901 Karluk - Wind Energy System

Proposer: Karluk Tribal Council

Benefit/Cost Ratio: Applicant: **0.48** AEA: **0.43** AEA (Benchmark): **0.86**

Project Description:
Karluk Tribal Council is proposing to perform a feasibility study and complete the design and permitting for a wind energy system and heat recovery system. Data from a meteorological tower already installed at the proposed wind turbine location will be available for the analysis and design. The wind energy system would consist of wind turbines installed on a mountain 0.7 miles from the existing power plant, the transmission line to connect the power plant, and an electric boiler for excess energy utilization. The heat recovery system would consist of upgrading the existing power plant generators with waste heat recovery units and installing a total length of up to 1,000-ft hydronic heating loop to connect the power plant with the community buildings.

The Applicant is proposing a 44-kW wind capacity system (4 11-kW Gaia wind turbines) to be incorporated into the community's existing power plant that utilizes 2 diesel generators with a generation capacity of 110 kW. The feasibility and conceptual design would determine the optimal type of wind turbine for the community. The conceptual design, when completed, would specify how power from the wind turbines would be integrated and delivered into the existing power generation facility.

As noted above, the Applicant is proposing to include a waste heat recovery system that would require upgrading the existing power plant generators and installing a heat distribution system from the power plant to the community facilities. For the purpose of this economic analysis, only the wind facility (with secondary load system) is evaluated. As per AEA guidance, the upgrades to the diesel generators that are necessary for an effective waste heat recovery system are not eligible for renewable energy grant funding.

Funding
The Applicant is requesting $81,000 for feasibility, conceptual design, final design, and permitting of a wind facility in Karluk. An additional project match of $300 will be provided by Karluk Tribal Council. The Applicant estimates $21,300 will be needed for the feasibility study, $60,000 for design and permitting. Construction and commissioning is estimated to cost $1.3 million.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The Applicant anticipates that the proposed wind project would displace over 11,000 gallons of diesel fuel used for electric generation and an additional 7,000 gallons of fuel used for heating.

AEA analysis however indicates a lower total fuel displacement of about 10,000 gallons per year (heat and power), based on a 50-kW system with a Class 6 wind resource and a net capacity factor of 29 percent).

The proposed wind facility could potentially displace 26 percent of the community's current fuel consumption.

Assumptions Modified:

System Capacity

The Applicant proposed a 44-kW system-- four 11-kW Gaia wind turbines; this was used in the 'APP' tab. The AEA analysis assumed a 50-kW system. According to the AEA wind project manager, if the site chosen is at least a Class 5, up to 50-kW of wind turbine capacity could be installed.

Annual Wind Generation

The APP tab assumes a Class 5-7 wind regime and net capacity factor of 50 percent, which results in expected gross annual wind generation of 234,000 kWh. The Applicant also presented information regarding their estimated annual net electricity produced from wind of 134,000 kWh, with excess annual wind energy of 84,880 kWh that can be used for thermal loads if a secondary load system is installed.

The AEA tab assumes a Class 6 wind regime and net capacity factor of 29 percent, which results in expected gross annual wind generation of 124,830 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 90,130 kWh, with excess annual wind energy of 34,700 kWh that can be used for thermal loads if a secondary load system is installed.

Fuel Efficiency

The Applicant stated that their existing diesel generators have a combined fuel efficiency of 12 kWh per gallon. The AEA analysis used the minimum fuel efficiency of 13 kWh per gallon, as per AEA guidelines.

Capital Cost

The Applicant tab and one of the AEA tabs used the same estimated capital cost of $1.3 million.

The Applicant did not provide a breakdown of the $1.3 million estimated capital cost for the project. This amount may include the cost of the waste heat recovery system that is part of the Applicant's project concept. Additional analysis as shown in the AEA (Benchmark) tab considers a lower capital cost using the AEA benchmark for capital costs in rural applications ($10,200 per installed kW), plus an additional $100,000 for secondary load components to utilize excess wind for thermal loads. This analysis also resulted in a B/C ratio less than 1, but higher than the analysis that assumed the same capital cost as the Applicant (0.86 versus 0.43).

Annual O&M Cost

The Applicant's estimated annual O&M cost for the proposed system is $20,000. This amount may include operations and maintenance for the waste heat recovery system. The Applicant also suggested that additional staff training will be required to operate and maintain the proposed system.

The AEA analysis assumed the AEA benchmark variable rate of $0.0469 per kWh, or annual O&M cost for the wind components only of about $6,000.

Concerns:
The AEA wind project manager is concerned about the operability of the 11-kW Gaia wind turbine in the location being considered (extreme wind conditions could destroy the turbine). Analysis of location specific wind data is critical in determining the most effective wind turbine for the location being considered.

AEA also notes that the Applicant is proposing a high penetration system which includes a battery-based system that has not yet been proven in other similar applications in the State.

Possible Enhancements:
The capital cost needs to be further explained in order to properly evaluate the costs and benefits of the wind-diesel system and the costs and benefits of a waste heat recovery system.

Long-term Sustainability:
The Applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through Applicant's operating revenues. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:
Lessons learned about renewable energy sources in Karluk will contribute to a better understanding of wind resources in rural locations around the state.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 902 Jack River Hydroelectric Feasibility Study

Proposer: Native Village of Cantwell

Benefit/Cost Ratio: Applicant: **2.43** AEA: **2.43**

Project Description
The applicant is requesting funds for a feasibility study to assess the hydrology, geotechnical data, and infrastructure requirements for various potential configurations of a hydroelectric facility at the Jack River.

Contribution to Lower the Cost of Energy
Electricity supply to the Village of Cantwell, Carlo Creek, and McKInley Village is provided by GVEA via the MEA/GVEA intertie. In the proper configuration, the project will be able to supply power into the GVEA system, displacing diesel fired generation and providing a currently nonexistent local power backup system when the link to GVEA goes down. At the highest potential output levels, 50,000 MWH annually, the project could displace over 3 million gallons of diesel fuel used for generation, saving nearly $10 Million per year in fuel costs. The feasibility study will determine if the project is more likely to generate in the neighborhood of 10,000 MWH per year or 50,000 MWH per year.

Assumptions Modified

None. The project is at such a preliminary stage of investigation, and each assumption is subject to such wide uncertainty (e.g. The cost estimate ranges from $10 Million to $250 Million based on configuration, what the technical investigation reveals, etc.) that the best we can do is look at sensitivities for various assumptions. This is reflected in the notes to the b/c analysis.

Concerns

For this stage of the project, anticipated issues seem to have been well thought out, including a review of impacts to the transmission and distribution system that might be required. If GVEA continues to generate using diesel over the next 50 years, our analysis is valid. However, if a lower cost per MMBtu alternative is put into place, this could significantly change the direct economic benefits of fuel displacement used in our analysis. Given the 2 to 5 year permitting process should the feasibility study come back with a recommendation to proceed, it is likely this project would come on line somewhere in the 2018/2019 time period, coincident with current estimates for a gas line from the North Slope.

Diversification of energy supply, and a local source of power when the transmission line goes down, have their own thus-far unquantified benefits in terms of personal safety and economic development.

Possible Enhancements

During the feasibility study, it would be useful to include in the economic analysis a high level review of potential generation alternatives that GVEA may have in 2020 and beyond. Also, if it is possible to quantify the impact on the community of transmission line outages that would be useful.

Long-term Sustainability

Various hydro projects in Alaska have succeeded in economically producing power for decades. If constructed, this project would be an asset to the railbelt grid for the foreseeable future.

Potential Public Benefits

The project will provide a local source of generation for the Native Village of Cantwell, Carlo Creek, and McKinley Village. It will also provide a source of local employment. Denali National Park has indicated a desire to purchase renewable energy as a national policy directive. This project would contribute to the state's policy of moving towards renewable energy over the next 15 years. The project seems to have broad community support.

No. 903 Kotzebue Photovoltaic Solar Project

Proposer: Northwest Arctic Borough

Benefit/Cost Ratio: Applicant, as shown on paper application: .068
Applicant as calculated by economist on applicant worksheet in model: .86
AEA worksheet: .83

Project Description
Northwest Arctic Borough (NWAB) is requesting funds for project construction and commissioning of a 10kW array of photovoltaic (PV) modules in Kotzebue, Alaska. The array would serve the 11 communities of Kotzebue, Ambler, Shungnak, Kobuk, Kiana, Selawik, Noorvik, Buckland, Kivalina, Noatak, and Deering, in the Northwest Arctic Borough, Alaska. Applicant does not report any information regarding its current electrical system beyond that it uses both diesel and wind sources.

Contribution to Lowering the Cost of Energy
The PV project will offset diesel generated electric power for the communities. The proposed PV system would offset 704 gallons of diesel fuel, producing between 9,504-9,514Kwh per year, saving approximately $2,988 per year.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- Economist used Applicant O&M rate for the AEA analysis

Concerns

- **Intended PV manufacturer.** No model or make is provided for the PV array.
- **Warranty.** No warranty information is supplied for array.
- **Unclear integration.** Applicant does not provide information regarding existing electrical system that PV array will integrate with.
- **Land.** Like the uncertainty around the existing system integration, the land and site control of the project is uncertain.
- **Shungnak PV application.** AEF Rd. VI #946 application for Shungnak community is also in review by the AEA for AEF Rd. VI

Possible Enhancements / Recommendations

- **Warranty Information of system should be included**
- **Make and model of proposed system should be included**
- **Past feasibility studies for solar potential**
- **Integration of the existing electrical system and proposed PV system**
- **Address the two concurrent PV project requests in the Borough (946&903)**

Potential Public Benefits

- **Reduced annual electrical costs**
- **Stabilizes electric costs**
- **Cleaner Air**

No. 904	Dimond Park Library Geothermal HVAC System

Type: "Geothermal" (Ground-Source Heat Pump)

Proposer: City & Borough of Juneau

Benefit/Cost Ratio: Applicant: **0.60** AEA: **0.78,** AEA Small Heat Pump: **1.68**

Project Description
This project will design and construct a ground-source heat pump HVAC system for the future Dimond Park Library located in Juneau's Mendenhall Valley.

Contribution to Lowering the Cost of Energy
The heat pump HVAC system is an alternative to utilizing oil boilers for providing heat and electric chillers for providing cooling. The heat pump system substitutes efficient electric heat (COP = 3.2, i.e. 320% efficient) for the building's heating and more efficient electric cooling for the building's cooling needs. Because of the high COP of the heat pump and the relationship between electricity and oil prices in Juneau, the electricity cost per delivered heating Btu with the heat pump system is about 4.5 times less expensive than the cost of delivering heat with oil.

Assumptions Modified
Certain benefits quantified in the applicant's proposal were not included in both the Applicant and AEA model scenarios due to the need to remain consistent with AEA methodology. The applicant estimated $27,000 per year of health benefits due to air quality improvements; these were not included in either the Applicant or AEA model scenarios.

In the direct benefit life-cycle cost analysis performed by the applicant, a 5% per year real oil price escalation was assumed. This assumption was not used in favor of the standard AEA fuel price forecast.

There were two main differences between the applicant's assumptions and the AEA assumptions leading to the difference in benefit/cost ratios shown above. The Applicant model uses a 20 year study period, as did the life-cycle cost analysis provided by the applicant. Also, large salvage values were incorporated in the applicant's life-cycle cost analysis, values equaling the initial cost of the system. Those large salvage values were included in the Applicant model. The Applicant model calculated a **0.60 benefit/cost ratio.**

In contrast, the AEA model uses a 50-year life for the system, since the Library will most likely be used for at least that long, and the expensive loop field for the ground-source heat pump is expected to have a 50+ year life, according to the US Department of Energy. In the AEA model, the cost of replacing the indoor HVAC equipment is assumed to occur at the 25-year mark. Because of the 50-year study period, no salvage value is included in the model. The AEA model calculates a **0.78 benefit/cost ratio**.

Concerns
There is uncertainty in the cost of drilling and installing a loop field that has suitable performance for this building. Experience from the nearby Dimond Park Aquatic Center

heat pump was used to design this system, instead of incurring expensive loop field testing costs. The ground characteristics may differ at the library site.

The estimated efficiency of the heat pump, COP = 3.2, has uncertainty, but the overall economics of the system are much more sensitive to the capital cost than the electric cost of operating the system.

The funds requested for this project, $700,000, are less than the total cost of the heat pump project ($875,000); however, the requested funds exceed the incremental cost of the heat pump relative to the conventional HVAC system ($555,000)

Potential Enhancements

The economics of this heat pump system are severely hampered by the low utilization rate of the heat pump capacity. The annual average heating requirements of this building are about 62,000 Btu/hour, as determined from the estimate of 5,000 gallons per year of oil heat requirement. The heat pump system for this building has been designed to produce 515,000 Btu/hour of output, over 8 times the average requirement of the building. Because of this very large heat pump size, **the utilization of the heat pump's capacity averages out to 12% on an annual basis.** Because ground-source heat pump capacity is expensive to install, it is very difficult for it to be cost-effective with a 12% utilization rate.

It appears as though this heat pump was sized to supply the building's peak heating load including a sizeable safety margin. The peak heating load of a building like this in a Juneau climate should be about 5 times the average heating load; this system is sized at 8 times the average load. A potentially more cost-effective design would be to size the heat pump for 1.5 to 2 times the average heating load and then to meet loads above that level with oil boilers. A heat pump sized to meet twice the average heating load will typically supply over 80% of the annual heating needs of the building, leaving less than 20% to be served by oil. So, less than 20% of the benefits of the heat pump are lost, but the heat pump loop field is 4 times smaller and substantially less expensive than the one currently designed for the library, which is expected to cost $550,000. Oil boiler capital cost will need to be added, but the net capital cost reduction of the design is large. A sensitivity case was run modeling these design changes and the **resulting benefit/cost ratio was 1.68.** The incremental capital cost of this design beyond the 100% oil design is estimated to be $179,000.

Also, the electric load factor presented to the electric utility by the building will be much improved because a large portion of peak heating loads will be supplied by the oil boilers instead of through the use of electricity. One possible concern with this design is more intensive use (40% annual average utilization) of the smaller loop field; some reduction in ground temperatures and performance could occur over time.

Long-Term Sustainability

This project substitutes electricity for oil through use of an efficient heat pump. Because the bulk of Juneau's current and future electricity generation is supplied from hydroelectric plants, this substitution avoids a price-volatile non-renewable resource by substituting a price-stable renewable resource. The heat pump system, with required mechanical system replacements, should be able to serve the heating and cooling needs of the building for its 50+ year life.

Potential Public Benefits

The capital and O&M costs of the heat pump system exceed the like costs of the conventional oil system, thus creating construction and O&M jobs. The fuel used by the heat pump system, electricity, will add to future jobs related to construction of hydroelectric plants. The heat pump system reduces the combustion of oil, providing air quality and health benefits in the Mendenhall Valley. This project will add to the information base concerning Alaskan operation of ground-source heat pump systems.

No. 905	Hydropower Surplus to Stored Hydrogen Feasibility Study

Type: Other

Proposer: The Southeast Alaska Power Agency

Benefit/Cost Ratio: **Applicant**: **NA** **AEA**: Mid**: 0.08,** Favorable**: 0.15**

Project Description

This project will perform a feasibility study of using hydrogen (or ammonia) to store the normally wasted energy that occurs when water is spilled from the SEAPA hydroelectric production facilities. Spill typically occurs during late summer and fall when the inflows to the dams exceed the outflows needed to meet electric demands. Instead of spilling this water, hydroelectric production would be increased to create hydrogen. That hydrogen would be stored until winter periods when diesel generation is normally needed to meet electric loads. At that point, the hydrogen would be used in fuel cells to create electricity, thereby avoiding the use of expensive diesel generation.

Contribution to Lowering the Cost of Energy

A storage facility contemplated by this project would reduce the operating cost of producing electricity in the region served because essentially free energy (normally-spilled water) would be used to offset expensive diesel-generated electricity. However, this review's economic analysis indicates that the capital costs required for the project will far exceed the life-cycle savings from avoided diesel generation.

Assumptions Modified

The only economic data present in the application regarding the technology concept is on page 6 indicating that the ultimate project will save $1,020,000 per 5,000 MWh. 5,000 MWh is the applicant's conservative estimate of the annual availability of hydroelectric spill. No backup was provided for the $1,020,000 figure. This review's analysis shows avoided diesel electricity costs ranging from $601,000 to $704,000 in the first year, based on AEA suggested diesel generator efficiency, O&M, and fuel cost data. Also, the review analysis models the hydrogen roundtrip storage efficiency at a value between 35% and 41% depending on the scenario (these are National Renewable Energy Laboratory (NREL) mid case and best case assumptions for an electrolyzer/hydrogen storage/fuel cell plant). Thus, 5,000 MWh of spill energy can only avoid between 1,750 and 2,050 MWh of diesel-generated electricity.

Because of the lack of economic data in the application, an "Applicant" benefit/cost scenario was not completed.

Concerns

The cost and storage efficiency data used for the review analysis comes from a 2009 NREL study on hydrogen storage. The calculated benefit/cost ratio of the proposed storage system is poor. The fundamental economic problem is that storage of electricity is expensive, and this project concept only utilizes the storage for *one* charge and discharge cycle per year on average. A kWh of electricity is stored during the summer/fall spill period and that kWh is used later during the winter. Therefore, one kWh of hydro-to-hydrogen storage only offsets one kWh of diesel electricity each year. To

demonstrate the economics, the "Favorable" economic scenario uses hydrogen storage system capital costs of $58 per kWh of storage output (from the NREL study, expressed in 2011 $). Amortizing that cost over a 40 year life results in an annual cost $2.51 per year per output kWh stored. Since the storage is utilized only once per year, the storage cost alone amounts to $2.51 per kWh delivered from the system, far in excess of the cost of diesel generated electricity. This does not include the costs of the electrolyzer and the fuel cell, which are included in the more detailed benefit/cost analysis.[1]

Because the hydrogen storage cost is the critical element in the economic analysis, a break-even cost for that parameter was calculated. Economic break-even results when the storage cost (including compressors and storage-related balance-of-plant) is lowered to $6.13 per kWh of system output. In the more conventional method of expressing storage costs, the break-even is $3.38 per kWh of hydrogen energy stored. (The difference between these two values is due to the efficiency of the Fuel Cell.)

As another possible Concern, the public perceives safety issues with storing hydrogen, although most of those concerns appear to be addressed by good storage design.

Potential Enhancements

Although not suggested by the applicant, if storage is possible in geologic formations, storage costs are generally much less expensive than storage in above-ground steel tanks, and the economic analysis would be improved.

If the waste heat generated by the electrolysis process and the fuel cell generation process could be used to offset heating oil, further benefit could be realized from the project. The roundtrip storage efficiency is only 35-41%, so substantial waste heat is available.

The electrolyzer that produces the hydrogen could also be used during non-spill periods to produce hydrogen for other uses, such as vehicles.

Long-Term Sustainability

The hydroelectric resource is long-lived and the applicant expects spill to regularly occur. Hydrogen storage systems have long lives.

Potential Public Benefits

As with all capital projects, construction jobs will be created. Some operation and maintenance is expected for the fuel cell and electrolyzer, amounting to about $50,000 per year. Some of that will be labor and therefore job-creating. The information acquired concerning storage technologies will be useful for other renewable electricity generation projects in the state. Other renewable projects such as wind and solar can more cost-effectively utilize storage because they have many more charge/discharge cycles per year than the spilled hydro concept.

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[1] As a point of reference, utility-scale battery storage has capital costs of over $200 per kWh stored, larger than the values used in both of the hydrogen storage scenarios.

Additional Reviewer Comments

If there is interest in funding this project, I would suggest awarding a much smaller than requested amount of money to have the applicant document a more economically viable scenario than the ones analyzed here.

There may be economic uses of the spilled power that do not involve storage and could save as much or more oil than hydrogen storage systems. The spilled power could be directly used for space heating, domestic water heating, or swimming pool heating in situations where oil is normally used. 1 MWh of electric heat saves 32 gallons of oil that would have been burned in an 80% efficient oil heating appliance. 1 MWh of electricity stored in a system with a roundtrip efficiency of 35% and used to offset diesel generation only saves 27 gallons of oil.

No. 906	Coffman Cove Distribution Line Extension

Proposer: City of Coffman Cove

Benefit/Cost Ratio: Applicant: **34.74** AEA: **3.52**

Project Description
The applicant is requesting funds to construct a line extension of the Coffman Cove distribution system to 91 residential lots, 13 of which are occupied by private residences, 15 of which have building pad improvements, and 63 of which are vacant.

Contribution to Lower the Cost of Energy
Alaska Power Company is the certificated electric utility for Coffman Cove. This project is requested by the City of Coffman Cove to extend APC's distribution system to 91 residential lots where grid power is currently unavailable. Of the 91 lots, 8 have full time residences, 5 have seasonal residences (occupied 4 months/yr.), 15 have building pads, and 63 are vacant and undeveloped. The lots were apparently purchased by individuals during a land disposal from the University of Alaska Land Trust. Lots in Coffman Cove are currently being offered through the University for $24,000 to $50,000. The applicant states that the owners of these 91 lots are impoverished and find energy costs to consume an inordinately large portion of their income which the applicant estimates at $22,045 per year.

Of the lots that are occupied, power is provided with portable electric generators. By connecting to the Prince of Wales Island electric grid, these lots can take advantage of hydro facilities serving the island, essentially eliminating all fuel costs. The applicant estimates that homeowners, while on premises, spend $39/day in generator fuel costs, or $1,170/month, or $14,000 per year for full time residents and $4,680 per year for seasonal residents. With 8 full time and 5 seasonal residents, this amounts to a fuel savings of $136,000 per year.

The applicant states that comparable service from APC would cost $112/month, saving $123,000 per year in energy costs for current residents, and $1,000,000 per year if all 91 lots signed up for power.

For the City's contribution to the project, APC has, according to the applicant, agreed to a $4,000 credit for the first 9 customers to hook up. The applicant states that this $36,000 contribution to construction costs is the utility's normal "hookup fee". APC's tariff for Coffman Cove states its "Connection fee for new service" is $48. For line extensions, APC's tariff states that the tariff rates charged to customers include recovery of $3,000 in line extension costs – in other words, if 60 of the 91 lot owners signed up for power, the utility would cover all of the $175,000 cost of the extension of distribution facilities.

Assumptions Modified
1. The applicant states that the average fuel cost per KWH from portable generators is $2.35/KWH based on $4.50/gal. fuel, or an implied fuel efficiency of about 2.0KWH/gal. According to advertising literature, the Honda u2000i generator will, on average, run for 9.6 hours on a gallon of fuel. At 50% loading (the same assumption used by the applicant), this would equate to a fuel efficiency of 9.6 Kwh/gal. which is what was used in the b/c analysis.

2. For the construction cost of the project I did not include the $36,000 "hookup fee" contribution. Section 2.6 of the application states that the total cost of the project is $175,000.
3. In estimating savings the applicant assumed displaced diesel generation would occur for all 91 lots. I estimated fuel displacement based only on the 13 lots that have structures on them and currently utilize power. Fuel that is not being used cannot be displaced.

Concerns

Given the compelling economics, it is unclear why APC's tariff line extension policy has not already resulted in placing the distribution facilities. The City of Coffman Cove, in its application, apparently believes it is the City's responsibility to build electric infrastructure serving the community, ownership of which is then turned over to the Alaska Power Company.

Most of the parcels that would be served by the distribution line are apparently recreational or second-home parcels. It is unclear why owners of the parcels have not signed up with the local utility, APC, for power. A policy of using state grant money to build electric distribution facilities to recreational properties throughout the state could quickly absorb much of the funds intended to reduce the cost of energy to Alaskans.

Possible Enhancements

None.

Long-term Sustainability

Once placed, the distribution facilities will increase property values and add to the enjoyment of the neighborhoods served.

Potential Public Benefits

Increased property values, less noise pollution, fewer emissions, more home building, increased economic activity for Coffman Cove.

No. 907	Petersburg Community Heating System Retrofit Feasibility Study

Type: Other

Proposer: City of Petersburg

Benefit/Cost Ratio: Applicant: **NA** AEA: **Ground-Source Heat Pump: 1.59**
Air-Source Heat Pump: 2.39
Cordwood Boiler: 4.17

Project Description
This project proposes to evaluate the technical and financial feasibility of integrating renewable energy based heating technologies to offset oil and electricity use in six different Petersburg facilities. The facilities include schools, an aquatic center, senior housing, and a municipal building. Technologies that will be included in the study at a minimum are electric boilers, ground-source heat pumps, air-source heat pumps, and wood boilers.

Contribution to Lowering the Cost of Energy
The City of Petersburg currently spends $350,000 per year to heat these facilities. The fuel and operating costs of the technologies being investigated are lower than oil costs per delivered Btu. Thus, ongoing heating costs will be reduced by use of the technologies. The study will determine whether these savings can justify the capital costs required to implement the renewable technologies.

Assumptions Modified
One of the primary purposes of this application is to evaluate the economic feasibility of possible renewable heating technologies. It is somewhat difficult to do an economic analysis of an application that proposes itself to perform an economic analysis.

The approach this reviewer took was to do a very general analysis of these technologies to determine if there was some reasonable probability of cost-effectiveness. Three of the proposed technologies were analyzed: ground-source heat pumps, air-source heat pumps, and cordwood boilers. Each technology was assumed to be installed in a building having the average oil use of the four school facilities included in this study, 21,124 gallons per year. No building specifics such as space constraints or unfavorable HVAC arrangements were considered in this simple analysis.

A favorable assumption was made concerning the sizing of these renewable heat systems. Instead of attempting to meet the peak heating load of the facility, each renewable technology was sized at 1.5 times the annual average heating load of the facility. This sizing approach requires that some oil heating capacity remain to meet peak loads, but over 80% of the annual oil use of the facility should be avoided by a heating system with this level of output. With this sizing strategy, the annual average utilization (capacity factor) of the renewable heating systems is 53%, improving the economics of these capital-intensive systems.

The calculated benefit/cost ratios ranged from 1.6 to 4.2, clearly indicating there is the possibility that the applicant's study will reveal cost-effective approaches to reducing oil heat use in these facilities. The net present value benefit ranged from $340,000 to

$540,000 for this *one* facility (which has approximately 1/5 of the total heating load addressed by the study), indicating that the applicant's $51,000 study cost will easily be recovered if any of these alternatives are implemented with economics similar to those modeled here.

The estimates in this review are very approximate and will certainly be improved upon by the applicant's analysis.

Concerns

This cursory analysis necessarily contains substantial uncertainty in the cost estimates and technical feasibility of the technologies examined. The fuel price forecasts used are uncertain as well. For the heat pump analyses, no real inflation was assumed in the price of electricity.

Potential Enhancements

The more detailed investigation by the applicant may reveal better technologies or better implementation strategies than addressed in this review. Oil prices may escalate faster than the default AEA assumption.

Long-Term Sustainability

The renewable technologies addressed by the application have long lives and with suitable maintenance and replacements, should last the remaining life of these facilities. The heat pump and electric heat technologies are served primarily through hydropower, a renewable resource. The biomass technologies rely on renewable biomass fuels that can be sustainably harvested.

Potential Public Benefits

Construction of these systems will create temporary jobs. Operation and maintenance costs will add to ongoing labor requirements. In particular, the biomass options require substantial labor for harvesting biomass and for operating the biomass heating systems. The electric-based technologies will improve air quality from the reduction in oil combustion.

No. 908	Iliamna Newhalen Tazimina Hydro Expansion

Proposer: INN Electric Cooperative

Benefit/Cost Ratio: Applicant: **13.07** AEA: **10.97**

Project Description
The applicant is requesting funds for a feasibility study of replacing hydro generating units with larger units. The study will consider increasing capacity from the current 824 KW capacity to 1,500 KW, allowing for an increase in diesel generation displacement and stove oil for heating in the community.

Contribution to Lower the Cost of Energy
Currently the INN system uses over 6,000 gallons of diesel annually to generate power. In addition, much of the community relies on stove oil for heat. If all of the incremental hydro energy from increasing generating capacity can be sold, 160,000 gallons of fuel oil could be displaced in the community.

Both the potential energy supply and amount of community energy demand are uncertain; the feasibility study will determine the likelihood of whether or not it is economic to proceed.

Assumptions Modified
None. On the Applicant analysis I used KWH displaced. On the AEA analysis I used gallons of fuel displaced. It is unclear which will be the likeliest substitution since both diesel electric generation and stove fuel oil might be displaced. The feasibility study will determine this.

Concerns
Since the hydro facility currently exists, and the project would replace existing generators, the largest concern is whether or not demand in the area served by the electric distribution system can absorb increased output. The study will address this.

Possible Enhancements
It is likely that the project economics can be enhanced by estimating a salvage value for the two 412 KW generators that would be replaced if the project goes forward. HDR may have some idea as to their market value and cost of delivering them to a potential purchaser.

Long-term Sustainability
Increased hydroelectric capacity in the area may add to the economic sustainability of the area and allow for expansion.

Potential Public Benefits
Less fossil fuel use, more dollars remaining in the community, additions to long term sustainability and power supply.

No. 909	Mahoney Lake Hydroelectric Project Phase III

Proposer: City of Saxman and Alaska Power and Telephone

Benefit/Cost Ratio: Applicant: **8.67** AEA Full Power Sales: **8.67**
AEA Sales to Cruise Ships: **3.08**
AEA no Speculative Sales: **0.0**

Project Description
The applicant is requesting funds to resurrect final design work, permitting, and market assessment for the Mahohey Lake 9.6 MW hydroelectric facility. Initially licensed by FERC in 2001, the license was stayed until the Swan-Tyee intertie was complete. At present, the stay remains in effect. A $1,000,000 grant is requested to update the engineering and design, file for permits, and assess the market to determine if the energy output can be sold economically.

Contribution to Lower the Cost of Energy
Increases in population, an expanding industrial base, and conversions to electric heat are causing demand for electricity in Southeast to outstrip supply according to the applicant. Additional hydro power can displace the need for liquid fuels to generate power and heat buildings. If the entire 42 GWH annual production can be sold into markets displacing fuel oil, this will reduce fuel consumption by over 3 million gallons of fuel per year. The applicant states the project can be expected to sell power for 7.3 cents/KWH (versus diesel costs of 22 cents/KWH) if the state pays for 50% of the $47 Million construction cost as a grant. If so, this would result in a b/c of 8.67.

Sensitivity analysis shows that if only sales to cruise ships (120 days per year of sales @ 7 MW, 15 hours a day) occur in the initial year of operation, 2019, and sales grow at 2% thereafter until 2045, the b/c drops to 3.08. If no market develops, the b/c drops to zero and it is likely this project will not move forward at this time after the $1.1 Million for this phase is spent.

Assumptions Modified
Two alternate scenarios were considered with respect to sales of energy from the project:

1. No sales occur. Under this scenario, the phase of the project currently requesting funding would determine no market exists for the output and the project will be mothballed after the $1.1 Million outlay for the design and economic analysis.
2. Sales occur to cruise ships only for 120 days a year with a load of 7 MW 15 hours a day. See above results.

Concerns
The market for the power produced by this project is uncertain. The applicant states that Ketchikan Public Utilities, a major utility in the area, has not supported the development of the project. Because hydro projects are extremely capital intensive, financing arrangements require the last-built hydro project to be the last dispatched in supplying power to the grid. Consequently, power sales from other existing hydro projects will need to meet their capacity before power from Mahoney Lake can be sold.

If grant funding is not approved and/or the market cannot absorb the total output from the project, the economics quickly erode. If utilities enter into take-or-pay contracts for

power from the project, and load growth fails to materialize due to lack of economic expansion, energy efficiency programs, etc., significant increases in community costs of power could occur.

Since this project has been dormant for an extended period of time, cost estimates may be significantly different than shown in the application. Improvements in construction technologies and changes in commodity costs may act to substantially increase or decrease costs.

Apparently the FERC license remains stayed even though the Swan-Tyee intertie has become operational. If the license has performance metrics tied to time, the project may face license expiration.

Possible Enhancements

The applicant may want to perform its business case analysis and gauge interest in purchasing power from the project prior to moving forward with design and permitting work. In addition, an estimate of the energy rate that would be charged if the state does not contribute 50% of the construction cost should be developed. If the power has no market, it makes little sense to spend resources on the physical project. The applicant may also want to act to remove the stay of the FERC license sooner rather than later.

Long-term Sustainability

Hydroelectric power in Alaska has shown itself to be long-lived, sustainable, and advantageous as costs of fuel-based generation have increased.

Potential Public Benefits

Increased availability of renewable energy, construction jobs during construction, long term employment once the facility becomes operational, displacement of over 3 million gallons of liquid fuels per year, lower energy costs for the community, available electric capacity for economic expansion.

910 Igiugig - Wind Turbine Design

Proposer: Lake and Peninsula Borough

Benefit/Cost Ratio: Applicant: **1.21** AEA: **0.52**

Project Description:
Lake and Peninsula Borough (LPB) is requesting funding for design and permitting for a wind energy project in the community of Igiugig. Applicant states that the funds will be used to design an approximate 100-kW wind system. The design will include its integration into the new generation system recently installed to maximize output and efficiency.

Funding
LPB requests $205,000 in renewable energy grant funding. They will match the grant with a cash contribution of $45,000 (18 percent).

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility.

Igiugig has several small business and other entities that are not eligible for PCE and the installation of a wind turbine lessen the burden of high electricity bills and will displace thousands of gallons per year. The displaced diesel also allows the community to stretch its fuel supply longer and hot have to fly in even costlier fuel at the end of winter.

Assumptions Modified:

Annual Wind Generation
The Applicant indicated that their expected annual wind generation is 180,000 kWh assuming a Class 2 (5.8 m/s); this was used in the applicant's tab.

The AEA tab assumes a Class 2 wind regime and net capacity factor of 15.4 percent, which results in expected annual gross wind generation of 131,400 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 105,120 kWh, with excess annual wind energy of 26,280 kWh that can be used for thermal loads if a secondary load system is installed.

Capital Cost
The Applicant estimated the project cost to amount to $1.25 million. Note that in the B/C analysis, the cost of the final design and permitting ($250,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

The applicant does not suggest a secondary load system (to capture excess heat) in the application, but such a system is mentioned in the attached wind resource study. However, no costs or benefits associated with heat recovery were indicated, and therefore, omitted from the 'APP' tab.

In the AEA analysis, besides a 100-kW wind turbine, a thermal load component and a short transmission line are included in the estimated capital cost.

Operation and Maintenance

The Applicant indicated that the annual O&M cost for the wind component is $10,000, or $0.056 per kW, and was used in the 'APP' tab. O&M costs for the 'AEA' tab used the benchmark rate of $0.0469 per kW.

Fuel Efficiency

The applicant stated a fuel efficiency of 12.1 kWh per gallon for their existing diesel generators. The AEA analysis assumed the minimum efficiency of 13 kWh per gallon as per AEA guidelines.

Concerns:

Applicant mentions that a full economic analysis will be available upon the completion of the wind study. It is indicated that LPB will submit this report as it becomes available. Applicant also states that the previously funded wind study has 11 months of wind data collected and are awaiting the final month before the wind study can be complete.

Complete wind resource and feasibility studies would be useful to determine optimal wind system configuration.

A class 2 wind resource may not be enough to provide sufficient project economics.

Possible Enhancements:

Applicant should provide finished wind resource and feasibility studies.

