RACE for 2030
RELIABLE AFFORDABLE CLEAN ENERGY

Leading the Charge

Integrating electric vehicles into residential precincts – The Witchcliffe Ecovillage

Australian Government
Department of Industry, Science and Resources
Cooperative Research Centres Program

What is RACE for 2030?

RACE for 2030 is a 10-year cooperative research centre (CRC) with $350 million of resources to fund and support research towards a reliable, affordable, and clean energy future.

racefor2030.com.au

About SEVI

The Strategic EV Integration (SEVI) project aimed to identify practical pathways for integrating EVs as energy assets across three key Australian contexts: business/government fleets (NSW), residential precincts (WA), and holiday parks (SA). The project sought to understand the economic, social, and environmental impacts of EV adoption, address industry concerns, and develop actionable guidance for stakeholders.

racefor2030.com.au/project/strategic-electric-vehicle-integration/

Acknowledgment of Country

The authors of this report would like to respectfully acknowledge the Traditional Owners of the ancestral lands throughout Australia and their connection to land, sea and community. We recognise their continuing connection to the land, waters and culture and pay our respects to them, their cultures and to their Elders past, present, and emerging.

Project Partners

Foreword

from Curtin University Sustainability Policy Institute.

It gives me great pleasure to provide the foreword for this important work.

The Witchcliffe Ecovillage was chosen as a leading case study of how EV charging can be strategically integrated into shared-use precincts. The Ecovillage is a distinctive housing and commercial development that brings together multiple eco-innovations that together make a compelling and globally relevant story that is important to be researched. It is also important to see how these innovations work for the people who live there and those who love to visit, like me.

I have known Mike Hulme and Michelle Sheridan, co-founders and leaders of the Ecovillage, for many years and have watched the project evolve from the early days. I have seen the lengths that they have gone to in order to make this outstanding development a reality. Their dedication and emphasis on building a strong, supportive community have helped create a truly amazing place to live. It is a tribute to their deep commitment to sustainability that they now have an internationally significant project that demonstrates what a net zero future can look like in practice and is also a great place in which to live, and to visit.

The Eco-Village has a powerful video on its website which starts with a film welcoming us to the Wadandi Boodja Country by local indigenous elder Wayne Webb. He welcomes us to the Kirrup, or camp, and says: ‘We are on Country created with benefits for Country; looking after Country means it will look after you’. This is a profound endorsement of the values that underpin the Ecovillage, and Mike and Michelle must be very proud of such an assessment of their work.

Whenever I visit the site, I feel that the Eco-Village is doing the right thing for the global and local environment and is also looking after me. It makes a meaningful contribution to the sustainability challenges of our time, and to all who live there and visit there, it is a special place. It does seem to look after us.

The Witchcliffe Eco-village is a global leader in demonstrating a net zero settlement as is shown in this project. It is important to document and evaluate these innovations as a global demonstration, particularly how the shared EV charging system fits into the economy of the Ecovillage. It is also important to understand how this EV system helps look after Country, and how this, in turn, supports all who live there or visit.

Professor Peter Newman,
Distinguished Professor,
Curtin University Sustainability Policy Institute

About this guide

Residential precincts can position electric vehicles as valuable components of integrated energy systems.

Drawing on the Witchcliffe Ecovillage demonstration, this guide shows how strata-managed EV charging, integrated with solar, batteries and smart controls, can reduce energy costs, generate shared revenue, and improve resilience. It presents evidence-based lessons on governance, user behaviour, business models, and staged investment to support viable precinct-scale EV charging.

Who is this guide for?

- Property developers planning new residential or mixed-use precincts
- Strata managers and owners' corporations responsible for shared infrastructure
- Councils, planners, and precinct stakeholders seeking to understand EV charging integration at a precinct scale

How to use this guide

- Use this guide to better understand the costs, benefits, and risks associated with EV charging in precincts
- It can support decisions about staging EV charging infrastructure in line with EV uptake
- It highlights how EV charging can be integrated with onsite solar, storage, and smart charging to manage costs and improve outcomes
- It is a general guide and should be used alongside professional technical, legal, and energy advice where required

Context

The Witchcliffe Ecovillage in the Margaret River Region of Western Australia is an early example of how residential developments can deliver world class sustainable energy solutions.

The Ecovillage was designed with the intention to provide residents with forward thinking options for renewable energy generation, energy storage and public electric vehicle charging, managed by residents as part of a dedicated microgrid. The development provides an exciting glimpse into the future and offers a unique opportunity to explore a range of practical solutions that when combined create a blueprint for sustainable energy solutions in residential developments. The key question of focus in the research project was around the viability of providing community-owned public EV charging infrastructure as part of residential developments, that benefits both residents and visitors.

Professor Peter Newman addressing a seminar involving researchers, partners and residents of the Witchcliffe Ecovillage

What were the main issues and opportunities?

Residential developers are increasingly seeking guidance on how to reduce energy costs of developments in a manner that reduces reliance on the grid and compliments well established options for energy efficiency and demand management.

In particular, assistance is needed to navigate a range of emerging options for onsite electricity generation, storage and use that can be aggregated across precincts for mutual benefit. Furthermore, the rapid uptake of electric vehicles in the near future stands to put additional strain on electricity systems if they are not properly integrated.

Electric vehicles are now seen as an additional controllable load for households and are emerging as sources of electricity generation that can reduce evening peak demand costs. However, it is at the precinct level that the strategic integration of EVs brings real value. Precincts are now being presented with a new business model, one that harnesses onsite electricity generated by rooftop solar, stores excess in batteries and is focused on reducing energy bills. In parallel, the inevitable transition to EVs provides another opportunity to create a new revenue source for communities by offering public fast chargers. This is especially important from a financial point as feed-in tariffs significantly decrease and restrictions on grid export tighten.

However, as many early adopters are finding out, fast EV chargers come with high initial capital costs and fixed operating expenses, making them a challenging economic balancing act. To maximise returns, the managers of the microgrid need to consider the potential for surplus to be generated and used on site, as well as drawing from the grid, especially during winter months with lower solar PV generation. To capture benefits at precinct level, it will be crucial for microgrids to be orchestrated by suitable control systems that dynamically manage the import, export, generation, and storage of electricity to meet demand whilst satisfying grid connection requirements.

