

SA Government green paper on the energy transition.

Public Consultation

AUSTRALIAN INSTITUTE OF ARCHITECTS

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ABOUT THE INSTITUTE

- The Australian Institute of Architects (Institute) is the peak body for the architectural profession in Australia. It is an independent, national member organisation with more than 13,000 members across Australia and overseas.
- The Institute's vision is: *Everyone benefits from good architecture.*
- The Institute's purpose is: *To demonstrate the value of architecture and support the profession.*
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The Australian Institute of Architects recognises the unceded sovereign lands and rights of Aboriginal and Torres Strait Islander peoples as the First Peoples of these lands and waters. This recognition generates acknowledgement and respect for Aboriginal and Torres Strait Islander Countries, Cultures and Communities, and their ways of being, knowing and doing. Caring for Country practices including architecture and place shaping have existed on this continent since time immemorial.

The Institute recognises a professional commitment to engage and act meaningfully through reciprocal partnership and relationships with Aboriginal and Torres Strait Islander peoples. Together we will support and develop the emergence of new possibilities for our shared future

Regenerative Design Resources - Australian Institute of Architects (architecture.com.au)

As the Institute works with our members and the community to facilitate the decarbonising journey, we align with strategies that educate emission reduction from the outset. Including embodied, operational carbon and whole life cycle measurement as part of the design process. We consider what resources will be available for buildings over the next 30+ years in a world of depleting finite materials and design for regeneration.

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INTRODUCTION

The profession of architecture and the scope of an architect's work crosses so many sectors that the Institute feels it is advantageous to highlight the important considerations whilst planning the energy transition.

The government consultation for this energy transition is welcomed by the Institute as is the inclusion of the built environment, in line with the Federal Government's recent Net-Zero Authorities announcement in 2023.

Energy directly impacts architectural design through

- Supply chain delivery
 - Material manufacturing and Company ESG profiles
 - Complete or partial electrification of new and existing buildings
 - Resource recovery, remanufacturing by-products, and dematerialisation to design out waste material, waste/surplus water, waste energy
 - Consider logistics and proximity to supply chains, paths of travel and ethical sourcing of products and labor conditions
 - Design for manufacture, assembly, reuse
 - Climate risk mitigation for floods, acute heat and cool shocks, impact to community and infrastructure above ground from other extreme climate events.
 - Designing for the unknown, mitigating what might occur and how to respond.
-

We believe in creating a positive impact through regenerative design and believe the government can achieve this through reductions in excessive resource use which focuses on delivering natural, cultural and financial balance¹. As our work is governed by regulation, the Institute seeks out opportunities that enable members to reduce emissions, design out fossil fuels, work with other sectors to deliver climate appropriate **regenerative** design.

Traditional zero-carbon strategies fragment energy, water, infrastructure, and other sectors and work independently to their sustainability goals. The institute recommends the government facilitates positive relationships on a **regenerative** integrated emissions strategy. This would provide an **integrative system understanding the master pattern of 'place' and the 'entirety of what makes a place healthy'**.² Three aspects of the regenerative pattern can: provide understanding of the 'master pattern' form, provide guidelines of how the larger living system is positively influenced by embedded smaller scales of action, and reciprocate measurement from the small to large, and consciously incorporating ongoing feedback, reflection and dialogue³.

The Institute acknowledges that the government trajectory will formulate targets for emissions reduction, and the areas the Institute wishes to address are; energy supply, rooftop solar, energy storage, hydrogen, natural gas and fossil gas, mining, manufacturing, recycling, the built environment and transport.

¹ Hames Sharley (2022) [Defining Regenerative Design](#)

² Reed, Bill. (2007) [Forum: Shifting from 'sustainability' to regeneration. Building Research and Information.](#)

³ Reed, Bill. (2007) [Forum: Shifting from 'sustainability' to regeneration. Building Research and Information.](#)

1.1 SA government progress in decarbonisation

The SA Green Paper cites several measurements that the government feel support the state's downwards trajectory of emissions, and transition to 100% renewable energy society.

