

July 2023

Report to Department of Planning and Environment

Evaluation of the Empowering Homes Program (end of pilot)



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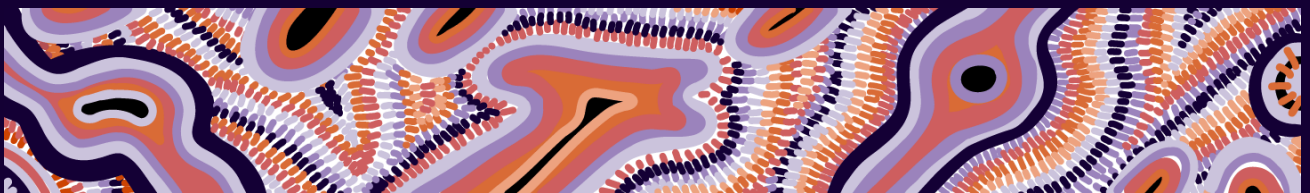
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Goomup, by Jarni McGuire

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Glossary

AEMO	Australian Energy Market Operator
ARENA	Australian Renewable Energy Agency
CCF, the Fund	Climate Change Fund
CO ₂ -e	Carbon dioxide equivalents
CEC	Clean Energy Council
CEFC	Clean Energy Finance Corporation
CER	Clean Energy Regulator
COAG	Council of Australian Governments
DER	Distributed Energy Resources (renewable energy units/systems, e.g. solar systems, batteries)
DNISP	Distribution Network Service Provider
DVA	Department of Veterans' Affairs
EHP	Empowering Homes Program
EVs	Electric vehicles
FCAS	Frequency control ancillary services
GHG	Greenhouse gas
KEQ	Key Evaluation Question(s)
kg	Kilogram
kW	Kilowatt
kWh	Kilowatt hour
LGA	Local Government Area
MW	Megawatt
MWh	Megawatt hour
NEM	National Electricity Market
NSW	New South Wales
OECC	Office of Energy and Climate Change, NSW Treasury which performed analysis for the EHP Pilot and assumed responsibility for delivering the EHP Pilot towards the end of the 2021-22 financial year

Paris Agreement	A 2015 international, legally binding treaty that aims to limit global warming to below 2.0 degrees, preferably to 1.5 degrees Celsius, compared to pre-industrial levels
PJ	Petajoules
PV	Photovoltaic
ROI	Return on Investment
SA	South Australia
(the) Department	The NSW Department of Planning and Environment, which commissioned the evaluation, along with its predecessor (the NSW Department of Planning, Industry and Environment) involved in launching and delivering the EHP Pilot
(the) Framework	The NSW Climate Change Policy Framework
TOU	Time of Use
VPP	Virtual Power Plant
V2G	Vehicle to grid
V2H	Vehicle to home
WHS	Workplace health and safety

Executive summary

The NSW Climate Change Fund (CCF, the Fund) was established in 2007 under an amendment to the *Energy and Utilities Administration Act 1987*.¹ The CCF was established to address the impacts of climate change, encourage energy and water saving activities, increase public awareness and acceptance of climate change, and support NSW to transition to a net zero emissions future.²

Administered by the NSW Department of Planning and Environment (the Department) and Office of Energy and Climate Change (OECC), the CCF is currently investing \$1.4 billion between 2017-22 in a series of programs aimed at supporting households and businesses to:

- save energy and money
- improve energy reliability and affordability
- improve the resilience of communities across NSW to climate change.³

The Empowering Homes Program (EHP) aims to further the penetration of solar and battery systems in residential settings by supporting the installation of up to 300,000 systems over ten years and to unlock up to \$3.2 billion in clean energy investment and add up to 3,000 MW hours of storage in NSW. It aims to allow households to store unused solar energy for use during non-daylight hours (resulting in lower use of grid-sourced energy during the peak demand period when electricity prices are typically higher), reduce reliance on the grid, place downward pressure on energy costs and support job creation, emissions reductions, and increased system security and reliability.

