

CONSORT

Bruny Island Battery Trial

Social and Technical Outcomes

Energy Consumers Roundtable: 27th Feb 2019

Dr Phillipa Watson - Research Fellow, School of Social Sciences, and
School of Technology Environments Design, University of Tasmania

Assoc. Professor Evan Franklin - Centre for Renewable Energy and
Power Systems, University of Tasmania



UNIVERSITYof
TASMANIA

About the CONSORT BRuny Island Battery Trial

What is the Bruny Trial?

**How can we enable “residential power plants” to provide services to the power system in a safe way for networks?
= *Network Aware Coordination (we have got the NAC)***

ARENA funded

~7.9m total value, \$2.9m ARENA funding

April 2016 – March 2019

3 year research/2 year trial

Manage cable load and Diesel use with the NAC (Network Aware Coordination)

~150 kW battery capacity

~34 customers

Collaboration: ANU, USyd, UTAS, Reposit Power, TasNetworks

3 years (2016-19), funded by Australian Renewable Energy Agency

CONSORT

Bruny Island Battery Trial



Social Research

Engaging with the people involved
(...consumers, technology users or whatever
we want to label them...)

The social research team:

- Professor Heather Lovell;
- Dr Phillipa Watson;
- Dr Hedda Ransan-Cooper;
- Dr Andrew Harwood; and
- Veryan Hann (PhD candidate)

The social research broadly asks:

What are the householder responses?

34 Participants: mix of life stage, and socio-economic backgrounds

Before/after installation approach:

- **3 in-depth interviews** with each household– 1 prior to install, 1 just after install and 1 (about) a year after install
- **House observations**
- **Context observations**, observations of processes,
- **Energy diaries**
- **Focus groups** pre and post.

Social research findings

Finalising analysis for 30th March

Overall, the trial worked!

We learnt so much due to critiques from participants - This was a very engaged participant group.

1. Context – the island and the community
2. Householder motivations/values
3. DER at home
4. Complicated technology
5. Installations as a key moment
6. Reactions - emotions as an indicator

1. Context – the island and the community

Bruny Island – Natural and special



Rural roads, line lines and many poles

Outages happen, infrastructure has to stretch. Small permanent population, but



Bruny Island is a tourist destination

Fluctuating pressures from tourists, including on the electricity network.



2. Household motivations/values

Three common values on top of financial value

the environment
the community
reliability



Reliability

Battery back up and energy security are strong motivators. However, reliability is a different concept for householders, compared to utilities and regulators.

'We've got to run a bore pump, we've got to run electric fence and ...have it set up so if we ...have a power outage, the batteries would supply power to those systems. Our main risk, especially in summer, it is bushfire, so if we don't have a bore pump operating we can't really supply water around the house. Also we also have troughs to the cattle so that supplied by the bore pump as well, so they were able to do that, and a bit more. They were able to set it up so that it supplies power to this kitchen area too. So it means the fridge and our deep freezer's connected to the battery.' (BT123 post install interview May 2017)

Concern for backup

'But then, last night didn't charge up the battery, and I really need the battery power today, and I asked her why - I asked the girl at Reposit, you know, how come my battery isn't charging up when it's flattened over night during the evening, and she said it's probably trying to save the number of recycles and stuff it does.' (BT104 post install interview May 2017)

'As I see it, our only choices are when to use appliances.'

'I would like to be able to say, 'Charge it up now,' because I know, as opposed to the software, that tonight's going to, ...We're going to have lots of people round or we're going to be cooking big meals ... But we currently don't have that facility. And [...] made a point on the participant's forum that, you know, if it's not a particularly cold day, he'll use the heat pump. If it is a very cold day, he'll light the wood fire. And, of course, Reposit doesn't know that. And whether Reposit's clever enough to start picking up these subtle differences or not, well, who knows?' (BT132 post installation interview July 2017)