- 2020 financial year measured 25.4 tonnes of carbon dioxide emissions which was 35% below 2005 greenhouse gas (GHG) emissions.
- Since 2000, renewable electricity generation has grown and with 70% of the electricity being generated through renewable wind, solar, rooftop photo voltaic (PV) systems etc.
- The 2022 Climate Change Bill as introduced by the Federal Government formed the initial targets of GHG reduction, which was to be 43% lower than 2005 levels by 2030, and net zero emissions by 2050⁴.
- Federal funding and support for hydrogen development on scale. Including electrolyser projects. Existing and proposed hydrogen projects such as the Tonsley Innovation District and on the Eyre Peninsula. Feasibility of economic modelling also for the export of this energy, including the development of the state's Hydrogen and Renewable Energy Act and Hydrogen Jobs Plan.
- Mining and Energy investment and stimulus contributed almost 10% to the state's economic output, over 50,000 employees since 2020 and 40% of total goods exports⁵.

Whilst the Institute recognises that the above data supports the decarbonisation journey to net-zero by 2050, we also encourage the government to also seek firmer related targets that we believe are achievable now.

1.2 Recommended overarching considerations:

1. Implement policy in line with the GBCA and Property Council's **'Every Building Counts'** (2023) document that includes the need to completely phase out gas in the built environment⁶.
2. Prioritise the use of hydrogen for sectors identified in the Energy Efficiency Councils **'Clean Energy, Clean Demand'** (2023) report which highlights that hydrogen use focused to sectors away from the buildings but embedded in material manufacturing is a more efficient trajectory to 2030⁷.
3. Support immediate implementation on NCC each cycle as ASBEC's **'Built to Perform'**⁸ report noted that this measurement of buildings could deliver \$29b, cut energy network costs by up to \$13b and deliver up to 78m tCO2 collective emissions savings' across Australia.
4. Green Industries and GBCA **Circular Economy 2023 Paper**⁹ and the GBCA **'Embodied Carbon and Embodied Energy in Australia's Buildings'**¹⁰ note delivering a circular economy and embodied carbon strategy including beginning to measure carbon whole lifecycle is an enabler to emissions reduction. GBCA noted by 2050 Embodied Carbon could be 5 times (85%) the amount that it is today.

⁴ Parliament of Australia (2022) [Climate Change Bill](#).

⁵ Government of South Australia (2023) [SA's Green Paper on the energy transition](#)

⁶ Green Building Council of Australia & The Property Council (2023) [Every Building Counts](#).

⁷ Energy Efficiency Council (2023) [Clean Energy, Clean Demand](#).

⁸ ASBEC (2018) [Built to Perform Report](#)

⁹ GBCA & Green Industries SA (2023) [Circular Economy in the Built Environment](#)

¹⁰ GBCA (2021) [Embodied Carbon and Embodied Energy in Australia's Buildings](#)

1.3 Summaries against sectors

The following summaries directly address those components of the SA Green Paper energy transition that the Institute has made recommendations to.

GAS

11.90

OIL

3,300

ELECTRICITY

11,90

RESIDENTIAL AND COMMERCIAL EMISSIONS (ktCO²-e) FY19/20

Renewables did not provide emissions from residential and commercial buildings during this period.

STATS: National Greenhouse Accounts: Total emissions from Australia's commercial and residential buildings (kt or CO² equivalent) FY19/20. & ASBEC 'Unlocking the Pathway'

GAS

231

OIL

45

ELECTRICITY

453

RENEWABLES

66

RESIDENTIAL AND COMMERCIAL ENERGY CONSUMPTION (PJ) FY19/20

Renewable consumption only accounted for 32.5%¹¹.

STATS: National Greenhouse Accounts: Total consumption from Australia's commercial and residential buildings (**One Petajoule is 10¹⁵**) FY19/20. & ASBEC 'Unlocking the Pathway'

The ASBEC 'Unlocking the pathway' report demonstrates benefits for electrification of the built environment, over hydrogen, gas, and fossil fuels with an Australian NPV savings of \$49 billion over real estate for residential and commercial sectors.

¹¹ ASBEC (2022) [Unlocking the Pathway](#)

2 SECTOR COMMENTS

2.1 What do you want from SA's energy transition?

A review needs to be done to identify which of these industry consumption sectors are the highest contributors to waste and the circular economy. A review of the National Waste Database would identify the sectors that overlap the materials and products supply chains, and those that would have the biggest 'whole of lifecycle' carbon impact.

