



Towards Net Zero in ACT Apartments



Pearcey
FOUNDATION



Dear Chief Minister

Last year at the Presentation of the 2022 ACT Chief Minister Pearcey Award you challenged the ACT Pearcey Cohort to investigate what initiatives might be considered to assist the ACT with the transitions required to reach Net Zero in the ACT.

ACT Pearcey is pleased to provide the attached Report for consideration at our 2023 Round Table, which complements the national [Australia Net-Zero conversations](#) the Pearcey Foundation is leading. We note that the ACT Government is currently seeking community views on its Integrated Energy Plan and a copy of this report will be sent to the IEP Transition Team.

To achieve Net Zero there must be a whole community effort otherwise the ACT will fail to reach the target.

Soon more than 50 percent of the ACT population will reside in Apartments, which provide a very complex energy efficiency challenge. We decided to concentrate on Apartments because the complexity and difficult implementations may discourage any action.

We ask you to review the report and invite you and your officers to attend the 2023 Annual Pearcey Round Table for discussion on the recommendations.

The Round Table has been scheduled for Tuesday 17 October at a dinner (venue TBA) to announce the 2023 winner of the ACT Chief Minister Pearcey Award.

We hope your schedule can accommodate the 2023 Round Table.

Perhaps you might also consider a challenge for the Pearcey 2024 Round Table.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Ti Tu', written in a cursive style.

Dr Tim Turner
Chairman
ACT Chapter
Pearcey Foundation

ACT Honour Roll

Year	Pearcey Medal	Hall of Fame	ACT Chief Minister's Pearcey Award
2022	John De Margheriti	John De Margheriti	Adam Zeglin Ben Bromhead
2021			Dr Daniel Shaddock
2020			Shane Hill
2019			Matthew Wilson
2018		Dr Robin Stanton	Ken Kroeger
2017		Kate Lundy	Phil Williamson Mark Riley
2016		Robin Eckermann AM	Dean Spaccavento
2015			Greg Boorer
2014			John De Margheriti *
2013	Dr Alex Zelinsky	Dr Alex Zelinsky	
2012			Dr Vikram Sharma
2011	Brand Hoff AM	Brand Hoff AM	Matt Bullock
2010			Dr Raymond Choo
2009			Michael McGoogan
2008			Matthew Purcell
2005	Dr John O'Callaghan	Dr John O'Callaghan	

* Also National Entrepreneur of 2014

Start of Awards nationally: 1998

Start of ACT Awards: 2008


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Executive Summary

In presenting the ACT Entrepreneur of the Year awards for 2022, the Chief Minister, Mr Andrew Barr, challenged the ACT chapter of the Pearcey Foundation to give thought, in 2023, to initiatives that could accelerate Canberra’s progress towards a net zero carbon economy—leading Australia in this important quest.

This challenge resulted in a series of meetings, throughout 2023 and discussions amongst the ACT Pearcey Division. We also acknowledge the work being done by ACT Suburb ZERO consortium and the Owners Cooperation Network of the ACT (OCN). The Pearcey ACT Committee would like to thank and acknowledge all those who generously and openly gave of their time, thoughts, and suggestions (see Contributors).

With various initiatives already in place to promote energy efficiency measures in detached housing, members of the Pearcey community elected to focus on apartments, since these present unique and complex challenges that are not easily addressed.

Further, as this segment of the housing community is growing rapidly and promises to account for more than 50 percent of the ACT market in coming years it is extremely important that the specific issues relating to apartment living be examined, and where possible simplified, to encourage the transition to net-zero.

This submission highlights many every-day situations that lead to “net-zero uncertainty” by apartment dwellers, including:

- problematic retrofitting of renewable energy infrastructure
- difficulty in identifying and accessing available capital funding, and
- frustration in navigating complicated Owner Corporation and Strata Management legalities.

The impact of this uncertainty is summarised in the words of Dean Spaccavento, Reposit Power CEO, “**Uncertainty Kills Action**”.

What this means is that without engagement and an all-out action by 50 percent of our population (and their Owners Corporations) the ACT is likely to fail to reach Net Zero!

Since 2008 the ACT Government has supported the [ACT Chief Ministers Pearcey Entrepreneur Award](#), with the 2023 award expected to be announced at our Annual Round Table to be held on Tuesday 17 October 2023.

The topic for this year’s Annual Round Table will be “**Towards Net Zero in ACT Apartments**”

The Pearcey Foundation invites the Chief Minister and ACT Government officials to consider this report and to join the discussions at our Round Table. We commend the report to the Chief Minister.

ACT Division of the Pearcey Foundation (www.pearcey.org.au)

1. Enhance apartment net-zero achievement through ‘net-zero design’

Many of the initiatives outlined below focus on overcoming problems in established strata buildings. Parallel with these initiatives, there is an urgent need to avoid the proliferation of these problems in future buildings by introducing appropriate design, regulatory and skills and services framework that will enable and design pathway framework legislation.

Right from the design stage, new buildings should be planned with:

- transformer scaling and grid connections that contemplate an electrified future
- maximum capacity to support on-site solar generation and battery storage
- support for in-situ EV charging in residents’ parking locations
- no gas usage—within units or for communal hot water systems
- energy-efficient insulation and window treatments
- low-energy LED lighting, etc.

Unless this is done, the magnitude of the problem currently faced will simply grow over time.

Recommendation 1

That the ACT Government introduce appropriate design, regulatory, and skills training frameworks that will enable new Canberra apartments to be designed, constructed, and fitted out to be ‘net-zero’ ready.

Relevant appendices:

- Why retro-fitting net-zero infrastructure is a headache
- Residential Vehicle to Grid (V2G) capacity and capability

2. Accelerate the rollout of public Fast Electric Vehicle charging stations

The uptake of Electric Vehicles (EVs) in Canberra is running well ahead of the national average, and reducing emissions in the transport sector is one of the key goals to achieve the transition to a zero-carbon economy.

For detached homeowners, retro fitting of EV charging is relatively easy—with options ranging from trickle charging from a regular power outlet, to installing higher capacity and/or 3-phase charge points for higher speed charging.

The situation for those living in apartment complexes is much more difficult. In most existing apartments it is impractical to connect a power outlet in an owner's car space back which is connected to the meter through which power to the owner's apartment is monitored.

Instead, a solution needs to be developed around charging EVs from the apartment's communal power infrastructure that provides basement lighting and other shared electrical services.

Electrical capacity of the building is often constrained, requiring sophisticated solutions to manage demand within available capacity. Additionally, energy supplied for EV charging needs to be charged back to the EV owners.

Retro-fitted EV charging solutions invariably involve substantial up-front investment in a 'framework' to which individual charging outlets can be connected. The time, cost and complexity involved means many complexes will not be able to offer EV owners the option of charging their vehicles overnight in the near and mid-term future.

Given the increasing proportion of ACT residents living in apartment complexes the Pearcey Foundation believe that the lack of in-situ apartment EV charging presents one of the most significant barriers to the ACT Government's achievement of its Pathway to Electrification strategy.

