ALASKA STATE LEGISLATURE
SENATE RESOURCES STANDING COMMITTEE
April 4, 2014
3:30 p.m.

MEMBERS PRESENT

Senator Cathy Giessel, Chair
Senator Fred Dyson, Vice Chair
Senator Peter Micciche
Senator Click Bishop
Senator Anna Fairclough
Senator Hollis French

MEMBERS ABSENT

Senator Lesil McGuire

COMMITTEE CALENDAR

INFORMATIONAL HEARING: ALASKA COAL AND CLEAN COAL TECHNOLOGY

- HEARD

PREVIOUS COMMITTEE ACTION

No previous action to record

WITNESS REGISTER

LORALI SIMON, Vice President
External Affairs
Usibelli Coal Mine
Fairbanks, Alaska
POSITION STATEMENT: Presented overview of using coal for power generation in Alaska with Mr. Graham.

DAN GRAHAM, President
Alaska Coal Association
Fairbanks, Alaska
POSITION STATEMENT: Presented overview of using coal for power generation in Alaska in conjunction with Ms. Simon.

BRENT SHEETS, Deputy Director
Alaska Center for Energy and Power (ACEP)
University of Alaska Fairbanks
Fairbanks, Alaska

POSITION STATEMENT: Presented a "primer" on available coal conversion technology and power generation.

MIKE WRIGHT, Vice President
Transmission and Distribution
Golden Valley Electric Association (GVEA)
Fairbanks, Alaska
POSITION STATEMENT: Talked about their Healy Unit 2 Plant and some of the obstacles to clean coal technology usage.

JASON HERRING, Chief Executive Officer Vivify, Inc.
POSITION STATEMENT: Presented a new technology that will help Alaska deal with some of its energy concerns.

JUSTIN POTTS, Vice President
Vivify, Inc.
POSITION STATEMENT: Presented a new technology that will help Alaska deal with some of its energy concerns.

BRUCE FOMHOFF, Chief Operation Officer/Chief Technology Officer
Vivify, Inc.
POSITION STATEMENT: Presented a new technology that will help Alaska deal with some of its energy concerns.

BUDDY PAUL, Chief Executive Officer
Vivify, Inc.
POSITION STATEMENT: Presented a new technology that will help Alaska deal with some of its energy concerns.

ACTION NARRATIVE

3:30:22 PM
CHAIR CATHY GIESSEL called the Senate Resources Standing Committee meeting to order at 3:30 p.m. Present at the call to order were Senators Bishop, Micciche, Dyson, Fairclough, and Chair Giessel.

INFORMATIONAL HEARING: ALASKA COAL AND CLEAN COAL TECHNOLOGY
Alaska Coal: Abundance and Composition

3:31:12 PM
CHAIR GIESSEL welcomed the Alaska Coal Association.

3:31:28 PM
LORALI SIMON, Vice President, External Affairs, Usibelli Coal Mine, Fairbanks, Alaska, said she was here today on behalf of the Alaska Coal Association, for which she is vice president and

secretary/treasurer. She said the association is a rough group of many stakeholders in the coal industry in Alaska.

3:31:46 PM
DAN GRAHAM, President, Alaska Coal Association, Fairbanks, Alaska, said he would do a shared presentation with Ms. Simon. Alaska is blessed with an abundance of coal and diverse locations throughout the state, he said. The bulk of them are on the North Slope and therefore not extractable at this time, because access to market is needed. There is only one operating mine: Usibelli Coal Mine in Healy. A UCM development project is happening in the Palmer area of Wishbone Hill and a project for PacRim Coal is in the advanced permitting phase proposed on the west side of Cook Inlet. Riversdale Alaska's Chickaloon Coal is another project and Black Range has coal leases and a mine permit in the Wishbone area. And DNR had been asked to do a lease sale in the Susitna Basin.

For infrastructure, Mr. Graham said, they have one port currently: the Alaska Railroad has the port in Seward and the rail line to connect that to coal resources.