The Government should prioritise development of a centralised and open-source measurement system for the whole of lifecycle carbon, especially on those supply chains that will be delivering electrification to the building industry in this state. For instance, tracking transport and logistics on heat pumps, solar panels, insulation, structure, glazing, metal and timber fabrication, compounds for electrical wiring, waste and recycling from site etc. This could be an enabler for the construction industry to make significant changes. This would also build on the discussion paper from Green Industries and the GBCA on the circular economy in South Australia's construction sector¹². Giving foresight for retrofitting existing homes under the NatHERS and the Residential Energy Efficiency Disclosure Initiative¹³ (REEDI) will enable monitoring of increases in manufacturing, logistics, mining, and embodied carbon as work is done to lower housing operational emissions. The quandary for the upcoming decade will be how to provide the health and amenity that is required in existing buildings through better thermal performance, at the same time as lowering emissions mentioned above. We implore the Government to be on the front foot.

Green Industries also notes that 27% or 7.7 million tonnes of CO² could be saved in South Australia, as per the figures below¹⁴.

GHG Reduction by actioning efficient and renewable energy gains

21%

GHG Reduction by actioning material efficiency gains

6%

2.1.1 Sectors by net energy consumption and the construction industry

Figure 7 of the Green Paper notes the sectors of net energy consumption by industry¹⁵.

- Agriculture consumes less than 5% in SA and nationally.
- Mining consumes less than 10% in SA, and less than 15% nationally.
- Manufacturing in SA consumes just over 25%, and nationally approximately 17.5%.

¹² Green Industries & GBCA (2023) [Circular Economy in South Australia's built environment](#).

¹³ Australian Government – [DCCEEW \(2023\) 2023-24 Federal Budget](#)

¹⁴ Green Industries (2023) [Circular Economy Benefits](#)

¹⁵ Government of South Australia (2023) [South Australia's Green Paper on the energy transition](#).

- Electricity Generation in SA consumes approximately 12.5%, and nationally just over 25%
- Other Industry, Water and Waste, and Construction industries consumes less than 2.5% in Nationally
- Transport has the highest cost in SA, with consumption of energy almost 30% compared to the national average of 24%
- Commercial and Services industries in SA consume approximately 7% compared to 5% nationally
- Residential industry consumes 10% in SA, and nationally about 8%
- Other Industry, Water and Waste, and Construction industries consumes less than 2.5% in nationally for each industry sector.

The Institute is concerned that the Step Change scenario provided (p 24) does not align with the current delay in regulations in SA and positive collaboration between the government departments to become **synergised** in policy. Furthermore, there would be benefit for the government to work closer with the Institute as of most the strategy areas are in their scope of general understanding of the profession. It is important to include the Institute in all government working groups to plan key patterns and guidelines in a regenerative approach. Such as, designing worker accommodation for remote energy projects, which also have the capacity to self-regulate indoor air quality and designing for disassembly or reuse.

2.1.2 Opportunities, barriers and success indicators for a smooth energy transition?

Delays to the National Construction Code in each 3 year cycle.

Each delay in implementation each NCC cycle causes significant risk to the government's ability to project and mitigate climate risk. Considerable research has been undertaken by ABCB well in advance of the implementation dates. There is cyclical expectation that the code updates will be adopted in full by those in the economy with assets, investments in manufacturing sectors who's businesses are placed at risk by delays. Health of the community at considerable climate risk also with many more houses expected to be built below minimum standards. With the expectation that housing is going to grow considerably to account for population increases, this needs to be prioritised.

In this strategy, the Institute supports full adoption of renewable electrification onsite, growth needs to occur in housing and the manufacturing. Particularly for heat pumps, inverters, battery storage, autonomous ventilation and the like, these should be supported innovations.

For the commercial sector, new buildings can be mandated to increase energy efficiency and electrification. However, government support is needed for existing assets to be upgraded by improving building fabric, connection to renewables, condensation mitigation and rectification, particularly around the heritage space. There is a significant knowledge gap in condensation mitigation and retrofitting detail analysis that could be done to ensure that more heritage buildings could be kept and the embedded carbon benefits of retaining old buildings can be seen.

Manufacturing and adaptive reuse extension beyond the built environment.

