

2010

Chignik Lagoon Alternative Energy Action Plan



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Summary of vision, goals, and motivations

Vision:

“To provide affordable energy that will contribute to the growth of our local economy, and reduce our dependence on outside energy resources, while preserving our way of life and the natural and cultural resources of the land.”

Goals:

Immediate (0-3 years): A 20% reduction of fuel consumption for both electrical generation and heating using energy efficiency and conservation measures. 15% of electrical needs will be generated using a wind/diesel system.

Mid-term (3-10 years): 75% of electrical needs will be generated using hydroelectric and 15% will be generated using a wind/diesel system. A 35% reduction of fuel consumption for both electricity and heating using energy efficiency and conservation measures.

Long-term (10-30 years): 85% of electrical needs will be generated using hydroelectric and 15% will be generated using a wind/diesel system. A reduction of 45% of fuel consumption for both electricity and heating using energy efficiency and conservation measures.

Motivations:

Chignik Lagoon Village Council would like to see research completed on various alternative energy resources in and around the village, as well as action taken on goals outlined within this plan. While the cost of fuel is steady for the moment, the Council would like to take preemptive steps to be ready for any spikes in fuel costs; which would additionally result in stimulation of the local economy as reduction of fuel costs may allow for residents to invest into business opportunities.

Background information

Why an energy plan is important

An energy plan is very important to the community of Chignik Lagoon because of the expense of fossil fuels. With this plan we are able to seek out feasible alternatives to diesel-powered energy within our community and begin the planning process and cost analysis for possible alternatives.

Current energy sources, costs, and demands

Prior to 1997, the Village of Chignik Lagoon did not have a centralized power system. Each individual household provided their own electricity by individual diesel generator sets. These generators were very expensive and noisy to run. There also was the danger of engine exhaust gas emissions. Today the community has a centralized power system consisting of three alternating diesel-powered generators with an average monthly generation of 45,522 kWhs. This system consumes 3,800 gallons of fuel each month. Additionally, approximately \$3,400 gal/mo is used for diesel-powered heaters for individual homes.

The fuel efficiency to run the generator averages 12kwh/gal. Target for village's engine size is 12-13 kWh/gal, according to Alaska Energy Authority (AEA). However, the amount sold was on average is about 3,924 kwh less than what is generated. Currently the fuel prices are \$4.22/gal for #1 diesel, \$4.51 for #2 diesel, and \$3.84 for gasoline¹. In addition, the community currently has two households generating wind power.

Commercial buildings consume much of the fuel in the form of diesel generated electricity. The school generates the most kWh, averaging around 6,500-7,000kwh/mo. ACS runs approximately 2,000-2,500 kWh/mo. Other community buildings, such as the post office run between 1,000-1,400 kWh/mo. The clinic and street lights are also high on the list. Residential buildings average 700-800 kWh/mo with outliers of 500kWh/mo and 1,400 kWh/mo.

Energy conservation and efficiency

"Energy efficiency is defined as using less energy to produce the same level of energy service. This typically involves using improved technology to save energy, such as using high-efficiency lights to produce the same light output using less energy. An example would be buying newer light bulbs that consume less energy. Energy conservation is defined as decreasing the quantity of energy used. Technically, energy conservation encompasses any method of decreasing the quantity of energy used, including using more efficient equipment. But in general daily use, it typically refers to human decisions and behaviors to save energy. An example would be turning off the lights when you are not using them."- Alaska Energy Authority

Why energy conservation/efficiency is important

Energy conservation and efficiency efforts are the cheapest and quickest way to battle rising fuel prices. Many of the actions that can be taken cost little to nothing and can be put into place immediately.

Residential energy conservation/efficiency opportunities and projects

Much can be done in the way of energy conservation and efficiency in our homes and community buildings. According to Steve Haagenson, Executive Director of the Alaska Energy Authority, rural Alaskan residents spend up to 60% of their income on energy

¹ Based on prices as of August 2010

costs. 81% of these costs are attributed to home heating and electricity usage. Alaska Energy Authority (AEA) and Southwest Alaska Municipal Conference (SWAMC) have published a booklet entitled *“Energy Savers Tips for Rural Alaska”*. In this booklet, you will find various ways to get the most out of the unit of energy purchased. Most of these tips have little to no cost associated with them. Included in the booklet are things that you can do with lighting, water, laundry, kitchen, appliances, living room, heating, wood heating, and insulate. It also mentions various programs that the state of Alaska has to offer.

