

**ALASKA STATE LEGISLATURE
SENATE RESOURCES STANDING COMMITTEE**

April 17, 2024

3:31 p.m.

MEMBERS PRESENT

Senator Click Bishop, Co-Chair
Senator Cathy Giessel, Co-Chair
Senator Bill Wielechowski, Vice Chair
Senator Scott Kawasaki
Senator James Kaufman
Senator Forrest Dunbar
Senator Matt Claman

MEMBERS ABSENT

All members present

COMMITTEE CALENDAR

PRESENTATION: NEXT GENERATION MINERAL ASSESSMENTS IN ALASKA

- HEARD

PREVIOUS COMMITTEE ACTION

No previous action to record

WITNESS REGISTER

ERIN WHITNEY

Director

Arctic Energy Office

U.S. Department of Energy

Anchorage, Alaska

POSITION STATEMENT: Delivered the presentation Next Generation Mineral Assessments in Alaska.

PAUL MCKINLEY

Joint Hydrogen Advisor

Arctic Energy Office

U.S. Department of Energy

Alaska Center for Energy & Power

Fairbanks, Alaska

POSITION STATEMENT: Answered questions during the presentation Next Generation Mineral Assessments in Alaska.

ACTION NARRATIVE

[3:31:17 PM](#)

CO-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 Wielechowski, Kaufman, Kawasaki, Dunbar, and Co-Chair Giessel. Senator Claman and Co-Chair Bishop arrived thereafter.

PRESENTATION: NEXT GENERATION MINERAL ASSESSMENTS IN ALASKA

[3:31:57 PM](#)

CO-CHAIR GIESSEL announced the consideration of a presentation titled, "Next Generation Mineral Assessments in Alaska."

[3:32:23 PM](#)

CO-CHAIR GIESSEL announced invited testimony.

[3:33:43 PM](#)

ERIN WHITNEY, Director, Arctic Energy Office, U.S. Department of Energy, Anchorage, Alaska, delivered the presentation Next Generation Mineral Assessments in Alaska.

[3:33:53 PM](#)

CO-CHAIR BISHOP joined the meeting.

[3:34:42 PM](#)

MS. WHITNEY advanced to slide 2 and described the Arctic Energy Office:

[Original punctuation provided.]

Who We Are, What We Do & How We Can Help

A team with expertise in:

- Engineering
- International affairs
- Science and research
- Military and government relations
- Tribal consultations
- Communications

Our main objectives:

- Collaborate with Arctic stakeholders

- Advance Arctic energy transitions in remote and rural communities
- Ensure tribal voices are heard
- Connect Arctic entities and residents with government resources
- Ensure national security

MS. WHITNEY gave a brief overview of her work in the energy field. She briefly described the work done by the Arctic Energy Office, which is the only regional office of the Department of Energy in Alaska. She described the Arctic Energy Office as a portal into the Department of Energy (DOE), to guide visits and direct questions. She said the team covers the three pillars of DOE - science, energy, and security. She added that DOE reports directly to the undersecretary for science and innovation.

[3:36:47 PM](#)

SENATOR CLAMAN joined the meeting.

[3:36:56 PM](#)

MS. WHITNEY advanced to slide 3 and provided an overview of hydrogen opportunities in Alaska:

[Original punctuation provided.]

Alaska Hydrogen Opportunities Report (April 2024)

- Follows publication of U.S. National Clean Hydrogen Strategy & Roadmap (June 2023)
- Alaska has the potential to make progress in a number of hydrogen ecosystem components, including:
 - Hydrogen production from both vast renewable energy potential as well as natural gas resources combined with carbon capture;
 - Seasonal energy storage for Alaskan communities;
 - Storage in depleted oil and gas reservoirs to enable affordable delivery of hydrogen at scale.
- Near-term demonstrations will help pave the way.

MS. WHITNEY said that the hydrogen working group is a joint effort between AEO and the University of Alaska Fairbanks (UAF). She explained how to access the Alaska Hydrogen

Opportunities Report and described how the report was compiled.

[3:39:42 PM](#)

MS. WHITNEY advanced to slide 4 and spoke to the report structure:

[Original punctuation provided.]