Developers and residents are also discovering that the success of these systems depends as much on governance arrangements as on the underlying technology. Precincts that rely on shared assets, such as community batteries or strata-owned public EV chargers, must establish internal processes that allow decisions about pricing, maintenance, and operational settings to be made transparently. Without this, shared assets may become underused or financially unviable. Early precincts show that resident understanding and involvement can materially influence outcomes; where governance structures support active participation, precincts are better placed to adapt tariffs, charging rules, and operational priorities in response to changing conditions.

Another issue emerging from early demonstration sites is the importance of access to reliable data. Developers often expect that energy and charger data will be readily available, yet in practice the collection, sharing, and interpretation of system data can be fragmented. In the absence of complete datasets, precinct designers may need to rely on indicative or synthetic energy profiles to estimate system behaviour, at least in the early stages. As systems mature and real data becomes available, assumptions can be refined and model outputs recalibrated. This iterative process is proving essential for identifying where precinct-scale benefits are achievable and where operational adjustments are required.

At the same time, the shift toward precinct-scale energy systems presents a genuine opportunity to trial new approaches before they are deployed more broadly. Demonstration projects such as those examined in the SEVI research show that precincts can act as early testing grounds for understanding user behaviour, tariff responses, and the economic performance of shared infrastructure. Lessons from these early sites can help developers anticipate issues such as low initial utilisation of chargers, the timing of EV charging relative to solar generation, and the impacts of export limits on energy flows. These insights can then be applied to future developments, reducing uncertainty and improving the likelihood that precinct-scale energy systems will deliver the intended financial and operational benefits.

What were the main partner interests?

The main interest from the project partners was around the viability of providing public EV charging infrastructure as part of residential developments operating on a microgrid, considering the energy flows to and from the grid, the agreements needing to be reached with residents, and how the finances stacked up.

The Demonstration Partner behind the Witchcliffe Ecovillage, Sustainable Settlements Pty Ltd, led by Mike Hulme was an innovator and adopted promising emerging energy technologies well ahead of the game. This leadership has now provided the opportunity for the residential development sector to learn from a real-world testbed; an opportunity unique to this research project. This forward-thinking approach has set the precinct up to take advantage of innovative energy solutions long into the future.

However, due to the current low penetration of EVs in Western Australia, there has been temporary disconnection of some of the pre-installed public chargers until EV uptake increases accordingly. To prepare for this increase in uptake of EVs, the research team was asked by partners to understand the conditions necessary to make public EV charging in residential precincts profitable and, more importantly, how to influence these conditions. More broadly, the lessons learned can form a blueprint for the wider industry, as property developers seek new ways to reduce costs, generate new revenue streams and make their developments attractive to buyers.

Partners were also interested in the practical considerations that sit around the operation of shared energy assets once a development is completed. This included how responsibilities for managing public EV chargers and shared batteries might shift from the developer to the strata and residents, and what arrangements would be needed to ensure these systems continue to operate as intended. There was particular interest in how different governance approaches might influence the long-term performance of the microgrid and the level of resident involvement required to maintain reliable operation.

Another area of interest related to the availability and quality of system data. Early expectations that energy and charger data would be straightforward to access were not always met, which highlighted the need to understand what information is realistically obtainable and how it can be shared across stakeholders. Partners sought clarity on the type of data that is needed to support decision-making, the level of monitoring required to identify operational issues, and the extent to which developers or technology providers may need to assist in the early years of system operation.

Finally, partners wanted to better understand how user behaviour affects the financial performance of public EV chargers. This included interest in the likely rate of growth in utilisation, the factors influencing drivers' decisions to use a charger, and whether interventions such as clearer signage or tariff adjustments could influence usage patterns. Understanding these behavioural factors was seen as important for interpreting early performance results and for informing how precincts might adjust their settings over time to improve financial outcomes.

What were the key lessons from the research?

The research undertaken in partnership with the Witchcliffe Ecovillage has revealed a number of insights into how community-scale electrification can succeed or struggle, depending on the approach to design, governance, and community engagement.

The key lessons from the research have relied on effective stakeholder engagement, detailed data analysis and modelling, and practical consideration of associated business models. Lessons and risks highlight what we have learned from our research and collaboration with the village stakeholders in making distributed energy, EV charging, and microgrids work in real residential settings.

1 Harness the Power of Community-Led Energy Management

As part of each strata committee an 'Energy Leader' is nominated, referred to as the "Power Rangers", with the responsibility to monitor and report on the energy management of the system, gaining insights about the electricity system across the precinct. These frequent round-table discussions generate practical ideas that are shared with residents, the developer, and the developer's electrical engineer through the strata committee. This approach has been successful in building residents' understanding of their innovative energy system which involves shared batteries and public EV chargers. However, residential developments where the developer retains control of the energy assets, or outsources their management to an external party, may miss the opportunity to engage residents meaningfully, as residents are less directly vested in the infrastructure or involved in decisions about its management.

2 Capitalise on shifting from Household to Precinct-Scale Systems

The ecovillage shows that residential developments can be largely self-sufficient in energy if well-designed and collaboratively managed. With the right mix of energy-efficient equipment and dwellings, household solar panels, private and shared batteries, and microgrid control, precincts can greatly reduce grid dependence and provide energy resilience, a new selling point for the development sector. However, it is important to use land titles which allow for flexibility in the configuration of the microgrid and simplified interconnection of shared energy assets, in order to capitalise on the precinct system solutions. It is equally important to ensure leading practice management and control systems are in place to coordinate energy assets as, if not, this can lead to missed revenue and under-used assets. Hence it is important to set the system up right from the start to capitalise on full precinct-scale energy benefits and enhance both the system's performance and residents' confidence in collaborative energy solutions.

3 Smart Energy Management and Control is Essential

It is essential for automated, data-driven control systems to be used to reliably and dynamically orchestrate energy flows across the microgrids in precincts. The energy management system should continuously coordinate rooftop solar PV generation, energy storage in the shared battery, controllable loads across the microgrid (such as the speed of EV charging), and the system's interaction with the grid. Digital modelling can be used to guide the design, equipment selection and operation across the precinct to harness onsite options and provide back-up during disruptions. However, inadequate control systems can cause inefficiencies that can lead to higher than needed grid fees, unnecessarily stress equipment, triggering local outages, which can undermine resident confidence in the reliability of microgrid energy management systems within the precinct.