Long-term Sustainability:

The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded by Igiugig Power Utility. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:

Lessons learned about renewable energy sources in Igiugig will contribute to a better understanding of wind resources in rural locations around the state.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

911 Levelock - Wind Reconnaissance Study

Proposer: Lake and Peninsula Borough

Benefit/Cost Ratio: Applicant: **N/A** AEA: **1.17**

Project Description:

Lake and Peninsula Borough (LPB) is requesting funding for reconnaissance for a wind energy project in the community of Levelock. Applicant states that the funds will be used for the installation of a 10-meter meteorological tower to gather at least one year of wind data. The data will then be analyzed by a professional firm and a report will be prepared to give an indication of whether or not the wind resource merits a full feasibility study and conceptual design.

Funding

LPB requests $10,000 in renewable energy grant funding. They will match the grant with an in-kind contribution of $1,000.

Contribution to Lower the Cost of Energy:

The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. False Pass hopes to integrate wind power into the existing system and generate the same amount of energy output using less fossil fuels.

Levelock currently pays $0.70/kWh before PCE and $0.38/kWh with PCE. These costs are a tremendous burden on residential, governmental, and other users. The development of any commercial or industrial activity is cost-prohibitive at these levels.

Assumptions Modified:

Capital Cost

The Applicant did not provide any information regarding the proposed project costs or benefits. The B/C analysis was conducted using information provided from AEA wind project manager.

AEA suggested a 95-kW wind system with an estimated total project cost of $1.021 million. This amount includes a remanufactured wind turbine, transmission line, secondary load system, and the cost of the reconnaissance study.

Annual Wind Generation

The AEA tab assumes a Class 3 wind regime and net capacity factor of 20 percent, which results in expected annual gross electricity from wind of 163,943 kWh. Furthermore, analysis estimates annual net electricity produced from wind of 140,991 kWh, with excess annual wind energy of 22,952 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Fuel Efficiency

The applicant stated a fuel efficiency of 11.3 kWh per gallon for their existing diesel generators. The AEA analysis assumed the minimum efficiency of 13 kWh per gallon as per AEA guidelines.

Concerns:

Applicant states a Class 4 wind resource. AEA believes a Class 3 wind resource is more likely near the village and that Class 4, if found, would be further south along the coast. One full year of met tower data would provide a more accurate wind resource estimate.

Potential Enhancements:

Applicant indicates that any site chosen for the installation of the meteorological tower will be within 5 miles of the airport. Therefore, approval from the Federal Aviation Administration is mandatory before reconnaissance may commence.

Long-term Sustainability:

Sustainability cannot be determined until more thorough details are reported.

Potential public benefits:

Lessons learned about renewable energy sources in Levelock will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

912 Egegik Wind Reconnaissance

Proposer: Lake and Peninsual Borough (LPB) on behalf of the City of Egegik

Benefit/Cost Ratio: Applicant: **N/A** AEA: **1.42**
AEA (benchmark cost): **1.26**

Project Description:

The Lake and Peninsula Borough (LPB) is requesting funding for reconnaissance for a wind energy project in the community of Egegik. The project will consist of the installation of a 10-meter or 30-meter wind tower within the city to gather one year of wind data. The wind data will be analyzed by a professional firm that specializes in the interpretation of wind data. Following the completion of data gathering, the firm will prepare a report that will give an indication on whether or not the wind resources merit a feasibility study.

For the purpose of this analysis, a 95-kW wind facility is assumed to be built in 2016, given Class 5 wind resource (AEA assumptions).

Funding

LPB requests $80,000 in renewable energy grant funding. They will match the grant with an in-kind contribution of $10,000 (11 percent). Applicant states that LPB and the City of Egegik are both willing to contribute funds for further studies if the results are positive.

Contribution to Lower the Cost of Energy:

The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. Egegik experiences an additional seasonal workforce of up to 2,000 workers during the height of the Bristol Bay sockey fishery. If a reconnaissance study merits further work, applicant believes a wind tower could offset a significant amount of diesel usage and open up the possibility of economical processing for value-added processors.

Egegik currently pays $0.90/kWh before PCE and $0.60/kWh with PCE. These costs are a burden to consumers and the State. The development of any commercial or industrial activity is cost-prohibitive at these levels. A project that has the potential to lower the cost of energy would be helpful.

Assumptions Modified:

The Applicant did not provide project costs or benefits other than the cost of the Reconnaissance Study.

The AEA analysis is based on the following assumptions provided by the AEA wind project manager:

- 95-kW wind capacity (estimated wind penetration of 35 percent)
- Class 5 wind resource (28 percent capacity factor)
- Estimated project cost of $840,000
- Annual gross wind energy production of 233,016 kWh

- Annual net excess wind energy for thermal loads of 39,613 kWh (equivalent to displacement of 1,145 gallons of heating fuel)
- Fuel efficiency of 13 (note: the applicant indicated that current fuel efficiency of their diesel generators is 11.3 although the 2011 PCE data for the the utility shows an efficiency 12.98 kWh per gallon)

Further analysis assuming the AEA benchmark cost of $10,200 per installed kW for rural applications with no thermal component, also resulted in a positive B/C ratio (1.20).

Concerns:

While the resulting B/C ratio suggests that a 95-kW wind facility is economically feasible, more information is needed to be able to define and evaluate the project. As suggested by the AEA wind project manager, data logging of loads would be important in determining the optimal system design, given the seasonal population and loads from the fish harvesting and processing sector.

The estimated cost of the reconnaissance study of $90,000 seems high. A typical cost for a more in-depth conceptual design and feasibility study (including met tower installation, wind resource assessment, and geotechnical analysis) is $150,000.

Finally, the fuel efficiency needs to be verified in the next stage.

Potential Enhancements:

None at this preliminary stage.

Long-term Sustainability:

Sustainability cannot be determined at this preliminary stage.

Potential public benefits:

Lessons learned about renewable energy sources in Egegik will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 913	Stetson Creek Diversion Project – Cooper Lake

Proposer: Chugach Electric Assoc

Benefit/Cost Ratio: Applicant: **0.58** AEA: **5.23**

Project Description
The applicant is requesting funds to assist with construction and commissioning of a project at Stetson Creek to add water to Cooper Lake and release water into Cooper Creek to enhance fish habitat.

Contribution to Lower the Cost of Energy
Adding water to Cooper Lake will increase output from Cooper Lake by 5,500 MWH per year, displacing a commensurate amount of natural gas generation. In and of itself, this would save about $385,000 in annual gas purchase costs. At $23 Million, this project would increase rather than decrease costs if the only economic benefit is the fuel savings from the 5,500 MWH increase in output. However, the diversion project is a requirement contained in the 2007 FERC relicensing of the plant. Should the diversion project not proceed, the license would need to be reexamined, putting $3 Million per year in natural gas costs for 50 years in jeopardy. Completion of this project is the only way to ensure the requirements of the current operating license are met, and Chugach states that is will proceed with the project regardless of whether or not the grant application is approved.

Full production at Cooper Lake generates approximately 42,000 MWH currently. With the additional 5,500 MWH, the plant will be capable of delivering 47,500 MWH of energy into Chugach's grid. If this energy were required to be generated using gas-fired generation, the cost would be in excess of $3 Million per year.

Assumptions Modified
The applicant states that the project will generate an incremental 5,500 MWH of energy each year. Because relicensing is uncertain without construction of the facilities to divert water into Cooper Lake and release water into Cooper Creek, I have assumed that the entire 47,000 MWH per year is associated with the incremental investment. This may or may not be the case.

Concerns
The project appears to be well thought out, benefitting from $3 Million in studies, design and procurement thus far. Past AEA grants to the project amount to $576,000. MWH Americas and HDR have provided contractor services for this project. The greatest concern with this project is the impact on Chugach's customers if the project is not completed. Reopening the FERC licensing process would require engaging several stakeholders and parties that agreed in a Settlement Agreement to allow the relicensing to go forward.

Cost and completion risks apply to this project and can be mitigated with best practices in procurement and project management.

Possible Enhancements

None.

Long-term Sustainability

Cooper Lake has been producing power for decades. This project should provide benefits for 50 years.

Potential Public Benefits

Completion of this project will increase fish habitat for salmon and rainbow trout by increasing stream flow and water temperature, improving the chances for spawning and incubation. It will also provide solid employment opportunities during the 2 year construction window.

No. 914	Connelly Lake Hydroelectric Project Conceptual Design/Permitting

Proposer: Alaska Power & Telephone Company (APT)

Benefit/Cost Ratio: Applicant, as shown on paper application: 2.2
Applicant as calculated by economist on applicant worksheet in model: 0.11
AEA1 (no cruise ship sales) worksheet: 0.12
AEA2 (cruise ship sales) worksheet: 2.24

Project Description

The applicant is requesting $1,752,000 from this funding round and will match $438,000 for a total grant cost of $2,190,000 for the project phase comprised of conceptual design and permitting for a hydro project, including run of river. The previous phase is still underway so much of the data and information needed for a comprehensive and more current analysis is not available in this application. The Project facilities will include a dam at the lake outlet, a penstock about 6,200 feet long, a 12.0 MW powerhouse (40GWh) with two generating units, a 14-mile-long 34.5 kV transmission line and a 14-mile long access road. Field studies, permitting and final design for this Project will be completed during Phase III. The energy generated by the Project will be derived from the inflow to Connelly Lake and the head between the lake and the power plant. The Connelly Lake outflow was measured by the USGS from August 1, 1993 to September 30, 1997; based on that gage record, the Applicant expects the average annual inflow to be 39 cfs. Average daily flows will vary from near zero during cold winter periods to several hundred cfs following intense storms. The actual generation will vary depending on the installed capacity, reservoir size, and load to be served.

According to the applicant, the project will add stability to the region and potentially prevent a serious and lengthy loss of power to the region, it will provide additional generation to the interconnected Haines and Skagway electrical systems (existing 15-mile submarine cable), to provide backup renewable power to Haines should the submarine cable fail, or should the only other storage project in Upper Lynn Canal, Goat Lake Hydro, have a major problem with a long term shutdown. And in the early years of operations to possibly provide summer power to cruise ships moored at Haines or Skagway.

Contribution to Lower the Cost of Energy

The primary use of the resource will be to provide energy to the cruise ships and to serve as a back up to the region's current system, should something happen to the submarine cable that currently connects Haines and Skagway. The applicant does mention that there is a potential for benefits to the State's PCE program, but at this time it is not clear to what degree the savings would impact the residents or the State via PCE.

Assumptions Modified

The following assumptions were modified (or clarified) from what was provided in the grant application, please note that there is very little concrete information in the applicant's worksheets regarding the proposed system's configuration and costs.

- **Estimate of kWh currently consumed by cruise ships.** The economist calculated this using the 9MWh load per ship, for two ships. In order to arrive at this number, the analyst used middle of May to Middle of September and counted 89 week days for analysis. The applicant does not state the dates in the beginning or end of the season, but the Cruise Ship Calendar (http://www.sitnews.us/0512News/050712/calendar_ketchikan.pdf) places the ships

arriving and leaving for the season at about May 10 to Sept 12, 2012, it is reasonable to benchmark these to May and Sept 15. It's important to note that other applications reviewed, which also address serving the shipping industry cite consumption by the ships at 7MW, not 9MW per ship.

- **Fuel oil costs.** The economist used the ISER fuel oil estimate of $4.54 per gallon in 2019 in both worksheets.
- **O&M.** Because the application is in need of better information regarding the system costs and configuration, the economist used the applicant's figure of $600,000 p/y as the O&M figure and subsequent calculations, but used the AEA standard in the same worksheet.

Concerns

- **Cruise Ship Reliability.** According to the 2011 Alaska Visitors Statistics Program study (http://www.commerce.state.ak.us/ded/dev/toubus/pub/2011AVSP-FullReport.pdf), the "While global and North American cruise passenger volumes show growth over the last five years, Alaska's cruise passenger volume has fluctuated considerably. Volume increased by 7 percent in 2007, was essentially flat in 2008 and 2009, then declined substantially in 2010, before rising very slightly in 2011. When the economic recession hit the US in 2008, cruise ship schedules for 2009 were already set and sailings could not be reduced or canceled. Although cruise lines were able to fill berths in 2009, they were forced to offer steep discounts. The significant reduction in prices attracted passengers that spent less than their predecessors on land tours, other activities, and in stores while in Alaska. The following year's decline of 14 percent was an after-effect of the global recession along with cruise line response to new cruise ship head taxes and regulations that affected their Alaska operations. The Alaska Legislature, responding to efforts by the Governor of Alaska and the visitor industry, reduced the passenger head tax in 2010." 2013 indicators are trending up but not having a solid agreement with the cruise industry puts the projected revenues for the project at risk; even if the resource is developed to benefit the cruise ship industry, there are many factors that affect the industry's reliability, that are outside of the utility's control.

- **Upper Lynn Canal/submarine cable at risk?** The applicant makes a case for the prevention of a significant and prolonged loss of power to the region should the submarine cable fail. This is especially troublesome if said outage happens during the winter; however, the applicant does not provide adequate rationale as to why the cable is at risk or will be at risk now/soon. It is possible that it could fail but the case would be more compelling if one knew what the risk factors are, what the probability is and if there has been anything currently that warrants preventive measures.

- **Is there demonstrated site control?** The project will be on State and private land, including the Haines State Forest and Chilkat Bald Eagle Preserve. There is a lack of information regarding what it will take/costs associated with securing the site. In addition, attention should be placed to the project's impact on the eagle preserve and public opinion.

- **Will FERC review impact cost?** The applicant has received a preliminary FERC permit (P-14229), depending on the outcome of further reviews, the overall cost of the project may change.

Possible Enhancements / Recommendations

- **Funding.** The applicant indicates that the project will be funded at 80% by grants from the State but does not provide a clear plan as to the remaining 20%. If the 20% is projected to come from revenues, particularly from cruise ships, there should be a purchase agreement in place. In addition, the applicant should consider providing more detail, should the 80% not materialize in its entirety from State funding.

Long-term Sustainability

- **Management structure appears adequate.** Because the hydro project will be owned and operated by the utility, the management infrastructure is considered reliable.
- **Revenue for operations.** Revenues are dependent on cruise ship reliability.

Potential Public Benefits

- **Reduction in diesel fuel use.** The project could reduce the amount of diesel consumed by the cruise ship industry, which as the benefit of reducing costs and potential environmental impacts from the use of (and transport) diesel.

- **Long term regional stability.** The project has the possibility of helping stabilize the region and improve the overall reliability of the exiting utility resources, on and off tourism season.

No. 915 Eagle Photovoltaic Electric Project, AP&C

Proposer: Alaska Power Company (AP&C)

Benefit/Cost Ratio: Applicant, as shown on paper application: 5.29
Applicant as calculated by economist on applicant worksheet in model: 1.52
AEA1 worksheet: 1.82
AEA2 worksheet : 2.54
AEA3 worksheet (preferred): 1.58

Project Description
AP&C is requesting funds for project construction and commissioning of a 30kW array of photovoltaic (PV) modules in Eagle, Alaska. The arrays would serve the communities of Eagle and Eagle Village, which are 3 miles apart. Both communities annually consume 770,00kWh of diesel generated electric power, and applicant reports that both communities are listed by the Denali Commission in 2012 as "distressed communities". The applicant is requesting $132,600 for this grant period, and it proposes to provide $33,150 in in-kind match for a total of $165,750.

Contribution to Lowering the Cost of Energy
The PV project will offset diesel generated electric power for the two communities. The proposed PV system would offset 3,200 gallons of diesel fuel, producing between 40,000-41,600kWh per year, saving approximately $13,000 per year. HOMER models calculate that the applicant may have undervalued their system, and up to 4,322 gallons of diesel fuel and 57,964 kWh/yr could be displaced.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- O&M costs were not reported in application, economist used AEA assumption of .02/kWh for analysis.
- Applicant provided a much higher B/C ratio than workbook calculated.
- kWh displaced per year increased to 57,964 kWh/yr due to panels increased performance at lower temperatures, ground and snow bounce, and HOMER modeling results. A second AEA worksheet was added to the workbook to report this scenario's B/C ratio.

Concerns

- **Taylor Highway.** Applicant reports that the section of highway between Tetlin Junction and Eagle may get frost heaves or see multiple wash outs that could delay construction
- **No Letters of Support.** The Native Village of Eagle could provide a letter support, but the solar system will be located on property owned by APC so no risks to the project should arise. Applicant showed former letters of support from the Village Council for past hydro feasibility research.
- **Local Representation.** Most of APC listed engineers and project management are located in the State of Washington. However, Vernon Meitzer, located in Skagway, has extensive experience since 1972 with Alaskan power project.

Possible Enhancements / Recommendations

Economist has no recommendations at this time.

Potential Public Benefits

- **Reduced annual electrical costs**
- **Stabilizes costs across two communities**
- **First renewable power in the region (after hydro & wind studies)**
- **Cleaner Air**

916 Hydaburg Schools Wood Fired Boiler Project

Proposer: Hydaburg School District, with partner Southeast School District (Prince of Wales Island) REVISED October 29.

Benefit/Cost Ratio: Applicant: **3.93**
AEA: **2.85**

The Hydaburg School District received an AEA grant to conduct a feasibility study, completed in December, 2010. That study, prepared by Haight Engineering (Juneau) considered three pellet options and a wood chip option; no Garn options were considered, though Coffman Cove now has an operational Garn and Thorne Bay is currently installing Garn heating.

This application seeks to correct the Garn omission (in 2010) with Design and Permitting funds (AEA: $20,000; Applicant: $5,200, consisting of $4 000 in cash and $1,200 from in-kind match) to evaluate a Garn Pac of twin 1500/2000 units at a total project cost of $463,216.

Project Description

This project involves placing supplemental cord wood fired boilers in the schools. The supplemental heating system would be located at the Hydaburg City Schools in Hydaburg, AK on Prince of Wales Island in Southeast Alaska.

School district personnel state: We intend to use wood biomass to heat the school buildings, replacing diesel as the energy source. The project involves placing two Garn type wood fired boilers adjacent to the school site and running underground pipes from the wood fired boiler to plumb into the school's heating system.

Contribution to Lower the Cost of Energy

An estimated 28,367 net gallons of fuel oil (equivalent) will be displaced by installing the Garn units. School District personnel expect the Garn unit will displace virtually all the heating oil.

Assumptions Modified

School District and AEA assumptions were modified.

The District projects 200 cords per year annual use. Discussions with USFS personnel (Dan Parrent) suggest Coffman Cove (approximately 25 students) purchased 100 cords, but through storage and drying only burned approximately half that amount. For Hydaburg, with an estimated 82 students, fuel purchases were reduced to 150 cords. AEA and SE School District (POW Island) confirm 66 cords and $200 per cord at Coffman Cove, actual fuel quantity and fuel cost, most recent year.

AEA projects 90% displacement of fuel oil or 25,530 gallons of the 28,367 gallons.

Concerns

The long-term timber supply from the nation's largest national forest has been an issue for at least two decades and will continue to be a concern. There is sufficient private land

near Hydaburg (village and regional corporations) to supply firewood, as well as access to the Prince of Wales road systems for potential delivery of firewood from other areas, such as Thorne Bay.

Possible Enhancements

The School District noted cooperation with the Southeast Island School District's Jonathan Fitzpatrick (Thorne Bay) who has experience with both Coffman Cove and Thorne Bay Garn units. This is a sound enhancement and will lead to a more efficient analysis and, if approved, project.

Long-term Sustainability

This project would enhance the long-term viability of the Hydaburg School District. With a renewable resource such as cordwood, the amounts required will add additional sales for the local logging infrastructure.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. Cordwood purchases will potentially add infrastructure to both the school (drying shed) and the local logging industry.
2. Employment. This system will add, potentially, a 0.25FTE, perhaps including time for maintenance personnel at Hydaburg, but also Craig, Klawock, and Thorne Bay.
3. Community solutions. This system could generate additional flows of firewood into the community.
4. Improve existing energy system. The proposed Garn system will improve both the existing heating system but also reduce costs and strengthen the local community if local purchases are made, such as those at the City of Tanana.
5. Statewide Applicability. Like other Garn installations, this will strengthen the community (and knowledge) of those who use Garn units.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. School costs would be lowered and more firewood could generate jobs with the regional area.

No. 917	Blue Lake Hydroelectric Expansion Project

Proposer: City and Borough of Sitka

Benefit/Cost Ratio: Applicant: **2.02** AEA: **2.02**

Project Description

The applicant is requesting $4,000,000 in funds to partially offset the cost of a $145 Million addition to the Blue Lake hydro facility that will add 9.6 MW to generation capacity and raise the spill level by 83 ft. $49 Million in grant funds have been received to date while project cost has escalated between $35 and $50 Million over the design engineer's original cost estimate.

Contribution to Lower the Cost of Energy

In 2011 the City and Borough of Sitka electric utility generated 118 GWH using the Blue Lake and Green Lake hydro facilities, and 3.8 Million KWH using diesel generators. With organic load growth and conversions from fuel oil to electric heat in the area, additional diesel generation is expected in the future without additional hydro. In a low water year the existing hydro system might only produce 90 GWH. The proposed modifications will increase hydro capacity by 32 GWH, allowing the CBS to meet projected needs while avoiding the need to use diesel generation.

CBS estimates the total cost of diesel generation to be $0.43/KWH when diesel fuel cost $4.10/gallon compared to a $0.15/KWH cost of hydro. According to the applicant, the community consumes 9 million gallons of liquid fuels for all purposes – power, heating, transportation. It is estimated that 2 million gallons, costing over $9 Million per year, could be saved with the completion of the Blue Lake expansion and substitution of electricity, phased in over the next 20 years, for heat and ground transportation as well as power. While conversions take place, the CBS believes there are opportunities to sell excess power on a non-firm basis to generate revenue and help pay for debt service on the facility.

The CBS will be requesting a $43 Million capital appropriation in the Governor's FY2014 budget in addition to the $4 Million grant request. If the state provides total grants of $72.5 Million – i.e. 50% of the total cost of the project, the CSB estimates the cost of Blue Lake power to be included in rates will be 14.73 cents/KWH at full utilization of the output.

Of the $145 Million in total costs for the project, $33 Million has already been either spent or encumbered and cannot be saved if the project does not move forward. If the b/c analysis is completed using just the additional capital outlays required – i.e. $112 Million CapEx, the b/c ratio improves from 2.02 to 2.62 assuming full utilization of the facility and displacement of liquid fuels.

Assumptions Modified

None.

Concerns

Significant increases in project costs, not unique to the Blue Lake project, can increase completion risks due to lack of capital. With all but $3.5 Million in construction costs already bid under firm contract, $5 Million in construction contingency, and $3.5 Million in reserves, this mitigates but does not eliminate risks. The largest concern is the market for

produced power, and ability to generate revenue to offset debt service, during the initial decade of operation. According to the applicant, under certain grant funding and load scenarios, electric rates in the community may increase from the currently approved 2013 customer rate of 11 cents/KWH to 15.8 cents/KWH in 2017. This could, ironically, dampen conversion from the use of liquid fuels to electricity, reducing the economic benefits to the community.

Possible Enhancements

None. The CBS has done a quite thorough review of the options and issues associated with project.

Long-term Sustainability

Adding additional hydroelectric capacity in the CBS will encourage use and conversion of other energy forms to this renewable source, ensuring its sustainability.

Potential Public Benefits

Lower emissions, availability of an adequate energy supply for economic development, lower costs for power, heat, and potentially ground transportation, less cash outflow from the community, it appears the project is a source of community pride.

No. 918	West Creek Hydroelectric Project Feasibility and Conceptual Design

Proposer: Municipality of Skagway Borough (Borough)

Benefit/Cost Ratio: Applicant, as shown on paper application: 1.92
Applicant as calculated by economist on applicant worksheet in model: 1.53
AEA worksheet: 1.45
AEA (2) worksheet: 0.77 (see note on scenario)
AEA (3) worksheet: -- (see note on scenario)

Project Description
The applicant is requesting $236,000 from this funding round and will match $84,000 for a total grant cost of $320,000 for project feasibility and conceptual design for either a run of the river or storage hydroelectric project on West Creek , approximately seven miles from Skagway. The primary purpose of the Project would be to offset diesel generation by cruise ships that dock in Skagway from May through September each year. Up to four cruise ships per day dock in Skagway for 12-15 hours and continuously operate their diesel gensets to provide for onboard electricity requirements. The configuration of the system and type will be determined during the proposed phase. Currently, the information used in the application and for analysis is provided by the applicant and is based on 1982 Beck/APA study. At this time, the applicant proposes to evaluate a system that has 25MW installed capacity, with a 27GWh annual generation. The full cost of the system is stated at $140,000,000.

Contribution to Lower the Cost of Energy
The primary use of the resource will be to provide energy to the cruise ship industry. The applicant mentions that there are between 4 and 5 ships at Skagway during the tourism season. The applicant believes the system can support 1-3 ships docked and running 12-15 hours per day, five days a week, from May-Sept. Each ship is estimated to have a 7MWh load.

A secondary use is to possibly provide backup renewable energy for the ULC system in the event of an emergency, e.g. an extended outage of the Goat Lake hydro project as well as provide winter energy to other electric utilities in the area, but from the application it is not clear how feasible this is, especially considering that there is an additional resource for consideration to supplement the ULC system, the Connelly Lake Hydro project.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application, please note that there is very little concrete information in the applicant's worksheets regarding the proposed system's configuration and costs.

- **Construction schedule.** No construction schedule was provided by the applicant for the project itself, only for Phase II. However, the applicant mentioned on Pg 15 a project start date of 2015. Given the potential time required for design, permitting, and construction, the economist estimates the project start date at 2019. *This assumption was used the AEA worksheets, and the 2015 date was used in the applicant worksheet.*
- **Estimate of kWh currently consumed by cruise ships.** The economist calculated this using the 7MW load per ship, for three ships. In order to arrive at this number, the

analyst used middle of May to Middle of September and counted 89 week days for analysis. The applicant does not state the dates in the beginning or end of the season, but the Cruise Ship Calendar (http://www.sitnews.us/0512News/050712/calendar_ketchikan.pdf) places the ships arriving and leaving for the season at about May 10 to Sept 12, 2012, it is reasonable to benchmark these to May and Sept 15.

- **Fuel oil costs.** The economist used the ISER fuel oil estimate of $3.98 per gallon in 2015 and the applicant indicated that fuel oil was $3.88 per gallon in the grant application. The applicant does not state whether the price of fuel per gallon is retail or utility price. *The ISER fuel oil assumption was used in the applicant and the AEA worksheets.*
- **O&M.** Because the application is in need of better information regarding the system costs and configuration, the economist used the applicant's figure of $1,500,00 p/y as the O&M figure and subsequent calculations.
- **Scenario AEA (2) worksheet:** B/C 0.77 adjusts the project costs to re-sized plant from 25MW to 10MW, and adjust 10MW costs from 1982 to 2011 dollars. Under this scenario, there would not be enough energy to supply 3 ships, but could supply one, with some excess capacity. Consumption would still be dependent on the cruise ship industry.
- **Scenario AEA (3) worksheet:** B/C ---, this scenario assumes that no cruise ships would purchase power. Since the resource is dependent on the cruise ship industry, if no ships purchase power, neither a 10MW nor a 25MW hydro plant would be feasible.

Concerns

- **Cruise Ship Reliability.** According to the 2011 Alaska Visitors Statistics Program study (http://www.commerce.state.ak.us/ded/dev/toubus/pub/2011AVSP-FullReport.pdf), the "While global and North American cruise passenger volumes show growth over the last five years, Alaska's cruise passenger volume has fluctuated considerably. Volume increased by 7 percent in 2007, was essentially flat in 2008 and 2009, then declined substantially in 2010, before rising very slightly in 2011. When the economic recession hit the US in 2008, cruise ship schedules for 2009 were already set and sailings could not be reduced or canceled. Although cruise lines were able to fill berths in 2009, they were forced to offer steep discounts. The significant reduction in prices attracted passengers that spent less than their predecessors on land tours, other activities, and in stores while in Alaska. The following year's decline of 14 percent was an after-effect of the global recession along with cruise line response to new cruise ship head taxes and regulations that affected their Alaska operations. The Alaska Legislature, responding to efforts by the Governor of Alaska and the visitor industry, reduced the passenger head tax in 2010." 2013 indicators are trending up but the annual energy use of 265,000 kWh is much less than the current capacity of the unless there is a firm commitment and solid purchase agreements, it appears that even if the resource is developed to benefit the cruise ship industry, there are many factors that affect the industry's reliability, that are outside of the Municipality's control.

- **Is there demonstrated site control?** By the time a project would be considered to be built all lands in and around the project would be owned by the Municipality of Skagway.

- **Will the project trigger FERC review?** The applicant indicates that the project will likely not fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC). However, there is the risk that FERC could assert jurisdiction based on West Creek being navigable or because of proximity to the Klondike Gold Rush National Historical

Park. A non-jurisdictional determination will be applied for early in Phase II, but if the project is under FERC jurisdiction, it could affect the overall cost.

- **Delivering power.** Delivering the power to the Skagway dock will require approximately 12 miles of new or upgraded transmission line, as well as new switchyards, substations, and shorepower switches and connections. The costs need to be addressed.

Possible Enhancements / Recommendations

- **Funding.** The applicant indicates that the project will be funded at 80% by grants from the State and, 20% being funded by the Municipality with 6%/30-year municipal bonds. The applicant should consider providing more detail, should the 80% not materialize in its entirety. Are there incentives for the cruise ships to be at the table?

Long-term Sustainability

- **Management structure appears adequate.** Because the hydro project will be owned and operated by the Municipality, the management infrastructure is considered reliable.
- **Revenue for operations.** Revenues are dependent on cruise ship reliability.

Potential Public Benefits

- **Reduction in diesel fuel use.** The project could reduce the amount of diesel consumed by the cruise ship industry, which as the benefit of reducing costs and potential environmental impacts from the use of (and transport) diesel.

- **Long term viability of the community.** The project has the possibility of improving the long-term viability of the Municipality, ensuring continued benefits from the tourism season.

No. 919 Metlakatla-Ketchikan Intertie

Proposer: Metlakatla Indian Community (MIC)

Benefit/Cost Ratio: Applicant: **1.94** AEA: **1.94**

Project Description
The applicant is requesting $9,570,434 in grants to complete the construction of a $14.5 Million transmission line between Metlakatkla and Ketchikan. Page 5 of the application indicates that the Metlakatla Indian Community has funded $440,165 of the construction costs to date and that $4.5 Million in past grants have been awarded.

Contribution to Lower the Cost of Energy
According to the application, the tie line will make 3,000,000 KWH in excess power from the Chester Lake Hydro (1 MW) and Purple Lake Hydro (3 MW) projects available for delivery to Ketchikan to displace liquid fuels used for power and space heating. Power sales to Kake could also occur if the Ketchikan/Kake intertie is built and Ketchikan is unable or unwilling to purchase all of the excess supply from MIC.

The application states that diesel generation cost Ketchikan about $0.28/KWH, so displacing 3 GWH would result in a reduction of fuel costs in Ketchikan by $840,000 per year. MIC anticipates that the dollars saved can benefit customers of both Ketchikan Public Utilities and MIC customers. By selling power to KPU for 8 to 14 cents/KWH, KPU can reduce its cost of power and MIC can generate revenue that can be used to offset electric utility operating costs. In addition to offsetting liquid fuel costs, the tie line would further diversify Ketchikan's power supply and allow it to reduce the dollars spent on backup capacity, although the value of this benefit is not quantified.

According to the applicant, future expansions of existing hydro facilities and the development of a new one at Triangle Lake have an estimated potential to produce an additional 24 GWH in annual energy that could be delivered via the intertie. This could eliminate, delay, or cause to be short term the need to generate with diesel as load in the area increases due to economic activity and conversions to electric heat.

Assumptions Modified
None.

Concerns
The estimated cost of this project from REF Round V to REF Round VI has increased by 10% - from $12,725,200 to $14,510,599 – while the anticipated energy available for transmission has dropped by 50% - from 6 GWH/year to 3 GWH/year. Total generating ability from the 4 MW in installed hydro capacity is 24 GWH while local use is 18.7 GWH.

Depending on the hydrology, relatively modest increases in local use over the coming decade could absorb much of the excess energy supply that is being proposed for sale to KPU. As such, the economics that assume displacement of 3 GWH per year in diesel generation is suspect.

Possible Enhancements

Estimate local energy needs to determine the likelihood of being able to offer firm power to KPU; also, obtain a current level of interest determination from KPU about the desire of KPU to add this energy to its portfolio.

Long-term Sustainability

Adding additional hydroelectric capacity and diversity to the Southeast energy supply picture will encourage use and conversion of other energy forms to this renewable source in the region.

Potential Public Benefits

Lower emissions, lower costs for power, heat, and potentially ground transportation in the region, less cash outflow from the community, diversity of supply helps everyone deal with emergencies.

No. 920 Tlingit-Haida Regional Electric Authority Walker Lake Hydro

Proposer: Tlingit-Haida Regional Electric Authority (THREA) & Inside Passage Electric Cooperative (IPEC)

Benefit/Cost Ratio: Applicant, as shown on paper application: Not provided
Applicant as calculated by economist on applicant worksheet in model: NA
AEA worksheet: .43
AEA (alternate) worksheet: 0.01

Project Description

The applicant is requesting funds for feasibility, project permitting, and final design of a reservoir hydroelectric project. Grant funds sought are $640,000, the applicant will match $50,000 for a total of $690,000 for this phase. The applicant does not provide total current project costs but does provide previous project costs from 1988, adjusted for 2011 dollars, the estimated project cost is $20,031,414 2011 dollars. The AEA (alternate) scenario workbook models a scenario using 20,854 diesel generated kWh offset, per request by AEA project manager.

The project includes two small dams located at the southeast end of Walker Lake. The dams will be rock filled construction with a membrane and concrete lining, 15 feet in width at the crest. The two dam's estimated crest length is approximately 250 feet and 325 feet respectively, the lake surface will elevation will rise 1,189 feel MSL to 1195 feet MSL, in the surface area of the lake from 160 acres to 180 acres. A spillway for each dam to release water to the creek is planned, each dam will have a concrete intake structure approximately at 1,170 feet MSL, and 24 inch penstocks will run the length of the dams, and a penstock from a both intake structures will join together in one penstock that will drop to the planned powerhouse, 11,000 feet of piping. The powerhouse is a prefabricated 26 feet by 38 feet wood and metal-framed building; it will contain one generating unit with 1MW installed capacity. The hydraulic head capacity is 18cfs with an estimated 780 feet of net head. Existing logging roads will be used, but a 1-mile access road may be needed.
The project will include a 12.5kV transmission line, approximately 4 miles long to transmit the power for the switchyard to an interconnection location near Klehinin River Bridge, 25.5 Mile Haines Highway.

Contribution to Lowering the Cost of Energy

The Walker Lake hydro project aims to displace the increasing amount of diesel generated electricity IPEC purchases from AP7T at $.3357kWh. Both IPEC and AP&T loads are growing, and from 2010 to 2011 IPEC increased its purchase from 722,868 to 759,960kWh. IPEC generates 56% of its energy for its service area from 10 Mile hydro plant, and purchases the remaining 44% of its annual kWh from AP&T. IPEC's power sales agreement with AP&T is up in 2017 and IPEC will purchase power from THREA Walker Lake project at a wholesale power rate of $.07 per kWh, a savings of $.0573. Applicant reports $43,546 in annual savings.

