Illinois Department of Commerce & Economic Opportunity
JB Pritzker, Governor

Hydrogen Economy Task Force
May 14, 2024
8:30am – 10:30am
Minutes

Location: Virtual WebEx Video Conference
Meeting link: https://illinois.webex.com/illinois/j.php?MTID=m1e1fcb4218e5c21a132a8cb95b9cdb3f
Meeting number: 2632 219 7884
Password: RYgAAwJ2W27
Join by video system: Dial 26322197884@illinois.webex.com
You can also dial 173.243.2.68 and enter your meeting number.
Join by phone:
+-312-535-8110 United States Toll (Chicago)
+1-415-655-0002 US Toll
Access code: 2632 219 7884
https://illinois.webex.com/illinois/j.php?MTID=mfea3d30b1c27f61791afebd2e62ed2bf

Agenda:

I. Call to Order at 8:32 am.

II. Roll Call of Membership

Rep. Terra Costa Howard: Yes
Sarah Duffy: No
Patrick Evans: Yes
Bradley Fritz: No
Jim Hoyt: No
Dan LeFevers: No
Carly McCrory-McKay: No
Chad Parker: No
Laura Roche: Yes
Dr. Petros Sofronis: Yes
Michael Wang: No
Patrick Devaney: Yes
Sen. Laura Ellman: Yes
Kyle Freeman: Yes
Jon Horek: Yes
Elizabeth Irvin: Yes
George Letavish: Yes
Dulce Ortiz: Yes
Sen. Sue Rezin: Yes
Doug Scott: Yes
Catherine Stashak: Yes
Dana Wynn: Yes

Quorum was met with fourteen members being present.

III. Approval of March 19, 2024 Minutes.

Rep. Terra Costa Howard moved to accept the minutes from March 19, 2024. Pat Devaney second. The motion passed unanimously by voice vote.

IV. Chair Report.

Senator Ellman stated how hydrogen storage can be a constraint in building out the hydrogen economy. Along with how choosing a method for storage that is most suitable to the industry is important as well as safety.

V. Topic Presentation (Carbon & Hydrogen Storage)

Presenter Donna Willette of Prairie Research Institute did a presentation on Subsurface Hydrogen Storage Illinois Opportunities and Challenges (see presentation for details).

Presenter Kevin O'Brien, PhD, Director of Illinois Sustainable Technology Center and Director of Illinois State Water Survey Research Affiliate, Nuclear, Plasma, and Radiological Engineering of the Prairie Research Institute did a presentation on Hydrogen, Carbon Capture, Utilization and Storage (CCUS) and Their Role in Achieving Net Zero (see presentation for details).

All questions and answers were held until the end of both presentations.

Senator Ellman opened the floor to members for questions.

Senator Ellman's question to Donna Willette was "If there is brine in the water that has some chlorine in it could there be a hydrogen and chlorine could actually react and that kind of environment and would that pose a risk?"

Donna Willette replied, "When you're talking about brines. What you're talking about are actually molecules: sodium chloride, magnesium chloride, potassium chloride. They are already bound up. Because the chloride is a negative, sodium is a positive charge, so unless you have a few little negative ions running around in the sub surface. Usually in brine's though, those are already captured into those molecules. So, hydrogen when you inject hydrogen into brines for the most part there is no solubility because the hydrogen is a positive. It cannot attach to a molecule that is already bound with a positive and negative. So yes, you could have some hydrogen, a loss associated, in the subsurface if there's like these, negative ions running around, but typically in brines they are already bound up as molecules and so then they are stable."

Senator Ellman asked, "When we're injecting hydrogen what kind of temperatures are ranges are there? Because I know that there's been storage and cryogenic and liquid its very cold. If there's going to be underground storage, what's that temperature? And then will the temperature change over time once it's underground?"

Donna Willette replied by saying, "So to get hydrogen to inject hydrogen into the subsurface. You're going to need a compressor. Because hydrogen is a small molecule, it's a light molecule. You need a compressor to get it into the substance. So, usually the compressor,

there'll be some kind of heat associated with that injection. However, as the hydrogen moves, we're talking about 2,000 feet, 3,000, feet, 5,000 feet, almost a mile in the subsurface. By the time hydrogen gets there, whatever heat was kind of transferred in the injection is pretty much dissipated and you only have the reservoir formation. Temperature and the reservoir information temperatures here in the state of Illinois had those kind of depth range between 60 to 90, 95 degrees Fahrenheit. So, not really hot. So, the hydrogen isn't going to affect the temperature, at least that's what the modeling has shown us. The hydrogen isn't going to affect the reservoir temperature. Does that answer your question?"