3:33:54 PM
MR. GRAHAM explained "Why Coal Now," because it's a fuel of the past. The next slide showed the mix of the U.S. electrical generation market, a diversified portfolio for stable fuel prices in which coal has traditionally been 50 percent. That started to drop in 2008 and is now down to about 35 percent. That is primarily because the current administration has imposed regulations to reduce electrical production. The other reason is that the price of gas in the Lower 48 has gone from $6 to as low as $3, because of fracking. He explained that a lot of utilities that used to run their coal plants full out and used the gas for peaking have switched it around and are running their gas plants full out and shutting down some of their coal plants.

Alaska, by contrast, is not quite as diversified. Before the 1990s, 72 percent of our power generation in the Railbelt was by gas and only 3 percent was by coal. Gas was running as a by-product in Cook Inlet. So, it was $1 or $2 a unit. In the early 2000s, Golden Valley added some capacity, a gas-fired turbine run on naphtha, a by-product produced at their new plant in North Pole that increased reliance on petroleum and gas. Currently ML&P and Chugach have added over 400 megawatts, which is almost all gas-fired power; Matanuska Electric added more gas-fired power, Homer Electric added more, too, and gas dependence has now gone up to over 76 percent.

3:35:05 PM
MR. GRAHAM He pointed out his concern for higher gas prices, because they are now running higher than Henry Hub and the in-state gas line has projections for LNG and gas at $11.

3:36:40 PM
MS. SIMON explained that coal accounts for almost 30 percent of the electrical energy capacity and nearly one-third of the electrical energy generation in the Interior's and the six coal burning power plants equal about 136 megawatts of coal.

3:37:05 PM
MS. SIMON noted that coal is the Interior's lowest-cost source of energy; on a per-btu basis, coal is half the cost of gas, one-third the cost of naphtha and one-sixth the cost of diesel.

MR. GRAHAM said a study in 2000 indicated underutilization of coal in Alaska and an export market opportunity. Coal demand is growing world-wide, and even though the U.S. use has dropped below a billion tons, a 50 percent growth is projected to happen between now and 2040. China and India are a big part of that, because the easiest most inexpensive means for them to modernize and energize some of their populations is with coal-fired power.

MR. GRAHAM explained that coal supplies come mostly from Indonesia and Australia; the U.S. isn't really much of a player in the world export market. Going forward, Australia has some constraints on infrastructure, labor, and taxes that could affect their pricing. Indonesia has actually looked at imposing limits on exports to preserve their resource for their own use. So, there is an opportunity for the U.S. to expand supply and that could benefit Alaska.

3:38:38 PM
SENATOR FRENCH joined the committee meeting.

3:40:23 PM
MS. SIMON noted a copy of McDowell Group's Energy and Economic Impact Assessment for coal on the Interior of Alaska and said it's important to remember the importance of the economic impacts of the coal industry to Alaska. It provides 692 jobs statewide with an average wage of over $100,000 per year. In the absence of coal, the Interior of Alaska could face energy costs of up to $200 million more annually.

3:41:20 PM

MS. SIMON said that the U.S. is meeting the requirements of the Clean Air Act. Coal use in the U.S. from 1970 to 2013 has increased 173 percent, yet emissions have decreased by almost 90 percent. It's important to consider that developing economies are growing, because of their use of coal.

What makes Alaska's coal clean? She explained that this concept isn't just a marketing tool; it is a scientific fact. Alaska is blessed with ultra-low sulfur coal that also has low mercury levels (two-thirds less than other Pacific Rim coals). So, she often explains to people how aside from benefiting Alaska's economy, nothing is wrong with helping our international neighbors reduce their emissions by using Alaska's clean coal.

3:42:21 PM
SENATOR FAIRCLOUGH asked what naphtha is.

MR. GRAHAM answered that it's a liquid fuel, one of the products made at the North Pole refinery when they pull the crude out of the pipeline.

3:42:58 PM
SENATOR DYSON asked about the future for exporting Usibelli's coal and what can the legislature do to remove barriers to it.

MS. SIMON answered that since Usibelli supplies 100 percent of the in-state demand, the only opportunity for them to grow their business is in the export market, and that is what they are looking at doing. Their current customers are in Chile, South Korea and Japan. She noted the need for stability in regulations and permitting.

3:45:28 PM
SENATOR DYSON asked for specific regulations to be submitted.

3:45:55 PM
SENATOR BISHOP iterated his support for coal saying the coal industry brings jobs to Alaska.

