ALASKA STATE LEGISLATURE
HOUSE SPECIAL COMMITTEE ON ENERGY
March 12, 2014
8:09 a.m.

MEMBERS PRESENT

Representative Doug Isaacson, Co-Chair
Representative Pete Higgins
Representative Shelley Hughes
Representative Benjamin Nageak
Representative Andy Josephson

MEMBERS ABSENT

Representative Charisse Millett, Co-Chair
Representative Neal Foster

COMMITTEE CALENDAR

PRESENTATION: CHENA POWER/CHENA HOT SPRINGS

- HEARD

PREVIOUS COMMITTEE ACTION

No previous action to record

WITNESS REGISTER

BERNIE KARL, Proprietor
Chena Hot Springs Resort LLC
Fairbanks, Alaska
POSITION STATEMENT: Provided a presentation on the renewable energy programs and sustainable properties of the Chena Hot Springs Resort, Chena Power, and K & K Recycling.

ACTION NARRATIVE

8:09:48 AM

CO-CHAIR DOUG ISAACSON called the House Special Committee on Energy meeting to order at 8:09 a.m. Representatives Higgins, Hughes, Nageak, Josephson, and Isaacson were present at the call to order.

PRESENTATION: CHENA POWER/CHENA HOT SPRINGS

8:10:56 AM

CO-CHAIR ISAACSON announced that the only order of business would be a presentation by Mr. Bernie Karl of Chena Power/Chena Hot Springs Resort and K & K Recycling.

8:11:49 AM

BERNIE KARL, Proprietor, Chena Hot Springs Resort LLC, provided a brief personal history. Mr. Karl said Alaska should have the cheapest energy and the best food in the world, but Alaska only grows 2 percent of the food consumed and pays the highest cost of energy because of a lack of passion and vision. He directed attention to the PowerPoint presentation entitled, "Chena Hot Springs Resort Renewable Energy and Sustainable communities." Mr. Karl provided a short history of the resort which was purchased from the state and has become a community [slides 1-4]. The vision statement of Chena Hot Springs is the following: We strive to become a self-sustaining, self-reliant community that can produce the energy, food, and fuel to meet our needs while being environmentally responsible [slide 5]. He encouraged other communities in the state to become sustainable and urged all to use an "energy pie" to chart the energy use of electricity, transportation, refrigeration, supplemental heating and base load heating [slide 7]. The biggest cost of energy in Alaska is for heat. In response to Co-Chair Isaacson, he explained that the supplemental heating for Chena Hot Springs is for remote sites that are not connected to the geothermal heating system, but are heated with wood or fuel pellets. He described a gasification system that uses wood products or fuel pellets that can power vehicles, noting that aviation fuel at Barter Island costs $18 per gallon and diesel fuel costs $12 per gallon [slide 8].

8:22:16 AM

REPRESENTATIVE NAGEAK observed that the high cost of fuel is the same in all of the villages in rural Alaska.

MR. KARL explained that the gasification system is not new technology and can be built for $3,500. He displayed examples of steam-powered equipment from the industrial revolution [slides 9-12]. The machines are on display with the hope of sparking the imaginations of the younger generation. In operation at Chena Hot Springs is the first geothermal plant in the world that runs off of 165 degrees Fahrenheit (F.) water

[slide 13]. In partnership with United Technology, Chena Hot Springs has installed a screw expander that will "change the way you look at doing things." After drilling two new wells the resort produced water at 179.8 degrees F. [slide 14]. Mr. Karl described the drilling process [slide 15].

8:27:51 AM

CO-CHAIR ISAACSON asked how much more geothermal production is possible from water 15 degrees hotter.

MR. KARL answered that the well pumps 1,000 gallons per minute which produces electricity that grows food and heats 54 buildings. The goal is to produce five megawatts of power from a new, bigger well. He informed the committee that 2 percent of the world's geothermal energy is 1,000 times more than what the world consumes.

REPRESENTATIVE HIGGINS asked for the indicators that predicted drilling for hot water would be successful.

8:29:46 AM

MR. KARL said exploration wells were drilled and geochemistry tests were done on water samples, which indicated 200 degrees F. water would be found at 4,000 feet. Future plans include drilling a deeper well and running 69,000 volts of direct current (DC), by a single cable, to a power plant that will be equipped with four one-megawatt units. The technology is currently being tested in New Mexico.

CO-CHAIR ISAACSON suggested Mr. Karl could advise those who are looking for a geothermal source near Anchorage.