Laura Ellman answered yes, so it will just be a gas?

Donna Willette answered yes, it's just gas. Hydrogen is so low density, low viscosity. That once you inject into the reservoir. It rises, it percolates through the pore space into that interface with the cap rock and there's no real increase in temperature.

Laura Ellman said so for, like, if we're injecting in sandstone… So, it would fill up the space, the pores with the gas and you'd have to vent out something in order to take that space?

Donna Willette replied, "No it displaces the water. So, remember, I was showing you those plumes. Those little spaceship things that I showed."

Laura Ellman said, "I think you answered my question so the water would be displaced to make way for the gas."

Donna Willette said, "Correct and the water would move laterally and the gas at the surface at that cap rock interface, as you cycle through, it also move laterally. So, the plume that I was showing in that diagram, the little spaceships. After the initial fill, we were at about 1,000 feet of lateral displacement, and after 180 days, it went up to 1,400 feet. Now, I just want to reiterate a couple of things. 1 is, these are models these are dynamic simulation models, these are reservoir models. That have been developed and been modified and develop for how to understand oil and gas distribution in the sub service, they've been modified to handle and now to handle a hydrogen. We do the best inputs that we can. On the rock properties, we use actual rock data, we use actual capillary pressure data. As much as we can, and that gives us a sense of how hydrogen might move in the subsurface. But these are just screening models as we get more data, we can populate the simulations in a better way. It's a work in progress is what I'm trying to say. But it does appear that hydrogen as long as you've got a viable capital, we'll be able to vertically prevent vertical displacement from the reservoir."

Daniel LeFevers asked, "Can you give background on what happens to CO2 underground as well as hydrogen?" (Daniel LeFevers also added in the chat Accelerating the Deployment of Underground Hydrogen Storage • GTI Energy)

Donna Willette replied, “There are two things to remember hydrogen is always going to be a gas in the subsurface, it's always going to be a gas it's in paper phase, C02 once you get, I believe it's around 101,000 feet a 1,000 psi and 80 something degrees Fahrenheit it turns from a gas into what's called a super critical fluid. So, it's got viscosities that are similar to water, but it's got buoyancy characteristics that are more similar to a gas, but it's called super critical and so when you're trying to store in the subsurface forever. You want to keep it where it's at? You're adding C02 all the time, right? You're not injecting and then producing. So, you're adding C02, so what happens is just like, with hydrogen, C02 will displace water, but the is a heavy model of your molecule it's in super critical phase. You're keeping adding volume to it so the pressures in the subsurface, as you add the C02 it'll start to increase and so as you displace the water, you're going to have kind of what's called a pressure front around the C02 plume. So, the pressure increased away from the C02 plume will be a lot larger than what you would do with hydrogen. Hydrogen, you're not adding volume all the time. They're initially putting a cushion gas in your initially putting work in gas in and once that's in and because hydrogen satellite, and it's in vapor phase you don't have that pressure contrast. Does that answer Dan's question? C02 and hydrogen are subsequent storage has physics that are very, very different from each other.”

Senator Ellman asked, “I really don't understand too much about the earth's crust, but I'm thinking that it's fairly slow moving that there's not a lot of dynamic changes going on. Unless water is moving what happens they're If the hydrogen cycle is going to be a lot faster than what's usually happening. Is that going to have any effect? What kind of effect will having that faster exchange going on is there any kind of modeling there?”

Donna Willette replied, the basics, the basics are when you inject usually when you inject cushion gas and this is the same for mapping for natural gas. And remember, we've got a whole bunch of natural gas storage builds here in Illinois. You don't inject all at once it takes days to do that and then what happens is you let the subsurface equilibrate for a period of time. And then you inject the working gas, and then you do some test on injection and production cycles. With methane, because methane is always a gas and with hydrogen, because it's always a gas and because both method and hydrogen are pretty buoyant. You don't see a lot of dramatic pressure fronts associated with those injections and it's pressure fronts that can actually impact the subsurface sometimes. I've just never heard of anything with our missing gas storage fields causing any issues, and I anticipate that hydrogen would cause any issues as well. When you look at C02, you do need to take into account the pressure front and then do modeling to make sure that that will not impact, you know, say any pre-existing fractures or anything like that. Does that help answer your question?

Doug Scott’s question was for Kevin O’Brien, about more clarifying questions Kevin, about the dolman, uh, pilot that you referenced. When I changed jobs, I lost track of that project a little bit. Why is it labeled a pilot? Are they, what's the percentage that they're trying to capture? And where are they going?