Assumptions Modified

The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Total Project Cost.** The applicant did not supply a total project cost for construction, but did supply a feasibility cost. The AEA directed the economist to use a total project

cost from a study in 1988, that estimated a higher capacity (1.9MW) than the application (1.0MW), and economist was tasked to escalate the total project cost from $10.8 million in 1988 to $20,031,414 2011 dollars.

- **Application grant amount.** Applicant requested $690,000 for feasibility, permitting and final design. Economist provided both their request as found in their application, and an AEA guided review based on a1988 project study.

Concerns

- **Permitting.** The permitting process for this project requires both state and federal agency, including ADEC, EPA, US Coast Guard, Us Army Core of Engineers, DNR, ADF&G, and FERC. THREA filed for a FERC preliminary permit application on June 11, 2012. Their permitting timeline allows for three years, which may be reasonable considering their past hydro experience and their partnership with Oregon based Kleinschmidt, but it could take longer and affect their 2017 power sales goal.
- **Availability of 200 acres of State land.** The dams would expand the surface of Walker Lake and require 200 acres of Alaska State Land.
- **Prior FERC application:** Applicant lists as their main concern a competing FERC permit application by a private entity. THREA was organized in the 1970's formed by Tlingit-Haida Central Council, a Federally recognized Alaska Native Tribe, to build infrastructure and provide electricity to several small villages. In 2004, THREAs Board of Commissioners elected to restructure the utility to a member owned cooperative renamed Inside Passage Electrical Cooperative. In doing so, THREA unknowingly set aside its "municipal preference" priority with respect to FERC preliminary applications. IPEC became aware of private application for FERC permitting, and to "protect its interests", they asked the Executive Council of the Central Council Tlingit and Haida Indian Tribes of Alaska to re-authorize THREA and regain their municipal priority, which they did. They fully expect to receive the permit with this adjustment, but on top of their other permitting tasks this may at worst halt their project and perhaps slow its schedule.
- **Future Mine Plans.** A potential future mine in the region is mentioned by applicant, and the excess power from Walker Lake hydro could be sold to the mind, and perhaps back to AP&T as their total demand increases. The benefit of the project with a large mine operation changes with a mine operation and the relationship of the two projects may need to be accounted for.

Possible Enhancements / Recommendations

- **Reference Earlier Studies.** Walker Lake was researched in 1988 and the findings from that study should be incorporated into the project description. Economist would like see the changes in design and output clearly.
- **Mine Operation.** Provide some estimates for excess hydro sales to future mine.
- **State of Alaska Land (200acres).** Update application with progress or difficulties on State's willingness to participate in real estate portion of the project.
- **Details on Private Entity FERC request.** Explore how they understand a competing entity harming their interests. It could be for example that a private hydro project supporting a future mine could sell power to IPEC at cost saving rates. Applicant could clarify their concerns.

Potential Public Benefits

- **Reduced annual heating and electrical costs**
- **Stabilizes costs across multiple villages**

- **Builds toward growth trends and provides room for industrial power to new business sectors**

921 AVCP RHA Wood Biomass Heating System

Proposer: AVCP Regional Housing Authority

Benefit/Cost Ratio: Applicant: **0.65**
AEA: **0.67**

AVCP conducted a pre-feasibility assessment of wood-fired heating system, revised as of August 13, 2012. The analysis, conducted by CTA Architects Engineers, concluded a wood pellet system, with a district heating loop, would require about 540 tons of wood pellets per year.

Project Description

From the applicant: AVCP Housing intends to construct a Wood Biomass Heating System plan within its campus to reduce high energy costs. The wood biomass heating system is expected to supplant 85% of the estimated heat usage. The current diesel fuel cost is $6.78/gallon in Bethel. Without the benefit of a biomass heating system, it is estimated we will be using 67,766 gallons of heating fuel annually beginning in the winter of 2012-2013.

The total estimated project cost is $3.4 million.

Contribution to Lower the Cost of Energy

An estimated 57,601 net gallons of fuel oil will be displaced by installing the wood pellet system. At $6.78 per gallon, this is approximately $390,500 of savings.

Assumptions Modified

School District and AEA assumptions were modified. Repair costs were not stated and were included at half of the annual estimated O&M costs, for both the current system (12 boilers, 4 hot water heaters) and the proposed system.

Concerns

Wood pellet costs, delivered to the AVCP campus were estimated at 540 tons per year and $460 per ton, or $248,400 per year. The proposed delivery system included an external silo for auger-delivery; however, wood pellets, at 7%, absorb moisture from ambient air, along with rain or snow, if exposed. At higher moisture contents, the pellets dissolve and become unusable for heating, especially with augur-delivery. Shelf life is an issue.

Also, bagged pellets are 40-pounds per sack and 50 bags per pallet (one ton). The proposed fuel supply, if bagged, represents a substantial number of pallets that would require considerable storage space.

Both the applicant and CTA are silent as to how wood pellets would be delivered, stored, and transported to external silo(s).

Possible Enhancements

As currently configured, wood pellet fuel costs are high; should Alaska develop a robust pellet manufacturing industry, the delivery and storage of wood pellets could be spread

out over a year, with less delivery and storage impact when compared to a full year's supply. In addition, wood pellets are a high volume, low value commodity, and much of the delivered fuel cost is transportation. As an example, wood pellets in North Pole are quoted at $295, FOB factory, while wood pellets in Southeast Alaska are delivered at a $360 per ton cost.

An in-state wood pellet facility could provide a more even flow of pellets at a reduced cost, much like fuel oil tankers haul product from the Tesoro refinery at Nikiski to western Alaska.

Long-term Sustainability

The conversion of existing fuel oil systems to wood pellet fuels represents a major commitment for AVCP, and one that places them at the remote end of a long supply chain. At $360 per ton, a recent price quote for Southeast Alaska (also by waterborne barge delivery), the economics of the proposed action are improved with a B/C ratio exceeding 0.90.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. No new infrastructure would be added, just retrofits to the existing heating system.
2. Employment. No direct long-term increase in jobs is expected.
3. Community solutions. Wood pellet systems, if adopted in several Bethel locations, could strength the community energy independence by offering a choice of fuels.
4. Improve existing energy system. The existing heating system would be improved somewhat as new boilers and controllers are added at the time of retrofit.
5. Statewide Applicability. There are currently few pellet boilers in Alaska and this project would provide a proof of concept for rural and non-forested Alaskan communities.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. AVCP notes wood ash could be used as fertilizer for local gardeners.

No. 922	Gartina Falls Hydroelectric Project Construction/Commissioning

Proposer: Inside Passage Electric Cooperative (IPEC)

Benefit/Cost Ratio: Applicant, as shown on paper application: 1.8
Applicant as calculated by economist on applicant worksheet in model: 1.68
AEA (2) Rural worksheet: 2.26

Project Description

The applicant is requesting $6,694,000 from this funding round for construction and commissioning of the hydro project. IPEC will match $15,000 in-kind, for total capital costs of $6,709,000. IPEC expended Development costs of $1.3M, of which $450,000 were paid for through a cash match from DOE. The total cost of the project, including development is $8,009,000.

The project will be a run of river hydroelectric project that benefits the community of Hoonah, Alaska directly. Hoonah is located in Southeast Alaska, 40 miles West of Juneau. The project will include construction of a small diversion dam and intake structure just above Gartina Falls, installation of a steel penstock, a powerhouse at the base of the falls, a new access road, 0.1 miles of transmission line buried in conduit, and installation of power poles for 3.8 miles of overhead transmission line within the access road right-of-way. The project will divert water from above the waterfall into the power plant and then discharge water back to the base of the waterfall. The new hydroelectric system will have an installed capacity of 455 kilowatts (kW) and will therefore be used to avoid an estimated 30 percent of Hoonah's current diesel-powered electricity through hydro generation.

Contribution to Lower the Cost of Energy

Hoonah is part of the Inside Passage Electric Cooperative, the applicant. The applicant states that Hoonah has a population of 823, but this the current AKDOL estimate is 753 and it appears there is a slight downward population trend. However, because Hoonah is part of IPEC, which currently serves Hoonah, Kake, Chilkat Valley, Angoon and Klukwan, and because IPEC's rates are balanced across all the communities, lower cost for Hoonah will directly benefit the other communities as well.

The current system is comprised of four diesel generators that produce an estimated 4,860,308 kWh, the new system would offset about 30 percent of those with Hydro, which is approximately 100,000 gallons of diesel annually. The applicant states that the current cost per gallon is $4.12, which is higher than the AEA assumed pricing. The projected AEA price per gallon for 2014 is $3.73, which means that the savings when the project comes online could be less than what IPEC estimates but still significant.

Assumptions Modified

The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Fuel oil costs.** The economist used the ISER fuel oil estimate of 3.53 per gallon in 2012 and $3.73 in 2014 while the applicant used $4.12 per gallon in the grant application. The applicant does not state whether the price of fuel per gallon is retail or utility price. *The ISER fuel oil assumption was used in the applicant and the AEA worksheets.*

- **Life of project.** The applicant does not give the life of the project, but does on page 19 of the application, use a 30 year mark to calculate benefits, the economist used 30 years in the app worksheet and the AEA 50 year standard for run of river in the AEA worksheet.

Concerns

- **Is there demonstrated site control?** In order for the project to deliver, it will have to traverse Sealaska Corporation, Huna Totem Corporation and the City of Hoonah lands. Although all three have expressed support for the project and a willingness to work with IPEC, a more substantial accord from each of the entities over the long-term usage of lands would be beneficial to put in place prior to construction start.

- **Will the current FERC review increase the project costs?** The applicant has already filed with FERC and resolution to the FERC permitting process should conclude at the end of 2012. If all goes well, the project will be within the budget scope, but the applicant does acknowledge that there is a risk to higher project costs. AEA should be kept abreast of any impacts to costs.

- **Heat Recovery and public buildings:** The applicant mentions that heat could be provided to some public building via a heat recovery system. However, little to no information is provided about the demand of these buildings and the plan for their comprehensive integration.

Possible Enhancements / Recommendations

- **Expand Heat Recovery for public buildings.** Any time that heat recovery can be successfully implemented and integrated into the sustainability of public buildings, it benefits the community at large. This project has the potential to present a more developed plan for this type of initiative.

Long-term Sustainability

- **Management structure appears solid.** Because the hydro project will be owned and operated by IPEC, and its development and construction has local support and IPEC is working with a well-known contractor, the management of the project and subsequent operations appear to be solid.

Potential Public Benefits

- **Reduction in diesel fuel use.** The project could reduce the amount of diesel consumed, which as the benefit of reducing costs and potential environmental impacts from the use of (and transport) diesel.

- **Long term viability of the community.** The project has the possibility of improving the long-term viability of the village of Hoonah if less expensive electricity and possibly heating are provided to residents and businesses.

923 Afognak Biomass Feasibility Study

Proposer: Native Village of Afognak, Kodiak Island.

Benefit/Cost Ratio: Applicant: **3.22**
AEA: **3.47**

Project Description

The applicant proposed to do a study on the feasibility of installing a biofuel system at the Kodiak High School to provide fuel/heat to the building, decrease the overall waste going into the Kodiak landfill and provide a biofuel education service through the Kodiak High School Career and Technical Program.

Contribution to Lower the Cost of Energy

Phase I and Phase II of the analysis would determine if syngas (biofuel) could displace up to 85,000 gallons of a total 155,000 gallons consumed each year.

Assumptions Modified

AEA assumptions were modified:

1. The current O&M cost for Kodiak Schools was stated as unknown and it was set equal to the new system O&M ($28,000 per year) as a minimum. The current heating system is 46 years old and at least one of two proposed boilers may be replaced in the near future. More accurate figures will refine the analysis, if provided.

The applicant's figures were analyzed as presented.

Concerns

The resource base for syngas generation is based on 707 tons of fiber waste recycled in 2011 from both Kodiak and the US Coast Guard base. No data were presented to suggest whether this is a high (or low) annual volume; the amount of time needed to process this material in the proposed conversion unit is unknown.

No cash match is proposed and in-kind match is considered "unsure at this time."

Possible Enhancements

None noted. The proposed Phase I and Phase II is well-thought out and addresses most concerns and should identify enhancements.

Long-term Sustainability

If successful, the proposed project could reduce solid waste and displace additional diesel fuel.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The biogas generation system would be located near or adjacent to the Kodiak school.
2. Employment. No additional jobs are identified though one to two are likely, should the unit go into full production.
3. Community solutions. This system could generate additional energy from a municipal solid waste, at a small scale.
4. Improve existing energy system. The system could be integrated into the proposed school boiler replacement and provide dual-fuel capabilities.
5. Statewide Applicability. If successful, Alaska would benefit from small scale solid waste driven syngas units.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. School costs would be lowered and landfill life would be extended.

924 Seward Schools Biomass Heating System

Proposer: Kenai Peninsula Borough School District

Benefit/Cost Ratio: Applicant: **6.01**
AEA: **5.54**

Project Description

The Kenai School District will undertake final design and construction of a wood-fired hydronic heating system in three Seward schools (elementary, middle, and high school). The current request, based on two prior studies (pre-feasibility and reconnaissance), will implement:

- Phase III, Final design of a wood-fired hydronic heating system to heat the combined Seward High, Middle and Elementary School campus with woody biomass fuel
- Phase IV, Construction, Commissioning and Operation of the heating system and follow up reporting on operation and maintenance

Contribution to Lower the Cost of Energy

Total fuel oil displaced for the three schools is 120,600 gallons, based on two prior analyses and a series of heat loss calculations and actual experience.

Assumptions Modified

Both Applicant and AEA assumptions were modified:

1. The AEA spreadsheet and application instructions tell applicants to note Railbelt South or North. Railbelt South uses a formula for natural gas costs but there is no natural gas in Seward. The location was changed to North of Alaska Range to accept gallons of fuel oil displaced.

2. No current system repair or O&M costs are required, per instructions in the application. However, an AEA-R6 spreadsheet submitted with the application included $4,678 for major repairs and $9,356 for O&M, non-fuel and this supplied the needed numbers for annual repair and O&M costs.

3. Pellet costs, delivered at Seward, were increased from $300 per ton to $340 reflecting a recent sales transaction at Sitka, with barge delivery.

Concerns

No concerns are noted.

Possible Enhancements

None noted. The proposed Phase I and Phase II reports are well-thought out and address most common concerns and issues.

Long-term Sustainability

A long-term demand for wood pellets would help stabilize Alaska demand for bulk pellets and also provide demand for out of state pellets on a per-barge basis.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. Pellet storage and in-feed systems (silos appear most likely) would be needed.
2. Employment. No additional jobs are projected as current maintenance staff would meet system needs.
3. Community solutions. This system would reduce costs of heating three schools at Seward and have a broad community impact.
4. Improve existing energy system. The current system will be integrated into the proposed wood pellet system.
5. Statewide Applicability. A large wood-pellet system would provide operating costs and information to others in Alaska that are considering a similar conversion (or installation).
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. School costs would be lowered and a renewable resource would be put to productive use.

No. 925	Upper Tanana CHP Project Biomass

Proposer: Alaska Power and Telephone

Benefit/Cost Ratio: Applicant: **1.76** AEA1: **1.76** AEA2: **1.12** (preferred)

Project Description

The applicant is requesting $1,990,000 in state grants to complete a $2,050,000 Design and Permitting Phase of a $20.9 Million 2 MWe Combined Heat and Power biomass system. $60,000 in in-kind and direct services will be provided by APT. If constructed, the facility would be located in Tok, provide power used in the communities of Tok, Tanacross, Tetlin, and Dot Lake, and render the existing diesel fired generators as backup units.

Contribution to Lower the Cost of Energy

The electric system serving the four Interior Alaska communities is isolated from any large power grids. Heat and power in the area is estimated to annually consume 1 million gallons of fuel oil and 4,200 cords of wood. On page 14 of the application the applicant estimates the impact on consumer's to be negligible while on page 5 it estimates rates may be reduced by up to 25%.

By using local biomass as fuel, long term fuel cost stability can be obtained through long term contracts. On page 13 of the application it states that APT is in negotiations to finalize a 25 year contract with the State of Alaska Department of Natural Resources. Feedstock might also be obtained from standing dead trees from past and future wildfires in the area. Removing wildfire fuel on a preventative basis may allow for a very cost-effective biomass feedstock from state lands.

Final design will provide a better idea of costs relative to the existing liquid fuels systems for heat and power.

Assumptions Modified

AEA PM modified capital costs, O&M costs, biomass fuel costs, biomass fuel use, displaced electricity and displaced heating fuel for the AEA2 analysis.

Concerns

It is unclear which community(ies) will benefit from heat generated from the project, or whether the estimated capital costs include the investment necessary for heat distribution. The forthcoming Feasibility Study (due Nov 2012) should address the design and economic risk/reward factors at a high level necessary to review the prospects going forward.

Possible Enhancements

Review the Nov 2012 Feasibility Study to determine if updates to cost or benefit parameters are available. Clearly identify where the anticipated 90,000 gallons of heating fuel savings will occur. Provide a conceptual schematic of the power and heat displacement systems.

Long-term Sustainability

It appears sustainable biomass fuel is available in the region with proper rotation of fuel harvest. With long term contracts, price and availability stability can be ensured.

Potential Public Benefits

Lower emissions, lower costs for power and heat, less cash outflow from the community, economic development for a new industry in the area, economic development opportunities associated with lower energy costs.

926 AGSD District Heat Loop Project

Proposer: Alaska Gateway School District

Benefit/Cost Ratio: Applicant: **1.05**
AEA: **0.72**

Project Description

The Alaska Gateway School District (AGSD) Heat Loop Project is for Phase III Design and Phase IV Construction of a waste heat recovery application for AGSD's existing 5.5 MMBTU wood biomass energy facility. The project will recover waste heat which would otherwise be rejected and distribute it to ten (10) State-owned and Community building-clusters.

The district heat loop will directly replace heat from the existing fossil fuel heating systems, offsetting the equivalent of 49,100 gallons of #1 fuel oil per year. Heat customers will be charged for heat on a cost-based rate, and the hydronic heat sales are exempt from RCA regulations, according to the AGSD.

Over the 18-month project period, AGSD plans to explore various collaborative business structures with the local utility, Alaska Power & Telephone (AP&T) and other potential contractors to operate and maintain the heat loop. AGSD is prepared to independently operate and maintain the district heat loop, if necessary.

Contribution to Lower the Cost of Energy

Total fuel oil displaced for the linked buildings is 49,100 gallons per year, based on inventory and discussion.

Assumptions Modified

The applicant's assumptions were analyzed as presented, including a 27-year project life, generating a B/C ratio of 1.05. That assumption was changed to 20 years for the AEA analysis, generating a B/C ratio of 0.72.

Concerns

No concerns are noted.

Possible Enhancements

The applicant notes the possibility of revenue recovery from pricing biomass-based heat at a $1.50 per gallon fuel oil equivalent, along with a one-year incentive to entice more connections to the proposed heat loop. See page 12 of the application.

The School District states the Regulatory Commission of Alaska does not economically regulate hot-water loops, based on Aurora district heating in Fairbanks. Aurora's steam-heat loop rates are RCA-regulated while its three hot-water loops are not.

For this analysis, the avoided (displaced) cost of fuel oil was used without attempting to forecast how many users would connect, at what price, and at what rate. A more

secure contractual arrangement, especially with state and other government agencies, could change the economics of this application.

Long-term Sustainability

A long-term use for heat at Tok would aid both the School District as well as the potential system proposed by AP&T. At present, venting excess heat is necessary but still a loss of useful BTU's.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. A heat loop would contribute to the Tok community infrastructure.
2. Employment. No additional jobs are projected as current maintenance staff would meet system needs.
3. Community solutions. This system would reduce costs of heating for both the school (less biomass cost incurred with heat sales) and the community, especially nearby government buildings.
4. Improve existing energy system. The current system will be integrated into the proposed heat loop.
5. Statewide Applicability. The only known district heat loops in Alaska are at Fairbanks; this one, if successful, would suggest it could be a model for less dense areas in other communities.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. School costs would be lowered and a renewable resource would be put to productive use.

927 Galena Community Wood Heat Project

Proposer: City of Galena

Benefit/Cost Ratio: Applicant: **4.71**
AEA: **3.41**

Project Description

The City of Galena is requesting AEA Round 6 funding to provide a sustainable and predictable energy resource for its school district. The Galena Community Wood Heat Project will substantially reduce high costs for heat for the Galena Interior Learning Academy School (GILA) by utilizing woody biomass harvested and processed from local forests.

The project will implement Phase III Final Design and Phase IV Construction over a two-year period to install a biomass boiler system for the GILA campus.

Local coordination among the stakeholders group is strong, infrastructure and administrative resources are in place to support the project, and the Galena City School District has committed to purchasing the resulting heat. Existing Feasibility Studies and strategic community planning documents align with the project.

Contribution to Lower the Cost of Energy

Total fuel displacement, by biomass, is projected at 227,050 gallons; total consumption for the most recent year was 230,000 gallons. Biomass-fueled heat will not be able to displace all fuel oil needs.

Assumptions Modified

The applicant's assumptions were analyzed as presented, including a 25-year project life, generating a B/C ratio of 4.71. That assumption was changed to 20 years for the AEA analysis, generating a B/C ratio of 3.41.

Concerns

No concerns are noted beyond those voiced by the applicant's consultants related to geographic isolation, lack of roads and forest infrastructure, and the need for coordination among the City, Village Corporation, and government land owners. These are well addressed in the supporting documents.

Possible Enhancements

The applicant's contractors addressed a number of enhancements, including warm storage for equipment and biomass storage, along with advance planning for biomass delivery.

Long-term Sustainability

The unique characteristics of the Galena steam heat loop provide a first-rate opportunity for biomass to step-in and demonstrate its use for heating. Addressing this critical energy

need, along with the on-going maintenance of the current pumps and piping, will sustain both the school and the City over the long-term.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. Biomass heating in the only addition to current infrastructure.
2. Employment. The applicant estimates a 0.5 FTE for project management, during construction and start-up.
3. Community solutions. This system would reduce costs of heating for both the school and the community, especially nearby buildings.
4. Improve existing energy system. The current system will be integrated into the existing heat loop.
5. Statewide Applicability. This is the only known existing heat loop with biomass potential in a rural setting.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. School costs would be lowered and a renewable resource would be put to productive use.

No. 928 Bathymetric Survey Ouzinkie Kodiak Inter Tie

Proposer: City of Ouzinkie

Benefit/Cost Ratio: Applicant: **1.04** AEA: **1.04**

Project Description
The applicant is requesting $356,400 in state grants to complete a $431,400 bathymetric survey and marine geological study to determine the optimal route for a submarine cable connecting Ouzinkie to the Kodiak Electric grid. The work will assess the underwater structures in the channel between Kodiak Island and Spruce Island where Ouzinkie is located.

Contribution to Lower the Cost of Energy
The electric system serving Ouzinkie consists of 3 diesel generation units with a combined capacity of 335 KW plus one 125 KW hydro unit. According to the application Ouzinkie residents use 700,000 KWH annually. Diesel generation consumes 30,000 gallons of liquid fuel each year and operations and maintenance expenses total $340,000. Much of the O&M expenses may be one-time expenses attributable to a collapsing wooden dam that allows the hydro unit to continue to work while dam replacement moves forward. Displacing all of the fuel ($4.70 per gallon according to the application) would save $141,000 per year.

Local O&M expenses ($0.49/KWH currently) would be reduced to minimal levels – enough to cover maintenance of the small hydro facility. The b/c analysis assumes a net O&M reduction of 70% after maintenance on the transmission line becomes a part of Kodiak Electric Association's normal operations. Combined fuel and net O&M reductions amounts to $240,000 per year, or $0.34/KWH at present consumption levels.

It should be noted that the actual impact to overall operating costs is more of an educated guess than definitive review of lifecycle costs. No review of the impact on O&M costs is provided in the application even though that is a greater cost per unit of energy output than fuel. If O&M cost savings are not ultimately achievable, it is likely that the b/c ratio will fall below 1.0.

Assumptions Modified
None.

Concerns
The impact of O&M costs on life cycle costs of the Inter Tie is unclear. Since this is such a large part of current operations, and costs per unit of energy, the resulting economic analysis could vary considerably.

Possible Enhancements
Obtain a reasonable estimate of the net change in O&M costs that will result once the Inter Tie becomes operational.

Long-term Sustainability
Once the Inter Tie is in place electric rates in Ouzinkie should be significantly reduced, allowing the community to take advantage of Kodiak Electric Association's diverse mix of renewable energy resources. This situation should remain indefinitely.

Potential Public Benefits

Lower emissions, lower costs for power, less cash outflow from the community, economic development opportunities associated with lower energy costs, economic development opportunities associated with a reliable source of power.

No. 929	Waterfall Creek Run of River Hydroelectric Project

Proposer: City of King Cove, Waterfall Creek

Benefit/Cost Ratio: Applicant, as shown on paper application: 3.3
Applicant as calculated by economist on applicant worksheet in model, three potential flow scenarios: App B/C of 2.36 (if 1.2GWh is permitted); App (2)B/C 2.11 (if .95GWh is permitted); App3 B/C 1.87 if (1.07GWh is permitted);
AEA worksheet: B/C 2.16 (assuming "unofficial" permit decision of .95GWh)

Project Description
The applicant is requesting funds for project construction and commissioning of a run of the river hydroelectric project on Waterfall Creek to serve the King Cove community. King Cove is located south west Alaska, on the south side of the Alaska Peninsula in the Aleutians East Borough. They are requesting $2.6M from AEA FY13, $200k from the Aleutians East Borough, $1M from the State Power Project Fund, and will expend an already confirmed FY13 AEA energy Fund #5 grant for $200k and a confirmed $300k City of King Cove local match. Total Project cost is estimated to cost $4.3M.

Contribution to Lower the Cost of Energy
Electricity supply to King Cove is produced using diesel fuel via diesel generators and by the Delta Creek hydro facility, all part of King Cove Electric Utility. The current price of diesel fuel is per gallon $3.87 (per the application) and $3.85 per gallon (per ISER). The use of expensive diesel fuel in King Cove results in an electrical rate of as much as $0.54 per. If constructed, the Waterfall Creek Hydroelectric project would reduce electricity by $.02 per kWh for all utility customer classes. Part of the reduction in kWh costs is due to quicker debt servicing using revenues of Waterfall Creek power sales to Peter Pan Seafood (PPSF), between .5-1GWh.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Construction schedule.** The hydro project is assumed to come on-line in 2014. The permitting and final design is already in process. Applicant has experience with run of river hydro, and because the powerhouse already exists from the Delta Creek project, the city should be able to make their 2014 projection with only small expansion of the powerhouse. Also, the city's relationship with HDR has continued from Delta Creek through the feasibility, design, and now construction process. This is not a new partnership, but an established long term relationship.
- **Fuel oil costs.** The economist used the ISER fuel oil estimate of $3.85 per gallon in 2012 and the applicant indicated that fuel oil was $3.87 per gallon in the grant application, nearly identical.
- **Stream Flow.** As indicated in the Project Concept Design Report, the project has begun the permitting process, initial ADF&G and ADNR permit concerns reduced flow by .5cfs and energy output to 1,200,000kWh (from 1.4GWh). To obtain a Title 41permit (fish habitat) an additional .5cfs reduction will be required, reducing output to 1,070,000kWh. As of 9/20/2012, the City was "unofficially" informed that ADF&G will require a 1.5cfs reduction a Title 41permit, reducing the energy output of the system from 1.07GWh to .095GWh. The city is contesting the permit restrictions and believes

the project will produce 1.2GWh; applicant may want us to revisit their project after a final permitted flow rate is set.

Concerns

- **Will the applicant's appeal for higher flow permit be accepted?** The applicant received a lower (.5cfs) permitting level for Waterfall Creek than applicant listed in grant request, but did provide the lower flow data. The lower flow would reduce the displaced annual kWh to 1,070,000/year. The economist kept the higher flow assumptions for the applicant portion, and the lower, currently permitted flow number for the AEA.
- **PPSF Memorandum of Understanding (MOU) and Private Industry Benefit.** The applicant attached an MOU with PPSF to purchase "excess" power from the expected Waterfall Creek Hydro project. The understanding is that power would be sold only for non-fish processing needs of the factory workers. However, PPSF is offering no money or matching grants to the project, and will receive a benefit through freed up loads formerly used for workers kitchen, laundry, store, Anchor Inn dormitories and housing, and other non-process loads (up to .8GWh annually). The MOU is non-binding, neither party must purchase.

- **Is there demonstrated site control?** The project requires a real estate purchase of $100,000 for the project from King Cove Village Corporation; applicant attached a letter of support for the village corporation. Twenty acres of land will be purchased in total.

- **Will the project trigger FERC review?** The applicant does not indicate that the project will fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC). However, the applicant does not mention whether a Declaration of Intention to FERC has been made.

- **O&M costs.** Applicant reports debt service and annual costs, but not any scheduled maintenance costs.

Possible Enhancements / Recommendations

- **Power Purchase Agreement with PPSF.** Rather than a non-binding MOU, a purchase agreement could be in place, or at least some in kind support from PPSF could be outlined. PPSF is the cities largest employer, and while benefits to both entities will be shared and affect residents, some support or match could be reasonable from an entity that has so much to gain from public infrastructure dollars.

- **Long-term Sustainability.** The project at the higher flow rate could produce all power needed by PPSF and the city for six months out of the year, reducing air pollution and lower cost of power for all classes of rate payers.
- **Management structure appears adequate.** Because the hydro project will be owned and operated by King Cove, which currently provides electricity to King Cove, there are no issues associated with insuring that an entity receives Independent Power Provider status. King Cove currently has the proper permits from the State RCA to operate a utility in King Cove. This management structure assists in ensuring the long terms sustainability of the project. The King Cove City Administrator will be the project manager on the project, so a local and long-term city official will ensure project success.

Potential Public Benefits

- **Less expensive electricity**. The project could provide lower cost (a $.02kWh reduction) electricity to commercial buildings and community facilities if capital construction is funded through grants.

- **Reduction in diesel fuel use.** The project would reduce the amount of diesel consumed, which has the benefit of reducing costs and potential environmental impacts from the use of (and transport) diesel. Provides cleaner air by reducing public energy usage, industrial usage, and emissions.

No. 930 Allison Creek Project

Proposer: Copper Valley Electric Association

Benefit/Cost Ratio: Applicant: **4.10** AEA: **4.10**

Project Description
The applicant is requesting $6,114,000 in state grants, to be matched by a cash contribution from CVEA, to reduce the net cost to the utility of completing the $38.8 Million 6.5 MW Allison Creek diversion hydro project. While the project is estimated to be able to produce 23.3 GWH annually, initially the CVEA system is expected to utilize 16 GWH.

Contribution to Lower the Cost of Energy
CVEA consumer electric rates to consumers are very high relative to many major cities in Alaska. The utility's blended cost of power has risen from 11.59 cents/KWH in 2009 to 18.24 cents/KWH in 2011. This increase is almost entirely explained by increases in the cost of diesel fuel used to provide over 20% of CVEA power. Completion of the project will allow displacement of 1.2 million gallons of fuel per year, reducing annual fuel costs by over $4 Million when liquid fuel cost $3.50/gallon.

After accounting for construction, financing and operating costs, CVEA estimates inception year costs of 15.93 cents/KWH compared to diesel fuel costs of $0.27/KWH. As sales growth occurs, and the additional output (i.e. from 16 GWH/yr to 23 GWH/yr) from Allison Creek absorbed into the generation mix, further reductions in per unit operating costs should occur, bringing down the overall cost of power paid by customers.

Assumptions Modified
None.

Concerns
The estimated cost of this project was developed based on 2010 dollars by Hatch Acres Corp. Commodity, freight, equipment and material costs may have changed significantly from the time of initial estimate to the time of bidding the final design and construction contracts. Other projects around the state have seen costs increase as much as double when moving into that phase. Should costs differ markedly from those in the application, the final financing plan may be more difficult to arrange and/or the economics might be less compelling.

While a FERC license application was submitted in August, 2011, no FERC license has been issued. The applicant estimates it will be received by the end of February, 2013. Any delays in securing the license - additional studies needed, turnaround time at FERC, etc. – could negatively impact the economic benefits associated with the project by delaying construction permits or causing design modifications.

Even though the cost of power from the project is substantially lower than diesel costs, at 16 cents a KWH it is still relatively expensive, which will serve to dampen demand. If loads fail to grow – due to economic conditions, conservation/efficiency measures, the availability of distributed generation alternatives, etc. – the community could experience increasing costs as debt service on the facility overtakes its benefits.

Possible Enhancements

Determine if it is possible to make an estimate of how design and construction costs have changed since 2010 to get an up-to-date sense of the economic payback for the project.

Long-term Sustainability

Adding additional hydroelectric capacity and diversity in the Valdez area energy supply picture will encourage long term commercial development and add to the sustainability of the local economy.

Potential Public Benefits

Lower emissions, lower costs for power, less cash outflow from the community, diversity of supply helps everyone deal with emergencies.

931 Nenana Collaborative Biomass Heating System Project

Proposer: Nenana City School District
Partners: City of Nenana, Nenana Native Council

Benefit/Cost Ratio: Applicant: **2.79**
AEA: **2.02**

Project Description

The School District proposes a heat distribution loop, connecting several nearby buildings with a wood fired district heating system. The buildings for the City of Nenana include the Water Plant and the Fire Department. The building included for the Nenana Native Council is the Youth Educational Resource Center (YERC), which houses the Early Learning, Head Start, and Youth Center programs.

The school district buildings included in the project are the Nenana City Public School, the Administration Building, the Warehouse/Vocational Education Building, and the Nenana Student Living Center.

Contribution to Lower the Cost of Energy

Total fuel displacement, by biomass, is projected at 87,800 gallons times 85% or 74,630 gallons.

Assumptions Modified

Applicants correctly noted Nenana was in the Railbelt and omitted certain O&M costs. These were estimated for both Application and AEA as follows:

1. Renewable O&M – total less fuel of $50,035, Applicant stated $63,060 on page 22 of master application. Former figure had superior detail and was used.
2. Estimated repairs of current system: projected at 1% of fuel or $3,161 per year.
3. Estimated O&M (non-fuel) for new system, 3% of fuel or $9,482 per year.
4. Estimated repairs for new system, 1% of CAPEX or $34,735 per year.
5. Applicant project life reduced from 30 years to 20 years for AEA analysis.

Concerns

During design, wood pellets, at an estimated $325 per ton (delivered) may be more efficient than wood chipping.

Possible Enhancements

None noted; applicant's contractors did due diligence.

Long-term Sustainability

The use of either wood chips or wood pellets would enhance both the forests in the Interior as well as provide three organizations at Nenana with lower fuel costs.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The district heat loop and heating unit will be added.
2. Employment. No additional FTEs are forecasted.
3. Community solutions. This system would reduce costs of heating for both the school and the community, especially buildings for the three partners and perhaps others as costs to connect are developed.
4. Improve existing energy system. The existing heating system will be used for peaking and as a standby.
5. Statewide Applicability. This would apply across most parts of Alaska with those in similar conditions having the most applicability.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. School, City, and Tribal Council costs would be lowered and a renewable resource would be put to productive use.

