ALASKA STATE LEGISLATURE
SENATE RESOURCES STANDING COMMITTEE
March 6, 2023
3:30 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(S): DEVELOPMENT ISSUES IN TODY'S CARBON CAPTURE UTILIZATION STORAGE MARKETPLACE

- HEARD

PRESENTATION: ALASKA CCUS WORKGROUP AND A ROADMAP TO COMMERCIAL DEPLOYMENT

- HEARD

PREVIOUS COMMITTEE ACTION

No previous action to record

WITNESS REGISTER

DAVID GREESON, President
Proven Project Development Group
Houston, Texas
POSITION STATEMENT: Presented Development Issues in today's Carbon Capture Utilization Storage Marketplace.

FRANK PASKVAN, Affiliate Professor
Institute of Northern Engineering
University of Alaska Fairbanks

Fairbanks, Alaska
POSITION STATEMENT: Presented Alaska CCUS Workgroup and a Roadmap to Commercial Deployment.

ACTION NARRATIVE

3:30:21 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, Kawasaki, Dunbar, Claman, Kawasaki, Co-Chair Bishop, and Co-Chair Giessel. Senator Kaufman arrived during the introductions.

PRESENTATION(S): DEVELOPMENT ISSUES IN TODAY'S CARBON CAPTURE UTILIZATION STORAGE MARKETPLACE
[Contains discussion of SB 49.]

3:30:54 PM
CO-CHAIR GIESSEL stated the committee was beginning the discussion of the governor's SB 49 relating to carbon capture, utilization, and storage with presentations from two experts in the field. She welcomed David Greeson to begin his presentation.

3:31:54 PM
DAVID GREESON, President, Proven Project Development Group, introduced himself, reviewed his credentials in the carbon capture industry, and conveyed his interest in helping to figure out how to continue to use fossil fuels.

MR. GREESON began the presentation with an overview of the carbon capture process based on the diagram on slide 3. The drawing on the upper left represents a power plant where something is being combusted. This is a source of flue gas and CO2 is emitted into the atmosphere. To prevent that emission, the flue gas is sent to a post-combustion carbon capture system. Today's state-of-the-art technologies capture more than 90 percent of the CO2 in that flue gas. He noted that most technology providers are guaranteeing 95 percent CO2 capture. The clean flue gas that has less than 1 percent CO2 is emitted into the atmosphere. The remaining pure CO2, which is close to food grade, is ready for secure geologic storage.

He mentioned a project in North Dakota where the pure CO2 can be injected directly into the storage facility beneath the power plant and noted that many other carbon capture projects in the Lower 48 have landowner issues associated with running pipelines

to connect the source and the carbon capture system with the storage facility.

3:37:46 PM
MR. GREESON advanced to slide 4, State Policy Should Focus on Deployment - Not More Research, and spoke to the following:

- DOE is shouldering the burden on research
- Congress has enacted incentives for first movers
- States should focus on filling the gaps to deployment
    - Policies and local incentives that make sense

3:39:41 PM
MR. GREESON conveyed that policymakers asked him to talk about opportunities for states to enhance decarbonization. He directed attention to the chart on slide 5 that shows the energy-related carbon dioxide emissions by state, as of 2016. It shows that Texas, followed by California and Florida are the largest CO2 emitters whereas Alaska is a low emitter. If the US is to have an impact on decarburization, he said it is those states on the far left of the chart that need to think about incentivizing capture and storage.

3:41:18 PM
MR. GREESON turned to slides 6 and 7 to discuss the economics of carbon capture. He said the charts came from a peer-reviewed report by the National Petroleum Council. The numbers show the estimated cost of carbon capture by facility type. He described natural gas, ethanol, and ammonia processing as the low-hanging fruit. The off-gas from processing natural gas is 90 percent CO2, from ethanol it's 90-95 percent CO2, and from ammonia it can be as much as 99 percent CO2. He said hydrogen producers and cement plants are next with CO2 concentrations in the flue gas generally in the 20-30 percent range. Refinery FCC (fluidized catalytic cracking) facilities and those farther to the right are clustered in the 10 percent range for flue gas concentration.

