Diesel Displacement through
Renewable Energy Integration and Strategy

APICDA Communities:

Akutan
Atka
False Pass
Nelson Lagoon
Nikolski
St. George

APICDA Board Directors:

Akutan – Hugh Pelkey
Atka – Mark Snigaroff
False Pass – Gilda Shelikoff
Nelson Lagoon – Justine Gundersen
Nikolski – Arnold Dushkin
St. George – Patrick Pletnikoff

Table of Contents

INTRODUCTION	4
STATUS QUO: BASELINE COMMUNITY ASSESSMENT	5
WHAT ARE OUR ALTERNATIVES: RENEWABLE ENERGY IN THE REGION	7
COMMUNITY RESOURCE ASSESSMENT	13
FUNDING	15
RECOMMENDATIONS	17
CONCLUSION	19

INTRODUCTION

This paper provides an overview of the current state of APICDA communities, renewable energy options available to each community, an assessment of the energy potential for each community and funding options. It concludes with recommendations for consideration.

Following the 2008 Community Conference, the APICDA Board of Directors directed staff to evaluate the capabilities and applications of renewable energy in its villages. This followed on the heels of cancelled or postponed fuel barge deliveries for numerous reasons, the escalating cost per fuel with associated increases in electricity, heating fuel and food. For these reasons, emergency fuel conservation or emergency measures were undertaken by numerous communities and their residents. Residents took – and continue taking - drastic measures of choosing to 'heat or eat' just to make it day by day.

The primary purpose of this document is to identify ways to reduce and displace diesel fuel use by shifting to alternative energy forms. Furthermore, it is important that a "renewable energy plan" for our communities be seriously considered and developed.

Additionally, it is imperative that a funding source is identified to implement a diesel displacement strategy for the APICDA communities. Financing and funding will be addressed in more detail later in this document.

Eventually, APICDA should work with regional entities to identify a mechanism that shifts the villages' primary reliance of energy production away from diesel, redefining how each of our communities heat, electrify, and transport themselves in the communities they live.

As one reads through this document there are some general principals that should be considered:

- Most importantly, what is the role of APICDA? Are we a grant applicant on behalf of a community, a co-applicant, or none? How do we assist? How does a community want us to assist?
- Energy must be affordable, reliable, and long-term
- Energy conservation must be encouraged for all APICDA communities
- Energy alternative research and development must be encouraged and supported
- Energy providers and producers must plan collectively for energy infrastructure development
- The APICDA region must be on a path of energy self-sufficiency by 2010 and energy self-sufficient by 2020, if not earlier.

Taken together, these principals could form the basis for an energy policy that guides the further development and implementation of low cost and sustainable energy based upon alternative energy resources within the APICDA region.

STATUS QUO: BASELINE COMMUNITY ASSESSMENT

Various community assessments through the APIA or APICDA's own internal inquiry were conducted through the summer to generate information regarding each community's current state (Appendix C). The following information is a status quo assessment for each of our communities. The assessment will assist in understanding what next steps may be required to develop a plan to reduce diesel fuel use.

Akutan

The City of Akutan owns and operates the local utility. Currently, there are 40 occupied homes in the City. The school, the Bay View Hotel, city building, and corporation office are the primary significant users of electricity in the City (Trident Seafoods generates its own power).

The City reported that sales of the following fuel took place in 2007:

- 10,000 gallons #1
- 80,000 gallons #2

The City further reported that about 3,143 gallons per month, or an annual total of approximately 37,716 gallons, of #1were consumed by the utility in 2007.

The total kWh energy production in 2007 is unknown at this time.

Current fuel costs as of August, 2008 are:

- #1 - $4.78/gallon
- #2 - $4.73/gallon

A diesel fuel delivery occurred in June and the City will not see another delivery until November or December 2008. The City is unsure of what the price will be when they receive their next delivery.

There are no large construction projects planned in the near future that the City has identified that would draw additional energy loads.

Atka

No diesel fuel was sold in 2007 – fuel was used strictly for the power plant. According to the Alaska Energy Authority's PCE FY 2007 report, the Andreanof Electric Company used 57,483 gallons of diesel fuel, producing 404,665 kWh.

As of the AEA report, the cost per gallon for diesel fuel was at $4.85.

Atka has a population of about 90 residents, with 28 occupied homes.

False Pass

The City of False Pass owns and operates the local utility and does not sell fuel. The utility consumed 65,000 gallons of diesel fuel in 2007.

Peter Pan sells heating fuel and we do not have a figure on how much fuel was sold in 2007.

The current cost of diesel fuel is $4.09.

The City of False Pass reports that there are 23 occupied homes, noting that the significant users of electricity include the school, post office, airport, city office, community center, and health clinic. A total of 10 community buildings receive electric services.

Future projects that may require more capacity are a trailer that houses the Kelley Ryan employees who are working on the harbor and fish processing plant. Furthermore, there is a plan for a waste water treatment center to be constructed.

Nelson Lagoon

The Nelson Lagoon Corporation owns and operates the local utility. No diesel fuel was sold in 2007.

The utility consumed 34,000 gallons of diesel fuel in 2007 producing approximately 754,313 kWh (Appendix I, pg. 8B).

The current cost of diesel is $5.96/gallon. A fuel barge made a large delivery in late July 2008.

Future projects consist of a seafood processing facility that could potentially draw up to an additional 60 kW.

Nikolski

The IRA owns and operates the local utility. 22,000 gallons of diesel fuel were sold in 2007 with an additional 23,000 gallons of diesel fuel consumed by the utility.

Approximately 500 gallons of fuel were used for vehicles; with 15,000 – 20,000 gallons of fuel used for heating homes.

The current cost of diesel fuel ranges from $4.17/gallon to $7.00/gallon with an elder rate of $6.30/gallon.