To 'buy time' and prevent the non-availability of in-situ apartment charging from inhibiting the uptake of EVs (and replacement of fossil fuelled vehicles) it is critical that there be more public charging stations in the near vicinity of apartment 'densification' hot spots. An expanded network would also help Canberra's tourism industry as the number of visitors travelling in EVs to the city grows.

Recommendation 2

That the ACT Government expand a network of publicly accessible EV charging stations specifically to facilitate the take-up of EV ownership by ACT apartment dwellers.

Relevant appendices:

- The challenge of EV charging at Saturday morning soccer
- Speedy electric car adoption drives charging challenge

3. Provide funding support for apartment net-zero sustainability infrastructure

The ACT Government has provided interest-free loans to assist many owners of detached homes to invest in sustainability infrastructure, and this has helped the ACT to become an Australian leader in the progress towards a low-carbon future. Many elements of the scheme are in practice not available to apartment owners since they would necessitate use of common property, owned by the Owners Corporation rather than the unit owner. The extent to which unit owners have been able to benefit from the scheme is unknown but expected to be limited.

A scheme was recently announced to support strata buildings installing solar infrastructure up to a limit of \$100,000 for any building. Whilst full details have yet to be announced, it is understood that 50 percent of the funding will be provided by the Commonwealth government in the form of a grant, and 50 percent will be provided by the ACT Government in the form of an interest-free loan to be repaid over 10 years. With a total of only \$3.6m available and the cost of a solar array in any larger complex likely to exceed \$100,000, the number of potential beneficiaries of this scheme may be limited.

The challenge of reducing the energy footprint of strata buildings has two key elements—measures that can be taken by individual unit owners, and measures that can affect the building as a whole and which can only be undertaken by the Owners Corporation.

Opportunities to improve the contribution that strata communities make to a more sustainable net-zero energy future at a ‘whole building’ level include:

1. Installing solar arrays on whatever rooftop space may be available (*this is costly*). Where this is simply impractical, the option of buying capacity from a remote solar/wind farm could be a fall-back alternative, albeit without the inherent efficiency of generating energy where it is used.
2. Establishing support for in-situ EV charging in parking areas (*this is costly*)
3. Replacing gas-fired communal hot water system with an alternative (*this is costly*)
4. Upgrading building electricity supply substation capacity to cope with an increasingly electrified future - in particular, the additional demands of EV charging and electrified hot water systems (*very costly, and without this infrastructure the Government’s Pathway to Electrification goals will not be achieved*)
5. Replacing incandescent and fluorescent lighting with low-energy LED lighting (*easy*)
6. Double glazing of windows (*difficult and costly*)

7. Improving insulation (*difficult and costly*).

The key challenge that any Owners Corporation faces is securing majority support for any initiative that would require owners to increase the levies that they pay. Unless this reality is addressed, progress on the above kinds of measures will be very slow.

To address this challenge, the Pearcey Foundation recommends that the proposed ‘solar scheme’ be generalised to allow investment not only in solar, but in any of the measures outlined above. What best suits a particular strata community can be decided by the Owners Corporation. A key aspect of the scheme would be scalability—with the level of funding provided shaped by the measure proposed and scaled by the number of units in the complex.

Most of the measures result in savings to some or all the residents in a complex, but the period needed to repay the up-front cost can be lengthy. Accordingly, the Pearcey Foundation recommends any loan component attract a low or zero interest rate and be repayable over a period of 10 years.

Recommendation 3

That the ACT Government establish a generalised low-interest infrastructure funding scheme to facilitate take-up of whole-of-building net-zero initiatives by apartments under the direction of Owners Corporations, repayable over a 10-year period.

Recommendation 4

That the ACT Government amend the Unit Titles Act to permit third parties to sublease the apartment complex’s roof tops to install, own and operate PV systems (similar to recent amendments that enable small commercial business such as cafes etc to lease roof top areas on common property).

Relevant appendices:

- Solar savings on the way for ACT apartment residents

4. Owners Corporations Resident Subscription Services

The regulatory framework applying to strata complexes can make it very difficult to secure agreement on important net-zero sustainability initiatives, for instance the installation of EV charging in apartment basement car parks. For any resolution taken to a General Meeting of Owners a 75 percent majority is required for its support. This can be especially difficult to achieve where a resolution involves owner investment.

A resolution to install a framework to support EV charging illustrates the challenge, with owners usually taking one of the following positions:

- I already have an EV and want in situ charging now (*committed*)
- I would like to buy an EV, but will wait until there is an in-situ charging solution (*supportive*)
- I have no plans to buy an EV - costs should be borne by those who do (*opposed*).

In most complexes, it is likely to be many years before the cohort of those opposed to spending on EV charging infrastructure (point 3 above) drops below 25 percent and investment in charging infrastructure can proceed. As a result, the uptake of EVs is likely to be constrained by the lack of in situ charging options. This is despite evidence that the availability of such charging options adds substantially to the rental or sale value of units, whether the owner drives an EV. As a side note, the lack of availability of in situ EV charging for apartment residents will directly impact demand on the sparse number of public EV charging stations distributed around the ACT.

The constituency of any strata building commonly ranges from financially well-established owners through to those who are under significant financial pressure. All contribute to the cost of operating the building in proportion to their unit's entitlement, but not all are able to support investment decisions with the same ease.

A possible and equitable approach to such impasses would be to provide appropriate legislative support for initiatives that are funded by a subset of owners, with appropriate privileges or returns relating to that initiative flowing only to that subset of owners.

In this example, the cost of installation of EV charging facilities would be borne only by those owners supporting the resolution, and not be dependent on requiring a 75 percent or greater majority of owners support to progress. The benefits of the initiative—the availability of EV charging in the residents allocated parking bay—

would only be available to contributing residents, by way of mechanisms for others to join the scheme later predefined terms.

Recommendation 5

That the ACT Government progress legislative changes that allow Owners Corporations to operate net-zero initiatives that are funded by a subset of owners, with appropriate privileges or returns relating to that initiative flowing only to that subset of owners.

Relevant appendices:

- Creating more sustainable strata lots—what can be done?

5. End commercial electricity tariff rates for Owners Corporations

EVO Energy applies different charging regimes for residential and commercial customers. For large commercial customers, peak demand occurs between 7am and 5pm on weekdays, and retail electricity rates carry a loading per kilo-watthour (kWh) supplied to as much as 22c.

Many residential complexes, or predominantly residential complexes, are charged commercial rates for the supply of communal use electricity: for corridor lighting, basement lighting, lifts, and garage doors. As solutions to enable in-situ charging of EVs from common power are deployed, EV owners will be confronted with the 22c per kWh loading, plus any surcharge that is needed to repay loans taken out to establish the charging infrastructure. At peak times, electricity may cost an EV owner living in a strata complex and charging from communal power well in excess of 50c kWh.