The EHP Pilot (launched in February 2020) aimed to test the parameters and operations of the EHP by installing 500 systems over 12 months prior to potential roll-out of the full Program. While initially set to run for 12 months, it concluded in July 2022. The Department commissioned ACIL Allen to undertake an evaluation of the EHP Pilot to inform future NSW government programs and initiatives. The evaluation examined the 534 installations to March 2022.

The evaluation was guided by the EHP Pilot evaluation framework developed by the Department and the OECC. It focuses on program outcomes and impact, and only addresses process issues (i.e., those issues pertaining to administrative efficiency) as they directly impinge on outcomes. The intended audiences of the report include the NSW Treasurer and Minister for Energy, NSW Minister for Environment and Heritage, the CCF Administration Committee, and the NSW Government.

¹ NSW *Energy and Utilities Administration Amendment (Climate Change Fund) Act 2007* (No. 35), s 34E.

² NSW Department of Planning, Industry and Environment (n.d.). *NSW Climate Change Fund*. Accessed 23 December 2020: <https://www.environment.nsw.gov.au/topics/climate-change/nsw-climate-change-fund>.

³ Ibid.

Methodology

The evaluation was undertaken in four phases, as follows:

1. project planning, which involved discussing data and key areas of focus for the project
2. project planning, which involved a review of program documentation and data and key informant interviews
3. consultation and analysis, which involved detailed program data analysis; review of the methodology for calculating changes in grid energy consumption; interviews with 36 stakeholders
4. reporting, which involved two draft reports, a final report, a findings workshop and a presentation to NSW Government executive.

Key findings

The key findings from the evaluation of the EHP Pilot are outlined below according to KEQs.

A. To what extent have the systems installed through the Pilot successfully delivered benefits to households?

On average, solar battery systems installed in the Pilot led participants to reduce their grid energy consumption by an average of 3,847 kWh for each participant in the sample analysed. Assuming the sample is representative of a 12-month period analysed for all participants in the EHP Pilot, the total energy benefits of the EHP Pilot were 2,054 MWh per annum across the 534 systems installed to March 2022. On average across the participants in the sample of 47 installations, this varied by system sizes and installation type, with participants that installed a:

- battery retrofit (retrofitting a new household battery to an existing solar system) (less than 6 kWh) reducing their grid energy consumption by 333 kWh (n=20)⁴
- battery retrofit (greater than 6 kWh) reducing their grid energy consumption by 3,348 kWh (n=6)
- battery (less than 6kWh) plus solar (less than 8 kW) reducing their grid energy consumption by 6,600 kWh (n=17)
- battery (greater than 6 kWh) plus solar (any) reducing their grid energy consumption by 10,466 kWh (n=4).

The systems enabled participants to save an average of \$885 (as measured using a time of use, TOU tariff) on their electricity bills. Expanding this to the whole program suggests annual bill savings in the order of \$420,000 - \$473,000, which would vary depending on tariff type. Across the sample analysed, 2,533 kg of greenhouse gas (GHG) emissions were avoided for each participant over a 12-month period or 1,353 tonnes CO₂-e per annum across the EHP Pilot (assuming the sample is representative for the 12-month period).

Other benefits of the EHP Pilot include participants worrying less about energy bills and feeling that they are able to more freely use heating and cooling to improve thermal comfort. This may mean that some participants increase their energy use and their energy savings are impacted as a result (i.e., where potential energy savings from clean energy solutions are partially offset by increased consumption of energy). Participant consultation and survey data also identified instances where participants self-reported benefiting from the freedom to use appliances, having stable power

⁴ Note that the number of installations in some categories is small and these calculations should be interpreted with care. Further, the distribution of system sizes within each category is unknown.

through blackouts, and perceived improvements in terms of environmental impact. On balance, participants were highly satisfied with the program.

However, a small proportion (6 per cent) of respondents self-reported that they strongly agreed or agreed (1.6 and 4.8 per cent, respectively) that they were stressed repaying their loan.