There are many programs, rebates, and loans that are offered by the state of Alaska and federal agencies to promote energy conservation and efficiency in homes. Some of these programs are listed below.

- Home Energy Rebate Program – Alaska Housing Authority
- Weatherization Program – Alaska Housing Finance Corporation
- Housing Improvement Program – Bureau of Indian Affairs
- NAHASDA Services/Home Repair – Bristol Bay Housing Authority
- Small Building Material Loan – Alaska Housing Finance Corporation
- Energy Star Rebate Locator – Energy Star
- Appliance Rebate for Alaskans with Disabilities
- Residential Energy Efficiency Rebate Program for Builders – Alaska Housing Finance Corporation
- Energy Efficiency Interest Rate Reduction Program – Alaska Housing Finance Corporation
- Second Mortgage Program for Energy Conservation – Alaska Housing Finance Corporation

You can find links to all of these programs on www.chigniklagoon.net or www.energyefficiency.org.

Commercial energy conservation/efficiency opportunities and projects

Village End Use Efficiency Measures (VEUEM) is a program that upgrades rural Alaskan community buildings to help achieve energy savings by replacing or installing energy-efficient lighting, switch boxes, motion sensors, set back thermostats, weather stripping and low mass boilers. The Denali Commission had previously funded this program but pulled funding this year to focus it elsewhere. However, AEA planned to carry out the program in Chignik Bay and Chignik Lagoon before funding was pulled, and they are still planning to continue. \$75,000 will go toward each of these communities. AEA plans to go beyond lighting retro-fits, and do things such as blow insulation.

Commercial fishing is another business that consumes huge amounts of fossil fuels. Unfortunately, there are very few programs/information addressing this energy consumer at this time.

- Alaska Sea Grant Marine Advisory Program
<http://seagrants.uaf.edu/map/recreation/fuel-efficiency/index.html>
- Commercial Fishing Loan Fund (provides funding for engine rebuilds, engine replacements, and gear purchases.)
<http://www.commerce.state.ak.us/investments/vgu.cfm>

- “Energy Efficient Ways to Improve the Economic Bottom Line of your Fishing Business” - Ministry for the Environment-Sustainable Management Fund (<http://www.energyfed.org.nz/fishing.pdf>)

The Lake and Peninsula Borough provided the school district funds to apply energy efficiency measures to the schools in the district. Chignik Lagoon School is currently being outfitted with new lights and windows. Also, an initiative is in place for the schools to conserve more energy than the previous year. The saving is directly placed into the student government account. A few programs and/or lesson plans that may be of interest are listed below:

- SEE - Schools for Energy Efficiency program
- Green Schools Program – Alliance to Save Energy
- Free Lesson plans – Alliance to Save Energy

Action Plan

Short-Term: In an effort to share this valuable information with the community a website has been designed with a special section on energy, www.chigniklagoon.net.

In addition, the Chignik Lagoon Village Council has agreed to a yearlong incentive program to encourage the community members to look at ways to reduce their energy consumption. Also, for the weatherization programs that are available but waiting for funding, the Village Council has written a letter of support to their local state legislator. The energy plan coordinator has encouraged the school district to provide a program to engage the students in conservation efforts within the school as well as at home. At this time, the school district is not able to provide such a program, but is in support of the energy plan coordinator providing such a service. The teachers will be encouraged to imbed subjects relating to energy conservation and awareness into their lesson plans.

Long-Term: Recommended is the continued research of methods and programs available for energy efficiency and conservation efforts for commercial fishing boats. The continuation to promote efficient facility operations within the school using behavior modification and other awareness techniques is also recommended.

Clean energy generation

Why clean, community-based energy is important

Chignik Lagoon’s economy is almost solely based on the fishing industry; by using clean energy there would be a reduction in the opportunity to pollute fishing grounds. By utilizing local resources the community will save on transportation costs and provide local jobs. Taking actions to produce clean and community-based energy will provide a sense of self-sufficiency and accomplishment for the entire community.