3. DER at home

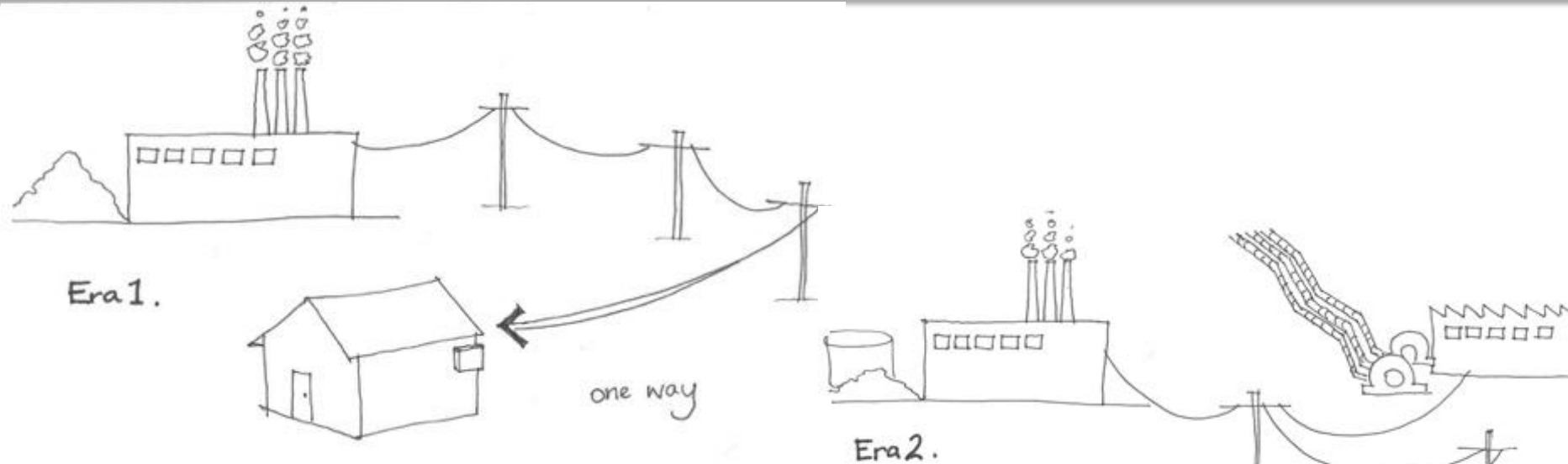
Aesthetics and technical integration in homes



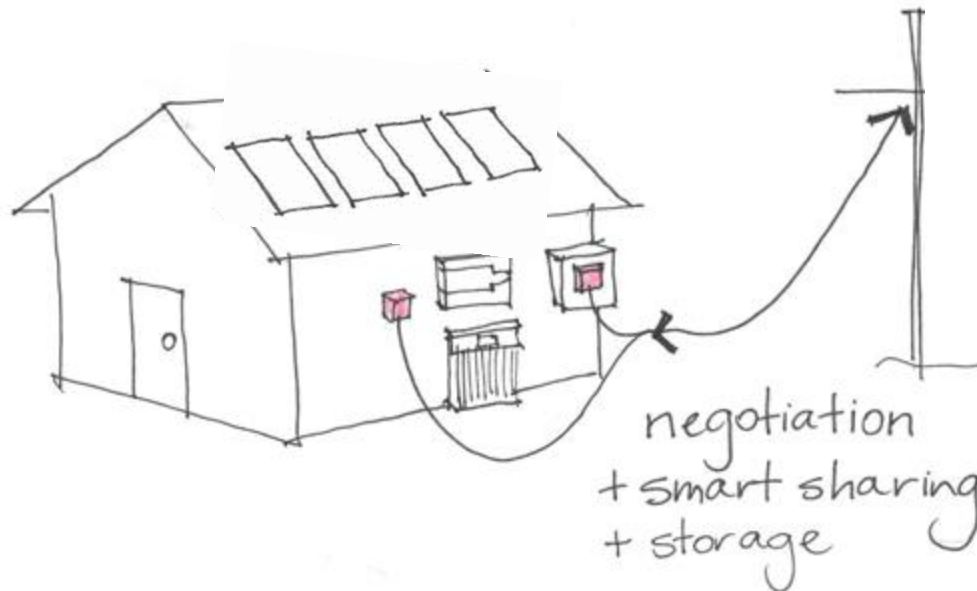




4. Complicated technology... new relationships



A new role for householders



Testing two way, negotiated, controlled sharing



5. Installations as a key moment

‘That guy came here and blinded me with statistics, and pages and pages of stuff. And what I found that each installer - and I said to people it’s like choosing an insurance policy. Everyone’s got their own version of what solar system is best for you.

And remembering I knew nothing about solar systems before this at all, bar the fact that I was always thought the return would take about 20 years or so.’ BT122

Information needs are significant – TasNetworks, Reposit, social researchers all called on much more than anticipated. Tailored support is needed. Face to face information is preferred and there is a need for it to be ongoing (one-off won’t work).

But the market model puts a lot of this on installer who have very tight margins.

6. Reactions – emotions as an indicator

‘Typical’ participant

- Well educated
- Keen to help the community/the environment
- Easily overwhelmed by installation – often went with the person they felt they could trust; who seemed ‘expert’
- Confused about the details of how network support works, and the financial nitty gritty of the tech, tariffs, etc
- Willing to change behaviour, interested in own energy use