There are 16 occupied homes in Nikolski.

Nikolski Adventures Lodge, school, store, FAA bldg, and AWOS system are all significant users of electricity in the village.

The Umnak Power Company produced 252,641kwh in FY2007 (Appendix I, pg. 9B).

St. George

The City of St. George owns and operates the electric utility.

Approximately 190,000 gallons of fuel was sold on St. George in 2007 with about 80,000 gallons consumed by the City of St. George electric utility. The diesel power plant produced just over 1,008,000 kWh in 2007.

At this time there are 37 occupied residential homes, plus the six-plex – bringing the total occupancies in use to 43.

Projects that are scheduled for construction and operation in the future are a lodge and seafood processing facility. Loads that these operations may have on the local utility are projected at 67,000 kWh annually.

WHAT ARE OUR ALTERNATIVES: RENEWABLE ENERGY IN THE REGION

This section considers the availability of the more common renewable energy sources in all or some of APICDA's communities, what is typically required to monitor and evaluate that resource, as well as potential impediments to development of those resources. Common renewable energy resource opportunities that we find in our communities are biofuels/biomass, geothermal, hydro, tidal/wave, and wind (Appendix F, pg. 3).

There are plenty of manufacturers of equipment and hardware to consider using for renewable energy projects. On wind energy alone, there are 86 various small wind manufacturers that have developed vertical and horizontal wind turbines; conventional to the un-conventional and unproven.

Large scale, commercial or utility grade wind turbines typically range from the 225kw (kilowatt) on up to 2MW (megawatt) wind turbines. Manufacturer examples include GE, Suzlon, Vestas, Fuhrlaender and Siemens.

Depending on load requirements, waste heat dumping, existing diesel power generation and other technical variables, utility grade turbines that you could find installed in one of our communities may be a 90kw to 225kw capable turbine. For example, when diesel and wind are integrated together, for example in St. George, and depending on the size of wind turbine, it is possible to displace up to 75,000 gallons of diesel fuel at a cost savings of $410,000.

The proven technology and more commonly used wind turbines generally are three-bladed, horizontal access turbines. There are many variations, of course, such as two-bladed systems. Each project is a case by case scenario; however, in the Aleutian/Pribilofs, we will generally expect to see a three bladed wind turbine installation. These installs have been proven and can withstand the unique conditions that Alaskan conditions present.

Geothermal energy can, in some situations, be a more complicated and cost prohibitive effort compared to other alternative technologies. However, being able to tap into the geothermal resource and extract its energy generating potential can offer long term base-load electric and heat production capabilities. Geothermal energy is a sustainable source of energy as the heat extraction is small compared to the size of the heat reservoir. With the cost of diesel fuel, combined with electric rates, a small geothermal power plant could potentially serve well for a small rural community.

Before we come to any final determinations, let's examine a little closer alternative energy options typically found in our region.

Biomass/ Biofuels

Biomass refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown for use as biofuel, but it also includes plant or animal matter used for production of fibers, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. It excludes organic material which has been transformed by geological processes into substances such as coal or petroleum. For instance, the combustion of wood for heat would be an example of biomass fuel (of which, several of our communities have access to). A simple program could be set up where wood is gathered from the beach, hauled, cut and dried in a localized area, sold or given to community members to use instead of burning diesel fuel.

Biofuel can be broadly defined as solid, liquid, or gas fuel derived from recently dead material. This distinguishes it from fossil fuels, which are derived from long dead biological material. Biofuel can be theoretically produced from any (biological) carbon source – such as fish waste. Utilizing fish waste to convert into fish oil is a legitimate option for communities to consider.

For instance, Alfa Tec, Inc. is a company that has experience capturing fish oil using Alfa Laval systems on shore and off. Each system is sized around a specified production rate. Alfa Tec, Inc. has systems for fuel as well as omega 3 fish oil. Alfa Laval has plants throughout the world with a very strong focus on the northwest fishing industries. They have both shore based plants as well as floating processors. Alfa Tec, Inc, in conjunction with Alfa Laval has spent time and money in extensive research in the fish oil recovery process. The process and handling of the oil is very important as far as heating and storage. This is a growing area and the company maintains both new and remanufactured equipment as companies up grade (Appendix E).

Other mobile biofuel manufacturing systems are available like the Biobox (Appendix D). This system too, can be operated and maintained with minimal manual labor – manufacturing fish oil into biodiesel for use within the community.

By utilizing fish waste, a fish processing facility and community reduces the need to discharge into local waters, thereby harnessing the full potential of the waste and converting into energy or value added pharmaceutical products.

Geothermal Energy

Geothermal power (from the Greek words *geo*, meaning earth, and *thermal*, meaning heat) is energy generated by heat stored beneath the Earth's surface or the collection of absorbed heat derived from underground in the atmosphere and oceans. The largest group of geothermal power plants in the world is located in The Geysers, a geothermal field in California. As of 2007, geothermal power supplies less than 1% of the world's energy.

High and moderate temperature geothermal resources can be used to generate electricity. Low temperature geothermal resources can be used for a wide range of direct uses, e.g. district and space heating, industrial processes, greenhouses, aquaculture and spas.

Geothermal energy offers a number of advantages over traditional fossil fuel based sources, primarily that the heat source requires no purchase of fuel.

Geothermal power plants work continuously, day and night, making them base load power plants. From an economic view, geothermal energy is extremely price competitive in some areas and reduces reliance on fossil fuels and their inherent price unpredictability. It also offers a degree of scalability: a large geothermal plant can power entire cities while smaller power plants can supply more remote sites such as rural villages.

Several of APICDA's communities are in relatively good locations to explore and possibly capitalize on harnessing and converting geothermal power into electricity and heat. Some of the barriers to developing this great resource are permitting, land use, population base, logistics – particularly in the case of APICDA region, geography can be cost prohibitive.