3:46:46 PM
MS. SIMON bragged that Usibelli had just surpassed 600 days without a last time injury at the mine.

SENATOR MICCICHE noted the need for jobs and energy and asked what exactly the holdup is for permitting Wishbone.

MS. SIMON replied according to statute there is a successive right of renewal for their mining permit, which was first obtained in 1991. Every five years it comes up for renewal and every five years the company has renewed it. It was up for renewal in 2011, but then DNR asked Usibelli for additional information that is outside of regulation or law, the type of data collection that takes time and money. So, it has been a frustrating process. However, they believe they have answered all of DNR's questions and provided all the requested information, and anticipate that permit to be renewed very soon.

3:48:42 PM
SENATOR MICCICHE stated that diesel fuel leaks, is bulky and hard to handle, and asked about the possibility of using some localized mining production for energy.

MR. GRAHAM replied that he had been working in the coal industry for 25 years and that has always been considered. You could have a seasonal summer mine, take it up and down the river system. The bottleneck has traditionally been having an adequate packaged boiler-type system that could be set up and operated in the village system. The problem with that technology is that the loads in the villages are too small to make it practical.

3:51:15 PM
MS. SIMON added that if there is a diesel spill on a river that is a much bigger problem than a coal spill.

CHAIR GIESSEL asked her to talk about some of the archaeologic artifacts that they have uncovered in the Chuitna project.

MR. GRAHAM answered that defining your project and its footprint is part of any coal project; for your baseline studies you do clearances and one of them is archaeological. They hired archaeologists who walked a ten-meter grid, and down by the coastal bluffs along Cook Inlet they found some depressions which turned out to be old house beds dating from 600 to 250 years old. They spent two more summers investigating, carbon dating, surveying, and mapping them. Once you look at it in contours they really stand out. As a result, they have moved all of their facilities off of those locations. Recovered artifacts will be curated at the Museum of the North. The Kenai Peninsula Borough owns the property and will transfer ownership of them to the Native Village of Tyonek, once they have been curated.

3:53:39 PM
CHAIR GIESSEL thanked him for his presentation.

Coal Power Generation and Coal Conversion Technology

3:53:57 PM
CHAIR GIESSEL welcomed Brent Sheets to provide a presentation on coal power generation and coal conversion technology.

3:54:12 PM
BRENT SHEETS, Deputy Director, Alaska Center for Energy and Power (ACEP), University of Alaska Fairbanks, Fairbanks, Alaska, explained that his presentation is kind of a "primer" on coal conversion technology that is available and then focusing on power generation.

3:54:44 PM
MR. SHEETS said he had been around Alaska for 12 years working on energy issues. Formerly he was with the U.S. Department of Energy as regional manager of the Arctic Energy Office.

He said that back in 2002 everyone was murmuring a little about whether Cook Inlet was going to run out of gas, and his office is the one that looked at that first. They came up with some assessments and that's what got the ball rolling on the Alaska Natural Gas Development Authority (ANGDA). They also did some of the first studies on how to size the gas pipeline and, even more relevant to this committee, when Agrium was first looking at closing up they approached his office asking to look at coal gasification as a technology (a process that also produces a choice between ammonia fertilizer or transportation fuel). So, phase 2 of their study took the plant they designed for Agrium and moved it over to the Usibelli at Healy to see what would happen to the economics.

3:56:26 PM
MR. SHEETS said he has a decade of experience working with Alaska energy issues and has been with the ACEP for two years. It primarily focuses on reliable and affordable power for Alaska, especially for villages. They have 20 staff, mostly research engineers, and 35 faculty affiliates from throughout the system, three of whom sit with staff regularly.

One of the things he is most proud of is ACEP's power system integration lab which has a 300 kilowatt (kw) diesel generator with the capability of totally programming that lab to act like virtually any community in Alaska, so they can accurately see how different systems work. They are also developing a hydro-kinetic test site on the Tanana River in Nenana that he invited them to visit.

3:57:40 PM
MR. SHEETS explained that ACEP has brought in $26 million in grants over the last six years and on average receives about $500,000 in appropriations from the state.