UNIVERSITYof
TASMANIA

NAC and Network outcomes

Some results

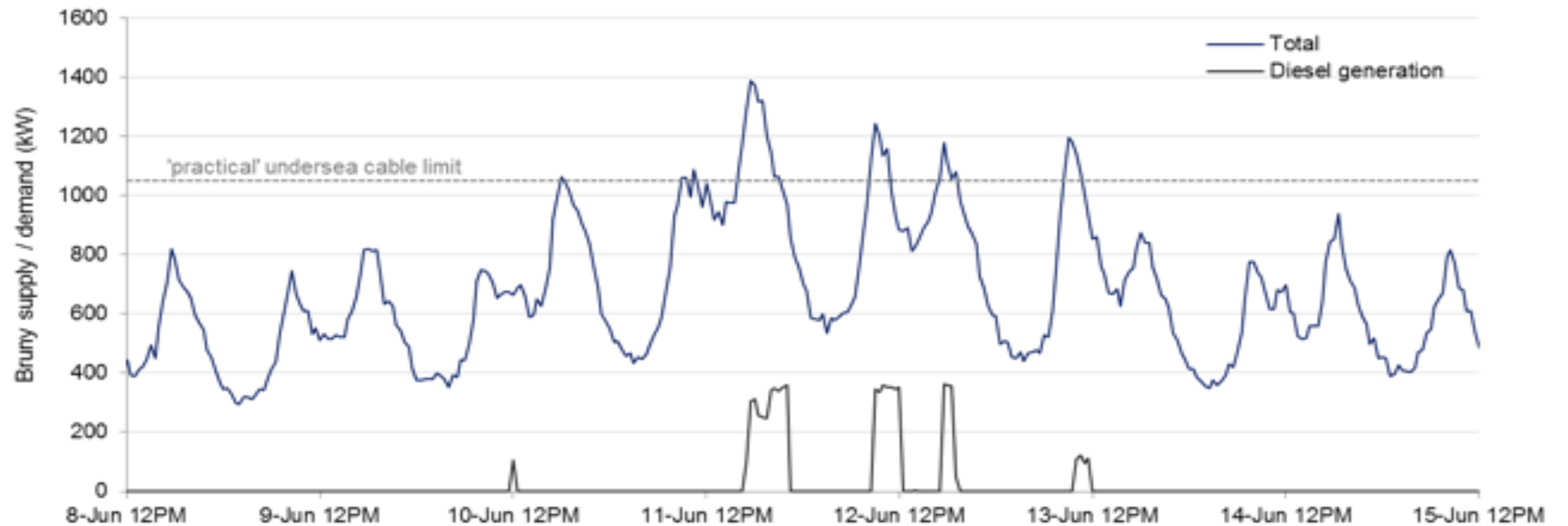
Why coordination of consumer DER is a necessity?

- High penetration DER does / will result in new technical challenges / problems
- Many technical problems (network or power systems level) can be minimised or solved by coordination of DER
- Value of DER to consumers can be maximised via coordination of DER
- DER are coupled via the physical network; all coordination must be done within its technical constraints

➔ **Network Aware Coordination (NAC)**

Bruny Island provides a ready made problem to solve!

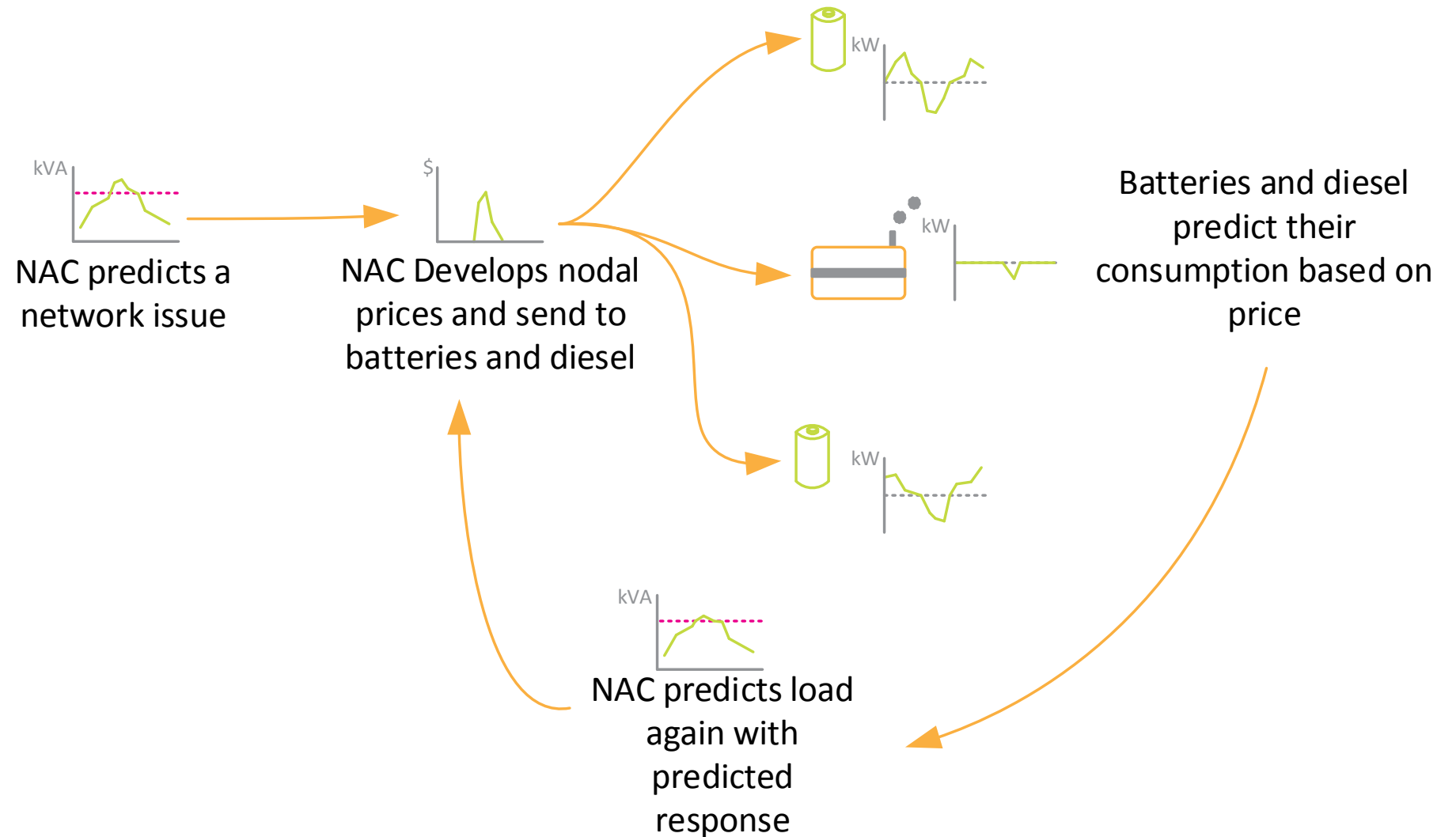
- Majority of network issues are related to high penetration of solar PV
- Most network issues and power system issues not apparent yet
- Bruny has an atypical problem... but one that makes sense to solve now using NAC!