4 Identify EV Charger User Behaviour and Preferences

It is important when designing public EV charging offerings within residential precincts to understand likely user behaviour and preferences and how these might affect demand in the short and longer terms. In the case of the ecovillage, running a survey with users (n = 55) of the public EV charger and analysing the actual charging data revealed key insights into this area. It was found that public EV charging mainly occurs during the day and that drivers who come to charge value convenience, rather than amenity, even ahead of cost. Such insights allow the owner of the public charger to make informed decisions on improvements to increase the utilisation of the EV chargers and, ultimately, the revenue from their asset. However, while the survey showed that charger location was the most important factor, in a community setting, relying on phone apps without the support of road signs may be insufficient due to patchy data across charging station applications. This could prevent the chargers from achieving the anticipated returns.

5 Understand the Economics of Public Chargers

Public EV charging offerings that are embedded in precincts can generate new revenue streams for residents, assuming the business models are designed to balance early low utilisation with long-term adoption. For instance, it is important to set appropriate internal pricing mechanisms for residents excess solar energy and to stage deployment of chargers to ensure financial viability. In particular, flexible pricing arrangements can be responsively adjusted to accommodate low initial utilisation while EV adoption grows. Such low initial utilisation can impact financial returns due to fixed fees associated with chargers which can be misaligned with internal and external pricing. If not handled well, this can lead to short term disconnection of non-economically viable public chargers and in turn may delay EV adoption and erode trust in innovative energy solutions.

6 Prepare for Resident Electric Vehicle as both Energy Load and Storage

Electric vehicles provide the most benefit when they are charged during the day with solar energy and are intelligently integrated into the precinct energy system. Currently this means accounting for them as a load on the system, but in the not-too-distant future it will mean also being able to draw on them to provide energy back into the system, referred to as Vehicle-to-Grid (V2G). This will usher in a new era of energy management in precincts with EVs becoming an integral part of the energy system, providing flexible storage that can assist in optimising the system and supporting the microgrid at critical times, such as during the evening peak demand period or in the case of blackouts. This can have positive impacts beyond the precinct itself, such as helping to stabilise the grid and defer costly infrastructure upgrades. However, unmanaged or poorly timed charging may cause increased reliance on grid energy, local instability, or costly upgrades, potentially creating significant challenges for the electricity grid and precinct operations as well as driving up costs.

How did the research team model the energy system?

A key early step in the research was to develop a working model of how electricity flows around the development by gathering information on the characteristics and components of the microgrid, as can be seen in Figure 1, which was developed drawing on information in the Witchcliffe Residential Energy Handbook.

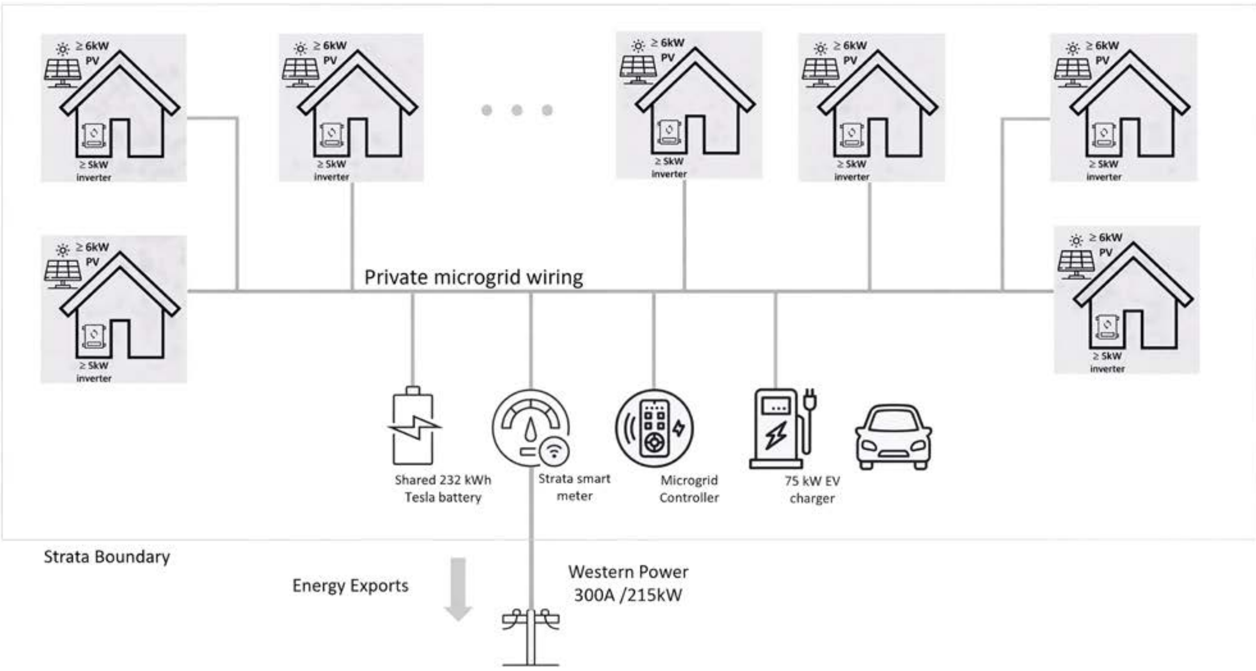

Figure 1: Schematic of the microgrid configuration in the Witchcliffe Ecovillage

A digital model of the microgrid was created using mathematical modelling tool, MATLAB Simulink, to replicate the energy flow around the microgrid, including rooftop PV generation, battery charging and discharging behaviour and the level of grid import and export. An early lesson from the project was that although it seemed that data on the energy system and its use was easily accessible, in practice the research team needed to demonstrate that their work would bring direct value to the developer and the residents. To do this the team used initial data that was publicly available on energy devices, solar insolation and export limits, which was then combined with synthetic data based on industry held assumptions to create indicative energy profiles for dwellings, as shown in Figure 2.