In contrast, EV owners living in detached housing may pay as little as a quarter of this cost for off-peak charging, or in many cases, can utilise free solar energy from their own rooftops. Similarly, in strata complexes where it is practical to connect EV charging outlets to the metered supply of individual units, costs are incurred at residential rates.

This commercial loading is discriminatory and will inhibit the transition to EVs across many apartment complexes. It should be disallowed in relation to (at least) the residential proportion of any communal power supplied to a strata building.

Recommendation 6

That the ACT Government undertake to work with Evoenergy to progress the discontinuation of commercial loading of electricity tariffs for the supply of apartment communal areas, to be replaced with a tariff appropriate for apartment residential usage.

Relevant appendices:

- Embedded Networks in New South Wales (November 2022)

6. Introduce Energy Efficiency Ratings for strata buildings

The ACT Government's EER (*Energy Efficiency Rating*) scheme provides a basis for rating living units (detached houses, units etc) on their energy efficiency. However, the ratings allocated to units do not consider the efficiency of the building within which the units are located.

In contrast the NABERS (*National Australian Built Environment Rating System*) schemes provides a framework for assessing the energy efficiency of the buildings within which units are located - albeit at a relatively non-trivial cost (*estimated between \$4,000 and \$13,000*).

Many of the benefits of a NABERS style rating could be achieved with a simple rating system that does not necessitate costly analysis by specialists, but which simply allocates stars on readily verifiable information, such as the list of energy efficiency measures listed in (3) above. Units in strata complexes could then be traded with a dual star rating, one representing the EER of the unit itself, and the other recognising the energy sustainability of the building within which the unit is housed.

Recommendation 7

That the ACT Government complement the residential Energy Efficiency Rating scheme with the energy sustainability of strata title buildings, not just units within apartment complexes.

Relevant appendices:

- Do you know your NABERS from your NatHERS?

7. Promote ACT Electricity Grid modernisation

Electricity supply networks are going through a period of rapid change. Historically these networks were designed to supply centrally generated power to relatively simple and predictable consumers at the fringes of the network. The rise in renewable sources of generation (*including the high uptake of rooftop solar and solar & wind farms*) and distributed battery storage coupled with the growing electrification of everything (*including vehicles*) is transforming the grid into more of a mesh-style operation. A parallel transformation took place in the information technology sector, away from large, centralised mainframes supporting ‘dumb’ terminals to a mesh of information processing and storage devices connected by high-speed telecommunications.

With increasing scale and variability in both the supply and demand side of electricity, the potential for occasional mismatches is growing (AEMO responsibility)—where demand outstrips supply or vice versa. Technology has an important role to play to prevent outages and/or instability in the grid in these situations—with an infusion of sensing and analytics to detect problems looming, and control mechanisms to handle the problems when they do occur. Mechanisms for maintaining stability may include greater supply capacity, increased energy storage facilities (*potentially including EVs*) that can be used as a readily available source of, or sink for, electricity, and protocols for shedding or activating discretionary loads.

Smart sensors and meters have a role in this evolving energy ecosystem, and long-term network operations can be significantly improved with more real-time communications and automation—eventually extending to smarter appliances in the user’s premises to shape their energy usage having regard to the state of the grid at the time.

The evolution of the grid is not helped by current regulatory approaches that prescribe the reasonable returns permitted on investment in major grid infrastructure. The long timeframe over which operators can recover the cost and a margin on network expenditure (*low voltage transformers etc*) can be an obstacle to timely upgrades to meet the emerging needs of electrified communities.

Whilst regulatory changes lie outside the direct remit of the ACT Government, it is a major stakeholder in Evoenergy and therefore has a vital interest in seeing the ACT electrical infrastructure upgraded as required. As such, it is urged to take a proactive role in promoting grid modernisation processes locally and in national forums.

Recommendation 8

That the ACT Government as a major stakeholder in Evoenergy take a proactive approach in promoting grid modernisation locally and in national forums.

Relevant appendices:

- ACT Government to build infrastructure for the electric bus fleet transition
- ACT government calls for Evoenergy payouts to cover power surge damages
- Evoenergy Regulatory Proposal for the ACT electricity distribution network 2024-2029

8. Home-to-Hub—Light Rail and Bus Autonomous Electric Vehicle integration

A reduction in use of transport related fossil fuels can be achieved through the increased use of eclectic vehicles and/or public transport.

While policy and incentives currently exist to stimulate EV ownership as well as use of public transport, there is a strong community perception that the time to travel between an individual's home and their most relevant Transport Canberra's bus or Light rail stop, presents an almost insurmountable barrier to their take-up of daily public transport use - in favour of continued daily private motor vehicles commuting (regardless of energy source).

Autonomous Electric Vehicles (AEVs), which connect residential streets to Canberra's Bus and Light Rail suburban hubs, could provide convenient scheduled and on-demand local services that reduce the 'home-to-hub' time needed to access the Canberra public transport system. Increased public transport use would lead to reduced fossil fuel consumption and emissions—assuming electric or green gas-powered buses, and reduced need for private transport for daily commuting.

On the assumption that regulatory approved AEVs become available, it will be entirely possible to conduct community focused pilot projects of AEVs that operate over a local pre-set route, to enable residents to travel from their residences to Light Rail stops and bus stations, and onto their workplaces.

Recommendation 9

That the ACT Government commission a pilot project to assess the feasibility of Autonomous Electric Vehicles providing the local home-to-hub connection between suburban residences and Transport Canberra Bus and Light Rail stops.

Relevant appendices:

- Virtual Bendy Busses for Canberra
- Autonomous Electric Bus in Canberra
- Revolutionizing Public Transportation: The Role of Autonomous Electric Vehicles in Achieving Net-Zero Carbon Targets
- Connecting Suburban Commuters

9. Utility Smart Sensors and Real Time Measurement Availability

While many recently built apartments have a real time measurement capability that enable monitoring of utility services consumed by individual apartments as well as communal areas, this is not necessarily the case for older apartment complexes.

The absence of such systems can present a barrier to the implementation of new, energy efficient net zero strategies for the increasing number of apartment dwellers in the ACT. This is especially an issue where transparent attribution of use and cost of services is required for implementation of ‘user pay’ services.

Additionally, real time monitoring by apartment complexes of their total net-zero energy usage and PV generated sell-back to the grid would enable fully transparent participation in community net-zero strategies such as use of, and top-up to, shared community batteries. This is important where apartment complexes are restricted in installing storage batteries within their own buildings due to engineering or regulatory considerations.

Recommendation 10

That the ACT Government introduce incentives to encourage the installation of new smart sensors and real time utility monitoring equipment in older apartment complexes that will enable take-up and participation in net-zero initiatives.

10. Be Bold—Test the difficult net-zero challenges

Many Owners Corporations through their Executive Committees and Strata Managers are struggling to come to grips with the changes that are needed to move to an increasingly electrified future with energy demands minimised.

