Australian National University

Battery Storage and Grid Integration Program

An initiative of The Australian National University

Response to ACT Government Integrated Energy Plan Consultation

The Battery Storage and Grid Integration Program (BSGIP) at the Australian National University (ANU) is grateful for the opportunity to provide input into the ACT Government's Integrated Energy Plan. BSGIP is proud to be a key ACT Government partner in decarbonisation research, development and demonstration activities.

The ACT has developed a national and international reputation as a renewable energy innovation cluster, with world-leading capabilities. BSGIP has strong roots and a focus on impact in the ACT. The Program was established in 2018 through ACT Government investment from the Renewable Energy Innovation Fund (REIF) and works in close partnership with many ACT-based organisations, businesses and government departments. Our work with these organisations includes current and emerging projects that are developing, deploying, and managing vital pieces of ACT infrastructure, including solar energy generation, batteries at all scales, electrifying transport, and integrating distributed energy resources (DER) into the grid.

The principles and policy directions proposed in the Integrated Energy Plan (IEP) Position Paper are sound, considered, and well designed, and demonstrate that the ACT Government is taking a sophisticated, thoughtful approach to the Territory's transition. The Paper demonstrates understanding that with the increasingly distributed nature of energy assets in people's homes and lives, we must acknowledge that we are now working in a socio-techno-economic energy system. We need to be very clear about how we operate assets for the benefit of householders and the community while maintaining energy reliability, security, and resilience.

While the IEP represents a sound plan, the approach would benefit from stronger emphasis and detail around grid integration, coordination and control of distributed assets, and further detailed work on supporting households on lower incomes and renters. BSGIP recommendations for forward development of the Plan include:

- Incorporating grid integration capabilities as a headline principle in the Plan
- Implementing energy efficiency alongside electrification, ensuring consideration of how to support the health and wellbeing of lower income householders
- Providing innovative solutions to mitigating the impacts of electric vehicle charging on the grid, as well as reducing barriers to access for renters and apartment-dwellers
- Coordinating generation, storage and consumption of energy as much as possible within buildings; this approach is more efficient, can offset the need for infrastructure upgrades, and contributes to supporting increased penetration of variable renewable energy generation into our electricity grid
- In considering electrification support for renters, address the power imbalance between tenants and landlords
- Undertaking research and demonstration in the potential and applications of complex electrification and grid integration problems (such as in multi-dwelling and apartment complexes) can underpin future development in the ACT and beyond, while also ensuring it is economically achievable and socially equitable.

Economy-wide decarbonisation

BSGIP is proud to be part of the ACT Government's efforts identifying and tackling the energy transition, deploying our socio-techno-economic analysis and modelling capabilities in support of planning and efforts towards reaching net zero emissions through the simultaneous and integrated decarbonisation of the five pillars of Australia's economy:

- Electricity and energy
- Transport
- Buildings
- Agriculture and land
- Industry

Our response to the ACT Government Integrated Energy Plan (IEP) Position Paper uses this lens and applies these capabilities to suggest areas where the Plan could be strengthened, to ensure an energy future that best serves the Territory and everyone in it. This submission focuses on electricity and energy, transport, and buildings as the key issues for the ACT.

Electricity and energy

The ACT has achieved a 100 per cent renewable electricity supply, a significant achievement and substantial boost to the Territory's net zero ambitions, along with those of organisations such as the ANU that are based here. The next step is to move towards 100 per cent renewable *power*, where the ACT is using renewable 'electrons' 100 per cent of the time. The ACT has made a great start on establishing the required firming storage infrastructure, which will need to be scaled up rapidly and should therefore be a key element of the IEP.