How does NAC work? How does it integrate with the consumer?

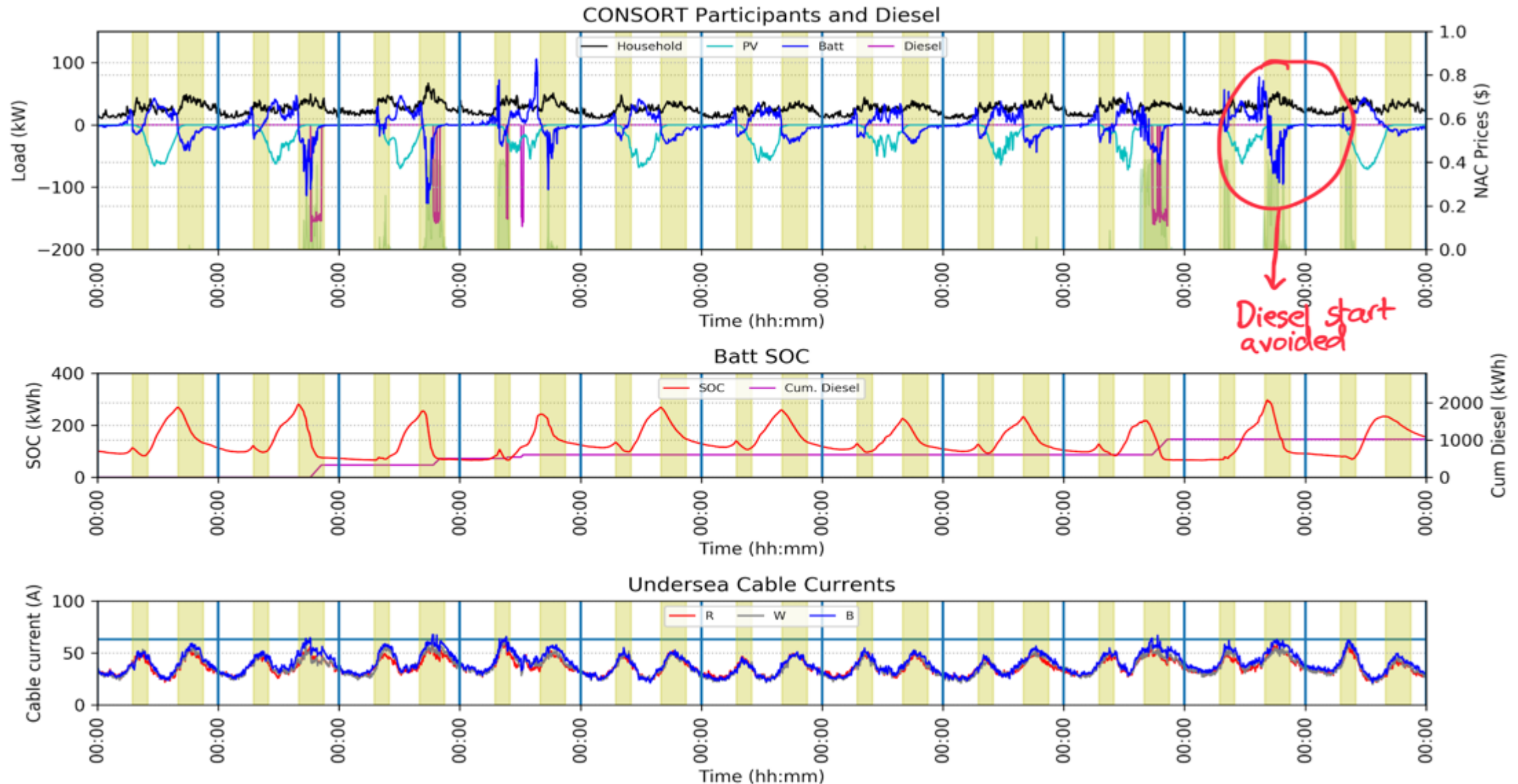
- Each consumer owned device (battery + Reposit box) predicts solar generation and household load for the next 24 hours and used knowledge of tariffs (eg retail TOU) to determine 24 hour battery charge / discharge schedule, to minimise energy costs.
- Updated continually (eg. every 5 minutes)
- NAC uses own predictions of network load and anticipated action of all batteries, resolves network power flow and checks that technical constraints are met.
- When NAC forecasts a large network peak (or could be low / high voltage), it sets a marginal price (24 hours ahead, 5 minute prices) for each battery.
- Batteries alter their charge / discharge schedule so as to minimise energy costs.
- Iterative optimisation procedure arrives at 'least-cost' solution; repeated / updated every 5 minutes.
- Each battery may see a different NAC price; but actual consumer payments can independent of these.