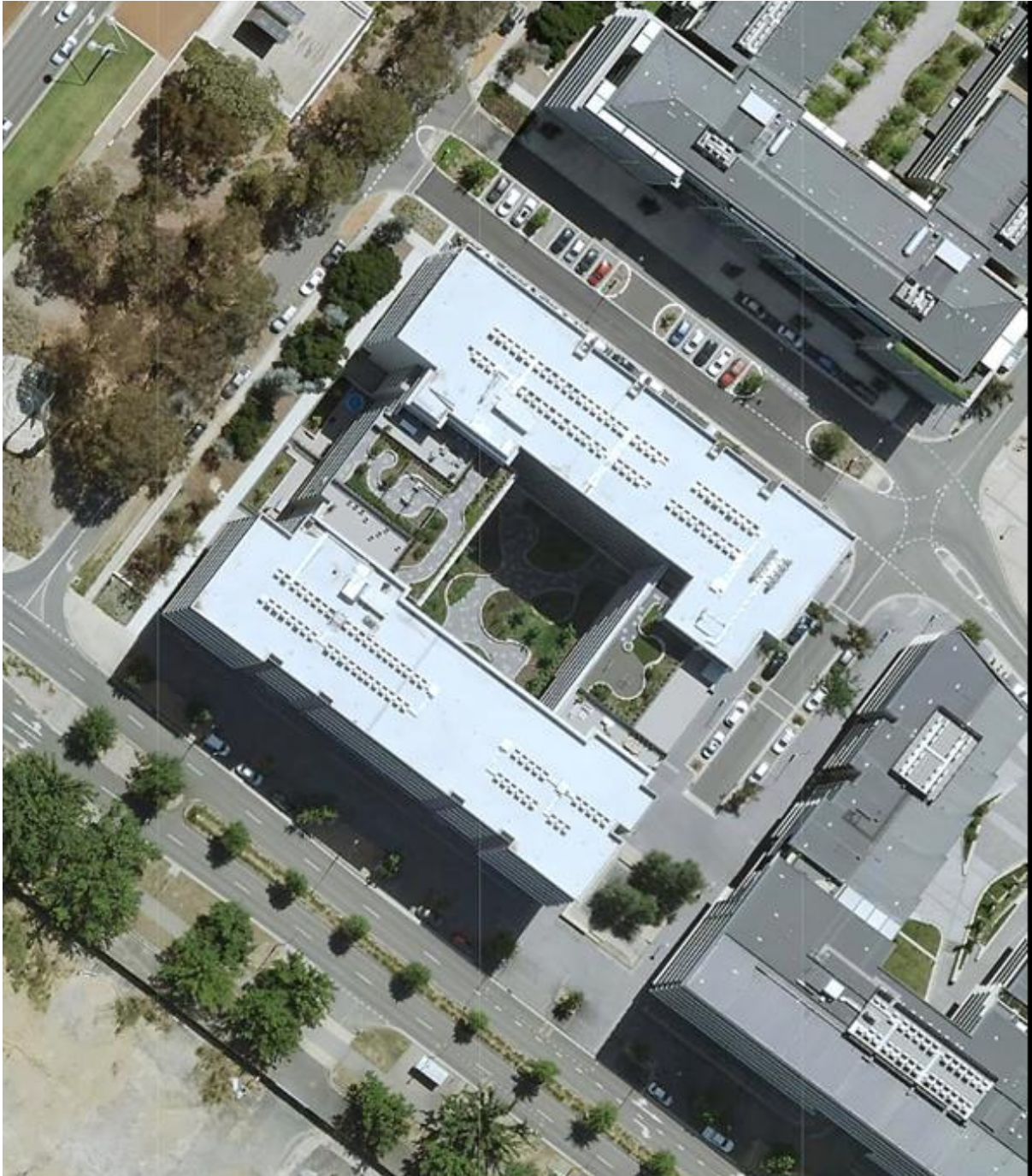
A series of pilot projects addressing the more difficult energy sustainability opportunities such as gas hot water replacement and EV charging installation, and spanning a range of strata contexts (heritage, mid-20th Century, early 2000's, and modern), could establish valuable models for wider scale replication.

Transparency and documentation would naturally be a key requirement for any pilot projects undertaken with ACT Government support.

At minimum, it would assist the strata sector if the government could fund a range of investigative and design studies spanning the range of difficult use cases - delivering costed solution templates to inform Owners Corporations and Executive Committees with vital planning information.

Recommendation 10

That the ACT Government commission pilot projects addressing the difficult energy sustainability opportunities across a range of strata contexts to provide models for wider scale replication.



About the Pearcey Foundation

The Pearcey Foundation Inc. was established in 1998 - 25 years ago - to raise the profile of the Australian Information and Communications Technology (ICT) sector. It was created in the memory of one of the greatest pioneers of the Australian ICT industry, [Dr Trevor Pearcey](#). Trevor was the designer and creator of CSIRAC, the first digital computer in Australia, making Australia the third country in the world to invent a digital computer.

By identifying, sharing, and celebrating our heritage, achievements and heroes of the Australian ICT sector, the Pearcey Foundation is promoting broad engagement, thought leadership and encouragement to all Australians to value and pursue success for our nation through the creation, innovation, and commercialisation of advanced technologies. Incorporated as a non-profit company limited by guarantee and registered as a charity with ACNC, the Foundation is led by an all-volunteer Board and National Committee supported by volunteer committees in each state and territory.

The core initiatives of the Pearcey Foundation are its awards programs, heritage program and thought leadership events. This report represents our contribution to furthering national thought leadership on this national challenge as we approach Net Zero Emissions for Australia. In other states, a similar initiative, entitled [Australia 4.0](#), is underway to examine this challenge through a digital and data lens (as has been done in this submission).

Each year, the [Pearcey National Awards](#) recognise outstanding achievements by individuals.

- The [Pearcey Medal](#) and the [Pearcey Hall of Fame](#) recognise significant lifetime achievements.
- The [Pearcey Entrepreneur Awards](#) recognise mid-career individuals who have ‘taken a risk’, ‘made a difference’ and ‘are an inspiration’. The National Entrepreneur Award is selected from the recipients of the Pearcey State Awards which recognise upcoming individuals in each Australian State.

Over the last 25 years, the Pearcey Awards have recognised more than 130 outstanding individuals around Australia.

The [Pearcey Oration](#) is the flagship event for the Foundation. Presented each year by an eminent global expert reflecting on critical contemporary issues impacting our nation, arising from the introduction and adoption of new and advanced technologies into our society. Delivered every year since 2008, this Oration is the most significant, sustained event of its type in the nation. In 2023, Prof Michelle Simmons, UNSW, will deliver the [Pearcey Oration](#) on the topic of Quantum Computing.