As examples, the Mt. Makushin geothermal project, just outside of Unalaska, would provide power to the City of Unalaska, and the Akutan Project would provide power to the City of Akutan. If developed, the Makushin and Akutan projects would also provide district heat and process heat to local, municipal, and fish processing customers. Each of these proposed geothermal power projects has the potential to produce tens and possibly hundreds of megawatts of electric power (Appendix F).

Hydropower

Hydropower or hydraulic power is power that is derived from the force or energy of moving water, which may be harnessed for useful purposes. Hydropower is manifested in the force of the water on the riverbed and banks of a river. It is particularly powerful when the river is in flood.

Damless hydro or damless hydro-electric is a renewable technology based on capturing the kinetic energy of rivers, channels of chutes, spillways, irrigation systems, tides and oceans without the use of dams.

Since no dam is required, damless hydro may dramatically reduce the following:

- The safety risks (of having a dam)
- Environmental and ecological complications
    - Need for fish ladders
    - Silt accumulation in basin
- Regulatory issues
- The initial cost of dam engineering and construction
- Maintenance

Several of APICDA's communities currently utilize hydro power as a source of generating electricity. What could be extremely valuable is conducting additional cursory analysis by reviewing site maps and other available information. Those analyses can then help determine which communities should consider and invest in field reconnaissance. Hydro power serves as a cost effective base load – similar to what diesel power generation currently provides for many villages across the state.

Wind Energy

Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines. At the end of 2007, worldwide capacity of wind-powered generators was 94.1 gigawatts. Globally, wind power generation increased more than fivefold between 2000 and 2007.

Most wind power is generated in the form of electricity. Large scale wind farms are connected to electrical grids. Individual turbines can provide electricity to isolated locations. In windmills, wind energy is used directly as mechanical energy for pumping water or grinding grain.

Wind energy is plentiful, renewable, widely distributed, clean and reduces greenhouse gas emissions when it displaces fossil-fuel-derived electricity. The intermittency of wind seldom creates problems when using wind power to supply a low proportion of total demand, but it presents extra costs when wind is to be used for a large fraction of demand. However, these costs (even for quite large percentage penetrations) are considered to be modest.

Additional consideration should be recognized as to the waste heat that is generated by the turbine and use of that waste heat. Capturing all the energy produced by a wind turbine (in this case in the form of heat) can be beneficial to public use buildings (i.e., greenhouses like Nikolski, school, library) that are connected to a waste heat distribution system.

APICDA communities have some of the most remarkable wind resources in the world. The classification system used in the wind industry to describe least favorable to most favorable wind regimes is by describing a wind resource as a class 1 (lowest) to class 7 (highest).

Each class represents a range of mean wind power density (in units of W/m^2) or equivalent mean wind speed at the specified height(s) above ground. Areas designated class 3 or greater is suitable for most wind turbine applications, whereas class 2 areas are marginal. Class 1 areas are generally not suitable, although a few locations (e.g., exposed hilltops not shown on the maps) with adequate wind resource for wind turbine applications may exist in some Class I areas.

You will typically find APICDA communities with Class 6 or 7 wind regimes – making wind integration into the current power generation system very desirable. To fully understand the capability of the wind resource in an area, wind data is required. The Alaska Energy Authority manages an anemometer loan program, allowing communities to borrow a tower and associated wind data gathering equipment for up to a year. This data is then used to make a quantitative determination as to the available wind resource.

Based on an economic analysis of currently available individual PCE eligible communities, roughly 31 rural Alaska communities representing 15,000 residents, present attractive opportunities for wind resource development, with reconnaissance benefit/cost ratios ranging from 1.0 up to 1.7. These communities represent, in aggregate, a total present value benefit of $38.6 million and a total present value cost of $35.2 million. The potential net economic benefits for these communities are sufficient to justify a wind resource development program on the order of $35 million, including $1.6 million for detailed reconnaissance, preliminary design, and final feasibility, plus $27.5 million for final design and construction contingent upon a finding of net economic benefits at the final feasibility analysis stage (Appendix H, pg. ES-7).

Tidal and Wave Energy

Tidal power, sometimes called tidal energy, is a form of hydropower that converts the energy of tides into electricity or other useful forms of power.

Although not yet widely used, tidal power has potential for future electricity generation. Tides are more predictable than wind energy and solar power.

Tidal power may be a solution for Nelson Lagoon for instance. Nelson Lagoon which is adjacent to the Izembek National Refuge and its winged residents, has a more difficult time with renewable energy choices. For instance, the Stellar's Eider, which is listed as an endangered species, is a common species in the Nelson Lagoon locale during the winter months. Although Nelson Lagoon has a superb opportunity to harness its wind resource at the utility grade level, the endangered species listing will most likely not allow utility grade installs in the area.

Diesel

Although diesel fuel is not considered an alternative energy source it does require some discussion.

Diesel generation accounts for 94% of power production in the 181 rural communities that receive Power Cost Equalization assistance. Measures that improve the efficiency of diesel generation offer substantial savings in a wide set of situations.

AEA's Alternative Energy and Energy Efficiency program is assisting 16 communities throughout the state in upgrading to high-efficiency diesel generators and automated switchgear and developing systems that supply recovered “waste” heat to community facilities. AEA's construction program routinely incorporates these efficiency measures in new power systems. Diesel efficiency measures funded under AEA's Denali Commission-funded Energy Cost Reduction program are estimated to save $10.2 million, chiefly in diesel fuel costs, over the lives of the projects. Installed cost of the projects totals $5.5 million (53% grant, 47% local share).
(akenergyauthority.org/programsalternativediesel.html).