How does NAC work? How does it integrate with the consumer?

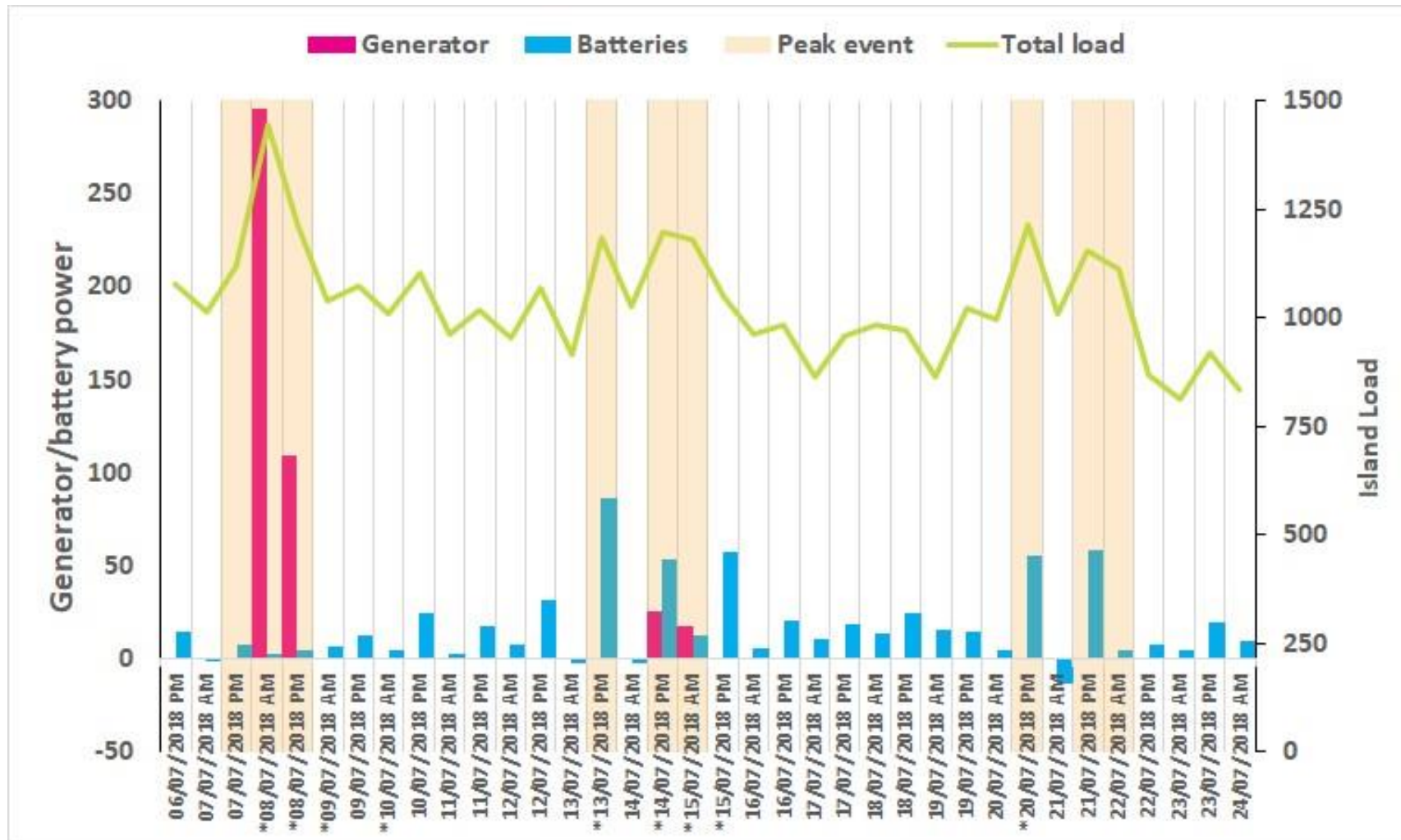


How did customer batteries and NAC solution work?