Report Structure

- Executive Summary
- Background: Why Hydrogen? Why Now? Why Alaska?
- Alaska's Current Energy Production and Use
- Alaska's Hydrogen Production Potential and Derivatives
- Alaska's Storage, Transmission, and Distribution Potential
- Alaska's Potential Hydrogen Markets and End-Use Applications
- Factors Affecting Hydrogen Opportunities in Alaska
- Alaska's Key Opportunities and Next Steps

MS. WHITNEY provided examples of hydrogen uses and its applications. She invited members to follow up for more detailed information.

[3:40:59 PM](#)

MS. WHITNEY advanced to slide 5 and explained the chemistry of hydrogen molecules. She listed a variety of long-chain hydrocarbons. She commented that liquid fuels provide many advantages in terms of energy density. She noted that ammonia is a hydrogen derivative that could be considered as a transportable liquid fuel.

MS. WHITNEY moved to slide 6 and stated that hydrogen is intriguing due to its physical properties. She explained that hydrogen has a low volumetric energy density. She compared the volumetric energy density of hydrogen with other fuels, including diesel and petrol. She acknowledged that these have high energy density; however, she explained that while hydrogen has a comparatively low volumetric density, it has a high gravimetric density (density by mass). She stated that this makes it a "hero" in the energy

world and noted that the cost to make hydrogen is decreasing.

[3:44:41 PM](#)

MS. WHITNEY advanced to slide 7 and explained hydrogen colors:

[Original punctuation provided.]

Hydrogen Colors (not used so much anymore)

- Gray hydrogen uses fossil fuels and produces carbon dioxide as a byproduct
- Blue hydrogen captures and stores most of the carbon dioxide output
- Green hydrogen's byproduct is oxygen

MS. WHITNEY noted that there are roughly ten different colors of hydrogen and those listed are the most common. She added that currently, hydrogen is most often referred to as "clean" versus "conventional" hydrogen. She said that the majority of the earth's hydrogen is gray hydrogen. She pointed out that green hydrogen is "clean hydrogen" and explained the process of creating this form of hydrogen. She said that blue hydrogen (also considered a form of "clean" hydrogen) is derived from fossil fuels and explained how the carbon dioxide is removed and stored so that it does not impact earth's atmosphere. She commented that power of "clean hydrogen" is found in the variety of energy sources from which these molecules can be made and briefly discussed this process.

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CO-CHAIR GIESSEL asked about white hydrogen or "naturally occurring" hydrogen.

[3:47:05 PM](#)

MS. WHITNEY replied that "white hydrogen" or "naturally occurring hydrogen" is also called "geologic hydrogen" and has received quite a bit of press within the past year. She noted that, while it is not included in the report, she participated in a panel at Arctic Encounter discussing this type of hydrogen. She explained that white hydrogen comes from naturally occurring sources and can also be created under simulation. The Department of Energy is investing (roughly \$20 million) into exploration of natural hydrogen sources. She explained that there are potentially large deposits of naturally occurring hydrogen around the world. She commented that there is a naturally

occurring hydrogen well in Africa that is providing electricity for a community. She stated that United States Geological Survey (USGS) is mapping the United States to determine where these might occur. She added that AEO is working hard to ensure that this mapping is done in Alaska, as Alaska seems to have the necessary geologic conditions to produce natural hydrogen.

[3:49:16 PM](#)

MS. WHITNEY advanced to slide 8 and elaborated on the big picture:

[Original punctuation provided.]

The Big Picture

On February 28th, 2022, the Intergovernmental Panel on Climate Change (IPCC) released its latest report under the Sixth Assessment cycle.

One of the key takeaways:

It is critical that we try to stay **below 1.5 degrees warming.**

- If global warming exceeds 1.5 degrees Celsius in the coming decades or later, then many human and natural systems may face additional severe risks compared to remaining below 1.5 degrees Celsius.

MS. WHITNEY briefly discussed the impacts that CO2 emissions are having on the climate. She emphasized the importance of finding fuel sources that do not emit CO2 and pointed out that hydrogen is one path toward realizing this goal. She noted that many companies around the world are committed to this goal. She commented that, for those who do not share these climate-related concerns, hydrogen is another fuel to add to the list of energy resources and thus can act as a path toward energy diversity. She stated that energy diversity is akin to energy security and opined that for this reason, it is worthy of consideration.