3:58:07 PM
MR. SHEETS said that brings them to the meat of today's presentation, coal technology. There are three technologies: pulverized coal, fluidized bed, and integrated gasification combined-cycle plants. He would focus on fluidized beds, because the integrated gasification combined-cycle are not an appropriate scale for what they are trying to accomplish.

He said the coal plants in Alaska are largely a fixed bed type, a conveyor belt you put the coal in on one side and it passes through the boiler; by the time it gets to the other side of the conveyor belt it is largely used up and then the ash gets disposed of. He explained that the rest of the industry currently uses a fluidized bed process that has two types: bubbling bed and circulated fluidized bed.

3:59:15 PM
MR. SHEETS illustrated how a 100 megawatt (mw) (way larger than any in Alaska) coal-fired power plant works. You have a coal supply that is delivered into the boiler (losing 15 mgw up the stack right away). The 85 mw is from boiling water and high pressure steam that gets passed through a turbine that in turn generates electricity. Once the low pressure steam has passed through the turbine it still has a significant heat content, worth 45 mw of the power. So, of the coal being put through the plant, 40 mw were used to generate electricity (a 40 percent power plant efficiency); most power plants are in that range. Then there are multiple ways of extracting more energy from the 45 mw of low-pressure hot water.

4:00:59 PM
MR. SHEETS explained the bubbling bed is his favorite technology, mostly because it uses a wide range of feed stock like coal and biomass. They are seen in really small applications like on farms and in municipalities to deal with sewage and waste. A lot of mass can be burned at relatively low temperatures.

He said the circulating fluidized bed has tremendously good environmental performance and is what the University is upgrading to. What makes it different is the coal particles are

suspended in a tall chamber by a large volume of air at a very fast rate, so that you don't have a bed of materials bubbling away on the bottom. Everything is always in motion through the large tower; the heavier particles will be at the bottom. As the coal particles burn up they become smaller and lighter so they can move further up into the column of hot air continuing all the time to burn. So, in the end, the particle is fully consumed. The occasional particles that get through are caught in the cyclone outside of the main chamber and are directed right back into the bed - to make sure every last bit of energy is obtained. This is highly efficient and therefore is good for the environment.

4:03:53 PM
MR. SHEETS said the University needs a power plant and had settled on a circulating fluidized bed. It will be permitted to accept 15 percent biomass and will generate 17 mw of power. The University will keep the diesel/natural gas boilers for backup.

4:04:42 PM
He said that energy is what keeps the University of Alaska Fairbanks (UAF) working. They have 3.1 million square feet of public facilities with an average age of 34 years and they all need power. It is not unique for a university to have its own power plant; 500 schools, universities and hospitals have their own because it makes economic sense. His old alma mater had a power plant fueled by lignite, a brown coal with low energy content. Alaska's coal is far superior.

4:06:05 PM
MR. SHEETS pointed out that the boiler at UAF was built in 1962 and had a design life of 50 years, and it is in need of re-tubing now. That would cost $15 million. He said boiler failure would require clean up and triple fuel costs (using the backup system) during the cleanup time. He said that oil would cost the University three times more than coal.

4:08:03 PM
MR. SHEETS said the chancellor always asks why they don't buy power from Golden Valley and that is because they need heat, as well. So it wouldn't be efficient. Building a natural gas plant would not be competitive with coal; it would have to be $10/mmbtu and nobody is talking that even in the best case scenario. With a circulating fluidized bed, operating costs of the power plant would go from $10 million per year to $5.3 million.

He reiterated that the circulating fluidized bed is also a better environmental performer. Building the plant would create a lot of jobs from 2015 to 2018, and he hoped that once it is designed and built that the design could be used again by someone else up here, like the Army.

4:09:38 PM
MR. SHEETS explained that the University has $3 million now for the preliminary design and permitting stage and has a request before the legislature for $245 million ($195 million appropriated funds and $50 million of bonds, which would be paid for from the savings of the operating costs).

4:10:02 PM
So, what do they do about the villages in rural Alaska? In 2006, Mr. Sheets explained that his former office designed a barge mounted, coal-fired, power plant. The Yukon River FBC Unit is 5 mw, a good size for Nome or Bethel, but they looked at putting it in Nome. On the north side of the Seward Peninsula there is a coal find called Chicago Creek, but they figured it wouldn't be economic to use it. So, they looked at bringing Usibelli coal around the coast of Alaska or importing British Columbia coal (avoiding the Jones Act).