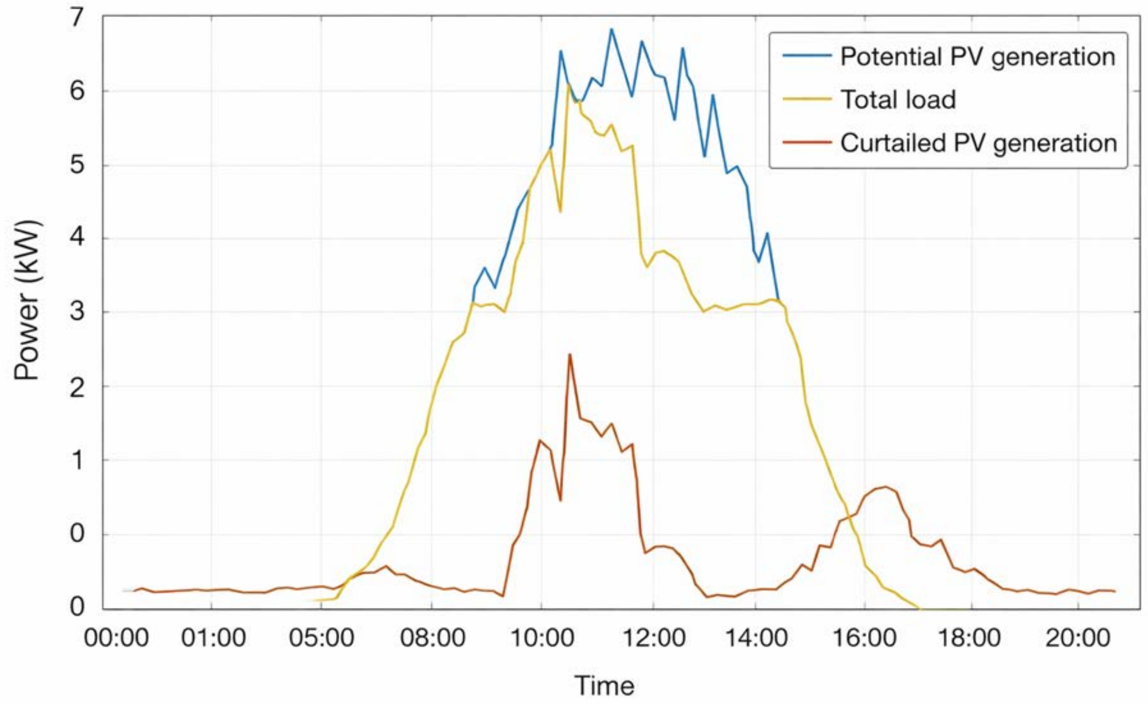

Figure 2: Estimated energy profile for a medium house in summer with daytime EV charging

The synthetic energy profiles were then used to calculate the aggregated energy profile of the microgrid and used to simulate the community battery energy profile state of charge and interaction with the grid in order to estimate the likely financial returns from the public charger.

Based on the findings the research team gained greater access to real data from the developer and residents which was used to verify the profiles, including the shared battery energy profile and interval data from the grid. The verified energy profiles were then used to simulate various scenarios, such as the expected energy flow once the precinct was fully developed, an increase in public EV charger events, and the greater uptake of EVs by residents charging behind the meter. The research team complemented this new data by conducting a survey to collect behavioural data from users of the public EV charger, accessed via a QR code displayed on the charger. The team also analysed charging event logs to extract key insights into the utilisation of the public EV chargers. After cleaning and processing the data, usage patterns and trends were identified and interpreted. This data also served as input for the development of financial models to assess the value proposition of the public EV charger and its operational settings in various financial scenarios.

The model, as in the real system, assumed that the controlling logic of the system was based around the shared battery system with active monitoring of the power flow at the cluster's connection to the grid across the day. If the battery senses a surplus of electricity is detected after local demands are met, including the public EV charger, the battery will first charge itself and, if there is any energy left over, it is exported to the grid. If there is a deficit of electricity, and the battery has enough charge left, it provides electricity to the microgrid up to its maximum discharge rate and, if there is still a deficit, then electricity would be imported from the grid. The power output and state of charge (SoC) for the shared battery were modelled based on its technical characteristics and an assumed state of charge at the start of the modelling period of 20 percent (in summer), as shown in Figure 3.

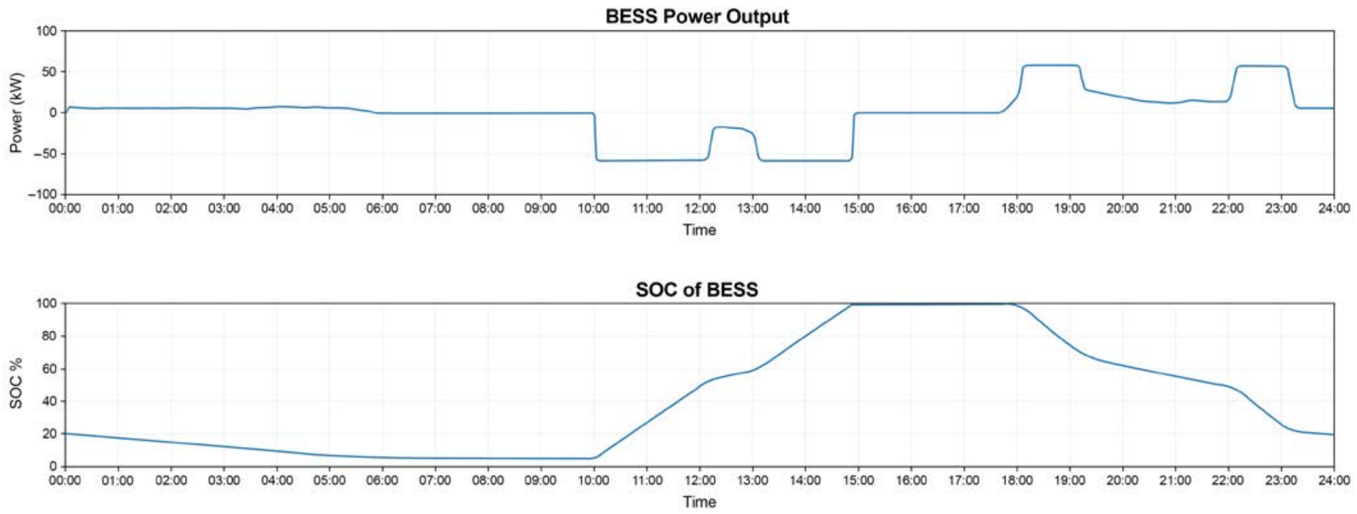

Figure 3: Modelled shared battery power output and state of charge in Summer

As can be seen, the battery covers the load of the microgrid overnight until the sun rises and the rooftop solar systems take over from around 6am. The latter then supply both the residents and charges the battery until it's full by 3pm. A public EV charger event was simulated between 12 and 1pm with the battery charge rate shown to reduce with the charger using part of the excess energy from the residents' solar panels. At the end of the day the battery starts to again supply electricity to the residents and to the public EV charger with charging events simulated from 6 to 7pm and 10 to 11pm, with the battery ending its 24h cycle at 20 percent charge.