Kevin O'Brien answered by saying, this is labeled a pilot because number 1, we're not taking all of the C02 missions. This is 10 megawatts out of the 200 megawatts. And in this case under the DOE funding we are not allowed to store it or do anything with it. So, we will demonstrate the capture unit works and then, but we'll send it back up the stack. Now, obviously there's potential that if this looks good to move forward and look at full CCOFs. But this particular funding DOE says this is all that you can do with it. Now, there's also been discussions that once we finish this project, what can you do with it? And there's a lot of ideas that then we would, for example, take the C02 and utilize it for a lot of different applications. But those would be beyond the existing DOE funded project, which will end roughly mid-2026.

Doug Scott asked was their feed study was for 90 capture?

Kevin O'Brien replied yes, for this project, you had to do a minimum of 90% capture. With this technology frankly we know we can get to about 95% capture. You had to have 95% based on previous results, we should be able to get about 99- plus percent purity.

Petros Sofronis' question was for Donna. Do you include any fracture issues in your models? Are there or are there tall such issues that you are concerned with when you inject?

Donna Willette replied, "Is the question is the question. Do we include any fractures in the model? Yes, that's our intent. That's why we're doing the core flooding experiments. Because what we're going to do is we're going to induce fractures on some of those cores, and we're also going to get the cores that already have pre-existing seal fractures most of the fractures on the subsurface are sealed. And they're sealed with quartz, they're sealed with different kinds of carbonate usually it's quarts and so, the question is, can hydrogen diffuse through those seal fractures so that's what we're going to be doing in our next project. We need to make sure that our cap rocks are, can hold the hydrogen because it's such a small molecule and so we need to consider both the best case and the worst case scenario.

Petros Sofronis asked, "What is the partial pressure of hydrogen that you expect that you may have in those seals or even next to the brine?

Donna Willette replied saying, I don't have a good answer to the question. I can probably give you that offline. But what we found in our reservoir simulators, we put in compressibility. We put in density viscosity the normal physics of those molecules and then we've also put in capillary pressure data that we get from doing MICP analysis on the cores and all of those are integrated in addition to utilizing equation of state parameters for these modeling scenarios. However, well, let me just put this out there. I was saying this again I would look at these models basically as screening models, models typically aren't totally accurate. Models can be very useful, but in the subsurface they only give you a range of possibilities and so that's kind of what we're using on this.

Petros Sofronis second question was for Kevin O'Brien, I was in Washington last week, and the Department of Energy's meeting, I normally review an evaluation meeting with the entire hydrogen program that runs every year. And there was a lot of attention for geologic hydrogen. Where is our state? Do we have natural hydrogen underneath our state? Is there such a possibility?

Donna Willette answered instead saying as far as we know no, but we don't know a lot. There's two logic, hydrogen that appears to be generated along the Nemaha Ridge uplift in Kansas. It's a basement uplift and I think it has to do with synchronization, chemical reaction with certain kinds of rocks, based rocks in Kansas. There was a field, a gas field that was drilled on the Nemaha Ridge and they walked away from the gas field because the gas contain 40% hydrogen and not enough methane. So, people are going back and looking at that. Here in Illinois we have a basement complex called fixed dome in the South and we are trying to understand because nobody's really real deeply down into hit stone. We are trying to understand what kind of basement rocks are there? If they're the correct kind of rocks where you can have a lot of iron content theoretically, we may be able to generate geologic hydrogen either naturally or by injecting water down the hole. So that possibility exists, but we still need a lot of work to do to see if that's actually a possibility. So, the fixed dome is the site of a lot of critical mineral work right now with the DOE and Department of Defense there's a lot of critical minerals associated with and so once again, Illinois it's amazing to me how Illinois has been favored with some subsurface rocks that may end up being very useful to the United States as well as to the economy in Illinois and hydrogen might be part of that.

Petros Sofronis said he asked this question because one of the objectives of our task force here is to bring federal money to the state. So, my understanding is the agency is very much interested in this geologic hydrogen. So perhaps the state along with the geological survey we can work to bring some money here in order to check this out.

Donna Willette said I totally agree with you. We can converse offline and I can put you in contact with our section head for the critical minerals department here at the Illinois State Geological Survey, Jared Fiber who knows a lot about the basement rocks, especially if it picks down.

Dana Wynn had a question for Kevin about the dolman unit, and this is specifically for tasks that are related to work that are going to be like, in these pilot projects, and some of these geological spaces. Do you know how many people are kind of on that project with the operations and maintenance at that dolman unit and Springfield? And what are the backgrounds for those people? Are there any individuals that are coming in with, is there a requirement to have a bachelor's degree? Are there people that are being trained that have just associates degrees with some kind of background and chemistry or that kind of thing?

