APRIL 2021

MY ENERGY MARKETPLACE

INTERIM PUBLIC PROJECT KNOWLEDGE SHARING REPORT

mydata.energy

This project received funding from the Australian Renewable Energy Agency (ARENA) as part of ARENA's Advancing Renewables Program. The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

Interim Public Knowledge Sharing Report

Executive Summary

Now at its halfway point, My Energy Marketplace (MEM) is an innovative 'New Energy' initiative led by Wattwatchers Digital Energy (Wattwatchers). It is an $8 million-plus, three-year, Australia-wide project that is supported by a $2.7 million grant from the Australian Renewable Energy Agency (ARENA).

The project lies at the intersection of three key clean energy transition themes: distributed renewables, digitalisation and consumer empowerment within the electricity system. Key elements of MEM delivery are:

- Installation of Wattwatchers smart energy management devices at 5,000 homes and small businesses, plus 250 schools, and also enrolment of 1,500 non-Wattwatchers devices
- Development of a smart energy mobile app
- Development of a consumer-facing 'energy data hub' (i.e. the 'Marketplace')

In spite of inevitable impacts on the project due to the global COVID-19 pandemic, important interim progress points include:

- Hundreds of end users are already using data from MEM devices in the mydata.energy mobile application to understand and optimise their energy use, and change behaviours
- User testing, which is ongoing, has been an effective method of evaluating the features and identifying what works and what needs to be improved, as well as assessing priorities for the next features to be developed
- The project's Data Advisory Panel has met several times in 2020 and 2021, and functions as a core source of expert advice and guidance for the MEM, with direct relevance to achieving project outcomes

Based on early progress, and looking ahead to establishing a sustainable business model for the MEM, we see that:

- More data from more devices is required to be available in the 'MEM pool' for commercial and non-commercial purposes.
- The actual 'Marketplace' functionality, currently in development, is a pre-condition for assessing the viability of a sustainable business model.

Getting the balance right between security and privacy on one hand, and access, portability and shareability on the other, has been confirmed as a defining challenge for the MEM project.

Project overview

The MEM is a key contribution to the development of consumer-facing energy data platforms. It is building a trust-based marketplace for sharing and transacting around data-driven services that utilise consumer-generated energy datasets as opposed to industry-generated or regulated data.

Most energy consumers have limited access and understanding of their own energy data. Many households and businesses typically receive power bills in arrears between one month and three months after they have used the energy, and often based on *estimated* usage. This situation has improved in areas where smart meters have been deployed, but consumers still find it difficult to access and share this data with third parties that could provide them with a range of energy data–backed products and services, such as more personalised and accurate quotes and savings estimates on key energy-related purchases, for example.

Better data can help to reduce bills by providing an enhanced understanding of energy use, within a household and its appliances, or a small business and its key plant and equipment. This enables households and businesses to:

- increase energy efficiency and cut energy waste
- support consumers in sourcing a 'better deal' from available electricity retail packages
- use electricity at the best times for affordability
- optimise rooftop solar
- right-sizing new energy investments e.g. solar, battery, electric vehicle
- enable programs that reward energy behaviours that help the overall energy system.

For schools, not only can school administrators harness these benefits, but better data can drive energy engagement and literacy among students and the wider school community.

For third-party service providers, better energy data can support the improved management of the Australian electricity grid and better integration of renewables such as solar, batteries and electric vehicles.

In order to achieve the project objectives, we have embarked on three strands of activity:

1. 5,000 devices to be installed into homes and businesses, plus 250 schools, and data collected from 1,500 non-Wattwatchers devices.
2. Develop a smartphone application **mydata.energy** that provides:
    - basic energy visibility and cost saving tools,

- tools to manage data permissions, and
- an 'app store for energy' providing a gateway to innovative apps that utilise energy data (i.e. the 'Marketplace')

3. Development of a cloud-based 'energy data hub' for making data available to software and service providers, industry participants such as traditional energy companies, network and market operators, regulators and new participants in the solar, energy efficiency and Distributed Energy Resources (DER) sectors.

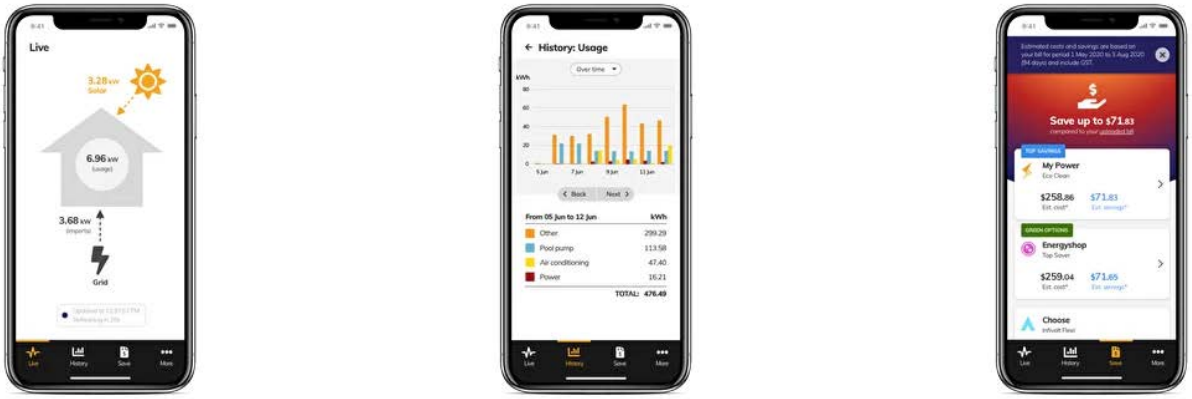

Figure 1: Example screens of the 'MEM App'

