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DIGITAL ENERGY

MY ENERGY MARKETPLACE

FINAL PUBLIC KNOWLEDGE SHARING REPORT

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Terms and Definitions

Term	Definition
ACAP	Australian Centre for Advanced Photovoltaics
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ANU	Australian National University
API	Application Programming Interface
APVI	Australian PV Institute
ARENA	Australian Renewable Energy Agency
BSGIP	Battery Storage and Grid Integration Program (ANU)
C&I	Commercial and Industrial
C4CE	Coalition for Community Energy
C4NET	Centre for New Energy Technologies
CDR	Consumer Data Right
CEDAP	Consumer Energy Data Advisory Panel (interchangeable with DAP)
CER	Consumer Energy Resources
CRC	Collaborative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAP	Data Advisory Panel (interchangeable with CEDAP)
DEIP	Distributed Energy Innovation Program
DER	Distributed Energy Resources
DCH	Data Clearing House
ECA	Energy Consumers Australia
EDP	Energy Data Platform
ERICA	Energy Research Institutes Council for Australia

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ESB	Energy Security Board
ESCO	Energy Services Company
EV	Electric Vehicle
GDPR	General Data Protection Regulation
HEMS	Home Energy Management System
IoT	Internet of Things
LV	Low Voltage
MEM	My Energy Marketplace
MV	Medium Voltage
MyEnergy	Wattwatchers MyEnergy mobile application
NEM	National Electricity Market
NSW	New South Wales
PV	Photovoltaic (solar panels)
REST	Representational State Transfer
RRCRF	Regional and Remote Communities Reliability Fund
SAPN	South Australia Power Networks
SEC	Smart Energy Communities
SME	Small and Medium Enterprise
SOCI	Security of Critical Infrastructure (Act)
T&Cs	Terms and Conditions
UNSW	University of New South Wales
UTS	University of Technology Sydney
UTS ISF	University of Technology Sydney Institute for Sustainable Futures
V2G	Vehicle To Grid
VPDP	Virtual Power and Demand Plants
VPP	Virtual Power Plant

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1. Executive Summary

The My Energy Marketplace (MEM) is an innovative 'New Energy' initiative led by Wattwatchers Digital Energy (Wattwatchers). It focuses on striking a working balance between consumer energy data access, choice of services and privacy protections on one hand; and secure and ethical data shareability and portability for the benefit of consumers themselves, the electricity system, and the clean energy transition on the other.

The MEM was a $9.6 million Australia-wide project, running over three years and eight months (October 2019–June 2023), a period of time which featured severe disruption to participant recruitment and site installation due to the Covid pandemic. It was supported by a $2.7 million grant from the Australian Renewable Energy Agency (ARENA).

Now, the MEM is continuing beyond its ARENA project end date of 30 June 2023 as an emerging Wattwatchers business stream, providing *energy data as a service*. The service consists of a continually expanding, ethically shareable dataset from over 5,000 Australian sites under Wattwatchers near-real-time monitoring. The sites are mainly homes with rooftop solar, but the cohort of sites also includes small businesses, strata complexes, community facilities and schools, and is set to expand post-ARENA to add commercial and industrial (C&I) sites.

At its inception in 2019, the project lay at the intersection of three key clean energy transition themes:

1. distributed renewables,
2. digitalisation, and
3. consumer empowerment within the electricity system.

The 'electrification of everything' is another key theme that has emerged during the life of the project. This is driving increased demand from researchers, the energy industry, and commercial innovators for access to customer data.

Key elements of MEM project delivery, ending 30 June 2023 were:

- Installation of Wattwatchers smart energy management devices at 5112 homes and small businesses as well as 117 schools. In addition, data from 1500 non-Wattwatchers devices is provided from utility smart meters and EV chargers.
- Development of a smart energy mobile app achieved with the release of the MyEnergy app during the project, which will be further upgraded in FY2024 and rebranded as MyEnergy Flow.
- Development of a consumer-facing 'energy data hub'—i.e. the 'marketplace' (development is ongoing, however the MEM is already working with third-party consumer-facing apps as well as the Wattwatchers MyEnergy app).

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- Make energy datasets available for researchers (achieved and ongoing, with established MEM data sharing partners from the research community including UNSW, ANU, UTS ISF and the CSIRO).

Key conclusions from the project are:

- End users (customers) are willing to share anonymised data in exchange for zero cost or discounted devices and data subscriptions.
- A range of cost and environmental factors are driving the acceleration of the 'electrification of everything', and access to data to validate savings and other beneficial outcomes is of increasing importance.
- The near-real–time availability of MEM data as anonymised circuit-level data via modern APIs is cutting edge and unsurpassed by other datasets currently available, such as the well-known but ageing Smart Grid Smart City[1] dataset.
- Research institutes and other businesses are willing to pay for access to data, but the value of this data is not well understood, nor adequately budgeted into many existing projects.
- There is opportunity for multi-stakeholder value for data that exceeds the initial installation costs and provides benefits to a range of users and industries.[2]
- The independent Data Advisory Panel provided valuable insights on consumer expectations from industry and community perspectives, and also experience in research and data sharing to assist the project team to design and develop a successful project. But it also revealed a challenge in recruiting participants without remuneration as they were volunteers from often time and resource poor community and consumer advocate organisations.

Learning from MEM, reinforced by several other projects where Wattwatchers has led data acquisition, has formed the core of our response to numerous industry presentation opportunities and a number of regulatory submissions to the AEMC, AER, ESB and more throughout the life of the project.

Key recommendations from the project are:

- Access to granular and currently invisible CER data from large numbers of sites is required for modelling, research, and operating a grid that is rapidly transitioning to increased renewables, localised generation and widespread electrification.
- Research projects need to allocate an adequate budget and realistic lead time for data acquisition, including the MEM dataset option, and weigh this strongly against the much higher cost and time-lag of installing new devices.

[1] https://data.gov.au/dataset/ds-dga-4e21dea3-9b87-4610-94c7-15a8a77907ef/details
[2] Please refer to Section 7. Commercial model for additional information.

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- Customer recruitment offers need to be simplified as much as possible, to make it understandable to the widest possible audience. Providing too much information about the ARENA subsidies and data use-cases tended to confuse the message and value proposition, versus promoting a simple discount to rollout partners and end users (where consumers were targeted directly).
- For projects with a large rollout of devices, it is vital to identify and engage scale partners for recruitment and deployment as early as possible.
- Sufficient time must be allowed for customer recruitment and installations before making data available externally. At least 12 months of data is required for a 'critical mass' of sites before data services become valuable to research institutions and other data users.

This Final Public Knowledge Report, which follows an interim version in 2021, is the MEM project's official public record. It covers how Wattwatchers has successfully created this new energy data platform, including:

- the challenges that we faced along the way (global pandemic included);
- the rethinking and repositioning we did as circumstances evolved;
- the ongoing legacy of the project in the new era of energy digitisation for the accelerating clean energy transition;
- the relationship to Net Zero decarbonisation and green building; *and*
- the 'electrification of everything', which includes surging uptake of electric mobility and the de-gasification of homes and businesses. (This has emerged as a major theme only within the life of the MEM project).

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2. Project Overview

Snapshot

Welcome to My Energy Marketplace (MEM), a new 'e-infrastructure' for electrification and the clean energy transition in Australia. The MEM energy data platform is built on highly-granular, continuously updating, near real-time data from household, strata property, small business, community facility and school electricity customers.

When this Wattwatchers-led project began, in 2019, the Australian Renewable Energy Agency (ARENA) summarised it thus: *Wattwatchers aims to build, operate and deploy the 'My Energy Marketplace' or 'MEM', a consumer-facing energy data platform, designed to securely collect, process and productise vast amounts of energy data.*[3]

That is now a reality for 2023 and beyond, with the MEM embedded in the Wattwatchers third-generation cloud architecture, known internally as 'Mercury.' It handles billions of data points daily—up to 100,000-plus data points per Wattwatchers device per day—and is hosted in Australia by Amazon Web Services. Local hosting has proven to be vital for Australian utilities, in particular, in the context of strict and strengthening cybersecurity requirements (i.e. relevant sections of the National Electricity Rules,[4] network licences, and the evolving Security of Critical Infrastructure Act,[5] which includes electricity as an 'essential service').

From the start of the MEM project it included the core themes of consumer data rights, balancing the privacy imperative with enabling legitimate access to energy data for multiple use cases, and keeping pace with escalating security and cybersecurity priorities. These themes have proven to be more important than ever by the conclusion of the project, as a result of major national privacy breaches for telecommunications and healthcare providers as well as the Security of Critical Infrastructure Act[6] and implications for solar curtailment and flexible demand management.

Open for business

The MEM 'data store' is now open for business, with data captured from 5100-plus sites and secure and ethical sharing for research, community initiatives and commercial services distributed via Wattwatchers' widely-used REST API.[7] Consumers can participate through the Wattwatchers MyEnergy mobile app, a data-driven Home Energy Management System (HEMS). Alternatively consumers can use third-party HEMS and solar performance/optimisation app offerings, such as Clipsal Cortex, SimbleSense, and Solar Analytics. Multiple app choices for users amplifies the 'marketplace' concept

[3] https://arena.gov.au/projects/wattwatchers-my-energy-marketplace/
[4] https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules
[5] https://www.cisc.gov.au/legislative-information-and-reforms/critical-infrastructure
[6] https://www.cisc.gov.au/legislative-information-and-reforms/critical-infrastructure
[7] https://docs.wattwatchers.com.au

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embedded in the MEM, reinforcing the objectives of energy data being ethically-collected and held, and secure and privacy-protected, while being portable and shareable too.

The 'stock' in the MEM 'store' is made up of highly-granular three-year datasets, drawn from across Australia, although mainly concentrated in the East Coast's National Electricity Market (NEM). The sites include 5100-plus households, small businesses, stratas, community facilities and schools. In addition, the MEM also includes nascent 'marketplace' functionality embedded in the MyEnergy app,[8] which was developed through the project.

Figure 1: Example screens of the MyEnergy app, a core part of the MEM service

Origins

The MEM originated in ARENA A-Lab ideation and incubation workshops held in 2017. The original concept was articulated by Wattwatchers as a 'people's energy data bank', which evolved into an 'app store for energy,' and later a 'marketplace for energy data.' It was formally approved by the ARENA Board in March 2019, after a two-stage panel evaluation process in 2018; officially began in October 2019 after completion of the Funding Agreement (officially announced[9] in December 2019); and was launched at a public event[10] at EnergyLab in Sydney in February 2020, days before the first major Covid-19 shutdowns began.

Crucially, the 2017–2018 genesis period for the MEM was marked by a strong global public policy focus on data security and consumer data rights, prompted in part by the Cambridge Analytica/Facebook data misuse scandal (exposed publicly in 2018),[11] and the

8 https://mydata.energy

9 https://arena.gov.au/news/smart-energy-devices-to-empower-consumers/

10 https://wattwatchers.com.au/wattwatchers-led-project-will-revolutionise-how-australians-access-use-and-trade-their-energy-data/

11 https://www.businessinsider.com/cambridge-analytica-a-guide-to-the-trump-linked-data-firm-that-harvested-50-million-facebook-profiles-2018-3

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introduction of the General Data Protection Regulation (GDPR)[12]—billed as the world's toughest data security and privacy law—in the European Union in 2016.

This meant that data security and consumer data rights were major themes for the ARENA evaluation and approval of the MEM. This, importantly, led to key features of the project:

- the formation of an external Data Advisory Panel (DAP), originally recommended by Energy Consumers Australia (ECA), which proved to be a highly-successful innovation;
- the development of customised 'plain language' customer Terms and Conditions (T&Cs), which are embedded in the MyEnergy HEMS app;
- an Information Security Policy, with a security testing regime; and
- a Data Governance Framework, which includes clearly-articulated principles for managing energy data.

Learning from the MEM has been extended across the Wattwatchers *business-as-usual* operations, and also in some cases to partners' operating models and their T&Cs. These learnings have contributed substantially to the Wattwatchers solution ecosystem, with MEM data and insights feeding into Wattwatchers' own very active product development roadmap.

Figure 2: Pictorial representation of the Wattwatchers solution ecosystem, which underpins the MEM

[12] https://gdpr.eu/what-is-gdpr/

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Fast-forward to today and privacy, cybersecurity and consumer data rights are more prominent and important than ever. The Consumer Data Right (CDR) For Energy was launched in Australia in November 2022,[13] after a five-year development process. Additionally, Australian governments are pursuing major reviews and recalibrating regulatory requirements, consistent with the emerging expectations of the *Security of Critical Infrastructure Act* (SOCI). This reflects global geopolitical priorities and recent major malicious hacks of Australian enterprises including Optus, Medibank and Latitude Financial. In the US, in June 2023, first-of-its-kind legislation was introduced to the US Senate to address 'electric app stores' and potential-related 'anti-competitive behaviour'. It's being called the E-Access Bill[14].

Data and lessons learnt from the MEM have fed into a number of Wattwatchers conference presentations, publications and regulatory submissions, details of which are collated in this report.

Core project partners

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The project was led by Wattwatchers,[15] Australia's leading digital energy platform, enabling consumers and industry to maximise the benefits of renewable energy through energy data and control. Wattwatchers' technology underpins fast, powerful and scalable solutions to monitor, analyse and control electrical circuits in real-time that are particularly suited to the rapid growth of renewables and DER. Wattwatchers has a strong social and environmental 'net positive' impact[16] ethos as a core aspect of its business operations.

ACCURASSI

Accurassi[17] provides API-driven microservices to leverage energy data, including tariffs and usage information, so that enterprises can empower their customers. Its proprietary AI data solutions enable large enterprises to step past their legacy problems with data and technology to create seamless digital customer experiences. Among other customers, Accurassi provides the backend enablement for the NSW and Victorian governments' energy tariff comparison schemes. Accurassi provided services to Wattwatchers for bill data parsing and tariff comparison in the MyEnergy app, along with other project support.

[13] https://www.energy.gov.au/government-priorities/energy-markets/consumer-data-right-energy
[14] https://mailchi.mp/48dc13e73557/doe-announces-funding-5692509?e=467741425d
[15] https://wattwatchers.com.au
[16] https://wattwatchers.com.au/wp-content/uploads/2021/04/WATT119-Impact-Statement-2021_d6.pdf
[17] https://accurassi.com

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Established in April 2018, the Battery Storage and Grid Integration Program (BSGIP)[18] consists of a diverse team designing and implementing the building blocks of a resilient energy system, for the benefit of all energy users. The program's academic expertise ranges from computer sciences, engineering, physics and chemistry, to economics and the social sciences. Hosted by the Australian National University (ANU), the program places a strong focus on interdisciplinary research, development and demonstration (RD&D). BSGIP undertook a range of research activities in partnership with the MEM project as part of a PhD study.

Solar Schools[19] engages schools around renewable energy, energy efficiency and sustainability, both at the operational level (e.g. monitoring and optimising the school's energy usage) and the educational level (e.g. data visualisation and curriculum-aligned lessons and games to engage students). School administrators can reduce costs and improve environmental outcomes, while students can also benefit through curriculum-based learning materials for schools that opt-in to receive enhanced features through the program. These activities also can help to engage the wider school community through parents, teachers and supporters. The MEM project's schools component[20] was led by Solar Schools.

Cogniss[21] is (now) a no-code ecosystem to develop sophisticated consumer and patient-facing digital health solutions (native iOS, native Android and Web) – digital therapeutics, real-world evidence tools, research apps and more. It aims to deliver personalised and engaging experiences that drive measurable improvements in health and behaviour change. When the MEM began Cogniss was also pursuing energy

18 www.bsgip.com
19 www.solarschools.net
20 www.solarschools.net/energy-starter
21 https://www.cogniss.com

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behaviour change opportunities and provided support through the first two milestone periods, but had to withdraw early in the project due to Covid disruptions.

Data Advisory Panel

With the centrality of data in the MEM project, decision-making was both quantitative and qualitative, requiring values-based judgements as well as fact-based ones. Based on initial advice from Energy Consumers Australia (ECA), Wattwatchers proposed, and ARENA endorsed and adopted, the establishment and operation of a Consumer Energy Data Advisory Panel (CEDAP), with external experts as members. The Panel, which internally was simply referred to as 'the DAP', played a highly-valued guidance role across the project.

The volunteer participants in the DAP were members of energy system-relevant organisations, but participated in a personal capacity rather than as an official representative of their organisations. Over the life of the project, DAP members included personnel from:

- Energy Consumers Australia (ECA)
- the Australian Energy Market Operator (AEMO)
- the Energy Security Board (ESB)
- the Australian Energy Market Commission (AEMC)
- The Energy Charter
- the University of Technology Sydney (both UTS Data Centre and UTS Design Architecture Build)
- Monash University
- the Coalition for Community Energy (C4CE)
- local government and the private sustainability consulting sector.

The DAP mechanism also facilitated awareness-raising in regard to the MEM project and its evolution, and provided channels for MEM-related learning to be shared across relevant stakeholders—including regulators, the energy industry, and academia.

Over three years, the DAP met a total of 11 times, for about two hours at a time. Designed before the pandemic, it was originally envisaged to have a mix of in-person and online meetings. However, once Covid hit, online meetings became the accepted format, and the DAP stayed 'virtual' throughout the project. The DAP's charter aimed to have at least seven members, with a maximum of nine members, who were identified and recruited by Wattwatchers.

The DAP provided valuable insight and guidance on a range of issues for the project and was recognised as a highly functional and beneficial part of the project.

Please refer to Attachment 1: Data Advisory Panel for additional information.

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Project adapted to Covid and other disruptions

Originally planned to run for three years, the project was extended twice, to a total of three years and nine months (October 2019–June 2023). Severe disruptions due to the Covid-19 pandemic were the main reason for project delays, with lockdowns restricting rollouts and community engagement. There were also impacts from global supply chain challenges for technology components that were attributed to the pandemic, global silicon shortages, and conflict in Ukraine.

More positively, however, a final extension from ARENA of nearly two months, from 2 May to 30 June 2023, allowed installations for an important proof-of-concept initiative, with the NSW Government-owned network business Essential Energy, called Smart Energy Communities (SEC).[22] This late sub-project aligns strongly with the pre-Covid ambitions for the MEM, which had a strong focus on coordinated community recruitment and device deployments. As at 30 June 2023, the SEC had achieved its target of deploying Wattwatchers devices at 200-plus residential, business and community facility sites across three regional or remote communities, including Tibooburra and Ivanhoe in the far-west of NSW, and Palm Lake Resort at Tea Gardens on the NSW Mid-North Coast. The SEC pilots are scheduled to run until the start of 2026.

Ongoing app development

In keeping with our commitment to continuous improvement, the MyEnergy app is being continually updated beyond the MEM project completion date. This includes a major new feature, MyEnergy Flow, which is based heavily on learnings from user testing during the MEM project period. MyEnergy Flow will provide more than just information, presenting users with insights—why it matters, and what they can do about it—prompting users only when something warrants their attention, at a time when they can take action. Supporting information intuitively unfolds for users as they 'dig in' to each insight, providing further guidance on what to do, and ultimately so users can see the results of their actions.

Wattwatchers is also harnessing data processing capabilities provided by Shifted Energy, a third-party innovation partner, to provide insights and maintenance alerts for customers with electric hot water systems. This includes notifications related to potential leaks or failures of hot water systems, as well as system identification and usage profile analysis. These features provide additional value to customers in the form of useful insights into their energy usage, without the need to understand the technical parameters of how a hot water system normally operates. These insights and alerts are being integrated into the MyEnergy Flow feature.