With the Manufacturing industry in SA consuming 25% of the state's Net Energy Consumption, it is highly likely that this figure grossly dilutes the gross operational carbon standpoint. There should be significant investment in localised embedded grids and load sharing in manufacturing sectors, with incentives for the sector to connect wholly to 100%

renewables. With Hydrogen also only on the horizon, the government's role in reaching 2030 targets seem far out of sight from a gross operational energy perspective.

Distributed Energy Resources (DER) is noted as a key driver in the State's emission reduction strategy and yet this contradicts the delay of future NCC building codes which mandates for total electrification of residential buildings. The government needs to ensure that demand and supply are considered together and as one so that there is a focus on reducing excessive resource depletion concurrently. In doing so, government revenue from new buildings is not likely to be significantly diminished by adopting these stricter codes. At the same time, they should also encourage a 'adapt-re-use first policy', encouraging keeping carbon embedded in existing buildings. A ratchetting incremental adoption by central regions in line with the City of Adelaide's Adaptive Re-use strategies, and then extend to outer suburbs in the following year, including infill electrification of the missing middle housing in the studies by Damian Madigan¹⁶. It would also save considerable heritage buildings in the process and align education coming from the Institute about how to get existing buildings to exceed current energy regulations.

2.1.3 Quantifiable risks in the transition

Risking health by not pushing the built environment to ban gas – 'don't leave health to a game of chance'.

There is the need for industry to shift away from the use of natural gas and fracking. The Institute wholly supports a 100% renewable electrification trajectory and promotes to our members and community, that our policy position on gas, that all new homes should be solely electrified to reduce Australia's emissions. Ideally using underground infrastructure to protect electrification infrastructure from climate events.

SA Green Paper's figure 9, notes the 2020–21 data for electricity generation by fuel type. Indicating that;

- SA had 61% from renewables (national 27%)
- 38% from Natural Gas (national 19%)
- 1% from oil products (national 2%)
- Nationally, there is still 53% of electricity generation from coal, identifying economic benefit from energy storage and distribution in SA from renewables,

The State Government needs to adopt a no gas connection policy on new buildings, and we refer to the **appendix** to this document to support the health and science basis for this approach. This would decrease the reliance considerably on natural gas and the increased use from renewables from the grid and support stabilisation. Considerations need to be made for lost gas infrastructure in the process with some sectors having previously required it in planning growth development areas such as Mount Barker. Whether this material resource could be recovered should be explored.

Rapid uptake of renewables in housing will likely to be seen and in line with the predicted annual operational consumption statistics from the Australian Energy Update (2022).

By adopting a regional approach to electrification and empowering the Regional Climate Partnerships in SA, to drive consumer led education, we should see a reduction of

¹⁶ Madigan, D (2017) [The Missing Middle](#).

logistics/transport carbon (gross-energy consumption) as more EV's and decentralised charging stations are activated. This would complement the new hydrogen fleet of transportation recently invested in by the government and address some of the scope 2 (& FiT) and 3 emissions for businesses in Adelaide.

2.1.4 Further government support is needed to aid the energy transition

By-products and bio products

Byproducts of existing manufacturing processes should be supported to decrease the amount of operational energy required to make like-for-like products, or to reduce the energy consumption in transport from interstate.

For instance, the SA Government in the last year undertook an inquiry in to Woodfibre manufacturing in this state, particularly in response to the logging areas south of Adelaide. The significant investment of the CLT manufacturing facilities and adaptive reuse of old sawmills has seen the establishment of TimberLink, growing jobs in the region. The company also set up reporting of scope 1, 2 and 3 emissions from the outset with a firm ESG strategy¹⁷ and with little or no reliance on fossil fuels except for logistics emissions taking supplies to distribution terminal at Port Adelaide.

Woodfibre insulation techniques also address the NCC condensation, bushfire and building fabric provisions that we'd likely see in 2028 NCC. If the state government supports this introduction now, then homes under the 7-star NCC 2022 are likely to perform much higher by using Woodfibre insulation as a continuous thermal insulation and removing the need for thermal breaks from XPS/foam fossil fuel products.

Competition in both the CLT and Woodfibre space in Australia is very limited and therefore there is a massive opportunity to increase the economic benefit, reduce operational emissions in buildings and manufacturing, and at the same time provide dwellings and neighbourhoods with a reduction in the urban heat island effect from poorly energy performing neighbourhoods.