8:32:04 AM

MR. KARL described his past experience visiting Akutan and the hot springs there. Returning to the project at Chena, he said it was necessary to purchase a Wassara water hammer to drill through the granite using 2,000-2,500 psi cold water. Mr. Karl learned in Iceland about a drilling process using cold water instead of drilling mud. He also visited geothermal projects, farms, and greenhouses in Iceland. Mr. Karl explained that his joint venture with Kaishan Compressor Co., Ltd. has produced the first 300 kilowatt (kW) screw expander, with a synchronous generator, which is currently operating at Chena Hot Springs [slides 16-22]. A synchronous generator is one with a rotating

field so that as soon as it begins to spin, it generates electricity without the need for diesel fuel to power an electrical grid. The design of the generator incorporates a unique shape of screw expander. There are now four one-megawatt units running in New Mexico that were fabricated and built in four months.

CO-CHAIR ISAACSON asked how the generator operates without using any diesel fuel or without a grid.

8:38:01 AM

MR. KARL explained that the screw generator can be powered by a liquid or a gas vapor and uses geothermal at Chena Hot Springs. The compressors built by the Chena Power/Kaishan Compressors joint venture are for sale in the U.S. and Canada, and are portable. The units are affordable, do not have a gear box, make electricity as soon as the screw begins to turn, and "instantly syncs with your grid." In response to Co-Chair Isaacson, he explained that the water running through the generator boils into a vapor which spins the screw at a low pressure. The system is low-tech, but produces 300 kW; the average amount of power needed for a village is only 50 kW. He advised that the average cost of power in Alaska's villages is $0.59, and the screw generator can produce power for $0.10.

REPRESENTATIVE HIGGINS asked how the pump is powered.

8:41:25 AM

MR. KARL responded that the parasitic load required to produce 300 kW is 100 kW; however, the 100 kW used also grows all the food and heats the buildings in Chena Hot Springs, saving much more in heating oil. He pointed out that the only communities that will ever have cheap natural gas are those located near a gas field, as are Nuiqsut and Barrow. Mr. Karl further described the construction of the screw expander generator. Also available next year will be a small 2.5 kW unit for home use that can run from a wood stove or any source of 180 degree F. water [slide 23]. In response to Representative Nageak, he said the unit can heat cabins by burning biomass or using the heat from the sun.

8:45:23 AM

CO-CHAIR ISAACSON surmised the home unit would be connected to a furnace that burns biomass.

MR. KARL described a portable unit mounted on two trailers with its own cooling system that is operating in Utah [slides 25-27]. The unit is designed to work at oil well sites and has an oil separator that supplies 25 gallons of water, otherwise, oil and water can stream through the system. The unit produces over 200 kW of electricity and has proven its technology, although he estimated there will be six additional months of testing before the units are marketed.

REPRESENTATIVE HIGGINS asked for the cost of the unit.

8:48:13 AM

MR. KARL answered $375,000, and the portable unit requires an investment of $500,000. The payback is 18-24 months in savings from not burning oil. He turned attention to the value of biomass and informed the committee that residents need to be responsible for their waste products. Burying and burning waste creates a mess for future generations, but in Fairbanks pellets are made from wastepaper and cardboard which produce 7,600 British thermal units (Btu) per pound of pellets [slides 28-31]. A briquetting machine will be integrated into the recycling program at Chena Hot Springs to make wastepaper and cardboard into bricks [slides 32 and 33].

REPRESENTATIVE NAGEAK asked whether the briquetting machines were available for individual use.

MR. KARL recommended installing a briquetting machine in each community to be run as a small business turning wastepaper and wood into pellets or briquettes that can be packaged and shipped for use, instead of burying wastepaper in landfills.

8:53:49 AM

REPRESENTATIVE HIGGINS added that landfills are required to use layers of dirt.

MR. KARL restated that biomass is a resource that should not be buried and a market for pellets and wastepaper bricks should be developed. He described the briquetting machine that was purchased from a company in Germany at a cost of $240,000, and which will produce two tons of briquettes and fuel pellets per hour for use in home woodstoves.

CO-CHAIR ISAACSON asked for the Btu equivalent.