Other key activities supporting the MEM include:

- Data Advisory Panel: see *Appendix 1: Data Advisory Panel* for more detail
- Development of customer-centric Terms & Conditions[1]
- ANU PhD research: see *Appendix 2: ANU research* for more detail
- Internal management plans and related documentation, e.g. for information security and risk management

The three-year project is expected to achieve the following outcomes[2]:

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

[1] See online at: https://mydata.energy/terms
[2] As published on the ARENA website at https://arena.gov.au/projects/wattwatchers-my-energy-marketplace/

- *increase understanding and awareness of cybersecurity risks and data privacy management.*

Project partners

The project is led by Wattwatchers[3], 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[4] ethos as a core aspect of its business operations.

Accurassi[5] 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 is providing services to Wattwatchers for bill data parsing and tariff comparison in the mydata.energy app, along with other project support.

[3] www.wattwatchers.com.au

[4] Wattwatchers Impact Statement 2021 https://wattwatchers.com.au/wp-content/uploads/2021/04/WATT119-Impact-Statement-2021_d6.pdf

[5] www.accurassi.com

Established in April 2018, the Battery Storage and Grid Integration Program (BSGIP)[6] 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, the program places a strong focus on interdisciplinary research, development and demonstration (RD&D).

BSGIP is undertaking a range of research activities in partnership with the MEM project.

See *Appendix 2: ANU Research* for more information about ANU's activities and contribution.

The Solar Schools[7] team engages with schools around renewable energy, energy efficiency and sustainability, both at the operational level (i.e. monitoring and optimising the school's energy usage) and the educational level (i.e. data visualisation and curriculum-aligned lessons and games to engage students).

School administrators can reduce costs and improve environmental outcomes, while students 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 schools component[8] of the MEM project is led by Solar Schools.

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6 www.bsgip.com
7 www.solarschools.net
8 www.solarschools.net/energy-starter

Findings and outcomes

Significant progress has been achieved in the first 18 months of the project, with an emphasis on laying strong foundations to achieve the MEM's targeted outcomes.

This has included establishing the Data Advisory Panel, developing the consumer Terms and Conditions (T&Cs), designing and developing the mydata.energy mobile app, enlisting channel partners for recruitment, and rolling out installations to homes, small businesses and schools (see below for details of early deployments).

Key interim progress points include:

- Hundreds of end users are already using data from MEM devices in the mydata.energy mobile application to understand and optimise their energy use, and change behaviours.
- User testing, which is ongoing, has been an effective method of evaluating the features and identifying what works and what needs to be improved, as well as assessing priorities for the next features to be developed.
- The Data Advisory Panel has met several times in 2020 and 2021, functioning as a core source of expert advice and guidance for the MEM, with direct relevance to achieving project outcomes.

Based on early progress, and looking ahead to establishing a sustainable business model for the MEM, we see that:

- More data from more devices is required to be available in the 'MEM pool' for commercial and non-commercial purposes.
- The actual 'Marketplace' functionality, currently in development, is a pre-condition for assessing the viability of a sustainable business model.

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

Wattwatchers has received early inquiries about MEM datasets, and their availability, from research institutions and a state government agency. Two commercial partners with their own app offerings have come onboard to be partners via the planned MEM 'Marketplace' model, and several commercial or community-based energy service providers have been signed on as installation partners operating under the MEM model and using its T&Cs.

Progress to date

Sites installed

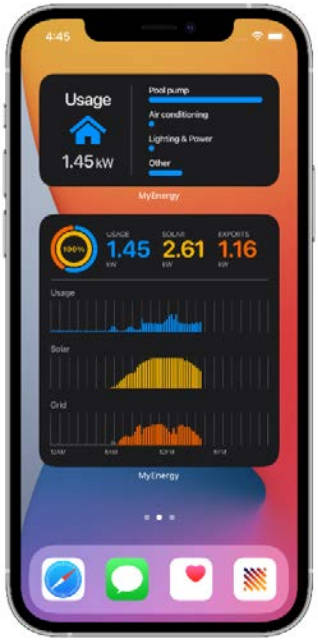
Site Type	Number Installed
Residential and Small Business	405
Schools	44
Non-Wattwatchers Devices	100

App downloads

Platform	Number of App Downloads
Apple iOS	254 (75%)
Google Android	86 (25%)
Total	**340**