Network support over the July school holidays, 2018



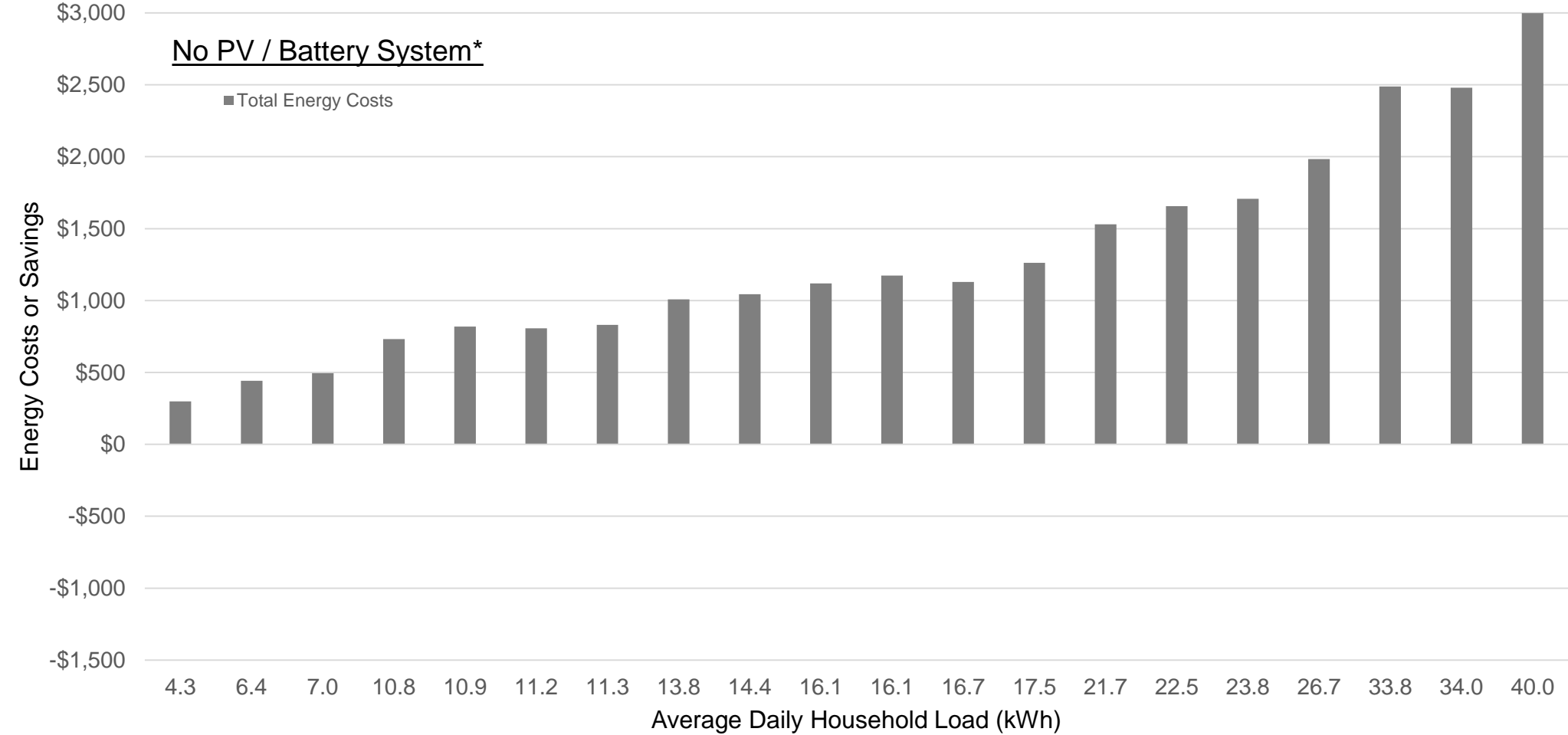
Network support over the July school holidays, 2018



Graph generated by Laura Jones, TasNetworks for a participant 'forum post': permission given to use

How did Bruny participants' energy costs change?