Data, digitisation and demand-side

The MEM project was framed originally by the pivotal roles that data, digitisation and consumer-side demand and generation will play in the transition to 100% renewable

[22] https://www.essentialenergy.com.au/smartenergy

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electricity, which the Australian Energy Market Operator (AEMO) is expecting to be reached, initially for short periods, as early as 2025.[23] AEMO's *Integrated System Plan* 2022,[24] a key planning document for the future of Australia's energy system, indicates that rooftop solar could increase fivefold by 2050, from today's already world-leading per-capita levels (around one-third of Australian homes). This reinforces how a substantial percentage of total generation and storage will be sourced from consumer-owned energy assets in households, businesses and community facilities (known traditionally as DER, for *distributed energy resources*, and more recently as CER, for *consumer energy resources*).

Remote visibility and coordinated controllability of millions of CER assets, which can be enabled by near real–time data, is a critical challenge for grid and network stability. Over half of the MEM fleet of monitored sites has rooftop solar installed and nearly 30% are monitoring air-conditioning systems as key loads to consider in CER management.

Enhanced dataset with differentiation from utility metering

Wattwatchers devices provide an enhanced dataset including:

- 5 minute 'Long Energy' and 30 second 'Short Energy' measurements, compared to traditional 30 minute and 15 minute interval data from smart meter data.
- Data transmitted and available in near real–time compared to once-per-day data transmission from traditional smart meters.
- Direct monitoring of the grid connection, solar generation and major loads such as hot water, air conditioning, pool pumps and other significant circuits within the property. In contrast, a smart meter only records the net consumption from the grid and export of excess solar energy to the grid.
- Power quality data, such as voltage, frequency and power factor. This data benefits not only the consumer, but also the network, along with research and commercial partners who utilise this data for network and solution planning as well as diagnostic data for fault identification and resolution.

Engagement with a range of industry stakeholders throughout the project, including user research interviews undertaken to inform the design of the 'marketplace,' has repeatedly confirmed that there are limited datasets currently available for research and commercial purposes. The most referenced example is the smart meter data from the Ausgrid-led Smart Grid Smart Cities[25] project. This dataset only contains net import and export data at the connection point and is at the time of writing nearly 10 years old. Unlike the MEM, this data does not include gross solar generation before it is consumed on site or sent to the grid, generally contains solar systems that are much smaller than systems currently being

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23 https://www.aemo.com.au/initiatives/major-programs/engineering-framework

24 https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp

25 https://data.gov.au/dataset/ds-dga-4e21dea3-9b87-4610-94c7-15a8a77907ef/details

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installed (i.e. 1–3kW systems then, versus 6kW-plus systems now), and does not provide circuit-level data for major equipment and appliances at each site (e.g. electric hot water, air-conditioning units, pool pumps, EV chargers).

The MEM dataset is shared under conditions of use that are agreed with Wattwatchers, and, whether or not payments are involved, are captured in a signed and countersigned *Term Sheet that outlines responsibilities and accountabilities, including appropriate use and limits additional sharing*. Early customers and partners are already on board to access MEM datasets. Data recipients include members of the research sector, where the electrification theme is a strong, new driver for research activities. The list of data recipients for MEM data already includes:

- the CSIRO and its Data Clearing House (DCH),
- the University of New South Wales (UNSW) and the Energy Data Platform (EDP), project it leads for the Australian Centre of Advanced Photovoltaics (ACAP),
- the Australian National University (ANU) and its Battery Storage and Grid Integration Program (BSGIP),
- the University of Technology Sydney (UTS) and the UTS Institute for Sustainable Futures (UTS ISF),
- community energy and electrification initiatives, app developers, energy consultancies, and
- an electricity network business—the NSW Government-owned Essential Energy.

The MEM, while still evolving and growing, has already become the foundation for an emerging new business stream for Wattwatchers based on *energy data as a service*. This is a stepping stone towards a long-term sustainable business model that is envisaged for the MEM in its post ARENA–grant phase. Other key requirements of a sustainable business model include capturing additional supporting and linked data about households, equipment and appliances, whilst also maintaining and expanding the number of participants including in sectors such as C&I buildings. These are activities Wattwatchers will be undertaking in the next 12–24 months as part of additional activities described further in this report.

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3. Findings and outcomes

The 'need' case

In describing why the MEM was needed at the outset of the project, energy consumers were the initial focus:

> *Most energy consumers have limited access to their own energy data. Households and businesses typically receive power bills, with estimated usage, several months after they have used the electricity. Better data, sourced independently from power providers and in real-time, could help reduce bills by:*
>
> - *Cutting energy waste*
> - *Improving consumer understanding of electricity retail packages to source a 'better deal'*
> - *Using power at the best times*
> - *Optimising rooftop solar (or right-sizing new solar investments)*
> - *Enabling programs that reward energy behaviours that help the overall energy system.*[26]

Other beneficiaries included:

- *For schools, better data could drive energy engagement and literacy among students, while also assisting with reducing energy bills.*
- *For third-party service providers, better energy data could provide improved management of the Australian electricity grid and better integrate renewables.*[26]

At completion of the MEM project in mid-2023, these 'need' cases have been either substantially delivered, and/or will continue to be pursued by Wattwatchers as the MEM moves into its post-ARENA phase.

Objectives

As ARENA's official MEM project page summarises, the actions supported by the grant for the MEM deployment project were as follows[26].

Nationally roll-out Wattwatchers energy monitoring hardware and software packages to thousands of homes and small businesses, and hundreds of schools

A total of 5112 homes, small businesses, and strata and community facilities were installed, exceeding the project target of 5000; and also 117 schools, which failed to meet the original target of 250 schools. The MEM systems are also ingesting data from the target of 1500-plus non-Wattwatchers energy devices. These non-Wattwatchers sources

[26] https://arena.gov.au/projects/wattwatchers-my-energy-marketplace/

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are mainly utility-style smart meters provided by agreement with a metering solutions provider, and EV charger data from a startup software solution provider.

Develop and deploy the MEM, with input from industry and market representatives. The MEM will source data from Wattwatchers hardware, smart meters, inverters, EV chargers and sensors, and provide energy data software applications

The MEM is operational and its database is embedded in Wattwatchers' third-generation cloud infrastructure, Mercury. Data is made available via our secure and scalable REST API.[27]

Formal industry and market partners for the project were Accurassi (billing meter data integrations), Solar Schools (energy and education software) and ANU's BSGIP (three-year PhD student project). A number of 'channel partners' also played important roles in recruitment of MEM sites and deployment of devices.

These included industry players such as Clipsal Cortex, Solar Analytics and Radian Energy for general deployments; Wattblock for strata apartment sites; and a number of community groups including the Heyfield Community Resource Centre, Hepburn Wind,[28] 1 Million Women, Cowan Energy Cooperative and Noosa Lakes Resort Body Corporate.

Data from smart meters and electric vehicle supply equipment is also incorporated into the MEM through partnerships with a metering services provider and an EV charging software solution provider.

Development and deployment was guided throughout by a data advisory panel (DAP) made up of external experts drawn from a number of industry and market organisations including AEMO, the Australian Energy Market Commission (AEMC), the Energy Security Board (ESB), The Energy Charter, Energy Consumers Australia (ECA), and UTS and Monash universities (see *Appendix 1*).

Provide aggregators, distribution network services providers and other services providers with access to granular consumer energy data and visibility of distributed energy resources (DER).

The MEM has already made multiple early data transactions, across the spectrum of monetary payments for data, the creation of in-kind value based on MEM data, and free-of-charge data provision. This includes energy solution developers using small

[27] https://docs.wattwatchers.com.au/
[28] https://hepburnznet.org.au/program/energy-smart-schools/

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batches of MEM data to assist in testing and further developing and proving up the app and service offerings.

Target Outcomes

The key target outcomes identified by ARENA and published on the project's public information page,[26] which would result from Wattwatchers successfully completing the project, were as follows.

Demonstrate how an energy data platform can deliver value and savings to end users and ultimately become a sustainable business model

The MEM energy data platform contains all of the shareable data provided by the MEM devices in near real-time. It uses the Wattwatchers REST API to enable ethically-managed data sharing with third parties. And the MyEnergy app provides an interface for the end-users (consumers) to view and engage with their live and historical data, as well as to manage the terms and conditions of data sharing with Wattwatchers and third parties. User value is delivered to end-users through self-use of the MyEnergy app, as well as enabling access to additional rewards and offers. Establishing a sustainable business model is based on research and other organisations paying for access to the anonymised data available in the MEM energy data platform, which in turn funds incentives for users to remain active and engaged by providing 'special offers' and supporting ongoing discounts for new hardware installations.

The MyEnergy app, developed as a core part of the MEM project, provides end users with a range of information, alerts and insights to support energy, carbon and cost savings e.g. better time of use, retailer switching, solar optimisation, load shifting and more. It is important to understand that the MyEnergy app, and likewise with similar third-party app offerings which were substituted for MyEnergy at many sites, typically don't automate savings on their own, but rather empower engaged consumers with near real-time information so that they can adapt behaviours and make informed decisions about further CER investments.

Through the MEM, Wattwatchers established confidence in working with multiple partner apps, as well as our own MyEnergy offering, because this widened the net for recruitment while supporting our quest to offer more choice for customers by facilitating portability and shareability of their data. Third party apps provided by MEM channel partners like Clipsal Cortex and Solar Analytics provide similar, and in some cases superior, features to end-users, powered by data from Wattwatchers devices in the MEM fleet. Choice of apps and portability of data is potentially an important feature for customers, rather than being 'locked in' to a one-to-one relationship between monitoring device and app. Although currently this flexibility for customers does not exist as a commercial offering.

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Wattwatchers was able to test three main pricing levels for the MEM hardware and data subscription packages, where the ARENA rebates provided the equivalent of 100%, 50% and 25% discounts to substitute for future revenue to come from the anonymised data services. We were ultimately able to demonstrate how the 25% discount level was the equivalent of a commercial agreement established with UNSW as part of a data sharing project.

The value of data for some of these data services stakeholders has been demonstrated to be in the range of a total revenue of $250 to $1000 per device for 3–5 year data sharing agreements. This has been considered excellent value for money by those customers when considering the cost to rollout new devices being $1500 to $2000 per device when factoring in recruitment, training, installation, operations, maintenance, support and project management, and the 1-2 year time delay to wait for installations and 12 months of data to become available.

Wattwatchers also is working with earlier stage energy technology startups and solution offerings, using MEM datasets and our REST API, to develop additional integrations with new features. Data recipients of this nature include solutions for:

- Optimise EV charging from rooftop solar
- Solar and battery scoping
- Electric hot water management
- Combined FinTech and EnergyTech services (i.e. banking, super, energy and carbon).

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Provide end users and services providers valuable information about energy consumption and generation, to increase the value of DER and to improve the integration of renewables into the grid

A number of MEM sub-projects demonstrate the value and usefulness of the MEM model. This includes sub-projects both for site recruitment/deployment at the start of the process, and for data services at the end of the pipeline. This is also especially true for innovation and problem-solving related to demand-side participation in the energy transition and electrification. Such projects include:

- a first-of-its kind community solar project by the Body Corporate at a large Queensland townhouse complex, the Noosa Lakes Resort[29];
- parallel MEM deployments at Heyfield, in country Victoria, which helped to kickstart another innovative and data-driven project exploring microgrids and local energy solutions in a regional community[30];
- deployments at a number of early-mover strata apartment buildings looking to better understand their electricity use ahead of cost-effectively installing EV charging and adapting to electrification and renewables more broadly. Wattwatchers developed a targeted 'MEM strata offer' delivered with strata sustainability experts Wattblock[31];
- a new project in NSW where Wattwatchers is working with the CSIRO and its Data Clearing House, which both uses existing MEM datasets and will create new ones in the C&I sector;[32] and
- the Smart Energy Communities project[33] with NSW network business Essential Energy. The project benefits from MEM subsidies, draws heavily on MEM-derived methodologies, and has helped navigate MEM data integration with a regulated utility.

Increase understanding and awareness of cybersecurity risks and data privacy management

Wattwatchers has further developed an Information Security Policy, the Data Governance Principles and MEM Terms and Conditions either as a direct result or with substantial input from the MEM project learnings. The DAP also covered and addressed many of these issues as both input the project and output for their own member learnings.

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29 https://wattwatchers.com.au/noosa-strata-community-making-money-from-sunshine/
30 https://www.heyfieldcommunity.org.au/mytown-microgrid
31 https://www.wattblock.com/uploads/4/4/9/8/44984189/strata_electricity_monitoring.pdf
32 https://www.csiro.au/news/All/News/2023/August/Smart-buildings-project-to-cut-emissions-and-electricity-costs-in-NSW
33 https://www.essentialenergy.com.au/our-network/network-projects/smart-energy-communities

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Wattwatchers also developed new technical solutions to securely share the anonymised data with data services customers via the Wattwatchers API. This ensured that the potentially identifying data created by installers and fleet managers to identify and maintain devices is automatically removed when sharing data externally.

MEM deliverables and learning have fed into the development of a security-enhanced, new-generation Wattwatchers device, the Auditor 6MW. The 6MW is in final field testing at the end of the MEM project (30 June 2023) and will be released in the first half of the 2024 financial year. Further in-house innovation is underway to enable more secure CER monitoring and remote control down to residential level.

Wattwatchers has drawn on MEM data, learning and core themes (i.e. near real-time data, consumer data rights, cybersecurity) to make regulatory submissions to the Australian Energy Market Commission (AEMC) metering review[34] and the Energy Security Board (ESB) data strategy process,[35] and to deliver presentations at key industry events including Smart Energy 2021[36], EnergyNEXT 2022[37], All Energy Australia 2022[38] and the State of Energy Research Conference (ERICA) 2023.[39]

Make energy use and management datasets available to researchers, solution developers, and commercial partners under sharing agreements consistent with privacy and security conditions set by energy users.

The MEM is now operational as a prototype *energy data as a service* business stream for Wattwatchers. Consumer data is currently being shared securely and ethically with a number of leading Australian research institutions, including ANU, UNSW, UTS and the CSIRO, and also a range of solution developers and commercial partners. Currently Wattwatchers makes case-by-case decisions on how much (or *if*) to charge per site for MEM datasets, where larger-scale research projects and commercial access is sought. On a number of occasions has granted small-batch access to MEM datasets to startups free-of-charge to support their early-stage proof-of-concept initiatives. How to package

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34 https://www.aemc.gov.au/sites/default/files/2023-02/wattwatchers_submission.pdf

35 https://www.datocms-assets.com/32572/1677730463-wattwatchers-response-to-esb-data-services-delivery-model-consultation-paper-february-2023-1.pdf

36 https://wattwatchers.com.au/getting-the-data-and-function-balance-right-between-energy-consumers-and-the-industry-that-serves-them/

37 https://wattwatchers.com.au/watch-our-video-and-get-an-opportunity-to-win-a-wattwatchers-smart-energy-package/ and https://wattwatchers.com.au/power-price-surge-highlights-why-we-need-to-dive-deeper-into-energy-data/

38 https://wattwatchers.com.au/five-key-principles-for-a-new-energy-data-strategy/ and https://wattwatchers.com.au/serious-upgrades-are-required-to-electrify-everything/

39 https://www.erica.org.au/2023-soerc

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datasets, and what to charge for them is a work in progress as the MEM becomes part of Wattwatchers' business model.

Wattwatchers has confirmed a willingness to pay $250 to $1000 per device for data from MEM devices, depending on the use case and project data requirements. This compares very favourably when considering the $1500–$2000 cost to install, operate and maintain a fleet of devices plus the 1-2 year delay before sufficient data is even available for use.

Key conclusions and recommendations

Key conclusions from the project are:

- End users (customers) are willing to share anonymised data in exchange for zero cost or discounted devices and data subscriptions.
- A range of cost and environmental factors are driving the acceleration of the 'electrification of everything', and access to data to validate savings and other beneficial outcomes is of increasing importance.
- The near real–time availability of MEM data as anonymised circuit-level data via modern APIs is cutting edge and unsurpassed by other datasets currently available, such as the well-known but ageing Smart Grid Smart City[40] dataset.
- Research institutes and other businesses are willing to pay for access to data, but the value of this data is not well understood nor budgeted into existing projects.
- There is opportunity for multi-stakeholder value for data that exceeds the initial installation costs and provides benefits to a range of users and industries.
- The independent Data Advisory Panel provided valuable insights on consumer expectations from industry and community perspectives, and also experience in research and data sharing to assist the project team to design and develop a successful project. But it also revealed a challenge in recruiting participants without remuneration as they were volunteers from often time and resource poor community and consumer advocate organisations.

Learning from MEM, reinforced by several other projects where Wattwatchers has led data acquisition, has formed the core of our response to numerous industry presentation opportunities and a number of regulatory submissions to the AEMC, AER, ESB and more throughout the life of the project.

[40] https://data.gov.au/dataset/ds-dga-4e21dea3-9b87-4610-94c7-15a8a77907ef/details

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Key recommendations from the project are:

- Access to granular and currently invisible CER data from large numbers of sites is required for modelling, research and operating a grid that is rapidly transitioning to increased renewables, localised generation and widespread electrification.
- Research projects need to allocate an adequate budget and realistic lead time for data acquisition, including the MEM dataset option, and weigh this strongly against the much higher cost and time-lag of installing new devices.
- Customer recruitment offers need to be simplified as much as possible, to make it understandable to the widest possible audience. Providing too much information about the ARENA subsidies and data use-cases tended to confuse the message and value proposition, versus promoting a simple discount to rollout partners and also end users (where consumers were targeted directly).
- For projects with a large rollout of devices, it is vital to identify and engage scale partners for recruitment and deployment as early as possible.
- Sufficient time must be allowed for customer recruitment and installations before making data available externally. At least 12 months of data is required for a 'critical mass' of sites before data services become valuable to research institutions and other data users.

The project also has identified emerging data-driven opportunities which are already being incorporated into new research projects, community initiatives, and commercial products and services.

The energy landscape, meanwhile, has changed significantly, with the energy transition accelerating thanks to more favourable policy and funding settings driven by public demand for climate action. In the past 12–18 months, the rise of electrification has become a major theme for action at customer, industry and government levels, incorporating electric vehicles and degasification of the built environment.