932 Design and Construction of Biomass Systems in Interior Villages

Proposer: Interior Regional Housing Authority, Fairbanks

Benefit/Cost Ratio: Applicant: **1.47**
AEA: **1.90**

Project Description

This project will design and construct wood heating systems in three Interior Alaska rural communities; the selected communities will be drawn from those with current (completed) feasibility assessments, or those with future feasibility assessments, should additional studies be funded.

Contribution to Lower the Cost of Energy

Total fuel displacement, by biomass, varies from village to village and from simple installation to more complex district heating loops. See Assumptions Modified below, discussed with AEA engineers, analysts.

For this prototype, 21,736 gallons of displaced fuel were selected, based on Huslia's July 2011 submission. This estimate included a water plant, washeteria, and a near-by clinic.

Assumptions Modified

Applicants submitted a request in total for three villages. Following discussion with AEA, a simple candidate system (prototype) was developed from existing feasibility reports and, more importantly, from actual biomass experience in similar conditions (especially the City of Tanana).

1. Capital cost. A candidate capital cost of $474,000 (rounded) represents a single community.
2. Fuel. An average of 254 cords per year for a Garn system was used for analysis, based on July 2011 figures from Huslia.
3. Fuel cost. $350 per cord. This is likely an upper limit.
4. O&M, non-fuel. A Garn-type unit includes $12,200 (rounded) per year, based on chemicals, gaskets, fan-power, and labor, at 600 hours per year (2 firings per day, 300 days) and $18 per hour. These are based on engineering estimates for Nulato, from Dalson Energy.
5. AEA assumptions reduced biomass volumes slightly (to 250 cords) and used a price of $300 per cord, reflecting larger purchases and greater operator efficiency.

Concerns

The actual selection of the three candidate villages will be based on community-specific fuel cost projections (from ISER), gallons displaced, and volume and cost of delivered biomass. This analysis draws from several sources for the communities represented in the application.

Possible Enhancements

A community-specific analysis, with a B/C of at least 1.25, is suggested for minimum consideration under AEA's guidelines. For remote rural Alaska communities, the gallons of fuel oil displaced is a critical variable, perhaps the most significant.

Long-term Sustainability

Local purchases of biomass would benefit communities by buying local and enhancing both the economic condition of the area, but also lead to lower costs, as vendors operate more efficiently.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. Biomass plants require both enclosed and open structures.
2. Employment. No additional FTE's are forecasted in this generic prototype.
3. Community solutions. This system would reduce costs of heating for schools (if considered practical) and the community, especially public buildings such as washeterias and clinics.
4. Improve existing energy system. The existing heating system will be used for peaking and as a standby.
5. Statewide Applicability. This would apply across most parts of Alaska with those in similar conditions having the most applicability.
6. Long term sustainability. See the above paragraph on LT sustainability.
7. Other public benefits. School, City, and Tribal Council costs would be lowered and a renewable resource would be put to productive use.

933 Biomass Feasibility Studies in Public Facilities, Interior Region

Proposer: Interior Regional Housing Authority, Fairbanks

Benefit/Cost Ratio: Applicant: **1.05**
AEA: **1.43**

Project Description

This project will fund feasibility assessments and forest inventories in the communities of Alatna, Allakaket, Northway, Grayling, Shageluk, Beaver and Stevens Village. All communities are located in the Interior/Doyon Region of Alaska.

Three of these seven villages (Stevens Village, Beaver, Northway) conducted preliminary feasibility studies in 2008, with recommendations for more specific detail on heat demand, forest resource, and projected costs. These are included in this application.

For the other four villages, IRHA proposes to contract for a feasibility analysis, along with a contract with Tanana Chiefs Conference forestry department for a forest inventory and wood harvest plan.

Contribution to Lower the Cost of Energy

Total fuel displacement, by biomass, varies from village to village and from simple installation to more complex district heating loops.

See Assumptions Modified below, discussed with AEA engineers, analysts.

For this prototype, 21,736 gallons of displaced fuel were selected, based on Huslia's July 2011 submission. This estimate included a water plant, washeteria, and a near-by clinic. As such, these conditions may reflect a better-than-average situation, with refinements following actual project work for the villages proposed by IRHA.

Assumptions Modified

Applicants submitted a request in total for all seven villages. Following discussion with AEA, a simple candidate system (prototype) was developed from existing feasibility reports and, more importantly, from actual biomass experience in similar conditions (especially the City of Tanana).

1. Capital cost. A candidate capital cost of $474,000 (rounded) represents a single community.
2. Fuel. An average of 254 cords per year for a Garn system was used for analysis based on July 2011 figures from Huslia.
3. Fuel cost. $350 per cord. This is likely an upper limit.
4. O&M, non-fuel. A Garn-type unit includes $12,200 (rounded) per year, based on chemicals, gaskets, fan-power, and labor, at 600 hours per year (2 firings per day, 300 days) and $18 per hour. These are based on engineering estimates for Nulato, from Dalson Energy.
5. AEA assumptions reduced biomass volumes slightly (to 250 cords) and used a price of $300 per cord, reflecting larger purchases and greater operator efficiency.

Concerns

The proposed work entails, by its nature, an evaluation of the factors and costs for each of the seven villages. No specific concerns were noted, other than those voiced by IRHA.

Possible Enhancements

A community-specific analysis, with a B/C of at least 1.25, is suggested for minimum consideration under AEA's guidelines. For remote rural Alaska communities, the gallons of fuel oil displaced is a critical variable, perhaps the most significant, assuming costs projected as state by ISER.

Long-term Sustainability

Local purchases of biomass would benefit communities by buying local and enhancing both the economic condition of the area, but also lead to lower costs, as vendors operate more efficiently.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. Biomass plants require both enclosed and open structures.
2. Employment. No additional FTE's are forecasted in this generic prototype.
3. Community solutions. This system would reduce costs of heating for schools (if considered practical) and the community, especially public buildings such as washeterias and clinics.
4. Improve existing energy system. The existing heating system will be used for peaking and as a standby.
5. Statewide Applicability. This would apply across most parts of Alaska with those in similar conditions having the most applicability.
6. Long term sustainability. See the above paragraph on LT sustainability.
7. Other public benefits. School, City, and Tribal Council costs would be lowered and a renewable resource would be put to productive use.

934 Savoonga Heat Recovery System – Power Plant to Water Plant

Proposer: City of Savoonga

Benefit/Cost Ratio: Applicant: **2.21**
AEA: **1.62**

Project Description

Currently, AVEC is not utilizing either the jacket heat from its diesel engines or the heat generated by the electric boiler installed to dispose of excess wind energy. This project would recover heat from both sources at the AVEC plant and send that heat to the water treatment plant to heat the building, the circulating water loops, and the water storage tank. The AVEC power plant and the Savoonga water treatment plant are located next to each other in Savoonga.

A feasibility study has been done for this project; the design has been completed; and a construction cost estimate has been prepared. Funds are being requested for construction only.

Contribution to Lower the Cost of Energy

All oil must be barged into Savoonga during the summer months. The impact of this project will be to reduce the overall use of oil in the City of Savoonga by approximately 8,800 gallons per year. This reduction will not change the price of oil in Savoonga, but it will reduce the community's consumption of oil, replacing that consumption with a combination of jacket heat from the diesel engines and excess wind energy from the AVEC power plant.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system. The AEA analysis used a 20-year life based on the AEA standard.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler in addition to maintenance costs for the proposed heat recovery system.

Concerns

None noted.

Possible Enhancements

The heat available from the power plant significantly exceeds that required by the water treatment plant, as indicated by the attached feasibility analysis. Additional uses for excess heat may be identified.

Long-term Sustainability

Installing the necessary heat exchangers, piping, pumps, and controls necessary for implementation has been done many times before and proven effective for many years.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The cooling loop exists in the AVEC plant and the recovered heat will be delivered to the water treatment plant through a series of heat exchangers and new piping between the buildings. Heat exchangers, piping, pumps, and controls will be installed as necessary.
2. Employment. No effect on employment is noted in the application. ARUC and AVEC employees are capable of operating and maintaining the heat recovery system.
3. Community solutions. The project would provide heat used by the water treatment plant to heat the building, circulating water loops, and water storage tank.
4. Improve existing energy system. The recovered heat available from the power plant is in excess of that used by the water treatment plant. Therefore, the optimum installed capacity is already available.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraphs on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

935 Atmautluak Washeteria Heat Recovery Project

Proposer: Atmautluak Traditional Council

Benefit/Cost Ratio: Applicant: **1.49**
AEA: **1.10**

Project Description

This project will provide waste heat from the existing electrical power plant to the washeteria. Waste heat infrastructure will include waste heat transmission lines and upgrades necessary in the power house and washeteria.

Contribution to Lower the Cost of Energy

Heating oil must be barged in during the summer months. The impact of this project will be to reduce the overall use of heating oil by approximately 4,395 gallons per year; the washeteria currently uses 4,800 gallons of fuel oil annually for its operation. While this reduction will not change the price of oil in Atmautluak, it will significantly reduce the community's consumption of oil, replacing oil demand with otherwise wasted heat from the power plant diesel engines' cooling system.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system. The AEA analysis used a 20-year life based on the AEA standard.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler in addition to maintenance costs for the proposed heat recovery system.

Concerns

None noted.

Possible Enhancements

None noted. There is sufficient recovered heat available to heat only the community washeteria.

Long-term Sustainability

This project increases the sustainability of the water treatment plant and washeteria by reducing its operating cost. The minimal maintenance and operating cost can be funded out of its revenue stream and out of its savings over the life of the project.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. Waste heat infrastructure will include waste heat transmission lines and upgrades necessary in the power house and washeteria.
2. Employment. No effect on employment is noted in the application.

3. Community solutions. The washeteria benefits all the residents of Atmautluak, AK, but the cost of energy to operate the facility threatens its sustainability. This project is expected to reduce the fuel oil usage of the facility, nearly offsetting the total fuel usage.
4. Improve existing energy system. The recovered heat available from the power plant is in excess of that used by the washeteria. Therefore, the optimum installed capacity is already available.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraphs on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

936 Heat Recovery for the Water System

Proposer: City of Chuathbaluk

Benefit/Cost Ratio: Applicant: **0.92**
AEA: **0.71**

Project Description

This project will provide waste heat from the existing electrical power plant to the water system. The estimated fuel oil savings to the community water plant is projected to be 1,400 gallons of heating oil per year, out of the current consumption of 1,834 gallons.

Contribution to Lower the Cost of Energy

Heating oil must be barged in on the Kuskokwim River, during summer months. The impact of this project will be to reduce the overall use of oil by approximately 1,400 gallons per year. While this reduction will not change the price of oil in Chuathbaluk, it will significantly reduce the community's consumption of oil, replacing that consumption with jacket heat from the diesel engines.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system. The AEA analysis used a 20-year life based on the AEA standard.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler in addition to maintenance costs for the proposed heat recovery system.

Applicant notes that the construction cost is escalated 3% annually. The AEA analysis adjusted costs to 2012 dollars.

Concerns

The city has not yet signed a Heat Sales/Right-of-Entry Agreement with Middle Kuskokwim Electric to define the parties' responsibilities, detail the cost of recovered heat, and authorize the connection to the power plant heat recovery equipment. However, a detailed heat recovery study has been completed to support the technical feasibility of the project.

Possible Enhancements

None noted. The applicant does not specify if additional heat would be available for other uses.

Long-term Sustainability

Installing the necessary heat exchangers, piping, pumps, and controls necessary for implementation has been done many times before and proven effective for many years.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The currently unused glycol heat trace system can be modified to recover heat from the power plant and can be used to heat all three community circulating lines and the WST. The glycol heat trace system was not designed for heat recovery and will require new controls and installation of new heat transfer equipment, including controls, additional piping, and a heat exchanger for the WST. The recovered heat is transferred via below-grade arctic piping to the water system.
2. Employment. No effect on employment is noted in the application.
3. Community solutions. The water system benefits all the residents of Chuathbaluk, AK; however, the cost of energy to operate the facility threatens its sustainability. This project is expected to reduce the fuel oil usage of the facility by 1,400 gallons per year, nearly offsetting the total fuel oil usage.
4. Improve existing energy system. Although the existing boilers would still be considered the primary heat source, the heat recovery system will be capable of providing all of the heat. The boilers will continue to fire if the heat recovery fails for any reason.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraphs on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

937 Heat Recovery for the Water Treatment Plant and Washeteria

Proposer: Native Village of Kwinhagak

Benefit/Cost Ratio: Applicant: **2.48**
AEA: **1.96**

Project Description

This project will provide waste heat from the existing electrical power plant to the washeteria and combined utility building. The estimated fuel oil savings to the combined utility building and washeteria is projected to be 14,200 gallons of heating oil per year.

Contribution to Lower the Cost of Energy

Heating oil must be barged in during the summer months. The impact of this project will be to reduce the overall use of oil by approximately 14,200 gallons per year. While this reduction will not change the price of oil in Kwinhagak, it will significantly reduce the community's consumption of oil, replacing that consumption with jacket heat from the diesel engines and, potentially, excess wind energy in the future.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system. The AEA analysis used a 20-year life based on the AEA standard.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler in addition to maintenance costs for the proposed heat recovery system.

Applicant notes that the construction cost is escalated 3% annually. The AEA analysis adjusted costs to 2012 dollars.

Concerns

A Heat Sales/Right-of-Entry Agreement will be required between AVEC and the end users to define the parties' responsibilities, detail the cost of recovered heat, and authorize the connection to the power plant heat recovery equipment. However, a detailed heat recovery study has been completed to support the technical feasibility of the project.

Possible Enhancements

The system could be extended, potentially, to excess wind energy in the future.

Long-term Sustainability

This project increases the sustainability of the water treatment plant and washeteria by reducing its operating cost. The minimal maintenance and operating cost can be funded out of its revenue stream and out of its savings over the life of the project. Installing the necessary heat exchangers, piping, pumps, and controls necessary for implementation has been done many times before and proven effective for many years.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The existing combined utility building provides heat to the circulating water lines and heat to one of the WSTs. The system was not designed for waste heat and will require controls and installation of new heat transfer equipment, including a new heat exchanger and new circulating pumps.
2. Employment. No effect on employment is noted in the application.
3. Community solutions. The combined utility building and washeteria benefit all the residents of Quinhagak, AK; however, the cost of energy to operate the facilities threatens their sustainability. This project is expected to reduce the fuel oil usage of the facility by 14,200 gallons per year, nearly fully offsetting the fuel oil usage.
4. Improve existing energy system. Although the existing boilers will be maintained and are actually the primary heating source in the water treatment plant and washeteria, their use is to be greatly curtailed.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraphs on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

No. 938	Feasibility Study and Conceptual Design of Tenakee Inlet Geothermal Resource

Type: Geothermal

Proposer: Inside Passage Electric Cooperative

Benefit/Cost Ratio: Applicant: **1.06** AEA: **0.38**

Project Description

This project proposes to investigate further the geothermal resource at Tenakee Inlet primarily for producing electrical power to be used by the community of Hoonah and possibly other communities on Chichagof Island. A reconnaissance study of this resource was funded previously and is expected to be complete in June 2013. This project will continue that work by drilling one to two slim holes for more detailed investigation of the resource, by conducting a feasibility analysis, and by developing a conceptual design for the project.

Contribution to Lowering the Cost of Energy

This project will nearly eliminate the use of diesel generation in the community of Hoonah, thereby saving diesel fuel costs and diesel O&M costs. The project could also substantially reduce the oil heat in Hoonah by substituting electric heat powered by the geothermal plant. All of these savings are offset by the cost of building and operating the geothermal plant and associated facilities.

Assumptions Modified

The applicant's analysis of the benefits and costs of the project utilize a $27 million capital cost for the project. This does not includes capital for building and improving roads to access the project, which is approximately 32 road-route miles from Hoonah. Nor does the $27 million figure include money for a transmission line to deliver the power. The AEA scenario adds $78 million to cover those additional road and transmission line costs.

The applicant's economic analysis assumes that 8.2 cents per kWh of diesel O&M will be avoided by the project. For the AEA scenario, the default 2 cent/kWh variable diesel O&M avoidance was used. Because of possible outages of the geothermal plant and associated transmission line, the Hoonah diesel plant will need to remain ready for service during geothermal outages.

Although mentioned in the application, the applicant did not include any benefit for avoidance of oil use for space heating in Hoonah. The proposed plant size of 5 MW is sufficient to meet all space heating needs in Hoonah via electric heat. In the AEA scenario, this benefit was included along with the relatively small capital cost required to realize the benefit.

In the economic analysis provided by the applicant, $200,000 of revenue from greenhouses per year was included as a benefit. If greenhouse benefit were to be included, it should be entered as the net benefit after subtracting greenhouse costs. Due to the relatively small level of the net benefit and due to its speculative nature, it was not included in either the Applicant or the AEA models.

The applicant included a very large carbon credit benefit in the economic analysis they provided. However, that benefit was erroneously calculated based on continual operation of the plant at full output. Since the economic model already includes some carbon benefit in the fuel price used in the model, no additional carbon avoidance benefit was included in either the Applicant or AEA model.

Concerns

This analysis assumes that if the geothermal project is not built, Hoonah electric generation will continue to be provided entirely by diesel. However, the "Concept Design Report and Construction Cost Estimate for Energy Projects in the Community of Hoonah" prepared for the AEA in 2009 shows three potential hydroelectric projects for the community of Hoonah, which appear to be cost effective. This geothermal project should really be compared against a base case where these hydroelectric projects are built; doing so would lower the benefits of the geothermal project.

Increased energy efficiency efforts in Hoonah would reduce the benefits of this geothermal project.

There is substantial uncertainty in the cost estimates for developing the resource, which could either negatively or positively affect the economics.

Potential Enhancements

If a road were built between Hoonah and Pelican, the cost of developing this project would drop substantially, improving the economics.

The AEA analysis includes the cost of building a road to this project, but no non-energy benefits of the road were included. However, we used the low end of the road cost range per mile estimated by the Alaska Department of Transportation. In addition, we did not include road maintenance costs as part of the project O&M costs.

Benefits from greenhouse or resort developments associated with the geothermal resource could add additional benefit to this project.

Long-Term Sustainability

The project replaces a fuel source with substantial price volatility with one having relatively stable ongoing costs. Although the AEA default assumption of geothermal plant life is 20 years, the Geyers geothermal plant in a California has operated for more than 50 years, although not at peak production.

Potential Public Benefits

As mentioned above, the roads built for this project could have public benefits. Construction of the plant and associated facilities costing approximately $108 million will create a substantial number of temporary jobs. Operation and maintenance costs for the plant are $260,000 per year, and some of that cost will be labor, providing jobs for local residents. By adding an additional generating source to the Hoonah power generation system, more backup capacity will be available, improving the reliability of the system. Because of the few geothermal plants in Alaska (currently one), an additional plant will provide additional Alaska-specific information regarding this energy technology.

939 Stebbins Heat Recovery Project

Proposer: Alaska Village Electric Cooperative, Inc.

Benefit/Cost Ratio: Applicant: **4.28**
AEA: **3.38**

Project Description

This project will provide recovered heat from the new AVEC power plant to the new water treatment plant (WTP), existing WTP, washeteria, clinic, Head Start Building, and school. The estimated fuel reduction for the six buildings combined is estimated to be 57,000 gallons a year.

Contribution to Lower the Cost of Energy

Heating oil must be barged in during the summer months. The impact of this project will be to ultimately reduce the overall use of oil by approximately 57,000 gallons per year. While this reduction will not change the price of oil in Stebbins, it will significantly reduce the community's consumption of oil, replacing that consumption with recovered heat from the diesel engines and, potentially, excess wind energy in the future.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system. The AEA analysis uses a 20-year life based on the AEA standard.

Applicant notes that the construction cost is in 2014 dollars. The AEA analysis uses costs adjusted to 2012 dollars using the heat recovery study's stated 3% escalation rate.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler in addition to maintenance costs for the proposed heat recovery system.

Concerns

A Heat Sales/Right-of-Entry Agreement will be required between AVEC and the end users to define the parties' responsibilities, detail the cost of recovered heat, and authorize the connection to the power plant heat recovery equipment. However, a detailed heat recovery study has been completed to support the technical feasibility of the project.

Possible Enhancements

The energy resource available is the heat from the water jackets on the power plant engines. The heat available from the power plant significantly exceeds that required by the new and existing WTPs, washeteria, clinic, Head Start Building, and school most of the year. The application does not address the remaining heat resource, which could potentially be used for other purposes.

The applicant also notes that this technology could be extended, potentially, to excess wind energy in the future.

Long-term Sustainability

Currently, the cost of energy to operate the six community facilities threatens their sustainability. This project increases the sustainability of these facilities by reducing fuel consumption over the life of the project. The minimal maintenance and operating cost can be funded out of its own revenue stream and out of its savings over the life of the project. Installing the necessary heat exchangers, piping, pumps, and controls necessary for implementation has been done many times before and proven effective for many years.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The project will install new heat exchangers, piping, pumps, and controls necessary for implementation.
2. Employment. No effect on employment is noted in the application.
3. Community solutions. The project benefits all the residents of Stebbins, AK by reducing the fuel oil usage and cost to operate six community facilities.
4. Improve existing energy system. The existing boilers will be maintained in the six facilities as primary heat, although they are not expected to be needed when recovered heat is available.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the paragraph above on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

940 Heat Recovery for the Water Treatment Plant and Community Store

Proposer: City of Marshall

Benefit/Cost Ratio: Applicant: **4.61**
AEA: **3.64**

Project Description

This project will provide waste heat from the existing electrical power plant to the water treatment plant and village store. The estimated fuel oil savings to these two facilities is projected to be 7,700 gallons of heating oil per year.

Contribution to Lower the Cost of Energy

All heating oil must be barged in during the summer months. The impact of this project will be to reduce the overall use of oil by approximately 7,700 gallons per year. While this reduction will not change the price of oil in Marshall, it will significantly reduce the community's consumption of oil, replacing that consumption with recovered heat from the diesel engines.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system. The AEA analysis uses a 20-year life based on the AEA standard.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler in addition to maintenance costs for the proposed heat recovery system.

Applicant notes that the construction cost is escalated 3% annually. The AEA analysis uses costs adjusted to 2012 dollars.

Concerns

A standard Heat Sales Agreement will need to be executed between the power company and the City of Marshall to define the terms and methods for heat sales. However, a heat recovery study supports the technical feasibility of the new system.

Possible Enhancements

The heat available from the power plant significantly exceeds that required by the water treatment plant and store for the entire year. As a result, additional demand and/or facilities may eventually be able to benefit from the remaining heat resource.

Long-term Sustainability

This project increases the sustainability of the water treatment plant and village store by reducing their combined operating cost. The minimal maintenance and operating cost can be funded out of their revenue stream and their savings. Installing the necessary heat exchangers, piping, pumps, and controls necessary for implementation has been done many times before and proven effective for many years.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The existing power plant was modified in 2007 for heat recovery and has a brazed plate heat exchanger already installed. The existing heat recovery controls and piping need to be upgraded to prevent excessive pressure drop through the cooling system and the cooling system needs to be insulated. No other work is required to incorporate heat recovery.
2. Employment. No effect on employment is noted in the application.
3. Community solutions. The water treatment plant and village store benefit all the residents of Marshall, AK; however, the cost of energy to operate them threatens their sustainability. This project is expected to reduce the fuel oil usage of the facilities by 7,700 gallons per year, fully offsetting their current fuel oil usage.
4. Improve existing energy system. Although the existing boilers will be maintained and are actually the primary heating source in the water treatment plant, their use is to be greatly curtailed.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraphs on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

941 Heat Recovery for the Water Treatment Plant

Proposer: City of Noorvik

Benefit/Cost Ratio: Applicant: **2.25**
AEA: **1.65**

Project Description

This project will provide waste heat from the existing electrical power plant to the water treatment plant. The estimated fuel oil savings to the community water plant is projected to be 18,600 gallons of heating oil per year.

Contribution to Lower the Cost of Energy

All heating oil must be barged in during the summer months. The impact of this project will be to reduce the overall use of oil by approximately 18,600 gallons per year. While this reduction will not change the price of oil in Noorvik, it will significantly reduce the community's consumption of oil, replacing that consumption with jacket heat from the diesel engines.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system. The AEA analysis used a 20-year life based on the AEA standard.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler, in addition to maintenance of the proposed heat recovery system.

Applicant notes that the construction cost is expressed in 2014 dollars. The AEA analysis uses costs adjusted to 2012 dollars based on 3% annual escalation.

Concerns

A Heat Sales/Right-of-Entry Agreement will be required between AVEC and the end users to define the parties' responsibilities, detail the cost of recovered heat, and authorize the connection to the power plant heat recovery equipment. However, a detailed heat recovery study has been completed to support the technical feasibility of the project.

Possible Enhancements

None noted.

Long-term Sustainability

This project increases the sustainability of the water treatment plant. Installing the necessary heat exchangers, piping, pumps, and controls necessary for implementation has been done many times before and proven effective for many years.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The existing power plant was not designed for heat recovery and must be retrofitted.
2. Employment. No effect on employment is noted in the application.
3. Community solutions. The water treatment plant benefits all the residents of Noorvik, AK; however, the cost of energy to operate the facility threatens its sustainability. This project is expected to reduce the fuel oil usage of the facility by 18,600 gallons per year, which is most of the 21,300 gallons currently used.
4. Improve existing energy system. The existing boilers will be maintained in the water treatment plant as a backup to the heat recovery system.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraphs on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

942 Heat Recovery for the Water Treatment Plant/Washeteria Building

Proposer: Native Village of Tuntutuliak

Benefit/Cost Ratio: Applicant: **1.57**
AEA: **1.22**

Project Description

This project will provide waste heat from the existing electrical power plant to the water treatment plant/washeteria. The estimated fuel oil savings to the community water plant and washeteria is projected to be 6,000 gallons of heating oil per year.

Contribution to Lower the Cost of Energy

Heating oil must be barged in during the summer months. The impact of this project will be to reduce the overall use of oil by approximately 6,000 gallons per year. While this reduction will not change the price of oil in Tuntutuliak, it will significantly reduce the community's consumption of oil, replacing that consumption with jacket heat from the diesel engines and, potentially, excess wind energy in the future.

Assumptions Modified

Applicant stated a 30-year life for the heat recovery system in most places of the application, so this duration was used for the applicant analysis. The AEA analysis uses a 20-year life based on the AEA standard.

Under the proposed operation, 25% of the base system O&M costs are included in the AEA analysis for continued maintenance of the existing boiler in addition to maintenance of the proposed heat recovery system.

Applicant notes that the construction cost is escalated 3% annually. The AEA analysis uses costs adjusted to 2012 dollars.

Concerns

A standard Heat Sales Agreement has yet to be executed between the power company and the Native Village of Tuntutuliak. The agreement will define the terms and methods for heat sales. However, a detailed heat recovery study has been completed to support the technical feasibility of the project.

Possible Enhancements

The heat available from the power plant significantly exceeds that required by the water treatment plant/washeteria most of the year. Additional heat may be recovered for other uses. Excess wind power may also be used in the future for the water plant.

Long-term Sustainability

Installing the necessary heat exchangers, piping, pumps, and controls necessary for implementation has been done many times before and proven effective for many years.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The existing power plant was designed for heat recovery and has a brazed heat exchanger and electric boiler already installed. The electric boiler will be used to convert excess wind power into heat used by the water treatment plant/washeteria.
2. Employment. No effect on employment is noted in the application.
3. Community solutions. The washeteria benefits all the residents of Tuntutuliak, AK; however, the cost of energy to operate the facility threatens its sustainability. This project is expected to reduce the fuel oil usage of the facility by 6,000 gallons per year, nearly fully offsetting the fuel oil usage.
4. Improve existing energy system. The project's objective is to reduce the consumption of expensive heating fuel by utilizing available recovered heat.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraph on long-term sustainability.
7. Other public benefits. An unused heat resource would be captured to offset imported oil.

No. 943 OIT Waste Heat Turbine Project

Proposer: Organic Incineration Technology, Inc. (OIT)

Benefit/Cost Ratio: Applicant: **2.15** AEA: **2.15**

Project Description
The applicant is requesting $1,629,223 in state grants to fund 50% of a project to capture and utilize heat generated by the existing oily waste incineration process to generate electricity. A 335 KW turbine generator will be installed which is expected to generate 2.4 GWH of power annually.

Contribution to Lower the Cost of Energy
OIT currently obtains 100% of its power from Golden Valley Electric Association at a cost of about $20,000 per month. The project would generate enough electricity to displace all of the power currently purchased from GVEA (which generates with fuel oil) plus sell 1.1 GWH per year to GVEA under GVEA's purchased power rate schedule.

In addition to fuel cost savings associated with displacement of diesel-generated electricity, this cogeneration facility would provide incentives for oily waste producers – e.g. Alyeska, BP, Flint Hills refinery, an affordable in-state option for disposal, eliminating at least part of the cost of transporting oily wastes to tax-advantaged cogeneration facilities in Spokane, Washington. Because of the nature of the feedstock in OIT's waste incineration business, it currently only operates 6 months out of the year. With cogeneration OIT believes it can operate year-round. While the cost savings associated with the reduction in the overall use of hydrocarbons is not quantifiable, it is probably significant.

Since OIT will sell excess generation to GVEA at GVEA's avoided fuel cost, GVEA customers will likely not see reduced electric rates as a result of this project. But it will significantly benefit OIT's operating costs.

Assumptions Modified
None.

Concerns
It is difficult to determine how this project will reduce energy costs for the community at large.

Possible Enhancements
None.

Long-term Sustainability
According to the applicant a stable long-term supply of oily waste and OIT maintains long term contracts with its customers. A backlog of contaminated soils waiting for processing exists. The project should be sustainable over a long period of time.

Potential Public Benefits
Lower emissions, less cash outflow from the community, economic development opportunities associated with lower energy costs for OIT, increased local employment from moving from a 6 month to 12 month operation.

944 New Stuyahok Heat Recovery

Proposer: Southwest Region School District

Benefit/Cost Ratio: Applicant: **4.54**
AEA: **4.54**

Project Description

This project includes upgrades to the AVEC power plant cooling system, installation of heat exchangers at the AVEC plant and school boiler module with appropriate pumps and controls at both sites and 700 feet of underground piping between the plant and school boiler module.

Contribution to Lower the Cost of Energy

This project will reduce the overall use of fuel to heat the school building by approximately 27,000 gallons per year.

Assumptions Modified

Applicant provided detailed information that supports the analysis and is consistent with AEA standards for heat recovery projects.

Concerns

None noted. The applicant is currently working with AVEC on the final heat sales agreement.

Possible Enhancements

At this time, there are no other commercial buildings in the area that could utilize the recovered heat. The new school was designed and the placement chosen to be able to utilize the recovered heat system when it became available.

Long-term Sustainability

Once this project is complete, the benefits will continue throughout the life of the school and power plant using an untapped resource.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The system would include heat exchangers at the AVEC plant and school boiler module with 3" insulated underground piping (300') between buildings.
2. Employment. No effect on employment is noted in the application.
3. Community solutions. The Village is in support of the school trying to use the recovered heat from the power plant. This project has been discussed since the start of the new school design in 2005. Two regional school board members from New Stuyahok supported the resolution to seek grant funding for this project.

4. Improve existing energy system. Currently there is no use for the excess heat being produced at the power plant and this valuable resource is not being tapped.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above paragraphs on long-term sustainability.
7. Other public benefits. This project would reduce fuel consumption by a significant amount and would allow the school district to direct more funds to the educational process not only in New Stuyahok but in our other six communities.

945 St. Mary's / Pitka's Point Wind Energy Project

Proposer: Alaska Village Electric Cooperative

Benefit/Cost Ratio: Applicant: 1.15 AEA: 1.19

Project Description:
Alaska Village Electric Cooperative (AVEC) is requesting for funds to construct a wind facility near Pitka's Point that would be connected through an existing intertie to the community of St. Mary's. The applicant intends to construct one 900 kW EWT at a location 2.5 miles from St. Mary's and 1 mile east of Pitka's Point and will connect it to the existing power generation system.

This project, using previously awarded REF funds, is currently under design. Permits are expected to be in hand by December 2012 and final design completed by the end of 2012.

Funding
The applicant is requesting $5,538,592 for the construction of a wind facility to be connected to the communities of St. Mary's and Pitka's Point. An additional project match of $615,399 would be provided by AVEC. The total project cost is $6,153,991. AVEC anticipates procuring the turbine in the summer of 2013 and commissioning the project by the end of 2014.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. As stated in the application, AVEC hopes to displace 97,126 gallons of diesel fuel per year used for electric generation and 2,250 of diesel per year for heating.

AEA analysis indicates that 102,816 gallons of fuel will be displaced each year but with only 76,807 saved from electric generation and 26,009 from displaced heating fuel.

Assumptions Modified:

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 2,483,000 kWh. Based on the amount of fuel for generation claimed to be displaced and generation efficiency in Section 4.4.4, the amount of diesel generated electricity offset by wind was 1,343,253 kWh per year.

According to the AEA Wind PM, total gross wind production would be 1,962,240 kWh per year. Each year, 1,062,240 kWh is used to offset electric generation and 900,000 kWh is used to displace heating fuel.

Annual O&M Costs
The applicant indicated that their annual O&M costs were $48,250 based on $0.018/kWh. The annual O&M costs were divided by 1,343,253 kWh to generate the O&M costs per displaced diesel generated kWh. The total annual O&M remained unchanged.

The AEA benchmark of $0.0469 per kWh was used in the AEA analysis.

Concerns:

AEA wind project manager expresses concern on the relative size of this system to the St Mary's and Pitka's Point. The applicant indicated that this project was submitted along with applications for planned transmission lines to neighboring communities. The impact on St. Mary's and Pitka's Point of these transmission lines is unknown.

Possible Enhancements:

Long-term Sustainability:
The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through the applicant's general operating costs. It is reasonable to assume long-term sustainability.

Potential public benefits:
If the project is connected with neighboring communities the existing diesel generation systems may be consolidated, resulting in lower diesel generation costs in addition to the savings from wind production.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 946 Shungnak Solar Energy Construction Project, AVEC

Proposer: Alaska Village Electrical Cooperative (AVEC)

Benefit/Cost Ratio: Applicant, as shown on paper application: .65
Applicant as calculated by economist on applicant worksheet in model: .63
AEA worksheet: .66

Project Description
AVEC is requesting funds for project construction and commissioning of 50kW array of 288 photovoltaic (PV) modules in Shungnak, Alaska. The arrays would serve the communities of Shungnak and Kobuk (7 miles apart) that are connected via an existing electrical intertie. Shungnak is located 150 miles east of Kotzebue.

Contribution to Lowering the Cost of Energy
The PV project will offset diesel generated electric power for the two communities. Annually, the array is estimated to produce 44, 623kWh, offsetting 3,300-3,500 gallons of diesel per year.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- Applicant was very aware AEA grant assumptions and provided grant numbers in line with AEA figures. O&M cost per kWh, and diesel efficiency per kWh both used AEA figures and did not need any adjustments.
- A slightly higher displaced fuel amount from applicant estimate
- Applicant reports a higher cost per gallon ($6.95) in the village, but does not use this figure in application, but instead uses ISER values. They wanted to note that their fuel costs improve the payback from what ISER values will allow.