Rural Alaska utilities, schools and residential households account for approximately $170 million in annual energy expenditures: utility payments for fuel & non-fuel costs; school payments for heating fuel & electricity; residential household payments for heating fuel & electricity; and PCE payments to utilities (Appendix H, pg. ES-1).

For all practical purposes, our communities cannot simply take diesel power generation out of the equation; the reliability of diesel power is critical to ensuring that residents and other community buildings receive power - yet, that should not stop us from pursuing the displacement of diesel fuel consumption.

In many of the communities, the diesel generators may not be well maintained – they are legacy equipment - and leave communities spending more money than is necessary to keep the generators running. This translates into inevitable inefficiencies and accompanying increased spending well beyond what would be required if more efficient and modern generators were installed.

Diesel power generation systems need to be part of the short to mid-term plan as communities explore their shift to renewable energy production. Some villages may not have a reliable base load system to maintain the power they rely on; diesel generated power allows that base load to remain consistent. Renewable energy integrated into a state-of-the-art diesel system allows a more smooth transition to lowering the overall cost of electricity to the consumer as well as displacing high cost of gallons of diesel to the local utility.

Approximately 27 percent of the existing rural Alaska electricity diesel generating plants operate combined heat and power systems where heat from the diesel generator jacket water is used to reduce the need for fuel consumed by heat-only boilers. System configurations vary widely. Some communities have a district heating system where multiple buildings are served by the heat from the diesel plant. Others use the heat from the diesel plant for the washeteria, water tank, piped water distribution system, or other heating load. And most simply do not capture the waste heat.

Based on a preliminary assessment of the market, it appears that 70 percent of rural Alaska communities should be able to make cost effective use of combined heat and power systems, whether to heat a school, clinic, water system or other local energy need (Appendix H, pg. ES-5).

Appendix A contains additional renewable energy options and information not included in this section.

COMMUNITY RESOURCE ASSESSMENT

Akutan

Akutan has a reliable wind resource. According to FirstLook (firstlook.3tiergroup.com), Akutan has a Class 6 wind resource that, if adequately powered, could provide electricity for a majority of homes and commercial/businesses.

Additionally, geothermal activity and hydro electric power opportunities do exist within the community, however they may not be practical to develop due to costs, population base, transmission, or permitting issues.

Renewable energy potential: Wind, hydro-electric or geothermal
Need:

- Wind - Meteorological tower installed to gather wind data – Alaska Energy Authority Anemometer Loan Program
- Hydro – assess damage to existing hydro power plant – is it salvageable? Is additional hydro power available to integrate into the existing hydro power plant?
- Geo-thermal – a geo-thermal assessment or update to existing studies is recommended

Atka

The Atkan wind resource is graded as a Class 7 wind resource. The City of Atka is currently wrapping up construction of a hydro electric power generation system. There is opportunity to develop additional hydro power resources in the community.

Renewable energy potential: Wind, hydro-electric or geothermal power
Need:

- Wind - Meteorological tower installed to gather wind data – Alaska Energy Authority Anemometer Loan Program
- Hydro – assess if additional hydro power is available to integrate into the pending hydro power plant

- Geo-thermal – a geo-thermal assessment or update to existing studies is recommended

False Pass

The wind resource in False Pass is rated as a Class 6 or 7 resource. Wind data has been collected by the Alaska Energy Authority and is currently under review for its 'official' capabilities. Once this data is analyzed, the City of False Pass will have the opportunity to proceed with filling out an AEA renewable energy grant application in the fall of 2008 for a potential 2009 install.

Furthermore, hydro electric power may be possible from several different sites relatively close to the city center. 'Paper assessments' would be needed before an onsite visit was commissioned.

Renewable energy potential: Wind, hydro-electric or geothermal power
Need:

- Wind - Meteorological tower was installed to gather wind data through the Alaska Energy Authority Anemometer Loan Program; wind data is currently being studied
- Hydro – assess if hydro power is available to integrate into the current diesel power plant

Nelson Lagoon

Tidal power is a likely source of renewable energy for the community. Assessments need to be conducted on the potential of the in and out tidal movement for power generation and associated impediments to development. Additional considerations that need to be taken are most definitely how tidal power could impact the salmon.

APICDA purchased a Skystream 1.8 kW wind turbine to show the potential for wind energy in the community. The Skystream will be tied into the Nelson Lagoon Storage Company.

Issues that could delay the development of renewable energy projects in the Nelson Lagoon could be endangered species issues.

Renewable energy potential: Wind, tidal or hydro power
Need:

- Wind - Meteorological tower installed to gather wind data – Alaska Energy Authority Anemometer Loan Program
- Hydro – 'paper study' assessment if hydro power is possible to integrate into the diesel power plant
- Tidal – a tidal assessment and feasibility study is recommended for Nelson Lagoon.

Nikolski

The Village of Nikolski had a Vestas wind turbine installed nearly two years ago. The wind turbine is projected to save the community up to $178,000 annually in avoided diesel fuel purchases.

Future wind installations should be investigated at Nikolski to determine whether or not the community can be completely free of diesel fuel use.

Additionally, TDX Power will look at the use of waste heat from the turbine to heat a greenhouse that was recently constructed as well as the Ugludax Lodge.

Renewable energy potential: Wind
Need:

- Wind – Vestas wind turbine installed. Assess if additional wind is needed. Capture waste heat for community use.

St. George

Through APICDA, the City of St. George recently received a $1million grant from the Denali Commission/Alaska Energy Authority to install a wind turbine on the island. Construction of this wind turbine is slated to commence in spring 2009. Wave technology has been explored by Max Malavansky, Jr. and the St. George Tribal Council. Through their continued work and exploration, they may be able to identify additional capacity that wave power has for the community.

Renewable energy potential: Wind, wave
Need:

- Wind – Complete wind turbine installation in 2009
- Wave – additional feasibility studies are needed to follow up with the work that the Tribal Council has already begun.