2.1.5 Do you consider the Government of South Australia should explore a DC-only system as part of the energy transition future?

AEMO

The Institute refers to AEMO, The Australian Energy Market Operator, at this time as the specific understanding of the total energy infrastructure and grid and its stabilisation is not a position developed by the Institute based on the scale of the question.

Building scale Direct Current (DC) or Alternating Current (AC)

Alternative Current technology has enabled users to really understand how load sharing works, giving owners more time and space to develop their homes all electric systems, whereas Direct Current provides some operational governance by the energy suppliers to stabilise the grid.

¹⁷ NexTimber (2021) [Sustainability Report](#)

Page 34 of the SA Green Paper, suggests several strategies to be adopted **prior** to mandating DC, those include:

- more onsite and offsite storage
- more efficient building envelopes and appliances
- smarter buildings which can reduce their energy usage at peak times, either by timed appliances or by storing heat/coolth within the fabric of the building so heating and cooling can be switched off when the grid is constrained¹⁸.

Concentrating on other forms of renewables such as wind that produce more energy at the evening and morning peaks, and at night could be a benefit for the government and user. In looking at regulation, if National Construction Code (NCC) 2022 commences as scheduled October 1st, 2024, the government could also investigate adapting requirements of the NCC Deemed To Satisfy Elemental Whole of Home (W.O.H) calculator. Adopting the same methodology as the new AccuRate software for housing and have export limits. The societal costs, supply and demand including basic appliances are now being integrated into the code and provides opportunity for the state government to implement state provisions to include measures such as this.

In doing so, the government also needs to move away from using the term “Net Zero”, where energy is netted over a year, and develop new terminology which encourages a better understanding of the real issues of supply and demand¹⁹.

In line with the ABCB implementation over the next 10 years, it is important to facilitate the adoption of DER in housing to support the long-term emissions Rapid Step Change approach recommended by AEMO.

ABCB are already guiding provisions for Net-zero DER strategies through the inclusion of ventilation, condensation, building fabric and conditioning approaches which see more uptake of Building Management Systems- in commercial, and smaller scale systems for Residential.

A twin action could be to also encourage uptake of existing quantifiable and compliance worthy pathways for buildings. Particularly for the conditions in the Adelaide Hills and South, to assure:

1. Occupant health during bushfires and extreme climate events due to it’s airtightness. South Australian’s are expected to endure longer, harsher summers and bushfire periods with more buildings being closed from the outside.
2. A higher level of electrification and continuous daytime supply of fresh air and thermal comfort. Lowering operational emissions, possibly by half in some instances
3. Mechanism for measurement and disclosure of predicted energy for housing through the planning process
4. Pathways to commercial, community and other education sectors that could benefit from the DER monitored indoor environment and predicted energy use
5. Consistency of energy surplus to the grid can be managed. There are also minimal interventions the government would need to have themselves in the certification process as the resourcing and maintenance of this standard is globally aligned and managed

¹⁸ Green House Architecture, Robbie Gibson (2023)

¹⁹ Green House Architecture, Robbie Gibson (2023)

6. Consumer led increase in demand for other electrification with more disposable income to spend in the economy.

The recommendation from the Institute is that in SA, the government could include a state-based amendment to the Whole of Home NCC 2022 Deemed-to-satisfy calculator that also looks at the export limits. Some homes in the Adelaide Hills have a 1.5kW export limit whereas the WOH calculator has a 10kW limit²⁰.

This would also provide the government with a trigger mechanism to control grid stability, as there is currently only an average of 35% of residential building approvals being issued with a NatHERs certificate. A NatHERs certificate and WOH calculation under NCC 2022 is a mechanism to report predicted energy consumption. With 65% of residential building approvals going through under the verification (VURB V2.6.2.2) and Deemed-to-satisfy (DTS) methods, there are a lot of buildings not meeting a 6-star (2019 NCC) or 7-star (NCC 2022) energy disclosure, and therefore provide unreliable assumptions on the expected energy consumption for the state. This is also far behind the 80% national average for energy disclosure on residential buildings.

2.1.6 Step Change approach

Support supply chains who are investing in adopting new regulations by improving their products and materials.