Most participants' payback time is longer than their interest free loan term (i.e., the bill savings will not be large enough to pay off the loan within the loan period) or the battery warranty period (commonly 10-15 years). The average payback time for battery retrofit participants is about 22 years (with a 10-year loan) as the existing solar has already substantially reduced grid electricity and reduced the remaining benefits available from installing a battery. The payback period is substantially smaller for participants installing a solar plus battery system. It is closer to 10 years (with an 8-year loan).

A.1 What factors show material impact on customer savings? How could savings be maximised?

Energy bill and emissions savings are higher for participants with solar plus battery installations (compared with battery retrofit), larger systems, more dependents (i.e., more than three people compared to homes with one to two people), and a flexible TOU tariff (compared to a flat tariff). This is likely due to different energy needs and usage behaviours.

Potential participant savings are also affected by the falling price of feed-in tariffs (i.e., for energy that is produced in excess of the available storage capacity of the battery that is exported to the grid), network tripping issues and system disruptions. These other factors are largely out of the participant's control. By storing energy rather than simply exporting energy to the grid (as is the case for solar systems without batteries), batteries reduce the risk that participants receive less benefit from their solar and battery systems in the case of falling feed-in tariffs.

A.2 To what extent can the increase in residential solar and battery capacity be attributed to the Pilot?

The majority of participants (58 per cent) were either somewhat or very unlikely to have purchased a battery system without the EHP Pilot. However, 29 per cent of surveyed participants would have or probably would have installed without the EHP Pilot and were in essence 'free-riding'. However, the EHP Pilot may have brought forward installation for these participants that may otherwise have installed in the future or enabled participants to install larger system sizes. As a result, this has still generated benefits for participants and, in turn, contributed to renewable energy generation capacity in NSW (through adding solar systems) and supported the development of the renewable energy and household battery market in NSW.

B. How did the Pilot influence the DER market (including suppliers, customers and regulators)?

Over the first 12 months of the Pilot, only 213 systems were installed (which was below expectations). However, the repercussions of the unforeseen COVID19 pandemic had not been accounted for when this prediction was made. The number of installations was likely impacted by limited awareness of the EHP Pilot among the target audience and the limitations of conducting installations during the COVID-19 pandemic. The EHP Pilot installed 0.06 per cent solar of the total NSW and 4.6 per cent of the total battery capacity between February 2020 and November 2021. This is a small proportion of the NSW market (but given that the Pilot targeted only 24 of 128 local government areas in NSW, the percentage uptake in the target areas will be substantively higher).

The small scale of the EHP Pilot, and the corresponding limited number of approved system installers, has limited the impact of EHP on the broader Distributed Energy Resources (DER) market. Further, there is limited visibility of the DER market, which makes it challenging for Government and sector participants to understand the impact of installations on the network.

Several stakeholders identified that successful battery programs in other states were incentivising DER in Australia and VPP uptake. The successful battery programs have had high levels of awareness due to the large number of service providers and public awareness raising activities by industry and respective state governments.

B.1 What motivators were relevant for customer uptake of DER? What barriers did the program remove for participants? What barriers were not addressed?

Note, this evaluation question was addressed with reference to solar and batteries, not DER systems (which incorporates a wider range of technologies).

The key motivators for participants to take up the EHP Pilot are affordability/bill savings, self-sufficiency and sustainability. Stakeholders reported that the key barriers the program targeted are the high up-front costs, lack of participant knowledge about the technology and lack of participant knowledge about how to explore battery options and identify trustworthy suppliers/installers. Stakeholders perceived that the EHP Pilot removed these barriers.

B.2 Do participants understand how to get the most out of their DER systems? Why or why not and how could this be improved?

Note, this evaluation question was addressed with reference to solar and batteries, not DER systems (which incorporates a wider range of technologies).

While the NSW Government provided information to participants, installers took the primary role in participant education. Participant's understanding of their DER system and energy practices is limited and varied by installer (with local installers providing more support and education). Most participants have monitoring systems and find these useful. However, there were missed opportunities to educate participants on how to understand, safely operate and maintain their systems (i.e., by providing more appropriate information (greater depth, readability and usefulness)).