He explained that many communities have coal right outside their city gates. It would be a wonderful job creator and money savings thing if in the winter time a community could build an ice road out to it and dig coal all winter long. The money could stay in the community. A barge to bring the coal in could be built in the Lower 48 in a shipyard where there are many tax incentives to keep jobs.

4:12:00 PM
MR. SHEETS said if he were to do the barge project over he would probably look at a coal gasification unit. It is similar to a fluidized bed in that the feed stock has some flexibility. Gasification is simply heating the coal in a very controlled oxygen environment to the point of driving off the gases. The ultimate products to go after are carbon monoxide and hydrogen.

So, following his diagram, the gas would come off the top of the first chamber and go through a gas stream cleanup process that would provide a clean synthetic gas. The syngas could be used in a combined cycle plant where it could be combusted to make electricity; some of the heat could be recovered for making additional electricity or steam. The water (left from the steam) would be re-injected back into the circulating process.

Once the coal is in a synthetic gas form, there are many options for the final product. For instance, they could make ammonia fertilizer as they did for the Agrium plant or put it through a Fischer Tropsch process and make transportation fuels and ultra-low sulphur diesel.

MR. SHEETS explained that gasification was developed in WWII by Germany and was also further refined by South Africa during the apartheid days when the rest of the world just wouldn't do business with them. Now Sasol Co. is the largely known company in the gasification field, Fischer Tropsch in particular.

He said the military wants alternatives to oil for fuel and has investigated use of coal.

4:18:24 PM
MR. SHEETS noted Healy economics from their 2007 study as an example of the sorts of analyses that have gone into this work for Alaska. Back in 2007, they looked at putting a gasification plant at the Usibelli coal mine mouth and used site plans for the Emily Creek power station. And they found that economically a Fischer Tropsch liquid fuels plant probably wouldn't pan out there, and that traditional refining of oil was still more economic than refined coal products. It would have made 14,600 barrels per day of ultra-low sulphur diesel, with the expectation that it would have been delivered to the Williams Refinery in North Pole and be blended with a diesel product that would meet the EPA requirements for ultra-low sulphur diesel fuel. This plan warrants continued monitoring and given that now the North Pole Refinery has announced its closure, he encouraged someone to go back and look at this study and update it to see if there are some synergies that could be useful to help out the whole industry in that whole region.

4:19:27 PM
MR. SHEETS related that two projects, CIRI and Linc Energy, are both pursuing underground coal gasification projects in Alaska. Both would be essentially the same; a production well with a horizontal injection well some distance away. An oxidant would be injected to begin burning the coal product and you would end up with carbon monoxide and hydrogen again, a synthetic fuel that could be brought to the surface and turned into any number of products they had already discussed. The heavy things would all stay safely in the ground. He said that the Linc leases are just across the Cook Inlet from Nikiski.

Finally, Mr. Sheets said, he was really impressed with some of the work that the Alaska Division of Geologic and Geophysical Surveys (DGGS) did starting back in 1996. If you can't produce the coal and can't burn it using conventional technologies, you can drill into the coal perhaps if it's economic and in the right location, and start extracting coal bed natural gas. Some risk is involved, but that is a way to at least provide local energy to 37 communities that have been identified as sitting on or near coal bed methane. Nobody is talking about it, but he wanted it to be out there as an alternative to coal.

4:20:40 PM
SENATOR DYSON noted that 10 years ago, his coal enthusiasts said that coal gasification could compete with natural gas if those prices were north of $5 and asked him what he thought it would take.

MR. SHEETS replied that he didn't have the dollar figures any more, but it is more challenging now that natural gas has gotten cheaper. He mentioned importing liquefied natural gas into the country and that in those situations coal to liquid would have been competitive. He said to be mindful of gas bubbles and that he thought this one would be short-lived, because of the shale technology.

4:22:48 PM
SENATOR BISHOP said it appears that the new fluidized bed UAF plant was going to be 25 percent more efficient.

MR. SHEETS answered that was right.

SENATOR BISHOP said it was a plus that of the 37 communities, 70 percent of them are on or close to the water for shipping.

