

# 【The 4th IERE Webinar】 Chat Box

**Q**

Thank you for the wonderful presentation. I agree with your opinion of the necessity for long duration energy storage with lower cost. Surely, thermochemical of Hydrogen and Ammonia are the promising candidate. But their energy efficiency is not so high compared to the batteries, so I consider that chemical energy is not appropriate to convert to electricity again. I think it is useful to apply for another sector, oil refinery, chemical, and iron manufacture.

How do you think about my opinion?

And I didn't know about liquid air using storage. If enough time, please show me what high the increase of power generation efficiency is.

I agree that the round trip efficiency of Hydrogen and Ammonia for energy storage is quite low. However, thermochemical storage including H<sub>2</sub> and carriers is really the only technology option for seasonal storage since they have very low standby losses and can be stored in quantities comparable to existing hydrocarbon storage. In a high renewable scenario, it will be a case of cost/land use for overbuilding renewable capacity to meet seasonal needs vs. cost of thermochemical storage.

Also, the round-trip efficiency of Liquid Air Energy storage is expected to be ~50-70%.

**A**

**Q**

Thank you for your excellent presentation. For the sCO<sub>2</sub> cycle, how much of efficiency is realized at this moment, and how much is expected as per technical improvement and scale ups?

Our target for indirect sCO<sub>2</sub> cycle efficiency using indirect heat addition (e.g. through a heater similar to a steam boiler) is >50% thermal efficiency at a turbine inlet temperature of 715 deg C. Oxy-combustion sCO<sub>2</sub> cycles w/natural gas are targeting ~55-57% thermal efficiency including all carbon capture loads.

**A**

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**Q** I would like to thank both the presenters for excellent and very interesting presentations. Apart from critical minerals and water, I wonder what you both see as the biggest threats to achieving net zero in the energy and industrial sectors?

Thanks for your nice comment. Sure, the slides are already available at IERE's website. I think another challenge apart from water and minerals are related to social issues... How will we make sure that we continue to give access to more and more people worldwide while making sure at the same time, it is sustainable.

**A**

**Q** Thank you for both speakers for a very interesting presentation.. my question would be how does smart grid related software and hardware would play in the carbon neutral future... this will be closely related to power system control and planning, and asset management both on the transmission and distribution levels. thank you.

Thanks. Demand Side Management (DSM) and Energy Management Systems (EMS) are crucial tools to achieve our carbon neutrality since all speakers mentioned the challenges related to large scale storage so that DSM and ERM can help in reducing the need for it.

**A**

**Q** Thanks for your sharing. One of the hydrogen transport pathway that you mentioned is using Ammonia. I wonder if Australia has any plan to create an Ammonia economy domestically to achieve a reasonable economies of scale? Because I think the end use application (direct use of ammonia) is an important enabler.

Thanks. Ammonia's role is clear when it comes to distribution, and perhaps storage. There is some capacity already for NH<sub>3</sub> production in Australia - both for export, but also domestic fertiliser and explosives production. This offers a great opportunity to gradually convert from gas-fired to low-carbon hydrogen-fed, taking advantage of existing scale and infrastructure.

**A**

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**Q**

Thanks for the great presentation and happy to hear we can count on you to import molecules from :-). Wondering whether one of your DAC technologies that CSIRO works on also allows capturing water from the air?

Good question ... let me take that on notice. Two of our techs are amine based (one liquid, and one solid) and another on MOFS, so perhaps not. But don't quote me on that!

**A**

**Q**

Thank you for your nice presentation. I would like to ask about the hydrogen use for vehicles. Other than the EV, is there any plan to introduce or demonstrate the use of hydrogen for vehicle in Australia?

Yes, very much. In fact, CSIRO has just taken delivery of our own Mirai and are currently building our own refuelling station as part of our hydrogen facility. While battery EV is always going to be a good option for urban commuter style transport, we expect a role for hydrogen for larger vehicles or those needing to travel long distances. What's also interesting for us is the direct use of ammonia in large, slower-speed engines, such as in ships and locomotives.

**A**

**Q**

Thank you for your presentations. In terms of Japan's energy sources, I remember reading over the last few years that the extraction of under-sea methane hydrates is one area of research for a domestic fuel supply for the country. Is this something that is seen as having a high importance in terms of research for the country?

That's an interesting one. Methane hydrates is one of those topics that comes up regularly, and then seems to disappear quietly. I'm not sure what the state of the art in that area is.

**A**