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Sites installed and key insights

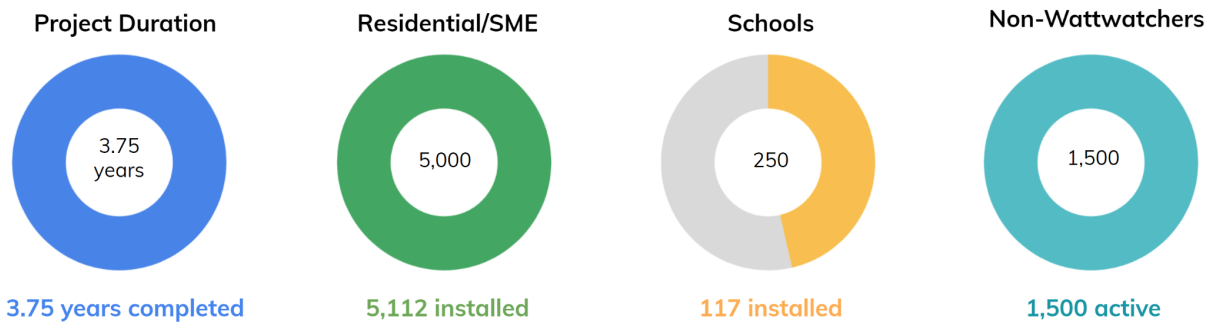

Figure 3 - Project Rollout Summary

Table 1: Sites Installed by Type

Site Type	Number Installed
Residential and Small Business	5112
Schools	117
Non-Wattwatchers Devices	1500

Residential and Small Business Sites

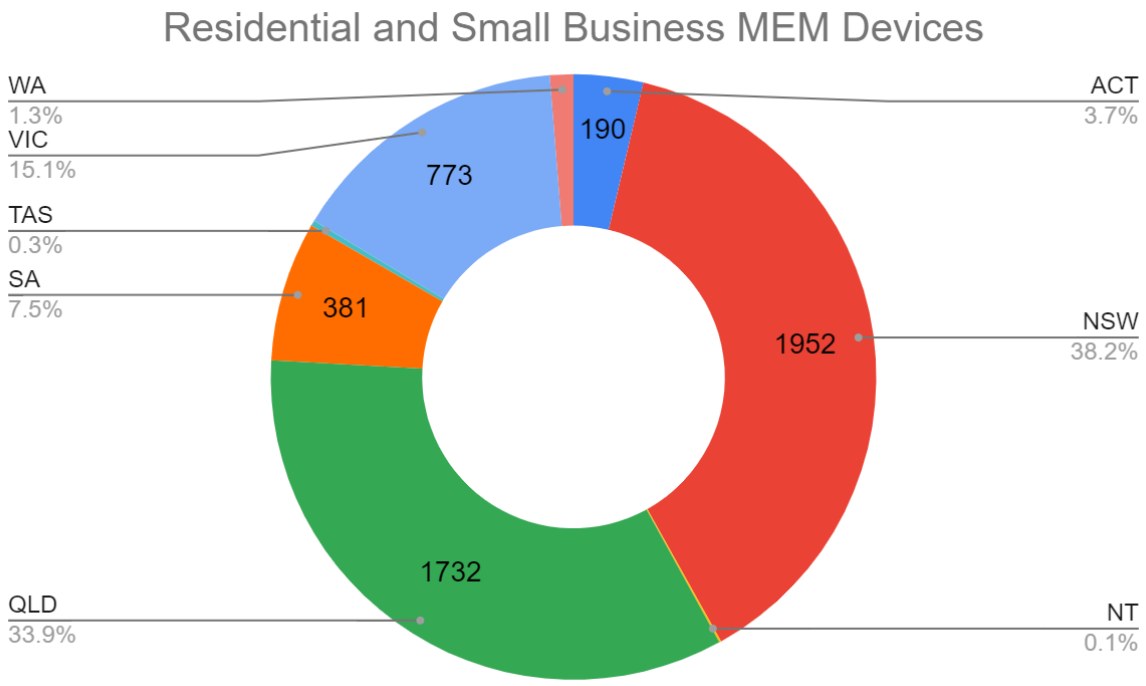

Figure 4 - Distribution of MEM residential and small business devices by state

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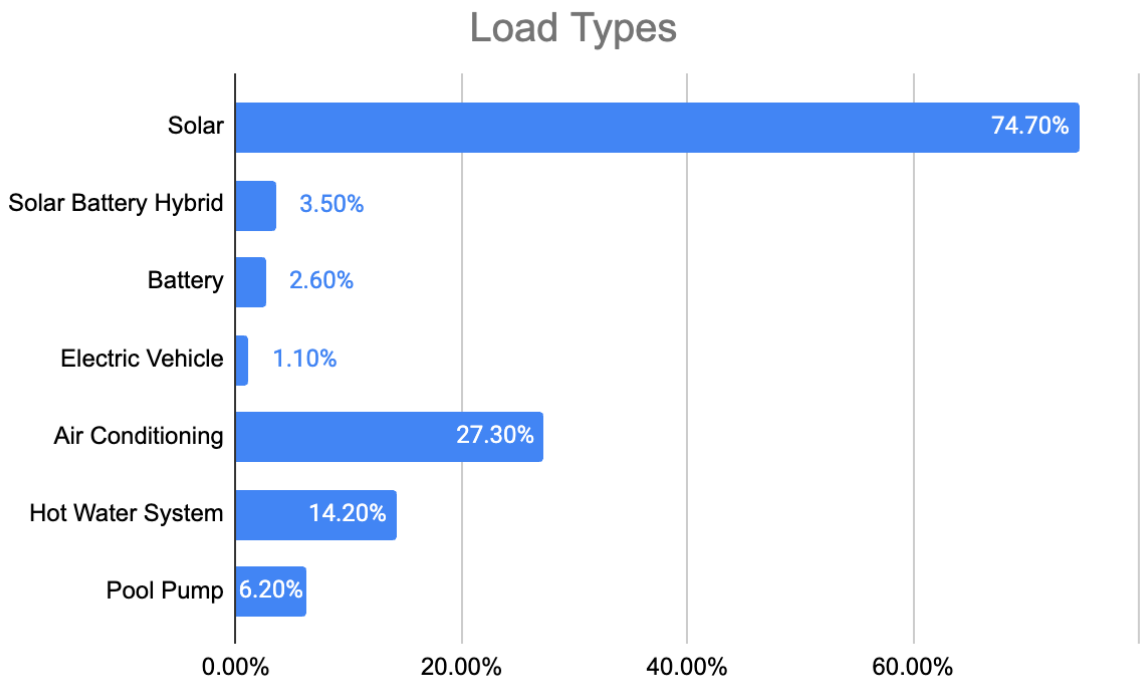

Figure 5 - Percentage of residential and small business sites containing a particular load type being monitored

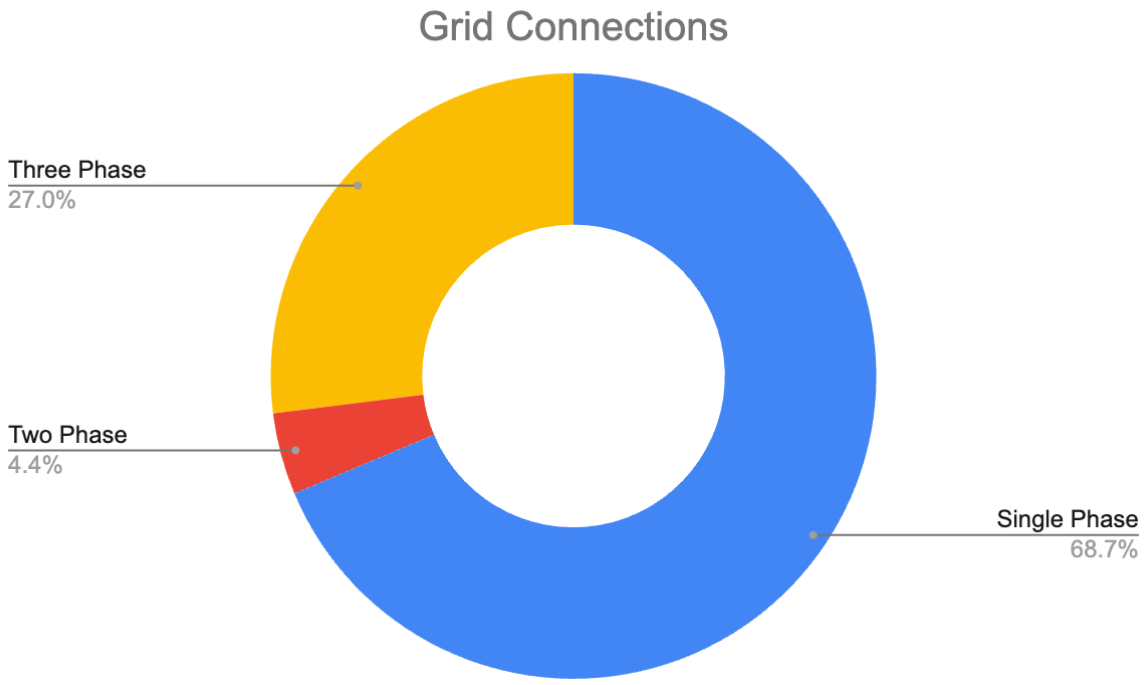

Figure 6 - Distribution of grid connection types across residential and small business sites

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As visible in Figure 6, nearly 75% sites in the MEM are monitoring solar output. This can be attributed to the major rollout partners and target customers having a focus on solar generation in one form or another. Air conditioning is also strongly represented in the fleet with 27.3% of sites monitoring this major point of energy consumption.

Hot water monitoring was not as high as anticipated, due to the wide range of gas storage and on-demand systems installed that can not be monitored by an electricity monitoring system. This suggests there are substantial opportunities for electrification of hot water systems to further the energy efficiency efforts already underway in many states.

Our MEM fleet also indicates that hybrid solar and battery systems still only represent a relatively small part of systems being installed. Only 6.1% of sites provided such data. Electric Vehicles with a dedicated charging circuit are also still in very early stages of adoption, with only 1.1% of sites providing data for this load type.

Figure 7 shows the distribution of the grid connection type at each site, with Single Phase (68.7%) the most dominant type (as expected), followed by Three Phase (27%) and a small number of (predominantly regional) sites with Two Phase (4.4%).

Table 2: Days of energy data available across sites (at time of writing)

Percentage of sites	Days of energy data available
75%	≥ 149
50%	≥ 234
25%	≥ 668

Due to the incremental rollout of devices over time, the amount of historical data available from each device varies depending on when it was installed. At the time of this report, 75% of devices had at least 4 months of historical data and 25% of devices had nearly two years of historical data.

Wattwatchers has repeatedly found that data research projects regularly seek 12 months or more data for trend analysis. The devices in the MEM continue to provide data updated in near real–time and thus the MEM dataset will expand to meet this requirement for the majority of devices.

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MEM Schools Sites

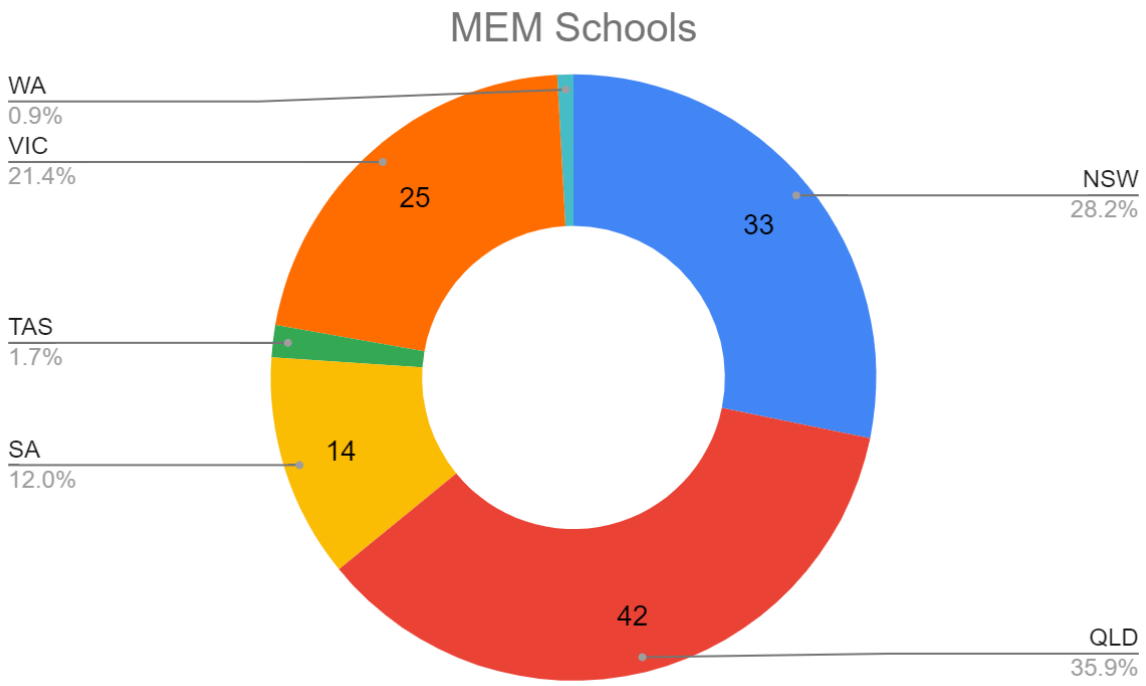

Figure 7 - Distribution of MEM Schools by state

The distribution of schools was broadly in-line with the population distribution in each state but slightly higher in Queensland due to the engagement of Queensland-targeted schools and solar programs available during the MEM project period.

Schools participating in the MEM provide a range of important data for commercial scale solar systems. School systems are typically in the 20 to 50kW range, but some systems are similar to large residential systems in the 5kW to 10kW range.

Non-Wattwatchers Devices

Data from non-Wattwatchers devices was also required as part of the project to demonstrate the potential use-cases beyond data from Wattwatchers devices. This was supported by data from smart meters from a metering services provider, and EV charging data from an EV charging software solutions provider.

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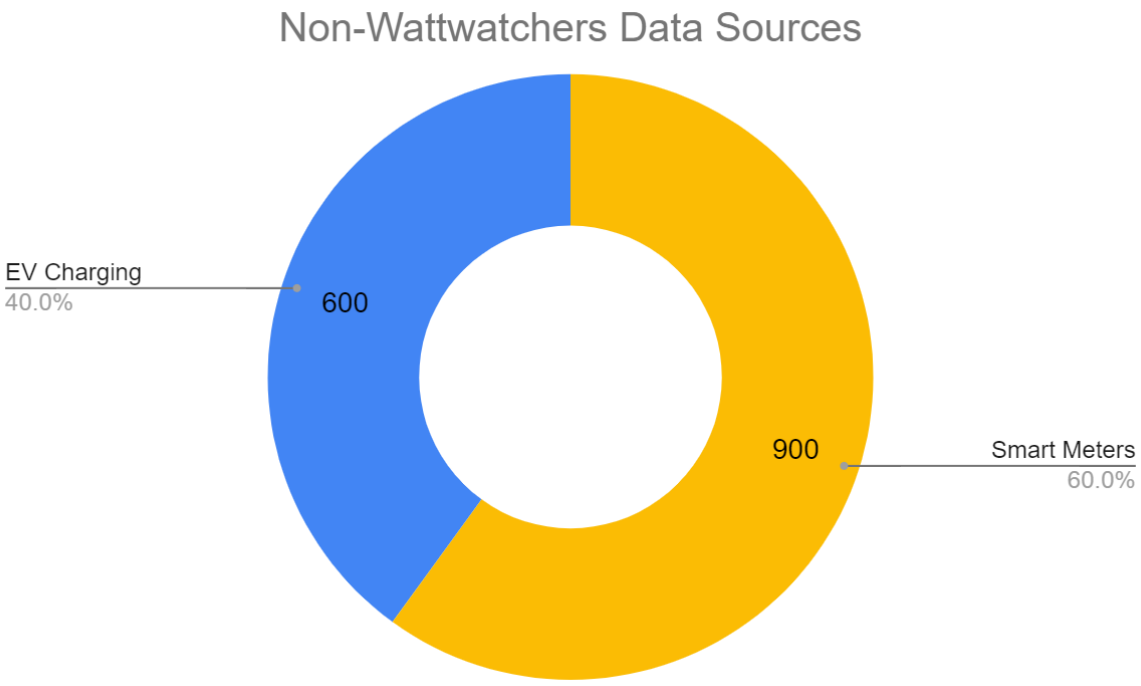

Figure 8 - Non-Wattwatchers Data Sources

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Wattwatchers MyEnergy app

Table 3: MyEnergy app users by platform

Platform	Number of App Downloads
Apple iOS	1,248 (78%)
Google Android	347 (22%)
Total	**1,595**

- Version 1.9.0 released for Apple and Android devices
- Self-registration feature for immediate activation by the customer after installation.
- Live energy data updated every 5 seconds when using the app.
- Pop-up charts on Live screen to provide information on where power is being used.
- History screens for usage breakdown, solar and grid imports and exports.
- Home screen widgets for at a glance views of solar generation and energy usage (iOS Only).
- Comparison of retail tariff offers by directly uploading into the app or via emailing to receive and review a range of available plans.
- Energy budget features to allow users to input tariff information and receive push notifications when reaching pre-defined thresholds of a daily, weekly or monthly energy usage budget.
- In-app account deletion required by Apple and Google, and aligns with our Data Governance Framework commitments.
- Back-end options for disabling the tariff comparison feature where appropriate for selected partners

Figure 9 - MyEnergy home screen widgets

Wattwatchers also observed a strong preference for Apple devices, with a relatively stable 78% of Apple iOS devices in the final months of the project compared to 22% of Android devices. This indicated that users of our devices are far more likely to have an Apple iOS device, but that it is also necessary to continue to maintain the Android version to maximise compatibility with all customer devices.

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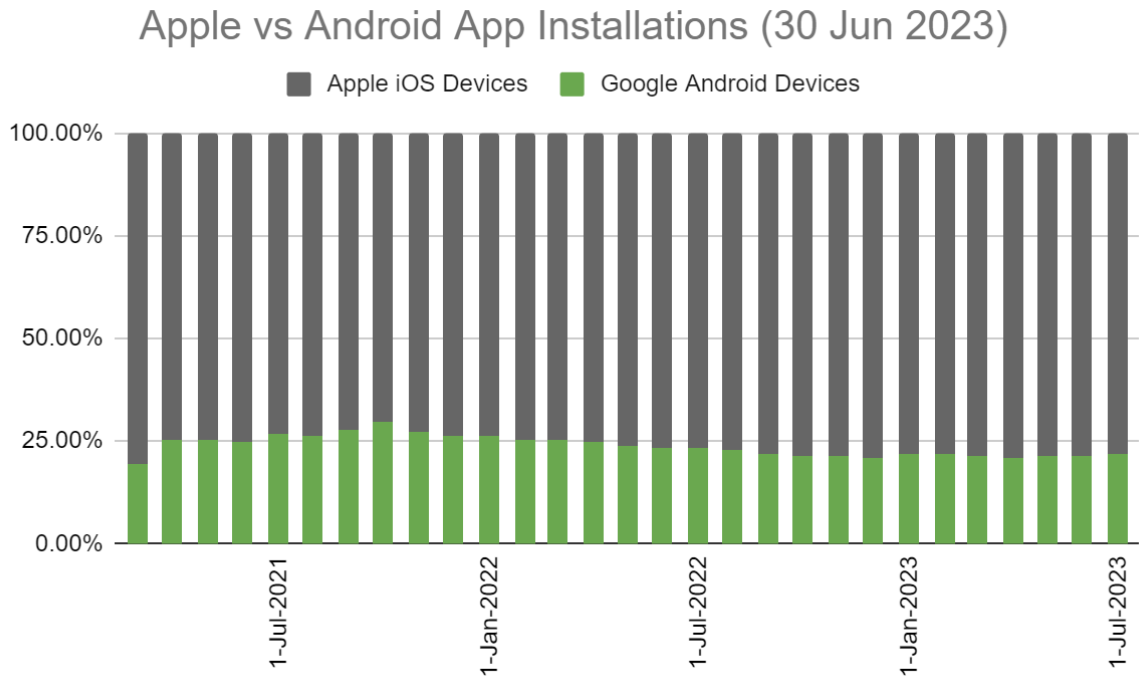

Figure 10 - MyEnergy app Apple vs Android App Installations

One hypothesis for this strong preference of Apple devices in our user base is that it is due to the type of customers interested in energy management being more likely to be interested in technology and the benefits of the integrated Apple device ecosystem. It could also reflect the age of participants and their relative affluence (as they are likely to be property owners).

MEM partner apps

MEM partner apps were provided by our rollout partners who had their own existing customer apps to present the data and MEM offers.

Table 4: MEM partner apps

Partner	Number of Users
Solar Analytics	1,723
Clipsal Cortex	1,766
Total	**3,489**

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Project partner insights

Wattwatchers is grateful to our partners for their commitment and contributions to the MEM. We invited them each to share their own 'wrap-up' statements and reflections on the project.

Solar Schools
Inspiring minds for a sustainable future

We are excited to share the incredible progress made by Solar Schools in our mission to engage with schools around renewable energy, energy efficiency, and sustainability.