The overall energy profile for the cluster, represented by the energy flow at the point of connection of the microgrid to the grid, materialised by the Parent Meter, was then modelled. The method used was to compare the total excess generation from residents' solar systems with the total site demand (including the load from charge events from the public EV charger), and the contribution from the shared battery (both as a load when charging and as a generator when discharging), as shown in Figure 4.

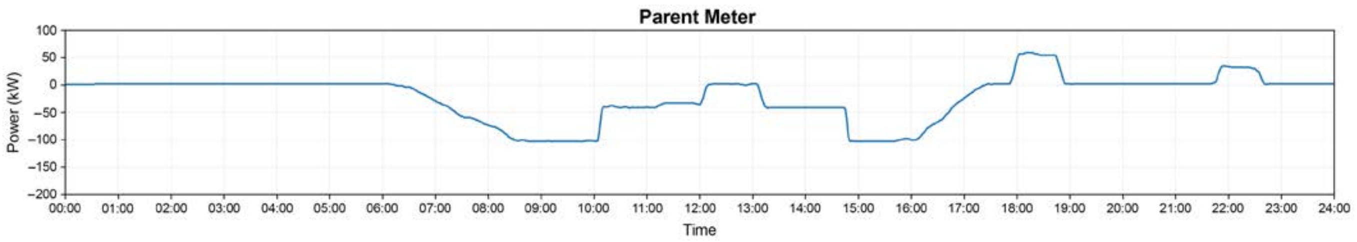

Figure 4: Estimated energy profile at the Parent Meter of a residential cluster in Summer

As can be seen, the cluster does not draw electricity from the grid in the morning (thanks to the battery) and starts exporting from 6am. In this scenario the export is limited to 100kW, and this limit is reached from 8:30 am to 10 am, and again from 3 pm to 4:30 pm. The reduction in energy export during the middle of the day is due to the battery charging and the use of the public EV charger. As the sun sets end of afternoon and solar generation decreases, the export decreases to zero, from which time the battery takes over to supply energy to the cluster. However, it is limited in how much it can supply (58kW) and the two charge events at the public EV charger (75kW) require some import support from the grid. The data collection and modelling undertaken provided a working digital model for the residential microgrid, which was used to simulate various scenarios. The most valuable simulation was to assess the excess energy that could be exported to the grid if the 100kW export limit were lifted to see the maximum capacity of the system. The same scenario as above was then simulated but without any curtailment of the residents' solar generation. The energy flow to and from the battery wasn't affected, but the export to the Grid increased, as Figure 5 shows.

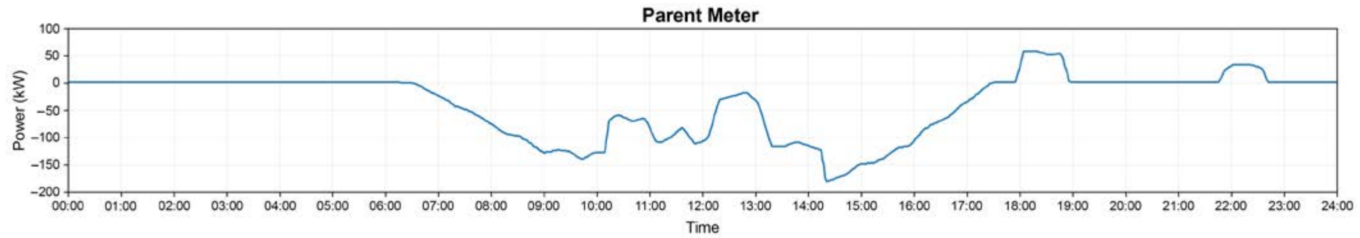

Figure 5: Estimated energy profile at the Parent Meter of a residential cluster in Summer without export limit

The additional export was estimated at around 130kWh, which is around $5 with the current Feed-in Tariff. The most important advantage would be to be able to manage the solar curtailment when an EV uses the public charger, as it would avoid importing energy from the grid during the day to supplement the charger.

Public electric vehicle charging station at the Witchcliffe Ecovillage with signage added as part of the research project

What did the Public EV charger data tell us?

Based on charging event logs from the public EV chargers installed at the village, the research team extracted the following insights on charger use by members of the public:

Energy Delivered

On average, EV drivers added around 30kWh of energy per charging session, enough to supply 30kW of power for a full hour, typically delivering around 180km of vehicle range.

Time of Charge

The charge logs showed that most public charging events (around 80 percent) took place during daylight hours. This is an encouraging trend when seeking to sell excess rooftop solar energy after the shared battery is full.

Speed of Charge

It was found that most charging events were over 50kW which suggests that most EVs are using the fast-charging capacity of the chargers and confirming the utility of the higher charging capacity.

Duration of Charge

Thanks to the high-speed capacity of the chargers, across the time there were over 480 charging events which took an average of 35 to 40 minutes.

What did the vehicle movement data tell us?

The data sourced from the location of mobile phones was used as a proxy for vehicles, with Figure 6 showing the paths for vehicles arriving at, or near, the Ecovillage over a 12 month period. The figure shows that vehicles come from as far as 300 km away with the majority from Perth and within a 100km of the village, however there are some long cross country paths also.

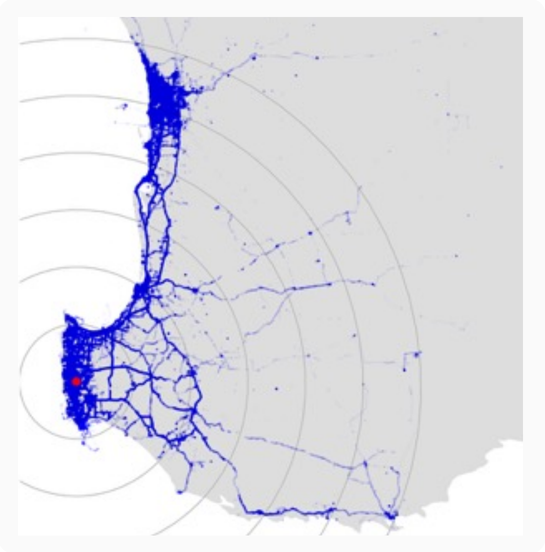

Figure 6: Origin of visitor trips to, or near, the Witchcliffe Ecovillage in a 12 month period