We agree with the paper's conclusion that a combination of consumer-led transition and staged transitions is likely the most appropriate for the ACT. This would require support for some consumers to transition if they are unable to do so themselves, complemented by planned and orchestrated optimisation, control and integration interventions in the system. Subsidies and loans are excellent for lowering cost barriers, but more complex solutions will be needed to accelerate uptake, ensure everyone is included and the benefits are shared. Substantial guidance and program support is known to be required for energy-related retrofits for households already experiencing significant income, life capacity or infrastructural barriers.[1] In Canberra this includes apartment occupants, renters, people living on low incomes, people living with disabilities, and people with intersectional life challenges. The ACT has recognised the need for support through a suite of various programs, such as rebates and incentives for both home owners and renters.

Grid Integration

As households are electrified, we need to ensure that these assets work together. At BSGIP we call this grid integration, referring to control, optimisation, coordination, and orchestration techniques that are needed to bring these disparate devices together to deliver energy reliability, security, and resilience. To get the best from these technologies this grid integration capability must be a key technology piece supported with significant further research, development and demonstration.

The IEP would benefit from explicit acknowledgement that grid integration will be a critical element of the ACT decarbonisation pathway. Grid integration will underpin the stability of the electricity system in the preferred decentralised model, which is acknowledged in Principle 6, but this is not just an issue for Evoenergy.

[1] Energy Consumers Australia, 2020, Power Shift Final Report. https://energyconsumersaustralia.com.au/wp-content/uploads/Power-Shift-Final-Report-February-2020.pdf

Consumers must be at the heart of this policy and there is therefore a strong role for Government, retailers, aggregators, and other actors in the energy system. Ensuring grid integration for stability is also likely to require policy and regulatory change, as well as close monitoring for equity in outcomes as the changes are implemented. The explicit inclusion of grid integration as an element in the strategy and guiding principles will ensure sufficient focus, investment and priority.

One element of electrification that is required will be to ensure that the right mix of new electrical assets have the ability to be effectively integrated, controlled and optimised. Such integration, control, and optimization capabilities may require considerations related to:

- metering and visibility capabilities both on operational (minutes) and billing (months) timescales
- optimisation and control systems capable of economic, network and market co-optimisation
- actuation capabilities on new electrical infrastructure
- physical and software integration with existing infrastructure management software

Optimisation and control of assets with a larger energy demand is particularly useful for some types of technologies such as electric vehicles where demand can often be shifted with lower impact on consumers. Additional solutions such as time of use pricing and accessible information can help consumers shift practices to better align use of other devices in their home to periods where there is excess generation capacity and network capability without the need for complex and expensive automation technology.

Ultimately, the electrification process will necessitate an increased focus on operating and optimising our electricity infrastructure and assets to ensure they meet the needs and expectations of the community at the same time as reducing the cost of transitioning to a purely electric economy.

Energy Efficiency

Alongside grid integration, as the Plan has identified, a key step for an energy strategy to make best use of renewable, sustainable resources is to reduce or eliminate avoidable energy use. Not only does this directly reduce emissions, but it also streamlines the scale of investment – monetary and in embodied emissions – required for the energy transition. This approach also cuts costs for energy supply as well as investment in infrastructure. Energy efficiency initiatives can increase the comfort of people's homes, and support health and wellbeing.[2]

People need to be supported in this transition, and the ACT Government is already doing much to ensure that efficiency is a hallmark of decarbonisation design. Areas to increase focus could include non-technical and smaller solutions with outsized impacts, such as reminders, timers, or curtains. These can help with ensuring efficient use of things like dryers, dishwashers and washing machines, as well as space heating and cooling.

It is also important to consider households who currently do not use enough energy to stay healthy – homes with poor thermal comfort with lower income occupants are likely to have this issue. For low income households, housing envelope improvements and other efficiencies are achievable and worthwhile, but these households would benefit from infrastructure upgrades without receiving the message to be more efficient with energy use. Expectations on behaviour change and the ability to retrofit need to align with the capacity people have to effect change.