At Solar Schools, we firmly believe that education is the key to creating a sustainable future. That is why we continue to develop a comprehensive approach that addresses both the operational and educational aspects of schools' energy practices. By partnering with schools, we help them monitor and optimise their energy usage, ultimately leading to reduced costs and improved environmental outcomes. Through real-time data visualisation, curriculum-aligned lessons, and an engaging App, we provide students with the knowledge and skills needed to become champions of energy.

Our dedication to turning invisible concepts like energy into tangible insights has been at the forefront of our work for over 18 years. Today, we want to highlight the remarkable achievements of the Solar Schools program and its impact on schools nationwide thanks to the partnership with Wattwatchers and the My Energy Marketplace (MEM) project.

The MEM project has enabled many schools to experience the full benefits of the Solar Schools program. Thanks to the generous subsidy provided by ARENA, participating schools have had the opportunity to access enhanced features and resources that may otherwise be challenging to obtain. We are proud to have offered this opportunity to schools across the nation, allowing them to continue their energy and sustainability education even during uncertain times.

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The Solar Schools program components include:

The School Portal

Track, visualise and analyse your school's own energy data over days, months, seasons and years

The Planet Watch App

Sustainable behaviour gamified, the app demonstrates the impacts of energy consumption.

The Display Board

Display your school's own energy data on any LED display on campus for a simple way to showcase energy savings.

The Engine Room

Interact with data more deeply. In-school displays and a weather station integrate the program further into the school.

The Power to Save

Discover the savings potential of energy efficiency in your school.

The Support Team

Our team is always ready to help with technical support, and resource questions.

Figure 11 - Solar School program components

Throughout the MEM journey with the Solar Schools program, we have gained valuable insights and learned important lessons that have shaped our approach to engaging with schools around renewable energy, energy efficiency, and sustainability. Here are some key lessons we have learned:

1. **Access to real-time data is crucial**
   The integration of the Solar Schools Platform with the energy data from the Wattwatchers energy meters has allowed schools to monitor their energy consumption in real-time (5-minute intervals), empowering them to make informed decisions and take proactive measures to reduce energy usage. Providing students

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and staff with tangible downloadable data has proven to be an effective tool in promoting energy efficiency whilst using live data in a learning environment.

2. **Education plays a pivotal role in successful energy reduction**
   Our program offered two levels of participation: Energy Hero and Energy Starter. The Energy Starter level offers focused educational materials, while the Energy Hero level provides comprehensive education resources, downloadable data and an interactive app. To illustrate the impact, consider a school that upgraded to the Energy Hero program. They outperformed their counterparts on the Energy Starter level, reducing their energy consumption by an impressive 24% on average.

   This outcome emphasises the importance of education in equipping schools with the knowledge and tools required to make informed decisions and implement effective energy-saving practices. By investing in education, schools can unlock the potential for significant energy reduction, leading to savings on their power bills, and ultimately contribute to a more sustainable future.

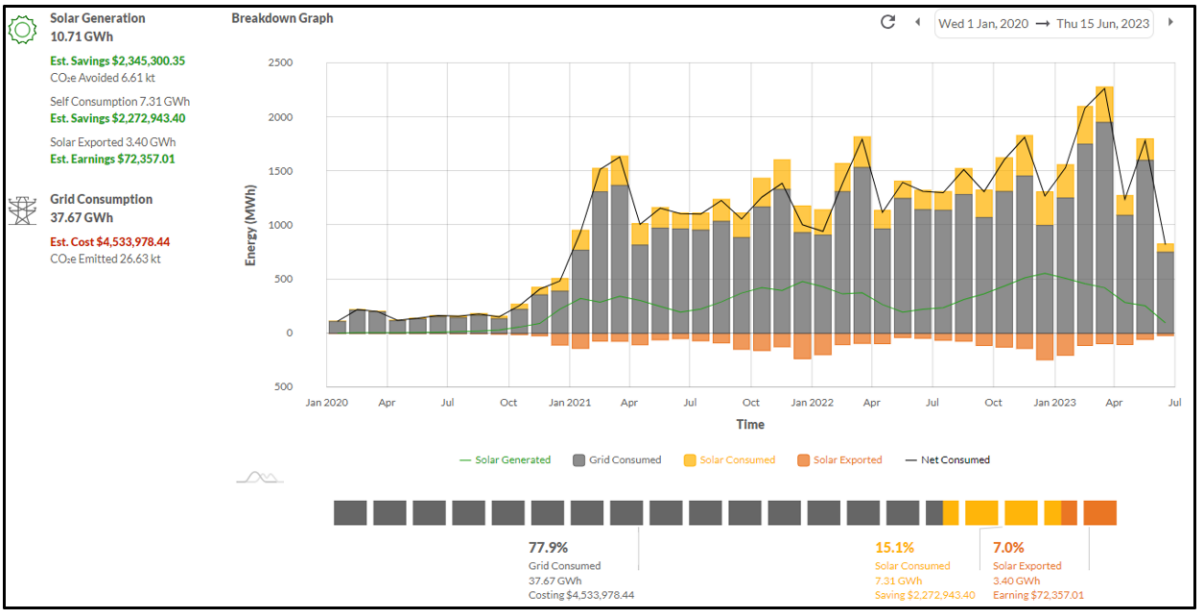

Figure 12 - MEM Schools - Breakdown Graph

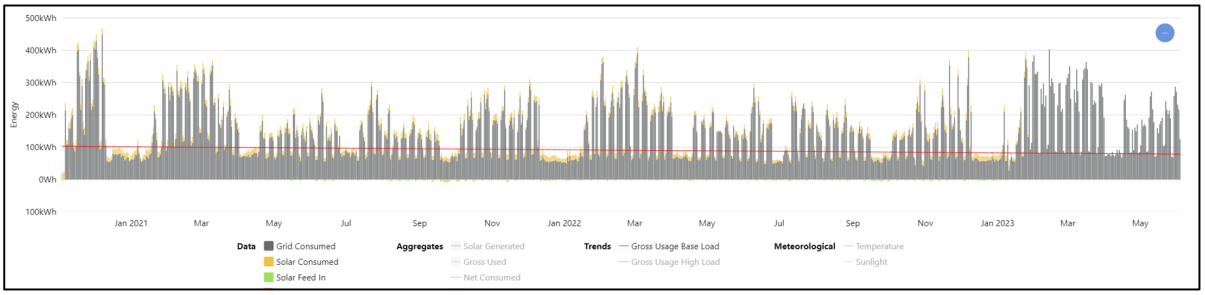

Figure 13 - Energy Hero Program Schools - Baseload Consumption Decrease

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3. **Partnerships enable greater impact**
   Collaborating with organisations like Wattwatchers has enhanced our ability to deliver comprehensive solutions to schools. Through partnerships, we can leverage each other's expertise and resources to provide schools with a broader range of tools and support.

   The utilisation of Wattwatchers 4G devices has facilitated the capture of energy data at 5-minute intervals from schools. This capability empowers students and teachers to incorporate real-time data into their energy and sustainability-focused educational activities within the classroom.

   Solar Schools makes expert staff available to schools to answer any questions regarding energy topics including understanding a schools energy bill as well as understanding the energy data.

   Solar systems installed at schools are continuously monitored by Solar Schools and plays a crucial role in alerting schools if their solar systems go offline, which may otherwise go unnoticed until the receipt of an electricity bill indicating higher-than-normal grid consumption and subsequent increased costs.

   By promptly notifying schools of system malfunctions, Solar Schools can provide guidance over the phone, including instructions for conducting a power cycle if necessary. This proactive approach to monitoring and support ensures that solar systems at schools operate at their maximum potential, resulting in significant cost savings and reduced CO_2 emissions.

   Schools generally see a minimum cost saving of 10% by schools that actively engage with the energy data and educational resources.

4. **Flexibility is crucial, especially in difficult circumstances**
   The Covid-19 pandemic brought unforeseen challenges as schools faced prolonged closures and a shift to online learning. During this uncertain period, the Solar Schools online portal ensured that teachers and students could continue their education in the vital subject of Energy & Sustainability from both home and the classroom.

   The pandemic did cause some disruptions in the typical energy data patterns of schools, posing obstacles for those already engaged in our program. Moreover, effectively engaging schools and delivering the MEM offer proved to be a significant challenge, hampering progress and resulting in lower-than-expected adoption rates over time.

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5. **Empowering students leads to long-lasting change**
   By engaging students through curriculum-aligned lessons and apps, we have witnessed firsthand the positive impact of empowering young minds. Educating students about renewable energy and sustainability not only fosters environmental consciousness but also equips them with the knowledge and skills to make a difference in the future.

6. **Monitoring and support are critical**
   The MEM offer allowed us to monitor schools' energy systems and provide assistance when needed. The ability to identify system faults, energy waste and offer guidance has helped schools stay connected and maximise the benefits of the Solar Schools program.

7. **Broadening access improves participation**
   Offering MEM to schools nationwide, regardless of whether they had solar installations, expanded the reach of the Solar Schools program. This inclusivity encouraged greater participation and enabled schools to engage with energy education, regardless of their infrastructure.

   The Sustainability Programs coordinator from a School in Queensland provided an excellent example of the energy and carbon emissions reductions achieved in the program.

   'During the month of May, we reduced our electricity by $74.96 a DAY. Saving $2,248.80 for the month!!!! Not only that, think of the CO2 emission avoided. We did this just by turning off appliances that weren't needed and changing our behaviours. At the beginning of the year, I conducted a Professional Development session and showed all of our staff some changes we could make throughout our day at school. I showed them some data from our school and compared it to others to show that we are a high energy using school. I showed them the impact we are having on the environment. I used statistics from the Solar Schools webpage'

   The activities undertaken that changed behaviours around energy were:

   - Reducing photocopying
   - Using less paper
   - Turning off lights in classrooms
   - Turning off data projectors when not being used.
   - Assigning a class to turn off all computers in labs at the end of the day instead of leaving them in sleep mode.
   - Checking fridge seals and turning off fridges during school holidays.
   - Turning off photocopies after school rather than leaving them in sleep mode.

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- Installing sensor lights in high traffic areas such as staff rooms, toilets and photocopier rooms.
- Changing fluorescent lights to LED.
- Setting air conditions to 24-22 degrees.
- Closing windows and doors when the air cons are on.
- Explaining demand charges to staff and to try not to put on everything at once.
- Using the internet less.

This school was able to save an average of 11% (monthly) on their energy base load simply by making behavioural change through the Solar Schools educational program by providing energy data to the entire school community.

Here we see how the collaboration between energy gathering technology combined with education (within the Solar Schools platform) can be used to engage teachers and students which then ripples out into the greater community (homes & businesses).

8. **Continuous improvement is key**
   The journey with Solar Schools and the MEM project has been a process of constant learning and improvement. Regular evaluation, feedback collection, and adapting to the evolving needs of schools have been instrumental in refining our program and ensuring its effectiveness.

These lessons have further shaped our commitment to supporting schools in their journey toward renewable energy, energy efficiency, and sustainability. We remain dedicated to enhancing the educational experience, empowering students, and fostering a sustainable future for all.

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The ANU BSGIP completed a PhD study as part of the My Energy Marketplace project to complete a literature review and investigate distribution state estimation and system identification in distribution grid models.

Distribution state estimation considering losses

Cost effective and widely distributed energy management technologies, such as the Wattwatchers Auditor energy monitoring devices, have a significant role to play in monitoring power quality and voltage in distribution networks.

This will become increasingly important as more rooftop solar, electric vehicles and batteries are integrated into the distribution grid, leading to power flows and voltages that are difficult to predict. Although this monitoring was previously the domain of network services providers, regulatory changes have resulted in an opportunity for innovative solutions to provide this data to both network business as well as other market participants.

The first goal of this project was to use distribution system state estimation (DSSE) to estimate power flow and voltage levels across all points in a distribution network, based on a limited number of actual measurements of power and voltage. For DSSE, equations that describe the behaviour of power systems are typically used, including the 'Distflow' equations[41] which provide estimates of the power (real and reactive) and the voltage at particular points in a network. In previous work, the Distflow equations were further simplified by ignoring losses, a method known as Lindistflow.[42]

Although ignoring losses simplifies calculations, the estimates are less accurate. Another study used a nonlinear power flow model to mitigate errors arising due to losses ignored as feedback. This increases the accuracy but also the computational time as there is a need to run a power flow model.

The focus of this project is to improve the accuracy of DSSE by considering losses in the system. Our goal is to develop a DSSE method that can accurately estimate power flows and voltages at all nodes within a distribution network (DN), with the minimal number of sensors and at a fractional computational cost. The proposed method is a tradeoff

[41] M. Baran and F. Wu, "Network reconfiguration in distribution systems for loss reduction and load balancing", IEEE Trans. Power Del., vol. 4, no. 2, pp. 1401-1407, Apr. 1989.

[42] M. E. Baran and F. F. Wu, "Optimal sizing of capacitors placed on a radial distribution system," IEEE Transactions on Power Delivery, vol. 4, no. 1, pp. 735–743, 1989.

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between computational time and accuracy. It produces better results than Lindistflow method and comparable results with the feedback method. The proposed method is faster than the feedback method computationally.

The method was tested on a medium voltage (MV) network and low voltage (LV) network. We estimated active power (P), reactive power (Q) and voltage (V) for the load points with limited measurements.

The error in the voltage and power estimates is less than half for the proposed solution compared with the Lindistflow method. The feedback method had a slightly lower error compared to the proposed approach but at a higher computational cost. The proposed approach is 8 times faster than the feedback method on MV network and 43 times faster on the LV network. This value will further increase as the size of the network grows. The maximum voltage percentage error for the Lindistflow method, Lindistflow method with feedback and the proposed method on the MV network is 6.02%, 2.37% and 2.44% respectively and 2.50%, 1.46% and 1.56% on the LV network respectively.

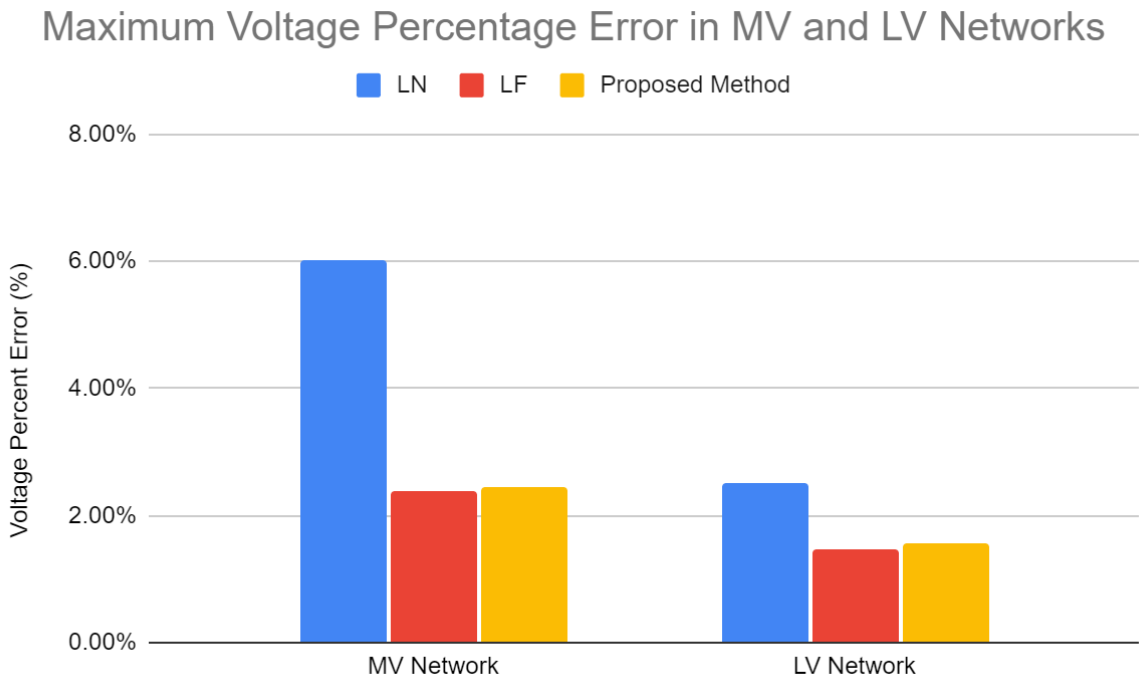

Figure 14 - Maximum Voltage percentage error levels in MV Network (left) and LV Network (right) models for the Lindistflow method (LN), Lindistflow method with feedback (LF) and the proposed method.

System Identification in Distribution Grid

The second goal was to estimate system state variables and line parameters simultaneously in a distribution network with noisy and/or missing measurements. A network contains two pieces of information: network topology and the line parameters which are not available easily. Identifying these are important for accurate power flow analysis and operation optimisation of active DN.

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This would help in voltage control, contingency analysis, fault management, accurate estimation of hosting capacity and calculating operating envelopes. Currently, studies estimating the line parameters are based on voltage magnitudes and voltage angles that can be obtained by phasor measurement units (PMUs). Usually, voltage angles are not available in DN as there are not many PMUs installed and only voltage magnitudes are available via smart meters. In our study, we will aim to estimate these parameters using the voltage magnitude available from smart meters or Wattwatchers devices.

The proposed approach uses a novel combination of Linearized Distflow and expectation maximisation (EM). Although in this study, the line losses were ignored we still got accurate estimates for the line parameters and the system parameters. It was demonstrated that the proposed approach achieves lower errors for the estimated state variables and voltage magnitudes than when the true line parameters are used for Bayesian regression with the Linearized Distflow model.

The method was tested on a medium voltage (MV) network and low voltage (LV) network. We estimated active power (P), reactive power (Q) and voltage (V) for the load points along with the line resistance and line reactance with noisy measurements.

The maximum error in the voltage magnitude was 0.0012 per unit which is only 0.12%, well under the acceptable range of 10% error in the DG. The maximum active and reactive power error was 0.010 and 0.011 per unit respectively which is way lower than the other method, Bayesian Regression with known line parameters, which was 0.024 and 0.020 for active and reactive power respectively. There were some errors in line estimates which is the expected behaviour since the losses are being ignored in the power flow model which introduces systematic bias in the line parameter estimates.

In future studies, we plan on including the line losses in the model which would give better line parameters estimates.

Conclusion

The research focuses on improving the visibility of the grid by estimating system state variables and line parameters. This is done so with limited and/or noisy measurements available in the grid. The study utilises the Wattwatchers devices to get these measurements. With more of these devices in the grid and this research, we can have a better understanding of the distribution grid and hence better control capabilities.

The full published reports can be found at the following links:
https://ieeexplore.ieee.org/abstract/document/9715689
https://ieeexplore.ieee.org/abstract/document/9640038

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ACCURASSI

Wattwatchers integrated the MyEnergy mobile application with the Accurassi platform to provide users with comprehensive tariff comparison capability. While the business development outcomes of the MEM were not as successful as originally intended for Accurassi, they provided valuable insights and technical lessons learnt into the methods used to integrate the MyEnergy app into the Accurassi APIs.

It was also important to recognise that the initial launch only had a limited range of retailer offers in some areas which grew substantially over the duration of the project as the Accurassi platform expanded. The Accurassi platform has now grown to support all market-available retailers in Eastern states with a growing number of partners using the platform for tariff comparison and other services.

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Data Advisory Panel Chair insights

Donna Luckman was the Chair of the DAP throughout the life of the MEM project. Donna also leads the Zero Carbon Moreland Campaign for Merri-bek Council (formerly Moreland City Council) in Melbourne. She is a non-executive director with the Coalition for Community Energy (C4CE) and a member of the Beyond Zero Emissions Investment Reference Group. Donna spent 16 years with Renew (the Alternative Technology Association), including six years as its CEO. Her personal reflection on the DAP follows:

The Consumer Energy Data Advisory Panel serves as a great model to bring in knowledge and experiences from across the energy and IT sector. The mix of panel members from across industry, academia, government and consumer sectors brought a wealth of expertise to the project. Discussions at meetings were rich, respectful and honest. The first twelve months of the panel was more onerous and procedural with the review of key policies. However, after a reset with the panel confirming its role as advisory and not governance, the full value of the panel was realised. The meetings were more a co-design process than a tick a box advisory panel.