App updates

- Version 1.2.0 released for Apple and Android devices
- Enhancements including pop-up charts on Live screen
- Widgets released for Apple devices
- Self registration feature
- Option for disabling the tariff comparison feature where appropriate for selected partners
- Usage charts changed from 'category' (grouped) to circuit labels to provide more detail
- Email bill functionality for tariff comparison bill processing



Upcoming app features

- Budget management features and push notifications (due early May 2021)
- Enhancements to Save section to replace tariff comparison
- Cost reporting on all key charts (no longer just kW)

Lessons learnt to date

Significant lessons learnt and/or revisited over the first 18 months of the MEM project include:

- **Customer engagement** - inevitably, this has been impacted by COVID-19. Our response has been a pivot away from physical promotional events such as conferences, trade shows and community fairs to online alternatives.
- **Participant recruitment** - the focus thus far has been concentrated on enlisting channel partners for scale rather than on individual consumer sales. This can be reviewed and adjusted as the app matures, and additional tools are added (e.g. Shopify ecommerce interface).
- **Deployment and installation** - the known cost burden and other difficulties of retro-fitting smart energy management solutions have been further validated; and, conversely, 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, with indirectly-managed installation processes proving better for piggybacking off other energy upgrades where electricians are already onsite.
- **Privacy vs shareability** - consumer data rights and service expectations for the energy sector are impacted by customers' experience of other sectors such as financial services and telecommunications. Getting the balance right between security and privacy on one hand, and access, portability and shareability on the other, is being confirmed as a defining challenge for the MEM project.
- **Data Advisory Panel** - the creation of an independent consumer energy Data Advisory Panel (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. With ARENA's support and participation, the Terms of Reference for the panel were clarified to 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 prompted discussion of a remuneration model being required.
- **Data services** - early requests for access to MEM datasets have been received from research institutions and a government agency. Based on these requests, there is demand for datasets with at least 12 months of monitoring at sites and with a scale of circa 1,000 devices being requested.
- **App functionality and flexibility** - several project channel partners have 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, and also more broadly for the Wattwatchers business (e.g. for international customers where Australian tariff comparisons are not relevant). Also, thus far there has been a very low conversion rate within the tariff comparison feature—i.e. in terms of MEM participants actually using it to change retailers within the app itself.

- **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 want to see cost calculations (i.e. in dollars and cents).
- **Data sourcing** - we've identified requirements for data from non-Wattwatchers devices to add more value for equipment such as solar inverters, although in some such cases a Wattwatchers device may still need to be installed at these sites in addition to the non-Wattwatchers device(s) to cover all data requirements.
- **Augmenting utility billing meters** - smart meter operators see value in the additional capabilities of Wattwatchers devices, such as multi-circuit monitoring for greater granularity. In these cases, Wattwatchers devices may be installed alongside a non-Wattwatchers device to provide both on-market and off-market metering services.
- **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.
- **Multiple devices at one site** - field experience for the MEM shows that customers not infrequently install solar systems on a garage or shed that is structurally separate from the main dwelling, and that has 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.
- **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 with atypical site configurations (e.g. solar or batteries installed on a secondary building).

Advancement of consumer energy data

In its first 18 months, the MEM already has made contributions to advancing consumer energy data. While it is still early days for the project overall, 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—is progressing well.

Early contributions are demonstrated by:

- Strong positive engagement from the expert advisors who are members of the data advisory panel, especially in regard to drafting of the plain-english, user-friendly T&Cs; and app development and associated user testing (i.e. the MEM Terms & Conditions are considered as class leading by panel members). Several panel members have further demonstrated their support by making introductions and referrals supporting MEM activities.
- Invitations to interface with relevant bodies and initiatives, such as the CDR for Energy process, and other ARENA projects (e.g. Project MATCH and the Alice Springs Future Grid project) etc.
- Presenting at industry conferences e.g. Wattwatchers' MEM lead Grant Young is a panel presenter at Smart Energy 2021 in Sydney (May 12–13, 2021) on the topic of 'Energy Data: Balancing consumer rights, security and function'.

The MEM approach and deployments, and the mydata.energy app functionality and T&Cs, are being exposed to a growing range of industry and market players, including via the data advisory panel which includes representatives from AEMO, the Energy Security Board, The Energy Charter, academia and the community energy sector (a panel slot allocated to Energy Consumers Australia currently is vacant due to personnel changes).

Significant industry and community engagement is occurring 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, community energy groups and projects (e.g. Hepburn Wind 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).

Ongoing development and impact

Remainder of the MEM

From commercial, industry and societal perspectives, a key benefit of the project centres on its mission to tackle, simultaneously, the key challenges for data-enabled evolution of the electricity system to allow high penetration of distributed energy resources (DER). These challenges include:

- Installation complexity and cost for smart energy devices
- Integration and interoperability of technologies
- Consumer participation and data rights
- Market and system-level concerns about security and cybersecurity

With key foundational work now largely completed, in the second half of the MEM the focus will shift from foundations (e.g. app and T&Cs development) to accelerating the rollout of devices to sites through scalable channels, development of the 'Marketplace' element with more choice of solutions for consumers, and following to the provision of data services as the MEM 'data pool' grows.