With the delays to construction code upgrades in the NCC and Australian Standards, there is a risk the government won't reach the Paris Agreement targets. Suppliers are already shifting their business operations to meet future needs. Further support for business scale storage, decentralised DER strategies and load sharing should be expected to deliver a large win and for services integration into the built environment.

The institute does not support carbon, capture and storage (CCS) as a **regenerative** strategy, as this method has provided very little proven accuracy and deliverables to target.

In line with the ['Clean Energy Clean Demand'](#)²¹ report, the Institute recommends the government increases wind, solar, storage and dispatchable energy and increase energy management, measurement and disclosure. ASBEC's 'Low carbon, high performance report'²² (2016) noted that the built environment needed to be included in the Government's Zero-Carbon strategy and in 2023, the Prime Minister Anthony Albanese included the sector. This was supported by ASBEC's studies demonstrating that:

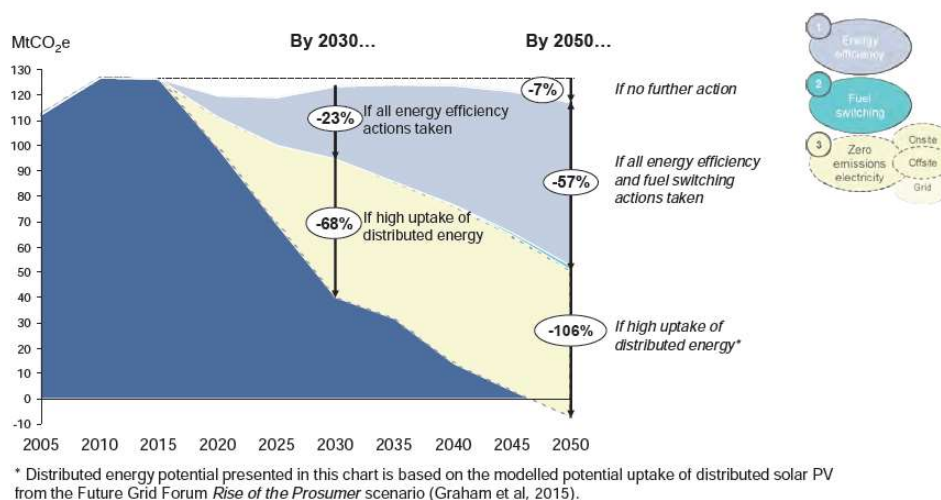
'enough distributed solar PV could be installed to meet over half of the remaining energy demand from buildings in 2030, and more than 100% of remaining demand by 2050. Some of this will require power to be shared between building owners who have access to substantial roof space and those who do not.'

²⁰ Green House Architecture, Robbie Gibson (2023)

²¹ Energy Efficiency Council (2023) [Clean Energy Clean Demand](#)

²² ASBEC, (2016) [Low Carbon, High Performance Summary Report](#).

Figure 4. Built environment emissions and opportunities to achieve zero carbon buildings (MtCO₂e)



Source: ClimateWorks team analysis

Figure 1: ASBEC Low Carbon, High Performance Report notes that the pathway to net zero can be made quick with a coordinated approach from sectors providing PV, electrification, storage and energy efficiency in the built environment.

The Hydrogen Superpower approach possibly could mean that there is excessive embodied carbon and operational energy in the transition to get technology to where it needs to be, and providing more energy that is needed to be consumed locally. If there is dispatchable electricity in this strategy, it is not likely going to be educating the consumers to reduce energy consumption from the outset, and without knowing the climate adversities SA will address in the future, it is safer to provide assurances of community health through better onsite reductions in demand through building envelope performance (energy efficiency) and electrification.

Basing the state’s approach to step-change on the EEC and ASBEC’s studies will encourage a faster transition.

Historically, energy efficiency has been the single largest source of global greenhouse gas emissions reductions²³. As recently as 2014 to 2016, energy efficiency accounted for more than 75 per cent of the stabilisation of global energy emissions²⁴.

The Institute understands that whilst hydrogen is planned as a key contributor to reducing emissions in alignment with the Paris Agreement, it has a specific role outside of the built environment. Particularly in terms of SA’s emission targets which could see the largest energy consumption of vehicles and logistics, become 100% renewable through hydrogen and biodiesel technology (EEC, 2023).