Diesel offset with installation of wind turbine: Approximately $400,000/annually (Polarconsult Alaska, Inc. power study, summer 2008)

FUNDING

Federal or State renewable energy grants, private capital, loans, carbon offsets, sponsorship, renewable energy credits, or other new streams of revenue generation are just a few ways that renewable energy projects can be funded within APICDA communities.

Important to recognize are the inherently different attributes of each community; from population to the load requirements in the community. It is hard to 'lump' the communities together and offer an overall renewable energy package that begins to reduce the amount of diesel spend occurring.

What each community has is a great opportunity to minimize the amount of money that is spent on purchasing diesel fuel by integrating a well planned renewable energy project. Generally speaking, renewable energy projects see a return on investment or 'simple payback' within four to six years – when talking cash on cash investment. With communities facing .$38 - $.72/kwh for electricity and upwards of $7.00/gallon for diesel fuel, it is easy to begin to understand that integrating renewable energy into the current diesel power generation system has merit.

Being creative and open to new methods of using existing funding mechanisms brings you that much closer to the reality of a renewable energy project in your community. Using tribal status for instance, can secure low interest loans to match with the State of Alaska's renewable energy grant program. Working with Native Energy to sell Renewable Energy Credits, in tandem with a grant and low interest loan is also an alternative.

Although the renewable energy resource may be free and available right now, the cost to build adequate and reliable infrastructure can be cost prohibitive.

There are a multitude of options available in the Aleut region to deliver renewable energy projects. Some are more realistic than others and it is important to identify what will work in the near and long term. The more prompt we are in executing a solution to the six communities' current energy crisis, the earlier we work to lower the cost of energy.

The feasibility of projects in the Aleutian/Pribilofs varies largely from one community to the other. Multiple variables play into developing a final plan for a renewable energy project such as:

- Location
- Population
- Funding sources
- Availability of utility grade equipment – wait times of 6 months to 2 years
- Current and proposed power use loads;
- Wind or river speed, tidal or wave frequency, solar activity –what is the resource;
- Transmission;
- Removal of old diesel generators and replacement with new;
- Transportation to and from sites;
- Cranes, drilling equipment, heavy equipment;
- Local labor force;
- Willingness of the village to proceed with the transition;
- Permitting

The feasibility of these projects are largely dependent on some of the above mentioned variables as well as taking into consideration the long term impacts of integrating renewable energy into your village. At the present rate rural Alaskan villages pay for diesel fuel, it will be difficult for those villages to continue to operate a utility, let alone for individual residents to afford to pay for heating fuel for their home.

Regardless of which renewable energy opportunity is determined to be the best fit, it needs to be emphasized that the cost to bring a renewable energy project into a community are very high.

Over time however, alternative energy is a good investment for the community – generating savings for the utility owner as well as the end user. However, the longer a community waits, the more expensive the integration will be; more importantly, the utility continues to spend more for diesel fuel and the consumer pays more per kilowatt hour.

RECOMMENDATIONS

The long term impacts of a village unable to heat and electrify at a reasonable and comparable rate to urban America are very alarming. The implication that villages may 'shut down' and residents face relocation principally due to high energy costs are unacceptable. In an attempt to minimize or eliminate the aforementioned possibilities, the following are thoughts and recommendations for consideration.

Stay status quo?

- It is conceivable that nothing is done in the foreseeable future and communities continue to use diesel fuel to power their communities. It is difficult to conceive of a community remaining viable under this scenario.

What role do we play?

- As stated in the beginning of this document, an important factor in how things proceed is defining what APICDA's role will be, now and into the future in terms of energy.

Be Smart!

- All renewable energy projects require that we be smart, move expeditiously yet methodically and communicate.

Assess the resource – now and for the future!

- Assessments for all potentially viable alternative energy solutions in each of our community's should be completed as soon as practical. Renewable energy resource assessments should be included in a 50 year community strategic planning. Once that information is secured, you are then able to more clearly define a plan regarding which project should take priority – recognizing project planning attributes such as:

    - Alternative energy recommendations by community
    - Project equipment costs/installs etc.
    - Funding sources
    - Adequate and realistic lead time - implementation and construction

Data.

- It is critical that data is secured. Whether it is wind data, river or stream flow, temperature for geothermal, solar power assessments or biodiesel production using fish oil, we must have data. Any project, whether we seek grant funds, loans, or private capital to move a concept to operation, requires irrefutable and 'bankable' data.

Consider a regional Short, Median and Long term Energy Strategy

- Many regions across the state have developed or are developing energy policies and plans. As an example, the Southwest Alaska Municipal Conference's (SWAMC) Energy Task force provided the SWAMC Board with recommendations and direction regarding a Comprehensive Energy Development Policy. They have created several documents that outline a long term Energy Policy and Implementation Strategy (Appendix B).

Energy Efficiency – can be done now!

- Homes should be audited for energy efficiency as soon as possible. The State of Alaska recently approved millions of dollars to assess and weatherize homes for energy efficiency. The Alaska Housing Finance Corporation is currently training auditors to conducted assessments of homes throughout Alaska (Appendix G).

Energy Conservation – can be done now!

- Energy conservation should be employed. For instance in a residential setting, we can operate a furnace efficiently, insulating and weatherizing the home effectively by, "Reuse-ing" heat, reduce lighting costs, water usage, household waste, reduce electricity usage – by simply shutting off a light, and defer electricity usage to off-peak hours.

Alternative home heating options

- In the home, use of electric radiant floor heating, electric boiler inline with an existing diesel fired furnace, electric baseboard heating or electric heated carpets are some examples of ways to use the less expensive electricity versus high cost diesel heating fuel.