Contributors

The ACT chapter of the Pearcey Foundation acknowledges the contributions of the following people to this report:

Dr Tim Turner	Chair, ACT chapter, Pearcey Foundation
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Brand Hoff	TOWER Software, NICTA
Dr Robin Stanton	ANU
Glen Hassett	ACT Government
Craig Davis	CBRIN
Tom Worthington	ANU
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Dean Spaccavento	Reposit Power
Dr Daniel Shaddock	ANU, Liquid Instruments
Dr Lachlan Blackhall	ANU



Trevor Pearcey in front of CSIR Mk1 in Sydney 1952

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Why retro-fitting net-zero infrastructure is a headache.

Researchers from UNSW Sydney have developed a national reference guide to help Australia hit its net zero targets. The free online resource provides a pathway to achieving ‘whole of life’ net zero carbon for Australian buildings by 2040.

[Race to Net Zero Carbon: A Climate Emergency Guide for New and Existing Buildings in Australia](#) is a 40-page guide which details critical information about materials and construction best practices to help architects, engineers and planners transform the building industry towards net zero carbon buildings.

“Our guide draws on Australian climate data but has global applicability,” says [Professor Deo Prasad](#), who is lead researcher of the guide. Prof. Prasad is recognised as a national leader in the field of sustainable buildings and among the leading advocates for sustainability in Australia.

The guide is the first to detail a holistic approach to achieving net zero and fills knowledge gaps on net zero carbon buildings.

Net zero means balancing greenhouse gas emissions produced by humans with emissions taken out of the atmosphere. “This guide provides a deeper level of knowledge on how this sector can rapidly move towards net zero carbon buildings in the short term. Using science-based evidence and analytics, the guide maps a clear roadmap to achieving net zero by 2040 in the building industry. It goes beyond the aspirational and into the achievable,” Prof. Prasad says.

Residential Vehicle to Grid (V2G) future capacity and capability

Bidirectional EV charging represents one of the largest potential enablers of Australia’s energy transition. To put it in context, AEMO’s 2022 ISP reported that the National Energy Market (NEM) will require 640 GWh of all forms of storage by 2050. As shown in Figure 1 (see link), the usable storage in Australia’s EV fleet at that time will be nearly four times total NEM storage requirements. Flexible bidirectional charging from only 10% of this capacity could provide 37% of total NEM storage needs, offsetting around \$94 billion of large-scale battery storage investment (at current prices)². By the early 2030s, EV fleet battery capacity is likely to surpass all other forms of storage in the NEM, including Snowy 2.0.

[V2X.au Summary Report Opportunities and Challenges for Bidirectional Charger in Australia \(PDF 3MB\)](#)

The challenge of Electric Vehicle charging at Saturday soccer matches

Case Study generated by ChatGPT

Title: The Challenge of Electric Vehicle Charging at Saturday Soccer Matches**Introduction**

In a suburban community of Musk, Canberra, a growing number of "soccer mums and dads" had embraced electric vehicles (EVs) as part of their commitment to reducing their carbon footprint. However, a unique challenge arose on Saturday mornings when these dedicated mothers, gathered at the local soccer field to support their children's games, found themselves competing for access to a single EV charging station. This case study explores the situation and its impact on these enthusiastic EV-owning soccer parents.

The Setting: Musk Soccer Field

Musk is a picturesque suburb where children's soccer matches are a cornerstone of community life. To support the eco-conscious parents in the area, the local authorities had installed a single EV charging station near the soccer field, reflecting the community's commitment to sustainability.

The Scenario: Saturday Soccer Showdown

On Saturday mornings, soccer mums and dads in Musk eagerly arrived at the field in their EVs. They hoped to charge their vehicles while watching their children play. However, the demand for the lone charging station often led to disputes, creating a unique challenge for the community.

Charging Station Tug-of-War

- **Scheduling Conflicts:** Soccer matches often overlapped, leading to scheduling conflicts as multiple parents arrived simultaneously, hoping to secure the charging spot.
- **Charging Etiquette:** Disputes arose about charging etiquette. Should it be first-come, first-served, or should a rotation system be established?
- **Communication Challenges:** The lack of a clear communication mechanism exacerbated the problem. Some parents resorted to heated arguments over who arrived first.
- **Missed Matches:** The competitive nature of securing the charging station sometimes caused parents to miss parts of their children's matches, leading to frustration.

Community Response

Canberra's local authorities recognized the issue and began addressing it:

- **Expanding Infrastructure:** Plans were made to install additional charging stations to accommodate the growing number of EV-owning residents.

- **Charging Scheduling App:** A smartphone app was developed to allow parents to reserve charging slots, reducing conflicts and promoting fairness.
- **Communication Campaign:** A campaign promoting EV charging etiquette was launched, encouraging parents to be considerate of others.

Results and Impact

The community's response led to several positive outcomes:

- **Reduced Conflicts:** The charging scheduling app helped reduce conflicts as parents could reserve slots in advance.
- **Enhanced Community Awareness:** The campaign improved awareness of charging etiquette, fostering a sense of community.
- **Improved EV Adoption:** The availability of more charging stations made EV ownership more attractive in Canberra.

Conclusion

The case of electric vehicle-owning soccer mums and dads battling over access to a single recharging station at Saturday soccer matches in Canberra underscores the importance of adapting infrastructure to meet the needs of a growing EV user base. By expanding charging facilities and promoting charging etiquette, the community was able to accommodate its eco-conscious residents and ensure a more harmonious Saturday morning soccer experience for everyone involved. This case study serves as a reminder that sustainable practices require thoughtful planning and community engagement.

Speedy electric car adoption drives charging challenge

Electric vehicle sales are charging ahead in Australia, outpacing predictions and expected to exceed government forecasts by a third during the next year. But the fast pace of adoption is delivering challenges for another type of 'charging' as power providers and service stations rush to meet surging demand.

Australia's big four electric car-charging providers are already ramping up investments in the field, including deals signed with shopping centres, energy firms, and hundreds of new sites locked in for upgrades.

But experts say policy reforms are needed to support the rollout and in the meantime early electric car adopters.

From a slow start, electric cars have made significant gains on petrol peers, with more than 120,000 on Australia roads, according to Electric Vehicle Council estimates.

Battery-powered vehicles accounted for more than eight per cent of new cars sold in June, up from 1.1 per cent in June 2022.

Evie Networks chief executive Chris Mills says the acceleration presented a serious challenge for charging operators, who needed to plan their builds 18 months in advance. “

(The Australian Energy Market Operator) predicted 70,000 electric cars at the end of the last financial year and we ended up with more than 100,000,” he said. “This year AEMO is predicting about 160,000 but we think there will be about 240,000 electric cars on roads by the end of next financial year.” Mr Mills says the company, which operates Australia’s largest charging network, had doubled the number of electric vehicle chargers built in the country for the past three years running, from 20 to 40 to 80 charging stations each year. “This year, our plan is to build 170 additional sites and that doesn’t include our fleet work,” he said. “I don’t believe we are incapable of building 200 sites on a steady basis every year, year on year, and I’m sure the others will be able to figure it out.”