The data services element 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, sufficient ongoing demand for data services at commercially-realistic prices will allow costs for participating consumer sites to be reduced or even eliminated.

Additional work during the life of the project will include:

- The development of terms and conditions for industry data customers
- The further implementation of a co-design approach, with users and also the data advisory panel feeding into the release of the 'Marketplace' features before the end of 2021
- Continued evaluation of data-related revenue opportunities through market testing
- The development of a dedicated MEM cloud platform that simplify data permission granting for both consumers and data recipients

Beyond the MEM

The ARENA-supported MEM project period is scheduled to wrap up during the 2023 financial year. Beyond the life of the ARENA project, extensive further evolution of the user-friendly, commercially-accessible MEM model is expected to include:

- 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?

The data journey

The My Energy Marketplace (MEM) initiative, led by Wattwatchers, is developing a consumer-facing energy data platform.

This means building a trust-based marketplace for sharing and transacting around data-driven services that utilise 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.

Note on data 'ownership'

A key learning is that our conceptual 'starting position'—that energy users own their energy data—is 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. With this in mind, Wattwatchers is seeking 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).

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. Significant attention is being paid to using 'plain english language' and visual communications, an approach that is strongly encouraged by the Data Advisory Panel.

A key challenge is ensuring that these T&Cs are properly managed and presented to customers with the project's shift to a 'scale rollout partner' model. This manifests in both practical and conceptual terms. For example, on the practical side if a partner has their own app and customer onboarding process, then it is necessary to ensure the MEM T&Cs are made available and agreed by the customer. Conceptually, we see that where rollout partners are defraying significant end-customer costs, data may end up being used by competitive offerings, for example, in the MEM Marketplace (which underpins genuine choice for consumers).

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 seeks to collect data that is needed for the purposes stated.

We are finding 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.

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.

The 'Marketplace' feature in the app will provide the principal mechanism for end users to set their permissions preferences. The first step of this process is acceptance of the T&Cs, however we will be expanding this with much more granular tools within the Marketplace.

Technical (digital management/ingress)

To date, a majority of the data collected for the MEM is coming from Wattwatchers devices. This provides a proven format for collecting and managing energy data.

As the project progresses, including bringing in more data from non-Wattwatchers devices, it is expected that limitations will be encountered (e.g. inverter system data usually will not include grid connection data, and smart meter data does not provide sub-circuit data including solar generation).

This raises a question as to whether Wattwatchers-style devices (i.e. collecting circuit-level data and/or interfacing with other systems) may be *required* as 'companion devices,' to provide more value-added services (e.g. fault detection, solar export control, operating status), operating alongside non-Wattwatchers devices.

Rollout

Coordinating the physical installation of devices interacts with our goals regarding data capture.

One is related to managing privacy. 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. In future reviews of the T&Cs and Privacy Policy, we may need to further consider this limitation with regards to handling of data.

The second is related to data quality. 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 are addressing 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 data sets. The adage "garbage in, garbage out" rings true for our datasets, so 'installation accuracy' is a prime objective of our activities as we move forward to manage the larger scale roll out.

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.

To date, data sharing has occurred only with project partners, or third-parties that are working directly with Wattwatchers to provide service to users (e.g. Accurassi for tariff comparisons).

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 need to be reconciled as we progress. For example, where the partners need to store data for other reasons than the MEM *per se* (such as regulatory compliance).

We are acutely aware that we have limited capability, outside of legal controls, to stop data recipients from using data for non-intended/approved purposes. We will continue to address this risk as the project progresses, through the development of strong T&Cs for data recipients, and also continued exploration of potential technical measures for data protection in sharing scenarios.

Processing

Streamlining data processing, and adding value to datasets are central to the evolution of MEM-based energy data services. Given where the project is in its lifecycle, related learnings to date are limited.

Data is processed within the Wattwatchers IT infrastructure in accordance with our Information Security policy. Limited external data processing has occurred to date, with distribution limited to MEM partners or contracted third-parties supporting Wattwatchers' delivery of service.

To date the delivery of data to research partners has primarily been static 'snapshots' rather than the 'living datasets' that the MEM aspires to. The solar export control work that Wattwatchers has been doing with SA Power Networks, via separate project and commercial work, provides further insights into how MEM capabilities may evolve. That is, rather than

seeing the MEM data as a 'static' body of historical data, that a more interactive model, based on real-time data coming from the API, can be leveraged,

We have also undertaken some internal research on load types, predictive analysis and 'exception' reporting, with this research informing future project activities. Thus we expect that as the project progresses we will be able to report further on innovations in this area. For example, in the development of the MEM-specific API, which will streamline data sharing capabilities.