Having spent 20 years as a consumer advocate in the energy sector it was great to see the open discussions and the panel's focus on the best solution for consumers. However, having dedicated consumer advocates on the panel is a challenge without remuneration for sitting members. This is an issue throughout the energy sector with a limited number of dedicated consumer advocate roles, and individuals stretched across a growing number of committees and consultations. To be able to engage a broader and more diverse set of community members, their time preparing and attending meetings needs to be compensated for.

The MEM's Data Advisory Panel is a great model for other ARENA funded projects. By creating a collegial environment, panel members were able to make valuable contributions for the MEM team and also enabled knowledge sharing across the panel. Insights and networks have added value beyond the funded ARENA project.

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4. Major lessons learnt

The significant lessons learnt throughout the MEM project included:

- **Customer engagement**
  Unexpectedly impacted by Covid-19, our response was to pivot away from physical promotional events such as conferences, trade shows and community fairs to online alternatives, as well as working with our existing network of business partners.

- **Participant recruitment**
  A focus on enlisting channel partners for scale, rather than on individual consumer sales as originally envisaged, to ensure the project met the rollout targets. It was also necessary to simplify the offer to make the discounted hardware and data sharing aspects clear and concise to appeal to the widest possible audience. Early offers that provided additional information on the ARENA rebates and broader program intentions were often confusing to end users.

- **Deployment and installation**
  The known cost burden and other difficulties of retro-fitting smart energy management solutions were further validated and, in keeping with this, the practical advantages of installing alongside other major energy upgrades, especially rooftop solar, have been further amplified. Directly-managed installers have been most effective for retrofit jobs, while indirectly-managed installation processes proved better for leveraging other energy upgrades where electricians are already onsite.

- **Privacy vs shareability**
  As a defining challenge of the project, consumer data rights and service expectations for the energy sector were further heightened by major privacy breaches from healthcare, financial and telecommunications companies during the project period. However, we consistently identified that customers were willing to share data 'for the greater good' and the development of a cleaner and more renewable energy system.

- **Data Advisory Panel**
  The creation of an independent consumer energy DAP is a standout feature of the MEM project model. Early teething issues were encountered due to the inherent challenges of maintaining a panel of voluntary experts who are highly supportive, but time poor. This was particularly apparent when the key initial project documents were being developed that required substantial input, review and approval from the DAP members. Whilst these challenges were ultimately overcome, a clear understanding of the expected level of input from DAP members is required while considering potential reimbursement for their time. With ARENA's support and participation, the Terms of Reference for the panel were clarified to

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recognise the ‘guidance’ and ‘advisory’ role it plays as distinct from a formal ‘governance’ one. Gaining the participation of consumer advocacy group representatives, often not-for-profit and especially resource-constrained, remains a challenge and has resulted in recommendations that future projects consider a remuneration model for advisory panel members.

- **Data services**
  Requests for access to MEM datasets have been received from research institutions and government agencies. There is clear demand for current and up-to-date datasets with at least 12 months of monitoring data available. Limited budget for access to data within potential data recipient projects has been encountered on numerous occasions, but the MEM still provides data immediately and at a fraction of the cost of deploying new devices.

- **App functionality and flexibility**
  Several rollout channel partners requested removal of the tariff comparison feature in the app. Wattwatchers has demonstrated its capacity to ‘edit’ the app in response to these MEM project requests, where legitimate reasons are demonstrated. This capability has also proven beneficial more broadly for the Wattwatchers business—e.g. for international customers where Australian tariff comparisons are not relevant. Thus far there has been a very low conversion rate within the tariff comparison feature—i.e. in terms of the number of MEM participants actually using it to change retailers within the app itself. This was not entirely unexpected given previously-identified consumer concern about commission-driven commercial comparison sites, a point that was raised by DAP members and user research participants early in the project.

- **Energy measurements vs dollars**
  Project feedback has confirmed our perspective that, while the mobile application currently provides technical information on kW and kWh, most users also want to see cost calculations (i.e. in dollars and cents) and more engaging means of interacting with their energy data. However, user testing also indicated a very low level of consumer understanding of tariffs and fees to configure the application to support this type of information display.

- **Augmenting utility billing meters**
  Smart meter operators see value in the additional capabilities of Wattwatchers devices, such as multi-circuit monitoring and higher granularity data collection. In these cases, Wattwatchers devices may be installed alongside a non-Wattwatchers device to provide both on-market and off-market metering services. In the project, non-Wattwatchers devices providing data to the MEM were excluded from having a companion-installed Wattwatchers device to support this ‘augmented’ value-add topology.

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- **Energy and education**
  Many schools already have a Wattwatchers device installed for solar monitoring but are not receiving the educational package provided by Solar Schools, nor the full picture of their energy story (i.e. only solar is monitored, not grid or other key loads). It is more efficient financially and operationally if already-installed Wattwatchers devices can be brought into the MEM, with new devices augmenting prior-installed devices, rather than duplicating installations to enable the MEM educational package. The MEM project required explicitly new installations, limiting our ability to support this value-add with subsidised devices. Support from the relevant government education department or private schools management group both in terms of device installation and data sharing is also necessary to ensure a successful rollout.

- **Multiple devices at one site**
  Field experience with the MEM shows that customers occasionally install solar systems on a garage or shed that is structurally separate from the main dwelling, connected to its own electrical sub-board. This requires at least two devices to be installed in order to effectively monitor grid import/export, solar generation, and major onsite loads. Customers with three phase grid connections and/or solar systems also often need two devices to provide adequate coverage of the additional circuits, as one device can be fully consumed by the grid and solar or air-conditioning monitoring.

- **Willingness to pay**
  Electrical installation of consumer-controlled data collection and control technologies is often difficult and more expensive than consumers expect to pay, especially in retrofit scenarios, and even more so when major switchboard upgrades are required or atypical site configurations (e.g. solar or batteries installed on a secondary building) are encountered. There is, however, an opportunity to stack the value for multiple participants, and multiple data recipients, thus reducing the cost to the consumer. This is a core concept explored in this project.

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5. Advancement of consumer energy data

Industry Engagement

The MEM has made significant contributions to advancing consumer energy data. The founding vision for the MEM—to be a commercial-scale 'field trial' for how key energy data concepts play out in real-world circumstances—has been realised.

These contributions are demonstrated by:

- A presentation to the ARENA-led Distributed Energy Innovation Program (DEIP) in the first year of the MEM project.
- Early participation in the Byron Local Microgrid project, with 25 MEM installations at light industrial sites near Byron Bay, in a project with retailer Enova Energy, network business Essential Energy, UNSW researchers and the NSW Government. (This project was disbanded in 2022 after Enova went into financial administration.)[43]
- Strong positive engagement from the DAP and its volunteer expert advisors throughout the project. Several panel members further demonstrated their support by making introductions and referrals supporting MEM activities, and making themselves available for one-on-one meetings with Wattwatchers team members to allow deep dives into complex areas that matched their experience and specialist expertise. A majority of DAP foundation members remained on the panel for the entirety of the project.
- MEM data outputs and lessons learnt have helped to shape Wattwatchers submissions to AEMC and ESB regulatory processes in regard to metering and data strategies.
- Invitations and opportunities to interface with relevant bodies and initiatives, such as:
    - the CDR for Energy process; the Australian Energy Regulator (AER) process for developing its Energy Innovation Toolkit (i.e. regulatory sandbox);
    - the ANU-coordinated DER API Technical Working Group (which has delivered CSIP-AUS (now officially a 'Standard')[44], the Australianised version of the international 2030.5 smart energy protocol;
    - interaction with other ARENA projects (e.g. Project MATCH and the Alice Springs Future Grid project); and
    - engagement and in some cases collaborations with a number of Australian Government Regional and Remote Community Reliability Fund (RRCRF) community microgrid feasibility and pilot projects. In particular the deployment of MEM sites alongside the MyTown Microgrid Heyfield[45]

[43] https://wattwatchers.com.au/wp-content/uploads/2021/08/Enova-Energy_Microgrid-Report_May-2021-.pdf

[44] https://www.standards.org.au/standards-catalogue/standard-details

[45] https://www.heyfieldcommunity.org.au/mytown-microgrid

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RRCRF project deployments, with this MEM data being shared for a Heyfield community data platform developed by Wattwatchers on its Adept integration platform (developed with Rayven IoT).[46]

- Presenting at several major industry conferences on related data and security themes between 2020 and 2023 including All Energy Australia, Smart Energy, Energy Next and the State of Energy Research Conference (facilitated by ERICA).
- Engagement with the RACE for 2030 CRC including participation in Opportunity Assessments and exploration of potential additional grant opportunities. This included the successful application to the NSW Government under its clean technology grants program for what is now the NSW Digital Infrastructure for Energy Flexibility[47] project. Led by the CSIRO and its Data Clearing House, with RACE for 2030 participation and Wattwatchers as one of several industry partners (MEM data from 2000 sites is being shared with the project as substantial in-kind value and MEM methodologies being used to target C&I site recruitment and installation, which will further diversify the MEM dataset in the 2023-2026 timeframe.
- Most recently, the Wattwatchers MEM project with network business Essential Energy which deployed monitoring devices at over 200 sites in three NSW communities as part of ongoing Smart Energy Communities[48] project.

The MEM approach and deployments, and the MyEnergy app functionality and terms and conditions, have been exposed to a wide range of industry participants as described throughout this document.

Significant industry and community engagement also occurred through MEM channel partners for recruitment and deployment. These include energy retailers, other technology companies, solar and battery installers, energy services companies, social housing operators and service providers (e.g. Home in Place and Housing Choices Australia), community energy groups and projects (e.g. Hepburn Wind. Sustainable Malmsbury and the Heyfield Community Resource Centre), not-for-profits such as 1 Million Women, consumer advocacy organisations, and government programs (e.g. NSW Empowering Homes and Victoria's Latrobe Valley Authority).

Consumer energy data modelling

As an example of in-house Wattwatchers use of MEM consumer data to explore an important public and industry issue for Net Zero decarbonisation, Wattwatchers app developer and Wattwatchers' resident data analyst Adriaan Stellingwerff has created a series of blog posts on the opportunity to move to 'high resolution carbon accounting', using 30–60 minute measurements that match the reporting interval of grid generation

[46] https://rayven.io

[47] https://www.csiro.au/news/All/News/2023/August/Smart-buildings-project-to-cut-emissions-and-electricity-costs-in-NSW

[48] https://www.essentialenergy.com.au/our-network/network-projects/smart-energy-communities

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data, rather than the annualised averages that are currently used in the carbon accounting mainstream. His first three blog posts[49] on the topic explain the concept in detail, and use data from 400+ MEM residential sites across four states in the National Electricity Market (NEM) to show how it works.

The graphs below represent a single site in South Australia. The top graph shows the site's grid imports per 30 minute interval.

The middle graph shows the inaccuracy when calculating emissions using the annual average emissions intensity compared to high-resolution accounting. Positive (blue) values indicate intervals where annual average accounting overestimates emissions. Negative (red) values indicate intervals where annual average accounting underestimates emissions. The majority of intervals in this site are blue, therefore average annual accounting overestimates emissions for this site.

This is confirmed in the bottom graph, which shows the cumulative error of average annual accounting. For this site, the overall accounting difference over the full year amounts to 147.8 kg CO_2-e. This represents a 16% overestimation of emissions when using annual average accounting, although variances of up to 80% were found in the sample data set.

Figure 15 - High resolution carbon accounting analysis using MEM data.

[49] https://wattwatchers.com.au/hourly-carbon-accounting-for-greater-accuracy/, https://wattwatchers.com.au/high-resolution-carbon-accounting-modelling-better-emissions-estimates/ and https://wattwatchers.com.au/high-resolution-carbon-accounting-higher-accuracy-for-better-outcomes/

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6. Ongoing development and impact

Continued commercial operations of the MEM

A core aim of the project was to address challenges in achieving the widespread integration of CERs into the electricity system. Data helps reduce the barriers to participation for such research and innovators alike and the MEM supports this aim by making access to energy data more affordable whilst simultaneously making anonymised data available securely to researchers and other 3rd parties. This multi-participant data sharing has required a number of challenges to be addressed as part of establishing continued commercial operations.

These challenges have included:

- Installation complexity and cost for smart energy devices
- Integration and interoperability of technologies
- Consumer participation and data rights
- Market and system-level concerns about privacy and cybersecurity
- The development of terms and conditions for industry data customers
- Continued evaluation of data-related revenue opportunities through market testing
- Embedding the MEM in the Wattwatchers cloud infrastructure, and especially data delivery via our REST API, to achieve the objective of simplifying data sharing permission granting for both consumers and data recipients

In 2023, AEMO highlighted the criticality of effectively managing CERs to achieving a 100% renewable grid, and is driving a nationwide push to:

- improve the performance of solar inverters during grid disturbances[50] (which uses data from Wattwatchers devices[51]); and
- to implement solar export control to allow remote curtailment by networks to protect the stability of the grid.

SA Power Networks, or SAPN, was the first to move in 2020, and Wattwatchers became a solution provider for South Australia's Smarter Homes[52] solar export control regulatory scheme.

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50 https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/operations/der-behaviour

51 These devices are operated by Solar Analytics outside of the MEM, but demonstrate the potential of MEM-related devices to provide similar utility.

52 https://www.sapowernetworks.com.au/data/308418/embedded-generation-regulatory-changes-for-smarter-homes/

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The importance that AEMO is placing on this work illustrates the commercial opportunities for Wattwatchers and other energy technology companies to develop and market solutions for managing and coordinating CER, especially with the electrification trend and the implications of EV charging for electricity demand and grid stability. Through the MEM, Wattwatchers has focused on these challenges ahead of an anticipated surge in the need for more data from behind-the-utility meter to support the electrification trends.

The data services element (*energy data as a service*) is vital to the longer-term proposition of a sustainable business model for a consumer energy data platform, which is the ultimate objective for the MEM beyond the life of the initial ARENA-supported project. Ideally, within several years if not earlier, sufficient ongoing demand for data services at commercially-realistic prices will allow costs for participating consumer sites to be reduced or even eliminated (or be sponsored by another party that needs data from the consumer side of the utility meter). While the MEM's initial customers are skewed to the research sectors as part of electrification studies and initiatives, demand is expected to substantially increase from electricity networks and the energy industry in parallel with non-energy use-cases will also expand significantly. We project that this requires data from tens of thousands of devices across all segments of residential, small business, commercial and industrial use cases.

Wattwatchers has ongoing obligations, including commercial ones, to MEM participants for both the installed devices and data services customers. These include the following considerations:

- Transitioning customers from the included 3-year data plan to paid subscriptions (or re-subsidised subscriptions), noting that the thousands of MEM customers installed in the final year of the project will still have 2 years or more to run on their MEM pre-paid subscriptions when the project wraps up on 30 June 2023.
- Support and maintenance for MEM data services agreements established during the project.
- Continued business development and customer engagement activities to establish new installed devices and data services customers. For example, the recently-secured role in the CSIRO-led NSW Digital Infrastructure for Energy Flexibility project, which will run until 2026.
- Continued development of the data and metadata within the MEM dataset to add further value. As an example, the UNSW EDP project wanted additional consents, extensive site metadata via a lengthy survey, and 5 years of data rather than the MEM standard 3 years, and was willing to pay for these additional requirements.

Beyond the MEM

By halfway through the MEM project, in 2021, Wattwatchers was already starting to see applications and opportunities beyond the original scope of the project. These included:

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- Consumer-owned assets contributing to grid stability without excessive 'enforcement' via regulation.
- Value-adding to customers while also addressing grid stability factors (e.g. the South Australian 'Smarter Homes' regulations for solar export control, with likely extension to controlling major loads such as EV charging, pool pumps and air conditioning units).
- Developing ways to leverage data services revenue and the data sharing model, creating conditions to meet market expectations in terms of both product cost for data service buyers, and also participation costs for consumers (i.e. the sources of data).
- Further exploring the relationship between consumer energy assets (i.e. Wattwatchers devices), and the data they generate, with regulated assets (i.e. smart meters). For example, are they 'companion devices', or just complimentary?

By the end of the project, all of these remained on the agenda and had become even more relevant to a beyond-the-MEM future for Wattwatchers, especially given the impact of the electrification trend.

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7. The data journey

The MEM initiative has developed a consumer-facing energy data platform—a trust-based marketplace for sharing and transacting around data-driven services that utilises consumer-generated energy datasets, as opposed to industry-generated or regulated data.

Data governance overview

A core tenet of the MEM project is to provide an enhanced experience for energy users to manage and protect their data rights, in a customer-centric manner, that balances practicalities, legal, security and user experience requirements. The project also seeks to take in the learnings from other sectors and data rights initiatives (both past and ongoing).

A robust and comprehensive Data Governance Framework has been developed as a key pillar in our approach to protecting energy users' data rights, and enabling them to better understand, establish and execute those rights.

Within the Framework, we outline a working definition of the different roles in relation to the MEM project, and also a set of data principles that is summarised below:

1. **Lawful:** complying with the law, including the Privacy Act, is a baseline or minimum requirement which the MEM aims to exceed.
2. **Energy user ownership:** data ownership is not a straightforward matter under law, but the MEM aims to put consumers in effective control of their energy data (see *Note on data 'ownership'* below).
3. **Transparent & permissioned:** Energy users must be made aware of any data being collected, and its intended use (scope of use, benefit received, and who will have access to it). Their informed consent is required to share data with third parties.
4. **Purposeful:** Data should only be used for the purpose for which it is collected. It should not be collected for its own sake or in the event that it 'may,' at some point in the future, be useful or beneficial.
5. **Shared benefits:** In the first instance, data should only be collected if it provides some benefit or potential benefit to energy users, regardless of any secondary benefits that may be derived by other recipients of data (e.g. third parties).
6. **Actionable:** The data process should be understandable, seamless for permissioning, and supported by appropriate tools.
7. **Available:** This includes being portable, timely, affordable, interoperable, useful, and correctable and deletable.
8. **Secure:** Steps must be taken to ensure that data is managed and transmitted securely at all times.

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Note on data 'ownership'

A key learning, quite early in the project, was that our conceptual 'starting position'—that energy users own their energy data—is actually at odds with legal norms. Through our work and legal advice received, we now understand that the entity that generates the data is generally considered the 'owner' from a legal standpoint. This principle is enshrined in established international agreements such as the GDPR[53] that support data sharing models in international markets and particularly Europe.

With these principles in mind, Wattwatchers sought to implement the intent of the principle of 'user ownership' (i.e. to get as close as practicable to this 'ideal' from a legal and operational perspective). The MEM is an 'opt-in' model where users accept and can revoke data sharing rights at any time, but this may remove them from the MEM entirely if they refuse to disclose *any* data. This has not been an issue during the MEM, with only a handful of devices being removed from the project (mostly due to residents selling or moving properties and no longer being able to participate).

Points on the journey

Collection

The collection of data is a key first step that creates responsibilities for how data is then managed, stored, analysed and shared.

Legal

Purpose-developed terms and conditions, and updating of Wattwatchers' Privacy Policy, reflect the project's focus on consumer data rights and protections. Significant attention was paid to using 'plain language' (in English) and visual communications, an approach that was strongly encouraged by the Data Advisory Panel.

These terms are available in the MyEnergy app and on the Wattwatchers website.[54]

User experience

Easy access to the T&Cs, with important information highlighted in plain language, is embedded within the app itself. In accordance with MEM data principles, Wattwatchers only collects data that is needed for the purposes stated.