8:56:13 AM

MR. KARL stated, when made out of solid wood, the Btu equivalent is 8,000 per pound and the briquettes will sell for the equivalent of $2 per gallon [of heating oil]. The pellets sell for the equivalent of $0.89 per gallon of heating oil. In response to Representative Higgins, he said the equivalent for a cord of wood would be $150 per cord, and a split cord in Fairbanks now costs $275. Subsequently, the ash is collected and used for other products. Mr. Karl observed thousands of dollars have been spent for studies, but the information is never used; however, all of the equipment he has reviewed will be available for perusal at the Renewable Energy Fair in August. In response to Co-Chair Isaacson, he related that customers return ash when they come to pick up more pellets or briquettes. Mr. Karl turned to the common problem of the disposal of scrap metal and informed the committee his business, K & K Recycling, collects scrap metal for shipping to a steel mill in Seattle, to sell in Anchorage, and to sell overseas [slides 35-38]. The business also collects wood, glass, and other metals for recycling, grinds glass with ash to make blocks, and has 400 dumpsters in the Fairbanks North Star Borough for the collection of recyclable waste products. K & K Recycling has a glass processing system that can process recycled glass into sand, crushed glass, and concrete products [slide 39]. Chena Power also has an air burner heat recovery system in Fairbanks which burns at 2,000 degrees F. The burner will be connected to a screw expander that will generate electricity from the heat. After testing, this system will be one solution for villages in Alaska. The unit is approved for use in a Class II landfill, so a village in Bush Alaska can burn its trash, generate electricity and possibly heat a greenhouse nearby [slide 40]. Mr. Karl informed the committee Chena Power is working with Matanuska Electric Association, Inc. (MEA) on generation systems. Using MEA's waste hot water, Chena Power can generate an additional 20 megawatts of power through a "bottoming cycle" at no additional cost. He explained that large diesel generators use one-third of a gallon of fuel to generate electricity, one-third for heat rejection, and one-third is exhaust. Chena Power will run hot water through its power plant and then cool the water. This eliminates the cooling system and the parasitic load, and the byproduct is electricity. Therefore, he recommended the use of a bottoming cycle which utilizes the wasted heat. He advised that the power plant in Fairbanks powered by the Usibelli Coal Mine needs 39,000 gallons of "make-up" water per day, and 46,000 gallons of water per day

are exhausted through the smokestack, but the water could be cleaned and used, and an additional 900 kW per day could be produced from the heat exhausted through the smokestack. The pollutants that are exhausted into the air could also be used instead. He expressed his belief that new coal plants are possible without smokestacks if there is encouragement from the government; in fact, with incentives from the government, industry will respond with great ideas.

MR. KARL continued to explain that Chena Power sells biomass heating systems that are gasification units, and coal-fired modular heating systems. The systems are clean-burning, and because coal is available in some areas, and Alaska coal has the lowest sulphur content, he listed some advantages of coal [slides 44-48]. Furthermore, coal is available, efficient, clean, affordable, and can be easily transported, and he predicted coal could be delivered to Kotzebue and Bethel at the equivalent of $2 per gallon of heating oil.

9:16:59 AM

REPRESENTATIVE NAGEAK stated that rural Alaska does not have the infrastructure to produce and transport coal to market.

MR. KARL said his plan is to bring coal in bags to Kotzebue and Bethel, and their surrounding villages, to be sold in the stores. Two thousand pounds of coal will last all winter for a cabin, and it is easier to handle than diesel fuel.

REPRESENTATIVE NAGEAK recalled coal for heat was tried in the North Slope Borough but it was unsuccessful, although it could have been due to old technology. He agreed that Alaska has plenty of coal; in the '80s it was shipped to villages on barges and stoves were supplied for the residents.

CO-CHAIR ISAACSON suggested that using coal for heat may have failed because the price of oil in the '80s was very low.

REPRESENTATIVE NAGEAK observed that the existing monopoly on transportation limits the possibilities in Bush Alaska.

MR. KARL was encouraged that the villages are equipped with coal stoves.

CO-CHAIR ISAACSON pointed out that the circumstances of supplying fuel and energy to the Bush will change if efforts continue to be made.

REPRESENTATIVE NAGEAK cautioned that other efforts have failed.

9:22:56 AM

MR. KARL related his personal experience with the difficulties of starting a new business. He then described how his coal supply business would use the existing barge infrastructure in Bethel and Kotzebue to deliver coal loaded at the railroad dock in Seward. By using existing infrastructure, there would be no cost to the state or the communities, and prices will be low. He estimated the cost of coal, including transportation, will be $2 equivalent. The past experience was with coal that was mined in Wainwright, but doing that requires building new infrastructure. At this time, using the available transportation on water, for a volume of 15,000 tons of coal per shipment, is cost-effective.

