



Facility integration and
thermal batteries

Wednesday 20 October 2021



Jarrod Leak

Chief Executive Officer

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A2EP member & partner organisations





Procurement and flexing recap

ARENA's load flex study will estimate greater demand flexibility could reduce transition costs by over **\$8bn (NPV)** due mainly to less battery capex and generator fuel costs.



Assess Your Risk Tolerance

Engage stakeholders to assess the corporate risk profile

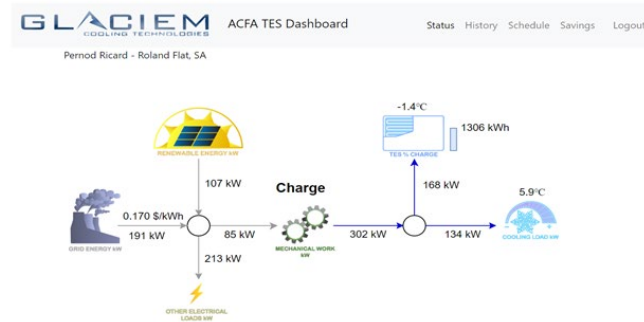
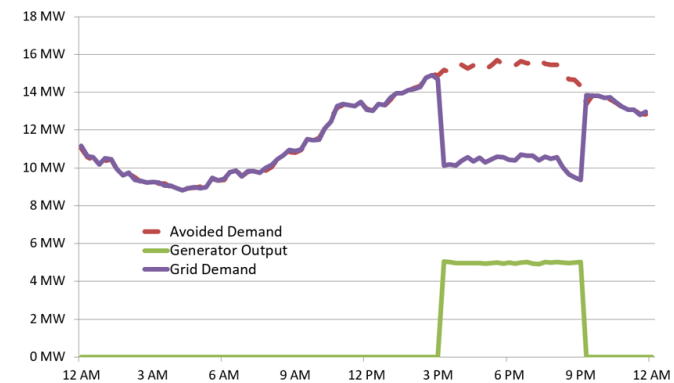
- Answered by stakeholders from their point of view
 - Corporate risk tolerance
 - Goals of risk management
 - Financial limits
- Typically, different functions within a company view goals and risk tolerance differently
- Determines suitability of products
- Fosters dialogue leading to consensus about organization goals

Confidential Property of Schneider Electric | Page 10

Life Is On | Schneider Electric

Load Shifting - Demand Response / RERT

- This 6 hour long Demand Response activation reduced grid demand by 5 MW during a Victoria peak electrical day, while not affecting building operations.



Today's presentations

Sunshine university – precinct cooling & thermal battery solution



Angela Cooney
Sustainable Solutions
Manager



Andrew Darr
State Manager
(Qld), Energy



Helen Fairweather
Senior Lecturer,
Environmental
Engineering



A novel tie-in to trigeneration at UTS



Jonathan Prendergast
UTS Green
Infrastructure Project
Manager



Today's presentations

Thermal battery and heat pump sizing



Charles Luo
Energy Consultant



Jarrod Leak
CEO



Combined electric and thermal storage systems



Florian Naumann
Country Director,
Australia



Today's presentations

EnergyNest Thermal Storage Systems



Nick Holmes
General Manager,
Australia



Thomas Palkovich
Vice-President,
Project Development





THERMAL BATTERY AND HEAT PUMP SIZING

A2EP Presentation

Charles Luo

Engineering Team Leader



Shell
ENERGY


Upcoming events




 AUSTRALIAN
ALLIANCE FOR
ENERGY
PRODUCTIVITY

Process heating alternatives

An A2EP webinar event
Thursday 4 November, 3:30 pm AEDT



 AUSTRALIAN
ALLIANCE FOR
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PRODUCTIVITY

High temperature heat pump solutions

An A2EP webinar event
Wednesday 10 November, 3:00 pm AEDT

Register and catch up on past events at www.a2ep.org.au/events



WEBINAR

INTEGRATING HEAT PUMPS INTO AQUATIC CENTRES

PRESENTED BY:



 AUSTRALIAN
ALLIANCE FOR
ENERGY
PRODUCTIVITY

Energy procurement and load-shifting

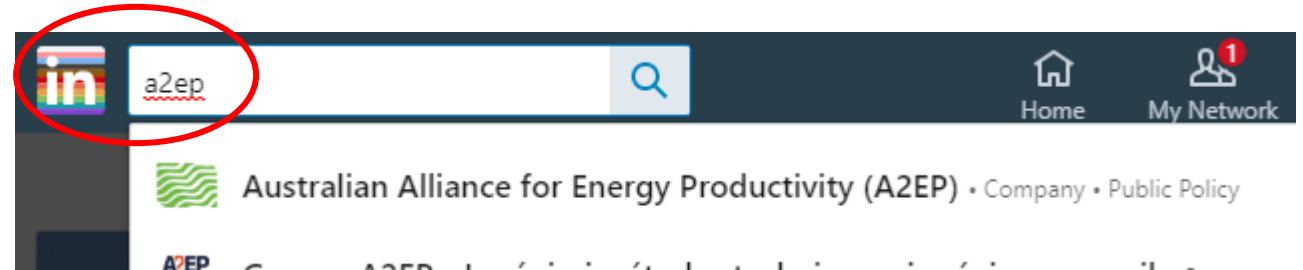
An A2EP webinar event
Wednesday 13 October, 2:30 pm AEDT