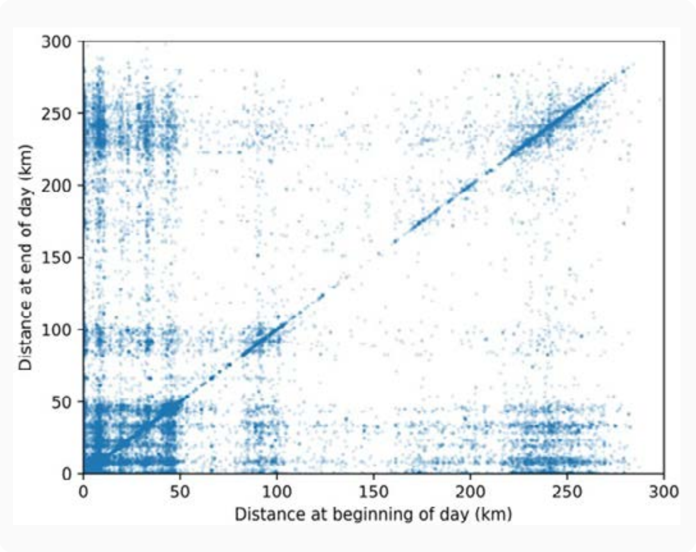

Figure 7: Vehicle location at start and end of day relative to the Witchcliffe Ecovillage.

The device location data was also used to identify on average how far vehicles are from the village at the beginning and end of each day, over a 12 month period. As can be seen in Figure 7, the bottom left corner indicates vehicles that start and finish within 50 km of the village; the top left corner indicates vehicles that start near the village and finish around 250 km away; the bottom right corner indicates vehicles that start around 250 km away and finish near the village; and the top right corner indicates vehicles that start and finish 250 km from the village. The vehicles staying within 50 km of the village, some 60 percent, are less likely to be customers for the public fast charger, however, as can be seen the remainder of the vehicles travel up to around 250km (with few doing a 250km round trip).

What did we learn about user behaviour?

To complement the event logs from the public EV charger, a user survey was conducted by the research team, with users of the charger invited to participate in an online survey by scanning a QR code on the charger, as shown in Figure 7,[1] with preliminary results shown to the right.

The survey asked respondents to rank the factors that influenced the selection of the charger, such as location, price, charging speed, sourced from renewable energy, and the provided amenities. Although the current level of utilisation of the chargers was low the survey received 38 responses, providing a glimpse of user perceptions. Overall, the findings suggest that users were generally satisfied with the charging experience, with some interesting differences between male and female respondents. Although the location of the charger was most important for both, men indicated that cost was the second most important factor, while women valued speed.

Another insight was that almost half, some 43 percent, of the drivers who took the survey were coming to the area for another reason other than to charge their vehicle (e.g., to visit someone in the Ecovillage). This suggests that these drivers were drawn to the charger location by the development, which may present an ongoing charging customer rather than an opportunistic charger using a phone app to guide them. Considering this the ranking of factors was analysed only using the results from the drivers who 'just came here to charge' as they represent the people charging opportunistically that are likely to grow faster than those already visiting the site.

Figure 8: Decal applied on public EV chargers to access user survey

Looking at the responses from people charging opportunistically, location was again the main factor influencing the choice to use the chargers, with speed and cost coming a close second and third. Together with the finding that the amenities provided at the charger site was the least influential factor suggests that convenience, rather than comfort, was more influential, even above cost.

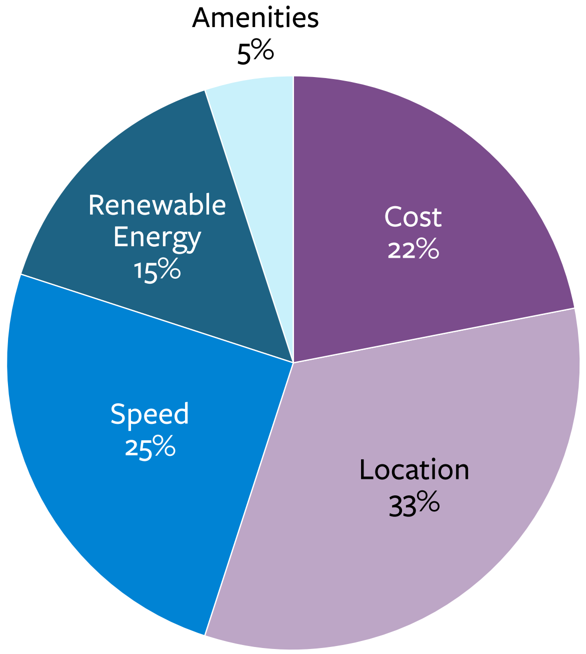

Figure 9: Factors influencing the choice to use the public fast chargers of opportunistic chargers

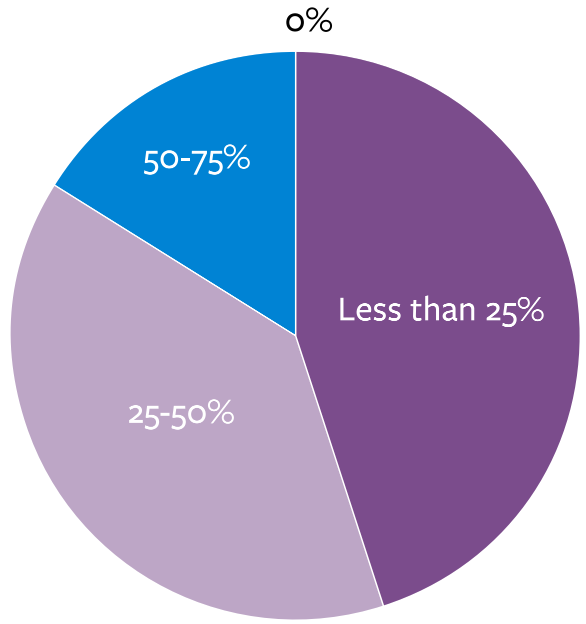

Figure 10: EV Battery level before using the public fast charger

In the survey, respondents also provided information on the state of charge of their EV batteries when they arrived at the charger, and when they left. The results showed that most EVs using the charger, some 85 percent, arrived with a battery level of with less than 50 percent, and nearly half, some 43 percent, arrived with less than 25 percent. The majority of respondents, nearly 80 percent, indicated that their goal was to charge the EV until it reached a charge of over 75 percent.

Given the significant traffic flow past the development along the Bussell Highway, the researchers designed an intervention to encourage greater use of the chargers by placing clear signage at the entrance of the village and enroute to the operating chargers within the village. The ongoing survey and charging logs will be used to compare before and after levels of charger use and associated preferences, following the completion of the project.