Concerns

- **Barge Timing.** The applicant expects the main risks to the project to arise from timing materials purchases to fit with the summer work schedule.
- **Shading of panels.** Applicant reports a need for some snow removal, and appropriate tilt angel for panels to maintain expected output.
- **Two solar array options.** Applicant reports figures that assume a 50kW, 288 175W solar modules, but lists on page 12 another option with a 56kW capacity using 240, 234W solar modules. No cost data or information for the second option reported in application figures.
- **Soils & Permafrost.** The applicant plans an adjustable ground mounted steel structure to support the panels and control their tilt. Applicant plans to use gravel to minimize permafrost effects, but gravel may be limited and other types of soils and fills need to be evaluated.
- **Warranties and life of inverter.** While the applicant projects a PV inverter it does not include any expected life or warranty guarantees. 10 year warranty for inverters is common, but the project has a 27 year payback period and may require inverter work before payback in the case of inverter failure.
- **Managing Tilt.** Project payback period assumes that in summer the tilt angle must change to 34 degrees to increase power production by 2.5%. If tilt is not adjusted properly, or annually, lower payback will result.

- **Payback.** Project is expensive for benefit. Numerous other PV options were all discarded because they would not payback within 30-year life of expected system (according to 2010 feasibility report). This project's payback sensitivity to the price of diesel is severe, and in the scenarios considered from the feasibility report many PV arrangements had 35-40 year payback. However, with more recent fuel costs the project enters the 25-30 year payback range.

Possible Enhancements / Recommendations

- **Provide manufacture warranty claims and guarantees of proposed system.**
- **Clarify exactly which array system that will be used, rather than provide a likely option and a potential option.**

Potential Public Benefits

- **Reduced annual electrical costs**
- **Stabilizes costs across multiple villages, first renewable power in the region**
- **Cleaner Air**

No. 947 Marshall Wind Energy Design & Permitting Project

Proposer: Alaska Village Electrical Cooperative (AVEC)

Benefit/Cost Ratio: Applicant, as shown on paper application: .93
Applicant as calculated by economist on applicant worksheet in model: 0.85
AEA worksheet: .79

Project Description
AVEC is requesting $332,500 in grant funding for the final design of a wind energy installation in the village of Marshall, Alaska. AVEC will provide $17,500 as a cash match for a total project cost of $350,000. AVEC has completed a concept design report and permitting to install two Northern Power Systems' Northern Power ARCTIC turbines with an installed capacity of 200kW. A MET tower recorded nearly a year of wind data, but blew over with two more months left in the year. The wind resource is rated class 4, the planned turbines operate at 37-meter hub height with a 21-meter diameter and will equipped with an arctic package enabling continuous operation down to -40 C.

Contribution to Lowering the Cost of Energy
The wind energy provided by the project would displace up to 28,475 gallons per year and 569,500 gallons over the life of the project. Applicant used HOMER software to model the kWh produced and reports 426,551kWh annual generation from the two turbines.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Gallons of displaced fuel.** Applicant provides two figures of annual fuel displaced, 28475 (Pg. 21 & Pg. 3) and 26475 (Pg. 20) gallons. At first the applicant indicates that 426,551kWh will displace 28475 gallons (Pg. 3), but then on page 20 reports that 426,551kWh will displace the lower figure of 26475. In case of typo error of the 26475 figure, economist left applicant tab in workbook to reflect 28,475 gallons and 426,551kWh. For the AEA tab economist calculated a lower kWh (396,591kWh) figure to correspond with the 2000 gallon per year lower figure of 26,475 also reported.
- **2015 cost of Diesel.** Applicant reports that they added together ISER's 2015 medium fuel cost for Marshall ($4.01), and added $.27 to ISER's cost from the "social cost of carbon" per gallon. Applicant appears to represent that by 2015 a carbon tax should be expected per gallon. Economist used ISER's workbook rate, which is identical to applicant derived rate, $4.28 per gallon in 2015.

Concerns

- **Gallons displaced / kWh generated.** The different figures reported alter the project from a positive NPV to an NPV of less than 1.0. However, if the applicant tab proves correct and the larger annual displaced gallons are used, the AEA and Applicant tabs would correspond on all inputs except life of project.
- **Site Control.** Applicant has yet to receive a lease agreement for the location of towers, but they did attach the MET tower agreement from 2008 and expect no problems.

Possible Enhancements / Recommendations

- **Clarify diesel figures and explain the two figures of displaced gallons**

- **Land agreement between AVEC and Maserculiq, Inc**

Potential Public Benefits

- **Reduced annual electrical costs**
- **Cleaner Air**
- **Greater price stability.**

948 Wales – Wind Energy Feasibility and Conceptual Design Project

Proposer: Alaska Village Electric Cooperative, Inc.

Benefit/Cost Ratio: Applicant: **1.33** AEA: **1.04** AEA (benchmark): **0.86**

Project Description:
AVEC is proposing to install two meteorological towers and complete geotechnical work to determine the feasibility of installing wind turbines in Wales. The proposed funding would be used for the geotechnical fieldwork, permitting, transporting and installing met towers at two locations, gathering a year's worth of wind resource data, along with conducting reconnaissance-level geotechnical investigations to develop the conceptual design.

The applicant is proposing a 100-kW wind capacity system to be incorporated into the community's existing power plant that utilizes 3 diesel generators with a generation capacity of 572 kW. The feasibility and conceptual design would determine the optimal location and type of wind turbine for the community. The conceptual design, when completed, would specify how power from the wind turbines would be integrated and delivered into the existing power generation facility. A secondary load control would also be evaluated to allow use of excess wind energy for thermal loads.

It should be noted that an early wind pilot project was built in this community in 1998. The turbines have operated sporadically for a time but are currently non-operational. The pilot project demonstrated that it is possible for a village power system with good wind resource to run for several days at a time with diesels off. AVEC would like to start over and determine an optimal wind system that would be more sustainable.

Funding
The applicant is requesting $190,000 for feasibility and conceptual design of a wind facility in Wales. An additional project match of $10,000 (5 percent) would be provided by AVEC.

Currently, AVEC only has a rough estimate of expected capital cost. AVEC estimates that the final design, construction, and commissioning phase will cost $1.02 million.

The applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding. Additionally, AVEC proposes that it will provide a cash match of 10 percent for construction.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The applicant anticipates that the proposed wind project would displace 25,777 gallons of diesel fuel per year.

AEA analysis however indicates a lower fuel displacement of about 17,000 gallons per year. According to AEA, a 100-kW system in Wales would generate about 269 MWh (with a Class 6 wind resource and a net capacity factor of 32.4 percent) of wind energy annually, displacing about 15,000 gallons of diesel fuel per year for electric generation and an additional 2,000

gallons of heating fuel savings, if a secondary load system is installed to capture excess wind energy for thermal loads.

Assumptions Modified:

Project Start
The applicant provides an estimated date of 2015 for operations to begin. However, according to the timeline provided in Section 3.2 of the application, the conceptual design and cost estimate are expected to be completed in November of 2014. If construction and commissioning commence in 2015, it is more realistic to assume first full of operations to occur in year 2016. The project start date was therefore adjusted to 2016 in both the 'APP' and 'AEA' worksheets.

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 318,864 kWh assuming a Class 7 wind regime and a net capacity factor of 36.2 percent; this was used in the applicant's tab.

The AEA tab assumes a Class 6 wind regime and net capacity factor of 32.4 percent, which results in expected annual gross electricity from wind of 269,633 kWh. Furthermore, Homer analysis suggests annual net electricity produced from wind of 194,724 kWh, with excess annual wind energy of 74,909 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Fuel Efficiency
The Applicant stated that their diesel generation system has a fuel efficiency of 12.37 kWh per gallon. This value was used in the App tab. For the AEA analysis, the 13 kWh per gallon minimum was used.

Capital Cost/Secondary Load System
The Applicant provided an estimated capital cost of $1.02 million. This figure is consistent with AEA benchmark costs per installed kW for rural projects. AEA benchmark costs include a short transmission line and installation of turbines. Note that in the B/C analysis, the cost of the feasibility and conceptual design ($200,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

In the AEA analysis, the estimated capital cost is $825,000 which is based on installation of remanufactured wind turbines. Further analysis however indicates that if remanufactured turbines are not available and AEA benchmark cost is used, the resulting B/C ratio would drop to 0.88.

Concerns:

The analysis assumes no additional cost for secondary load components. The applicant noted that the previously constructed wind facility consisted of a battery storage system, a synchronous condenser, dispatchable heater loads to absorb excess wind energy and customized controls. According to AEA, an audit of the system in 2011 showed that the battery system has been kept warm and the cells have not dried out, and a charge has been maintained

on the batteries by the diesel generators. The conceptual design will determine what components will be needed going forward. These costs are unknown at this time. If all the secondary load components need to be replaced, these costs need to be incorporated in the capital cost of the project.

Furthermore, as noted above, if the lower cost remanufactured turbines are not available, the B/C ratio drops to less than 1. It is important to determine during the final design and construction phase whether the Applicant would be able to use the lower cost remanufactured turbine.

Applicant has not obtained site control for the placement of met towers in their potential locations. This may prevent further development of the project from occurring, if control of these sites is not provided to the applicant.

Possible Enhancements:

Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:

The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through the applicant's general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:

Lessons learned about renewable energy sources in Wales will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

949 Kotlik - Wind Diesel Generation Project

Proposer: Alaska Village Electric Cooperative, Inc.

Benefit/Cost Ratio: Applicant: **0.99** AEA: **1.09**
AEA (heat & full cost): 0.84
AEA (no heat & full cost): 0.83

Project Description:
AVEC is proposing to install a meteorological tower and complete geotechnical work to determine the feasibility of installing wind turbines in Kotlik. The proposed funding will be used to install the tower and gather a year's worth of wind resource data, along with conducting reconnaissance-level geotechnical investigations to develop the conceptual design.

The applicant is proposing a 300-kW wind capacity system to be incorporated into the community's existing power plant that utilizes 4 diesel generators with a generation capacity of 1,698 kW. The feasibility and conceptual design would determine the optimal type of wind turbine for the community. The conceptual design, when completed, would specify how power from the wind turbines would be integrated and delivered into the existing power generation facility. A secondary load control would be evaluated to determine whether dispatch boilers could be installed to use excess wind energy while allowing the diesel generators to continue to run at efficient levels.

Funding
The applicant is requesting $142,500 for feasibility and conceptual design of a wind facility in Kotlik. An additional project match of $7,500 (5 percent) would be provided by AVEC.

Currently, AVEC only has a rough estimate of expected capital cost. AVEC estimates that the final design, construction, and commissioning phase will cost $3,060,000. This estimate is consistent with the AEA benchmark for capital cost in rural applications ($10,200/kw of installed capacity).

The applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding. Additionally, AVEC proposes that it will provide a cash match of 10 percent for construction.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The applicant anticipates that the proposed wind project would displace about 47,000 gallons of diesel fuel per year.

AEA analysis however indicates a lower total potential annual fuel displacement of about 41,600 gallons. According to the AEA HOMER analysis, the proposed wind project would generate 599 MWh (with a Class 4 wind resource and a net capacity factor of 24 percent) of wind energy annually, displacing approximately 39,070 gallons of diesel fuel used for power generation per

year and an additional 1,849 gallons of heating fuel per year if a secondary load system is installed to capture excess wind energy for thermal loads.

The proposed wind project could support 26 percent of the community's power requirements.

Assumptions Modified:

Project Start
The applicant provides an estimated date of 2015 for operations to begin. However, according to the timeline provided in Section 3.2 of the application, the conceptual design and cost estimate are expected to be completed in November of 2014. If construction and commissioning commence in 2015, it is more realistic to assume first full year of operations to occur in 2016. The project start date was therefore adjusted to 2016 in both the 'APP' and 'AEA' worksheets.

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 630,720 kWh assuming a Class 4 wind regime and a net capacity factor of 24 percent; this was used in the applicant's tab.

The AEA tab also assumes a Class 4 wind regime and net capacity factor of 24 percent. However, AEA estimates that the expected annual gross electricity from wind would be 599,184 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 529,218 kWh, with excess annual wind energy of 63,974 kWh which can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Capital Cost/Secondary Load System
The applicant provided an estimated capital cost of $3.06 million. This figure is consistent with AEA benchmark cost per installed kW for rural projects. AEA benchmark cost includes a short transmission line and installation of turbines. Note that in the B/C analysis, the cost of the feasibility and conceptual design ($150,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

The applicant suggested that a secondary load system (to capture excess heat) will be evaluated; however, no information was provided regarding additional cost for the secondary load system and expected reduction in heating fuel consumption. In the AEA analysis, a thermal load component is included in the recommended capital costs; and on the benefit side, the estimated additional heating fuel displacement from the AEA HOMER analysis was used.

AEA capital costs also considered the use of less expensive remanufactured wind turbines; hence a lower capital cost estimate compared to the Applicant. Based on communications with the AEA wind manager, remanufactured turbines are an option for Kotlik at this point. The suggested capital cost from AEA is lower and includes the extra benefit of a secondary load system. The resulting B/C ratio as indicated above is 1.10.

Further analysis was conducted to determine the resulting B/C ratio if remanufactured turbines are not available and AEA benchmark cost is used. The B/C ratio in this case, drops to 0.86. The estimated total capital cost in this case is $3.16 million, which includes a conservative estimate for the cost of the secondary load system components of $100,000.

Concerns:
One full year of met tower data would provide a more accurate wind resource estimate. AEA wind manager suggests that wind resource could vary significantly depending on the location in the community. This analysis assumed a Class 4 wind resource, the highest of the range suggested by the wind resource map.

The distance of the wind turbine to the power plant could also affect the capital cost of the project; a longer transmission line would increase the cost of the project.

Applicant has not obtained site control for the placement of a met tower in the potential location. This may prevent further development of the project from occurring, if control of the site is not provided to the applicant.

Possible Enhancements:
Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:
The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through the applicant's general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:
Lessons learned about renewable energy sources in Kotlik will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

950 Russian Mission - Wind Diesel Generation Project

Proposer: Alaska Village Electric Cooperative

Benefit/Cost Ratio: Applicant: **0.89** AEA: **0.52** AEA (no thermal): **0.57**

Project Description:
Alaska Village Electric Cooperative (AVEC) is requesting for funds to conduct a feasibility study of a wind facility in Russian Mission. The applicant intends to solicit professional consulting services to provide a wind resource assessment of the area (includes installation of a met tower), geotechnical work to determine feasibility of installing turbines, and a conceptual design of a wind-diesel system suitable to the community of Russian Mission.

According to the Applicant, given a viable wind resource, a proposed system will likely include a 150-kW wind capacity system which will be incorporated into the community's existing power plant that utilizes 3 diesel generators with a generation capacity of 849 kW. The project would include necessary modifications to the diesel generator set in order to allow integration of the wind component.

Funding
The applicant is requesting $142,500 for feasibility and conceptual design of a wind facility in Russian Mission. An additional project match of $7,500 (5 percent) would be provided by AVEC. The applicant estimates $58,000 for conceptual design, $25,000 for geotechnical work, $20,000 for detailed energy resource analysis, and $47,000 for other items including detailed economic and financial analysis, developing conceptual business and operations plans, permitting and environmental analysis, and detailed analysis of existing and future energy costs and markets.

Currently, AVEC only has a rough estimate of expected capital cost. They estimate that the final design, construction, and commissioning phase will cost $1.53 million. The applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding. No match is indicated by the applicant.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. As stated in the application, AVEC hopes to displace 21,854 gallons of diesel fuel per year (based on their preliminary numbers assuming Class 4 wind and 80 percent turbine availability).

AEA analysis however indicates a lower potential fuel displacement of about 15,000 gallons of fuel per year (for power and heat). According to the AEA analysis, the proposed wind project would generate 202 MWh (with a Class 2 wind resource and a net capacity factor of 15.4 percent).

The proposed wind project could support up to 18 percent of the community's power needs.

Assumptions Modified:

Project Start
According to the timeline provided in Section 3.2 of the application, the conceptual design and cost estimate are expected to be completed in November of 2014 with a final report and recommendations submitted in December 2014. If construction and commissioning commence in 2015, it is realistic to assume first full year of operations to occur in year 2016. The project start date was therefore assumed to be 2016 in both the 'APP' and 'AEA' worksheets.

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 315,360 kWh assuming a Class 4 wind regime and a capacity factor of 24 percent; this was used in the applicant's tab.

According to the AEA Wind PM, a class 4/5 wind site is possible on a location that is 5 miles south of the village, on steep terrain. This would render installation of a met tower and periodic accessibility difficult. It would also require the installation of an extended transmission line that would make the project much more costly.

The AEA tab assumes a Class 2 wind regime (this is a site closer to town that would involve a short transmission line). The net capacity factor in a Class 2 wind regime is 15.4 percent. As per AEA analysis, the expected annual gross electricity from the proposed wind project is 202,356 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 192,238 kWh, with excess annual wind energy of 14,367 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Capital Cost/Secondary Load System
The applicant provided an estimated capital cost of $1.53 million. This figure matches AEA benchmark costs per installed kW for rural projects, not including heat.

The applicant suggested that a secondary load system (to capture excess heat) will be evaluated, however, no information was provided regarding additional cost for the secondary load system. In the AEA analysis, a thermal load component (estimated to cost $100,000) is included in the capital costs. On the benefit side, the estimated additional heating fuel displacement from the AEA analysis was used. Further analysis indicated given only 10,118 kWh of excess wind energy expected, a secondary load system would not improve the economics of this proposed project. The resulting B/C ratio in this case is 0.57 compared to the B/C ratio of 0.53 with the thermal component.

Note that even assuming a Class 4 wind resource (as per the Applicant's tab), the B/C ratio is still less than 1.

In the B/C analysis, the cost of the feasibility and conceptual design ($181,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

Concerns:

AEA wind project manager expresses concern that there is no developable wind site near Russian Mission. AEA wind managers also express concern regarding the presence of tall trees around Russian Mission that would prevent the installation of a low-cost, 10-meter, met tower. Wind resource data from the airport and wind resource model reflect class 1 wind speeds in their respective areas.

Applicant has not provided any specific location for installation of a met tower, although the Applicant suggested a Class 4 wind resource without any supporting information.

Possible Enhancements:
Applicant states further investigation would be completed to evaluate the best location for met tower installation prior to grant award. Having this reconnaissance information could greatly improve the evaluation of this application.

Long-term Sustainability:
The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through the applicant's general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:
Lessons learned about renewable energy sources in Russian Mission will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 951 Stebbins / St. Michaels Wind Energy Design & Permitting Project

Proposer: Alaska Village Electrical Cooperative (AVEC)

Benefit/Cost Ratio: Applicant, as shown on paper application: 1.049 (V3 report); 1.49 (Northern Economics report)
Applicant as calculated by economist on applicant worksheet in model: 1.76
AEA worksheet: 1.64

Project Description
AVEC is requesting grant funding for the final design of a wind energy installation that will join the new Stebbins power plant to serve Stebbins and St. Michael's, cities located in Northwest Alaska. The grant request is for $332,500, AVEC will match $17,500 for a total of $350,000. AVEC has completed a concept design report that identified one EWT 52-900 as preferable to a system utilizing two smaller turbines. The single 131' tower will be equipped with a direct drive, permanent magnet synchronous generator, and an arctic cold weather for operation down to negative 40F. Site location provides a low Class 5 resource to the turbine, 6.5m/s. Construction of the new Stebbins power plant will finish summer of 2014.

Contribution to Lowering the Cost of Energy
The wind energy provided by the project would displace up to 26.02 gallons per year and 569,500 gallons over the life of the project. This project is estimated to provide 36% of the two communities' combined electric power needs by generating 1,448,432 kWh per year. It is estimated to generate an additional 807,227 kWh per year of excess energy available for thermal loads. Assuming 80% turbine availability, applicant reports savings of $455,000 during its first full year of operation. Economist workbook shows between $480,000-500,000 in first and second years of operations.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Applicant used AEA assumptions for O&M.**
- **Gallons of fuel per kWh.** Applicant's gallons of fuel displaced are based on power plant efficiency of 15.3kWh/gallon. **Applicant reported heating gallons figure.** Economist used applicant reported gallons of fuel displaced, to fit into workbook rather than the applicant reported kWh/yr heat offset. Displaced gallons figure is 26,072, displaced kWh for heat is 807,227kWh/yr. Applicant provides two numbers for fuel displaced, 26.072, and 26,072, economist used the larger 26,072 figure and treated figure with decimal rather than comma as a typo.

Concerns

- **Gallons displaced / kWh generated.** Total gallons displaced will be lower if the new power plant does not perform as planned. Lifetime calculations may also be lower due to changing efficiency as plant ages.
- **Site Control.** Applicant has yet to receive a lease agreement for the location of towers, but the letters of support from the region indicated that location will not be an issue.
- **Fuel for Heat displacement.** Applicant indicates that some portion of the renewable power will go to heating loads. Because the wind project will not displace the whole

load required by the two communities it's uncertain from application why/how that power would be allocated to heating rather than a greater portion to electrical loads.

- **Timeline.** Project timeline depends upon the successful implementation of the new power plant in Stebbins. Any setbacks will also setback this wind projects completion.

Possible Enhancements / Recommendations

- **Clarify wind penetration into diesel system to help explain electrical and heating load split of renewable resource.**
- **Land agreement between AVEC and City of Stebbins for final AEF grant request for construction**

Potential Public Benefits

- **Reduced annual electrical costs**
- **Cleaner Air**
- **Greater price stability**
- **Both heat and electrical load penetration**
- **Better communities planning with cost controls for public buildings and spaces**

952 Cosmos Hills – Wind Resource and Intertie Assessment

Proposer: Alaska Village Electric Cooperative, Inc.

Benefit/Cost Ratio: Applicant: **0.65** AEA: **0.64** AEA (utility savings): **0.96**

Project Description:
AVEC is proposing to install two meteorological towers and complete geotechnical work to determine the feasibility of installing wind turbines near Wesley Creek. In order to fully reap the benefits of wind energy in the Upper Kobuk region, and to reduce the cost of electricity for those communities, an intertie between Ambler and Shungnak will also be evaluated. The proposed funding would be used to conduct a feasibility analysis, wind resource assessment, and conceptual design to assess the possibility of using wind power at Wesley Creek via a transmission/intertie line between Ambler, Shungnak, and Kobuk.

The applicant is proposing a 900-kW wind capacity system to be built and incorporated into the multi-community system via an intertie/transmission line. The feasibility and conceptual design would determine the optimal type of wind turbine to be installed. The conceptual design, when completed, would specify how power from the wind turbine would be integrated and delivered into the existing power generation system.

Funding
The applicant is requesting $221,350 for feasibility and conceptual design of a wind facility and transmission line. An additional project match of $11,650 (5 percent) would be provided by AVEC. The applicant estimates $85,000 will be needed for the assessment of alternatives, $45,000 for detailed energy resource analysis, $36,000 for the conceptual design, and $67,000 for other items including permitting and environmental analysis, detailed economic and financial analyses, developing conceptual business and operations plans, and report preparation.

AVEC estimates that the final design, permitting, construction, and commissioning phase of the project will cost $13.15 million.

The applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the communities' future fuel purchases by incorporating wind energy into the existing power generation system. The applicant anticipates that the proposed wind project would displace more than 100,000 gallons of diesel fuel per year.

The AEA analysis indicates a comparable estimated fuel displacement.

AVEC also anticipates significant cost savings in annual non-fuel O&M cost by combining power generation for the three communities, thereby allowing idling/shutting down the other two existing power plants.

Assumptions Modified:

Project Start
According to the timeline provided in Section 3.2 of the application, the conceptual design and cost estimate are expected to be completed in November of 2014. If construction and commissioning commence in 2015, it is more realistic to assume first full of operations to occur in year 2016. The project start date was therefore adjusted to 2016 in both the 'APP' and 'AEA' worksheets.

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 1,235,546 kWh assuming a wind resource of 6.4 m/s (class 3); this was used in the applicant's tab.

The AEA tab assumes an annual gross electricity from wind of 1,646,880 kWh, with 1,204,127 kWh for power generation, and excess annual wind energy of 442,753 kWh for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Capital Cost
The AEA analysis assumes the same capital cost (and total project cost) as suggested by AVEC.

Annual O&M Cost
The AEA analysis includes an annual O&M cost for the new intertie, estimated at $20,000 per year. This information was provided by AVEC to AEA on a follow-up communication after the application was submitted.

AVEC also noted in the follow-up communication, that the estimated annual average cost savings on power plant O&M costs, not including fuel costs, that could be avoided by shutting down or idling the two other plants is $280,0000 ($140,000 each). The total annual non-fuel O&M cost savings of $280,000 were modeled in an additional AEA analysis. This assumption resulted in a B/C ratio of 0.96.

With respect to the annual O&M cost for the wind component, the Applicant suggested a low annual O&M cost of $17,000 per year. In the AEA analysis, a higher annual O&M cost (about $76,000) was assumed. This was based on the benchmark variable O&M rate for rural applications.

Concerns:
AVEC stated that for the purpose of the application, they used the NREL wind resource map which shows a Class 3 wind resource. AEA guidelines suggest that the net capacity factor in Class 3 wind resource is 19.7 percent and not 30.7 percent and 32 percent as stated by the Applicant on page 14. Site wind data will be important to closely approximate potential annual wind generation.

In the next phase, a more detailed examination of total project costs should be pursued. It was assumed in this analysis that the cost of building the intertie is already included in the estimated project cost. If a secondary load system is contemplated, the Applicant should describe how the excess wind will be captured and distributed (which facilities will be heated).

Applicant has not obtained site control for the placement of a met tower in their potential location. This may prevent further development of the project from occurring, if control of these sites is not provided to the applicant.

Possible Enhancements:

Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:

The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through ongoing sales to the villages. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:

Lessons learned about renewable energy sources in Wesley Creek will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbine and intertie would augment power generation already in place in the communities. Stabilizing energy costs would reduce the communities' exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

953 Hotham Peak – Wind Resource and Intertie Assessment

Proposer: Alaska Village Electric Cooperative, Inc.

Benefit/Cost Ratio: Applicant: **0.63** AEA: **0.56**

Project Description:
AVEC is proposing to install a meteorological tower and complete geotechnical work to determine the feasibility of installing wind turbines east of Noorvik. In order to fully reap the benefits of wind energy in the region, and to reduce the cost of electricity, an intertie between Noorvik, Kiana, and Selawik will also be evaluated. The proposed funding would be used to conduct geotechnical fieldwork, permitting, transporting and installing a met tower, studying the wind resource for one year, and conducting a reconnaissance-level geotechnical investigation to determine the soil conditions and required engineering at the site.

The Applicant is proposing a 900-kW wind capacity system to be built and incorporated into the existing power plant at Noorvik. The proposed project also includes a 50-mile intertie/transmission line between Noorvik, Kiana and Selawik that would electrically connect the three AVEC utilities .

Funding
The Applicant is requesting $207,100 for feasibility and conceptual design of a wind facility and transmission line. An additional project match of $10,900 (5 percent) would be provided by AVEC. The Applicant estimates $85,000 will be needed for the assessment of alternatives, $36,000 for the conceptual design, $30,000 for detailed energy resource analysis, and $67,000 for other items including permitting and environmental analysis, detailed economic and financial analyses, developing conceptual business and operations plans, and report preparation.

AVEC estimates that the final design and permitting will cost $2 million, while construction and commissioning of the project will cost $23 million.

The Applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, the Denali Commission, AIDEA, or the USDA Rural Utility Service Program, but intends to explore additional grant funding.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the communities' future fuel purchases by incorporating wind energy into the existing power generation system. The Applicant anticipates that the proposed wind project would displace more than 200,000 gallons of diesel fuel per year.

The AEA analysis indicates a lower fuel displacement of approximately 145,000 gallons per year.

AVEC also anticipates significant cost savings in annual non-fuel O&M cost by combining power generation for the three communities, thereby allowing idling/shutting down the other two existing power plants.

Assumptions Modified:

Annual Wind Generation

The Applicant indicated that their expected annual wind generation is 3,013,282 kWh, assuming a wind resource of 6.4 m/s (Class 3, 38.2 percent capacity factor); this was used in the Applicant's tab.

The AEA tab assumes annual gross electricity from wind of 2,364,273 kWh, with 2,051,800 kWh for power generation, and excess annual wind energy of 312,473 kWh for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) assumed a class 5 wind resource with a capacity factor of 28 percent.

Annual O&M Cost

i) Annual O&M Cost Savings

The Applicant did not provide information in the application regarding estimated O&M cost savings that could be realized by combining power generation for the three communities into one power plant.

In the AEA project summary provided by the AEA wind project manager, it was noted that the estimated annual average cost savings on power plant O&M costs, not including fuel costs, that could be avoided by shutting down or idling the two other plants is $280,0000 ($140,000 each). The total annual non-fuel O&M cost savings of $280,000 were included in the AEA analysis.

ii) Annual O&M for the Transmission Line

The Applicant did not provide information regarding estimated annual O&M cost for the transmission line.

In the AEA analysis, an annual O&M cost for the intertie was included. The estimate was based on the information provided by AVEC to AEA on the Cosmos Hills application which also included a ~ 30-mile intertie. For this project, the proposed intertie is 50 miles long. This O&M estimate is therefore considered very conservative; the maintenance cost would most likely be higher.

iii) Annual O&M for the Wind Facility

The Applicant suggested that the proposed 900-kW wind system would only cost $15,000 per year to operate and maintain.

The AEA analysis, assumed the benchmark variable O&M cost for rural applications of $0.0469 per kWh. Given this rate, the estimated annual O&M cost for the proposed wind facility is over $130,000 per year.

Concerns:

AVEC stated that for the purpose of the application, they used the AWS True Wind resource map which shows a Class 3 wind resource. This observation is accompanied by two wind studies completed in Noorvik indicating class 3 wind resource with annual wind speed of 6.4 m/s. AEA guidelines suggest that the net capacity factor in Class 3 wind resource is 19.7 percent and not 38.2 percent and 30.7 percent as stated by the Applicant in section 4.3.1. Site wind data will be important to closely approximate potential annual wind generation.

In the next phase, a more detailed examination of total project costs should be pursued.If a secondary load system is contemplated, the Applicant should describe how the excess wind will be captured and distributed (which facilities will be heated).

Applicant has not obtained site control for the placement of a met tower in their potential location. This may prevent further development of the project from occurring, if control of these sites is not provided to the applicant.

Possible Enhancements:

Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:

The Applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through ongoing sales to the villages. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:

Lessons learned about renewable energy sources near Hotham Peak will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbine and intertie would augment power generation already in place in the communities. Stabilizing energy costs would reduce the communities' exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

954 St. Mary's / Mountain Village Wind Energy Intertie Final Design

Proposer: Alaska Village Electric Cooperative

Benefit/Cost Ratio: Applicant: 0.68 AEA: 0.78

Project Description:
Alaska Village Electric Cooperative (AVEC) is requesting for funds to design and permit an electrical intertie between the communities of St. Mary's and Mountain Village. The project is intended to supply Mountain Village with wind power that could be produced in St. Mary's/Pitka's Point. For this project to supply renewable energy over the intertie the wind project in St. Mary's/Pitka's Point must first be constructed. The applicant indicates that they have request funding from AEA for the construction of one 900 kW EWT at a location 2.5 miles from St. Mary's and 1 mile east of Pitka's Point and will connect it to the existing power generation system.

Funding
The applicant is requesting $332,500 for the final design and permit for an intertie to connect Mountain Village to the communities of St. Mary's and Pitka's Point. An additional project match of $17,500 would be provided by AVEC. The total project cost, including construction, is estimated to be $7,449,000.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating planned wind energy into the existing distribution system. According to the application for the wind project at St. Mary's/Pitka's Point there could be 1,139,747 kWh of wind energy available.

Assumptions Modified:

Annual Wind Generation Utilization
The applicant indicated in their application that the St. Mary's/Pitka's Point wind project would have an expected annual wind generation of 2,483,000 kWh. Of this generation, it was estimated that the St. Mary's/Pitka's Point would utilize 1,343,253 kWh for electricity leaving 1,139,747 for Mt. Village. St. Mary's/Pitka's Point was using some of the existing excess wind generation to offset 2,250 gallons of heating fuel. Utilizing the wind generation for electricity in Mt. Village would eliminate the heating fuel savings in St. Mary's/Pitka's Point.

According to the AEA Wind PM, 651,130 kWh of excess wind generated electricity would be utilized in Mt. Village as a result of the intertie. It would also eliminate 13,004 gallons of heating fuel that the excess wind power was estimated to be offsetting in St. Mary's/Pitka's Point.

Annual O&M Costs
The applicant indicated that their annual O&M costs of the transmission system were $20,000. For the purposes of this analysis the O&M costs were spread over the utilized wind energy at a rate of $0.0175 per kWh.

According to the AEA Wind PM, the intertie would also reduce the diesel generation O&M in Mt. Village by $170,000 per year. Incorporating the $20,000 annual O&M costs of the intertie results in an annual net O&M decrease of $150,000.

Concerns:

This economic analysis assumed that the wind system was built in St. Mary's/Pitka's Point but the proposed intertie to Pilot Station was not built. There is concern over this projects dependence on wind in St. Mary's/Pitka's Point. Also, the benefits may be overstated if the intertie is built to Pilot Station as both Mt. Village and Pilot Station would be sharing the remaining excess wind generation.

Possible Enhancements:

This review was submitted along with proposals to build the wind system in St. Mary's/Pitka's Point and another intertie to Pilot Station. While the entire system may yield net economic benefits of avoided diesel generation and generator replacement was not clearly described. Including an analysis with more information on the diesel savings of the interties may increase the understanding of the economics.

Long-term Sustainability:

The applicant suggests that the intertie would decrease the current power plant operation costs. It is reasonable to assume long-term sustainability.

Potential public benefits:

If the project is connected with neighboring communities the existing diesel generation systems may be consolidated, resulting in lower diesel generation costs in addition to the savings from wind production.

The proposed intertie could replace the power generation already in place in the community. Sharing and stabilizing energy costs with St. Mary's/Pitka's Point would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

955 St. Mary's / Pilot Station Wind Energy Intertie Construction

Proposer: Alaska Village Electric Cooperative

Benefit/Cost Ratio: Applicant: 0.86 AEA: 0.92

Project Description:
Alaska Village Electric Cooperative (AVEC) is requesting for funds to construct an electrical intertie between the communities of St. Mary's and Pilot Station. The project is intended to supply Pilot Station with wind power that could be produced in St. Mary's/Pitka's Point. For this project to supply renewable energy over the intertie the wind project in St. Mary's/Pitka's Point must first be constructed. The applicant indicates that they have request funding from AEA for the construction of one 900 kW EWT at a location 2.5 miles from St. Mary's and 1 mile east of Pitka's Point and will connect it to the existing power generation system.

Funding
The applicant is requesting $5,581,800 for the construction of an intertie to connect Pilot Station to the communities of St. Mary's and Pitka's Point. An additional project match of $625,000 would be provided by AVEC. The total project cost, including construction, is estimated to be $6,202,000.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating planned wind energy into the existing distribution system. According to the application for the wind project at St. Mary's/Pitka's Point there could be 1,139,747 kWh of wind energy available.