[3:50:48 PM](#)

MS. WHITNEY advanced to slide 9 and explained that one key driver supporting hydrogen research and use - from an emissions standpoint - is that it can be used in sectors of the world's economy that are difficult to "de-carbonize." The industrial, transportation, and agricultural sectors (among others) currently depend primarily on natural gas for their high hydrogen requirements - which results in high CO2 emissions.

Considering alternative, hydrogen-based fuels can end CO2 emissions.

[3:51:56 PM](#)

MS. WHITNEY advanced to slide 10 and gave an overview of energy in Alaska. She commented that this sets the stage for understanding the resources available in Alaska for potential hydrogen production. She explained the British thermal unit (Btu) measurement and why it was used. She stated that one trillion Btu (TBtu) is equivalent to two million mid-sized vehicles running for one hour.

[3:53:45 PM](#)

SENATOR CLAMAN asked her to repeat the data to contextualize the value of TBtu.

[3:53:58 PM](#)

MS. WHITNEY repeated the data that demonstrates the value of a TBtu. She said that this measurement (Btu) is often seen on natural gas heating bills and contrasted this with electric bills, which measure in kilowatt hours (kWh). She directed attention to the graph on slide 10 and explained that Alaska's statewide electricity consumption is roughly 50 TBtu. Statewide energy consumption is close to 700 TBtu. She noted that the latter includes petroleum, natural gas, and renewable energy. She said that statewide energy production is 1330 TBtu (this includes crude oil, natural gas, coal, and renewable energy). She stated that this data is taken from Energy Information Association (EIA) and Alaska Oil and Gas Association (AOGA) reports from 2021. She stated that North Slope reinjected gas is 3088 TBtu and contrasted this with the proposed Alaska natural gas pipeline, which is roughly 1200 TBtu. She opined that it is helpful to consider these numbers in order to understand the scale of energy production and demands in the state.

[3:56:51 PM](#)

MS. WHITNEY advanced to slide 11 and discussed Alaska's untapped renewable energy potential. She directed attention to the bar graph on the left and compared Alaska's energy consumption to US energy consumption. She pointed out that energy is consumed in order to make energy. She then directed attention to the bar graph on the right and noted that while Alaska has large coal reserves, it is not included in the graph. She briefly discussed the various forms of energy shown on the graph and noted that these are maximum amounts, which gives an idea of the potential for each.

[3:59:57 PM](#)

MS. WHITNEY advanced to slide 12 and explained the Energy Earthshots portfolio. She said DOE has eight Earthshots, which represent goals for various technologies. For example, for both floating offshore wind and advanced geothermal, the target is to reduce the cost to the equivalent of 4-5 cents/kWh within the next decade. She compared this to energy from the Alaska Railbelt, which averages 20-25 cents/kWh. She noted that this amount is higher in rural areas. She acknowledged that the Earthshot targets are ambitious; however, they are based on extensive modeling. She shared her belief that the resources and investments DOE is making in these areas greatly increase the likelihood of achieving these goals. She noted that Earthshots that would potentially benefit Alaska are circled (i.e. floating offshore wind, enhanced geothermal, clean fuels and products, and hydrogen). She clarified that Alaska stands to benefit from lower costs in these areas. She commented that developing Alaska's resources would benefit Alaskan energy costs and its export economy. She added that geothermal and wind resources could be used to make hydrogen, which would be a way of marketizing and transporting energy resources to otherwise unrealizable markets.

[4:02:34 PM](#)

MS. WHITNEY advanced to slide 13 and discussed the potential for hydrogen exports to other countries. She stated that the slide shows hydrogen demand by 2030 (negative numbers indicate hydrogen imports). She added that Germany, Japan, and South Korea are both projected require imported hydrogen and surmised that this is a potential commerce pathway.

[4:03:50 PM](#)

SENATOR WIELECHOWSKI asked about the process of creating hydrogen and wondered why Alaska has this opportunity while hydrogen cannot be created in the aforementioned countries and must therefore be imported.

[4:04:17 PM](#)

MS. WHITNEY replied that Alaska has the potential to create hydrogen due to its land and energy resources. This includes wind, geothermal, and fossil fuel resources. She explained that these could be used to make blue hydrogen (from fossil fuel sources combined with CO2 capture) or green hydrogen from non-fossil fuel sources.