Access

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

One challenge that has emerged is how we provide access to data for rollout partners who have invested, for example in co-contributions to the cost of installing a device, in a way that is consistent with the MEM T&Cs and considerations such as re-identification.

As an example: a community group co-contributes to the cost of installation of devices. They wish to access the household data generated in a de-identified way for community planning, or to show aggregated statistics on average savings etc. As there are only a small number of participating households, re-identification risk is high even for de-identified data. It is notable that the issue of small numbers of devices is also an issue for larger scale partners who are in the early stages of their rollouts.

With this example in mind, presently the rollout partner needs to make their own legal arrangements for access to the data with the end customer when that customer can be identified. The planned 'Marketplace' feature in the mydata.energy app, combined with the MEM-specific API—which will employ an OAuth-style model for providing customer control of data sharing with other providers—will streamline this process significantly when introduced. Thus, our early experiences in this regard are reinforcing the value of the broader MEM vision for customer-led data sharing.

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.

Productisation

A focus on productisation of MEM datasets will come to the fore in the second half of the project. Until now, individual datasets have been available via the app with a minimum feature set, and there is a continuous process of upgrades.

There is pre-existing capability via the Wattwatchers API and also the Fleet Management tool to provide access to multiple sites. This has not yet been adapted specifically for MEM purposes. However, it is being used successfully by one early MEM partner project, the Byron Local Microgrid initiative, with data from 23 light industrial sites being provided to UNSW researchers for tariff modelling work (12 months-plus of data has now been accumulated for these sites to support the ongoing modelling).

More generally, while there has been initial interest in data acquisition from researchers and government agencies, no commercial terms have been agreed as yet. Some non-commercial, de-identified data has been shared within the standard terms of the MEM, but thus far this has been 'snapshots' of data rather than batches of full datasets.

To this point, Wattwatchers' standard REST API, and securely stored CSV data, has been adequate for handling the limited data sharing that has occurred. Stream/Push APIs may be required as the MEM data pool and related services develop, and work already is being done on developing this capability for Wattwatchers outside of the MEM (i.e. as part of Wattwatchers' business-as-usual); and new capability to create 'community dashboard' views for aggregating site datasets for community partners is being developed using Wattwatchers' ADEPT platform. This form of 'aggregated dashboard' may prove to be a commercialisation opportunity, linked with achieving our rollout objectives with scale partners.

The introduction of a new 'MEM API' that enforces consumer-led access, control and authorisation is scheduled for the second half of the ARENA-supported project. This API will form the basis of our approach to market to engage Marketplace participants, which is a key pillar in our productisation approach.

We expect learnings in this facet of the project to accelerate in future milestones.

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' has been further validated through the first half of the MEM, 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 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 aging datasets from the Smart Grid Smart City Customer Trial[9], 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."

It is noteworthy that MEM datasets from Wattwatchers devices will provide far greater granularity and timeliness than the Smart Grid Smart City datasets (from smart meters), including 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. A potential customer for MEM datasets referenced another option for purchasing similarly granular datasets, although the ultimate source of this data also was Wattwatchers devices.

As noted in the previous section, thus far the opportunities for data sharing have been limited, and as a result new learnings are slim. We expect the introduction of the 'Marketplace' and MEM-specific API to drive learnings in this area.

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

Dissemination of learnings

The MEM approach and deployments, and the mydata.energy app functionality and T&Cs are being exposed to a wide range of industry and market players, including via the Data Advisory Panel which includes representatives from AEMO, ESB, The Energy Charter, academia and the community energy sector.

Channel partners for recruitment and deployment include energy retailers, other technology companies, solar and battery installers, energy services companies, social housing operators, community energy groups and projects, consumer advocacy organisations and government programs (e.g. NSW Empowering Homes and Victoria's Latrobe Valley Authority).

Wattwatchers operates a busy weblog via its website, with regular posts related to the MEM, the app and consumer data rights. Thought-leadership is further amplified via social channels, especially LinkedIn and Twitter, and Wattwatchers participates in relevant industry forums. In May 2021, MEM lead Grant Young is speaking at the Smart Energy 2021 conference and trade show in Sydney (May 12-13), on the topic 'Energy Data: Balancing consumer rights, security and function.'

Grid visibility and management

Relevant data experts Tim Hewat (AEMO) and Sarea Coates (Energy Security Board) are members of the MEM Data Advisory Panel and have strong visibility of the project's work and progress.

The MEM team is already receiving expressions of interest in the project from research, industry and commercial players—some of whom are working on topics related to grid visibility, stability and management. We expect to explore these expressions and related opportunities in more depth in future phases of the project roll-out.

In Q1 of 2021, Wattwatchers engaged with Project MATCH, another project supported by an ARENA grant, which is led by UNSW researchers working with AEMO and Solar Analytics. Discussions have included the potential availability of datasets, including from the MEM, and Wattwatchers joining the Stakeholder Reference Group (which we have done).