Assumptions Modified:

Annual Wind Generation Utilization
The applicant indicated in their application that the St. Mary's/Pitka's Point wind project would have an expected annual wind generation of 2,483,000 kWh. Of this generation, it was estimated that the St. Mary's/Pitka's Point would utilize 1,343,253 kWh for electricity leaving 1,139,747 for Pilot Station. St. Mary's/Pitka's Point was using some of the existing excess wind generation to offset 2,250 gallons of heating fuel. Utilizing the wind generation for electricity in Pilot Station would eliminate the heating fuel savings in St. Mary's/Pitka's Point.

According to the AEA Wind PM, 481,130 kWh of excess wind generated electricity would be utilized in Pilot Station as a result of the intertie. It would also eliminate 8,092 gallons of heating fuel that the excess wind power was estimated to be offsetting in St. Mary's/Pitka's Point.

Annual O&M Costs
The applicant indicated that their annual O&M costs of the transmission system were $20,000. For the purposes of this analysis the O&M costs were spread over the utilized wind energy at a rate of $0.0175 per kWh.

According to the AEA Wind PM, the intertie would also reduce the diesel generation O&M in Pilot Station by $170,000 per year. Incorporating the $20,000 annual O&M costs of the intertie results in an annual net O&M decrease of $150,000.

Concerns:
This economic analysis assumed that the wind system was built in St. Mary's/Pitka's Point but the proposed intertie to Mt. Village was not built. There is concern over this projects dependence on wind in St. Mary's/Pitka's Point. Also, the benefits may be overstated if the intertie is built to Mt. Village as both Mt. Village and Pilot Station would be sharing the remaining excess wind generation.

Possible Enhancements:
This review was submitted along with proposals to build the wind system in St. Mary's/Pitka's Point and another intertie to Mt. Village. While the entire system may yield net economic benefits of avoided diesel generation and generator replacement was not clearly described. Including an analysis with more information on the diesel savings of the interties may increase the understanding of the economics.

Long-term Sustainability:
The applicant suggests that the intertie would decrease the current power plant operation costs. It is reasonable to assume long-term sustainability.

Potential public benefits:
If the project is connected with neighboring communities the existing diesel generation systems may be consolidated, resulting in lower diesel generation costs in addition to the savings from wind production.

The proposed intertie could replace the power generation already in place in the community. Sharing and stabilizing energy costs with St. Mary's/Pitka's Point would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

956 Goodnews Bay - Wind Diesel Generation Project

Proposer: Alaska Village Electric Cooperative, Inc.

Benefit/Cost Ratio: Applicant: **1.05** AEA: **0.88** AEA (without heat): **0.71**

Project Description:
AVEC is proposing to install a meteorological tower and complete geotechnical work to determine the feasibility of installing wind turbines in Goodnews Bay. The proposed funding would be used to install the tower and gather a year's worth of wind resource data, along with conducting reconnaissance-level geotechnical investigations to develop the conceptual design for the wind facility.

The applicant is proposing a 150-kW wind capacity system to be incorporated into the community's existing power plant. The power plant has 3 diesel generators with a combined generation capacity of 661 kW. The feasibility and conceptual design would determine the optimal type of wind turbine for the community. The conceptual design, when completed, would specify how power from the wind turbines would be integrated and delivered into the existing power generation facility. A secondary load control would be evaluated to determine whether dispatch boilers could be installed to use excess wind energy while allowing the diesel generators to continue to run at efficient levels.

Funding
The applicant is requesting $142,500 for feasibility and conceptual design of a wind facility in Goodnews Bay. An additional project match of $7,500 (5%) would be provided by AVEC.

Currently, AVEC only has a rough estimate of expected capital cost. AVEC estimates that the final design, construction, and commissioning phase of the project will cost $1.53 million; this is consistent with AEA's benchmark for capital cost in rural applications ($10,200 per kW).

The applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding. Additionally, AVEC proposes that it will provide a cash match of 10 percent for construction.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The applicant anticipates that the proposed wind project would displace about 28,000 gallons of diesel fuel per year.

AEA analysis however indicates that a 150-kW system in Goodnews Bay would generate about 426 MWh (with a Class 6 wind resource and a net capacity factor of 32.4 percent) of wind energy annually, displacing approximately 19,418 gallons of diesel fuel used for power generation annually. Energy from wind could support up to 32 percent of the community's power needs.

In addition, if a secondary load system is installed to capture excess wind energy for thermal loads, an additional 4,885 gallons of heating fuel savings per year could be realized.

Assumptions Modified:

Project Start

The applicant provides an estimated date of 2015 for operations to begin. However, according to the timeline provided in Section 3.2 of the application, the conceptual design and cost estimate are expected to be completed in November of 2014. If construction and commissioning commence in 2015, it is more realistic to assume first full of operations to occur in year 2016. The project start date was therefore adjusted to 2016 in both the 'APP' and 'AEA' worksheets.

Wind Resource

According to the applicant, wind resource in Goodnews Bay is rated as Class 5. However, AEA wind project managers indicated that the location is a Class 6 wind resource based on the AEA resource model map. One full year of met tower data would provide a more accurate wind resource estimate.

Annual Wind Generation

The applicant indicated that their expected annual wind generation is 367,920 kWh assuming a Class 5 wind regime and a net capacity factor of 28 percent; this was used in the applicant's tab.

The AEA tab assumes a Class 6 wind regime and net capacity factor of 32.4 percent. As per AEA analysis, the expected annual gross electricity from the proposed wind project is 425,736 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 252,430 kWh, with excess annual wind energy of 169,049 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Capital Cost/Secondary Load System

The applicant provided an estimated capital cost of $1.53 million. This figure is consistent with AEA benchmark costs per installed kW for rural projects. AEA benchmark costs include a short transmission line and installation of turbines. There is no capital cost difference between the App tab and the AEA tab-- without a secondary load system. Note that in the B/C analysis, the cost of the feasibility and conceptual design ($150,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

The applicant suggested that a secondary load system (to capture excess heat) will be evaluated, however, no information was provided regarding additional cost for the secondary load system. In the AEA analysis, an additional cost of $130,000 for the secondary load system was added to the total capital cost (this estimate was provided by AEA). On the benefit side, the estimated additional heating fuel displacement from the AEA HOMER analysis was used.

Note that adding the thermal load component changes the B/C ratio from 0.71 (without thermal component) to 0.88 (with thermal component).

Concerns:

As noted by the applicant, integration of wind into the existing diesel power plant will have to be examined carefully. The utility has a single phase system and some turbines may not be suitable for this configuration. A wind-diesel configuration with a secondary load system that could capture excess wind in this Class 6 wind regime would be worth exploring.

Possible Enhancements:

Given the amount of excess wind energy that could be generated, it might be worthwhile to invest in the secondary load system to realize additional heating fuel savings.

Long-term Sustainability:

The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Qualitative Assessment of Potential Public Benefits:

1. Infrastructure. Additional investments in power plant upgrades might result from incorporation of wind power into the existing power plant (i.e. the diesel generators could be replaced with more efficient units; a heat recovery system using excess wind could be installed, and the single phase system could replaced).
2. Employment. Operations of wind turbines may require additional staff at the power plant, or more training for current staff.
3. Community solutions. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel for power generation could provide long-term socioeconomic benefits to village households.
4. Improve existing energy system. Same as item 1 above.
5. Statewide Applicability. Lessons learned about renewable energy sources in Goodnews Bay will contribute to a better understanding of wind resources in rural locations around the state. Specifically, data from this study will be used to assist nearby communities along the Kuskokwim River understand their potential for wind power generation.
6. Long term sustainability. See the paragraph above this section.
7. Other public benefits. The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

957 Shishmaref - Wind Diesel Generation Project

Proposer: Alaska Village Electric Cooperative, Inc.

Benefit/Cost Ratio: Applicant: **1.17** AEA: **0.87** AEA (without heat): **0.89**

Project Description:
AVEC is proposing to install a meteorological tower and complete geotechnical work to determine the feasibility of installing wind turbines in Shishmaref. The proposed funding would be used to install the tower and gather a year's worth of wind resource data, along with conducting reconnaissance-level geotechnical investigations to develop the conceptual design for the wind facility.

The applicant is proposing a 200-kW wind capacity system to be incorporated into the community's existing power plant. The power plant has 4 diesel generators with a combined generation capacity of 1,600 kW. The feasibility and conceptual design would determine the optimal type of wind turbine for the community. The conceptual design, when completed, would specify how power from the wind turbines would be integrated and delivered into the existing power generation facility. A secondary load control would be evaluated to determine whether dispatch boilers could be installed to use excess wind energy while allowing the diesel generators to continue to run at efficient levels.

Funding
The applicant is requesting $142,500 for feasibility and conceptual design of a wind facility in Shishmaref. An additional project match of $7,500 (5 percent) would be provided by AVEC. The applicant estimates $58,000 will be needed for the conceptual design, $25,000 for the geotechnical investigation, $20,000 for detailed energy resource analysis, and $47,000 for other items including permitting and environmental analysis, economic and financial analyses, developing conceptual business and operations plans, and report preparation.

Currently, AVEC only has a rough estimate of expected capital cost. AVEC estimates that the final design, construction, and commissioning phase will cost $2.04 million.

The applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding. Additionally, AVEC proposes that it will provide a cash match of 10 percent for construction.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The applicant anticipates that the proposed wind project would displace 39,338 gallons of diesel fuel per year.

AEA analysis however indicates that a 200-kW system in Shishmaref would generate about 490 MWh (with a Class 5 wind resource and a net capacity factor of 28 percent) of wind energy annually, displacing approximately 30,000 gallons of diesel fuel per year. In addition, if a secondary load system is installed to capture excess wind energy for thermal loads, an additional 1,300 gallons of heating fuel savings per year could be realized.

Assuming that demand remains constant, wind power could support up to 30 percent of the community's power needs.

Assumptions Modified:

Project Start
The applicant provides an estimated date of 2015 for operations to begin. However, according to the timeline provided in Section 3.2 of the application, the conceptual design and cost estimate are expected to be completed in November of 2014. If construction and commissioning commence in 2015, it is more realistic to assume first full of operations to occur in year 2016. The project start date was therefore adjusted to 2016 in both the 'APP' and 'AEA' worksheets.

Wind Resource
According to the applicant, wind resource in Shishmaref is rated as Class 6. However, AEA wind project managers indicated that the location is a Class 5 wind resource based on the AEA resource model map. One full year of met tower data would provide a more accurate wind resource estimate.

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 567,648 kWh assuming a Class 6 wind regime and a net capacity factor of 32.4 percent; this was used in the applicant's tab.

The AEA tab assumes a Class 5 wind regime and net capacity factor of 28 percent, which results in expected annual gross electricity from wind of 493,239 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 432,243 kWh, with excess annual wind energy of 56,064 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Capital Cost/Secondary Load System
The applicant provided an estimated capital cost of $2.04 million. This figure is consistent with AEA benchmark costs per installed kW for rural projects. AEA benchmark costs include a short transmission line and installation of turbines. There is no capital cost difference between the App tab and the AEA tab-- without a secondary load system. Note that in the B/C analysis, the cost of the feasibility and conceptual design ($150,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

The applicant suggested that a secondary load system (to capture excess heat) will be evaluated, however, no information was provided regarding additional cost for the secondary load system. In the AEA analysis, an additional cost of $150,000 for the secondary load system was added to the total capital cost. On the benefit side, the estimated additional heating fuel displacement from the AEA HOMER analysis was used.

The analysis indicated that adding the thermal load component does not change the results of the B/C analysis. The B/C ratio with thermal component is 0.88 and the B/C ratio without the thermal component is 0.89.

Concerns:
Applicant has not obtained site control for the placement of a met tower in the potential location. This may prevent further development of the project from occurring, if control of the site is not provided to the applicant.

Possible Enhancements:
Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:
The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through applicant's general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:
Lessons learned about renewable energy sources in Shishmaref will contribute to a better understanding of wind resources in rural locations around the state. Specifically, data from this study will be used to assist nearby communities along the Bering Strait understand their potential for wind power generation.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 959 Ticasuk Brown School Pellet Boiler Project

Proposer: Fairbanks North Star Borough

Benefit/Cost Ratio: Applicant: **1.80/0.69** AEA: **1.80/0.69**

Project Description
The applicant is requesting $350,000 in state grants to fund Phase II of a 2 phase project to replace the 29 year old oil-fired boiler in the Ticasuk Brown school with a wood pellet burning system. Phase I, nearing completion, included delivery of the pellet boiler. Phase II consists of installation of the boiler, a heating loop, and electrical connections.

Contribution to Lower the Cost of Energy
The school currently heats using a diesel boiler. FNSB estimates that using the $900,000 pellet system to augment the diesel system will displace 20,000 gallons of fuel oil each year, providing a net saving of $31,000 in fuel costs. According to the applicant, wood pellets to run the boiler have a current cost of $295/ton, or $27 per Million net Btu. Current diesel fuel costs ($3.69/gallon according to the applicant) amount to about $34 per Million net Btu. The AEA project manager estimates that the project will require 175 tons of wood pellets annually to provide the heating requirement for the school.

The existing diesel system will remain in place and be used as backup. Limiting the use will extend its useful life and provide redundancy of heating capability.

Assumptions Modified
None.

Concerns
Operations and Maintenance processes and costs have yet to be determined. FNSB anticipates AEA will manage the project and turn over complete operational responsibilities to the school district; close coordination between the school district operational personnel who will be charged with ongoing servicing of the new plant and AEA project management is advised to create institutional knowledge of any startup issues.

The source of ultimate cost savings is unclear. Two b/c ratios were developed to analyze this project. If all Phase I costs are assumed to be sunk and only Phase II costs considered, a b/c ratio of 1.80 is produced. If the entire $900K project cost is considered, a b/c ratio of 0.69 results.

Possible Enhancements
Determine with greater certainty the cost and local availability of wood pellets. While importing wood pellets from the Lower 48 or Canada is possible, the logistical costs and energy use associated with doing so may outweigh the energy cost savings.

Long-term Sustainability
FNSB has a plan to incorporate the operation of the wood pellet system in ongoing staff and maintenance management processes. FNSB expects to work with a pellet mill in North Pole which has a capacity of 30,000 tons of biomass per year. Out of state sources from Canada and the Pacific Northwest are also available if local sourcing is unable to satisfy the requirement.

Potential Public Benefits

Lower energy costs for the school district, more cash in the local economy, a market for a new local energy source, potential applicability of experience in other locations in Alaska.

No. 960	TidGen™ Array Project	

Type:	Ocean/Tidal	
Proposer:	ORPC Alaska 2, LLC	
Benefit/Cost Ratio:	Applicant 600 kW: **0.01** AEA 600 kW: **-0.01**	Applicant 100 MW: **0.97** AEA 100 MW: **0.55**

Project Description

This project will fund three 150 kW tidal generation turbines in addition to the one 150 kW turbine that was funded in REF Round 4. The turbines will be installed at the East Foreland site in Cook Inlet near Nikiski. The previously funded turbine is expected to be constructed in 2014 and the additional three turbines proposed here are expected to be completed in 2015. These turbines constitute the pilot phase of a much larger project that will eventually result in 100 MW of installed tidal generation capacity in the year 2023.

Contribution to Lowering the Cost of Energy

The electricity from the tidal project will avoid the natural gas generated electricity on the Railbelt grid system, thus saving the fuel cost and O&M costs of operating those plants. In addition, the tidal generation will typically be operating during peak demand periods, so the plant will offset the need for some amount of peak generation capacity on the Railbelt system. Offsetting these energy cost reductions is the cost incurred to build and operate the tidal facility. Because the benefit/cost analysis shows a ratio of less than 1.0, the expected outcome is a net increase in the cost of energy due to tidal generation.

Assumptions Modified

Two separate economic analyses were performed in this review. The "600 kW" analysis addressed the set of four 150 kW turbines that constitute the pilot phase of the project. Three of these turbines are the subject of this application. However, these four small turbines are on route to a commercial-scale 100 MW project. Therefore, a second "100 MW" analysis was performed to examine the economics of the ultimate project.

The applicant estimates a capacity factor for the 100 MW plant of 44.6%, assuming a 98% availability for the plant. Given the tidal velocity distribution, the rated power characteristics of the plant, and a 90% availability assumption, this reviewer calculated a 32% capacity factor. Given uncertainty in the estimate and to remain consistent with prior AEA analyses, a capacity factor of 35% was used in the AEA 100 MW analysis.

Although the applicant mentioned the generation capacity benefit provided by the project, it was not quantified in their economic analysis. In this AEA review, a credit was calculated and included for the project's ability to offset the need for peak generating capacity.

In the 100 MW AEA scenario, the relatively small $2.45 million cost for a transmission line to the Bernice Lake substation was included.

A federal Production Tax Credit (PTC) subsidy of 1.1 cents/kWh was included in the Applicant scenarios. It was not included in the AEA scenarios due to uncertainty

regarding its availability for life of the project. Also, subsidies are generally not included in social benefit/cost analyses. If the PTC were included, the benefit/cost ratio of the AEA 100 MW scenario would increase to 0.64.

Some of the economic calculations in the application document include benefits for jobs created by the project. These benefits were quantified as equaling the payroll of the direct and indirect jobs created by the project. A conventional economic benefit/cost analysis considers labor to be one of the valuable resources consumed by the project, and therefore labor costs are only entered on the cost side of the ledger. The benefit/cost ratios calculated in this review do not include job creation as a benefit for either the Applicant or the AEA economic scenarios.

Concerns

There are concerns about impact to marine life, impact on sedimentation transport, and the impact of ice on the power plant. In addition, in-stream tidal generation technology is in its infancy and unforeseen operational and performance issues could arise. Having to contend with these issues may lower the availability and capacity factor of the generation units, thereby reducing the economic attractiveness.

The cost estimates for the commercial-scale plant are quite uncertain due to the early stages of the technology and due to construction of the plant being ten years in the future.

Potential Enhancements

Because in-stream tidal generation technology is in its infancy, unforeseen technological breakthroughs could occur that would reduce the cost or improve the performance of the technology. Because the commercial-scale phase of this project will not occur for about 10 years, there is time for these advancements to occur.

Long-Term Sustainability

The project substitutes a renewable and cost-less fuel for an exhaustible fuel so improves the sustainability of the Railbelt electric generation system.

Potential Public Benefits

The 600 kW project will create 28 direct construction period jobs and 4 direct ongoing jobs. The 100 MW project will create 677 direct construction period jobs and 155 direct ongoing jobs, according to the applicant. The project will be the first tidal generation plant on the Railbelt grid and thus will provide the added stability that results from increased diversity of generation sources.

Alaska has a very large tidal energy resource, and if this project proves successful, it could lead to other successful Alaskan projects. In addition, it could put Alaska at the center of tidal generation activity in the US.

961 Atka Wind Power Project

Proposer: City of Atka

Benefit/Cost Ratio: Applicant: **n/a** AEA: **n/a**

Project Description:

The City of Atka is requesting funding for reconnaissance and feasibility study for a wind energy project in the community of Atka. The Applicant states the study will analyze whether wind power used in combination with the recently completed Shunixsax Creek Hydro-Electric project and diesel generated power can provide additional power needed to support electric heat to the entire community of Atka and a planned expansion of Atka Pride Seafoods (APS) to a year-round processing operation.

The Applicant did not provide information regarding their proposed project to be able to analyze the benefits and cost of a wind facility. As noted in the application, the proposed system design capacity, fuel usage, costs, and annual average wind resource availability are to be determined by the study.

Funding

The City of Atka requests $140,000 in renewable energy grant funding. They will match the grant with an in-kind contribution of $20,000 and the Aleutian/Pribilof Islands Community Development Association will provide $30,000 for a meteorological tower to obtain wind data. The total cost of reconnaissance and feasibility phases would be $190,000.

Contribution to Lower the Cost of Energy:

The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The City of Atka hopes to integrate wind power into the existing system and generate 90 percent or more of Atka's energy needs using renewable energy sources.

APS is a subsidiary of the Aleutian/Pribilof Community Development Association and is partially owned by the community of Atka. Currently ASP operates its own power plant because the City does not have the capacity to supply power needed. APS's generation system includes two diesel generators and the expectation of adding a third in the fall of 2013. Wind power would help lower the costs of energy to the seafood processing plant. The community of Atka and APS would like to be less dependent on the variable price of diesel fuel, have a reliable energy source, lessen the environmental risks of fuel transport and storage hazards by requiring less diesel fuel to power their community.

Concerns:

The Applicant did not provide information regarding the proposed system capacity, wind resource, benefits, or costs. More information is needed to be able to evaluate the economic merits of the project.

Unless there are unforeseen benefits to conducting a reconnaissance and feasibility study concurrently, approving funding for one phase at a time might help ensure neither time or money are allocated to an uneconomical project.

Potential Enhancements:
Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:
Sustainability cannot be determined until more thorough details are reported.

Potential public benefits:
Lessons learned about renewable energy sources in Atka will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

962 Manokotak – Wind and Heat Feasibility Study

Proposer: Manokotak Power Company

Benefit/Cost Ratio: Applicant: **0.66** AEA: **0.99**

AEA (Benchmark + Heat): **0.87**

Project Description:

Manokotak Power Company (MPC) is proposing to install 3 to 4 small meteorological towers and complete conceptual design work to determine suitable wind turbine sites and optimal system design. The proposed funding would be used to complete a conceptual design report in compliance with the Alaska Wind Program Guidelines for Conceptual Design Reports that includes a wind resource analysis, electrical system overview, and heat load overview.

The Applicant is proposing a 100-kW wind capacity system to be incorporated into the community's existing power plant that utilizes a single diesel generator with a generation capacity of 260 kW.

Funding

The Applicant is requesting $193,000 for feasibility and conceptual design of a wind facility in Manokotak. An additional in-kind project match of $7,000 (3.5 percent) would be provided by MPC. The applicant estimates $70,250 will be needed for final report and recommendations, $51,000 for conceptual business and operations plans and economic and financial analysis, $36,000 for detailed energy resource analysis, $20,250 for the conceptual design, and $22,500 for other items including project scoping and contractor solicitation, identification of land and regulatory issues, permitting and environmental analysis, and detailed analysis of existing and future energy costs and markets.

Currently, MPC only has a rough estimate of expected capital cost. MPC estimates that the final design, construction, and commissioning phase will cost $1.02 million.

The Applicant indicated that further funding for may come from other local and regional funding sources supporting energy and economic development.

Contribution to Lower the Cost of Energy:

The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The applicant anticipates that the proposed wind project would displace close to 13,000 gallons of diesel fuel per year.

AEA analysis however indicates higher potential fuel displacement of more than 30,000 gallons of fuel per year. That is, if the utility would consider a higher capacity wind system and a location with a Class 5 wind resource and net capacity factor of 28 percent.

Wind power could displace at least 13 percent of the community's current fuel consumption.

Assumptions Modified:

Annual Wind Generation

The applicant indicated that their expected annual wind generation is 168,192 kWh assuming a Class 4 wind regime and a net capacity factor of 24 percent; this was used in the Applicant's tab.

The AEA tab assumes a Class 5 wind regime and net capacity factor of 28 percent, which results in expected annual gross electricity from wind of 466,032 kWh. Furthermore, AEA analysis estimates annual net electricity produced from wind of 363,505 kWh, with excess annual wind energy of 102,527 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Note that the Applicant suggested a 100-kW wind system while the AEA analysis considered a total installed wind capacity of 190 kW.

Capital Cost/Secondary Load System

The Applicant provided an estimated capital cost of $1.02 million for a 100-kW system (assuming one wind turbine). This figure is consistent with AEA benchmark costs per installed kW for rural projects, which includes a short transmission line and installation of turbines. The estimate however does not include the cost of secondary load components for thermal recovery.

In the AEA analysis, the estimated capital cost is based on the use of 2 95-kw remanufactured wind turbines (combined capacity of 190 kW). AEA wind project manager noted that a single 95-kW turbine would only provide 18 percent penetration; while 2 95-kW turbines could provide 37 percent average system penetration.

Additional analysis was conducted using the AEA benchmark capital cost for rural applications and adding an estimate of the cost of secondary load components for thermal recovery.

Note that in the B/C analysis, the cost of the feasibility and conceptual design ($200,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

Concerns:

Feasibility and conceptual design costs are 30 percent higher than similar studies performed in the region. However, the Applicant is proposing to install up to 4 met towers.

The success of the project is contingent on finding at least a Class 4 wind resource. The AEA analysis assumed Class 5 wind resource. According to the AEA, higher wind class locations are indicated by the wind resource model, but a suitable location with reasonable road access will have to be determined.

Possible Enhancements:

Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:

The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through ongoing energy sales. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:

Lessons learned about renewable energy sources in Manokotak will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 963	Mount Makushin Geothermal Project

Type: Geothermal

Proposer: The Aleut Corporation

Benefit/Cost Ratios: Applicant: **3.13** AEA Scenarios:
Utility Load Only: **0.49**
Utility Load Only with HDL Capital Costs: **0.99**
Utility + Self-Generation Load: **1.25**

Project Description

This application proposes to perform all phases (reconnaissance through construction/commissioning) of a project to build a 30 MW geothermal power plant utilizing the Mount Makushin geothermal resource near the City of Unalaska. The project would be large enough to supply the City of Unalaska utility electrical loads and the seafood-related self-generation loads.

Contribution to Lowering the Cost of Energy

Both utility electric generation and the self-generated loads in Unalaska are provided by diesel generation. This project would avoid the fuel costs and operation and maintenance costs associated with the bulk of that diesel generation (assuming agreements are reached for service of the self-generation load). Offsetting those savings would be the cost of building and operating the geothermal plant and associated facilities.

Assumptions Modified

Three AEA economic scenarios were developed for this project. The first scenario is one that only considers service to the city utility electrical loads and assumes no service of the self-generation loads. Also, a 90% geothermal plant availability was assumed as opposed to the applicant's figures that implied a 96% availability. The size and cost of the geothermal facilities were reduced to reflect the smaller plant required to serve just the utility load. The benefit/cost ratio for this scenario was **0.49.**

A second scenario assuming service to only the utility load was run. This scenario differed by using capital costs from the 2009 Hattenburg Dilley and Linnell (HDL) geothermal cost matrix study done for the AEA. For the 9 MW plant needed to serve the utility load, the applicant's cost data indicated a $265 million capital cost whereas HDL cost data indicated a midpoint cost estimate of $132 million. This lower capital cost raised the benefit cost ratio to **0.99**. Note that other assumption changes could easily bring this scenario over a 1.0 B/C ratio. An increase in the life of the geothermal plant to 30 years results in a 1.37 B/C ratio. Use of electric heat to eliminate 400,000 gallons per year of heating fuel in Unalaska results in a 1.15 B/C ratio.[1]

Finally, an AEA scenario assuming service of both the utility load and the self-generation load was performed. However, the applicant's assumptions concerning the size and the generation efficiency of the self-generation load were modified. The applicant assumed the energy equivalent of a continuous 22 MW self-generation load. The AEA scenario

[1] This scenario includes a $1.30/gallon heating fuel price premium, $1.50 geothermal O&M per gallon avoided, and an additional $3.3 million in capital cost to implement the electric heat.

assumed a 22 MW peak load having an annual average load of 11.4 MW due to the seasonality of the seafood industry. Also, this scenario assumed that 35% of the waste heat from the self-generation was being recovered and utilized, thus improving the efficiency of the self-generation plant. The applicant's geothermal plant capital costs were used, and the resulting benefit/cost ratio was **1.25.** Use of HDL capital costs instead would result in a B/C ratio of 2.15.

Concerns

There are substantial uncertainties in the capital cost estimates for this project and estimates of the size of the self-generation load, both critical elements in the economic analysis. Also, the ability to negotiate a contract for the self-generation load is uncertain.

This economic analysis compared geothermal energy against the current diesel-based generation. Other alternatives such as imported LNG, wind, hydro, and use of fish oil could cost-effectively offset some diesel generation and therefore should be considered as part of the base case alternative in the geothermal analysis. Further energy efficiency efforts would also lower the benefits of geothermal.

Potential Enhancements

During non-peak periods, the extra available capacity of the geothermal plant could be used to offset heating loads through use of interruptible electric heat. This benefit was not included in the main scenarios above (although casually analyzed above as sensitivity to the Utility-only scenario).

Only one diesel fuel price scenario was analyzed. Higher fuel price escalation would increase the benefits of this project.

The roads and dock facilities built by this project could provide non-energy benefits that were not accounted for in the economic analysis. Also, other uses of the geothermal heat such as greenhouses or recreational uses were not considered.

Long-Term Sustainability

The project replaces a fuel source with substantial price volatility with one having relatively stable ongoing costs. Although the AEA default assumption of geothermal plant life is 20 years, the Geyers geothermal plant in a California has operated for more than 50 years, although not at peak production.

Potential Public Benefits

As mentioned above, the roads and docks built for this project could have public benefits. Construction of the plant costing somewhere between $130 and $310 million will create a substantial number of temporary jobs. Operation and maintenance costs for the plant are up to $8 million per year, and some of that cost will be labor providing jobs for local residents. By adding an additional generating source to the Unalaska power generation system, more backup capacity will be available, improving the reliability of the system. Because of the few geothermal plants in Alaska (currently one), an additional plant will provide additional Alaska-specific information regarding this energy technology.

No. 964	Haines Borough Excursion Inlet Hydro Project Feasibility Part II

Proposer: Haines Borough

Benefit/Cost Ratio: Applicant, as shown on paper application: 1.16
Applicant as calculated by economist on applicant worksheet in model: 1.86
AEA worksheet: 1.87AEA (2) worksheet: 1.09

Project Description
The applicant is requesting $213,536 from this funding round and will match $10,000 for a total phase II cost of $223,536. In a previous grant request (AEA grant 625) the applicant requested funds for reconnaissance and feasibility. In the current grant request, the applicant checked off that this is a feasibility project request (sec 2.1 of application) but in the following page clarifies that the request is for feasibility and conceptual design. The project scope is similar to a 1979 scope referenced throughout the application. The project would develop two hydro sites at Excursion Inlet (North and South Excursion Inlet Creek). The total project cost for the current project is estimated at $15,900,000. The 1979 project cost estimate was $11,400,000. The project would primarily serve Ocean Beauty, the fish processing facility at Excursion Inlet.

Contribution to Lower the Cost of Energy
While the project would be beneficial to the fish processor because it would allow it to replace its aging diesel generators, it would have little to no significance to the community.

Assumptions Modified
Because the first phase of the feasibility study is still underway, there is still a lack of information necessary to assess the true impact of the project. Most of the known data comes from the 1979 project scope.

- **Project start date.** No construction schedule was provided by the applicant. The current phase will end in 2014; based on this and allowing for design, permitting and construction, the economist used 2020 as the start date.
- **Fuel oil costs.** The economist used the ISER fuel oil estimate of $4.05 per gallon in 2012 and the applicant indicated that fuel oil was $3.23 per gallon in the grant application. The applicant does not state whether the price of fuel per gallon is retail or utility price. The ISER fuel oil assumption was used in the applicant and the AEA worksheets.
- **O&M.** The applicant gives an O&M of $0.02, the same as AEA. Because new information is pending regarding from the feasibility study and related information, the AEA standard is assumed throughout.

Concerns

- **The community has a very low population.** The applicant states that the population of the community is growing, and that there are 95 landowners in the vicinity. While there may be 95 landowners, the community currently totals 14 inhabitants (AK DOL Place estimates, calc page). These 14 represent an increase but a very small one over the last decade. Even at this newly increased level, the community represents 0.53% of the Borough's population. There is no guarantee that the population trend is increasing at a significant rate.
- **Residential and Commercial benefits.** The borough anticipates market energy to residential and commercial interests as they develop over time, but there is no

concrete evidence to support this in the application, other than the current fish processor activity.

- **Integration of existing households into a power distribution plan.** Currently, the small number of households are not connected to any kind of utility distribution system; it appears that each household is responsible for its own power generation. The applicant does not provide a plan to integrate these households or the related costs to develop the infrastructure to deliver power to households.
- **Power purchase agreement or Partnership with Ocean Beauty?** The project primarily benefits Ocean Beauty, and there is an assumption that it would buy the power generated from the project to offset most of its diesel used. The processor provided a letter of support but there is no agreement in place. If the processor were to fold, or relocate, the hydro project would have no one to buy electricity. The applicant states that the processor could receive additional fish for processing if it had access to production in the shoulder seasons, but there are other processors in Southeast Alaska. Ocean Beauty has six processors in Alaska, with the closest one to Excursion Inlet is located in Petersburg, AK. According to the processor's website (http://www.oceanbeauty.com/?page_id=9), Ocean Beauty Seafoods LLC is a privately held corporation, 50% owned by the Bristol Bay Economic Development Corporation (BBEDC), and 50% by a group of individual owners. BBEDC is a Community Development Quota corporation, and one wonders if a partnership with the Borough wouldn't be beneficial to the project.
- **Site control?** The applicant will have to determine the affected land tracts and secure/buy the land from landowners but does not provide an estimate as to the cost of securing the land.
- **How much will the project really cost?** In 1979, the cost of the project was estimated at $11,400,000. The current estimate is $15,900,000. If the scope of the project is the same as the 1979 scope, and the costs of the technology and construction have kept pace with inflation, there is a risk that the current estimated cost is low. The 1979 costs, adjusted for inflation equal $29,591,080 in 2011 dollars (AEA worksheet 2).

Possible Enhancements / Recommendations

- **Partnership with Ocean beauty?** At the very least, the project would benefit from more active involvement from the processor, be it, a partnership, cost sharing or binding purchase agreement.
- **Plan to integrate households into power structure.**

Long-term Sustainability

- **Management structure appears adequate.** The project would be owned and operated by the Borough.
- **If developed, the project would be developed as long as the processor is in operation at Excursion Inlet.**

Potential Public Benefits

- **Reduction in diesel fuel use.** The project could reduce the amount of diesel consumed by the fish processor and by the community, IF the community can be intergraded into the resource.

- **Long term viability of the community.** The project has the possibility to extend the processor's production into shoulder seasons, which would indirectly contribute to the

Borough coffers via the raw fish tax, the assumption is that this would in-turn benefit Excursion Inlet but no plan is provided as to how the benefit will trickle down.

965 Haines Borough Pellet Heating Project

Proposer: Haines Borough

Benefit/Cost Ratio: Applicant: **2.17**
AEA: **1.77**

Project Description

Project funds will be used to design, purchase, and install six wood pellet boilers and storage silos at the following Borough-owned buildings: sewage treatment plan, human resource & pre-school building, Haines Borough School District vocational education building (also known as the voc-tec building), swimming pool, Borough administrative office, and visitor center.

Contribution to Lower the Cost of Energy

Total fuel displacement for the buildings noted is estimated at 30,790 gallons of fuel oil.

Assumptions Modified

The applicant submitted O&M cost estimates for the current and proposed systems, but no repair costs. These were estimated at 25% of O&M for the new system ($2,600) and 50% of O&M ($4,000) for the current system.

The applicant's project life was reduced from 25 years to AEA's standard 20 years for biomass projects.

Concerns

None noted. Submitted studies appear to confirm availability of resources (pellets) from the PNW, Canada, or possibly a local product (less certain). Sealaska price quotes are used for delivered price per ton.

Possible Enhancements

None noted; applicant's contractors did due diligence.

Long-term Sustainability

The use of either wood chips or wood pellets would enhance both the forests in the Interior as well as provide the Haines Borough with lower fuel costs.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. New pellet boilers will be installed with exterior silos.
2. Employment. No additional FTE's are forecasted.
3. Community solutions. This system would reduce costs of heating for both the school and the community.