Kevin O'Brien replied by saying, I can definitely get the detailed information that you're looking for there. What I can tell you is the original plan once the system is up and operational was to take some of the operators. So, as you know, they shut down some of the units there. And the concern was, you had operators who remember the operators Union, and the question was, what were they going to do with it? And the plan was that once we have this system up and operational, that we would essentially employ those people. So, if you're asking, once you have the carbon capture system up and operational, what would be the background of those people? And my understanding would be you'd be bringing in people who are from the existing union who run the operations at the plant. And those people would be trained to be able to run that system.

Ira Rainey asked everyone in the chat the following: 1) "What cushion gases are most probable for H2 storage? CO2, CH4, or similar? 2) Early slide showed low capex for reuse of depleted gas reservoirs. Does this not face same materials of construction/ equipment design challenges for H2 in NG distribution systems? 3) Any concern of impacting the subsurface microbial/archea through H2 injection that makes up as much as 20% of all biologic content on Earth?"

Donna Willette replied by saying, the 1st question: When we did the simulations, the modeling, we tried it when you're doing the screening model and you try and keep things really simple and so we use hydrogen as the cushion gas. But there's been a lot of work recently done by National Energy Technology Laboratory, looking at using mapping as a cushion gas basically. Because we are, we are very familiar and know how to handle, nothing short, you can also use nitrogen. And there has been initial just some initial, very initial work done on whether or not, we could actually capex C02 have it's like cushion gaps. But right now the bulk of the work is regarding nothing as a cushion gaps. And the 2nd question…

Ira Rainey said, you showed some capex and operational costs related to different options and mentioned reuse of depleted gas reservoirs and having real low capex costs. I'm assuming that's because they're reusing equipment and well, heads and all those kinds of things. Does it run into the same challenges, though of putting hydrogen down methane handling assets is like we are anticipating for distribution networks and things like that? Pressors and such?

Donna Willette said, "yes, I wasn't able to get into the weeds exactly on how Gaffney Climb did all their work. But what I did realize is what they did count on for the depleted oil and gas reservoirs was they were using lighters in the casing production and stuff for the methane gas storage the infrastructure that was already there. Then for the compressors, they were utilizing compressors with special, you know, the special, steel, there's some pressures that are to use hydrogen. And that's what they use in salt caverns along the go close and you can use those same compressors for methane? So, that's what they're doing there they are utilizing some of the with additional components. And your last question….

Ira Rainey said you were talking about hydrogen interactions with the microbial activity down there. and I was just curious of any concern going that kind of the opposite way of negatively impacting the microbial rather than just losing hydrogen?

Donna Willette said, “It was entirely new. Well, the microbial communities and brine in the subsurface. They are very specifically designed to and habit and do well in sailing environments most microbial communities don't do well. In those environments and so the microbial communities. I mean, we have microbial communities in our fresh water and when you're storing whatever it is, you're trying to store, you're trying to keep that storage away from any of your fresh water. So, the microbial communities in our portable water, and in the service would not be impacted at all.

Ira Rainey asked so just a delicate balance, right? For microbial activity always and we fiddling with it.

Donna Willette said yes.

Senator Ellman closed the question-and-answer section.

VI. Old Business

- Decision-Making one-pager.

Senator Ellman asked that the one-pager be distributed to the task force members via email to look over and provide comments for discussion to adopt and vote on at the next meeting.

VII. Task Force Administrative Business

There was no other business to discuss at this time.

VIII. Task Force Members information share.

There were no updates at this time.

IX. MachH2 News

Daniel LeFevers gave an update that MachH2 too is working with OSAD and DOE several meetings have taken place over the last few weeks. DOEs goal is to get everything done as quickly as possible and they would like to have assigned agreement sometime in August, if they can get it.

X. Audience Comment Period

Senator Ellman opened the floor for public comment. No one from the public requested to comment.

XI. Adjournment

The adjournment of the meeting was moved by Dana Wynn and second by Doug Scott is at 10:10 am.

Future Meetings

a. Tuesday, July 9th at 8:30 am
b. Tuesday, September 10th at 8:30 am
c. Tuesday, November 12th at 8:30 am

Materials:

1. Donna Willette presentation on Subsurface Hydrogen Storage Illinois Opportunities and Challenges
2. Kevin O'Brien presentation on Hydrogen, Carbon Capture, Utilization, and Storage: Their Role in Achieving Net Zero