Transportation

- Ways to conserve on vehicle energy usage are to consider driving less, turning off the vehicle when parked for long periods, driving light, driving conservatively and importantly, to keep a vehicle running efficiently. Consider battery powered vehicles and off road vehicles like electric powered four wheelers as an alternative to gasoline or diesel powered vehicles thus reducing the consumption of petroleum powered vehicles. Electric fork lifts and other electric utility style vehicles may be worth considering for city, tribal or municipal use.

What about a Regional Electric Cooperative?

- In order to streamline the operation and maintenance of six utilities, consider developing a single regional utility. That is, one owner that oversees the administration, management, operation and maintenance of the utilities in each of the villages. Cooperatives have been created across the State of Alaska as a type of electric utility that is owned by the members it serves. Its profits, or margins, are put back into the cooperative to help run the business efficiently, or are returned to the customer-owner. A co-op exists solely to provide high-quality service at the lowest possible price for its customer-owners.

Energy Summit – In Conjunction with the Community Conference

- Consider an energy conference for APICDA communities to address the current state of energy; topics of discussion could be:
    - Determine what APICDA's role may be in addressing the energy crisis in the Aleut region and other regional entities' roles;
    - Assist residents in becoming more knowledgeable of the current energy crisis and what it means to their communities;
    - Discuss ideas, potentially assessing communities concerns;
    - Define a long term outlook by developing a region-wide energy strategy maintaining a clear and agreed to timeline that ensures delivery of lower cost energy solutions.
    - General session with break out sessions that cover:
        - Conservation, energy efficiency, and weatherization
        - Options for alternative and renewable energy resources
        - Community, sub-regional and regional scale planning
        - Funding resources and options

CONCLUSION

As we continue with outlining solutions to our current energy crisis we should consider the importance and relevance of the following:

- Data acquisition and evaluation – helps define next steps
- Renewable energy grant writing for pre-construction and construction ready projects – how are these projects funded
- Conservation
- Weatherization
- Transportation – rethink how we mobilize within a community
- Interconnection – sub-region or regional; how can we maximize our renewable energy investment so our communities and residents benefit from low cost energy to the fullest extent possible?
- Long term strategy – what can our region's energy situation look like in 50 to 100 years; we can define the future of energy for the region today.

We understand the costs of fuel, electricity, food and transportation are high and continue to rise – and may not significantly change anytime in the near future. Impacts of high energy costs to people, business and the community, are proving to be debilitating. The APICDA communities have an opportunity to collectively define a path to energy self sufficiency allowing communities to catch their breath and capitalize on opportunities afforded to them through low cost renewable energy options.

ALTERNATIVE ENERGY 101

This section will cover some of the basics of renewable energy and what we may expect to find in our communities. Alternative energy is a term used for an energy source that is an alternative to using fossil fuels. Generally, it indicates energies that are non-traditional and have low environmental impact. According to some sources, the term *alternative* is used to contrast with fossil fuels.

In the case of APICDA communities, we are attempting to identify alternative energy opportunities in order to offset the use of diesel fuel.

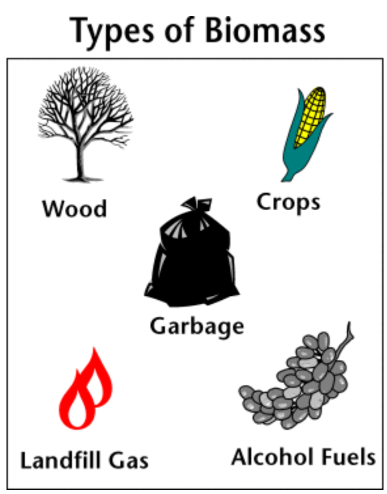
Alternative energy sources that may have potential in one or more of the six communities are wind, solar, geothermal, wood, PV (photovoltaic's or solar), hydro, wave or tidal energy. Other sources could be nuclear, hydrogen or batteries.

Biomass

Biomass refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown for use as biofuel, but it also includes plant or animal matter used for production of fibers, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. It excludes organic material which has been transformed by geological processes into substances such as coal or petroleum. For instance, the combustion of wood for heat would be an example of biomass fuel. Of which, several of our communities have access.

Biofuels

Biofuel can be broadly defined as solid, liquid, or gas fuel derived from recently dead material. This distinguishes it from fossil fuels, which are derived from long dead biological material. Biofuel can be theoretically produced from any (biological) carbon source, though the most common by far is photosynthetic plants. Many different plants and plant-derived materials are used for biofuel manufacture. Biofuels are used globally, most commonly to power vehicles and cooking stoves.



Geothermal Energy

Geothermal power (from the Greek words *geo*, meaning earth, and *thermal*, meaning heat) is energy generated by heat stored beneath the Earth's surface or the collection of absorbed heat derived from underground in the atmosphere and oceans. The largest group of geothermal power plants in the world is located in The Geysers, a geothermal field in California. As of 2007, geothermal power supplies less than 1% of the world's energy.

High and Moderate temperature geothermal resources can be used to generate electricity. Low temperature geothermal resources can be used for a wide range of direct uses, e.g. district and space heating, industrial processes, greenhouses, aquaculture and spas.

Geothermal energy offers a number of advantages over traditional fossil fuel based sources, primarily that the heat source requires no purchase of fuel.

Geothermal power plants work continuously, day and night, making them base load power plants. From an economic view, geothermal energy is extremely price competitive in some areas and reduces reliance on fossil fuels and their inherent price unpredictability. It also offers a degree of scalability: a large geothermal plant can power entire cities while smaller power plants can supply more remote sites such as rural villages

The United States of America is the country with the greatest geothermal energy production, some of the potential lies right in our communities backyards.

Hydrogen Power

A source of energy that converts hydrogen to electricity to provide heat, light, and power. Though hydrogen is readily available, the production of hydrogen power is expensive and not yet commercially viable.