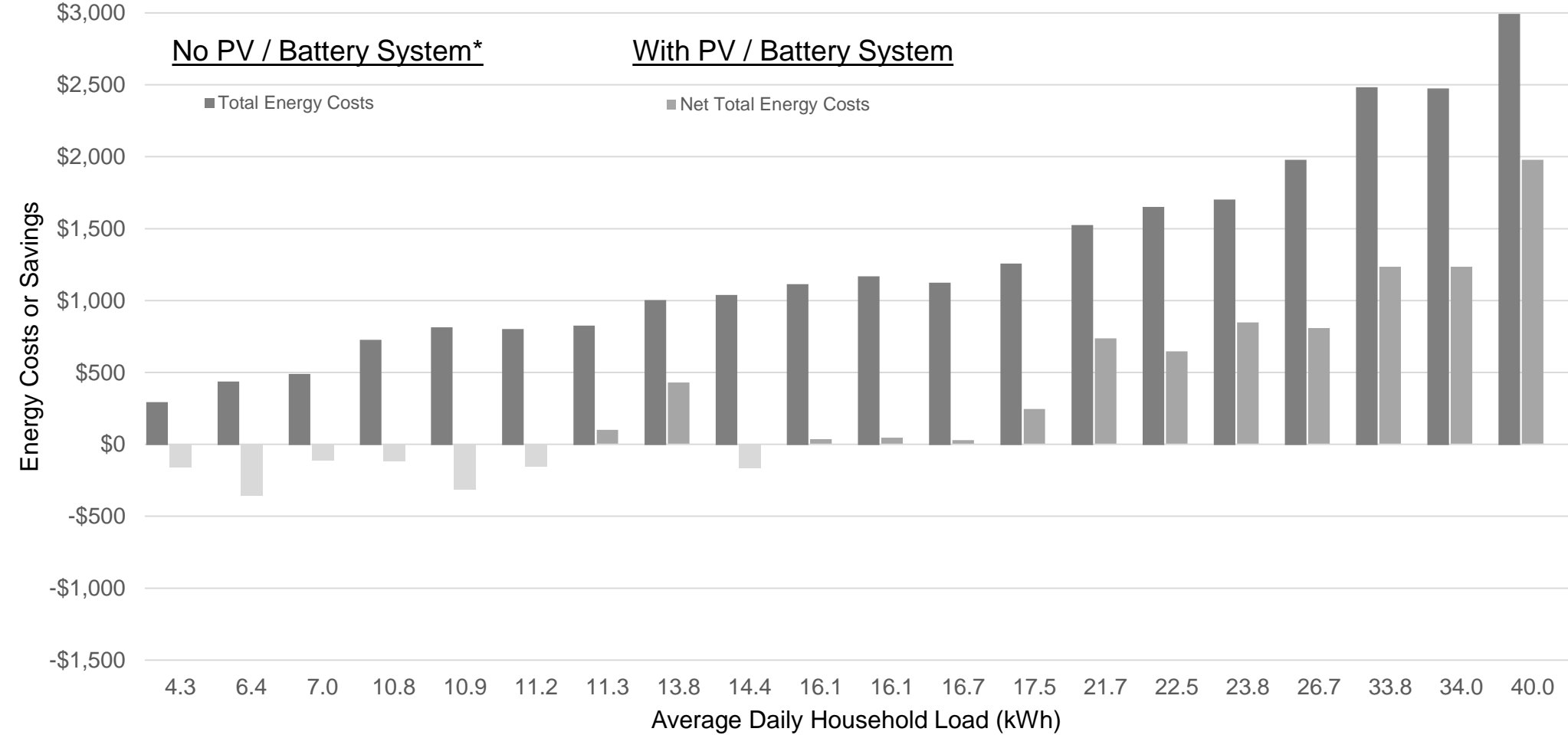
Household energy costs per year (excl fixed charges), 26 Feb '18 – 25 Feb '19



Note:

- Participant data only included if anomaly free and complete data set available for the period of interest
- Customers are on TOU tariff during the trial; this is assumed to be the case for the 'No PV/Battery' scenario