Want more? 3 steps to more A2EP

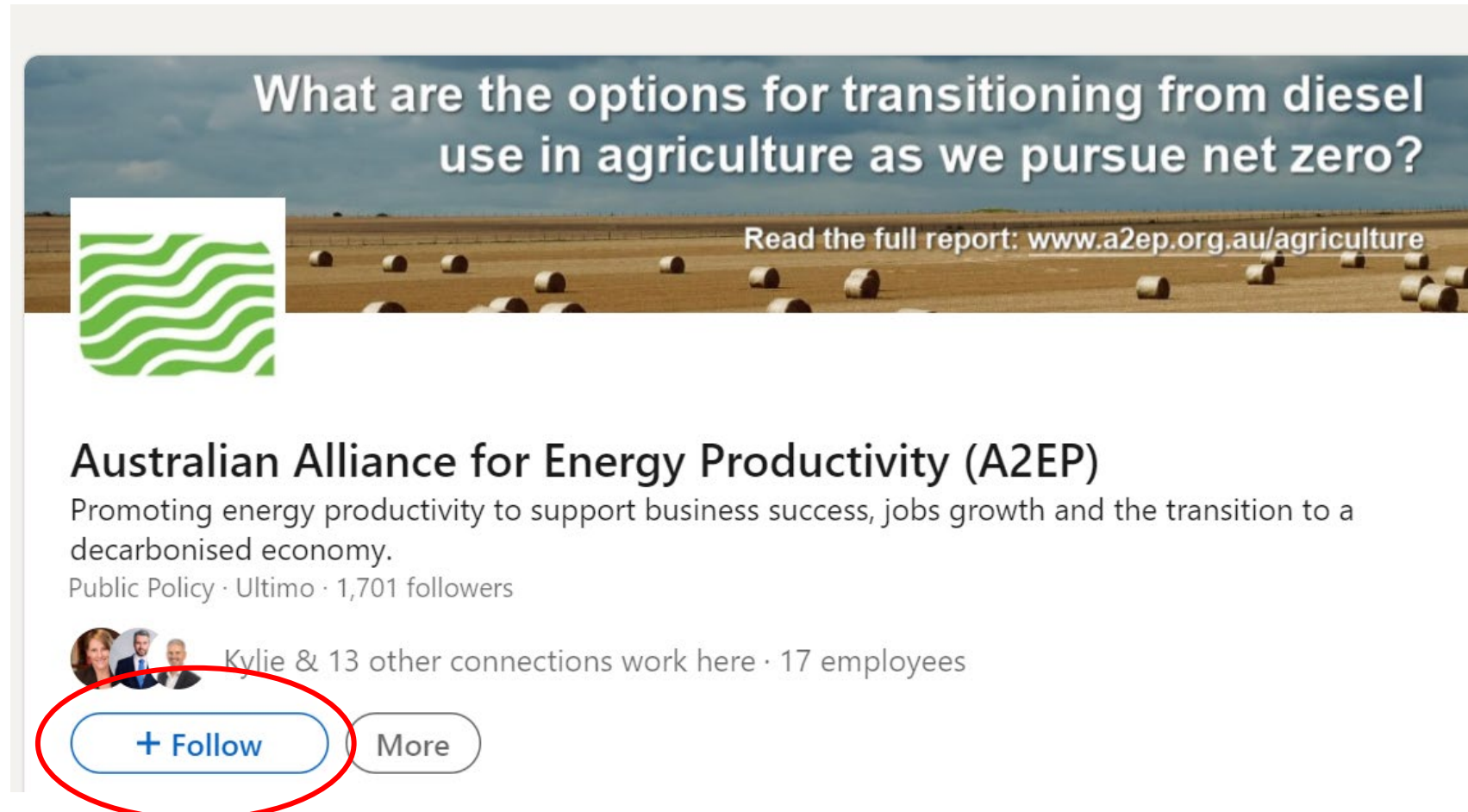
1

LinkedIn

2



3



A screenshot of a LinkedIn post from the Australian Alliance for Energy Productivity (A2EP). The post features a banner image of a field with hay bales under a blue sky. The text on the banner reads: "What are the options for transitioning from diesel use in agriculture as we pursue net zero?" and "Read the full report: www.a2ep.org.au/agriculture". Below the banner, the A2EP logo is visible. The post title is "Australian Alliance for Energy Productivity (A2EP)" with a subtitle "Promoting energy productivity to support business success, jobs growth and the transition to a decarbonised economy." and "Public Policy · Ultimo · 1,701 followers". At the bottom, it says "Kylie & 13 other connections work here · 17 employees". A red circle highlights the "+ Follow" button.