Hydroelectric Power

The Chignik Lagoon Hydroelectric Project is a run-of-river hydroelectric project located on Packer's Creek in Chignik Lagoon. Polar Consult Alaska, Inc and Chignik Lagoon Power Utility have been working together on this project. The 190 kW project can provide for most of the communities current power needs, which peak at about 116kW. The project involves construction of an intake, a 4,650 foot long, 18-inch diameter pipeline, a powerhouse, a 2,000 foot long transmission line, and access roads. (Renewable Energy Fund Grant Application prepared by Polar Consult Alaska, Inc. 11/6/09)

In July 2009, Chignik Lagoon Power Utility was awarded a grant from Alaska Energy Authority for \$150,000. This funding is being used for installation of a stream gauge, permitting, and design of a hydroelectric facility. Once Phase II of the project is complete, additional funding will be necessary to go to Phase III of the project which will be construction. Another grant application has been submitted to Alaska Energy Authority on September of 2010 for phase III funding. The project is supported fully by the community.

This run-of-river hydroelectric project will be located on Packer's Creek in Chignik Lagoon. Phase III of this project will include constructing an access route, a powerhouse, an intake, pipeline, and a transmission line as well as the integration into the current diesel system.

The proposed hydroelectric system on Packer's creek would eliminate about 85% of 60,000 gallons of diesel consumed by the generators per year. This would amount to a savings of \$150,000 annually.

Preliminary data was collected in the feasibility study.

Data to be collected in the fall of 2010:

- Stream flow data (at least 2 low flow measurements, etc)
- Geotechnical data collection
 - Layout of project
 - Soil boring data
- Analysis of intake site
- Data on electrical system

Project requirements include:

- Design and permitting – to be completed by Polar Consult
- Funding for Construction phase
- Construction equipment and manpower

Milestones for project include:

- Apply for funding for hydro project and admin.
- Acquire permits
- Complete design
- Secure construction, bids, and select contractor
- Identify jobs village residents can do and post
- Research vendors available for needed materials and order (early spring)
- Rent & mobilize equipment to site
- Construct access trail
- Construct intake & pipeline
- Construct transmission line & powerhouse

The estimated project development costs are as follows:

Land.....	\$ 70,000
Pipe.....	\$140,000
Turbine.....	\$150,000
Controls.....	\$50,000
Intake.....	\$60,000
Powerhouse.....	\$100,000
Transmission.....	\$60,000
Labor.....	\$270,000
Equipment.....	\$200,000
Shipping.....	\$400,000
Subtotal.....	\$1,500,000
Contingency (20%).....	\$300,000
Total Construction.....	\$1,800,000
Construction Management.....	\$250,000
Administrative (5%).....	\$90,000
Profit/Overhead (20%).....	\$360,000
Total.....	\$2,500,000

** Project budget is subject to change*

The payback period will be approximately 30 years (data taken from 1995 feasibility report).

Wind-Generated Power

Wind power is a very viable resource for Alaska. There are already several working wind-powered farms in operation in the state, including Perryville, a community about 20 miles away from Chignik Lagoon. Perryville's wind farm was established in November of 2008. With the use of 10 windmills, the community is saving approximately \$55/day on fuel and about 10,000 gallons of fuel/year. However, other factors must be considered to determine if the purchase and operation of wind turbines is a feasible option for our community.

Between October 2004 and February 2005, wind data was collected in Chignik Lagoon by Alaska Energy Authority (AEA) (see Appendix A). The average monthly wind speed was between 10 and 13 mph. However, this was collected for only 6 months. Additional data collection has been suggested. According to AEA at least an entire year of data should be collected to make a proper assessment. The data should be collected in the area in which the windmills would be erected. At the end of January 2010, Jay Yeger from Southwest Wind Power came to Chignik Lagoon to do an initial site assessment. The first area of

interest is located at the end of the beach near the HUD building and the second is located in front of the water pump house on the bluff. According to Jay Yeger, 4 to 5 wind towers could be erected in each of the above mentioned areas.

The goal for wind-generated power in Chignik Lagoon would be to compliment the proposed hydroelectric power. During times of low creek flow (mostly during the coldest months), wind may be significantly higher and able to compensate for the decrease in power generated by the stream.

Option 1: Install a met tower in each location proposed to collect data and determine the best course of action.

Option 2: Install one windmill near the water pump station and collect data while producing energy. (If does not work well with Hydro/diesel system it may be directly connected to pump station.)

Option 3: Hire a professional engineer to create an integration plan then proceed with best course of action.