Figure 11: Installation of signage at the entrance of the village as part of the research intervention

1 The research team would like to thank Chargefox for issuing the invitation to participate in the survey to its members that used the chargers.

What were the economics of the public EV charger?

Operating a public EV charger within a development managed by a strata was considered a relatively new practice for the development sector in 2025. As such, the most effective value propositions and business models are not yet established, however patterns are emerging.

At the Witchcliffe Ecovillage, the public EV chargers are owned as common property by the strata and form part of the development's microgrid. Each public EV charger is part of a local microgrid that connects household PV systems, shared battery storage, and provides allows residents to sell excess solar electricity to the charger. Operating the charger involves ongoing costs, such as annual fees, monthly subscriptions and maintenance costs which need to be recovered from income generated by the charger, otherwise the charger will run at a loss.

The ability for residents to sell excess electricity to the public charger raises a fundamental tension: the income of residents supplying solar energy becomes the expense of the strata operating the charger. Hence a suitable balance needs to be found between fair compensation for residents and financial sustainability for the strata. The key factor in this balance is the price residents are paid for excess energy. If the rate is set too high, residents who export may benefit but the charger risks reduced or unsustainable financial returns once operating costs are factored in. Conversely, if the rate is set too low (e.g., lower than the Feed-in Tariff to the grid), residents may have little incentive to participate. The financial situation is then directly affected by the price that users of the charger pay for the electricity, with all of these factors creating a complex financial picture.

To explore the dynamics associated with public EV chargers operated as part of a development, several scenarios were considered by the research team, as shown in Table A, exploring the impact of changes to parameters such as:

- The price paid to residents for supplying excess electricity,
- The price charged to use the public charger (which could be fixed or variable), and
- The number of charging ports in operation, with each charger offering two ports.

Table A: Example of input parameters that may be varied in financial scenarios

Scenario	Price paid to Residents	Type of rate charged to users	Number of ports**
Reference	Higher than grid FiT*	Flat rate	2 ports
Variation A	Equal to grid FiT	Flat rate	2 ports
Variation B	Below grid FiT	Flat rate	2 ports
Variation C	Higher than grid FiT	Flat rate	1 port
Variation D	Higher than grid FiT	Time-of-day rate	1 port
Variation E	Equal to grid FiT	Time-of-day rate	1 port

* FiT = Feed-in-Tarrif (which is paid when excess solar is exported to the grid.
** The fixed fee is calculated based on the number of ports active.

These scenarios are particularly useful for developers, residents and strata committees, allowing them to explore the potential trade-off between profitability of the charger, resident benefit and the development level, creating a set of possible outcomes as shown in the Table B below.

Table B: Example of outcomes to consider in financial analysis

Outcome Metric	Impact on Residents	Impact on Strata	Impact on Community
Profitability of Charger	Neutral, positive or negative	Break-even, at a loss, or generating a surplus	Determines long-term viability
Resident Benefit vs Grid FiT	Higher, equal or lower	Expense line item	Incentive for local participation
Development Result (residents + strata)	Positive, neutral or negative	Shared costs or benefits	Determines fairness of system

From testing the scenarios in Table A, and applying the metrics in Table B, several general insights were drawn from the research, namely:

- Utilisation matters: Chargers with higher usage rates are more likely to achieve financial sustainability, as would be anticipated; however this is still the case when residents are rewarded above the grid feed-in tariff.
- Variable rates are important: Adopting a flat EV charging rate for users may simplify operations, however the use of time-of-day rates better reflect underlying energy costs and grid conditions and provide greater flexibility leading to higher returns.
- A dynamic approach is preferred: A price that rewards residents while also covering the strata's operating costs is necessary to ensure the long-term viability of community-managed chargers. However, as this is affected by several factors the system needs to be dynamically managed to ensure benefits are achieved.

For developers considering the deployment of public EV chargers, it is recommended to undertake financial modelling in order to explore a range of rates and cost settings before committing to investments in hardware and the selection of a business model. The research suggests that achieving financial viability requires a careful balance between rewarding residents for their excess solar and ensuring the charger does not operate at a loss to the strata.

It is clear that even with low utilisation rates public EV chargers in developments can be financially viable, with this viability set to increase over time as the number of EVs on the road increases exponentially, doubling every 18 months.[2] Currently, EV uptake in Western Australia is low, with an estimated EV fleet penetration of just under 1.8 percent in June 2025.[3] Drawing on CSIRO and AEMO jointly developed projections, shown in Figure 12, it can be seen that strong growth in the uptake of EVs is predicted to continue over the coming decade. If these projections hold, not only will the public chargers within the Witchcliffe Ecovillage may be profitable in the near future, there will also be demand for additional chargers across the region. This highlights the importance of upfront investment in suitable EV charging infrastructure as part of longer-term planning or developments, especially in regional areas.

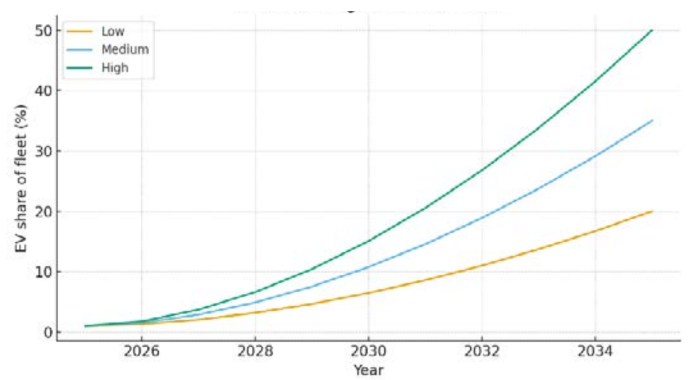

Figure 12: Forecasting of EV uptake in Australia
Source: AEMO & CSIRO. (2024). Electric Vehicle Projections 2024 (derived from Figure 5-4)[4]

Consideration was given to the future option to co-locate a shared EV with the public charger to increase EV charging demand, create a valuable community amenity, and optimise renewable energy usage while generating reliable revenue. In such an approach a vehicle would be located on site and managed by an external service provider who also provides a booking platform and takes care of insurance, cleaning and servicing. Depending on the deal reached with the service provider it is common for the provider to purchase electricity from the charger at public rates and to provide the strata with access to data that shows users' booking history, time of use, and booking calendar, providing valuable insights into the vehicles operation.