Wattwatchers has found increasing requirements to collect additional metadata relating to a customer's energy context—for example, solar system size, household size etc.—to support research requests, and value added services. Care must be taken to uphold the data principles, especially providing value back to the customer, in taking this step.

[53] https://gdpr.eu/
[54] https://mydata.energy/terms

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An example of this is the collection of billing data within the app. This is collected only for customers that wish to run a tariff comparison, or to fulfil the app's budgeting functionality. Once it is collected, however, the user can be presented with options for sharing this data further.

Technical (digital management/ingress)

A majority of the data collected for the MEM is coming from Wattwatchers devices, whether accompanied by the Wattwatchers MyEnergy app, or from third-party partner apps such as Clipsal Cortex and Solar Analytics. This provides a proven format for collecting and managing energy data.

As the project progressed and data from non-Wattwatchers devices was included, some of the limitations of these sources were identified. For example, inverter system data may not include grid connection data, and smart meter data does not provide sub-circuit data including solar generation.

This raises an opportunity for Wattwatchers-style devices (i.e. collecting circuit-level data and/or interfacing with other systems) to act as 'companion devices,' to provide more value-added services (e.g. fault detection, solar export control, operating status), operating alongside non-Wattwatchers devices.

Rollout

Installations are typically handled by third-party contractors, and thus information needs to be shared with those contractors as part of installation coordination. We have limited control over the systems and arrangements such installers have in place for managing and handling this data. This was managed by the commercial agreements with installers to ensure this information was handled appropriately.

Another important aspect related to data quality is that the rollout process is crucial to ensuring quality ('clean') data is coming into the system. It is well understood within the industry that this is a particular challenge, and the MEM is no different. In some early reviews of the MEM dataset, we have identified installation or configuration issues that have impacted data quality.

We addressed this in a number of ways:

- pro-active training of installers;
- auditing of initial data capture to validate that installations are correct;
- further development of our 'toolset' to support both on-site and remote review of installations.

This is critical to support data recipients that establish relationships with Wattwatchers around the MEM datasets. The adage 'garbage in, garbage out' rings true for our datasets, so 'installation accuracy' was a prime objective of our activities as we scaled up.

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Storage

Maintaining data security and privacy protections is core to Wattwatchers' 'business as usual' as much as it is to the MEM.

Data is stored in the Amazon Web Services (AWS) Sydney data centres with strong controls on access. Sharing of data with trusted commercial and project partners currently is managed on a case-by-case basis.

We've also encountered some challenges between the new MEM T&Cs on one hand, and some of our partners' data retention policies on the other, which were addressed as the project progressed. For example, where the partners needed to store data for other reasons than the MEM *per se* (such as regulatory compliance).

Even with legal agreements in place, we are acutely aware that we have limited capability to prevent data recipients from misusing data (i.e. for non-intended/non-approved purposes) if they are of a mind to do so regardless. Thus while we developed strong terms and conditions for data recipients to address the approved use cases, technical solutions were also put in place to ensure the anonymised data is not provided with any customer identifying information, which substantially limits the potential for malicious use. In cases where additional data from customers is required, this is stated and confirmed explicitly with users as part of those data capture processes—such as additional consent forms, surveys and other site information provided by the end user.

Processing

Streamlining data processing, and adding value to datasets are central to the evolution of MEM-based energy data services.

The delivery of MEM data to research partners has been a combination of static 'snapshots' as well as some integration with the Wattwatchers API for batched or semi-real-time applications.

To date, no substantial post-processing of the data has been required for commercial requests for data and we expect new use cases and opportunities to further optimise and add value to the data to emerge as the MEM continues into the future.

Access

The development of user-friendly T&Cs, that also provide conditional access to aggregated and de-identified datasets, is a key component of our approach to making data available to third parties.

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We developed a simple data anonymisation feature for the Wattwatchers API that allows the potentially identifying features of the device name to be hidden but still make all other data from the device available.

Our T&Cs permit the ability to share data with third-parties to fulfil the services of the app, as we do with Accurassi to provide the tariff comparison feature. Accurassi's process means that personal information is disclosed, so data processing and retention policies were discussed as part of the development of this feature.

We are currently only working with a small number of vetted third parties in a similar capacity (i.e. to provide services via the app). While at present these arrangements do not include personally identifying information, we are managing this process within the context of the Data Governance Framework.

Data sharing

A key part of the 'problem' being solved via the MEM is the historic 'non-availability' of granular real-time energy data and historical datasets for consumer use, research and commercial applications.

This 'non-availability' was been further validated throughout the project, at a time when there is a growing focus on modelling of tariffs and other factors to develop 'New Energy' solutions such as microgrids, VPPs, local energy trading, demand response and DER management, and electric vehicle deployment including vehicle-to-grid (V2G) trials.

This is reflected in correspondence with one influential state government agency representative who indicated that: *'It was interesting to hear about Wattwatchers' work and Wattwatchers' project with ARENA to establish a much needed pool of data.'*

In another case, a research entity discussing potential access to MEM datasets referenced using now ageing datasets from the Smart Grid Smart City Customer Trial, collected in the 2010–14 period, which refers to itself as "one of the few linked sets of customer time of use (half hour increments) and demographic data for Australia, as well as detailed information on appliance use, climate, retail and distributor product offers, and other related factors".[55]

It is noteworthy that MEM datasets from Wattwatchers devices provide far greater granularity and timeliness than the *Smart Grid Smart City* datasets (from smart meters). The MEM dataset includes 5-minute time-and-date stamped increments, streaming data down to 30-second or even 5-second increments, and monitoring of individual circuits including solar generation, as well as loads like pool pumps, EV charging, electric hot water and air conditioning. While one potential customer for MEM datasets referenced

[55] https://data.gov.au/dataset/ds-dga-4e21dea3-9b87-4610-94c7-15a8a77907ef/details

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another option for purchasing similarly-granular datasets, it turned out the ultimate source of this data also was from Wattwatchers devices.

Throughout the later stages of the project, a number of data customers commented how the type and volume of data we could make available was 'too good to be true.' The near real–time availability of MEM data as anonymised circuit-level data via modern APIs is cutting edge and unsurpassed by other datasets currently available.

The MEM now has a number of MEM data users, including major research institutions the CSIRO, the University of NSW (UNSW) and the Australian National University (ANU). One of these early customers for the My Energy Marketplace was former CSIRO energy researcher Tim Moore, now with the ANU and its prestigious Battery Storage and Grid Integration Program (BSGIP), who provided the following feedback:

> *'High quality residential energy data is extremely rare and valuable, leading to challenges in research data analysis. The Wattwatchers My Energy Marketplace dataset gave us quick access to dozens of end-points monitoring hundreds of individual devices, allowing us to perform a far deeper analysis than we expected would be possible – greatly improving our research outcomes and the impact we were able to create. The data was easy to access and required very little pre-processing, saving time and allowing us to get straight into the research with almost no overhead. We're already planning our next data project using this great resource!'*

Engagement with a number of research and modelling projects that had suitable use cases for MEM data indicated that many projects do not plan sufficiently for the cost to acquire data. While the cost of installing new monitoring devices may be known, we have repeatedly demonstrated that the cost to provide data immediately from the MEM is far lower than the cost of installing new devices as well as the substantial time saving of 1–2 years to access data immediately from the MEM.

Grid visibility and management

The MEM team has already received and completed a number of expressions of interest and commercial agreements from research, industry and commercial players—some of whom are working on topics related to grid visibility, stability and management. We expect to further explore these expressions and related opportunities in more depth in future, post-ARENA phases of the MEM.

MEM data from CERs will increasingly become important for research and commercial purposes to inform projects and decision-making based on real data. For example, MEM

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devices have been installed in South Australia under the Smarter Homes[56] program to remotely switch on and off solar inverter systems, based on electricity network and market conditions and signals from AEMO and SA Power Networks (SAPN). Wattwatchers technology, which is closely related to that provided by the MEM, was approved and employed by SAPN as part of this program.

Voltage readings and variations are a key example area of data that will be useful to network and market operators. The ANU Battery Storage and Grid Integration Program PhD study work for the MEM included investigating 'state estimation' to extrapolate from limited monitoring sites to calculate wider grid conditions. To explore this, ANU incorporated MEM data into their study as described in *Section 3. Findings and Outcomes - MEM Partner Insights* of this document.

Consumer data access

The MyEnergy smartphone application, available for iOS and Android phones, is the primary method of end-consumer access to MEM data.

Throughout the project, our customers continually provided extremely positive feedback about how the access to near real-time and detailed circuit-level data gave them a never before seen insight on where their energy was actually being used. This often drove immediate behaviour change or appliance maintenance and upgrades to combat the rising costs of electricity and limit environmental impacts.

The use of friendly visualisations, such as icons in the app like the 'sun' and the 'arrows' to indicate direction of energy flow, have generally been understood and well received, and were encouraged by responses from early user testing. Conversely, more 'technical' representations shown to user testing participants were poorly received, and were not pursued.

Consumers have a wide range of levels of comprehension of their energy consumption and the information must be presented in a clear and consistent manner that is easy to understand. The clear feedback from early users was the desire to see data in terms of cost ($) rather than just in technical terms like kilowatts (kW) and kilowatt-hours (kWh). This feedback reinforces our perspective coming into the project, and reflects broader industry learnings.

We've also identified user interest in other non-financial representations, such as carbon impacts and equivalent emissions saved, and these are earmarked for inclusion in future app upgrades. Providing useful insights, making things actionable, and situating the user

56 https://www.energymining.sa.gov.au/industry/modern-energy/solar-batteries-and-smarter-homes/regulatory-changes-for-smarter-homes

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in the overall process of optimisation for financial, environmental and other reasons are vital to the ongoing evolution of the app's presentation and functionality.

Some consumers are sceptical about the features like tariff comparison due to bad previous experience with comparison and switching services, with concerns about the range of offers being presented common. This led to a very low initial uptake of the retail switching capabilities of the MyEnergy app. It is relevant to note that the DAP also expressed concern about over-reliance on tariffs and switching functions, versus other actions that energy data can help to enable e.g. efficiency, solar optimisation, behaviour change etc.

The MyEnergy app is being continually developed and supported by Wattwatchers to improve its performance and features, including the scheduled 2.0 upgrade to MyEnergy Flow in the first half of the 2024 financial year, and is now a core part of the Wattwatchers solution offering.

Commercial model

A key premise of the project was that up-front hardware and provisioning costs, and ongoing communications/infrastructure costs, could be offset by revenue from multiple streams of data use.

In the preliminary business plan for data services based on the MEM, revenues from which are expected to be crucial to establishing a long-term sustainable business model, Wattwatchers identified the following areas (this is not an exhaustive list):

- **'VPDP' services**
  This groups 'Virtual Power Plants (VPPs)' and Demand Programs into 'Virtual Power and Demand Plants (VPDPs)'. It covers services to VPDP providers and marketplaces e.g. telemetry data + load control;
- **Grid/network visibility**
  Services to utilities providing visibility of network attributes in geographically-targeted areas (e.g. voltage and frequency, status of loads and assets, and 'last gasp' in the event of disruptions);
- **Vendor services**
  Leads + supporting data for vendors (e.g. installers, ESCOs, neo-banks etc.) targeting customer attributes (e.g. location, has solar and/or battery);
- **Real-time data access**
  Service fees for accessing real-time energy data for non-network/VPDP purposes (e.g. ESCOs, researchers etc.);
- **Historical dataset access**
  Static datasets provided to researchers, utilities and other parties for analysis.

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- **‘Clip of the ticket’**
  App providers paying for access to energy data and availability via the MEM ‘energy app store’.

Different aspects of a sustainable commercial model have been tested throughout the project—in line with the MEM Business Plan and Implementation Plan—including:

- Using the ARENA subsidy to test the pricing of hardware at 100% discount (no cost), 50% and 25% discount levels as a proxy for future sources of revenue from third parties.
- Developing a data services pricing model that shares the installation and data maintenance costs over groups of devices within the MEM while also supporting additional special requirements such as additional data analysis, verification and participant rebates and rewards.
- Securing commercial deals to sell Wattwatchers hardware in line with the subsidy structure in the Funding Agreement, with both direct end-customers and via channel partners.
- Developing and securing opportunities for MEM data services to third parties including the UNSW Energy Data Platform (EDP) project that is providing $250 per MEM device for access to data for 3–5 years for up to 400 sites.
- Developing and establishment providing data from 2000 MEM devices to the CSIRO data-hub project commencing in early 2023 until mid 2026.

These activities are helping to confirm that there are viable commercial models for the ongoing operation of the MEM that include the sharing of data between Wattwatchers and both direct customers and channel partners.

Wattwatchers has identified a range of stakeholders that can benefit from the access to the data as a stack of multi-stakeholder value that could help to reduce the upfront cost to consumers and potentially even exceed the upfront cost. This formed part of a number of our industry presentations as part of our Knowledge Sharing deliverables of this project.

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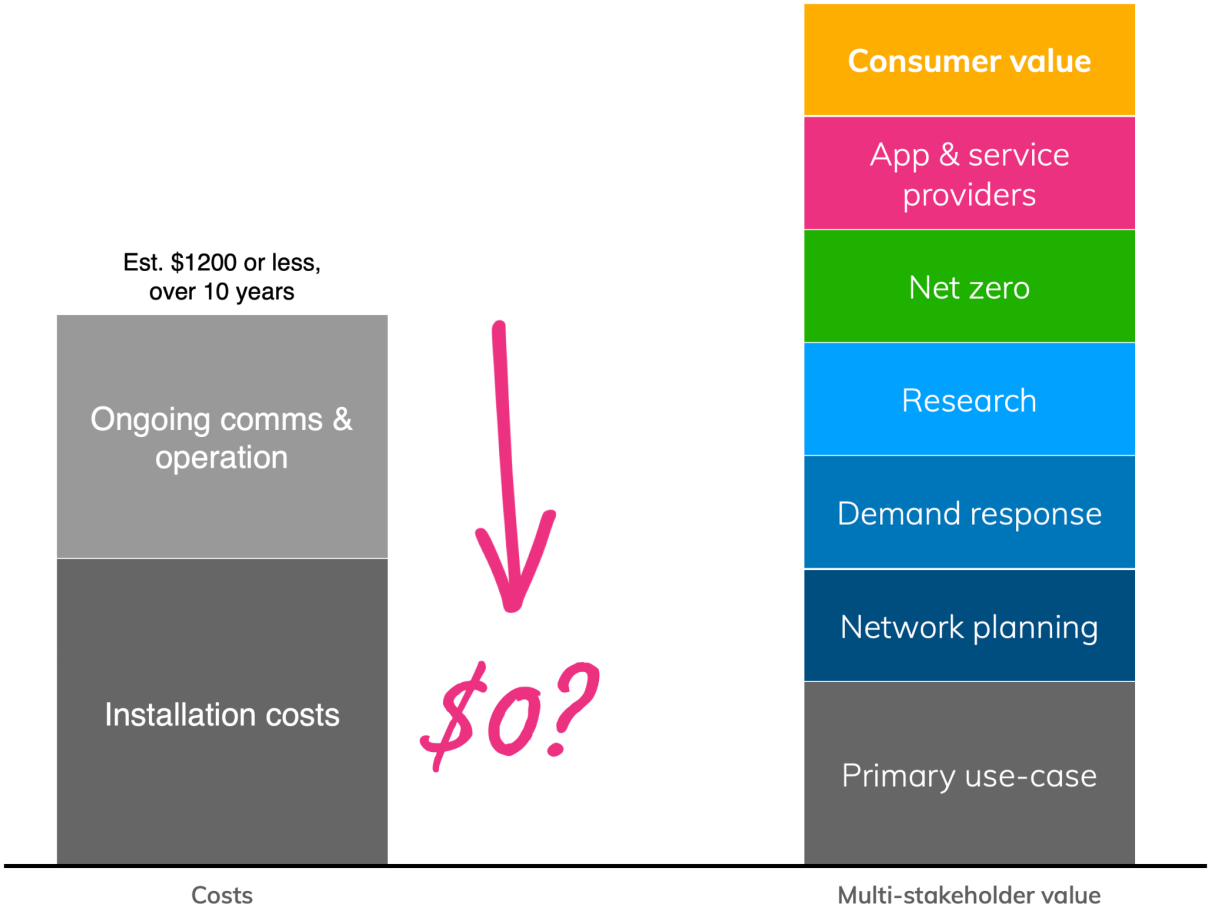

Figure 16 - MEM Device Multi-stakeholder value stack

The value of data for some of these stakeholders has been demonstrated to be in the range of a total revenue of $250 to $1000 per device for 3–5 year data sharing agreements. This has been considered excellent value for money by those customers when considering the cost to rollout new devices being $1500 to $2000 per device when factoring in recruitment, training, installation, operations, maintenance, support and project management not to mention the 1 to 2 year time delay to wait for installations and 12 months of data to become available.

Wattwatchers will also continue to develop other value streams for the data, such as to support marketing activities and lead generation for related industries such as major appliance retailers, solar and battery installers and EV providers inline with the multi-stakeholder value proposition.

Offering consumer energy data, whether as a commercial service or as a support for research and community initiatives, remains in its early stages of development in Australia and internationally. A key international precedent that informed the MEM project back to its ARENA approval stage circa 2018 is the Pecan Street Dataport project in the US, which describes itself as 'the world's largest resource for residential energy use data'.[57]

In Australia, the 300 residential-site Smart Grid Smart City dataset[58], the main legacy of a $100 million Australian Government-funded project a decade ago, has been a traditional

[57] https://www.pecanstreet.org/dataport/
[58] https://data.gov.au/dataset/ds-dga-4e21dea3-9b87-4610-94c7-15a8a77907ef/details

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'go to' for researchers doing modelling work. MEM deployment partner Solar Analytics, a long-standing Wattwatchers hardware customer, supports AEMO and other customers with data ultimately sourced from Wattwatchers devices, including for other ARENA projects (e.g. the UNSW-led Project MATCH[59]). We also are aware that other equipment manufacturers (e.g. energy devices, solar inverters, battery storage systems and EV chargers) have participated in *ad hoc* arrangements to share customer-level data for research and regulatory trial purposes.

The Victorian-based Centre for New Energy Technologies (C4NET) established its data access service[60] in 2021, after the MEM started, drawing on the data resource created by Victoria's $2.9 billion mandatory roll-out of smart meters about a decade ago. A key differentiator for the MEM is that by comparison to data derived from utility smart meters, Wattwatchers data is more granular and near real-time, including measuring individual household loads (e.g. electric hot water and heat pumps, air-con, pool pumps, EV chargers), and also rooftop solar generation.

[59] https://arena.gov.au/projects/project-match/
[60] https://c4net.com.au/services/data-access-services/

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8. Consumer insights

The Wattwatchers-led My Energy Marketplace (MEM) project aims first and foremost to empower consumers with *their* energy data for *their* benefit. The project's thesis, from there, is that consumers will then be more prepared to share their data with third parties and the broader electricity system, to use in exchange for further rewards.

A critical requirement for this to work is 'trust', and therein lies a key challenge for the MEM and the whole energy sector. Arguably, our starting position is a 'trust deficit'. Thus trust has to be earned.

In user testing before the initial release of the MEM app, MyEnergy, 'trust' immediately loomed large even among a small testing group (approx. 10). It's not a new revelation that the energy industry faces high levels of distrust from its customers, who make up a very large percentage of the population, and communities.