Proponents of a world scale hydrogen economy suggest that hydrogen is an environmentally cleaner source of energy to end-users, particularly in transportation applications, without release of pollutants (such as particulate matter) or greenhouse gases at the point of end use. Analyses have concluded that "most of the hydrogen supply chain pathways would release significantly less carbon dioxide into the atmosphere than would gasoline used in hybrid electric vehicles" and that significant reductions in carbon dioxide emissions would be possible if carbon capture or carbon sequestration methods are utilized at the site of energy or hydrogen production.

Critics of a hydrogen economy argue that for many planned applications of hydrogen, direct distribution and use of energy in the form of electricity, or alternate means of storage such as chemical batteries, fuel plus fuel cells, or production of liquid synthetic fuels from CO_2 (see methanol economy), might accomplish many of the same net goals of a hydrogen economy, while requiring only a small fraction of the investment in new infrastructure. Hydrogen has been called the least efficient and most expensive possible replacement for gasoline (petrol). A comprehensive study of hydrogen in transportation applications has found that "there are major hurdles on the path to achieving the vision of the hydrogen economy; the path will not be simple or straightforward".

Hydropower

Hydropower or hydraulic power is power that is derived from the force or energy of moving water, which may be harnessed for useful purposes. Hydropower is manifested in the force of the water on the riverbed and banks of a river. It is particularly powerful when the river is in flood.

Damless hydro or Damless hydro-electric is a renewable technology based on capturing the kinetic energy of rivers, channels of chutes, spillways, irrigation systems, tides and oceans without the use of dams.

Since no dam is required, damless hydro may dramatically reduce the following:

- The safety risks (of having a dam)
- Environmental and ecological complications
  - Need for fish ladders
  - Silt accumulation in basin
- Regulatory issues
- The initial cost of dam engineering and construction
- Maintenance

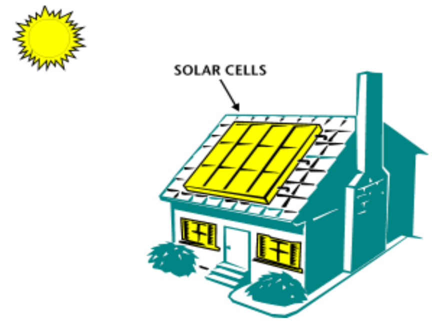
Nuclear Power

Nuclear power is any nuclear technology designed to extract usable energy from atomic nuclei via controlled nuclear reactions. The most common method today is through nuclear fission, though other methods include nuclear fusion and radioactive decay. All utility-scale reactors heat water to produce steam, which is then converted into mechanical work for the purpose of generating electricity or propulsion. Today, more than 15% of the world's electricity comes from nuclear power.

For instance, On December 14, 2004, the Galena City Council accepted a proposal from Toshiba to test their new Toshiba 4S (Super Safe, Small and Simple) “nuclear battery” reactor design, which would require only minimal staffing. If the reactor is successfully licensed, Toshiba will install it free of charge by 2012. It is expected to provide electricity for $0.05–$0.13/kWh, which factors in only operating costs. On paper, it has been determined that the reactor could run for 30 years without refueling.

Solar Energy

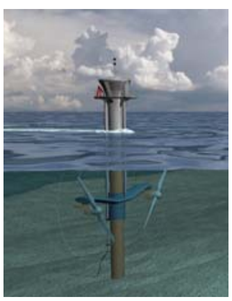
Solar energy is the utilization of the radiant energy from the Sun. Solar power is often used interchangeably with solar energy but refers more specifically to the conversion of sunlight into electricity, either by photovoltaic and concentrating solar thermal devices, or by one of several experimental technologies such as thermoelectric converters, solar chimneys and solar ponds.



Solar energy and shading are important considerations in building design. Thermal mass is used to conserve the heat that sunshine delivers to all buildings. Day lighting techniques optimize the use of light in buildings. Solar water heaters heat swimming pools and provide domestic hot water. Solar energy is the fastest growing form of energy production.

Solar distillation and disinfection techniques produce potable water for millions of people worldwide. Family-scale solar cookers and larger solar kitchens concentrate sunlight for cooking, drying and pasteurization. Clotheslines are a common application of solar energy. More sophisticated concentrating technologies magnify the rays of the sun for high-temperature material testing, metal smelting and industrial chemical production. A range of prototype solar vehicles provide ground, air and sea transportation.

Tidal Energy



Tidal power, sometimes called **tidal energy**, is a form of hydropower that converts the energy of tides into electricity or other useful forms of power.

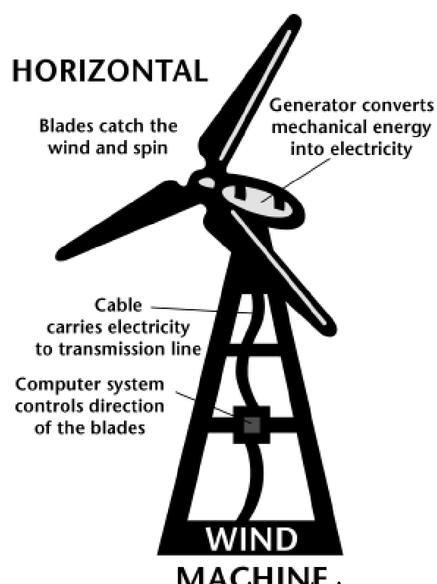
Although not yet widely used, tidal power has potential for future electricity generation. Tides are more predictable than wind energy and solar power.

Wind Energy

Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines. At the end of 2007, worldwide capacity of wind-powered generators was 94.1 gigawatts. Globally, wind power generation increased more than fivefold between 2000 and 2007.