He directed attention to the chart on slide 7 that reflects the large difference in economics between a typical carbon capture system for ethanol versus a power plant. He relayed that in the US, the wind industry is getting about $61/tonne in tax credit subsidies for its low-carbon power production. After the increase last year, the credit for fossil fuel or point-source carbon capture is $85/tonne. He opined that the cost differential made sense because wind facilities provide

intermittent power, which is less valuable. He stated that the delivery of pipeline-ready CO2 from an ethanol plant is about $30/metric tonne. For the average power plant, the cost is about $104/metric tonne; some power plants can deliver for about $50/metric tonne, and for others the cost is closer to $150/metric tonne.

MR. GREESON opined that the older and more expensive facilities probably would not be considered for investment in carbon capture; it would be plants in the $50-75 range that would be considered. The reason is that markets in the US are not offering more for carbon-free products, power in particular. The $85/tonne tax credit has to pay for all the carbon capture; if CO2 can be captured and delivered for $50-60/tonne, it leaves $20-25/tonne for transport to the storage facility and the storage itself.

3:48:43 PM
MR. GREESON advanced to slide 8, NPC Study Estimated Cost of CCS. The chart reflects the breakdown for the CCS components to arrive at the total assumed value of $110/tonne. Transport and storage are estimated to be about one-third of the cost. Storage fees on the Gulf Coast are projected to run from $7-14/metric tonne and transporters are quoting prices from $14-30/ tonne. So far, no firm transactions have been made in this range.

3:50:03 PM
MR. GREESON advanced to slide 9, CapEx as a Function of CO2 Concentration. The chart shows that the cost of carbon capture is directly related to the concentration of CO2 in the flue gas. The typical power plant configuration for natural gas combined cycle (NGCC) is about 3 percent; the stream is very dilute and hard to capture. Coal fired plants hit the sweet spot of about 11 percent. Moving to the right, cement and steam methane reforming (SMR) have higher concentrations of CO2. The steam methane reforming estimate is 22 percent, which is the average of two tailpipes. One tailpipe has a concentration of about 10 percent and the other is nearly pure CO2.

MR. GREESON advanced to slide 10, CCS is Expensive - There is Reason for Hope. The chart shows that when there's enough replication and enough effort is focused on lowering the cost, it will happen. He spoke to the following points:

- Solar technology was not even close to economic just 10 years ago

- Today, costs are close to the value of intermittent power

3:53:54 PM
MR. GREESON advanced to slide 11, Policies Developers Look For. He spoke to the following policies:

- **Primacy** on Class VI permitting
- Public lands opportunity for storage solves a lot of problems for CCUS developers
  - One creditworthy landowner
  - Storage cost certainty
  - Consistent with other public interest missions of the state
- Long-term liability for stored CO2

3:57:41 PM
SENATOR WIELECHOWSKI asked how long it takes states to get Class VI primacy.

MR. GREESON replied that it took Wyoming three years.

SENATOR KAWASAKI asked what the overall market was for carbon capture and storage.

MR. GREESON answered that there's currently a huge push for carbon capture projects in the US. Congress increased the tax credit to $85/tonne and direct pay is allowed for the first five years of the 12-year program, which moderates the risk of entering the market. The overseas market is more difficult because there isn't a comparable tax credit.

SENATOR KAWASAKI asked whether the Petro Nova project near Houston, Texas was still operating.

4:00:52 PM
MR. GREESON answered that the current owners recently announced they were actively working on restaffing and restarting the oil company. He explained that the project started before there was a tax credit so the carbon capture had to pay for itself. That wasn't a problem when the price of oil was $110/barrel, but the price dropped to $30/barrel before construction was completed. It ran for about six years, three with carbon capture.

SENATOR KAWASAKI asked if the federal tax credits were necessary for a project to be economic.

MR. GREESON answered yes; not everybody is capturing CO2 so that cost can't be passed along to the consumer.

4:04:54 PM
SENATOR DUNBAR asked how it will pencil out if Alaska has to import the carbon it stores and the estimates for transport are $27/tonne.

MR. GREESON answered that long-haul pipelines from North American sources would be one possibility, and tanker shipping the CO2 is another option. He cited existing examples in the Lower 48 and the North Sea. He also mentioned a carbon capture project in Greece that shipped the CO2 to the Middle East for enhanced oil recovery.

PRESENTATION: ALASKA CCUS WORKGROUP AND A ROADMAP TO COMMERCIAL DEPLOYMENT

[Contains discussion of SB 49.]

4:07:28 PM
CO-CHAIR GIESSEL welcomed Frank Paskvan to discuss carbon capture use and storage in the Alaska context.