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[2] A capture of benefits from Australian projects can be found in Acil Allen, 2017, Report to Energy Consumers Australia Multiple Impacts Framework: an Assessment Framework, October, for Energy Consumers Australia. https://energyconsumersaustralia.com.au/wp-content/uploads/Multiple-Impacts-Framework.pdf .
A capture of specific benefits of one of the projects in the Acil report are covered in - Rooney, M., Watson, P., Watson, S., 2016 Get Bill Smart Detailed Study Report, Sustainable living Tasmanian and University of Tasmania, June. https://apo.org.au/node/319556

Transport

Transport is the single largest contributor to the ACT's greenhouse gas emissions, making up over 60 per cent of the total. The ACT's Zero Emissions Vehicles Strategy provides an excellent framework for electrifying passenger transport, and we welcome the strategy's focus on encouraging greater community uptake of public transport and more walking and cycling infrastructure to support active travel options. Providing early and clear policy direction to inform the choices of households and businesses is critically important, and the ACT Government has done this very well.

Electrifying Canberra's transport will have a significant impact on electricity demand and grid stability, and these impacts must be carefully modelled and anticipated. Innovative solutions to mitigating these impacts can help to reduce risks to the grid as well as barriers to consumer segments such as renters or apartment-dwellers. This might include strategic deployment of slow, low impact chargers in public areas, an integrated workplace charging strategy, or charging hubs that service multiple sectors of Canberra's transport needs (bus, fleet, taxi, etc). As well as modelling, the ACT could consider investing in demonstrations and pilots of these innovative solutions.

Electric vehicle (EV) ownership is still beyond reach for many in the region, and this must also be considered in the Territory's decision-making around transport options. Similarly, the workforce and infrastructure must be supported in the transition, to ensure sufficient services are available to support EV drivers.

Buildings

Fossil fuel gas is the second largest remaining contributor to ACT greenhouse gas emissions, and it is predominantly used in buildings. Electrification of gas use will again place additional load on the electrical network.

One solution to mitigate the need for electricity network upgrades is to improve energy efficiency, as discussed above, and ensure coordinated generation, storage and consumption of energy occurs as much as possible within the building. Producing, storing and consuming energy locally is more efficient, can offset the need for infrastructure upgrades, and contributes to supporting the increased penetration of variable renewable energy generation into our electricity grid. Energy storage can take the form of stationary batteries, as well as smart heat pump hot water systems as thermal batteries (heating and storing water soaking up excess solar generation). These solutions are modular and scalable, meaning they can be implemented in single households, apartment or commercial buildings, or larger precincts.

A successful building retrofitting campaign will need to address individual issues faced by individuals, families and communities within these buildings. For example, private renters and people living on lower incomes have traditionally had the most difficulty retrofitting new energy technologies and infrastructures into their homes. Consideration particularly needs to be given as to how to support these people.

BSGIP advocates for early and close community consultation and co-design when developing decarbonising strategies. Our customer-focused network management research project[3] showed that people would like to see their values reflected in re/design and implementation processes, and are comfortable leaving details to domain experts. Building a system that reflects the values of people and communities will ensure increased ownership and uptake of the physical systems used to decarbonise buildings.

Apartment buildings

A particularly complex decarbonisation challenge is multi-dwelling (apartment) buildings and strata arrangements. These buildings pose unique challenges of multi-ownership, a mix of owner-occupiers and

[3] Customer focussed distribution network management project: Final Report. May 2023. Laura Jones, Brenda Martin and Phillipa Watson.https://bsgip.com/research/customer-focused-network-management/

renters, a mix of private and common energy usage, relatively small land area to occupant ratio affecting ability to install DER infrastructure, and embedded energy networks (including regulation).

Electrification of apartment buildings also poses unique integration questions, particularly in accommodating EV chargers, economically viable hot water and heating options, and co-ordination and control of demand augmented by various forms of energy storage. Without sophisticated modelling, design, and planning, these systems could be very expensive and challenging to operate. Integrating the energy systems in the building together and into the grid can provide value stacking outcomes that would not be realised if these systems were to operate in isolation. Basing this integration and optimisation in rigorous modelling and research will ensure the forecast benefits are realised.