9:27:33 AM

REPRESENTATIVE HIGGINS was supportive of the efforts of private industry.

REPRESENTATIVE NAGEAK said he would not discourage the proposal, but noted that a successful project would have to be adapted to the needs of the small villages in rural areas, as well as larger towns.

MR. KARL said many of the 44 villages near Bethel are served by Alaska Marine Line (AML) barges, whose crews know the rivers. He agreed that air transportation is a problem, but moving large loads on water has possibilities. Also, coal can be transported on trailers towed by snow machines. He returned to the presentation and called attention to slide 43, which illustrated a biomass heating system that can operate for $1.12 per gallon equivalent. Slide 49 illustrated the three greenhouses at Chena Hot Springs Resort where grape, beefsteak, cherry, and Roma tomatoes are grown by grafting onto wild tomato plants. Light-emitting diode (LED) lighting is used in the greenhouse to mimic the sun. The greenhouse system uses no soil, herbicides, or pesticides [slide 50].

9:34:46 AM

REPRESENTATIVE NAGEAK agreed the price for produce in Bethel is very high.

REPRESENTATIVE HIGGINS said on his recent trip to Washington D.C. he learned that "they" don't care about the price of food and energy in Alaska, and that the problems must be addressed locally. Alaska must stop relying on the federal government.

REPRESENTATIVE NAGEAK cautioned that most of Bush Alaska is taken care of by the federal government with federal money that flows through tribal governments. Support for rural areas does not come from the state.

CO-CHAIR ISAACSON returned attention to the topic of the meeting and suggested that any space that is available in rural areas could be converted to greenhouses to allow the local production of vegetables thus saving on transportation costs.

REPRESENTATIVE NAGEAK restated the difficulties of living a long distance from medical care and other services.

CO-CHAIR ISAACSON asked if the technology previously discussed was applicable in Bush Alaska, whether residents would benefit and have more money for other uses.

9:38:24 AM

MR. KARL warned that the success of every project depends on the cost of the initial investment, which in this case is to obtain the buildings. He promised the success of the greenhouses because a crop can be grown in 23 days. The LED lights used in the greenhouse burn 90 percent less electricity, which reduces the cost of power. Peppers and eggplant are also grafted to tomato roots to defeat aphids [slide 51].

REPRESENTATIVE HIGGINS asked for the purpose of high tunnels.

MR. KARL explained that high tunnels increase the length of the season. High tunnels are available from the U.S. Department of Agriculture (USDA) to farmers who grow, sell, or consume $1,000 worth of agricultural products per year. In the Kenai area there are 98 high tunnels in use, and about 20 are in use in Fairbanks. At Chena Hot Springs, one tunnel has shade cloths for plants that need dark periods for optimum growth. Mr. Karl described how to grow barley using horse manure [slides 64-65].

REPRESENTATIVE HUGHES inquired as to the difference between a high tunnel and a greenhouse.

9:44:00 AM

MR. KARL responded that a high tunnel has no heat or interior walls. He described how a refrigerated trailer van was transformed into the C-GRO production system that raises lettuce from a wood-burning heat source to supply the school lunch program at Glennallen School. The growing system can be built almost anywhere or moved in a van. The greenhouse grows grapes, bananas, and berries, and he assured the committee this could also be successful in Bethel.

REPRESENTATIVE HIGGINS asked how the school lunch program in Glennallen is faring.

MR. KARL said the program is in its infancy.

9:49:37 AM

REPRESENTATIVE NAGEAK recalled there used to be a greenhouse in Nome; however, land is scarce and is owned by the Native corporation.

CO-CHAIR ISAACSON encouraged the committee to research these possibilities and return to the committee with more information.

9:51:19 AM

MR. KARL returned to the activities at Chena Hot Springs: 30,000 flowers are grown and bees are kept for honey [slide 58]; there is working livestock [slide 59]; there is a developing reindeer herd [slide 60]; there is meat production [slide 61]; there is a goat and chicken house heated by a geothermal source [slides 62-63]; there is a barley grow-chamber, and under controlled conditions the barley grows in six days and is fed to the livestock and fish [slides 64-66]. He closed by inviting all to the Renewable Energy Fair, held on August 17, 2014, at Chena Hot Springs Resort [slide 67].

9:56:21 AM

ADJOURNMENT

There being no further business before the committee, the House Special Committee on Energy meeting was adjourned at 9:56 a.m.