4:07:58 PM
FRANK PASKVAN, Affiliate Professor, Institute of Northern Engineering, University of Alaska Fairbanks, Fairbanks, Alaska, advised that the presentation was based on a Society of Petroleum Engineers' paper that he and his co-authors prepared for the western region annual meeting that will be held in Anchorage in May 2023. Today he intended to discuss the Alaska CCUS Workgroup, why the group is interested in carbon capture, others who are interested in carbon capture, and Alaska opportunities in this space. He noted that UAF joined the Plains CO2 Reduction (PCOR) Partnership based in North Dakota in 2019, and he started working on carbon capture in 2021.

MR. PASKVAN stated that he is a reservoir engineer who does reservoir modeling and field appraisals. He has experience in subsurface and gas injection for enhanced oil recovery.

4:11:26 PM
MR. PASKVAN began the presentation on slide 2, Alaska CCUS Workgroup Focus. He spoke to the following:

> The CCUS workgroup mission is to accelerate commercial carbon capture projects in Alaska.

Why?

- To attract new investments and
- To create options to decarbonize activities vital to the State's economy including power generation, refineries, and oil and gas production.

MR. PASKVAN described the CCUS workgroup's four subcommittees:

- Develop a State legal and regulatory framework
- Track and respond to funding opportunities
- Perform public education and outreach
- Develop a Roadmap to accelerate commercial CCUS

4:12:56 PM
MR. PASKVAN advanced to slide 3 and further described the Alaska CCUS Workgroup:

- Kicked off July 2022, continuation of group working Alaska's Department of Energy (DOE) request for information (RFI) response
- 110 attending meetings
- 30—50 members meet up to 4 times a month
- Diverse representation on the Workgroup
- University of Alaska Fairbanks has lead role
- Leadership represents Academia, Industry, and State Government
- DOE funds support the UAF-led Workgroup via PCOR, a Regional Carbon Sequestration Partnership

4:15:51 PM
MR. PASKVAN advanced to slide 4, CCUS Impact on Emissions. He spoke about the dual challenge of increasing energy demands and addressing the risks of climate change, and that carbon capture and storage (CCS) can greatly reduce emissions. He pointed to the chart on the right that illustrates different styles of electrical generation systems and the proportional amount of CO2 that's released per gigawatt hour of electricity generated. The traditional unabated coal plant emits CO2 at a rate of about 1,100 tonnes per gigawatt hour (t/GWh), whereas a modern coal plant with a second-generation carbon capture system emits less than one-tenth of the CO2. With beneficial use, the heat and carbon dioxide that's emitted could be used to enable an Alaska-based agricultural facility. This could bring the opportunity for both energy and food security to the state. He directed

attention to the box on the upper right of the chart that indicates that CCS also prevents pollution through post-combustion capture of not just CO2, but also noteworthy levels of SO2, NOx, and both PM10 and PM2.5.

He pointed to the examples of different power plants on the X axis of the chart, and noted that a second generation CCS abated coal plant emits just 100/tGWh of CO2 compared to a wind plant that's backed up with natural gas that emits 250/tGWh. He also noted the box on the lower left of the slide that cites the [Intergovernmental] Panel on Climate Change (IPCC) estimate that the cost to establish clean energy security is more than twice as expensive without carbon capture, use, and storage.

4:22:08 PM
SENATOR CLAMAN commented that for Alaska to become a significant player in CO2 capture, it will need to import significant amounts of CO2 for storage.

MR. PASKVAN responded that this is about the world facing the dual challenge and Alaska establishing the laws and framework that allows the state to do its part. Right now Alaska's emissions for stationary sources is 14 million tonnes per year, so that's what the state needs to take care of. CCS systems in Alaska may be used for enhanced oil recovery initially instead of for pure sequestration, but the technology will continue to evolve.

MR. PASKVAN advanced to slide 5 that provides an example of carbon capture, use, and storage. The two images on the top left illustrate capturing CO2 either from a fossil or biomass fueled power station at an industrial facility or directly from the air. To Senator Claman's question, he said he could envision a wind farm that captures CO2 directly out of the atmosphere and permanently stores it in an underground geologic formation like a depleted gas reservoir. He noted that Southcentral has more than a few depleted gas fields that could be used for this purpose.

4:26:24 PM
MR. PASKVAN advanced to the diagram of the carbon capture and storage process on slide 6. It includes geologic storage potential, stakeholder engagement and community outreach, and the regulatory framework. It shows the CO2 captured at the power plant is either injected into a depleted gas field or piped offshore and injected into a saline aquifer. He noted that both storage options were available in Alaska.