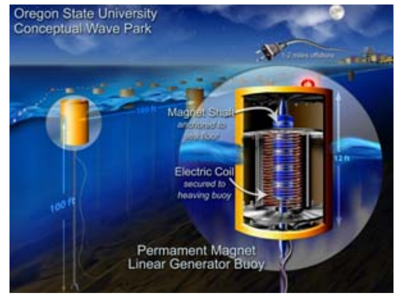
Most wind power is generated in the form of electricity. Large scale wind farms are connected to electrical grids. Individual turbines can provide electricity to isolated locations. In windmills, wind energy is used directly as mechanical energy for pumping water or grinding grain.

Wind energy is plentiful, renewable, widely distributed, clean, and reduces greenhouse gas emissions when it



displaces fossil-fuel-derived electricity. The intermittency of wind seldom creates problems when using wind power to supply a low proportion of total demand, but it presents extra costs when wind is to be used for a large fraction of demand. However these costs even for quite large percentage penetrations are considered to be modest.

Wave Energy



Wave power refers to the energy of ocean surface waves and the capture of that energy to do useful work — including electricity generation, desalination, and the pumping of water (into reservoirs). Wave power is a form of renewable energy. Though often co-mingled, wave power is distinct from the diurnal flux of tidal power and the steady gyre of ocean currents. Wave power generation is not currently a widely employed commercial technology.

The following recommendations are helpful guidelines as the APICDA region defines its next steps. Although the APICDA region has immediate tangible issues to address versus long term policy strategy and planning, it is just as important to parallel the near term solutions with a broad outlook and aspire to achieve some objectives that help our villages and their residents accomplish a low cost energy condition. The following are excerpts from the SWAMC energy documents for review, consideration and inclusion in a comprehensive long term strategy:

SWAMC Recommendations:

- Achieve 99% collection rates on electricity sales by 2010
- Reduce the cost of electricity per kWh to 50% below 2005 levels by 2015
- Reduce the use of diesel fuel for power generation to 50% below 2005 levels by
- 2015
- Generate 25% of electricity with renewable energy resources by 2015
- Reduce the cost of electricity per kWh—in all communities—to within 5 cents +/-
- the average cost per kWh in Anchorage, Fairbanks, and Juneau by 2025
- Eliminate the use of Diesel Fuel for primary power generation by 2025
- Increase power demands to 25% above 2005 levels by 2025

Obstacles:

- Heavy dependence on petroleum fuels for power generation and space heating needs
- Small economies of scale and delivery schedules increase already high fuel costs
- Communities lack financial resources to purchase renewable and other alternative energy systems
- Available financial resources are used to maintain bulk fuel storage and power generation facilities and purchase bulk fuel
- Severely inadequate financial support for renewable and other alternative energy project development from the State of Alaska and the Federal Government
- Lack of long-term financial incentives from the State of Alaska and the Federal
- Government made available to both for and non-profit entities for renewable and alternative energy project development
- Funding agencies place little emphasis on life-cycle costs of energy systems in project selection process
- Energy systems with the lowest capital costs typically provide small communities with new and improved energy systems, however they generally cannot afford the fuel to run the system
- High-Cost Energy is not conducive to commercial/industrial growth
- Regional emigration do to high energy costs disallows utilities to promote residential end-use energy efficiency and conservation because it would further decrease electric loads

- Utility problems compounded with delinquent accounts on the rise
- There is an innate and understandable reluctance from communities and policy makers to shift from previously tried and dependable petroleum energy sources to renewable and alternative energy sources as yet undemonstrated in rural Alaska

Tactics:

- Establish fuel cooperatives
- Seek and develop resources to assist regional utilities with administrative and financial activities
- Promote Renewable Energy Project Development
- Promote Alternative Energy Project Development
- Encourage the local recycling of all waste fuels and residual fuel products including biomass feed-stocks
- Promote End-Use Energy Efficiency and Conservation
- Utilities and organizations formally identify high cost energy as a number one concern and lowering energy costs as a number one priority
- Establish a state Renewable Energy Fund to be administered by an Alaska
- Renewable Energy Trust and funded by general appropriations
- Establish a state Alternative Energy Fund to be funded by general appropriations
- Seek long-term financial incentives from the State of Alaska and the Federal
- Government to be made available to both for and non-profit entities for renewable and alternative energy project development
- Advocate for energy policies that will assist the realization of previously listed
- Benchmarks

COMMUNITY	UTILITY OWNER	DIESEL FUEL CONSUMED BY UTILITY (ANNUAL)	FUEL COST DIESEL (CURRENT)		FUEL SALES (GALLONS)		VALUE OF ENERGY	Total KWh Energy Production (2007)	RECEIVED FUEL DELIVERY	# OF OCCUPIED HOMES	COMMUNITY FACILITIES	FUTURE PROJECTS
			#1	#2	#1	#2						
Akutan	City of Akutan	48,005	$4.78	$4.73	10,000	80,000	$227,063.65	540,924	June 2008 and Dec. 2008	40	12	
Atka	Andreanof Electric Company	57,483		$4.85	N/A	N/A	$278,792.55	404,665	N/A	N/A	2	Atka Pride Seafood expansion
False Pass	City of False Pass	65,000		$4.09			$265,850.00			23	10 - Recipients of electric service	Trailer that houses Kelly-Ryan employees; Waste water treament center
Nelson Lagoon	Nelson Lagoon Corporation	30,000	N/A	$5.96			$178,800.00	754,313	Jul-08		10	APICDA - Nelson Lagoon Seafood Processing Facility
Nikolski	Umnak Power Company	23,000		$4.17 - $7.00	20,000		$83,400 - $140,000	252,641		15	6	
St. George	City of St. George	80,000		$5.42			$433,600.00	1,008,000		43		Seafood Processing Facility; Lodge
Total		**303,488**		**$5.20**			**$1,578,137.60**	**2,960,543**				