2, 4 Western Australian electric vehicle licensing data June 2025 Quarter
3 Australian Energy Market Operator & CSIRO. (2024). Electric Vehicle Projections 2024. https://www.aemo.com.au/-/media/files/major-publications/isp/2025/stage-2/electric-vehicle-projections-2024.pdf

What are the wider economic and procurement implications?

Investment in public EV charging in developments stands to deliver benefits not only to residents and visitors but the wider community.

The research indicates that while these systems can be introduced successfully, the long-term value depends on decisions made early in the development process. In particular, aligning hardware choices, governance arrangements, and charging strategies with the expected growth in EV uptake will influence both financial outcomes and resident experience over time.

As shown at Witchcliffe, public chargers installed ahead of demand can provide future value but may remain under-utilised in the short term. This creates a period where the infrastructure is in place but not yet generating meaningful revenue, reinforcing the importance of matching procurement decisions to expected utilisation. Developers and strata committees therefore need to consider whether chargers are best installed in a single batch or staged over time. A staged approach can reduce early capital exposure while still allowing the precinct to scale as uptake increases. Regardless of approach, ensuring that conduit, electrical capacity and connection arrangements are EV-ready during construction appears to be a cost-effective strategy.

In addition to these practical considerations, there are broader economic implications. The presence of public charging infrastructure can create modest positive effects within the precinct by drawing visitors, increasing dwell time, and supporting small-scale local activity. These shifts are unlikely to be significant at a metropolitan scale, but they can matter within the context of a residential precinct, particularly where chargers are easily visible and paired with amenities or community facilities. For residents, lower transport fuel expenditure, better utilisation of rooftop solar, and improved resilience during grid disruptions represent additional benefits that may strengthen the perceived value of living in the precinct, even if the financial gains are not directly realised.

Procurement pathways also influence how these systems perform once the development is handed over. Choices regarding product interoperability, access to system data, and the allocation of maintenance responsibilities can affect how easily strata committees manage the microgrid in later years. Contracts that outline expectations for performance, uptime, software support, and reporting can reduce uncertainty for residents and ensure that shared assets remain functional and transparent. Given that EV charging technology continues to evolve, selecting open-standard systems and avoiding proprietary lock-ins can help precincts remain adaptable and reduce the risk of assets becoming outdated prematurely.

There are also implications for the financial governance of the precinct. Public chargers introduce a revenue stream for the strata, but the level of income depends on utilisation, tariff settings, and resident support for the chosen approach. Early engagement with residents helps clarify the purpose of the chargers, whether they are intended to recover costs, generate modest revenue, or provide a service, and how this relates to internal energy pricing. The research shows that clear communication around tariff structures, expected utilisation profiles, and the interaction between rooftop solar, onsite batteries and shared chargers can support more stable decision-making and reduce the likelihood of disagreement once the precinct reaches full occupancy.

Taken together, these findings suggest that the economic benefits of EV charging can be significant but procurement costs can be substantial and require clear energy management frameworks and staged investment. Developers who incorporate EV readiness during construction, establish practical procurement frameworks, and plan for the eventual transition to resident-led governance are better positioned to deliver systems that function reliably, adapt to increased EV uptake, and support long-term value for residents and the wider precinct.

What are the key recommendations for developers?

Experience from the Witchcliffe Ecovillage highlights the importance of aligning resident and community engagement, technical capability, and thoughtful investment when introducing shared energy and EV charging infrastructure. The findings of the research have informed the following recommendations:

1. Land Title Selection

It is important to select the appropriate land title for the development that allows the required flexibility in the configuration of the microgrid. For example, a 'Community Title' for developments enables simplified interconnection of shared energy assets.

2. Hardware Procurement

It is important to decide on either a staged or batched approach for the purchase and installation of public EV chargers. A staged approach takes advantage of advances in technology over time. and potential cost reductions. and allows capital investment to be guided by current EV uptake and likely future uptake. A batched approach may allow for discounts due to higher order numbers.

3. Microgrid Management Systems

Ensure that the microgrid is dynamically managed by an appropriate control system that ensures effective operation and automated responses to changing conditions on the microgrid, in order to maximise the value proposition and financial returns.

4. Charger Wayfinding

It is important to make sure that associated EV charger third party applications which guide vehicles to chargers are updated and complemented with physical signage at the entrance to and on route within the development.

5. Understandable Economics

When providing EV charging infrastructure it is important to ensure that residents understand the economics of the chargers in order to select appropriate financial settings, such as the type of cost structure for users of the charger (especially with low initial utilisation).

6. Resident Engagement

As part of the creation of the Strata Committee it is recommended that an 'Energy Leader' is identified and supported who is actively engaged in the management of the energy system and reporting to the residents.

7. Internal Price Setting

The internal energy pricing approach set by the Strata to buy energy from residents to power the charger must be designed, monitored and adjusted to balance the benefits between individual residents and the Strata.

Conclusion

The research at the Witchcliffe Ecovillage supported by RACE for 2030 CRC has offered a unique opportunity to explore the integration of onsite energy generation, shared batteries, and resident-owned public EV charging within a residential precinct. The findings reveal both the technical potential and the governance and business model challenges of precinct-scale electrification. Technically, the project confirms that well-designed microgrids, supported by appropriate control systems, can deliver lower energy costs and create new opportunities for selling energy. However, the viability of providing public EV charging in developments remains a balancing act between utilisation levels, structure of charging rates, and internal energy pricing arrangements that can determine whether chargers create opportunity or risk, particularly in the early stages of EV uptake.

Looking ahead, the Witchcliffe Ecovillage provides valuable lessons for future mixed-use developments across Australia seeking to be part of the energy transition. The lessons learned offer scalable models for integrating EVs and distributed energy resources like shared batteries into precincts, while also informing efforts to retrofit existing suburbs and developments. With its resident-managed energy system and collectively owned assets, such as the shared battery and public EV charger, the Witchcliffe Ecovillage demonstrates how mutual benefits and multipliers can be delivered through forward thinking approaches to energy infrastructure in development.

As the level of EV adoption increases, such approaches will help developers, utilities, and governments to identify new ways to defer and even avoid costly grid infrastructure upgrades, unlock new revenue streams, and deliver more affordable, responsive and sustainable energy for residents. In doing so, precincts like the Witchcliffe Ecovillage stand to be the long awaited catalysts for a fundamental shift in how developments planned and serviced, transforming communities from passive consumers into active contributors to a resilient, net-zero energy future.

Citation

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