[4:05:30 PM](#)

SENATOR WIELECHOWSKI asked for additional information on the type of land. He surmised that AEO is considering harnessing wind to create hydrogen and asked how this might work in rural Alaska.

[4:05:55 PM](#)

MS. WHITNEY replied that this brings up issues of land ownership and consideration of where the best site would be located. She offered an example of a wind farm in the Aleutian Islands and explained how this would work to create hydrogen.

[4:07:04 PM](#)

SENATOR WIELECHOWSKI said that this is helpful and added that he is considering the advantages Alaska has - and how these might be put to use.

[4:07:15 PM](#)

SENATOR CLAMAN asked if there are places using hydrogen to produce energy.

[4:07:31 PM](#)

MS. WHITNEY replied not in Alaska.

[4:07:48 PM](#)

MS. WHITNEY advanced to slide 15 and discussed the hydrogen possibilities in Alaska. She explained how hydrogen is created from fossil fuel sources and non-fossil fuel sources; hydrogen can then be converted into carrier fuels. She described the various ways hydrogen can be used as an energy source. She said that a hydrogen fuel cell generates power that can be used to power vehicles and to generate electricity. She noted that hydrogen can be combusted in hydrogen engines and can be used to produce heat. She explained how hydrogen can be mixed with other fuels such as natural gas, which would extend the reserves. She noted that there are applications across the state. She stated that AEO is holding meetings in various communities to discuss hydrogen use potential. She said that, to drive a hydrogen economy, hydrogen export (within the US and/or internationally) should be considered.

[4:11:35 PM](#)

SENATOR CLAMAN commented that hydrogen seems to have more small-scale uses that are, in many ways, more efficient due to their size.

[4:11:55 PM](#)

MS. WHITNEY clarified that hydrogen also has large scale uses, including converting hydrogen to ammonia, sustainable aviation fuel, and methanol. She briefly described these.

[4:13:06 PM](#)

CO-CHAIR GIESSEL commented that the Ted Stevens International Airport is the fourth largest cargo airport in the world. She asked about Australia's use of hydrogen for marine transportation. She shared her understanding that Hawaii is blending hydrogen with gasoline and asked for confirmation.

[4:13:43 PM](#)

MS. WHITNEY shared her understanding that Australia is utilizing hydrogen for microgrid use. She noted that Australia is using its solar, tidal, and wind resources to generate hydrogen. With respect to Hawaii, she confirmed that hydrogen is being combined with natural gas. She stated that Hawaii's model is successful and is one that Alaska could follow. She said that the Alaska Sustainability Conference would have representatives from both Australia and Hawaii. She offered to follow up with additional information at a later time.

[4:15:22 PM](#)

CO-CHAIR GIESSEL referred to slide 13 and conveyed that she has spoken to a company that would be interested in generating hydrogen in Alaska for export. She commented that this is an economic driver with exciting potential. She noted that permitting is a big consideration for a project of this size.

[4:16:22 PM](#)

MS. WHITNEY said that this is very exciting and added that DOE is in close communication with the company in question.

[4:16:42 PM](#)

MS. WHITNEY advanced to slide 14 and discussed hydrogen and carbon dioxide sequestration potentials:

[Original punctuation provided.]

Hydrogen and Carbon Dioxide Sequestration Potentials

- Maximum hydrogen storage potential is approximately 552 MMT based on the current North Slope's total oil and gas storage potential
- Approximately 1,200,000 MMT CO₂ sequestration potential statewide in all possible formations,

including oil and gas reservoirs, coal seams, saline aquifer sandstones

MS. WHITNEY said that it is important to consider CO2 if Alaska wants to produce hydrogen from fossil fuel sources and is also committed to a net-zero emissions.

[4:18:02 PM](#)

MS. WHITNEY advanced to slide 16 and offered concluding thoughts:

[Original punctuation provided.]