Option 4: Combination of above.

Potential Complications:

Since there is a high potential for the integration of a hydroelectric system into the diesel generators, there are potential complications having both wind and hydroelectricity running in conjunction with the diesel generator. Generating too much energy or having excess voltage can be as challenging as not generating enough energy. The hydroelectric system will be run of river and will not allow for build up or storage of water to use when needed. Wind is also variable and would need expensive batteries for power to be stored.

Suggestions made from professionals in field:

Having a good regulation system and integration plan was advised as well as looking into storing energy in order to optimize the alternative energy sources.

Suggestions made by James Jensen (AEA) and Jennifer Richcreek (Kodiak Electric) were to look into storage and to collect data from Hydroelectric system. Data collected would tell us when other energy may be needed.

Conclusions:

In order to properly make an assessment on the feasibility of wind-generated power, more data is needed. At least an entire year of data should be collected to make a proper assessment. The data should be collected in the area in which the windmills would be erected. Also a professional engineer specializing in these combined systems would be beneficial to come out and assess our current powerhouse and diesel generator set-up to determine the best possible integration plan combining hydroelectric, wind and diesel into one system for our community.

Estimated costs:

Engineering companies and quotes

Integration plans and system upgrades (wind/hydro/diesel) ~ \$20,000

EPS inc. - for conceptual design and/or report ~ \$15-20,000

Comprehensive site survey & evaluation (AWI)² ~ \$6,500

Estimated costs for MET tower

Lake and Peninsula Borough ~ \$10,000

Estimated budget for wind towers

10 windmills and parts- \$121,420

Shipping - \$11,000

Man/machine power ~ \$71,650

Cement/reed bar and wiring ~ \$34,000

Total ~ \$238,070

Total 1 windmill ~ \$23,807

Batteries

24-hour back-up at current loads (EE)³ ~ \$400,00 - \$500,000

Solar Power

Solar power has been introduced into Alaska's alternative energies. However, this form of alternative energy is relatively new to the area. The Bristol Bay Campus has recently installed a 4kW photo-voltaic system. Data is being collected, however at this point the payback period will be over 20 years. There is a Federal tax credit for solar panel installation of 30%.

Solar on boats

Some investigation was done on the idea of using solar power to charge batteries or run certain equipment on fishing boats. Little research has been compiled on the efficiency of this energy source on boats; however fishermen in the area have experimented with the concept with great success. Vessels in the Prince William Sound region have used solar panels for several years, and could serve as a model for testing in the Chigniks.

Suggestions

Conduct research on the feasibility of solar panels on fishing boats in this region.

Coal Bed Methane

Coal Bed Methane is a viable alternative energy for the future growth of the entire Chignik area. In 1885, coal was discovered along the Chignik River. By 1910 there were several coal mines in the area. The most recent data that was collected in the Chignik area was in 2005, *Draft Summary Report on Rural*

² Alaska Wind Industries, www.akwindindustries.com

³ Engineered Equipment- Contact Terry @ 345-3474

Alaska Shallow Gas Studies: Fort Yukon, Red Dog Mine, Chignik, and Wainwright, completed by Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys in October 2005. This report summarizes the collaborative efforts of a multi-agency team that evaluated the potential for shallow gas in rural Alaska. Chapter 3 of this report discusses the exploratory water well drilling done at Chignik Lake. The test drill was done to explore shallow gas in coal seams. The results of this test drill proved unsuccessful. Unfortunately during the drilling program torrential rains created considerable difficulties for the project. According to the above mentioned report, the potential for structural complexity in the Chignik area will require detailed mapping of the local structures and geology to select future drilling sites for potential coal bed methane resource.

1. A detailed map of local structures
2. Assessment of such a map to determine drill sites
3. Project coordinator
4. A drill – (possible drill in Naknek?)
5. Professional manpower to work drill
6. Food and housing for manpower
7. Assessment of findings

\$500,000- \$1,000,000 would be a very rough estimate of cost.

According to an article in BLM Alaska Frontiers- spring 2003, economic studies show that even a small field could help if it was beneath or right next to a community or an industry that uses a lot of power.