4:23:52 PM
CHAIR GIESSEL thanked Mr. Sheets for his informative presentation.

The Healy II Power Plant and Obstacles of Technology Usage

4:24:03 PM
CHAIR GIESSEL welcomed Mike Wright from the Golden Valley Electric Association.

4:24:47 PM
MIKE WRIGHT, Vice President, Transmission and Distribution, Golden Valley Electric Association, Fairbanks, Alaska, said he

would talk about their Healy Unit 2 Plant and some of the obstacles to clean coal technology usage. The definition of clean coal technology is a constantly changing dynamic. When the Healy Clean Coal Plant, which is now Healy 2, first began, the focus was on reduction of NOx, SOx, particulate matter, carbon monoxide, Ozone, and lead. The current focus is on reduction of greenhouse gases or CO_2. EPA is also focused on hazardous air pollutants such as mercury, but CO_2 is really at the forefront of current regulations.

4:25:51 PM
MR. WRIGHT said Healy Unit 2 was an official Department of Energy (DOE) clean coal plant when it was permitted in the early 90s. It uses pulverized coal (as does Unit 1) that goes into a boiler versus a fluidized bed or conveyor belt. For NOx control it used an advanced combustion technology with a cyclone burner with a slagging combustor that "lava-flowed" out of it and dropped into a cooling pond, which removed 75-80 percent of the ash; the pollutants went out into the slagging combustor.

For SO_2 control, a spray dryer absorber injected lime that mixed with the SO_2 and got captured in the "bag house." The combustion technology helped remove the particulate matter in the slagging combustor and the bag house picked up most of that.

4:27:06 PM
MR. WRIGHT explained that fuel diversity is an important thing for the Healy 2 plant and that GVEA is quite diverse, too, but one of their challenges is that they have to use oil, which is a relatively high cost of power. And unlike oil and gas, coal has a long-term stable price. Alaska has 350 years of coal reserves.

4:28:08 PM
MR. WRIGHT reviewed GVEA's generation assets from their most recent integrated resource plan. Their most efficient plant is North Pole 3 and 4, which is a gas-turbine combined cycle, just like the Southcentral plant that Chugach Electric put in. However, it uses naphtha that has high prices. So, while it is their best combustion turbine price, it is significantly more than the coal price even though coal plants are less efficient.

Healy 2 will be coming in around 12,500 Btu/kwh, a little better than Healy 1, but still not as good as some of their gas turbines, but cheaper, which is good for their members.

4:29:29 PM

MR. WRIGHT said they decided to purchase the plant, but as they were renewing air permits, some environmental groups opposed it. So they ended up agreeing to a consent decree with the EPA that says to restart the plant they have to install Selective Catalytic Reduction (SCR) for additional NOx reduction. Healy 1 would also have to install Selective Non-catalytic Reduction (SNCR), which is just injection of urea, but by 2024 they have to decide to either shut the plant down or add an SCR to keep it operating.

He said that one of the challenges in having two of almost anything is that retrofitting existing plants is a little bit more expensive than new build. He added that pre-consent decree their NOx level was at 1366 tons/yr. and post consent decree they have to be at 533 tons/yr. The SO_2 didn't change much, so their focus was on reducing NOx.

4:31:05 PM
MR. WRIGHT said the consent decree was done in November 2012, so last year GVEA hired an engineer and began some of the engineering for the SCR and SNCR, because it takes a lot of time to close the deal on purchasing for the plant. They selected Black and Vetch as their EPC contractor for SCR and SNCR for the two units and as their startup manager and commissioning manager for the Healy 2 plant. In December they closed on the plant.

They had also ordered some of the long-lead items like the plant digital control system and some special mill exhauster fans. The plant control system is being updated and that should be finished around June. Once that is in, they will start bumping the systems and checking motors and things. They will be adding 25-30 permanent jobs in Healy once the plant is up and running; it should start operating in about the second quarter.

4:34:17 PM
MR. WRIGHT explained the regulatory obstacles and challenges, specifying Utility Mercury and Air Toxics Standards (UMATS) and additional coal monitoring regulations on the horizon. They have to comply with UMATS by April 2015. Alaska coal is very clean, so they are pretty confident the plant will meet the requirements, and going forward, there will be minimal costs for monitoring the pollutants.

