House of Representatives Standing Committee on the Environment and Energy

ANSWERS TO QUESTIONS ON NOTICE

CSIRO

Inquiry into the current circumstances, and the future need and potential for dispatchable energy and storage capability in Australia.

11 08 2021

QUESTION 1: Hansard page 3 – Mr Josh Wilson

Mr Josh WILSON: ... Has CSIRO done some analysis that looks, on a comparative basis, at what currently is the most efficient form of storage, being mindful of course of the fact that that efficiency has a temporal element to it as well? I assume that, if you wanted to put it into a form of storage and then have it back within a 24- or 48-hour period, it might be that the batteries would be more efficient, but, if you wanted the storage for a month or longer, there might be a storage technology where the greatest amount of energy is retained. Has CSIRO done some of that comparative work on different forms of storage?

Dr Niemelae: CSIRO is working on this broad spectrum of different storage means and with a different depth of science there, depending also on the business unit that is engaged with it. This direct comparative basis that is described herein is a fairly complex issue, and I would take this question on notice—unless, Dietmar, you want to add something?

Dr Tourbier: I do think we should take that one on notice. We have done work in this space, but it's not at our fingertips at the moment that we can respond to it.

ANSWER

There are numerous forms of energy storage including potential (e.g. hydro and pumped hydro), chemical (various batteries, hydrogen), thermal (phase change materials, fixed bed solids) and pressure (compressed air). These range from novel to mature and each of these storage technologies has different strengths, limitations and round-trip efficiencies which need to be considered as well as the context in which the technology is to be deployed.

The most important factor to consider is cost (capex $/MWH installed) and opex ($/MWH)) but other factors such as response time, maximum discharge rates, maximum storage capacity and the manner and timeframes in which they are recharged also need to be taken into consideration when looking at comparisons.

Of current technologies, pumped hydro and large-scale lithium-ion batteries are typically the two main options with batteries suited to shorter duration (<4 hours), fast response applications. Pumped hydro is more suited to longer duration applications (>4 hrs). CSIRO has investigated a range of novel technologies and undertaken several technology scans over the years with that knowledge now embedded in our GenCost modelling tools and reports (Graham et al., 2021). A more recent technology scan has also been completed by National Renewable Energy Laboratory. This is available at: https://www.nrel.gov/docs/fy21osti/76097.pdf

Reference: Graham, P., Hayward, J., Foster J. and Havas, L. (2021) *GenCost 2020-21: Final report*, Australia. https://www.csiro.au/-/media/EF/Files/GenCost2020-21 FinalReport.pdf

QUESTION 2: Hansard page 5 – Ms Steggall

Ms STEGGALL: … Why are gas executives with clear conflicts of interest sitting on committees under the umbrella and the reputation of CSIRO? And how are you ensuring that the research and submissions of CSIRO stand as independent from influence from those gas executives?

Dr Niemelae: GISERA is funded largely by state governments, and then we have the industry key stakeholders as part of that research. All of our research findings in GISERA are scientifically sound. They are based on independent trust and advice; I think that we have addressed that in various panels and queries. Should there be a further need to elaborate, I will take that on notice and have a discussion with our research program and with those directly involved in GISERA, as they are not represented here today.

ANSWER

The key decision-making process within GISERA regarding scientific research focus and project funding approval is through its Research Advisory Committees (New South Wales, Northern Territory, Queensland, South Australia and Western Australia). These committees have a clear and hard-wired majority representation of independent and community members. All decisions are carried by simple majority.

The combined membership of GISERA's five Research Advisory Committees currently comprises 73 per cent community and independent members, 19 per cent government members, and 8 per cent industry members.

CSIRO representatives on the committees have no voting rights. The industry members are not "gas executives" – they are operational level managers with relevant experience in issues such as environmental approvals or hydrogeological expertise.

For example, the Northern Territory Regional Advisory Committee has one government member, two industry members, and six independent and community members, including current and former land council members.

CSIRO's GISERA has strict governance arrangements in place to ensure the independence of its researchers and the integrity of its science. Research is published regardless of the findings, and all data is made publicly available. More details about CSIRO GISERA's governance arrangements are available online at https://gisera.csiro.au/research-independence/national-gisera-agreement/.

QUESTION 3: Hansard page 5 – Ms Steggall

Ms STEGGALL: The Energy Security Board has come out backing a physical retail reliability obligation. In effect, it's involving payments to dispatchable generators to be available at times of peak demand. But it's really unclear who will pay for that physical retail reliability obligation, and it's really unclear what the evidence is for its necessity. Does CSIRO back the approach that payments should be made, essentially, to have that capacity on hold? And, ultimately, do you back that it is the consumer that should have to pay for that, because you've talked about the importance of pricings around energy?

Dr Niemelae: CSIRO doesn't comment on any policies or regulations. We are the science organisation that provides scientific facts and trusted advice, hence that's a question that doesn't fall into our mandate.

Ms STEGGALL: So you don't support that it's necessary to have that energy supply on hand?

Dr Niemelae: I will stick with the answer I provided. We don't comment on policies or regulations. We provide scientific advice.

Ms STEGGALL: There's either a demand need for that energy to be on standby or not. Does it come under the storage? Is there an actual market need or an energy supply need for that supply or demand to be available on call, in the way that it's being proposed?

Dr Niemelae: If there are any aspects to that question that has been raised that we will be able to address as a science organisation, we can take them on notice. On any aspects related to policy regulation, we will not be able to comment.

ANSWER

Every electricity system requires a mix of low-cost, slow responding generation capacity for the bulk of electricity supply as well as faster responding, higher-cost flexible generation for load following during peak times or during other generation outages.

The original design of the National Electricity Market envisaged that allowing energy market prices to rise during times of high need for flexible generation would be a sufficient signal to investors to ensure enough flexible capacity would be built. There are additional market mechanisms used around the world, including in Western Australia where an explicit capacity market exists alongside the energy market price.

CSIRO has not used its electricity market modelling capability to look at the necessity of additional payments to dispatchable generators in Australia's evolving electricity system. There are always practical requirements for reserve capacity in a grid system to deal with changes in demand and unscheduled disruptions due to equipment failure and other events to ensure supply and demand can be maintained in balance at all times. The form and quantity of this reserve is something that is specified by the operator based on the available assets in the system, the level of reliability required and their operating experience and protocols. Higher reliability typically requires more reserve.

This is a question best directed to the operator which is the Australian Energy Market Operator.

QUESTION 4: Hansard pages 6-7 – Mr Burns

Mr BURNS: Do you have a rough estimation of how much more affordable it is to use gas as a firming agent versus other forms of technology?

Dr Niemelae: I think that that's a question we need to take on notice. As was already indicated, it's not presently part of our GenCost scenario modelling; hence we cannot answer that readily. It might even be that we don't yet have that answer available, when we look into it in more detail.

ANSWER

The GenCost 2020-21 report conducted modelling which looked at options to achieve low or zero greenhouse gas emissions.

The analysis showed that low or zero emissions electricity systems are generally very similar in costs to those systems that are left to evolve without an emissions constrained pathway. In the modelled low emission future system, flexible capacity fuelled by natural gas is replaced by short and long duration storage technologies plus low emission fuels such as hydrogen and biogas which can be used in modified gas turbines. While the cost end-point is similar, there are additional transition costs depending on how quickly the system is required to reach a low or zero greenhouse gas emissions system.