4. Improve existing energy system. The existing heating system could be used for peaking and standby and one engineering analysis noted electric boilers may be a solution for winter-time use.
5. Statewide Applicability. This would apply across most parts of Alaska with access to pellets.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. As with other wood-base projects, emissions would be reduced, along with the carbon footprint.

966 High-Penetration Wind Energy Project - Kokhanok

Proposer: Kokhanok Electric

Benefit/Cost Ratio: Applicant: 9.77 AEA: 5.68

Project Description:

Kokhanok Electric is requesting funding to complete development, testing, and commissioning of the software for the Hybrid Systems Supervisory Controller which will allow for better utilization of the exisiting wind system. The work will be completed by the newly formed Sustainable Power Systems. The current wind system is currently producing electricity. The applicant is requestion funding to develop software that is expected to increase the utilization of the system.

Funding

Kokhanok Electric requests $185,000 in renewable energy grant funding. They will match the grant with an in-kind contribution of $5,000. The total cost of the remaining work would be $190,000.

Contribution to Lower the Cost of Energy:

The project is anticipated to reduce the community's future fuel purchases by incorporating more wind energy in to the existing system. The proposed software will allow the diesel generators to be turned completely off at times.

The existing wind turbines have performed well since installation in October of 2010. The applicant reports and effort to actually increase the capacity of the turbines from 90 kW to 105 kW base on their performance. Thie proposed improvement will allow for more of the generated wind power to be utilized.

Concerns:

The Applicant did not provide detailed information on how the incremental benefit of the software was calculated. This reduces the confidence in the exact magnitude of the incremental benefit.

The previous firm working on this project, Sustainable Autamation, went out of business. Marsh Creek is confident that Sustainable Power Systems will be able to complete the project with adequate funding.

Potential Enhancements:

Long-term Sustainability:

This project should decrease the dependency on operator intervention of the system which may increase its sustainability.

Potential public benefits:

The success of this high-penetration system may be useful in designing other high-penetration systems in Alaska.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

967 Cold Bay Waste Heat Recovery Project

Proposer: G&K Electric Utility

Benefit/Cost Ratio: Applicant: **1.58**
AEA: **1.58**

Project Description

Cold Bay requests funding for a waste heat recovery study as a step towards supplementing the high cost of diesel generators currently in use. The waste heat recovery study will include Phases I and II, Reconnaissance and Feasibility, and will result in a feasibility report on the technical, economic, financial, and operational viability and guidelines of implementing the next three phases of a waste heat recovery system. The grant will be managed by the Aleutians East Borough and calls for the solicitation of a contractor to perform the analysis and a community meeting with the contractor for presentation, review, and discussion of the results.

Participants in the project will include:

- G&K Electric Utility
- Aleutians East Borough, who will provide overall project management
- A contracted firm, who will provide civil and electrical system engineering

Contribution to Lower the Cost of Energy

This project will reduce fuel and the overall energy costs to the Cold Bay community. Other benefits will include:

- Reduced dependence on diesel fuel and the expense involved in its transportation.
- Savings on current operation and maintenance costs.
- Reduction of air pollution and climate change effects.

Assumptions Modified

Due to the preliminary nature of this analysis, the following assumptions were used based on initial estimates about the final heat recovery system design:

1. The heat recovery system will be put into use in 2016, two years after the conclusion of the proposed reconnaissance and feasibility studies in 2014.
2. The heat recovery system will have a 20-year life per the AEA standard.
3. The total capital cost will be the amount requested for this initial study ($114,765) plus the estimated construction cost ($850,714), for a total of $965,479.
4. Construction expenditures are assumed to be split equally between 2015 and 2016.
5. Generator O&M costs are assumed to be $500 annually, based on other heat recovery applications.

Concerns

This analysis is preliminary. The applicant is requesting funds for reconnaissance and feasibility studies. This analysis is based on preliminary estimates of the heat recovery system's cost, fuel displacement, and other characteristics provided in the application. If the final heat recovery system's characteristics differ from those in the application, a new analysis will be needed.

Possible Enhancements

None noted at this time.

Long-term Sustainability

Long-term sustainability will be evaluated during the feasibility study.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. The proposed study should identify potential infrastructure benefits.
2. Employment. Effects on employment have not been determined.
3. Community solutions. The proposed study should indicate community benefits.
4. Improve existing energy system. The project's objective is to reduce the consumption of heating fuel by utilizing available recovered heat.
5. Statewide Applicability. Similar systems could be installed at other power plants.
6. Long term sustainability. See the above section on long-term sustainability.
7. Other public benefits. If feasible, an unused heat resource would be captured to offset imported oil.

968 False Pass Wind Energy Project

Proposer: City of False Pass Electric Utility

Benefit/Cost Ratio: Applicant: **0.30** AEA: **0.64**

Project Description:

City of False Pass Electric Utility is requesting funding for design and permitting for a wind energy project in the community of False Pass. Applicant states that the funds will be used for the design and permitting phase, which will include project scoping and community solicitation for planning and design, permit applications and acceptance, final environmental assessments and mitigation plans, resolution of land rights and righ-of-way, final system design, engineers cost estimate, updated economic and financial analysis, and final business plan and operational plans.

Funding

The City of False Pass Electric Utility requests $185,195 in renewable energy grant funding. They will match the grant with an in-kind contribution of $5,000 (2.6 percent).

Contribution to Lower the Cost of Energy:

The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. False Pass hopes to integrate wind power into the existing system and generate the same amount of energy output using less fossil fuels.

False Pass is currently unable to recover the operating and maintenance costs of the existing diesel system. The applicant states that the City is unable to charge an energy rate that is affordable to customers. Applicant believes that by integrating wind energy into the exising system will allow False Pass Electric Utility to keep energy prices affordable.

Assumptions Modified:

Capital Cost/Secondary Load System

The Applicant did not provide consistent project costs or benefits other than the cost of design and permitting. The applicant did state expected project capital costs of $1,760,485 for the installation of a 200-kW system. However, this information was used in other applications and does not fit the magnitude of a system needed in False Pass. A "couple" 10-kW turbines are also listed as the proposed system to be installed. Albiet this system is much more realistic in magnitude; a capital cost of $1,760,485 is not realistic for a project of such size. The Applicant did not provide an estimate of total project cost. The AEA capital cost benchmark was used in the analysis.

Data received from AEA wind managers suggests a proposed 55-kW system and total project costs of $765,000. In the AEA analysis, a thermal load component is assumed (based on the inclusion of heat recovery benefits from AEA wind managers) in the recommended capital costs.

On the benefit side, the estimated additional heating fuel displacement from the AEA HOMER analysis was used.

Annual Wind Generation

Applicant stated, based on a 20-kW proposed system, an electricity generation of 27,120 kWh; this was used in the 'APP' tab. This figure conficts with information also provided by the Applicant in section 4.4.1 of the application which suggests a 200-kW system.

The AEA tab assumes a Class 3-4 wind regime and net capacity factor of 39 percent, which results in expected annual gross electricity from wind of 185,975 kWh. Furthermore, analysis estimates annual net electricity produced from wind of 148,028 kWh, with excess annual wind energy of 37,947 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Fuel Efficiency

The applicant stated a fuel efficiency of 11.43 kWh/gallon for their existing diesel generators. The AEA analysis assumed the minimum efficiency of 13 kWh/gallon as per AEA guidelines.

Concerns:

Applicant is requesting funds for design and permitting of a proposed wind system in False Pass. At this point in the grant funding stage it should be expected that the applicant have reasonable assumptions for proposed system design capacity and fuel usage, project cost, project benefits, and proposed project location. However, the particular application fails to have any of these details listed in the project cost worksheet (section 4.4.4). The worksheet only stated that information will be provided in a completed conceptual design report.

Aleutians East Borough was previously awarded a $25,000 grant from AEA in 2009 to perform a renewable energy resource feasibility study for the communities of Cold Bay, False Pass, and Nelson Lagoon. Applicant also states that assisntance is being given by the Aleutian Pribilof Island Association and Marsh Creek, Inc. to follow up on the project recommendations contained in the feasibility study. Both the feasibility study and the follow up recommendations are to contain much of the information contained in this application.

Potential Enhancements:

Applicant could supply previously completed feasibility study.

Long-term Sustainability:

Sustainability cannot be determined until more thorough details are reported.

Potential public benefits:

Lessons learned about renewable energy sources in False Pass will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

969 Nelson Lagoon Wind Energy Project

Proposer: Nelson Lagoon Electric Cooperative

Benefit/Cost Ratio: Applicant: **0.56** AEA: **0.93**

Project Description:

Nelson Lagoon Electric Cooperative (NLEC) is requesting funding for design and permitting for a wind energy project in the community of Nelson Lagoon. Applicant states that the funds will be used for a wind study report, which will include a feasibility report on the technical, economic, financial, operational viability, and guidance of implementing the next three phases of a wind energy system.

Funding

NLEC requests $218,195 in renewable energy grant funding. They will match the grant with an in-kind contribution of $5,000 (2 percent).

Contribution to Lower the Cost of Energy:

The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. Nelson Lagoon hopes to integrate wind power into the existing system and generate the same amount of energy output using less fossil fuels.

Nelson Lagoon is currently unable to recover the operating and maintenance costs of the existing diesel system. The applicant states that the city is unable to charge an energy rate that is affordable to customers. Applicant believes that by integrating wind energy into the exising system will allow NLEC to keep energy prices affordable.

Assumptions Modified:

The Applicant did not provide consistent project costs or benefits other than the cost of design and permitting. The applicant did state expected project capital costs of $1,760,485 for the installation of a 200-kW system. However, this information was used in other applications and does not fit the magnitude of a system needed in Nelson Lagoon. A "couple" 10-kW turbines are also listed as the proposed system to be installed. Albiet this system is much more realistic in magnitude, a capital cost of $1,760,485 is not realistic for a project of such size. Due to inconsistency, AEA capital costs benchmark was used in both the 'AEA' and 'APP' tabs.

Annual Wind Generation

Applicant stated, based on a 20-kW proposed system, an electiricy generation of 32,880 kWh and is used in the 'APP' tab. This figure conficts with information also provided by the Applicant on page 12 of the application which suggests a 200-kW system.

In the AEA analysis, a higher annual wind generation estimate was used. In the absence of information from AEA on the wind resource in Nelson Lagoon, a Class 7 wind resource was assumed (as suggested by the Applicant). This analysis therefore assumes a best case scenario with respect to wind resource.

Fuel Efficiency

The applicant stated a fuel efficiency of 11.23 kWh/gallon for their existing diesel generators. The AEA analysis assumed the minimum efficiency of 13 kWh/gallon as per AEA guidelines.

Concerns:

Applicant is requesting funds for design and permitting of a proposed wind system in Nelson Lagoon. At this point in the grant funding stage it should be expected that the applicant have reasonable assumptions for proposed system design capacity and fuel usage, project cost, and project benefits. However, the particular application fails to have any of these details listed in the project cost worksheet (section 4.4.4). The worksheet only stated that information will be completed in "CDR report."

Applicant was previously awarded a $25,000 grant from AEA in 2009 to perform a renewable energy resource feasibility study for the communities of Cold Bay, False Pass, and Nelson Lagoon. Applicant also states that assisntance is being given by the Aleutian Pribilof Island Association and Marsh Creek, Inc. to follow up on the project recommendations contained in the feasibility study. Both the feasibility study and the follow up recommendations are to contain much of the information contained in this application.

Potential Enhancements:

Applicant could supply previously completed feasibility study.

Long-term Sustainability:

Sustainability cannot be determined until more thorough details are reported.

Potential public benefits:

Lessons learned about renewable energy sources in Nelson Lagoon will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

970 Kipnuk - Wind Diesel Generation Project

Proposer: Kipnuk Light Plant

Benefit/Cost Ratio: Applicant: **1.49** AEA: **0.81**

Project Description:
Kipnuk Light Plant is requesting for funds to complete final design, permitting, and construction of a high-penetration wind diesel system for the community of Kipnuk. The project will be owned and operated by Kipnuk City Light and the community of Kipnuk.

The proposed wind system would include 5 WindMatic 17S 95-kilowatt wind turbines (combined capacity of 475 kW), wind diesel supervisory control and data acquisition system, 300 kWe load balancing boiler, 30 electric thermal storage (ETS) devices, advanced metering system to track diesel and wind sales, Static Var compensation device, and underground 12,470 volt 3 phase power line with fiber optic communications to the wind turbines.

The Applicant would like to construct the wind facility in conjunction with construction of the new school, power plant, and bulk fuel facility in the community. The design of the wind system was patterned after the systems installed in Kongiganak, Kwigillingok, and Tuntutuliak. According to the Applicant, the only design elements left to be completed are the installation and wiring diagrams for the specific installation of the load balancing boiler, system master control, communications gateways, and static var compensation in the new power plant. They intend to complete these design elements concurrently with the design and construction of the new diesel powerhouse.

Funding
The applicant is requesting $2,567,778 for final design, permitting, and construction of a wind facility in Kipnuk. A project match of $1,500,000 (36 percent) is acknowledged by applicant.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility and capturing the excess wind energy for heating. As stated in the application, the applicant anticipates that the proposed wind project would displace over 79,000 gallons of diesel fuel per year.

AEA analysis however indicates a lower potential fuel displacement of about 56,000 gallons of fuel per year (both power and heat). According to the AEA HOMER analysis, the proposed wind project would generate 948 MWh of wind energy annually (given a Class 5 wind resource and an estimated capacity factor of 23 percent).

The proposed wind project could potentially support about 35 percent of the community's power needs.

Assumptions Modified:

Annual Wind Generation

The applicant indicated their expected annual wind generation to be 1,125,000 kWh assuming average wind speeds of 7.78 m/s. This indicates a Class 6 wind resource and a capacity factor of 32.4 percent; this was used in the applicant's tab.

As per AEA analysis, the expected annual gross electricity from the proposed wind project is 948,708 kWh. This assumes a Class 5 wind resource and a lower estimated capacity factor of 23 percent. Furthermore, AEA's Homer analysis estimated annual net electricity from wind of 595,640 kWh, with excess annual wind energy of 353,068 kWh for thermal loads. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Capital Cost

AEA's estimated total project cost is the same as the Applicant's estimate; however, the applicant states $4,067,778, $3,886,450, and $4,062,778 in different sections of the application. Also, when NEI added up the line items of the grant budget in section 9 of the application, the total came to $4,068,978 or $4,069,978, depending on whether individual items were summed or subtotals (RE-Fund Grant Funds/Grantee Matching Funds) were summed. NEI used the summation of line items ($4,068,978) for total project costs.

Concerns:

AEA wind manager indicates that an actual wind resource is unknown to the Kipnuk region as a wind resource study has not been completed. Wind information given by the applicant is based on wind resource studies performed in Kongiganak, which is located 40 miles east of Kipnuk. Also, HOMER analysis was reported to be done for Kipnuk, but was not supplied with application. Installation costs were also estimated by using known foundation conditions. However, no geotechnical or feasibility work has been performed on the potential installation sites to the knowledge of NEI analysts. Without met tower data and geotechnical work, it is difficult to determine total project benefits and costs. One full year of met tower data would provide a more accurate wind resource estimate.

Possible Enhancements:

Applicant should have feasibility and geotechnical work complete to ensure optimal design and avoid cost overruns. Any HOMER analysis cited in the application should be provided with application.

Long-term Sustainability:

The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through the applicant's general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:

Lessons learned about renewable energy sources in Kipnuk will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 971	Eastern Copper Basin Geothermal Assessment

Type: Geothermal

Proposer: Copper Valley Development Association

Benefit/Cost Ratio: Applicant: **NA** AEA: **0.68 – 1.52**

Project Description

This project will perform a reconnaissance study of building a geothermal electrical power plant utilizing the Eastern Copper Basin geothermal resource.

Contribution to Lowering the Cost of Energy

If the geothermal project is cost-effectively built, it will lower the cost of electricity supplied by Copper Valley Electric Association (CVEA) by displacing more expensive diesel and oil-generated electricity. Because the electrical load on the CVEA system varies and because CVEA has substantial hydroelectric generating capacity, the proposed geothermal project will not be fully utilized to supply conventional electric loads. Therefore, additional benefit can be derived from the geothermal project by supplying space heating and water heating loads that are currently being supplied by fuel oil appliances. The economic calculations done in this analysis assume that these heating loads would be supplied by interruptible electric resistance heat, controlled by the utility to utilize as much of the excess generating capability of the geothermal project as possible. The applicant did not propose this concept, but some additional utilization of the geothermal plant is clearly necessary due to the large contribution of hydroelectricity to the existing CVEA load during many months of the year.

Assumptions Modified

The applicant proposed to study a 250 MW geothermal electrical plant, a size substantially in excess of the needs of the CVEA system, and in excess of the 10 MW plant analyzed by Hattenburg Dilley and Linnell (HDL) in their 2009 assessment of potential Alaskan geothermal plants done for the AEA. The plant size proposed by the applicant would require an intertie connecting the plant to the main Railbelt electrical grid.

Instead, an 11 MW plant was analyzed here. An 11 MW plant is sufficient to just meet the CVEA peak load that is not served by the existing hydroelectric generating capacity and the upcoming Allison Creek hydro plant.

Two AEA scenarios were considered: a “High B/C” scenario assuming project capital costs of $98 million and a displacement of 1.2 million oil gallons per year of space and water heating loads; and a “Low B/C” scenario assuming project capital costs of $184 million and a displacement of 0.86 million oil gallons per year of space and water heating loads. The High scenario generated a B/C ratio of 1.52 and the Low scenario generated a B/C ratio of 0.68. Capital costs for these two scenarios came from the range of costs estimated in the 2009 HDL study mentioned above.

The applicant put forth no economic data or analysis, so the Applicant B/C ratio was not computed.

Concerns
There are general concerns about the availability of the resource, even for an 11 MW plant.

The concept of using widespread interruptible electric space and water heating to utilize excess plant generation capacity is new to Alaska, but multiple utilities in the US have implemented electric water heater load management systems, which are similar to this concept. Also, the excess generation energy is weighted towards the summer months when space heating is the lowest. In the High B/C scenario, displacement of oil-fired space and water heat constitutes 58% of the benefit of the project, so issues surrounding this benefit are important.

The electric generation benefits depend upon displacing all (except for geothermal plant outages) of the diesel and cogeneration electricity currently produced by CVEA. The contract between CVEA and Petrostar (Petrostar provides fuel and uses the heat from the cogeneration plant) does expire in 2015, but displacing virtually all of the cogeneration plant output could still present issues.

Potential Enhancements
Even in the High B/C scenario, only 64% of the available output of the geothermal plant is being utilized. Finding uses for the additional capacity would provide additional benefit.

If a large and cost-effective geothermal resource were found, building a large plant and building an intertie to the Railbelt electric grid may provide a larger benefit than estimated here.

Long-Term Sustainability
The project utilizes a renewable resource with no fuel cost, and the project displaces a non-renewable resource (oil) with an unstable future fuel price. The project is analyzed with an assumed 20 year life, but some geothermal plants have operated for over 50 years (e.g. the Geyers geothermal plant in California).

Potential Public Benefits
The HDL study that provided cost estimates for this analysis assumed the construction of 5 miles of roads, which may have additional non-energy public benefits. Operation and maintenance costs for the plant amount to approximately $2.9 million per year, much of which will be labor costs providing jobs for local residents. By adding an additional generating source to the CVEA system, more backup capacity will be available, possibly improving the reliability of the system. Also, the interruptible electric heat will provide a backup source of heat for the homes and businesses that participate in the program. Because of the few geothermal plants in Alaska (currently one), an additional plant will provide additional Alaska-specific information regarding this energy technology.

972 Akiak - Wind Diesel Generation Project

Proposer: Akiak Native Community/Akiak IRA Council

Benefit/Cost Ratio: Applicant: **1.24** AEA: **0.58** AEA (benchmark): **0.55**

Project Description:
Akiak Native Community/Akiak IRA Council is requesting for funds to conduct a feasibility study of a wind facility in Akiak. The applicant intends to solicit professional consulting services to provide a wind resource assessment of the area (includes installation of a met tower), and a conceptual design of a wind-diesel system suitable to the community of Akiak.

According to the Applicant, given a viable wind resource, a proposed system will likely include a 200-kW wind capacity system which will be incorporated into the community's existing power plant that utilizes 4 diesel generators with a generation capacity of 840 kW. The project would include necessary modifications to the diesel generator set in order to allow integration of the wind component. One possible configuration being considered includes 2 Northwind 100 turbines with an addition of an electric boiler for additional thermal heat.

Funding
The applicant is requesting $181,000 for feasibility and conceptual design of a wind facility in Akiak. No additional project match of is acknowledged by applicant. The applicant estimates $48,000 will be needed for assessment of alternatives, $36,000 for the conceptual design, $30,000 for detailed energy resource analysis, and $67,000 for other items including detailed economic and financial analysis, developing conceptual business and operations plans, permitting and environmental analysis, and detailed analysis of existing and future energy costs and markets.

Currently, the Akiak Native Community/Akiak IRA only has a rough estimate of expected capital cost. They estimate that the final design, construction, and commissioning phase will cost $2 million. The applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding. No match is indicated by the applicant.

Contribution to Lower the Cost of Energy:
The project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The applicant anticipates that the proposed wind project would displace over 36,000 gallons of diesel fuel per year.

AEA analysis however indicates a lower potential fuel displacement of 17,638 gallons of fuel per year. According to the AEA HOMER analysis, the proposed wind project would generate 256 MWh (with a Class 2 wind resource and a net capacity factor of 15.4 percent) of wind energy annually, displacing approximately 16,388 gallons of diesel fuel used for power generation per year and an additional 1,250 gallons of heating fuel per year if a secondary load system is installed to capture excess wind energy for thermal loads.

The proposed wind project could support up to 25 percent of the community's power needs.

Assumptions Modified:

Project Start
According to the timeline provided in Section 3.2 of the application, the conceptual design and cost estimate are expected to be completed in December of 2014. If construction and commissioning commence in 2015, it is realistic to assume first full year of operations to occur in year 2016. The project start date was therefore assumed to be 2016 in both the 'APP' and 'AEA' worksheets.

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 438,000 kWh assuming a class 3 wind regime and a capacity factor of 25 percent; this was used in the applicant's tab.

According to the AEA Wind PM, a class 3 wind site is possible on a location that is 4 miles east of town. However, siting the wind turbines on this location would involve constructing a 4-mile transmission line across poor soils and a short span across the Kuskokwim which would be very costly and render the project uneconomic.

The AEA tab assumes a Class 2 wind regime (this is a site closer to town that would involve a short transmission line). The net capacity factor in a Class 2 wind regime is 15.4 percent. As per AEA analysis, the expected annual gross electricity from the proposed wind project is 256,318 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 213,050 kWh, with excess annual wind energy of 43,268 kWh that can be used for thermal loads if a secondary load system is installed. These annual wind generation estimates (for power and heat) were used in the AEA tab.

Fuel Efficiency
The applicant stated a fuel efficiency of 11.9 kWh/gallon for their existing diesel generators. The AEA analysis assumed the minimum efficiency of 13 kWh/gallon as per AEA guidelines.

Capital Cost/Secondary Load System
The applicant provided an estimated capital cost of $2 million. This figure is slightly less costly (by $40,000) than AEA benchmark costs per installed kW for rural projects.

AEA's estimated total project cost is the same as the Applicant's estimate; however, the AEA cost estimate considers the use of less expensive remanufactured wind turbines. Based on communications with the AEA wind manager, remanufactured turbines are an option for Akiak at this time. The suggested capital costs from AEA include a short transmission line and a secondary load boiler system.

The applicant suggested that a secondary load system (to capture excess heat) will be evaluated, however, no information was provided regarding additional cost for the secondary load system. In the AEA analysis, a thermal load component is included in the recommended capital costs. On the benefit side, the estimated additional heating fuel displacement from the AEA HOMER analysis was used. As noted above, the resulting B/C ratio in the AEA analysis, given a conservative capital cost estimate with the use of remanufactured turbines is 0.6.

Further analysis indicates that if remanufactured turbines are not available and AEA benchmark cost is used, the resulting B/C ratio would decrease slightly from 0.6 to 0.57. The estimated capital cost in this case is $2.04 million plus a conservative estimate for cost of the secondary load system components of $100,000.

Note that the applicant's estimated cost of $181,000 for design and feasibility is roughly 20 percent higher than comparable studies.

In the B/C analysis, the cost of the feasibility and conceptual design ($181,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

Concerns:

AEA wind manager indicates a class 3 wind resource site 4 miles East of Akiak. It should be noted that a 4 mile transmission line would most likely increase costs above the benchmark considerably. AEA wind managers estimate project costs closer to $4 million dollars to access that particular class 3 wind resource site. One full year of met tower data would provide a more accurate wind resource estimate.

Applicant has not obtained site control for the placement of a met tower in the potential location. This may prevent further development of the project from occurring, if control of the site is not provided to the applicant.

Applicant states that transportation of a met tower to the community would be challenging due to limited barge access (section 3.5). The costs associated with transportation of a met tower to Akiak should be considered before grant approval. It is likely that if transportation of a met tower poses a challenging feat, the transportation of a wind turbine could be much more difficult.

Possible Enhancements:
Applicant should secure a non-objection letter before funding is allocated to the project.

Long-term Sustainability:
The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through the applicant's general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:
Lessons learned about renewable energy sources in Akiak will contribute to a better understanding of wind resources in rural locations around the state. The project would also lend itself to improving the accuracy of the State High Resolution Wind Map.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent

rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.

No. 973	Elim Geothermal Resource Assessment / Feasibility

Type: Geothermal

Proposer: City of Elim

Benefit/Cost Ratio: Applicant: **0.39** AEA: **0.28 – 0.86**

Project Description

This project will perform resource assessment (reconnaissance) and feasibility analysis of the geothermal resource located near Elim, Alaska. Relatively low cost airborne and ground-based techniques will be used to develop a model of the geothermal resource. Feasibility, cost analysis and design of systems to utilize the resource will also be accomplished.

Contribution to Lowering the Cost of Energy

A geothermal project has the ability to reduce dramatically the use of diesel generation for the provision of electricity in Elim. Also, if sufficient geothermal resource exists, it will likely be cost-effective to use the resource to avoid most of the predominantly oil-fired heating needs of the community. Offsetting these fuel cost savings produced by the geothermal plant will be the cost of building and operating the geothermal system.

Assumptions Modified

Hattenburg Dilley & Linnell (HDL) studied geothermal costs in Alaska on contract to the AEA in 2009. The applicant cited costs in this study, but challenged the level of exploratory drilling and production drilling costs in that study. The applicant's costs for those components were approximately one-fourth the level of the HDL costs. The applicant economic scenario produced a benefit/cost ratio of **0.39** and used the applicant's average drilling costs and average HDL costs for all other cost components. That scenario assumed that 90% of Elim's diesel electricity production was avoided by geothermal power, and 71% of the community's heating fuel use was avoided by using interruptible electric heat.[1]

Two AEA scenarios were run that bracket the applicant scenario. A scenario producing a benefit/cost ratio of **0.28** used the HDL study midpoint costs for all of the cost components. However, HDL costs for production drilling and physical plant were scaled downward to reflect a more appropriately-sized one-well, 740 kW system.

A scenario with favorable inputs was also analyzed. Both HDL and the applicant gave a range to costs for each capital cost component. For this scenario, the lowest value was selected for each one of the cost components. In addition, the life of the geothermal plant was increased to 30 years instead of the default AEA assumption of 20 years. This scenario produced a benefit/cost ratio of **0.86**.

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[1] The applicant had no explicit assumptions concerning heating fuel avoidance. This reviewer performed analysis indicating that 540 kW of electric heat capacity could avoid 79% of the community heating load; that value was then reduced for the 90% availability of the geothermal plant.

Concerns
Because little is known about the geothermal resource there is very large uncertainty in the size of the available resource and the cost required to develop it. This could affect the analysis either negatively or positively.

This economic analysis assumes no change in the amount of diesel and heating fuel that will be avoided over time. Energy efficiency, use of other renewable technologies, or population decline could diminish the amount of fuel that can be avoided through use of a geothermal energy system.

Potential Enhancements
As mentioned in the Concerns section, substantial uncertainty is present in the cost estimates. Costs more favorable than modeled here are possible. In addition, only one fuel price projection is used in the economic modeling. Higher oil price escalation would result in higher benefits.

The economic analysis includes the full cost of the roads necessary to develop the geothermal system, ranging from $3.2 – 4.7 million in cost (2011 $). These roads should have value beyond geothermal energy production, and that value was not included in the analysis.

Development of the geothermal resource may provide benefits in addition to conventional electricity end uses and space/water heating. Swimming pools and greenhouses are examples of possibilities.

This proposal is only requesting funds for a reconnaissance/feasibility study; it is not requesting funding for the actual project. The study should produce benefits that extend beyond this individual project and provide useful information for other small-scale geothermal opportunities in Alaska. This reviewer found the quality of the application and of the project team impressive. The cost of the study may be justified by the broadly-applicable information benefits it provides. This economic review focused on the geothermal project economics, not on the economics of the proposed study itself.

Long-Term Sustainability
The project replaces a fuel source with substantial price volatility with one having relatively stable ongoing costs. Although the AEA default assumption of geothermal plant life is 20 years, the Geyers geothermal plant in a California has operated for more than 50 years, although not at peak production.

Potential Public Benefits
The HDL study that provided cost estimates for this analysis assumed the construction of 8 miles of roads, which should have additional non-energy public benefits. Construction of the plant will create a substantial number of temporary jobs. Operation and maintenance costs for the plant amount to approximately $176,000 per year, some of which will be labor costs providing jobs for local residents. By adding an additional generating source to the Elim power generation system, more backup capacity will be available, improving the reliability of the system. Also, the interruptible electric heat will provide a backup source of heat for the buildings in Elim. Because of the few geothermal plants in Alaska (currently one), an additional plant will provide additional Alaska-specific information regarding this energy technology.

No. 974	Neck Lake Hydroelectric Project Phase II and III

Proposer: Alaska Power Company (APC)

Benefit/Cost Ratio: Applicant, as shown on paper application: 3.92 for APC; 1.89 for State of Alaska
Applicant as calculated by economist on applicant worksheet in model: .88
AEA worksheet: .74

Project Description
The applicant is requesting funds for phase II and III of a run-of-the river hydroelectric project at Neck Lake in Whale Pass, Prince of Whales Island, AK. The project site is located 1.5 miles southwest of Whale Pass, a community currently generating all electricity with diesel. This $2.8 million dollar project taps a resource with proposed installed capacity of 124kw and will include 400 feet of penstock, an intake structure, a containerized powerhouse, a tailrace channel, upgrade to 4 miles of existing transmission line and construction of an access road. The applicant is requesting funds from this round of $297,600; the applicant will provide cash match of $74,400 for a total for these phases of $372,000.

The costs articulated in the application reflect early complications faced by the project. Primarily, APC was awarded $108,000 for conceptual design, environmental surveys, and a feasibility report in Round 2 of the REF grant program. Only a small amount of work was conducted before FERC determined on November 4, 2010, that a federal license would be necessary to construct this project because it could impact interstate commerce via impacts to salmon; FERC letter enclosed. At that point, APC canceled the Project due to the expected costs associated with the FERC licensing process and returned approximately $85,500 of the $108,000 Round 2 grant. The applicant's current request is to complete the work previously started and also undertake the design phase.

Contribution to Lower the Cost of Energy
The project will displace almost all of the diesel consumption in the community. Whale Pass is a PCE community, so the benefit of reduced cost would go to the state and residents/entities consuming more than 500kWh per month; residents consuming less would see very little impact. The applicant states that current customer pay $0.6067 per kWh; however, a current check of the PCE's 2011 Statistical Report (http://www.akenergyauthority.org/PDF%20files/FY11PCEreport.pdf) indicates that in 2011 the rate was $0.598 without PCE and the effective rate for customers was $0.248 per kWh.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Construction costs.** Costs were broken out over 5 years (not including monies already spent) in both worksheets. This was done to account for the time it will take to complete phase II and move through to the project start in 2018.
- **Generation efficiency.** The applicant assumed that generation efficiency for the displaced fuel was an average 11.3 kWh per gallon. The economic analysis used

11.3 kWh per gallon for the applicant and the AEA benchmark of 13 kwh per gallon on AEA worksheet.

- **O&M costs:** The applicant worksheet uses O&M figures based on 99.5 percent of current load and 25K per year in O&M..

Concerns

- **Declining Population.** The community of Whale Pass has been steadily declining. According to AK DOL S(see Calc page), the community had 58 inhabitants in 2000, and now has 31. The applicant does not address the long term effects of declining population on the community, infrastructure, schools or the proposed project.

- **Excess energy not adequately addressed.** The project has a lot of excess capacity that is not adequately considered.

- **Site control.** APC does not yet have development rights. The applicant acknowledges this is a necessary step.

Possible Enhancements / Recommendations

- **Excess energy plan.** The application would benefit from a plan to utilize excess energy.

Long-term Sustainability

- **Management structure is adequate.**

Potential Public Benefits

- **Less expensive electricity**. The project could provide less expensive electricity to Whale Pass and those residents using more than 500 kWh/month would benefit most, as would the State of Alaska.
- **Reduction in diesel fuel use.** The project could reduce the majority of diesel fuel used, which has the benefit of reducing costs and potential environmental impacts from the use, and transport, of diesel.

No. 975 Juniper Lake Hydroelectric Project Feasibility Study

Proposer: RAM Valley, LLC, an Independent Power Producer

Benefit/Cost Ratio: Applicant, as shown on paper application: 1.52
Applicant as calculated by economist on applicant worksheet in model: 1.55
AEA worksheet: 1.48
AEA worksheet 2: 3.19

Project Description

The applicant is requesting funds for a feasibility study of Juniper Lake Hydro project. Its requesting $127,000 and in addition, it will match $2,000 in cash and $42,800 in in-kind to the feasibility study for a total of $172,700. The proposed project is a run-of-river hydroelectric project located on private property along Juniper Creek in the Eagle River Valley, approximately 10 miles from Eagle River, Alaska. The proposed project would include an intake / diversion structure at approximately the 1900-foot elevation and powerhouse at the 1500-foot elevation. The design flow is estimated at 10 to 20 cfs, for an estimated installed capacity of 250 to 500 kW. The project would contribute to the overall stabilization of the area.

Contribution to Lowering the Cost of Energy

The project would provide an energy resource to existing railbelt utilities, primarily, Matanuska Electric Association (MEA). The project claims it would reduce the amount of fuel used for the new Eklutna Power Plant and although all of the energy produced can be absorbed by the existing grid, it would not have a significant impact to individual consumers but would help provide stability in the region, which continues to have increasing population trends. The annual generation is estimated at 1,530 to 2,190 MWh, depending on the final studies and subsequent configuration and design. For purposes of analysis, the 2,190 MWh is used throughout the worksheets. The applicant states that if the project is extended downstream, it could increase the energy generation to as much as 6,000MWh. At this point, more information is needed to assess the true potential energy production, scope of project and implications of funding a resource which will be fully situated on private property.