As noted earlier, requests for data so far have been in the form of static 'snapshots.' Part of the MEM thesis is that real-time data and control of solar generation systems allows more dynamic operation of the electricity network by the DNSPs (network businesses) to reduce

solar generation when constraints exist and signal additional capacity for equipment like batteries and energy storage (i.e. electric hot water) to operate.

MEM data from DERs will increasingly become available for research and commercial purposes to inform projects and decision-making based on real data. For example, MEM devices have been installed in South Australia under the 'Smarter Homes' program to remotely switch on and off solar inverter systems, based on electricity network and market conditions and signals from AEMO and South Australia Power Networks. Wattwatchers technology, which is closely related to that provided by the MEM, was 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 includes investigating 'state estimation' to extrapolate from limited monitoring sites to calculate wider grid conditions. They are incorporating MEM data into their study.

Consumer data access

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

The use of friendly visualisations, such as icons in the app like the 'sun' and the 'arrows' to indicate direction of energy flow, have been generally understood and well received based on early user testing. Conversely, more 'technical' representations shown to user testing participants were poorly received. Based on this and other user feedback, ongoing efforts towards simplification will be a requirement.

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. Making things 'actionable' and 'situating' the user 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 or concerns about the range of offers being presented. This has led to a very low initial uptake of the retail switching capabilities of the mydata.energy app. It is relevant to note that the data advisory panel also has 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.

Due to its 'by-design flexibility', the app is being updated regularly to improve its performance, as are project processes for installation, verification and troubleshooting.

Commercial model

A key premise of the project is that up-front hardware and provisioning costs, and ongoing communications/infrastructure costs, could be offset by revenue from multiple streams.
In a preliminary business plan for MEM-based data services, 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 (e.g. voltage and frequency, status of loads and assets, and 'last gasp in the event of disruptions) in geographically targeted areas
- Vendor services - leads + supporting data for vendors (e.g. installers, ESCOs, neo-banks etc.) targeting customer attributes (e.g. location, has solar &/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
- 'Clip of the ticket' - app providers paying for access to energy data and availability via the MEM 'energy app store'

As the project is still only part way through its implementation, with only about 10% of installations completed, at this stage opportunities for commercialising the data have been limited.

Of the potential revenue streams summarised above, thus far only one—researchers—has been explored with industry partners.

A small number of preliminary requests for data have been received, indicating a willingness to pay between $10,000 to $20,000 depending on the complexity and scope of the project for 12 months of data from a large number of devices. While there is potential commercial viability at these rates, low volumes of available datasets in the first half of the MEM have been a barrier to realising early income. It is a positive sign, nonetheless, that potential data services customers confirm that there is a market appetite for MEM-style datasets.

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, mydata,energy, '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 customers, who make up a 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 (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'[10] that are reflected in some tariff plans (i.e. concern about 'greenwashing').

A biasing 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]'.

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

Customer typologies

An early working assumption for the MEM is that having real-time and historical access to granular data, independent of regulated metering data, is most valuable to customers who have above average 'value at stake' via their electricity. There's also been 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 power bills averaging above $250 a month. Wattwatchers has been conscious of not wanting to exclude renters and particularly social housing occupants, with special effort to engage in the social/community housing sector. Our early experience in this regard has revealed particular sensitivity about data sharing amongst this group (i.e. another dimension of the lack of trust conundrum).

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).

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', plus 'early adopters'). It is worthy of note that COVID-19 pandemic restrictions have affected the MEM team's ability to engage directly with community groups and individuals.

As the MEM project has progressed, the recruitment emphasis has shifted to a wider demographic as we've 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, composing a base of mainly home owners from diverse backgrounds who are getting rooftop solar installed.

Recruitment & rollout

The COVID-19 pandemic and its disruption of rollout partners as well as Wattwatchers itself means recruitment of participants and installation of smart devices has been slower than originally anticipated.

Significant focus early on has been devoted to engaging community-based groups pursuing local programs for sustainability, climate action, zero emissions, 100% renewable, energy cooperatives and similar themes. Overall, uptake from these groups and their networks has been slower and weaker than expected, for reasons including:

- Key aspects of the MEM 'package' have been in development during the first 18 months (e.g. customer T&Cs, mobile app, marketing materials), and in some cases are still being worked on (e.g. an ecommerce payment gateway such as Shopify and also a wider network of trained installers)
- Despite significant ARENA-subsidised discounts, cost and administrative complexity continue to be barriers for often small, volunteer-led, poorly resourced community groups
- Growing areas of debate with community groups, especially around technology choices, and concern about becoming 'locked in' to one or another brand (related in part to the integration and interoperability challenges for digitalisation of the energy sector, through a community lens)

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 is looking most effective for these channels.

That said, and as indicated earlier, we posit that the best-suited recruitment and deployment partners are 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.

Thus a growing portion of our rollout partners are recommending or coordinating solar installations. Early indicators are that this approach has a very high uptake rate, as the solution meets the customers requirements for comprehensive energy monitoring of solar

generation, grid import and export and the additional circuit level data supported by Wattwatchers devices.