BSGIP is working to determine the technical feasibility of deploying a large amount of DER and electrified assets in an apartment building, co-ordinated and optimised to minimise energy flows to and from the grid so as to realise these benefits. This work will apply BSGIP's unique socio-techno-economic modelling and scenario-based approach to determine the feasibility and optimal design elements for a low emissions, electric apartment building. In parallel we will design, test and implement enabling capabilities for DER integration, and test scenarios that could deliver economic benefits to the building owners and tenants.

Research and demonstration in the potential and applications of apartment-scale electrification can underpin future development in the ACT and beyond, while also ensuring it is economically achievable and socially equitable. This robust, multidisciplinary research and modelling will provide a high level of confidence to underpin planning and implementation of innovative, ambitious decarbonisation projects, particularly in complex situations such as apartment buildings. The findings, methods, and tools BSGIP will produce from this project will be open source and transferrable, meaning they can be used across Australia and the world to further accelerate our energy transition. BSGIP welcomes further discussions with the ACT Government about this project.

BSGIP is also collaborating with the ANU Below Zero Initiative in providing a framework for decarbonising complex buildings or precincts through pilot implementation, discussed in the ANU submission to this consultation.

Renters

In considering electrification support for renters, the power imbalance between tenants and landlords must be clearly understood and planned for. BSGIP's meter unbundling conceptual analysis report[4] showed that this power imbalance has the potential to enable financial drivers for landlords to behave in ways that do not benefit tenants, for example maximising energy export to the grid from rooftop solar.

Currently, rental properties are considerably less likely to have rooftop solar installed than owner-occupied homes.[5] There are a variety of reasons for this, but the complexity of such an arrangement – and potential to exacerbate existing inequalities – are likely leading. In order to avoid these situations, it could be worth considering detaching any returns from rooftop solar to landlords from tenant energy consumption patterns.

Community solar farms are an alternative way to enable solar access for renters and apartment dwellers, without installing solar panels on their home. These initiatives could be extended to include solar canopies on community playgrounds and communal spaces to enable solar generation located close to people's homes, and also provide shade in summer.

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[4] Meter unbundling conceptual analysis: final report. June 2023. Laura Jones, Tim Moore and Michael Thomas. https://bsgip.com/research/meter-unbundling-conceptual-analysis/

[5] Solar for renters: Investigating investor perspectives of barriers and policies. Energy Policy, March 2023. Mara Hammerle, Lee V. White, Bjorn Sturmberg. https://www.sciencedirect.com/science/article/pii/S0301421523000022

Contact:

Thank you again for the opportunity to provide input into this consultation. If you would like to discuss any of our comments in this submission, please contact Alix Ziebell, BSGIP Engagement and Impact Lead, by email at alix.ziebell@anu.edu.au.

Further information:

- bsgip.com – for information on our mission, work and people
- ANU Below Zero[6] and BSGIP's work[7] on the Initiative – for information about our options assessment and grid integration work at ANU
- Projects evolve, Symphony and Converge[8] – software and social science exploring the grid participation of distributed energy resources
- Sans Limites[9]– an automated, public tool that aims to improve customer understanding of costs and benefits of acquiring DER assets, and how these benefits arise
- Meter unbundling conceptual analysis[10] – exploring ways novel metering arrangements can be evaluated as a vehicle to increase household electrification, reduce consumer energy costs, and genuinely improve household experience of their energy supply.

[6] https://sustainability.anu.edu.au/
[7] https://bsgip.com/research/anu-below-zero/
[8] https://bsgip.com/research/evolve/ ; https://www.westernpower.com.au/our-energy-evolution/projects-and-trials/project-symphony/ ; https://bsgip.com/research/converge/
[9] https://bsgip.com/research/sans-limites/
[10] https://bsgip.com/research/meter-unbundling-conceptual-analysis/