When the MEM team engaged volunteer 'consumer testers' with the prototype app's tariff comparison and retailer switching functions, lack of trust immediately appeared as a potential barrier. Many expressed concern that even by *just clicking* on a plan/provider's details that the provider would be notified, and they'd start receiving spam, follow-up calls etc. The MEM team concluded that:

- This reflects the poor practices of existing providers, in this case comparison and switching services, 'polluting' the field.
- When probed, it was difficult to discern what we could realistically do to address this perception—a high amount of distrust exists around these types of services.
- Participants who were concerned about privacy were particularly concerned about (or disinterested) in uploading bill data due to the additional personal information that would be gleaned from a bill. There also was resistance to uploading personal banking details as part of an in-app switching process.
- Multiple participants expressed scepticism about the bona fides of so-called 'green options'[61] that are reflected in some tariff plans (i.e. concern about 'greenwashing').

A biassing factor encountered for some user testing participants was an awareness of Wattwatchers (i.e. through promotion by project partners who helped with tester recruitment) and being considered a 'trusted brand'. For others, Wattwatchers was not known, prompting questions about what was being presented: i.e. 'I would read that as Wattwatchers is new and not a company I trust [yet]'.

Customer typologies

The early working assumption for the MEM was that having real-time and historical access to granular data, independent of regulated metering data, is most valuable to

[61] These options were GreenPower accredited options highlighted in the listing.

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customers who have above average 'value at stake' via their electricity. There was also a built-in bias in early recruitment towards owner-occupied sites, given that physical installation of smart energy devices is required (which needs landlord approval in the case of rentals); and towards free-standing homes (including duplexes and townhouses) versus apartments, especially smaller units due to practical challenges with installing meters in non-free-standing dwellings.

Thus we have mostly targeted owner-occupied houses with rooftop PV systems, where data helps to optimise the performance of solar as an investment, followed by non-solar homes with large power bills. Wattwatchers has been conscious of not wanting to exclude renters and particularly social housing occupants, with special efforts to engage in the social/community housing sector.

One experience in this regard revealed particular sensitivity about 'big brother' data sharing amongst this group (i.e. another dimension of the lack of trust conundrum). Conversely, experience with another social housing group indicated a level of apathy from residents on the basis that the property managers had approved the installation, so they accepted the device installation. This segment needs special consideration and engagement unique to each situation to ensure these community members are not left behind in the energy transition.

It's also been reinforced that a significant minority of customers are motivated, predominantly or additionally, by non-financial factors, especially environmental concerns and the desire to have more independence from 'the system' (i.e. 'get off the grid', or at least reduce reliance on it).

Wattwatchers also developed four consumer personas to support the development of MyEnergy features and market engagement strategies:

- **Solar optimiser**
  Consumers who have installed solar, driven by high bills, who want to ensure their investment in solar is working as expected.
- **Bill stress**
  Consumers where increasing energy bills are placing increased pressure on the household budget, and are thus looking to understand where they're using energy, and ways to reduce their energy consumption.
- **Smart home tinkerer**
  Technical consumers interested in automating and optimising their energy consumption.
- **Sustainability warrior**
  Consumers that consider themselves doing 'their bit' for the environment and want to bring about broader change.

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In selecting recruitment channel partners for the MEM, we've sought to address and leverage non-financial motivations by targeting community energy and sustainability groups, and not-for-profit environmental and climate action organisations, including 'green' and 'tech-savvy' users, plus 'early adopters'. (It is worth noting, again, that Covid pandemic restrictions affected the MEM team's ability to engage directly with community groups and individuals.)

As the MEM project progressed, the recruitment emphasis shifted to a wider demographic as we targeted rollout partners with potential to scale deployments. In particular, solar installers operating under a range of business models (including combined solar installation and electricity retailing) have clearly emerged as the strongest commercial fit for the MEM. Through these channels, the 'demographic' is a broad one, comprising a base of mainly home owners from diverse backgrounds who are getting rooftop solar installed.

Recruitment & rollout

The Covid pandemic and its disruption of rollout partners, as well as Wattwatchers itself, meant that recruitment of participants and installation of smart devices was slower than originally anticipated.

Significant focus early on was devoted to engaging community-based groups pursuing local programs for sustainability, climate action, zero emissions, 100% renewable, energy cooperatives and similar themes. Where Wattwatchers has found success with community groups, they have been more mature and at-least moderately well-resourced groups that have been able to leverage other, additional funding and resources to partner with the MEM. This suggests to the MEM team that a smaller number of deeper relationships, with the most suitable communities and groups, looks most effective for these channels.

The focus shifted in the second half of the project to the commercial operators engaged in solar installations as a core part of their business models (they may also be energy retailers, or install batteries as well as solar, or be new home builders etc). A key factor is that solar installations already require electricians to be on site, with the installation of smart monitoring and/or control devices being only an incremental additional cost, compared with a comparatively higher cost for special electrician visits to sites to retrofit smart devices.

This approach proved to be very successful with a very high uptake rate, as the solution met the customers' requirements for comprehensive energy monitoring of solar generation, grid import and export and the additional circuit-level data supported by Wattwatchers devices.

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Different project partners had different sensitivities. For example, participation by energy retail partners, or organisations and community groups with retailer affiliations, has required the removal of the app's tariff comparison features due to concerns that displaying a cheaper deal may not show the full consideration of features and benefits of the existing deal (there is a legitimate basis for some such concerns, if not all, and the DAP recommended that the MEM team further document the evaluations and case-by-case decisions being made to accommodate these partners). In practice, once modifications were made to accommodate these partners, they became very actively engaged with the project.

Wattwatchers identified that a key process to manually set up the access for the customer to their mobile application was missing a critical window of customer engagement and thus was impacting adversely on the overall customer experience. This was addressed by creating the ability for customers to self-register their device in the app and set up their account themselves as soon as it is installed. This reduces the lag between installation and access to data that is critical to the customer's 'moment of engagement' during the initial installation.

Customer feedback and support requests have driven a range of other changes in the development process and new features have been released. This is important to ensure that we have good engagement with the different types of data for a wide range of customers with different levels of energy understanding.

Engagement

Through the MyEnergy app features and offers made available, the following engagement insights were observed.

- Response rates to an in-app and email campaign were around 15% for a UNSW offer to receive a $50 voucher and ongoing entry in prize draws in exchange for responding to a survey and sharing data.[62] This is considered much higher than the 2–3% uptake (click) rate[63] from general marketing campaigns and indicated an engaged user base around the issues of sharing data for the broader research and benefit of the energy industry.
- Use of the retail tariff comparison features in the MyEnergy app increased shortly after users were first given access to the app. This indicates that users are trying out all of the features during the initial period of engagement immediately after the installation.
- Use of the budget notifications feature in the MyEnergy has continued to grow throughout the project indicating ongoing use of the in-app and push notification features.

[62] https://wattwatchers.com.au/how-to-get-rewarded-for-sharing-your-home-energy-data-with-researchers/
[63] https://mailchimp.com/resources/email-marketing-benchmarks/

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- MyEnergy user app sessions generally continued to grow throughout the project indicating that users do continue to use the app over an extended period of time.

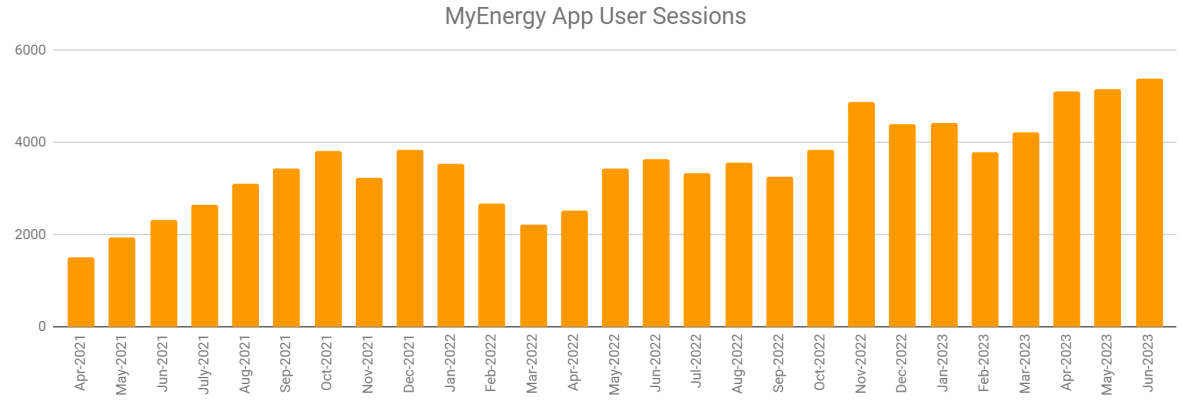

Figure 17 - MyEnergy app user sessions over the project life

Consumer feedback

Our participants have continually provided extremely positive feedback about how the access to near real-time and detailed circuit-level data gave them a never before seen insight on where their energy was actually being used. This immediate visibility helps to drive understanding and behaviour change as well as appliance maintenance and upgrades to combat the rising costs of electricity and limit environmental impacts.

One of the residents in Heyfield, Victoria commented:

> *'Since the device was installed, we have replaced 2 appliances - a fridge & reverse cycle aircon. Both units show a marked decrease in power usage as the monitor shows in real-time.'*

When school teacher Kristian Jackson wanted to invest in rooftop solar, he found his Wattwatchers device and MyEnergy app invaluable for sizing the right system.[64]

Living in the foothills of the notoriously chilly-in-winter Blue Mountains, west of Sydney, Kristian and wife Natalie have been relying on running their ducted air-conditioning in heating mode to warm their family's all-electric home in the colder months of the year.

Kristian confesses to being a 'bit of a data nerd', and has the full suite of common motivators for investing in solar: financial, environmental, with a dash of independence and self-sufficiency too.

[64] https://wattwatchers.com.au/real-data-takes-out-the-solar-guesswork/

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'At first the app was a nice-to-have,' he recalls, 'but it became indispensable and I felt so empowered when talking with solar installers.'

We have also had a range of feedback around potential new features to consider implementing in the MyEnergy app such as integration with home automation platforms, indicator light and sound methods for alerting users to different usage conditions as well as different ways of presenting the graphs and charts.

All of this feedback has been extremely useful in our continuous development and improvement processes for the MyEnergy app and user experience.

Consumer data sharing

While the T&Cs have been almost universally well received, there nonetheless is an expectation that most users will ignore them and simply click on 'Accept'. For those who did read the T&Cs, the feedback was that they have been well presented, and show an acceptable level of concern for consumers' rights.

We originally proposed an OAuth-style model of customer permissioning, allowing a MyEnergy user to opt-in to providing data to third-party app developers whose apps were promoted in the marketplace.[65] After discussions with multiple developers, however, we have landed on a simplified model that maintains Wattwatchers' standard API implementation, which in turn greatly reduces the effort required by third-party developers to engage in the marketplace.

The MyEnergy user interface has also been simplified to a simple 'approve access' option and an easy method for copying the Wattwatchers device serial number into an external application or website to complete the external registration process.

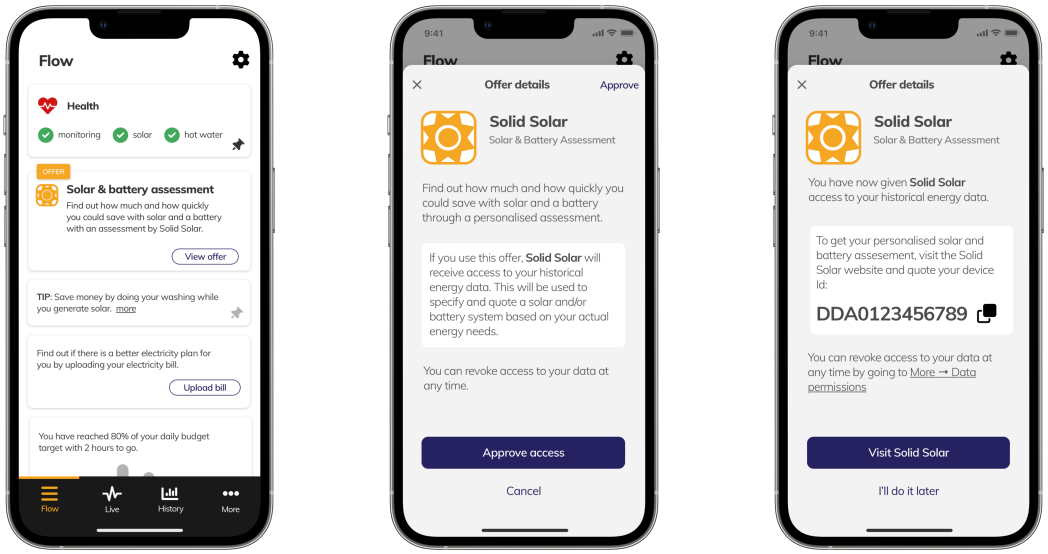

Figure 18 - New MyEnergy Flow simplified data sharing features (development preview of example offer only)

[65] https://www.oauth.com/

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This will support a number of offers to be easily accessible through the MyEnergy Flow interface from a variety of partners in the near future.

School behaviour changes with education

In addition to the MEM, Solar Schools has been involved with the rollout of Solar Systems and energy metering across more than 700 state schools. The energy data was used as a contract mechanism to prove energy savings from the solar generated by installed systems. Business service managers were provided access to the energy data, however no formal education was provided, and the energy data was generally not shared within the school staff or students.

The data shows that installing solar generation at schools, without supporting data and education, results in an increase in grid consumption. Across a range of different schools, a year-on-year increase in grid consumption was observed of between 8 and 10 percent after the installation of solar, essentially negating any benefit from installing solar after a three to four-year period. One example of this is below for a school in Queensland that showed an increasing trend in both base consumption (red trend line) and peak consumption (orange trend line) after the installation of solar.

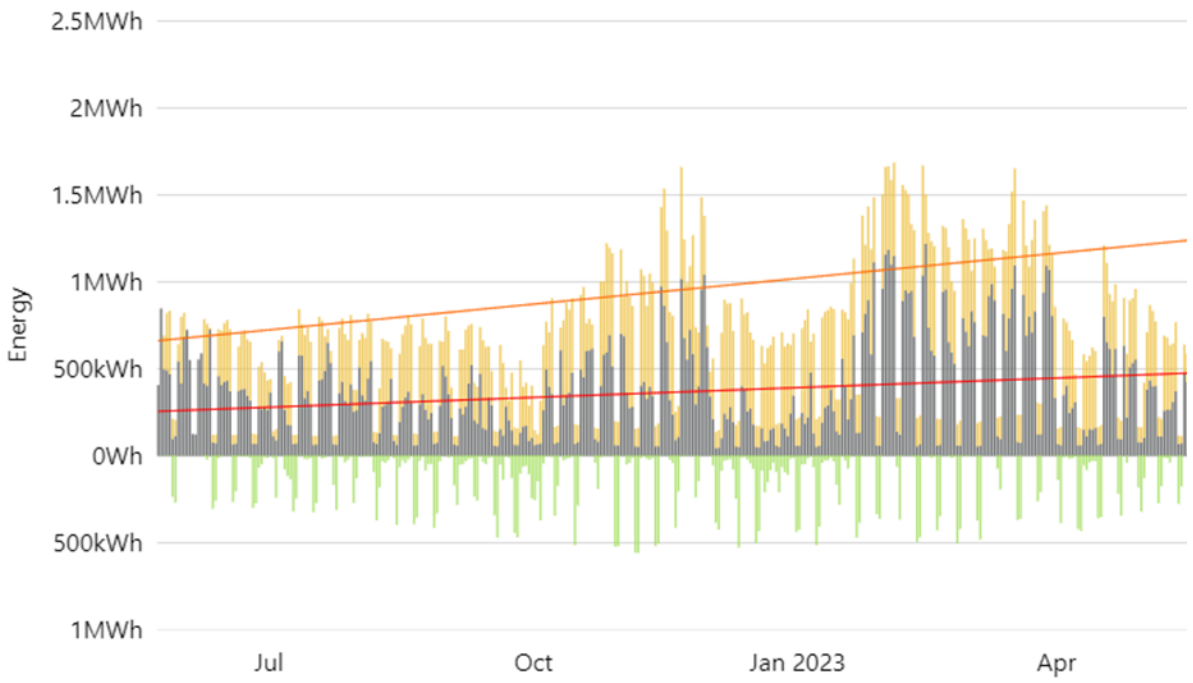

Figure 19 - Increasing energy consumption of a school in Queensland after the installation of solar and without a supporting behaviour education program.

In contrast, the results for a different school that actively participated in the Solar Schools program is shown below, where despite an increase in load from the installation of

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air-conditioning equipment in 2022, the school achieved a 13% decrease for base load (red trend line) and a 12% decrease during school hours (orange trend line).

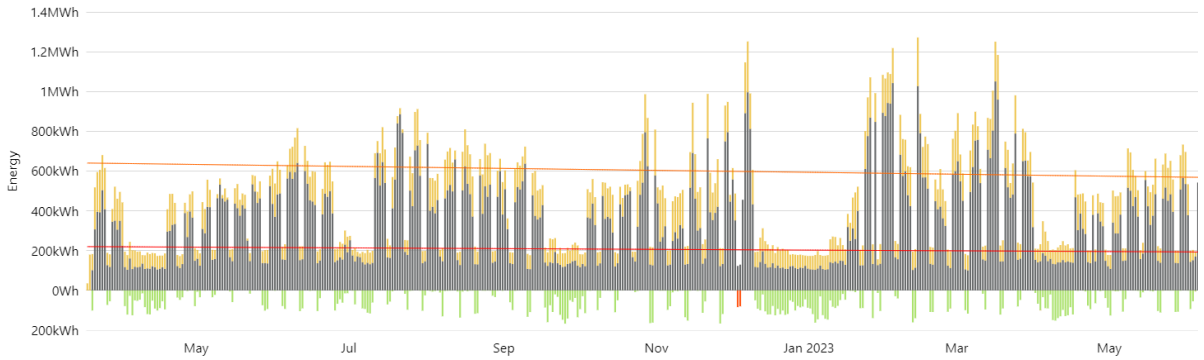

Figure 20 - Decreasing energy consumption of a school in Queensland after the installation of solar and air-conditioning with active engagement in the Solar Schools education program.

These results demonstrate that more cost effective and better long term outcomes can be achieved by installing energy meters and implementing an educational behavioural change program to schools as delivered through the MEM.

Data opportunities to investigate the efficiency paradox

The Jevons paradox is an economic theory that states when government policy or technological progress increases efficiency, the overall demand increases rather than decreases.[66] In the context of electricity, this is often considered as a potential explanation for consumption increasing when consumers install solar systems, because they now have access to an excess of 'free' or 'green' energy that is otherwise being exported into the grid.

We considered these issues, and performed some high-level analysis of the MEM data in regard to consumer energy trends, but were unable to identify any clear conclusions. In Figure 21, when comparing energy consumption 1 year after initial installation of the energy monitor, there was no clear trend towards either reduced energy use (month 13 < 100% of month 1 energy consumption) or increased energy use (month 13 > 100% of month 1 energy consumption) across the whole sample.

There are a range of considerations around the clean energy transition and its impact at the consumer level—including the electrification trend that is actively happening in the Australian market—which energy data alone does not identify or fully explain. Deeper contextual information is required to understand what steps consumers have taken in terms of efficiency, renewables and electrification, as well as changes in energy-related perspectives and consumption patterns. For example, changes may be due to many

[66] York, Richard; McGee, Julius Alexander (2 January 2016). "Understanding the Jevons paradox". Environmental Sociology. 2 (1): 77–87.

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factors including financial, educational, housing, demographic, social and economic considerations.