The initial participation by some social housing partners has initially proved difficult due to concerns from the residents about how the solution may be useful to them and/or scepticism that it might be another way for someone to charge them for a service they do not use. This has required targeted improvements in training and demonstration of the application to help users understand how they could save money and manage their energy consumption with the application.

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 data advisory panel has 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 have become 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 impacting the overall customer experience. This has been addressed by 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, including the upcoming features to support displaying cost information in dollars and cents, and not just technical information like energy consumption in kilowatts. This is important to ensure that we have good engagement with the different types of data for a wide range of customers with different energy understanding levels.

Engagement

With only about 10% of the rollout completed thus far, it is too early to draw any major conclusions in regard to specific aspects of user engagement. The user engagement program for 2021, to explore Budgeting Feature + Marketplace concepts, is expected to shed a lot more light on this. Examples of items that have caught our intention include:

- Users may focus more on 'where energy is used' rather than 'how much'
- Tariff switching support feedback has made it clear that even where this functionality is appreciated by users, they expect more from the app
- Further work is required on the 'education piece' for showing consumers with rooftop PV how to 'move electricity consumption under the solar curve' (self-consumption is not necessarily top of mind for users, especially those who had (or in some cases still have) access to generous gross feed-in tariffs
- Improved guidance is required to show users 'how to use the app to save' (feedback thus far has reinforced expectations that saving money is the primary driver for consumer energy action, with environment and independence secondary drivers
- Lack of headspace in time and resource constrained work environments is a key factor restricting uptake by schools

The budgeting feature, under ongoing development, will look very specifically at evaluating behaviour change through prompts.

Data services value proposition

This first half of the project has focused on the development of the terms and conditions for access to data, the deployment of devices and the development of the application. At this stage, a small number of preliminary requests for data have been received which has provided an indication there is a willingness to pay thousands to tens-of-thousands of dollars for access to long periods of data for research and commercial modelling purposes.

The next phase will focus more on packaging of datasets to support service offerings, and methods for adding value to those datasets.

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.

Thus far, however, the project hasn't fully tested the 'Marketplace' and permissions concepts.

During app user testing, the Marketplace was noted as 'interesting' by a number of participants. One was a member of a VPP with a top tier energy retailer (signed up because they'd purchased a cheap battery). Another had heard about 'demand response' programs from their provider. One was particularly interested in local energy trading opportunities (name-checking Power Ledger and Enosi specifically), and said that they would be interested in signing up via the Marketplace if offered.

Further user testing is scheduled for 2021, which also will feed into 'co-design' opportunities with the data advisory panel and selected users.

Appendix 1: Data Advisory Panel

My Energy Marketplace (MEM) is a 3-year, $8 million-plus, Australia-wide project to deploy smart energy applications, monitoring and control technologies to 5,000 homes and small businesses, and 250 schools, by 2022.

Led by technology company Wattwatchers Digital Energy, the MEM project has been awarded a $2.7 million grant from the Australian Renewable Energy Agency (ARENA). The majority of this grant funding ($2.3 million) is allocated to subsidising homes, small businesses and schools to participate in a new 'energy app marketplace'.

A core objective for the MEM is to develop and demonstrate a best practice 'technology ecosystem' - including easy-to-understand, user-friendly Terms and Conditions (T&Cs) - for consumers to access, control and share their energy data, safely and securely. This will empower consumers to be active participants in the evolving electricity system, equipped with their own data-driven solutions for a distributed and digital grid.

This coincides with an era of heightened public concern in Australia, and internationally in regard to consumer data rights, privacy, security and cybersecurity. To this end, an external Data Advisory Panel has been convened to guide the MEM project.

Advisory Panel

The Data Advisory Panel provides Wattwatchers with high-level independent expert advice and expertise on consumer energy data and key related issues, including but not limited to consumer perspectives, stakeholder engagement, technologies, privacy, security, and consumer data rights.

Specific MEM elements that the Advisory Panel provides guidance on include development of the new mydata.energy app, consumer T&Cs, an information security policy and a data governance framework.

Membership

The Terms of Reference for the Advisory Panel allow for nine (9) Members. Currently they are[11]:

[11] One position is currently vacant.

Donna Luckman (Chair)

Leads the Zero Carbon Moreland Campaign for Moreland City Council in Melbourne. Non-executive director with the Coalition for Community Energy (C4CE). Member of the Beyond Zero Emissions Investment Reference Group. Spent 16 years with Renew (Alternative Technology Association), including six years as CEO.

Ben Waters

Sustainability and cleantech leader. Co-founded Presync in 2014 after 17 years at GE in leadership, sustainability, commercial and engineering roles and, previously as an officer in the Royal Australian Air Force.

Sabiene Heindl

Director of The Energy Charter, a world-first whole-of-sector energy industry-led initiative to address customer expectations. A lawyer by profession, previously was ECA's Director, Stakeholder Engagement, and Corporate Counsel. Background in intellectual property law, telecommunications and the music industry.