Concluding Thoughts

Alaska is an energy producing state

- We currently produce twice as much energy as we consume
- Energy production is energy-intense

Alaska has vast untapped energy production potential

- Renewable energy projects are economical now
- As costs of emerging technology come down (Earthshots), will Alaska be ready to develop its resources?
- Pilot projects are critical to building capacity and proving technology in Alaska
- Hydrogen can be key to bringing stranded renewables to market

Energy projects create jobs

- Alaska's oil and gas sector will be critical to building projects and infrastructure
- New jobs! - wind turbines, solar installers, and more
- Old jobs! - pipelines, permitting, operations, safety, fuel production, others

[4:20:40 PM](#)

MS. WHITNEY advanced to slide 17 and discussed various avenues for developing hydrogen projects in the state.

[Original punctuation provided.]

What's Next for Alaska's Hydrogen Future?

Develop an Alaska hydrogen strategy and roadmap

- Evaluate policy opportunities to create state-level incentives for hydrogen production, transmission, storage, distribution, and use
- Create a database with planned clean hydrogen projects in Alaska
- Connect off-takers, producers and stakeholders in the state and other states and provinces
- Align Alaska's energy goals and strategic assets in meeting global market demand

Begin demonstrating hydrogen technologies in Alaska

- Support feasibility studies and pilot project demonstrations at local/rural and grid/Railbelt scales
- Create a pipeline ecosystem for demonstration projects to establish proof of concept
- Identify sites where ample renewable resources coincide with geologic storage for hydrogen and perform site assessments and economic feasibility analyses
- Use demonstration projects to create hands-on workforce development programs associated with energy transition and hydrogen ecosystem skills

Advance state-level programs required to support key elements of the clean hydrogen value chain including CCS

[4:23:33 PM](#)

MS. WHITNEY advanced to slide 18 and provided contact information for the Arctic Energy Office.

[4:24:09 PM](#)

CO-CHAIR GIESSEL noted that there are additional slides in the presentation.

MS. WHITNEY explained that these slides contain supplementary information. She suggested that she could either go over these or leave them for members to go over at their leisure.

[4:24:47 PM](#)

CO-CHAIR GIESSEL indicated that she would like to move on to other invited testifiers who may have comments.

[4:25:02 PM](#)

SENATOR WIELECHOWSKI referred to slide 5 and asked for confirmation that the goal is to create hydrogen (H₂). He asked what process is used and how much energy is required.

[4:25:32 PM](#)

MS. WHITNEY replied that water can be electrolyzed to create green hydrogen and briefly described this process. She deferred the question regarding the energy requirements.

[4:26:17 PM](#)

PAUL MCKINLEY, Joint Hydrogen Advisor, Arctic Energy Office, U.S. Department of Energy, Alaska Center for Energy & Power, Fairbanks, Alaska, answered that it is about 55 kWh per kilogram (kg).

[4:26:43 PM](#)

SENATOR WIELECHOWSKI asked for this to be put into the context of natural gas and asked how many thousand cubic feet (mcf) of natural gas would be required to make a unit of hydrogen.

[4:27:05 PM](#)

MS. WHITNEY asked for confirmation that the question is how many mcf would be required to make one kg of hydrogen.

SENATOR WIELECHOWSKI replied yes.

MS. WHITNEY deferred the question and added that if a sufficient calculation could not be provided during the meeting, she would provide this to the committee at a later time.

[4:27:44 PM](#)

MR. MCKINLEY said that without a direct number per kg of hydrogen, natural gas power plants operate around 30 to 40 percent efficiencies. He explained that - whatever the nominal value of natural gas - 30 percent of the energy content goes to electricity, which can then be converted into hydrogen.

[4:28:31 PM](#)

MS. WHITNEY reiterated that a more detailed answer could be provided at a later time.

[4:28:41 PM](#)

CO-CHAIR GIESSEL directed attention to slide 7 and wondered about the gasifier/reformer versus an electrolyzer to produce various forms of hydrogen. She briefly described her understanding of the different processes and said that the gasifier seems more expensive due to the necessary CO2 capture.

[4:29:16 PM](#)

MS. WHITNEY replied that electrolyzer prices are decreasing, though this equipment is still relatively expensive. She noted that there are currently 45Q tax credits for carbon capture. She suggested that there is substantial revenue to be made from these taxes and offered to follow-up with additional information.

[4:29:52 PM](#)

CO-CHAIR GIESSEL said that this is a key part of the carbon capture, utilization, and storage (CCUS) bill that will be before the committee in the coming days.