CO-CHAIR GIESSEL noted that DNR questioned whether there were saline aquifers in Cook Inlet.

MR. PASKVAN responded that the Alaska Oil and Gas Conservation Commission's (AOGCC) rules that protect underground sources of drinking water have exemptions for the injection projects offshore in Cook Inlet. This water isn't deemed a source of drinking water because of the distance from shore. He highlighted that DNR, DEC, and AOGCC were looking at this closely and were active participants in the Alaska CCUS Workgroup.

4:28:56 PM
MR. PASKVAN advanced to slide 7, US Department of Energy Perspective. He stated that Assistant Secretary of Energy Brad Crabtree spoke to the following during his address to the Alaska CCUS Workshop at Alaska Pacific University on February 21, 2023:

- US has a leading role in CCUS globally
  - BIL (Bipartisan Infrastructure Law)
    - Addresses all elements of CCUS
    - $12 billion for carbon management
  - IRA (Inflation Reduction Act)
    - $300 billion in clean energy including 45Q credits
    - Co-investment government & industry
    - Early project funding 80% Feds & 20% Industry; Later Stages 50/50 plus loan guarantees
- Cook Inlet – World Class Storage
- Alaska grid unique in USA, Potential for Decarbonization
- Impressed Alaskans are agents of opportunity

MR. PASKVAN advanced to slide 8 to discuss examples of funding opportunities for carbon capture projects. The slide shows notices of intent. On the left, $810 million was available for 10 large-scale pilot programs throughout the US. On the right, $1.7 billion was available for 6 carbon capture demonstration project programs. He pointed to the next slide that shows which US states either have or are in the process of developing sovereign legislation. The 13 states that already have comprehensive legislation are shown on the left and the states that have Class VI primacy or are seeking it are shown on the right. He credited DNR with the extensive research to develop

this slide; it reflects how active the topic of CCUS is throughout the US.

4:31:35 PM
MR. PASKVAN advanced to slide 9, Sovereign Legislation Survey. It shows a graphic of the states with comprehensive legislation. It's an indication of how active this topic is currently.

CO-CHAIR GIESSEL offered her understanding that North Dakota achieved Class VI primacy several years ago and was sequestering gas from Wyoming. She also mentioned hearing that Japan had communicated with North Dakota about shipping CO2 from Japan to North Dakota for sequestering. She asked what he knew about Governor Dunleavy's discussions about sequestering CO2 from Japan in Cook Inlet, which would not require a pipeline.

MR. PASKVAN responded that the opportunities to invest and make projects happen are in places that already have both Class VI primacy and comprehensive CCS legislation in place. For example, North Dakota is already an active hub for taking CO2 from other locations.

4:35:27 PM
SENATOR KAUFMAN noted that a bullet point on slide 11 of the previous presentation mentioned long-term liability for stored CO2. He asked what the maintenance requirements might be to retain carbon that was injected and stored over a long term.

MR. PASKVAN responded that if the state were to achieve Class VI primacy, managing the injection well would be part of the ongoing operation and there would be associated costs. The state would also have a long-term relationship with the EPA that manages the monitoring, recording, and verification (MRV) to ensure that the CO2 goes where it is supposed to go, that it doesn't migrate, and that it doesn't affect any other zones. The EPA also verifies the volumes of stored CO2. That is part of the process that an investor would have to establish to earn the 45Q tax credit.

4:38:08 PM
MR. GREESON added that the Class VI permit hearing that North Dakota went through addressed the issue of long-term

reservoir maintenance on the record. He suggested the committee look at that discussion and analysis.

CO-CHAIR GIESSEL noted that executive branch departments will present that information to the committee later in the week, which will include information about the integrity of the reservoirs that are available in Cook Inlet.

SENATOR CLAMAN asked what the typical timeline is to apply and get primacy and whether it's important for the state to have primacy before it actively pursues bringing CO2 to Alaska.

MR. PASKVAN replied that achieving Class VI primacy takes 2-4 years, and to show developers Alaska is open for business, it's necessary to get Class VI primacy and establish a regulatory framework for CCUS. He added that for a project to be eligible for the 45Q tax credits, construction must start by 2032. He said Alaska is in EPA Region 10 and the EPA has never done a Class VI injection in that region, so it would be a significant risk for an investor to consider Alaska compared to another jurisdiction such as North Dakota where it might take just a year.