Assumptions Modified

The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Total Project Cost.** The applicant supplied a couple of different project costs. On page 4, it give $4.3M; on page 11, it gives a range of capital costs between $500k and $2M; analysis in the AEA worksheets reflects the $4.3M and the $2M, thus, the BCs reflected at the top of the page.
- **O&M costs:** The applicant uses O&M of 0.015, this is used in the applicant worksheet but $0.02 is used in the AEA worksheets. At this point, there is not enough information to calculate an O&M with more precision.

Concerns

- **Private land accessibility.** The project will be primarily situated on the applicant's private land. However, the project will also require buy-in from neighboring private properties as well. At this point, agreements are not in place and assurances will have to be provided that address not only the availability of other private land for

the building process, but also the long-term agreements for the life of the project at least.

- **FERC application:** Applicant states that the project is likely not a under FERC jurisdiction but this will still have to be determined and the costs and permit times sill have to be adjusted accordingly.
- **Other permits/studies:** Other studies and permits will also be addressed through the feasibility study, including an RCA certification; all these will need to be provided for subsequent phases, should the applicant decide to move forward.
- **Selling to established utility:** The applicant expects that its main buyer will be MEA, and that MEA's standard purchase rate for non-firm power is $0.05 to $0.07 per kWh. MEA provided a letter of support in which it states the study of this project may be beneficial to it in fulfilling its energy objectives but this letter is non-committal, nor does it illustrate the degree to which MEA is or is not a potential buyer. Without MEA, selling the energy will be very challenging. Another concern is that because MEA is the primary buyer and the resource small compared to others in the region, the applicant will be at a disadvantage when negotiating a purchase price.
- **Relationship with South Fork Hydro, LLC:** South Fork Hydro is currently building a 1.2MW South Forth Hydro project, which will be operational in 2013. The LLC provided a letter of support and appears to see the Juniper Creek project as complimentary to its resource. The relationship between the two resources and other resources as a whole should be assessed to determine what the impact is in the region once more is known about the operations and capacity of the Juniper Creek project.
- **Real cost of the project:** The real costs of the project are not clearly defined yet, this should be resolved in this phase.

Possible Enhancements / Recommendations

- **Land assurances and plans.** It will be important to provide a plan that addresses land use and ownership agreements over the next 50 years, life of the project in order to secure resource accessibility.

Management/sustainability

- **Current project management plan is adequate.**

Potential Public Benefits

- **Helps stabilize region by providing a resource to existing utilities.**

No. 976	Knutson Creek Hydroelectric Project Permitting and Final Design

Proposer: Pedro Bay Village Council

Benefit/Cost Ratio: Applicant, as shown on paper application: 2.23
Applicant as calculated by economist on applicant worksheet in model: 2.14
AEA worksheet: 2.04

Project Description
The applicant is requesting $290,000 from this funding round and will match $2,500 for a total grant cost of $292,500 for project permitting and final design of a run of the river hydroelectric project on Knutson Creek to serve the Pedro Bay community. Pedro Bay is located on Lake Iliamna in the Lake and Peninsula Borough.

Contribution to Lower the Cost of Energy
Electricity supply to Pedro Bay is produced entirely using diesel fuel via three diesel generators. The current price of diesel fuel is $6.90 per gallon (per the application) and $5.83 per gallon (per ISER). Diesel fuel is expensive to transport to Pedro Bay and often arrives via air. The use of expensive diesel fuel in Pedro Bay results in an electrical rate of as much as $0.91 per kWh before price cost equalization (PCE) according to the applicant and confirmed on the 2011 PCE statistical report.

If constructed, the Knutson Creek Hydroelectric project would provide electricity at a rate of $0.20 to $0.80 per kWh (pre-PCE) depending on the source of capital funding. The project will replace the need to run the three diesel generators except for a few months in the late winter / spring. The diesel generators will remain for backup generation capacity.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Construction schedule.** No construction schedule was provided by the applicant. The economist assumed a 2-year construction period following 2015 when the power sales agreement, rate approval, and the final business and operational plan are complete. The hydro project is assumed to come on-line in 2018. This may be different from what the applicant assumed in the grant but specific information on the construction schedule was not provided. *This assumption was used in both the applicant and the AEA worksheets.*
- **Estimate of kWh currently consumed.** The economist picked the midpoint between the range of kWh of electricity currently consumed to reflect the amount of displaced electricity. *This assumption was used in both the applicant and the AEA worksheets.*
- **Fuel oil costs.** The economist used the ISER fuel oil estimate of $5.83 per gallon in 2012 and the applicant indicated that fuel oil was $6.90 per gallon in the grant application. The applicant does not state whether the price of fuel per gallon is retail or utility price. *The ISER fuel oil assumption was used in the applicant and the AEA worksheets.*

Concerns

- **Is there adequate demand for the new hydro project in a community with a declining population?** The annual energy use of 265,000 kWh is much less than the current

capacity of the diesel generators (245kW) and less than the capacity that will be available (150kW) should the new hydro project be built. Pedro Bay is losing population. Current state projections (through the DCCED community database) indicate that Pedro Bay has 47 people in the community. A recent trip to Pedro Bay in May of 2012 for a community meeting, led community members to indicate that the actual population may be closer to 20 or 30. The school recently closed due to a lack of students. If the population declines even more, will there be adequate customer demand to support a new hydro project in Pedro Bay?

It is possible that even with less expensive electricity, the resident population could continue to decline and the new hydropower source could be underutilized. Having said that, curbing the cost of electricity in Pedro Bay is critical to any plans to stabilize, and possibly grow the population in the community subsequently improving the long-term sustainability of the community.

- **Is there demonstrated site control?** The project requires site control from the village corporation (Pedro Bay Corporation) before construction can begin, yet there is no letter of support from the Pedro Bay Corporation in the application. This is not a critical issue for a design and permitting application but it would help to have the initial support of the entity providing site control during initial stages in the project.

- **Will the project trigger FERC review?** The applicant indicates that the project will likely not fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC). However, the applicant has yet to file a Declaration of Intention to FERC. If FERC asserts jurisdiction, then permitting expenses will be higher than estimated as part of the current grant application.

- **Possibilities for additional permitting expense related to fish habit.** The applicant indicates a low level of sockeye salmon in the project reach and a level of Dolly Varden that are "not a commercially significant." With regards to the Dolly Varden population, even if the number is not commercially significant, they may be significant from an environmental, species, and habitat perspective given their role in the overall ecosystem. There is potential for additional costs and impacts to the project from the fish habitat permit.

- **Home heating from excess capacity:** Although there is a project component that would facilitate leveraging excess heat to heat public buildings, the applicant does not specify additional costs associated with ensuring that the identified buildings are ready to take advantage of the excess capacity. Additional detailed plans would help clarify the full impact of excess capacity and the necessary resources needed,

Possible Enhancements / Recommendations

- **Gaps in information regarding operation costs.** The applicant indicates that the total operation costs for the hydro project will be $19,500 per year but additional information regarding operation costs are not included, as listed below. Including this information would enhance the application and provide a more detailed picture of the full costs and benefits of the project.
  - No cost estimate for scheduled repairs of the hydro facility.
  - No cost estimate for use of **diesel fuel** to keep the generators operational as a backup energy source and as a primary energy source during the late winter and early spring when river flows are not adequate to fully support the hydro project.

- No cost estimate for the **annual maintenance and scheduled repairs** of the diesel generators to keep them operational as a backup energy source and as a primary energy source during the late winter and early spring.
- No cost estimate of the scheduled repairs of the diesel generators as part of the base case.
- No details are provided on the operations costs related to using the hydro power as a heating source for the three public buildings.

➢ **Show existing RCA permits.** The application could be improved if it provided physical evidence of the RCA permit that allows the Village Council to provide energy to the Pedro Bay community.

➢ **Expand use of hydro for home heating.** Because of PCE, it is possible that the effective rate to residents will not be much lower, even with hydropower in Pedro Bay, assuming grant funded construction. A project that assists with heating costs will be more likely to ensure that the resident population is able to afford living in Pedro Bay. The proposed hydro project appears to have substantial capacity beyond what is projected for electricity use and to heat the three public buildings. The proposed system includes a dispatchable energy system capable of providing excess energy to space heating systems in public buildings. However, the costs of implementing and maintaining heating systems to public buildings is not discussed in the application. Finding a way to heat homes with cheaper electricity could improve the cost of living in Pedro Bay substantially. Including a more robust home heating plan in the application could improve the cost / benefit ratio.

Long-term Sustainability

➢ **Management structure appears adequate.** Because the hydro project will be owned and operated by the Pedro Bay Village Council, which currently provides electricity to Pedro Bay, there are no issues associated with insuring that an entity receives Independent Power Provider status. According to the application, the Pedro Bay Village Council currently has the proper permits from the State RCA to operate a utility in Pedro Bay. This management structure assists in ensuring the long terms sustainability of the project.

➢ **Revenue for operations.** Assuming the Pedro Bay population decline stabilizes, or reverses, adequate rate revenue should be available for operations and maintenance ensuring a sustainable source of electricity.

Potential Public Benefits

➢ **Less expensive electricity**. The project could provide less expensive electricity to commercial buildings and community facilities not receiving PCE if capital construction is funded through grants. The project could reduce the level of PCE subsidy to residential customers with the provision of less expensive electricity.

➢ **Reduction in diesel fuel use.** The project could reduce the amount of diesel consumed, which as the benefit of reducing costs and potential environmental impacts from the use of (and transport) diesel.

- **Long term viability of the community.** The project has the possibility of improving the long-term viability of the village of Pedro Bay if less expensive electricity and possibly heating are provided to residents and businesses.

No. 977	Carlo Creek Hydroelectric Project Reconnaissance Study

Proposer: Native Village of Cantwell

Benefit/Cost Ratio: Applicant, as shown on paper application: 5.27
Applicant as calculated by economist on applicant worksheet in model: 4.59
AEA worksheet: 4.59
AEA (2) worksheet: .94 (see notes below)

Project Description
The applicant is requesting funds for a reconnaissance study of a run-of-the river hydroelectric project on Carlo Creek, approximately 10 miles north of Cantwell along the Parks Highway. The applicant is requesting funds from this round of $66,500, the applicant will provide in-kind match of $3,500 for a total for this phase of $70,000. The applicant states that the total project costs are estimated at $7.5M, however, a 1982 USACE study estimated the cost of the project at $17.7M. At the Project Manager's request the economist ran an additional scenario adjusting the $17.7M to $36.6M, in 2011 dollars (AEA(2) worksheet). Cantwell is currently served by GVEA via the power transmission line between MEA and GVEA (the Alaska Intertie System). In order to improve reliability and provide lower cost electricity, the applicant is seeking funds for reconnaissance.

Contribution to Lower the Cost of Energy
The project will add renewable hydropower to the intertie system and the railbelt communities. The estimated cost of the hydropower, if sold to GVEA is the avoided fuel cost of $0.15 per kWh (sourced from the 2011 AEA/ISER price model by the applicant). However, the current economic model assumes an avoided fuel cost of 21 cents per kWh in 2019, when the project is estimated to come online.

The applicant indicates that GVEA currently spends between 20 and 90 cents per kWh on fossil fuel energy sources. A shift toward hydropower should have a positive impact on the provision of low cost energy in Cantwell, as well as other railbelt communities. The extent to which the cost is lower will be a function of the expense required to integrate the hydropower into the GVEA system via the power purchase agreement.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Construction schedule and life of project.** No construction schedule was provided by the applicant. The following construction scheduled was assumed.
  - Reconnaissance: 2013 to December 2014
  - Design / permits: January 2015 to January 2017 (2 years). Application indicates 1.5 to 5 years.
  - Construction: Summer 2017 and summer 2018
  - Project online: 2019

  This schedule was used in both the applicant and the AEA worksheets.
  A 50-year life cycle was used for the project because the applicant did not specify a length of time.

- **Construction costs.** The applicant provides a total development cost of $7.5 million, a total capital cost estimate of $7.050 million, and a project cost of $6.180 million (as

shown in the cost / benefit calculation). The economic analysis assumed $7.5 million in total development costs under both the applicant and the AEA worksheets.

The applicant states that the total project costs are estimated at $7.5M, however, a 1982 USACE study estimated the cost of the project at $17.7M. At the Project Manager's request the economist ran an additional scenario adjusting the $17.7M to $36.6M, in 2011 dollars (AEA(2) worksheet)

- **Generation efficiency.** The applicant assumed that generation efficiency for the displaced fuel was 15 kWh per gallon. The economic analysis used 13 kWh per gallon for the applicant and AEA worksheets, per ISER.

- **Fuel oil costs.** The applicant assumes that displaced fuel oil costs $3.00 per gallon. The ISER model assumes an avoided fuel cost of 21 cents per kWh in 2019 with an assumed Fairbanks fuel oil price of $5.02 per gallon. The ISER estimate is used in both the applicant and the AEA model.

Concerns

The application is requesting funding to conduct a reconnaissance study that would assess the potential to develop a hydropower resource on Carlo Creek. The project is at the earliest possible phase and, as such, is requesting funding to better understand potential concerns, as well as to develop solutions. The applicant flags various concerns and issues that will be addressed in the study. They are also listed below.

- **Adequate stream flow.** The reconnaissance study will examine the adequacy of the Carlo Creek stream flow to support the hydropower, particularly in the winter when the Cantwell community would like to utilize the renewable energy source as a backup when, and if, the GVEA system fails.

- **Business structures.** The application identifies three potential business structures:
  1) Independent power producer (IPP) - sell hydropower to the GVEA
  2) Joint venture with GVEA
  3) New electric utility with authority to provide electric service in the Cantwell area.

  The type of business structure implemented has impacts on the cost of electricity and the sustainability of the project. The reconnaissance study should include a component to evaluate the pros and cons of each structure.

- **Site control.** Site control over federal and private land is required. The applicant acknowledges this is a necessary step.

- **Permits.** The application identifies that the types of permits needed are being examined. The level of FERC review, for example, could add time and cost to the project.

- **Operations costs**. The applicant discloses that detailed operations costs are not available given that the project is at the reconnaissance phase.

Possible Enhancements / Recommendations

The applicant provides adequate information on the project given that it is at such an early stage in the process.

Long-term Sustainability

- **Management structure will make a difference.** Creating a new IPP or new utility could require a significant increase in organizational capacity for the Native Village of Cantwell. The reconnaissance study should examine the pros and cons of various management / business structures to ensure the long-term sustainability of the project.
- **Revenue for operations.** Current estimates of the annual revenue to sell the hydropower to GVEA indicate sufficient revenue to cover operating expenses at Carlo Creek ($788,000 in annual revenue to cover $75,000 in operations expenses).

Potential Public Benefits

- **Less expensive electricity**. The project could provide less expensive electricity to Cantwell and other communities in the railbelt. The extent of the lower cost electricity is determined by the cost to GVEA to integrate the renewable energy source into their grid.

- **Reduction in diesel fuel use.** The project could reduce the amount of diesel fuel or other fuels consumed, which has the benefit of reducing costs and potential environmental impacts from the use, and transport, of diesel.

- **Stable energy and a backup source.** The project has the potential to provide Cantwell with a backup source of power, when there are interruptions to the GVEA supply. However, this is still being studied, especially with regards to the capacity of Carlo Creek to provide adequate flow during winter months.

No. 978	Indian River Hydroelectric Project Construction

Proposer: City of Tenakee Springs dba Tenakee Springs Electric Department

Benefit/Cost Ratio: Applicant, as shown on paper application: 1.6
Applicant as calculated by economist on applicant worksheet in model: 1.70
AEA worksheet: 1.57

Project Description

The applicant is requesting $2,988,000 from this funding round for the construction phase. The applicant will match $20,000 in in-kind and provide $312,000 as cash match for a total grant cost of $3,320,000. The project is a run-of-river hydro with anticipated installed capacity of 180kw and annual generation of 1,169,000kwh/yr. The project will include the following:

1. A concrete diversion structure located at the head of falls 4 at an elevation of 126 feet. The structure will be co-located with an existing vertical slot fish pass built by the US Forest Service. The diversion will not impound a significant amount of water.
2. An intake structure utilizing an inclined plate overflow screen (coanda-type screen) intake to screen water from the creek and admit it to the project penstock.
3. An above-ground 36-inch diameter 1,534 foot long penstock supported on trestles and on grade.
4. A powerhouse fitted with a variable flow cross-flow turbine coupled to a three-phase synchronous generator via a gear box speed increaser.
5. 4,000 feet of transmission line to interconnect the hydro power house with the existing Tenakee electrical distribution system near the harbor.

Contribution to Lower the Cost of Energy

The project would displace the majority of diesel used in the community. The applicant states that the project would displace approximately 90% of the existing load and there would be additional excess capacity to displace between 6,500 gallons for heating. The community also uses approximately 20 cords of wood per year but it is not clear if these would be displaced as well. As a PCE community, the benefit of reduced cost would go to the state and residents/entities consuming more than 500kWh per month. A current check of the PCE's 2011 Statistical Report (http://www.akenergyauthority.org/PDF%20files/FY11PCEreport.pdf) indicates that in 2011 the rate was $0.66 without PCE and the effective rate for customers was $0.029per kWh.

Assumptions Modified

The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Efficiency.** The applicant provides an kWh efficiency rate range of 12.7 to 13.2 per gallon, economist used AEA's recommended 13 kWh/gallon throughout, including in calculations for displaced heating estimates.
- **Fuel oil costs.** The economist used the ISER fuel oil estimate of $4.59 per gallon in 2012, slightly higher than the applicant's $4.50 per gallon in the grant application. The applicant does not state whether the price of fuel per gallon is retail or utility price. *The ISER fuel oil assumption was used in the applicant and the AEA worksheets.*

Concerns

- **Is there demonstrated site control?** The project will be located on a combination of city and state land, and access from tidewater will be via a US Forest Service logging road. Alaska DNR issued a Final Decision to grant the city easements needed for the hydro project in September 2012.

- **Funding:** The $332,000 match contribution will be in the form of in-kind services, equipment usage, loans and/or matching grants, however, Tenakee does not have any matching grant funds for this project at this time. Of the $332,000 in matching funds, the City of Tenakee Springs will contribute a cash match of at least $1,000 and in-kind services of at least $20,000. The applicant expects the balance ($319,000) to be provided via the State of Alaska grant(s), if these additional grant funds for matching do not materialize, it will provide the matching funds from city assets or by a loan, bond, or other debt vehicle carried by the city or utility. The applicant does not provide additional information regarding its credit-worthiness should it need to relay on debt service.

Possible Enhancements / Recommendations

- **None at this time.**

Long-term Sustainability

- **Management structure appears adequate.**

Potential Public Benefits

- **Less expensive electricity**. The project could provide less expensive electricity to commercial buildings and community facilities not receiving PCE if capital construction is funded through grants. The project could reduce the level of PCE subsidy to residential customers with the provision of less expensive electricity.

- **Reduction in diesel fuel use.** The project could reduce the amount of diesel consumed, which as the benefit of reducing costs and potential environmental impacts from the use of (and transport) diesel.

- **Long term viability of the community.** The project has the possibility of improving the long-term viability of Tenakee Springs, especially considering that there is an upward population trend. (see Calc page).

979 Waste to Energy Biomass, Chugach Electric, Anchorage

Proposer: Chugach Electric Association, Inc.

Benefit/Cost Ratio: Applicant: **1.53**
AEA: **1.53**

Project Description

This proposed project is to perform a feasibility study, including a conceptual design, to assess the viability of a Waste to Energy (WtE) plant. Other than some recyclable materials, municipal solid waste (MSW) in Anchorage is largely disposed of in the municipal landfill. The quantity of refuse currently being disposed of in this manner is approximately 375,000 tons per year. There may also be an opportunity to incorporate other fuel, such as wood being disposed of in local woodlots. WtE plants, while somewhat rare in the U.S., are very popular, efficient, and environmentally effective in many European and Asian countries. If feasible, a WtE plant would be expected to provide energy, environmental, reliability, economic, and community benefits.

Contribution to Lower the Cost of Energy

The model indicates avoided generation costs of 166,440 MWh would approach $8 million per year.

Assumptions Modified

1. Assumed 20MW plant at $5 million per installed MW of capacity, $100 million.
2. Assumed two years for feasibility and two years for construction.
3. Annual non-fuel repairs and O&M projected at 1% of CAPEX or $1 million/year.
4. Fuel required projected at 50 percent moisture content, 157,000 tons/year.
5. Fuel cost set equal to current tipping fee of $58 per original weight ton.

Concerns

None noted. Applicant correctly notes major need for waste characterization (inventory) as first step.

Possible Enhancements

None noted.

Long-term Sustainability

If successful, landfill life would be extended and natural gas would be displaced.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. A new WtE power plant would be required.
2. Employment. No additional FTE's are forecasted at this early stage.
3. Community solutions. This system would reduce MSW and provide power.

4. Improve existing energy system. A stored (buried) energy resource would be utilized, but perhaps to the detriment of current natural gas plants.
5. Statewide Applicability. The potential application appears focused on the Railbelt, and existing power grid.
6. Long term sustainability. See the above paragraph on long-term sustainability.
7. Other public benefits. Other public benefits will be evaluated during the feasibility stage.

No. 980 Bristol Bay School District Energy Project Permitting, Final Design, Const.

Proposer: Bristol Bay Borough School District

Benefit/Cost Ratio: Applicant, as shown on paper application: 1.88
Applicant as calculated by economist on applicant worksheet in model: 1.06
AEA worksheet: 1.45

Project Description
The applicant is requesting funds for project permitting, final design, and construction of a Photovoltaic power (PV) system and a Heat Recovery (HR) system from exhaust air. The PV system has a cost of $235,000, and the HR system has a cost of $225,000; both systems would be installed at the Naknek School in the Bristol Bay Borough School District. Naknek is located in South-West Alaska in the Bristol Bay Borough. Construction on the PV system would begin in 2013, and construction for the HR system in 2014. Total grant funds requested are $460,000 for both systems and the district will contribute $10,000 dollars in kind labor contribution.

Contribution to Lower the Cost of Energy
Electricity supply School is provided by Naknek Electric Utility. The current price per kWh for the school is $.54/kWh, meaning that a PV project that offset the estimated 42,350kWh would save nearly $22,869 annually for the district. The PV project does not directly lower the cost of power set by the utility, but it does reduce the school's annual purchase. The HR system would reduce #1 fuel oil purchased annually by 3,300 gallons, saving $16,500 at current prices of $5.00/gallon.

Assumptions Modified
The following assumptions were modified (or clarified) from what was provided in the grant application.

- **Construction schedule.** The construction schedule provided spans a two-year period, with PV system construction beginning in 2013, and HR construction beginning in 2014. Economist chose project start dates that the applicant provided as construction start dates, not the permitting dates. Relatively little permitting is required for the two systems, and they are mostly fairly routine building permits.
- **Fuel oil costs.** The applicant reports $5/gallan fuel oil costs, nearly the same as the ISER assumed $4.97/gallon "low" figure from the workbook.

Concerns

- **Is there a need to fund both PV and HR system at the same time?** The PV system and the HR system are not dependent one another according to the application. The HR system would be beneficial, but very little is described about the system by the applicant. No maintenance is mentioned for the HR system. In the "Project benefit", pg. 14 of application, only impacts related to the PV section are listed and nothing regarding the benefits of the HR system. And then again in section six and seven of application, only the sustainability of PV system is reported no mention of the HR system is included.
- **Previous Energy Work at site, audit:** The applicant explains that the school received an investment grade audit to utilize performance contracting for ESPC work on the kitchen and other areas, but how the requested grant funds interact with the overall efficiency work needed at the school is unspecified. Will the savings from the HR

system be factored into the larger efficiency package offered by the contractor to the school? Will the work move forward without the grant money? It's unclear the way these two projects fit into the larger process that the applicant indicates, or why that should not matter.

- **No Resumes attached to the application.** Although the application contains a list of Bristol Bay School District contacts, it does not provide key roles or resumes to allow for assessment of management capacity because the applicant states that it will hire a full service Energy Service provider to provide complete turnkey services.
- **Possible Enhancements / Recommendations** Attach resumes to application or provide comparable information to AEA once Energy Service provider has been selected.

Potential Public Benefits

- **Reduced annual heating and electrical costs**
- **Provides educational opportunity to schoolchildren and their on energy systems that could affect their lives.**
- **Provides greater energy security by buffering the schools budget from fluctuation in heat and energy costs.**

No. 981 Tanana Solar Domestic Hot Water Heating Project

Proposer: City of Tanana

Benefit/Cost Ratio: Applicant, as shown on paper application: Not Provided
Applicant as calculated by economist on applicant worksheet in model: .92
AEA worksheet: .53

Project Description

The City of Tanana is requesting grant funding for a Solar Thermal system that will be used for Domestic Hot Water (DHW) heating. The applicant is requesting $81,700 in grant funds this round and It will provide $50,000 in in-kind for a total project cost of $131,700. The city is currently installing biomass space heating system using solar thermal collectors. Large domestic hot water demand arises from the Tribal Elders Residential complex and the City's Senior housing four-plex. Existing bio-mass GARN boilers exist at both locations, but at the City Senior Housing the internal GARN storage tank will be utilized, and in the Tribal Elder Complex, supplemental storage tanks will be installed. The City has used DOE EECBG funding to install biomass space heating at the Senior Housing site that includes thermal storage at a value of $50,000. Applicant allocates this $50,000 value toward thermal storage capacity and interface hardware needed to integrate the solar thermal system into the building's domestic water heating system. Economist included the in-kind contribution to total project cost for this analysis, however. The two buildings owners and their residents will not be billed for the reduced costs the project provides.

Contribution to Lowering the Cost of Energy

The solar thermal collectors will lower the amount of heating fuel purchased annually by the two buildings to heat their DHW.

Assumptions Modified

The following assumptions were modified (or clarified) from what was provided in the grant application.

- Applicant provided an offset fuel usage of 912 gallons annually. Economist calculations indicate that this figure could be as low 712 gallons. Applicant sheet reflects reported figure, and AEA sheet reflects economist figure.

Concerns

- **DOE Funding Bio-Mass Progress.** Applicant timeline is based on the successful completion of the Bio-Mass system, so that the tie-in for the Solar Thermal project has a complete system to tie into.

Possible Enhancements / Recommendations

- **Provide manufacture warranty claims and guarantees of proposed system.**
- **Provide Bio-Mass DOE funded project update and status report due to fact that solar thermal system benefit required on time completion.**

Potential Public Benefits

- **Reduced annual heating costs**

982 Community Facilities Woody Biomass Space Heating Project

Proposer: Mentasta Traditional Council

Benefit/Cost Ratio: Applicant: **2.08**
AEA: **1.76**

Project Description

Mentasta's predicament, as is the case for most of rural Alaska, is its dependence on imported expensive petroleum for space heating of community facilities. Mentasta's community facilities are centrally located and can be serviced by one woody biomass heating plant strategically located adjacent to Mentasta's clustered public facilities (see Map - Attachment II).

The project is estimated to cost $460,000 of Round VI funds, with donated building space having an estimated value of $50,000. It will serve the school, teen center, clinic, and tribal offices/post office building and it is expected to displace approximately 22,000 gallons of heating oil.

Contribution to Lower the Cost of Energy

Total displacement is estimated at 22,000 gallons of fuel oil.

Assumptions Modified

Existing system repairs estimated at 40% of O&M; no figure stated by applicant. Repairs per year on Garn cordwood boiler estimated at $500 per year, based on discussion with Dave Frederick, Garn representative in Alaska.

AEA price per cord: $250, based on City of Tanana and other operations with this level of harvest (200 cords per year). Actual burned cordwood volumes may be less, again, based on City of Tanana results.

Concerns

None noted. Amount of cordwood burned will likely be less than 200 cords but several buildings are included in heat estimate; no changes made.

Possible Enhancements

None noted.

Long-term Sustainability

Mentasta, like other Interior villages, has an adequate forest resource, based on its location near green forests and fire-killed wood from several large forest fires.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. No new infrastructure will be constructed.

2. Employment. No additional FTE's are forecasted.
3. Community solutions. This system would reduce costs of heating for both the school and the community buildings noted.
4. Improve existing energy system. The existing heating system could be retained as a backup and peak heating system.
5. Statewide Applicability. This would apply across most parts of Alaska with similar forest resources.
6. Long term sustainability. See the above paragraphs on LT sustainability.
7. Other public benefits. As with other wood-based projects, emissions would be reduced, along with the carbon footprint.

983 Wood Heat Feasibility Study and Conceptual Design for the Organized Village of Kake

Proposer: Organized Village of Kake

Benefit/Cost Ratio: Applicant: **0.60**
AEA: **0.60**

Project Description

The project will focus on a feasibility assessment and conceptual design for a wood heating system and district heating loop for an office building and lodge owned by the Organized Village of Kake (OVK).

The overall goal of the feasibility study is to determine what kind of wood heating system will best meet objectives of lower cost energy, local sustainability, etc., based on the 2008 Preliminary Feasibility Assessment for High Efficiency Low Emission Wood Heating in Kake, Alaska, prepared by Dan Parrent.

Contribution to Lower the Cost of Energy

Total displacement is estimated at 4,800 gallons, for two buildings: OVK Lodge and OVK Office Building.

Assumptions Modified

CAPEX costs adjusted from 2008 to 2012 at 3% per year. Wood heat repairs and O&M not submitted; 2008 estimates used at same cost adjustment as CAPEX. No current repairs or fuel O&M submitted; used 2% and 4%, respectively, of annual fuel oil cost.

Concerns

None noted.

Possible Enhancements

None noted.

Long-term Sustainability

Kake is in Southeast Alaska and cordwood fuel is available; experience at Coffman Cove suggests estimated cordwood consumption (53 cords) and price ($200/cord) are realistic.

Potential Public Benefits

Qualitative assessment of potential public benefits.

1. Infrastructure. A Garn wood burner and fuel storage area are proposed.
2. Employment. No additional FTE's are forecasted.
3. Community solutions. This system would reduce costs of heating for the two OVK buildings noted.

4. Improve existing energy system. The existing heating system could be retained as a backup and peak heating system.
5. Statewide Applicability. This would apply across most parts of Alaska with similar forest resources.
6. Long term sustainability. See the above paragraph on long-term sustainability.
7. Other public benefits. As with other wood-based projects, emissions would be reduced, along with the carbon footprint.

984 Noatak - Wind Resource Assessment

Proposer: Noatak IRA

Benefit/Cost Ratio: Applicant: **1.53** AEA: **0.98**

Project Description:
Noatak IRA is proposing to install a meteorological tower and complete a wind resource assessment, wind-diesel feasibility analysis, and conceptual design of a wind facility in Noatak.

The Applicant is proposing a 200-kW wind capacity system to be incorporated into the community's existing power plant that utilizes 3 diesel generators with a generation capacity of 1,210 kW. The project would include necessary modifications to the diesel generator set in order to allow integration of the wind system. The Applicant stated that one possible configuration being considered includes 2 Northwind 100 wind turbines with the addition of an electric boiler for additional thermal heat. The actual system configuration will be determined after evaluation of the wind resource and completion of the feasibility study.

Funding
The Applicant is requesting $181,000 for feasibility and conceptual design of a wind facility in Noatak. The applicant estimates $48,000 will be needed for an assessment of alternatives, $36,000 for conceptual design analysis and cost estimate, $30,000 for detailed energy resource analysis, and $67,000 for other items including permitting and environmental analysis, economic and financial analyses, developing conceptual business and operations plans, and report preparation.

The Applicant indicated that funding for final design and construction may come from several grant programs, such as the AEA Renewable Energy Fund, USDA Rural Utility Service Program, but intends to explore additional grant funding.

Contribution to Lower the Cost of Energy:
The proposed project is anticipated to reduce the community's future fuel purchases by incorporating wind energy into the existing power generation facility. The applicant anticipates that the proposed wind project would displace 36,500 gallons of diesel fuel per year.

AEA analysis however indicates a lower potential fuel displacement of approximately 27,500 gallons of fuel per year, assuming a 190-kW system with a Class 4 wind resource and a net capacity factor of 24 percent.

Assumptions Modified:

System Capacity
The applicant proposed a 200-kW system that is composed of two Northwind 100 wind turbines and was used in the 'APP' tab. However, AEA suggested that two Northwind 100s would not provide a cost-effective solution and proposed a 190-kW system that was used in the 'AEA' tab.

Annual Wind Generation
The applicant indicated that their expected annual wind generation is 438,000 kWh assuming a Class 4 wind regime and a net capacity factor of 30 percent; this was used in the applicant's tab.

The AEA tab assumes a Class 4 wind regime and net capacity factor of 24 percent, which results in expected annual wind generation of 399,456 kWh. Furthermore, AEA's Homer analysis estimated annual net electricity produced from wind of 367,500 kWh, with excess annual wind energy of 31,956 kWh that can be used for thermal loads if a secondary load system is installed. Note that the Class 4 wind assumption is considered by AEA as optimistic.

Capital Cost
The Applicant provided conflicting project cost information. In the Project Cost Worksheet (Section 4.4.4), an estimated capital cost of $2 million was stated. However, in Section 4.4.1 (page 10 of the application), it was stated that final design and permitting would cost approximately $600,000 and final phase (construction and commissioning) would cost $4 million.

For the App tab, the $2 million capital cost estimate was used. This amount is closer to the AEA capital cost benchmark of $10,200 per installed kW. Note that if the higher cost of $4.6 million is used in the model, the resulting B/C ratio is 0.7.

For the AEA analysis, the estimated capital cost suggested by the AEA wind project manager was used; a total estimated project cost of $2.976 million. The AEA analysis also assumed a thermal load component (based on the inclusion of heat recovery benefits from AEA wind managers) in the recommended capital costs. On the benefit side, the estimated additional heating fuel displacement from the AEA HOMER analysis was used.

Note that in the B/C analysis, the cost of the feasibility and conceptual design ($181,000) are included in the total project costs and are shown in the years 2013 and 2014 following the schedule shown in the application.

Concerns:

The primary concern expressed by AEA is the availability of wind. According to the AEA wind project manager, the probability of a viable, economic wind regime is very low. The Class 4 wind regime assumed in this economic analysis is very optimistic.

Data collected using the Automated Surface Observing System (ASOS), from the National Oceanic and Atmospheric Administration (NOAA), predict a class 1 wind resource near the airport. This observation is supported by the AEA wind resource map and suggests that any wind prospecting will need to be accomplished in the hills west of the Noatak.

The Applicant is requesting $181K for feasibility and conceptual design work. This is roughly 20 percent higher than similar studies that have been performed.

Possible Enhancements:

Applicant notes that a preliminary HOMER analysis has been completed and significant fuel savings can be achieved. Supplying this analysis could benefit the application.

Long-term Sustainability:

The applicant suggests that the wind facility would be incorporated into the current power plant operation and O&M will be funded through applicant's general operating costs. Depending on the outcome of the feasibility study, it is reasonable to assume long-term sustainability.

Potential public benefits:

Lessons learned about renewable energy sources in Shishmaref will contribute to a better understanding of wind resources in rural locations around the state. Specifically, data from this study will be used to assist nearby communities along the Bering Strait understand their potential for wind power generation.

The proposed turbines would augment power generation already in place in the community. Stabilizing energy costs would reduce the community's exposure to fuel price fluctuations and help facilitate budgeting for other important infrastructure and could help reduce or prevent rural to urban migration. Reducing the reliance on diesel fuel power generation could provide long-term socioeconomic benefits to village households.

The project has inherent environmental benefits such as improved air quality due to reduced fossil fuel use and reduced potential of contamination from fuel spills.