[4:29:59 PM](#)

SENATOR DUNBAR asked - in terms of efficiency - how far off the electrolyzer technology is from using hydrogen to fuel electrolysis. He asked if it would ever be possible for hydrogen to produce enough energy to fuel this process.

MS. WHITNEY asked if he is referring to something akin to a perpetual motion machine.

[4:30:43 PM](#)

SENATOR DUNBAR replied that a perpetual motion machine is impossible; however, in this case the hydrogen can act as a fuel that could potentially power the electrolyzer. He noted that an external fuel source would be required to provide the water necessary to fuel electrolysis. He argued that otherwise, they are using more efficient forms of energy (e.g. natural gas) to run an electrolyzer and create a less efficient form of energy (hydrogen). He acknowledged that hydrogen would be transportable. He rephrased his question and asked whether hydrogen ever produces enough energy to run the electrolyzer.

[4:31:38 PM](#)

MS. WHITNEY asked for confirmation that the question is whether hydrogen can potentially be used to fuel the electrolyzer to make more hydrogen.

SENATOR DUNBAR replied yes.

MS. WHITNEY explained that there is an efficiency loss each time an electrolyzer runs. She referred to earlier data regarding natural gas combustion efficiency to make electricity, which is around 30 percent. She shared her understanding that electrolyzer efficiency is 40 or 50 percent. She pointed out that none of these processes is 100 percent efficient. She shared her understanding that the question is whether hydrogen

could be used to power the electrolyzer with enough hydrogen left over to use and transport. She surmised that the scale of the system would need to be considered.

[4:32:52 PM](#)

SENATOR DUNBAR wondered how far this self-perpetuating technology is from becoming a possibility. He noted that petroleum and other transportable fuels have a high energy output, but it is either difficult or impossible to make more. He opined that hydrogen is unique and exciting because it can be made from water.

[4:33:47 PM](#)

MS. WHITNEY deferred the question.

[4:34:25 PM](#)

MR. MCKINLEY expressed his understanding that the question is whether hydrogen compares to wind, solar, petroleum, or coal in terms of energy generation. He explained that hydrogen is an energy carrier, rather than a fuel source. Therefore, fuel will always be required for hydrogen production. He stated that hydrogen is useful in situations where there is no way to transport or store energy. He offered the example of ammonia production for overseas markets and commented that hydrogen production could be considered worthwhile in this case. He briefly described how hydrogen can be used to store energy long term. He emphasized that, with hydrogen, the end-use application determines its usefulness rather than whether the hydrogen is efficient.

[4:36:46 PM](#)

SENATOR KAWASAKI inquired about the safety of transporting hydrogen and using it as an energy source.

[4:37:11 PM](#)

MS. WHITNEY explained that hydrogen derivatives such as ammonia or methanol (i.e. as liquid fuel) are much easier - and safer - to transport than a compressed gas. She noted that Maersk Shipping has committed to making the switch to methanol as a fuel source within the next 10-20 years and indicated that methanol is as safe as gasoline. She briefly discussed the safety concerns when dealing with compressed hydrogen and indicated that there are safe ways to "seed" natural gas with hydrogen (as is being done in Hawaii).

[4:38:57 PM](#)

CO-CHAIR GIESSEL asked what kind of water is necessary to produce hydrogen. She wondered if salt water could be used or if desalination would be necessary.

[4:39:16 PM](#)

MS. WHITNEY replied that producing hydrogen requires a level of purity and invited Mr. McKinley to comment.

[4:39:30 PM](#)

MR. MCKINLEY explained that there is ongoing research regarding desalination opportunities for electrolysis, particularly in offshore wind projects. He added that most electrolysis companies are equipped to use tap water (which has been run through reverse osmosis treatment device) to make hydrogen. He explained that most conventional water supplies are sufficient for use, providing there are no unforeseen contaminants. He noted that low water quality impacts electrolysis stacks; therefore, tests should be done prior to utilizing the water for this purpose.

[4:41:05 PM](#)

CO-CHAIR GIESSEL commented that Fairbanks water contains a large amount of minerals; therefore, Fairbanks may not be the best location for this.

[4:42:06 PM](#)

There being no further business to come before the committee, Co-Chair Giessel adjourned the Senate Resources Standing Committee meeting at 4:42 p.m.