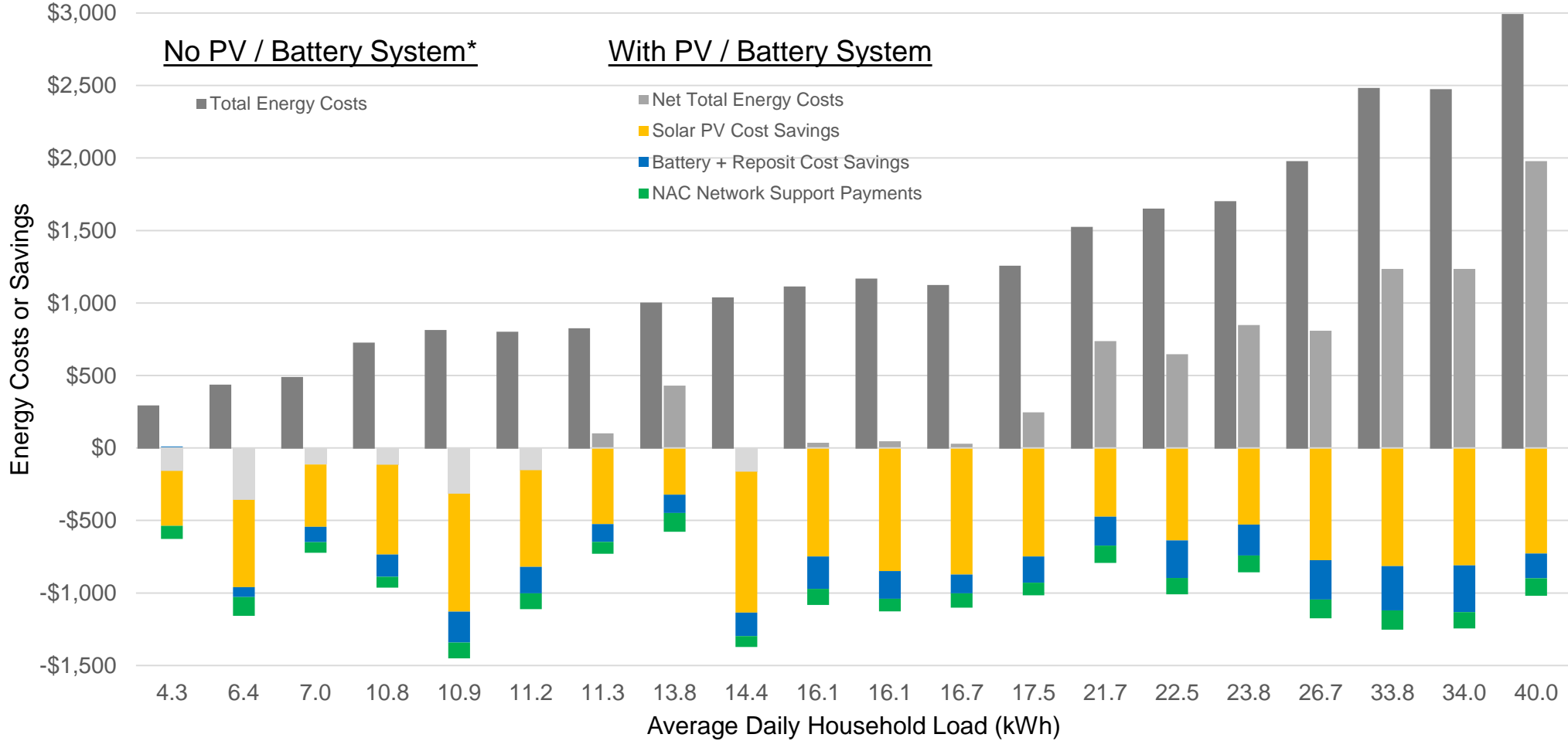
Household energy costs per year (excl fixed charges), 26 Feb '18 – 25 Feb '19



Note:

- Participant data only included if anomaly free and complete data set available for the period of interest
- Customers are on TOU tariff during the trial; this is assumed to be the case for the 'No PV/Battery' scenario

Household energy costs per year (excl fixed charges), 26 Feb '18 – 25 Feb '19



Note:

- Participant data only included if anomaly free and complete data set available for the period of interest
- Customers are on TOU tariff during the trial; this is assumed to be the case for the 'No PV/Battery' scenario

Technical findings

- NAC successfully run on physical network
- Demonstration of successful management of network peaks via consumer batteries and locational NAC prices
- Network voltage management shown to be possible via batteries and NAC; further work required to refine this.
- Accurate network data and reliable energy demand forecasts (network level and household level) are very important for coordination success
- Consumers can benefit significantly (financially) from solar PV, from smart batteries and by supporting the network.



UNIVERSITYof
TASMANIA

Cross-cutting learnings

Into the future

Trialling technology:

- Living laboratories are beneficial, but take significant effort, care and also a collective thick skin (!) due to constant critiques.
- Interdisciplinary technical and social research provides significant insight when looked at together.
- NAC needed a trial space to develop.
- Finding submitted 30th March.

Scaling up:

- We have gathered significant learnings for scaling up. Eg. The methods for engaging and maintaining relationships with people needs to be examined and systems put in place.
- The technology worked so NAC is viable to now be tested at scale.
- There is a to engage with installers concerns and challenges.

Thankyou!

Thank you to Laura Jones and Dan Gordon for the use of the graphs and to the overall CONSORT team for the data and the teamwork.

CONSORT's overall research lead: Professor Sylvie Thiebaux

Further information and contacts:

- <http://brunybatterytrial.org/>
- Phillipa.Watson@utas.edu.au
- Evan.franklin@utas.edu.au

The Australian Government, through the Australian Renewable Energy Agency (ARENA), is providing \$2.9 million towards the CONSORT trial under its Research and Development Program.