Although improving uptake of virtual power plants (VPPs) was not specifically included in the EHP Pilot objectives, all installations were VPP enabled, and the EHP Pilot informed participants that they "could potentially also access an additional rebate on your bill by signing up with a virtual power plant (VPP) provider".⁵ This aimed to increase their financial benefits from installation. However, participants have low awareness, understanding and trust in VPP programs, and suppliers are not motivated to sell VPP services as this requires more time to educate customers. There has been low uptake of VPPs as a result.

Participants with more information and support reported having a better understanding of their solar PV plus battery and monitoring systems and how to manage their energy usage patterns to get the best benefit. Participants with limited understanding are unlikely to get the most benefit from their system.

Most participants have changed their energy consumption behaviours, based on personal research, information from the installer and trial and error. Behaviour changes include time of day use, limiting appliance use, and limiting electricity use at peak periods.

Participants need more and simpler information on solar and battery installations and VPP services both at the decision-making and post installation stages.

B.3 How has the Pilot influenced safety, quality, standards and consumer protections for customers and participating suppliers? How much of this influence is permeating into the DER market in NSW?

⁵ NSW Government (2020). *Is the solar battery loan offer right for me? Empowering Homes program guide*. Sydney: NSW Department of Planning, Industry and Environment.

The NSW Government has sought full compliance by EHP suppliers with approved standards to ensure that the systems perform well for the duration of the loan tenure and maximise benefits for the households. Suppliers/installers indicated that program installations were much more highly scrutinised in comparison to the industry norm. This improved installers' compliance with standards and has led to improved safety, quality, and protections for EHP installations. Participants appear to be satisfied with the quality of their installation and system.

While all systems installed should fully comply with regulatory requirements, installers indicated that the level of reporting and auditing required under the program added an extra administrative burden compared with the industry norm. This may reflect lower levels of compliance outside the program. As such, program suppliers/installers considered that they are not operating on a 'level playing field' with other suppliers/installers in the industry.

Some stakeholders reported that installers faced increased administrative costs (relative to non-program installations) in fully complying with the standards under the program. While costs associated with compliance should be included as a basic business cost, these costs are not always reflected fully in the cost of service, in an effort to reduce prices for customers. An installer indicated that these administrative costs are in the order of an additional ~5–10 per cent for installations under the program. Some stakeholders noted that these costs are then passed on implicitly/indirectly to individual participants, incorporated into the total package costs for the system. This was reported to be, in part, a result of the program's strong focus on compliance with regulatory requirements. This demonstrates a benefit of government programs in supporting more installers to comply with standards.

Further, approaches used in the EHP Pilot to audit and ensure compliance may not be suited to scaling up for application under a future state-wide program. Government, suppliers/installers, and participants need more clarity and education on their roles and responsibilities (e.g. regulatory oversight, inspections and rectification work) to support compliance and reduce confusion. Harmonised standards and the opportunity to provide input into the development of standards would also be beneficial. It should be noted that it is not the role of the EHP Pilot to ensure standards are harmonised or developed appropriately. Rather, this is the role of agencies tasked with developing and maintaining standards, regulating suppliers and ensuring they uphold and adhere to appropriate work, health and safety practices.

Further, improvements in compliance were largely limited to approved installers and program participants, rather than flowing through to the industry in general. However, some considered that the EHP Pilot highlighted poor installation practices broadly in NSW and raised awareness of compliance issues in NSW and nationally.

B.4 What are the challenges and impacts of undertaking programs in a developing market?

The developing nature of the battery and no-interest loan markets presented many challenges for the EHP Pilot, including battery price volatility, competition and increased crowding in the no-interest loan market over time. Changes to these markets suggest that there is no longer a rationale for government intervention in this form (i.e., provision of a no-interest loan for battery systems). However, given the ongoing high upfront capital cost of a battery system, intervention in the form of a subsidy or a subsidy and loan model may be both appropriate and more suitable.

C. What lessons learnt could be applied to future programs?

There are several lessons which are applicable for future programs including: the need to improve promotion and awareness-raising of the program and the opportunity and benefit of joining a VPP; better targeting of participants through revised program eligibility criteria to improve the level of benefit delivered to the participant and NSW Government; improvement in the collection of data (including the right data); ensuring sector-wide compliance with standards (i.e. inverter, technical

and electrical standards); adoption of a coordinated NSW Government DER policy position; and development of a clear dispute resolution mechanism.