Other providers include Engie, electric car market leader Tesla, and energy giants BP and Ampol which have pledged to install hundreds of electric vehicle charging points at petrol stations. BP has installed 84 charging points at 42 locations over the past year, while Ampol has activated 40 charging points at 17 of its Australian outlets. “This makes up part of our national commitment to install EV charging infrastructure at more than 100 sites with over 300 charging bays to be delivered over 2023 to 2024,” an Ampol spokesman said.

The company also signed a deal to build EV chargers at Mirvac shopping centres, while BP revealed plans to offer public charging discounts through AGL and Uber.

The commitments will add to the almost 5000 public vehicle chargers that had been installed in Australia in 2022, according to Electric Vehicle Council figures.

Council energy and infrastructure head Ross De Rango says drivers are likely to see a lot more charging options pop up at servos over the next year as energy firms are particularly well placed to ramp up rollouts. “Deploying charging infrastructure can happen quite fast, especially if you’re talking about the kind of organisation that already owns the land,” he said.

“The thing that often holds them up is the ability to connect a new large load to the network and the processes associated with that.”

But electric vehicle drivers will face challenges while waiting for more charging facilities, including blackspots particularly in regional areas, Mr De Rango says. “If you drive the Great Ocean Road, along the coast from Torquay to the South Australian border there are no operational public fast-chargers that will work for anything but a Tesla,” he says.

“There are big stretches of blackspot in Australia where there are no high-power charging infrastructure because it just hasn’t been built yet.”

Government funding will be needed to help providers expand into low-demand locations, he says, though investments from states including Western Australia, Queensland, South Australia, and NSW was helping to close gaps.

Policy reform could also boost charging options faster, Mr Mills says, calling for governments to set tighter timelines for network connection approvals and to update electricity tariffs originally designed to cater for factories.

The reforms, he says, could also result in more high-speed car-charging facilities. “Tariff reform is really, really important,” he said. “We have a site in Proserpine in Far North Queensland, for example, where the energy costs are more expensive than the 65c (per kilowatt hour) we charge a driver to use the site. “We offer that because we need highway sites and we need people to feel confident they can get that recharge.

<https://canberraweekly.com.au/speedy-electric-car-adoption-drives-charging-challenge/>

Solar savings on the way for ACT apartment residents

Released 26/06/2023 - Joint media release

- More Canberrans will soon be able to enjoy cheaper, cleaner energy from solar, with new Commonwealth and ACT Government funding for the installation of shared rooftop solar on multi-unit apartments.
- The \$3.6 million dollar investment will incentivise installing rooftop solar on apartment blocks through rebates and concessional loans to body corporates - benefitting apartment tenants and neighbouring residents.
- It is anticipated that over 2,100 households will benefit, which could provide a 35 per cent reduction in electricity bills for Canberrans living in apartments.
- Multi-dwelling body corporates will be able to access up to \$100,000 for rooftop solar, half through a Commonwealth rebate or grant through the Solar Banks initiative and half from an interest-free loan offered by the ACT Government as part of the Sustainable Household Scheme.
- Minister for Climate Change and Energy Chris Bowen said the funding will ensure more Australians can access the benefits of cheaper, cleaner energy.
- “Solar banks, that help provide access to solar for people who have traditionally been unable to access solar, is a key part of the Albanese Government’s Powering Australia Plan and will help to deliver cost of living relief to Australian families.
- “We know that renewable energy is the cheapest form of energy,” Minister Bowen said.

- “This investment in ACT renters and apartment owners, who can’t currently access cleaner, cheaper solar, will ensure that everyone can reap the rewards of the clean energy transformation.
- “The Albanese Government has also announced 57,000 households in the nation’s capital will be eligible for energy rebates, saving \$327 on their power bills.”
- ACT Chief Minister Andrew Barr said the new incentives were part of an \$80 million boost for the Sustainable Household Scheme in the 2023-24 ACT budget.
- “We’re pleased to be partnering with the Commonwealth Government on this initiative, as any investment that prioritises sustainability while also helping Canberrans to reduce the cost of their energy bills is a step in the right direction.
- “We are committed to continuing to be a global leader in climate action, and this new program supports apartment households to share the benefits of solar.
- “It exemplifies our commitment to transitioning to a cleaner and more reliable energy mix towards our goal of reducing emissions to net zero by 2045,” said Mr Barr.
- The Commonwealth funding is part of the \$101 million commitment to shared solar, to ease energy bills for more than 25,000 Australian households. The 2023-24 Federal Budget also allocated more than \$1.7 billion for energy saving upgrades for homes, businesses, social housing and local governments.
- Eligibility for the program will align with the solar eligibility for households under the Sustainable Household Scheme, for which 92% of apartments are eligible. Applications will be open in Q3 2023.

For more visit www.climatechoices.act.gov.au.

https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/barr/2023/solar-savings-on-the-way-for-act-apartment-residents

Permit Owners Corporations to provide energy to residents

Where apartment resident’s EVs are charged from a communal power supply managed by the Owners Corporation, it is obviously necessary for the recipients of that energy to pay for and share the costs of establishing the charging infrastructure.

This is not the only area where an Owners Corporation could play a role in the billing of energy costs for the benefit of its residents. Currently many strata buildings have a central gas-fired hot water systems, with the cost of gas apportioned to residents on the basis of their metered hot water use.

Commonly this involves each unit owner establishing a gas account with a gas retailer, each paying a daily connection fee plus a share of the cost of gas supply. Collectively these supply charges can represent a cost of tens of thousands to residents in a single building. Currently the main alternative is to engage an embedded network operator, but this typically involves locking into the arrangement for a lengthy period, and the costs to residents are potentially only marginally lower than having each unit establishing their own retail gas account.

In contrast, many Owners Corporations (often through their appointed strata and/or building managers) have the capacity to assume responsibility for reading hot water meters, dividing up the cost of the single bulk gas supply and appropriately billing residents.

The technology to support an Owners Corporation playing a direct role in both the above scenarios is readily available. In the case of EV charging, prescribing the use of an Open Charge Point Protocol (OCPP) compliant charge point can capture usage information as a foundation for billing. For gas-heated hot water, even in a large complex, manually reading meters on a quarterly basis would not be an especially onerous task. However, in some of the more modern complexes, centralised data capture would make the task even easier.

It would be even better for owners if real time (or near-real time) data was made available via an dedicated digital services. In both cases, appropriate exemptions from the onerous responsibilities of becoming a fully-fledged energy retailer are required if the Owners Corporation is to directly manage the supply of energy to its residents for EV charging and gas-fired hot water supply.

Creating more sustainable strata lots—what can be done?

By Alex Smale - Owners Corporation Manager

Over the years as a strata manager, countless owners have come to me with bold plans to make their strata lot more sustainable by installing solar panels. They go out, get a quote, present it to their committee of management and it gets voted down. Why? Too often, simply because other owners don't like the look of solar panels. This is especially true at townhouse estates where owners want to maintain a consistent appearance.

It was always disheartening when aesthetics came before combatting climate change. However, things have changed.