Thank you



Jarrod Leak

Chief Executive Officer

jarrod.leak@a2ep.org.au



- I wonder the cost comparison between thermal storage and lithium battery storage. I imagine it is a lot cheaper!
 - From my research, costs of water storage is roughly \$6AUD per kWh and phase change materials are around \$150-\$200/kWh. Batteries are typically >\$800/kWh. These are capex costs only.
- I imagine there is some residual charging of the TES from the grid. Is there a preference for daytime to soak up low QLD grid prices, and therefore powered by solar?
- Why not put the storage tank underground to improve insulation? Was the heat gain outweighed by the extra cost of excavation?
 - Excellent question. We did consider that but the costs were prohibitive.
- What temperature are you storing at? What is the COP of the chiller for that temperature ?
 - Thanks, I can't recall the specific full load COP but it was between 6 and 7. Part loads over 10. Chilled water is produced at 5 deg C.
- Great Tool! Where can we access it from?
 - Thanks! If you are interested in trialling the tool Charles and Jarrod demonstrated, please email Jarrod: jarrod.leak@a2ep.org.au

Q&A from the webinar



- Using solar PV for TES charging means that charging cycle of TES coincides with solar, which is also the peak of cooling demand. What is the discharging cycle of TES? Do you have enough cooling demand in the after-hours?
 - Thanks, yes we have a substantial base load across the site.
- An environmentally friendly refrigerant for the cooling plant was mentioned. Do you know which refrigerant that was?
 - 514a was used. Chillers were the Trane CVHM.
- How the chilled water pipeline across the Broadway was constructed? Was that open-cut trenching or directional drilling etc? How much time it took to construct this line?
 - Answered live
- The COP numbers are quite low especially for ammonia. Are they both concurrent? So $1 \text{ unit in} = \text{COP}_c + \text{COP}_h$, in which case its a bit better.
 - Yes they are both con-current so combined COP of approx 5-6. Low COP coming from the large temperature lift for the case shown.
- For Azelio: Have you considered using other alloys (e.g. solders) to cater to other low temperature heat applications?
 - I am sure this has been considered by Development but AL turned out to be the best contender.
- Also is Azelio is considering coming to India as a potential business location? Considering renewable energy is rising strongly there?
 - Please send me an email in relation to that to florian.naumann@azelio.com.
- What is the round trip efficiency expected?
 - RTE depends on environmental factors as well as charge and discharge duration and cycle curve. Happy to walk you through it in a meeting. Main design consideration is that if you install 50MWh you will still have 50MWh in year 30 whereas chemical batteries require 1.5-1.7x to be installed to be able to guarantee the usable energy storage for 7-10 years under any temperature condition. If you take that to 30 years chemical batteries are not scalable.
- What is the energy recovery efficiency not including waste heat for TES POD? Power out compared to power in.
 - RTE depends on environmental factors as well as charge and discharge duration and cycle curve. Happy to walk you through it in a meeting. Main design consideration is that if you install 50MWh you will still have 50MWh in year 30 whereas chemical batteries require 1.5-1.7x to be installed to be able to guarantee the usable energy storage for 7-10 years under any temperature condition. If you take that to 30 years chemical batteries are not scalable.

Q&A from the webinar



- What is the round trip efficiency of your thermal battery (i.e electricity to electricity)?
 - RTE depends on environmental factors as well as charge and discharge duration and cycle curve. Happy to walk you through it in a meeting. Main design consideration is that if you install 50MWh you will still have 50MWh in year 30 whereas chemical batteries require 1.5-1.7x to be installed to be able to guarantee the usable energy storage for 7-10 years under any temperature condition. If you take that to 30 years chemical batteries are not scalable.
- Can the hot water from TES.POD be used directly for HVAC (space heating 60-80 degree C)?
 - Yes it can via a heat exchanger.
- What sort of \$/kWh is the storage+ energy generator combo?
 - This is highly dependent on the load curve, the location of the project, size of the project and PV charging costs. We have many projects we work on Australia where it is very competitive. Feel free to send me an email and we will have a look at your project. florian.naumann@azelio.com.au
- Florian, why are individual Stirling engines so small? Can they scale up to 100's of kW or MW for individual engines?
 - it is related to the pressures in the system and the temperature etc. The current size has been trialled and tested. Happy to chat. Just send me an email to florian.naumann@azelio.com.au
- The Stirling engines that powered the overland telegraph line in early last century used concentrated solar collectors to heat the phase change material. A perfect way to operate at a domestic scale to generate hot water and electricity 24 x 7 with sufficient stored heat - no electrical input required. Will domestic scale systems be part of the offering in Australia?
 - Feel free to send me an email to florian.naumann@azelio.com Currently we don't see the domestic sector as a main focus for us due to PV charging requirements and the size and space requirements of the TES.POD.
- Are there any building regulations a hot and cold water storage tank needs to meet?

Webinar concluded