Biomass

The production and use of biomass as an energy source was examined for Chignik Lagoon. Due to the lack of trees, and/or fishing processing facilities it is not a practical solution to the village's energy needs at this time. However as fuel prices rise there may be a need to re-evaluate the possibility of barging in wood pellets or to provide a log gathering service for the locals. Listed below are a few figures to consider when looking into this source of energy (costs based on pricing from June 2010).

Wood Pellets:

Northwestern Fuels- Washington:

Wood Pellets – \$270/ton + delivery to barge (\$50-\$100)

Freight – \$423.28/ton

Total - \$730/ton

Cost of fuel would have to be above \$6.00/gal in order to benefit from wood pellets at this price.

Superior Wood Pellets-Fairbanks:

Wood Pellets - \$250/ton

Trucked to Anchorage -\$25

Mailed to Chignik Lagoon- \$770.40/ton

Total - \$1045.40

Cost of fuel would have to be above \$8.50/gal in order to benefit from wood pellets at this price

Other energy-related projects

Innovative ideas for generating energy locally include; cultivating the eel grass, underwater turbines in the channel, cultivating underwater methane using a funnel system and harvesting beach wood or alders.

Grant opportunities for Alternative Energy

- Department of Energy- Tribal Energy Program
http://apps1.eere.energy.gov/tribalenergy/government_grants.cfm#Tribal
- Alaska Energy Authority Block Grant
<http://akenergyauthority.org/eeecbg.html>
- Lake& Peninsula Borough
<http://www.lakeandpen.com/>

Conclusion

The Chignik Lagoon Alternative Energy Action Plan has two main goals. The first is to take immediate action to help reduce the energy costs, both through education and programs for energy efficiency and conservation efforts and research and/or implementation of an alternative energy source(s). The second main goal is for the village to reach a high level self-sufficiency for all energy needs within the community within the next decade. This plan is designed to be interactive and to give a baseline for alternative energy actions as well as highlight available programs and granting opportunities.

Acknowledgement of partners

A special thank you to...

Southwest Alaska Municipal Conference for volunteering time, knowledge, and resources to this plan.

Lake and Peninsula Borough for their special interest and resources in the research of wind power in Chignik Lagoon.

Alaska Energy Authority for their helpful personnel and expertise in various subjects of alternative energy.

Pebble Fund for the funding of the Chignik Lagoon Alternative Energy Action Plan Project.

To the many agencies devoted to providing resources, knowledge and awareness for the need to examine alternative energy sources.

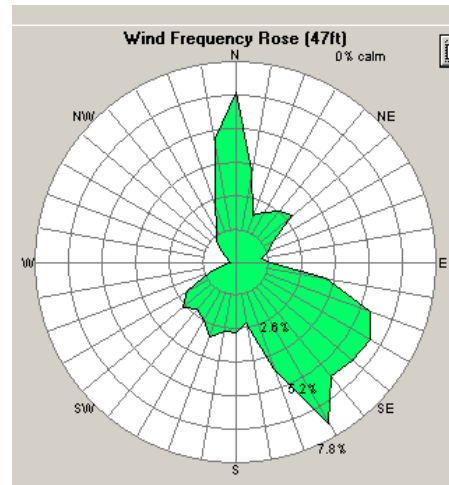
Resources and opportunities for external collaboration