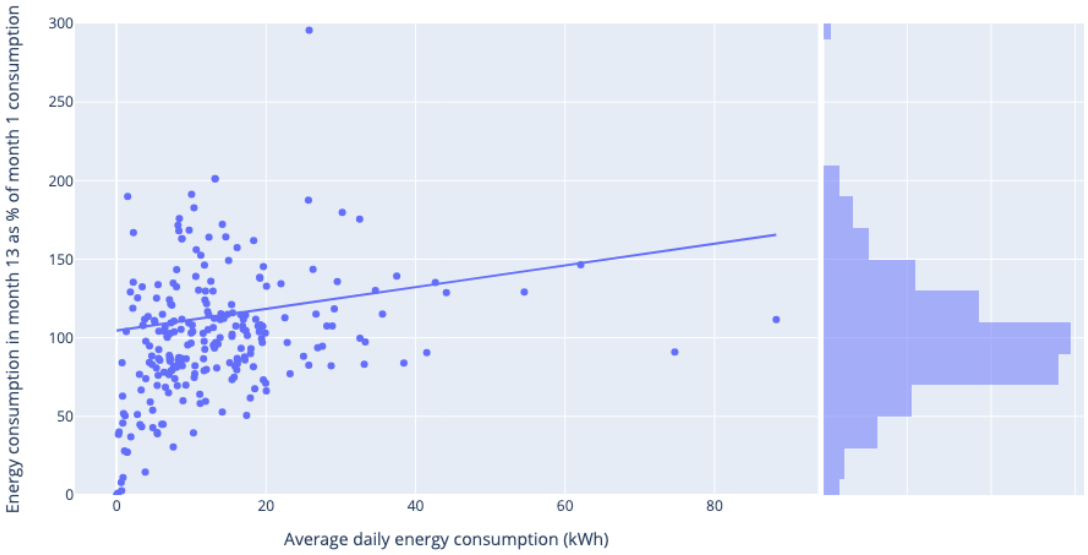

Figure 21 - Comparison of energy consumption in month 13 vs month 1 after install of energy monitoring for a sample of 251 residential MEM sites as a function of the average daily energy consumption of a site.

The MEM was not established to investigate these use cases specifically, but rather to create an up-to-date and 'living' data set that researchers and policymakers can use to investigate, through purpose-designed research, these kinds of issues in greater detail than was possible before. MEM users are available to be engaged through interviews, survey responses and other methods to gain the deeper understanding needed—the stage of renewable adoption, electrification and energy efficiency that is unique to each user.

The MEM can contribute towards addressing behavioural dilemmas by making invisible energy consumption data more visible directly to consumers, as well as research and industry participants. This data visibility is critical to the electrification and energy transition activities, as simple supply and demand principles may fail to create all of the pressure and participation the transition needs (as an example, see the ANU BSGIP 'Meter unbundling conceptual analysis' report[67], which was assisted by access to MEM data).

It is well known that while an essential building block, data alone is generally insufficient to effect behaviour change. Features within the MyEnergy app, like the Flow, which provides real-time prompts, insights that go beyond just the data, and remote circuit switching functionality, are ways that the MEM and Wattwatchers can increase the likelihood of positive behavioural shifts.

[67] https://bsgip.com/wp-content/uploads/2023/08/Meter-Unbundling-final-report.pdf

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There is also the consideration of carbon efficiency, in contrast to energy efficiency. That is, load shifting to times of plentiful renewable energy (i.e. middle of the day) can greatly improve carbon efficiency, without necessarily relying on an overall reduction in energy consumption. This is particularly important as the anticipated rapid increase in electrification, especially electric vehicle charging patterns, starts to be felt across the grid, and also as the amount of renewables in the grid continues to rise.

Data to compare, track and rank consumer energy activities will be important to leverage social signalling for businesses and consumers who want to demonstrate they are resource conscious, including actions outside the more commonly understood renewable energy drive.

For example, it could be argued that as solar generation installations are visible and widely understood, they can generate higher uptake even at lower levels of return on investment, purely from a public relations and social signalling perspective. The International Energy Agency notes, however, that "Energy efficiency represents more than 40% of the emissions abatement needed by 2040".[68] Some estimates suggest energy efficiency will contribute more than renewables to this goal.

Less visible energy efficiency and demand flexibility participation is more complicated and requires data to demonstrate the benefits. While Australia has one of the highest rates of solar uptake in the world,[69] substantial challenges exist to educate and engage consumers around demand management, flexibility and energy efficiency.

[68] https://www.iea.org/commentaries/how-energy-efficiency-will-power-net-zero-climate-goals
[69] https://www.energy.gov.au/households/solar-pv-and-batteries

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9. Next Steps

Wattwatchers has now completed the ARENA-funded stages of the project and has commenced transitioning the MEM to a business-as-usual activity as *MyEnergy Marketplace*,[70] as part of our products aligned around the MyEnergy brand and ongoing strategic growth initiatives. This involves continuing to offer discounted hardware in return for the rights to share the data under the MEM terms and conditions, whilst also engaging with research and commercial organisations which seek the valuable data the MEM has developed.

New opportunities continue to emerge in the data services space to utilise the MEM data for its intended purpose. Wattwatchers is excited to be a key part of the energy industry transition to deliver the outcomes of the MEM as a new range of innovative data services to energy and data users in the Australian and international markets.

10. More Information

If you would like more information regarding the My Energy Marketplace project, please contact us using the links below.

Website: https://wattwatchers.com.au/about/#contact-us
Email: info@wattwatchers.com.au

[70] https://wattwatchers.com.au/one-stop-shop-for-customer-data-enables-research-and-innovation/

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Appendix 1: Data Advisory Panel

With the centrality of data in the MEM project, decision-making was both quantitative and qualitative, requiring values-based judgements as well as fact-based ones. Based on initial advice from Energy Consumers Australia (ECA), Wattwatchers proposed, and ARENA endorsed and adopted, the establishment and operation of a Consumer Energy Data Advisory Panel (CEDAP), with external experts as members playing a guidance role, which within the project was known simply as 'the DAP', the Data Advisory Panel.

The volunteer participants in the DAP often were members of energy system-relevant organisations, but participated in a personal capacity rather than as an official representative of their organisations. Over the life of the project, DAP members included personnel from: Energy Consumers Australia (ECA), the Australian Energy Market Operator (AEMO), the Energy Security Board (ESB), the Australian Energy Market Commission (AEMC), The Energy Charter, the University of Technology Sydney (both UTS Data Centre and UTS Design Architecture Build), Monash University, the Coalition for Community Energy (C4CE), local government and the private sustainability consulting sector. This facilitated awareness raising in regard to the MEM project and its evolution, and provided channels for MEM-related learning to be shared across relevant stakeholders - including regulators, the energy industry, and academia.

Over three years, the DAP met a total of 11 times, for about two hours at a time. Designed before the pandemic, it originally was envisaged that it would have a mix of in-person and online meetings, however once Covid hit online meetings became the accepted format, and the DAP stayed 'virtual' throughout the project. It aimed to have at least seven members, with a maximum of nine members, who were identified and recruited by Wattwatchers. ARENA had an approval/veto right over the DAP membership, although in practice it endorsed all nominees who were put forward by the Wattwatchers MEM team (several DAP members resigned during the life of the MEM, usually due to role changes in their professional lives, and several replacements were inducted to replace them). ARENA was represented at DAP meetings by an 'Observer', who on most occasions was the designated 'Delegate' for the MEM grant project.

The DAP proved to be a learning experience for all involved, ARENA included, and it moved through three main phases:

Establishment challenges

There were initial teething issues with convening and establishing the MEM, primarily related to fine tuning the Draft Terms of Reference to satisfy all participants that the role of DAP members was clearly and properly defined. The core key issue related to the role and responsibility of being a DAP member, which required modest redrafting to spell out that DAP members provided guidance to the MEM and Wattwatchers, but did not make

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decisions or provide formal 'endorsements'. The amended Terms of Reference for the DAP say:

> 1.2 *The Panel's role is to provide recommendations and advice to Wattwatchers in the implementation of the My Energy Marketplace initiative (the MEM). The advice is for information and guidance to ensure that Wattwatchers is "heading in the right direction". It is not the purpose of the Panel to have a decision-making or formal endorsement role in the process of determining project activities, processes, priorities, or any similar matters.*

First year (2020) burden of work

The requirements for the DAP to consider and provide guidance on complex documentation for the project in the first year created a significant 'reading and review' burden on DAP members. This arguably exceeded what the volunteer participants, who were not remunerated in any way for their participation and guidance, felt they had signed up for. The documentation included the user-facing T&Cs developed for the MEM, but also confidential project documents i.e. the Information Security Policy and the Data Governance Framework. This overburdening of DAP members was acknowledged at the end of the first year—through reflection and discussion between DAP members, led by Chair Donna Luckman, and the Wattwatchers MEM team—which led to a more collaborative, co-design style approach being adopted (by consensus) in the second and third years of the DAP.

Valuable sounding board in 2nd and 3rd years

The DAP came into its own in its second and third years, when its 'guidance-only' role was well-established and understood, and the first-year burden of complex documentation was put firmly in the 'job completed' basket. The DAP meetings, held three times a year, became highly-valued 'sounding board' opportunities for the MEM team to share progress, and also frustrations or barriers, and to demonstrate and 'test' new developments for the MEM project, such as new app features and approaches, and third-party partner offerings that were demonstrated for the panel. DAP member guidance also included identifying potential partner, service provider and sub-project opportunities; and individual DAP members made themselves available for one-on-one, deeper-dive guidance for Wattwatchers MEM team members - outside of the regular meetings - where relevant to their particular expertise.

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Our thanks

The Wattwatchers team offers our heartfelt thanks and appreciation to all of the individuals who participated in the DAP as panel members or their alternatives. The panel members listed below participated as individuals, but we have included their relevant organisational affiliations for context. They are:

- Donna Luckman (Chair) - Merri-bek City Council and Coalition for Community Energy (C4CE)
- Adam Berry - University of Technology Sydney Data Centre
- Ben Waters - Presync
- David Havyatt - Energy Consumers Australia
- Ed Chan - AEMC
- Larissa Nicholls - Monash University
- Leena Thomas - University of Technology Sydney
- Mitch Grande - AEMC
- Sabiene Heindl - The Energy Charter
- Sarea Coates - Energy Security Board
- Tim Hewat - AEMO
- Wayne Pales - AEMO
- Yolande Strengers - Monash University

We also thank the ARENA observers and their alternates who participated across the life of the DAP:

- Adrian Rule
- Rachele Williams
- Megan Sanderson
- Tim Couchman

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Appendix 2: Project Knowledge Sharing Materials

Attendance and participation in a public industry events

May 2019 - Physical promotion of the MEM with a stall at the 1 Million Women Love Earth event

June 2020 - City of Sydney Visiting Entrepreneur Program: Asia's CleanTech Transition
September 2020 - EnergyLab 'Member Meetup' - presentation on Wattwatchers and the MEM to entrepreneurs in the EnergyLab program, as part of MEM outreach to the entrepreneur community including potential app developers.

October 2020 - Energy Efficiency Expo Australia's 2020 virtual conference panel participation.

October 28, 2020 - Latrobe Valley Authority (LVA) workshop to eastern Victorian community groups to allow a coordinated roll-out of MEM solutions for homes, small businesses and schools.

May 2021 - Smart Energy 2021 Conference Presentation on Consumer Data Rights.

July 2022 - Energy NEXT (Sydney) Conference presentation on Energy Management
En-Route to Net Zero - Data, IOT, the post-pandemic reset & the electrification of nearly everything.

September 2022 - Data in Real Estate Summit in Brisbane attendance and demonstration of MEM data solutions.

October 2022 - All-Energy Australia (Melbourne) Conference presentations
Getting strategic about energy data as open and shared infrastructure
Planning an Energy Project for behind the utility meter monitoring and control.

January 2023 - UTS ERICA State of Energy Research Conference 2023 presentation of use cases for MEM data in research and digital transformation projects.

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ANU Research Program

A Review of Publicly Available Energy Data Sets
https://arena.gov.au/knowledge-bank/a-review-of-publicly-available-energy-data-sets/

Consumer Engagement in Energy Data Services
https://arena.gov.au/knowledge-bank/consumer-engagement-in-energy-data-services/

ANU ISGT Europe Distribution System State Estimation With Losses
https://ieeexplore.ieee.org/abstract/document/9640038

ANU ISGT Asia Distribution System State Estimation with Losses in Radial MV and LV Networks
https://ieeexplore.ieee.org/abstract/document/9715689

Lessons Learnt Reports

Milestone 1 Lessons Learnt Report
https://arena.gov.au/knowledge-bank/my-energy-marketplace-lessons-learnt-1/

Milestone 2 Lessons Learnt Report
https://arena.gov.au/knowledge-bank/my-energy-marketplace-lessons-learnt-2/

Milestone 3 Lessons Learnt Report
https://arena.gov.au/knowledge-bank/my-energy-marketplace-lessons-learnt-3/

Milestone 4 Lessons Learnt Report
https://arena.gov.au/knowledge-bank/my-energy-marketplace-lessons-learnt-4/

Milestone 5 Lessons Learnt Report
https://arena.gov.au/knowledge-bank/my-energy-marketplace-lessons-learnt-5/

Knowledge Sharing Reports

Project Interim Knowledge Sharing Report
https://arena.gov.au/knowledge-bank/wattwatchers-interim-knowledge-sharing-report/

News articles and publications

A selection of articles that reference the MEM and/or Wattwatchers' energy data leadership:

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Australian Department of Industry, Science and Resources media release (archived) - December 19, 2019 - Keeping a close watch on energy data for consumer savings https://www.minister.industry.gov.au/ministers/taylor/media-releases/keeping-close-watch-energy-data-consumer-savings

The Sydney Morning Herald - December 19, 2019 - Morrison Government eyes new tech for household power savings https://www.smh.com.au/politics/federal/morrison-government-eyes-new-tech-for-household-power-savings-20191218-p53l3p.html

Energy Magazine - December 20, 2019 - $2.7 million funding for new energy data hub https://www.energymagazine.com.au/7-million-funding-for-new-energy-data-hub/

ASX Announcement - January 29, 2020 - Simble Group https://simblegroup.com/wp-content/uploads/2020/01/SIS-ASX-Announcement-Wattwatchers-ARENA_Final.pdf

ARENAwire - February 26, 2020 - Wattwatchers smart energy hub allows users to track energy usage in real time https://arena.gov.au/blog/wattwatchers-smart-energy-hub-allows-users-to-track-energy-usage-in-real-time/

ECD Online - March 25, 2020 - Smart data hub opens up renewable energy potential https://www.ecdonline.com.au/content/efficiency-renewables/article/smart-data-hub-opens-up-renewable-energy-potential-208798501

Energy News, Australian Institute of Energy (AIE) - Vol 38 Quarter 2 2020 p19 article on Solar Schools and Zero Emissions Noosa

One Step Off the Grid - October 13, 2020 - Solar Trinity: Rooftop PV to power S.A. school and student learning https://onestepoffthegrid.com.au/solar-trinity-rooftop-pv-to-power-s-a-school-and-student-learning/

Trinity College Joins Our Solar Schools Program - ZEN Energy - October 2020 https://www.zenenergy.com.au/knowledge-base/industry-news/trinity-college-are-the-first-to-join-the-zen-energy-sa-solar-schools-program/

Electrical Connection - April 29, 2021 - Clipsal Solar's Pulse app now works with Wattwatchers devices and data streams https://electricalconnection.com.au/clipsal-solars-pulse-app-now-works-with-wattwatchers-devices-and-data-streams/

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Renew Economy - September 27, 2021 - Energy monitoring platform Wattwatchers nets $5.3 million in Series B investment
https://reneweconomy.com.au/energy-monitoring-platform-wattwatchers-nets-5-3-million-in-series-b-investment/

Science Meets Business - June 27, 2022 - Energy innovation series
https://sciencemeetsbusiness.com.au/energy-innovation-series-trends-and-data-driven-solutions/

The Fifth Estate - July 14, 2022 - Building owners are looking for more power - and that's great news for this Aussie scaleup
https://thefifthestate.com.au/innovation/building-owners-are-looking-for-more-power-data-and-thats-great-news-for-this-aussie-scaleup/

Climate Salad - September 5, 2022 - Data and devices are delivering real-time climate impact
https://www.climatesalad.com/posts/data-and-devices-are-delivering-real-time-climate-impact

Ecogeneration - October 30, 2022 - Using data to maximise energy solutions
https://www.ecogeneration.com.au/using-data-to-maximise-energy-solutions/

ARENAwire - January 9, 2023 - Knowledge is power for consumers and industry
https://arena.gov.au/blog/energy-knowledge-is-power-for-consumers-and-industry/

PV Magazine Australia - June 2023 - 'Don't want to sleepwalk': potential cyberattack surfaces open with DER devices
https://www.pv-magazine-australia.com/2023/06/26/dont-want-to-sleepwalk-potential-cyberattack-surfaces-open-with-der-devices/

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New video features school students engaging with future energy options - Wattwatchers - May 29, 2023
https://wattwatchers.com.au/new-video-features-school-students-engaging-with-future-energy-options/

High-resolution carbon accounting: higher accuracy for better outcomes - Wattwatchers - April 27, 2023

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Serious upgrades are required to electrify everything - Wattwatchers - October 27, 2022
https://wattwatchers.com.au/serious-upgrades-are-required-to-electrify-everything/

Five key principles for a new energy data strategy - Wattwatchers - October 27, 2022
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Hot water insights will support customers for all-electric living - Wattwatchers - October 21, 2022
https://wattwatchers.com.au/hot-water-insights-will-support-customers-for-all-electric-living/

Data is critical connective tissue for the electricity system, but are we on track to unlock its power? - Wattwatchers - August 29, 2022
https://wattwatchers.com.au/data-is-critical-connective-tissue-for-the-electricity-system/

High-resolution carbon accounting: modelling better emissions estimates - Wattwatchers - August 25, 2022
https://wattwatchers.com.au/high-resolution-carbon-accounting-modelling-better-emissions-estimates/

We have a winner in our first $1000 prize draw for sharing home energy data with researchers - Wattwatchers - August 3, 2022
https://wattwatchers.com.au/winner-in-our-first-prize-draw-for-sharing-home-energy-data-with-researchers/

Sustainability-focused school adds 'energy and education' to its award-winning achievements - Wattwatchers - July 29, 2022
https://wattwatchers.com.au/sustainability-focused-school-adds-energy-and-education/

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https://wattwatchers.com.au/hourly-carbon-accounting-for-greater-accuracy/

Missed opportunity: electricity customers with solar continue to receive misleading power bills - Wattwatchers - April 11, 2022
https://wattwatchers.com.au/electricity-customers-with-solar-continue-to-receive-misleading-power-bills/

How to get rewarded for sharing your home energy data with researchers - Wattwatchers - February 2, 2022
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https://wattwatchers.com.au/energy-data-marketplace-wins-grant/

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AEMC Review of the Regulatory Framework for Metering Services - 2 February 2023
https://www.aemc.gov.au/sites/default/files/2023-02/wattwatchers_submission.pdf

AEMC Consultation Paper on Unlocking CER Benefits through Flexible Trading (ERC0346) - 16 February 2023
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https://www.datocms-assets.com/32572/1677730463-wattwatchers-response-to-esb-data-services-delivery-model-consultation-paper-february-2023-1.pdf

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National Energy Performance Strategy consultation by Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) - 3 February 2023
https://consult.dcceew.gov.au/neps-consultation-paper/survey/view/112

Wattwatchers Response to the ESB's Data Strategy Initial Reforms Consultation Paper June 22 - 19 August 2022
https://www.datocms-assets.com/32572/1663134043-data-wattwatchers-submission.pdf

Wattwatchers Response to Capacity Mechanism Project High-Level Design Paper - 25 July 2022
https://www.energy.gov.au/sites/default/files/2022-08/Wattwatchers%20Response%20to%20Capacity%20Mechanism%20Project%20High-Level%20Design%20Paper.pdf

Wattwatchers Response to the AER's Better Bills Guideline Consultation - 31 January 2022
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Wattwatchers Response to Proposed Remote Disconnection and Reconnection Requirements for Distributed Solar Generating Plants in South Australia - 10 July 2020
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