4:35:42 PM
MR. WRIGHT noted the Green House Gas (GHG) Reporting Rule requires recording and reporting of those, but EPA is also working on proposing new source performance standards. Those

don't impact them now, because it is for new sources, but the challenge would be that none of the existing GVEA units would meet the existing greenhouse gases standards as proposed unless there was some form of carbon capture and sequestration.

He said that most natural gas combustion turbines will meet the standards without any additional controls. Utility coal-fired boilers and others would require some form of carbon capture and sequestration to meet the proposed GHG NSPS and GHG emissions.

4:37:23 PM
MR. WRIGHT explained that GVEA's North Pole GT 3 comes close to the limit with naphtha, but it is slightly over and that limit is for new sources (theirs are already permitted).

4:38:04 PM
MR. WRIGHT noted that the challenges of the new coal regulation are the cost of the equipment, modifying the units (if retro-active), the energy penalty, and the sequestration location and transportation to it. CO_2 normally goes into a well and finding that is a challenge, too.

He said challenging future coal regulations are: greenhouse gases for already existing units and proposed coal combustion residual rules (for ash disposal). He explained that GVEA has an ash pond-type relationship with Usibelli in which ash builds up in a pit. It gets dredged up and Usibelli uses it for coal reclamation (also under EPA regulations). They don't have dykes, which is what have been giving way.

Another rule that is a "hot ticket item" is the Clean Water Act 316b rule governing intakes for the plants and making sure you don't damage fish stocks and things like that. It turns out that there are some fish in the Nenana River, so their plant needs some water intake protection work. It could end up being taken to cooling towers, which would cost a lot more than bringing in water from the river for cooling.

Effluent limitation guidelines limit certain waste water discharges, he said, and explained that GVEA takes water out of the river and returns it slightly warmer. So they monitor the water temperature to make sure they aren't causing any thermal issues.

4:40:21 PM
MR. WRIGHT summarized that GVEA feels that coal provides fuel diversity, long-term stable rates and significant reserves for

the Interior. But the challenge is future regulatory issues that are focused on coal.

4:41:17 PM
CHAIR GIESSEL thanked Mr. Wright for his presentation.

Cutting Edge Clean Coal Technology and Future Possibilities in Alaska

CHAIR GIESSEL welcomed Buddy Paul, Jason Herring, Bruce Fomhoff, and Justin Potts from Vivify.

4:42:05 PM
JASON HERRING, Chief Executive Officer (CEO), Vivify, Inc., said their sole purpose is to explain how a new technology will help Alaska deal with some of its energy concerns, and Vivify's founding members are with him to help answer questions.

4:42:41 PM
JUSTIN POTTS, Vice President, Vivify, Inc., said his was an informative presentation introducing and discussing new technology for capturing emissions. He said they are a scientific technology company primarily focused on energy challenges and problems.

4:44:18 PM
MR. POTTS said he would talk about the "next generation technology" called the "Clean Air Technology" that is about how power plants and energy companies clean their emissions, deal with pollution (not just CO_2, but sulphur dioxide, nitrous oxide, carbon monoxide, mercury, and air-borne particles, as well). They are focused on allowing power plants to take advantage of the availability of clean, affordable coal, yet not have the burden of emissions. One of the things especially appealing about this new generation technology, that used to be called scrubbers and flue gas desulphurization, is that it is a "perfect fit" for Alaska's coal power plants.

4:45:35 PM
MR. POTTS explained that this new technology is the "last jigsaw piece" to generating low cost electricity in a way that protects the environment. Rather than addressing individual pollutants, new technologies platforms are being developed that will address removing 100 percent of an entire pollution problem as well as providing 100 percent zero emissions.

4:47:37 PM

MR. POTTS said this kind of system will address everything from heavy and light particulates to mercury, nitrogen oxide, sulphur dioxide, carbon monoxide and CO_2.

He explained that the capture of these pollutants requires a lot of energy - called an energy penalty or a parasitic load - that detracts from the net efficiency of a power plant. As that net efficiency declines, the cost of electricity goes up for the users. So, one of the areas that the new technologies focus on is working at a zero parasitic load basis.