Yolande Strengers/Larissa Nicholls (alternates)

Yolande Strengers is Associate Professor of Digital Technology and Society at Monash University in Melbourne. Larissa Nicholls is Senior Research Fellow at Monash University. Both focus heavily on issues for energy consumers.

Adam Berry

Associate Professor, A/DRsch The Data Science Institute, University of Technology Sydney (UTS). Former leader of the CSIRO's Energy Use Data Model (EUDM), which is now known as the National Energy Analytics Research (NEAR) program.

Sarea Coates

Data Specialist with the Energy Security Board (ESB) and part-time advisor to the CSIRO's NEAR program. Previous roles with the Australian Government including Senior Policy Advisor in the Department of Environment and Energy working on the Consumer Data Right for Energy.

Tim Hewat

Head of Enterprise Data Services with the Australian Energy Market Operator (AEMO). Extensive cross-sector consulting and executive experience including government agencies, and the property, banking and gambling industries.

Support roles

ARENA observer: Adrian Rule, ARENA's Delegate for the MEM

Wattwatchers secretariat: Grant Young, Chief Innovation Officer; Murray Hogarth, Director of Communications and Community Networks.

Appendix 2: ANU Research Overview

Consumer engagement in energy data services: recommendations moving forward

Submitted: 1 Jul 2020

The overall goal of collecting and making better use of energy data is to benefit consumers, the energy system and the environment, as well as creating new business opportunities. This report[12] summarised recent studies that have investigated both opportunities and challenges in consumer engagement with energy data services.

Recommendations were provided for successful engagement of consumers with energy data services, including customer involvement through engagement, education, consumption feedback and supporting technology. Simple messages should be communicated through a good choice of themes and mediums, tailored to the target audience. Communication should be two-way as opposed to just raising awareness or selling imposed solutions. Communication should also take into account social and cultural factors, and the fact that households are diverse, the context in which households make decisions about their energy is crucial to understanding their receptiveness and preferences with respect to distributed energy resources. Reliable, objective information should be provided by trusted sources including research organisations (such as CSIRO in Australia) and universities. Trust is a critical element.

The main findings of this report were:

- In Australia and Europe, household savings from the deployment of utility smart meters have only been modest to date.
- Consumers need to be better supported with energy management tools and information, so they can continue to play a central role in the global transition to a low carbon society.
- Consumers can be supported through a better understanding of socio-economic and cultural factors, better communication and the provision of education programs.

[12] Download: https://wattwatchers.com.au/wp-content/uploads/2020/07/ANU_Review_Consumer_Engage_Energy_Data_services_V2.pdf

A Review of Publicly Available Energy Data Sets

Submitted: 1 Jul 2020

The goal of this report[13] was to understand what publicly available energy data-sets have already been collected, and how that data is being used. We reviewed 24 open-access data sets. With increasing levels of renewable energy powering our electricity system, data that tracks energy generation, distribution and consumption has never been more important. For consumers, energy data can inform decisions around home energy management, increasing energy efficiency, participation in aggregation schemes for demand response and Virtual Power Plants (VPPs), and investing in new assets like solar, battery storage or an electric vehicle. For network operators, energy data can improve the visibility of energy generation and consumption on the low-voltage grid and thereby improve their management of the grid. For policy makers, energy data are needed to make sound policy and regulatory decisions for shaping the energy systems of the future, including future renewable energy generation and storage.

Our results suggest that most research on energy data has been carried out to inform customer consumption behaviour, with noticeably less work having been done using energy data to monitor the stability of the network and to make investment decisions for the future grid. To make energy data most useful for monitoring the network, we recommend for future studies and research, that more information is included about

1. where metering devices are located in the network, and
2. frequency and phase values,

which will allow more work to be done with frequency stabilization or phasor base control.

A Review of Power Quality Event Detection and Classification

To be submitted: early-2022

Distribution grids are increasingly characterised by unpredictable and changeable power generation and loads, leading to distortions in grid voltage waveforms known as power quality (PQ) events. These events can cause damage to electrical equipment and unexpected

[13] Download: https://wattwatchers.com.au/wp-content/uploads/2020/07/ANU_literature_Review_of_Energy_Data_Sets.pdf

behaviour with grid monitoring and control systems. Therefore, accurate and efficient detection and classification of power quality events is important. In this report, we review PQ detection and classification techniques as applied to real voltage waveform data, collected using in-house hardware, and embedded with synthetic events.

Our method is able to detect at least five different types of PQ events, including sag, swell, interruption, harmonics and flicker, with very high accuracy and fast computational time. The highest accuracy was obtained using curve fitting for event detection, followed by Stockwell transform (ST) for classification, resulting in a mean classification accuracy of 98.79%. With a very slight reduction in classification accuracy (to 98.42%), Short-time Fourier Transform (STFT) is more than 200 times faster than ST (0.0007 vs 0.14 seconds).

These results will be published as a review. The next step would involve testing the event detection and classification methods on real PQ events, collected in the ANU DER lab, and estimating what data specifications would be required to apply these PQ detection and classification methods to energy data collected with Wattwatchers' devices.

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