 MW/14 MWh BESS	2.5	9.1	18.6			30.2
262 MWh Flexible Gas Storage	1.0	17.2				18.2
Unconstrain Bradley Lake Totals:	**13.7**	130.7	139.2	97.0	9.9	390.5