D. How could residential solar and batteries materially impact the electricity network (including security and reliability, and peak demand reduction) in the longer term? What other DER options could be considered to achieve these objectives?

Given its scale, the EHP Pilot did not have a substantial impact on the electricity network. The introduction of more battery systems may increase the reliability of the network through peak demand reduction management and VPP services. Curtailment,⁶ where an electricity generating system such as solar panels are stopped from exporting to the grid or temporarily shut down, is a growing issue. Better targeting battery installations in areas with network congestion may increase aggregated capacity and improve energy reliability and security. This includes the opportunity to explore other DER options to support a transition to net zero emissions, including vehicle to home (V2H), vehicle to grid (V2G) and smart appliances including hot water storage.

E. How can residential solar and batteries support the transition to Net Zero Emissions by 2050? What other DER options could be considered to achieve these objectives?

The NSW Government's Net Zero Plan outlines its approach to reducing emissions to net zero by 2050.⁷ This Plan and several stakeholders highlighted the substantial role solar PV and batteries could play in the transition to net zero emissions and support the grid moving away from coal-fired generation. Further, there is strong sentiment from the majority of participants on the role of the program in Net Zero, with 64 per cent installing their systems to improve sustainability (64 per cent). Solar and battery systems, VPP services and EVs facilitate energy storage and use when it is cheapest and in abundance. Stakeholders expected VPPs to have a substantial role in supporting grid stability as electrification of homes and transport increases.

Recommendations

Recommendations arising from the evaluation of the EHP Pilot are as follows:

Recommendation 1

To maximise program reach and realise the benefits of battery systems (a poorly understood technology), subsequent programs require targeted promotion and education activities focused on raising awareness and encouraging uptake of the program by the target audience; ensuring participants fully understand how to select the most appropriate option; ensuring participants fully understand how to safely use and maintain solar and battery systems to optimise benefits; and enabling stronger coordination of grid services delivered by batteries.

Recommendation 2

To maximise benefits for the participant and the NSW Government, future program design should include eligibility criteria that target the most appropriate audience; attract the intended audience; support participants to install systems that meet their needs (i.e., the appropriate size); and support participants to fully understand the commitment they are entering into and how it will impact their financial position.

⁶ Curtailment is taken to mean where a solar PV and battery system stops exporting to the grid or temporarily shuts down, effectively wasting energy that could have been used. This is generally referred to as 'tripping' but can also include intervention by the network operator.

⁷ New South Wales Government (2020). *Net Zero Plan Stage 1: 2020–2030*. Parramatta: Department of Planning, Industry and Environment <https://www.environment.nsw.gov.au/topics/climate-change/net-zero-plan>.

Recommendation 3

Data collection practices need to ensure that the Department and OECC have sufficient quality and quantity of data to identify the impacts of the program for participants (considering cost and data access), the grid and the broader NSW economy; and identify and manage emerging issues that may restrict the program impacts.

Recommendation 4

Government requires full compliance with safety, quality and protection standards across the sector and the state. Government should work with industry to raise the level of compliance across the sector and state, to ensure that all installers operate on a 'level playing field'.

Recommendation 5

A coordinated, whole of NSW Government policy position is required to improve DER visibility and support a transition to net zero emissions. This should incorporate additional DER integration options (including centralised, community-scale and premise-specific DER options) and better target installations in areas with curtailment issues that may increase aggregated capacity and improve energy reliability and security.

There is a need to consider other forms of market intervention (given crowding in the no/low-interest loan market). Intervention in the form of a subsidy or a subsidy and loan model may be both appropriate and more suitable to drive the uptake of DER technologies (given the ongoing high upfront capital cost of a battery system).

Recommendation 6

A clear, affordable dispute resolution mechanism between customers and DER manufacturers, installers, retailers, and network operators is needed to support consumer confidence, safety and the development of the DER market.