He said that power plants are 45 and 65 percent efficient. He explained that a lot of heat and power is lost through the exhaust and the new technologies are looking at how to tap into that heat and exhaust to fuel the pollution control systems.

4:48:51 PM
MR. POTTS pointed out a graph of how carbon capture technology affected a plant's net efficiency. Here the plant ran at about 35 percent net efficiency without any carbon capture. When the technology was added, energy was drawn away from the plant; therefore that plant had less energy. Historically, these technologies have required retro-fitting, which often required some kind of down-time, which has a huge impact on the cost, but the new technologies are coming in at the very end of the process, tapping into the exhaust, and therefore, can be implemented with zero or at least minimal down-time.

4:50:39 PM
BRUCE FOMHOFF, Chief Operation Officer/Chief Technology Officer, Vivify, Inc., expanded that the new technology uses turbines, compressors and generators. It uses the heat from the "fluid sauce" coupled with pressure to generate additional heat to power the actual generators, themselves, to offset the operational costs.

He explained that heat exchangers are used to extract the heat and precipitate the contaminants out of the pressurized gas. This way the carbon monoxide and volte organic compounds are captured and returned back to the system for combustion. It's really a simple technology, he said.

4:52:05 PM
MR. FOMHOFF said they use cryogenic chambers to cool and pump to separate the air compounds. This can be done to plants that are already mothballed and to the even newer technologies, and can work in conjunction with other carbon capture technologies. Each

compound will precipitate under its own ideal pressure and temperature within its own respective chamber within the plant.

4:53:15 PM
MR. FOMHOFF explained that for existing plants the exhaust would be mixed through water-filled hydroponic towers, which removes both heavy and light particles. He said that the heavy particles condense and separate under high pressure. They work in conjunction with an Anti-Gravity Enhanced Separator (AGES) that moves those particles out of the water where they can be sequestered individually as a resource (instead of being considered waste). Centrifugal force is used to capture particulates in the air by weight. It could even be used elsewhere in the plant for other conversion. Vivify's technology is a simple, cost-effective, advanced, complete emissions control and carbon capture solution.

MR. FOMHOFF said that Vivify's Pulsar technology is used where they are creating on-demand hydrogen and oxygen as needed to create an additional low-cost, high-yield burning fuel source. Their goal is to use all of the exhaust by repurposing it. He said the emission control system would help in recovering any capital costs needed for conversion.

4:57:12 PM
SENATOR DYSON asked for a fuller explanation of how pressure and temperature are used to separate the different elements.

4:57:39 PM
BUDDY PAUL, Chief Executive Officer, Vivify, Inc., explained that the cryogenic process, using both pressure and temperature, precipitates out water first, at 0-32 degrees. The next stage of precipitation would be CO_2 at -60 degrees and a 300-400 psi. At each stage a different element will precipitate out. Nitrogen is used as the feed stock to regulate all the other temperatures and pressures, because it precipitates at the coldest point and he could make the chamber exactly to match that particular by-product from the coal. The by-products get released through turbines to create additional electricity.

5:00:42 PM
SENATOR DYSON said he assumed that he used gravity to precipitate particles out in a vapor of some kind.

MR. PAUL responded that was a different scenario. There is a difference between the old and new technology. The older plants did not have the bagging systems that connect a lot of the

particles. In that case, when there are a lot of particulates, especially the heavy particles, that is when they use the particle acquisition towers (the cooling part), and then use centrifugal force to separate the heavy forces. That is just because the majority of the elements are there in the raw form. If it's a newer system, then he will use the cryogenic process primarily.

5:02:10 PM
SENATOR BISHOP asked if the process is still in the laboratory phase or have tests been run.

MR. PAUL answered that every portion of this technology is proven, but he couldn't design a model without having specs for a plant. So, there is no working model at this time. He said he developed the Pulsar system three or four years ago, and it is a low-cost way to make it marketable for emissions control.

5:04:10 PM
SENATOR MICCICHE said he had no doubt it was a fully functional system, but he was real interested in seeing a process flow diagram to understand a little better. It comes down to cost per unit and reliability.

5:05:13 PM
CHAIR GIESSEL thanked Vivify for their presentation. There being no further business to come before the committee, she adjourned the Senate Resources Standing Committee meeting at 5:05 p.m.