4:41:28 PM
CO-CHAIR GIESSEL highlighted that Section 31 of SB 49 empowers AOGCC to seek Class VI primacy.

SENATOR CLAMAN asked if there was any point in looking at carbon credits before the state had Class VI primacy.

MR. PASKVAN confirmed investors will look elsewhere if the state doesn't have Class VI primacy and the regulatory framework of CCUS. He said the federal 45Q tax credits provide $85/tonne for geologic storage and $180/tonne for direct air capture (DIC). He added that he was aware of investors that were interested in DIC in Alaska because it's more feasible than in warmer climates.

4:43:31 PM
SENATOR KAWASAKI asked him to expand on the discussion about the long-term liability associated with CO2 storage in either a saline aquifer or a shale cap, and whether the storage is permanent.

MR. PASKVAN answered that CO2 has been stored on the North Slope for decades. The gas that's produced in both Prudhoe Bay and Point Thomson has quite a lot of CO2 and that gas is reinjected into the reservoir. It's a very effective enhanced oil recovery technique, due in large part to the CO2. He directed attention to the diagram on slide 10 that shows the injection of CO2 under multiple layers of shale into a permeable formation. This requires drilling a geologic appraisal well to determine the quality of the injection formation, the storage volume, and the reservoir seal on top. Alaska has decades of experience with those processes at Prudhoe Bay and the process has proven to be secure. He noted that, as written, SB 49 assigns the management of this job to AOGCC.

4:47:16 PM
SENATOR DUNBAR recapped the estimated timeline to start construction and to achieve Class VI primacy then asked how soon Alaska could start to generate revenue from carbon storage.

MR. PASKVAN answered that these are capital investments that take 5-6 years for an investment decision. Last fall he learned that EPA is encouraging developers to co-apply to EPA and at the state authority that assumes Class VI primacy. He also understands that AOGCC submitted a letter to EPA expressing interest in the process so it can qualify for a portion of the $50 million EPA aside for any state that is interested in seeking primacy.

SENATOR DUNBAR restated his question about how long it will take for Alaska to start generating revenue from carbon storage.

MR. PASKVAN replied that it depends on the project, but the earliest timeline he'd seen was 5-6 years. He added that carbon capture is a long-term effort and Alaska can get in early and create new long-term opportunities for investment.

4:51:45 PM
SENATOR KAUFMAN asked if he'd seen a level 1 master project schedule with the key milestones [listed on slide 11].

MR. PASKVAN answered that he'd been working on a case study under a non-disclosure agreement, but he could say that it was a capture project that potentially would generate clean

electricity that would be available at a lower cost than the current system. The timeline was on the order of six years.

4:52:55 PM
SENATOR KAUFMAN said it would be easier for people to understand what needs to be in place to move forward if they could see an example of a level 1 master schedule with primary deliverables for a carbon project.

MR. PASKVAN responded that a schedule of that nature would be included in the public version of the study he described. He said it should be available in the near future.

CHAIR GIESSEL noted the short time that was remaining and asked him to discuss the opportunities outlined on slide 13.

4:54:51 PM
MR. PASKVAN advanced to slide 13, Alaska CCUS Opportunity Roadmap. He spoke to the following:

North Slope

Advantaged by low-cost natural gas

- Natural gas-fired capture
- Direct Air Capture (DAC)
- Subsurface data integration & site-specific data gathering needed
- 40 year track record of successful CO2 sequestration & use, ~15 TCF
- Major Gas Sales 2015 LNG plan sequestered CO2 back in reservoir

Interior

Existing coal plant infrastructure

- Coal-fired capture
- Basic regional subsurface data gathering needed

Southcentral

Proximity to Port, potential for import

Capture not attractive at natural gas plants or refineries due to gas supply shortage & high price.

Coal or Hydrogen power with CCS can address natural gas shortage, food security, lower emissions

Imported CO2 storage (US West Coast or Asia-Pacific)

Subsurface data integration & site-specific data gathering needed

4:59:45 PM
MR. PASKVAN noted that he was ending the presentation by showing the same slide that he started with; it talks about what the workgroup is doing and the reasons for doing so.

CO-CHAIR GIESSEL thanked the presenters.

5:00:30 PM
There being no further business to come before the committee, Co-Chair Giessel adjourned the Senate Resources Standing Committee meeting at 5:00 p.m.