With the changes to the Owners Corporation Act introduced in December 2021, owners corporations may no longer make rules that unreasonably prohibit the installation of a sustainability item on a lot. For example, if a lot owner wants to install solar panels, the owners corporation cannot deny this request simply on

aesthetic grounds. However, they may be able to deny the request if they have a legitimate reason. For example, if the solar panel impedes access for window cleaning.

RELATED - [OC Act Updates: all the key changes >](#)

This does not just apply to solar panels. The Owners Corporation Act defines a sustainability item as anything that eliminates or reduces a reliance on non-sustainable energy sources and includes: a solar hot water system, solar panels, and a roof with colours having a particular solar absorption value.

It is yet to be seen what impact this new legislation will have on the sustainability of owners corporations, but it is a positive step in the recognition that these upgrades should not be impeded. In fact, they will be crucial for us to achieve net zero.

What can we do without needing approval?

Owners can make minor alterations that don't change the external appearance without requiring permission from the owners corporation. Even better, the Victorian government has a number of rebates to reduce the cost for sustainable upgrades. This includes: replacement of inefficient TVs, lights, showerheads, pool pumps and lights.

I live in an old apartment building which still has its original fittings. I recently replaced my inefficient showerhead at no cost through the government scheme and saw a 30% reduction in my hot water bills as a result. All I had to do to arrange this was go to Energy Vic's website, find an accredited provider, and arrange a time for the swap. I encourage everyone to take a look at the Victorian Government's [Energy Upgrades website](#) and see if they qualify for any rebates.

RELATED - [Sustainable Strata >](#)

What more could be done?

A major hurdle in getting strata sustainable is that a significant alteration to the common property requires a special resolution. This means that 75% of all owners would need to vote in favour for a final resolution to pass on the installation of solar panels on a common roof. Lowering the threshold for approval would go a long way in getting more sustainable upgrades through.

RELATED - [A simple guide to OC resolutions >](#)

For now, though, if these sorts of improvements are something you're passionate about, we recommend getting involved in your owners corporation. Holding an information evening or contacting your fellow owners about the benefits can go a long way in getting special resolutions across the line.

This article was first written for and published by North West City News.

<https://www.theknight.com.au/our-news-and-insights/creating-more-sustainable-strata-lots-what-can-be-done/>

Embedded Networks in New South Wales (November 2022)

Extract from Chair's Foreword

The Committee also heard about unfair contract terms that locked owners into long term contracts with an embedded networks service provider, which were originally entered into by the building developer. This Committee considered this a significant lack of transparency and consumer choice and recommended that the NSW Government consider regulating embedded network contract provisions, including the term of the contract and conditions of termination, to ensure they are not unduly burdensome for consumers.

Throughout the course of the inquiry, the Committee discovered that much of the consumer issues above derive from a regulatory framework that was originally designed for 'traditional' embedded networks that did not have energy supply as their core business.

As such, it was originally considered that subjecting smaller private networks to the same regulatory requirements as larger energy distributors would be overly burdensome for its customers and negate any price improvements from the bulk on-selling of energy. These networks were therefore subject to certain exemptions from the national framework which provided consumer protections.

<https://www.parliament.nsw.gov.au/ladocs/inquiries/2873/Report%20-%20Embedded%20Networks%20in%20New%20South%20Wales.pdf>

Do you know your NABERS from your NatHERS?

One area where there is a framework in development projects to deliver tangible outcomes in sustainability is rating tools. From the National Australian Built Environmental Rating System (NABERS) to Nationwide House Energy Rating Scheme (NatHERS) to Building Energy Efficiency Certificate (BEEC) and beyond, these rating tools are evolving quickly, and we have seen a number of legal issues present in development projects we work on. This article discusses why it is important for developers to understand what these rating tools mean, when they apply, why they should be used and what the consequences are for getting it wrong.

<https://www.maddocks.com.au/insights/nabers-from-nathers>

ACT Government to build infrastructure for the electric bus fleet transition

The State Government has hired Evoenergy to build crucial electrical infrastructure to supply the Woden and Tuggeranong bus depots with the energy needed to hold and charge up to 300 battery electric buses.

More work is being done in collaboration with Evoenergy to deliver critical infrastructure modifications to the distribution network. This will help the ACT Government achieve its goal of converting to a zero-emission public transportation system by 2040.

<https://www.australianmanufacturing.com.au/act-government-to-build-infrastructure-for-the-electric-bus-fleet-transition/>

ACT Government calls for Evoenergy payouts to cover power surge damages

“Evoenergy should prioritise putting residents back to where they were before a damaging power surge knocked out thousands of dollars worth of appliances”, the Chief Minister and Energy Minister have said.

<https://www.canberratimes.com.au/story/8158225/govt-calls-for-evoenergy-payouts-to-cover-power-surge-damages/>

Evoenergy Regulatory Proposal. ACT electricity distribution network 2024-2029

We are pleased to present Evoenergy’s electricity network regulatory proposal for 2024-2029.

This proposal was prepared during a time of immense change across the energy sector. The change has been particularly pronounced in the ACT, where a strong push towards electrified modes of transport; a move away from gas, and an increasing number of high voltage customers using more power for major developments, means Evoenergy will be required to distribute more electricity than ever before.

<https://www.evoenergy.com.au/about-us/about-our-network/electricity-five-year-plan>

Virtual “bendy busses” for Canberra

(Tom Worthington: January 2023)

In Singapore a few weeks ago I saw an autonomous electric bus on display at a transport conference. This is intended for regular routes, but is still a work in

progress. What would be possible sooner is convoys of buses for the express routes from Civic to Woden and Turragnong. At peak times one bus with a driver would be followed by one or more driverless, making a virtual bendy bus. This would have a higher capacity than light rail, at a lower cost.

First published as a comment on "[Canberra's first of 12 electric buses charging up ready for next year](#)", 28 December 2022, Lottie Twyford, Riot Act

Autonomous electric bus in Canberra

(Tom Worthington: November 2017)

Yesterday I went for a short ride on an EZ.10 driver-less electric shuttle bus from company Easy Mile, on demonstration run in Canberra's city centre. The bus travelled a few hundred meters through Canberra's central mall. While it has a maximum speed of 40 kph, this was done at walking pace, as it weaved in between the street furniture.

The vehicle holds six people sitting in two rows facing each other and with room for another six to stand (or a wheelchair). There are very wide doors making entry easy. The vehicle is higher than it is wide and looks more like a cross between a lift and a golf buggy than a bus.

The ability of the vehicle to find its way between the obstacles in the mall was impressive, with a smaller turning circle than even a minivan. Also it was able to deal with pedestrians who strayed into its path. When the vehicle's sensors detected a person it would first ring a bell (like that of an old fashioned street car), then slow down and, if the person was not out of the way, stop. No one seemed perturbed or frightened by the vehicle slowing making its way along.

There is also a wheelchair ramp which can be deployed by the press of a button (the vehicle also kneels to make entry easier).

This would appear a practical form of transport around a university campus (the Australian National University could do with a half dozen such vehicles), or a city centre. It would be a useful way to get people to and from light rail and other more conventional forms of public transport.