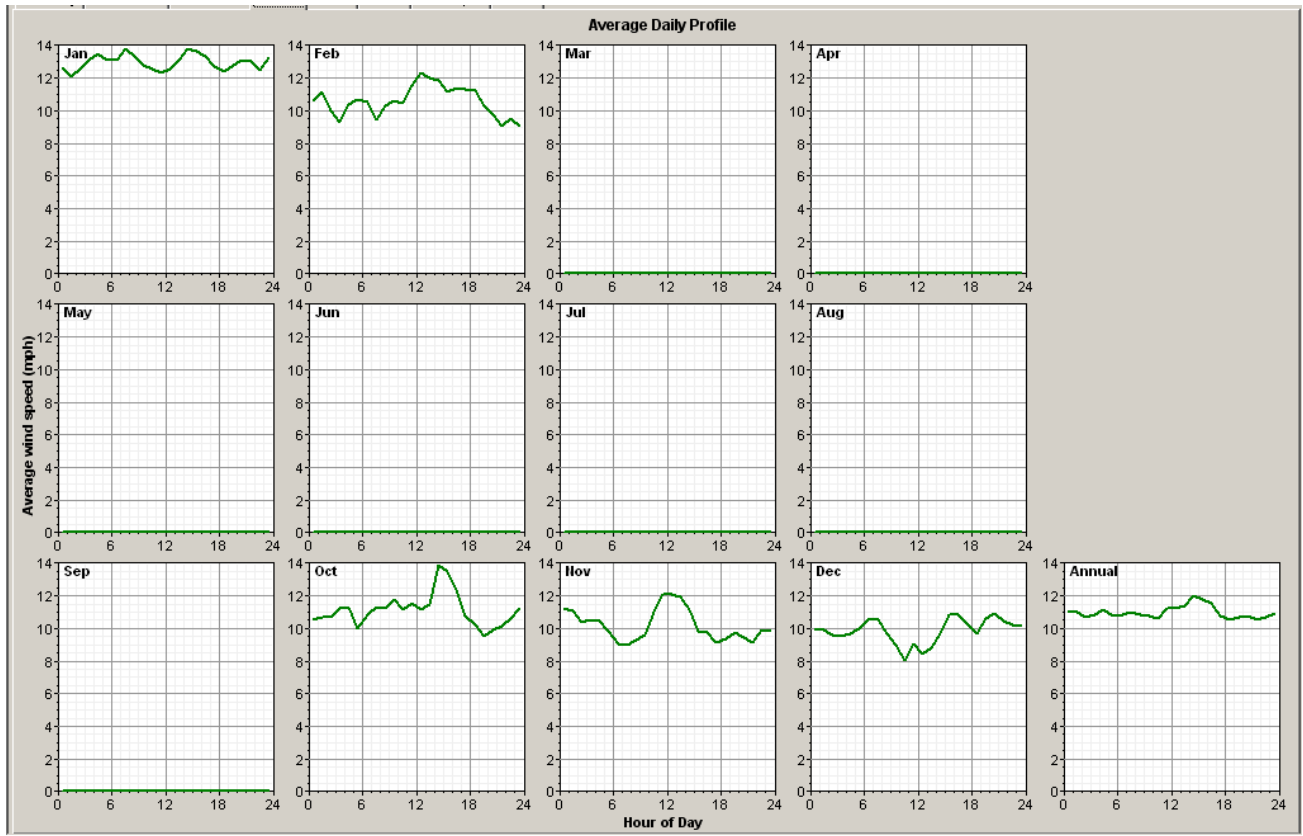
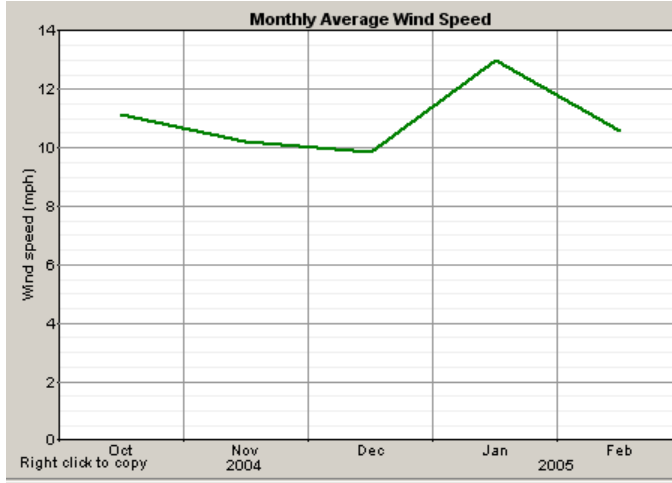
- Polar Consult, Alaska Inc., <http://polarconsult.net/>, (907) 258-2420- Contact Mike Dahl
- Alaska Energy Authority (AEA), <http://akenergyauthority.org/>, 1-888-300-8534
- AEA reference website - <http://akenergyefficiency.org/>
- Southwest Alaska Municipal Conference, <http://www.swamc.org/>, (907) 562-7380- Contact Andrew Varner
- Lake & Peninsula Borough, <http://www.lakeandpen.com/>, 1-800-764-3421- Contact Lamar Cotton
- Bristol Bay Housing Authority, <http://bbha.org/index.htm>, (907) 842-5956
- Bristol Bay Native Association, <http://www.bbna.com/>, (907) 842-5257

Appendices and bibliography

Appendix A:

Chignik Lagoon Wind Data compiled by Alaska Energy Authority (AEA).





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