While the EZ.10 is imported, this is an industry which Australia could enter. There are already [Australian companies making small electric vehicles](#) for farms, factories and the military. Our universities and high-tech companies have the expertise to design the software for the sensors to operate the vehicle.

The EZ.10 shuttle is on an Australian tour it will be in Canberra today (Sunday) until 12 Noon and 1pm to 3pm, then Cairns from 4 to 8 December and Mooloolaba from 14 to 16 December.

“Autonomous electric vehicles have maximised commuter take-up of ACT light rail and bus network by closing the ‘last kilometer’ of travel time between a commuter’s residence and their relevant Transport ACT connection”.

The role of autonomous electric vehicles in achieving net-zero carbon targets

Case Study Generated by ChatGPT

Introduction

As cities worldwide grapple with the challenges of reducing carbon emissions and addressing congestion, the integration of autonomous electric vehicles (AEVs) into public transportation systems has emerged as a transformative solution. This case study examines the impact of AEVs connecting to public bus transport in the fictional city of Muskville and how this innovation has contributed to the city's pursuit of net-zero carbon targets.

The Setting: Muskville

Muskville, a bustling city of 500 000 residents, faced mounting challenges related to urban congestion and air pollution. The city's leaders were committed to achieving net-zero carbon emissions by 2030 and recognized the need for innovative transportation solutions to meet this ambitious goal.

The Initiative: AEVs in Public Transportation

In 2021, Muskville embarked on a ground breaking initiative to introduce a fleet of autonomous electric vehicles into its public transportation system. This initiative aimed to provide a seamless, sustainable, and efficient mode of transportation for residents and reduce the carbon footprint of the city's transit network.

Implementation

1. **Fleet Deployment:** The city collaborated with a leading AEV manufacturer to deploy a fleet of 100 autonomous electric buses. These buses were equipped with cutting-edge technology, including autonomous driving capabilities and electric propulsion systems.
2. **Integration with Public Transit:** Muskville integrated the AEVs into its existing public transit network. AEVs were programmed to operate on dedicated lanes and pick up passengers at designated stops, synchronizing seamlessly with the city's bus routes.
3. **Charging Infrastructure:** To support the AEV fleet, Muskville invested in a network of fast-charging stations strategically placed throughout the city. These stations were powered by renewable energy sources, further reducing carbon emissions.

Results and Impact

The integration of AEVs into Muskeville's public transportation system had a significant impact on the city's efforts to achieve net-zero carbon targets:

1. **Reduction in Emissions:** By replacing traditional diesel buses with electric ones, the city experienced a substantial reduction in carbon emissions from its public transit system.
2. **Improved Efficiency:** AEVs optimized bus routes, reducing travel times and congestion. Passengers enjoyed more reliable schedules and quicker commutes.
3. **Increased Ridership:** The introduction of AEVs made public transportation more attractive, leading to a surge in ridership. This, in turn, reduced the number of private vehicles on the road.
4. **Economic Benefits:** The initiative created jobs related to AEV maintenance, charging infrastructure management, and software development.
5. **Enhanced Mobility:** AEVs provided accessible transportation options for elderly and disabled residents, promoting social inclusion.

Challenges and Future Plans

While the initiative was largely successful, it encountered some challenges, including initial implementation costs, cybersecurity concerns, and public acceptance of autonomous vehicles. To address these issues, Muskeville continued to invest in cybersecurity measures, public awareness campaigns, and research on improving AEV technology. Looking ahead, the city planned to expand the AEV fleet, increase the coverage of charging infrastructure, and explore partnerships with neighbouring municipalities to create a regional AEV network.

Conclusion

Muskeville's visionary approach to integrating autonomous electric vehicles into its public transportation system demonstrates how innovation in urban mobility can play a pivotal role in achieving net-zero carbon targets. This case study underscores the potential of AEVs to transform cities, reduce emissions, and create more sustainable and efficient urban environments for the benefit of residents and the planet.

Connecting Suburban Commuters—The Impact of an Integrated Autonomous Electric Vehicle Service on Net-Zero Carbon Targets

Case Study Generated by ChatGPT

Introduction

As cities strive to achieve net-zero carbon targets, innovative transportation solutions have become paramount. This case study explores the introduction of an autonomous electric vehicle (AEV) service in the fictional city of Muskville, aimed at seamlessly connecting suburban commuters from their homes to the nearest public transport hub, and its impact on the community's carbon emissions reduction efforts.

The Setting: Muskville

Muskville, a city and regional service centre of approximately 500 000, had a growing population of commuters who relied on private vehicles for their daily journeys. To achieve its net-zero carbon targets, the local government sought ways to reduce car dependency and promote eco-friendly transportation options.

The Initiative: Suburban AEV Service Integration

In 2022, Muskville launched an ambitious initiative to integrate AEVs into its public transport network with a specific focus on suburban commuters:

- 1. Service Deployment:** The city partnered with a leading AEV provider to introduce a fleet of autonomous electric vehicles tailored for suburban routes. These AEVs were equipped with the latest autonomous technology, ensuring safe and efficient journeys.
- 2. Integration with Public Transport:** The AEV service was seamlessly integrated with the existing public transport system. Commuters could book AEVs via a smartphone app, and these vehicles would pick them up at their doorstep and transport them to the nearest public transport hub.
- 3. Renewable Energy Charging:** The city invested in renewable energy sources for charging the AEV fleet, ensuring that the service had a minimal carbon footprint.

Results and Impact

The introduction of the suburban AEV service in Muskville had a profound impact on the city's efforts to achieve net-zero carbon targets:

- 1. Reduction in Emissions:** By providing a convenient and eco-friendly alternative to private cars, the AEV service significantly reduced carbon emissions associated with suburban commuting.
- 2. Increased Public Transport Usage:** The service boosted the utilization of the city's public transport network, reducing the number of individual vehicles on the road during peak commuting hours.
- 3. Improved Air Quality:** The reduction in car traffic contributed to improved air quality in the suburb, enhancing the overall quality of life for residents.

4. **Economic Benefits:** The AEV service generated jobs in vehicle maintenance, customer service, and technology management, benefiting the local economy.
5. **Convenience for Commuters:** Suburban commuters appreciated the convenience of door-to-door service, which saved them time and reduced the stress of finding parking at public transport hubs.

Challenges and Future Plans

While the initiative was a success, it faced challenges such as initial investment costs, the need for public awareness campaigns, and infrastructure development. To address these challenges, Muskegon planned to expand the AEV fleet, continue investing in charging infrastructure, and implement education programs to promote the service further.

Conclusion

Muskegon's innovative approach to integrating an autonomous electric vehicle service for suburban commuters, connecting them to public transport hubs, demonstrated the potential of such solutions in reducing carbon emissions. This case study highlights how smart transportation initiatives can make a significant contribution to net-zero carbon targets while improving the lives of suburban residents and fostering sustainable urban development.