However, in the process of architectural practices becoming more aware of their responsibilities in auditing ESG of supply chains and designing out embodied carbon, it is crucial for us to continue participation in forums regarding our scope 1,2 and 3 emissions. As

²³ Rosenow, J. and Eyre, N. 2022, “Reinventing energy efficiency for net zero”, Energy research and social science, 90, 102602

²⁴ International Energy Agency 2017, Energy Efficiency Market Report, IEA, Paris

such, we support the development of green hydrogen, which is produced using an electrolyser powered by renewable energy (EEC, 2023). Whilst we acknowledge the role of grey hydrogen in the steel production, we affirm the EEC's (2023) recommendation that Green and Grey Hydrogen doesn't yet prove its return on investment for **cars and buildings**.

2.2 Solar and Roof top PV

2.2.1 Evaluation of the charts and figures provided in the Green Paper.

The duck curve, what strategies it supports.

The duck curve chart for 'Average daily operational demand in South Australia (MW) (fig 16, SA Green Paper), suggests that decreasing daytime demand since 2016 from increased roof top solar installation, needs to be supported with:

- Building fabric improvements to contain energy and store heat/coolth inside the building for keeping homes within thermal comfort overnight. This can be done also by increasing the decremental delay²⁵ times associated with different materials. For instance, a wall with Woodfibre continuous insulation outside of the insulated stud framing, would increase the time that it takes for the outside heat or cool to penetrate the envelope. Whereas current rapid insulation methods in the volume home space often use EPS or foams that are rendered that can still let heat through quickly.
- Increased onsite storage of energy for nighttime release, like batteries.
- If the government doesn't support more electrical storage uptake onsite through incentives, it needs to adopt increased building fabric improvements and heat/cool resistance whilst also providing more wind power or those able to be captured at night.
- Increase the incentives for building owners to automatically monitor indoor environmental conditions in tandem with building fabric improvement. Building Management Systems are often common on high end commercial, however the integration of these systems on a smaller scale is beneficial to reducing energy consumption at night.

Wiring premises and total building electrification

All new buildings and major deep retrofits in SA should be mandated to eliminate gas in their buildings. Also, increase provisions for EV, and incentives for all new buildings to have storage or be able to connect to the virtual power plant. The NCC is already undertaking this in its code iterations however the state could get to the targets sooner.

For buildings that are not physically able to be connected or electrified, or where landlords are not able to achieve connection, the government should support transitions in line with recommendations afore mentioned from the ASBEC 'Low carbon, high performance' Report. Urban planning of communities and councils with each the same right to equitable continuous renewable energy should be a priority for the SA Government.

The City of Adelaide 'Solar Savers' scheme (2017)²⁶, has a model whereby there was upfront assistance by the local governing authority to purchase and install the solar system on rental

²⁵ 2050 Materials '[Decremental Delay](#)' Infographic

²⁶ [cityofadelaide.com.au/media-centre/solar-savers-scheme-makes-solar-more-inclusive/](https://www.cityofadelaide.com.au/media-centre/solar-savers-scheme-makes-solar-more-inclusive/)

and owner-occupied dwellings, with a view to incremental increases in quarterly rates (Australia Institute, 2021²⁷).

The Institute supports recommendations in the Australia Institute's, 'Something new under the sun: Solar PV on South Australian rentals'(2021). This study reported the potential benefits of expanding the City of Adelaide's 'Solar Savers' program more widely through suburbs. This same methodology could be used on a by region scale such as with Adapt West who also have a larger understanding of climate risk and urban heat mapping. Or alternatively, the government could mandate the inclusion of larger systems on all government or owner buildings that are within proximity of non-connected buildings, that can be partially or fully remotely disconnected during peak times, and then are connected and provide the conduit to other buildings around them.

Other enablers that this report highlights are the disclosure of energy ratings, energy costs and providing internal upgrades such as LED lighting and education with rates notices on improvement pathways for rental/owner accommodation. Also citing GEER's 'new to', 'without effort' and 'stressed about' energy segment recommendations²⁸.

Reforms for equity for renters and people in premises unsuited to PV systems.

Building on the GEER 3-energy-segment recommendations for rental upgrades²⁹, there are opportunities to target those new and familiar to energy in the one scheme. Providing circular economy buy back or exchange for energy efficiency upgrades for rentals. First approaching those items within the home that can be best recycled would also support a manageable transition. This would also promote a positive interaction between the tenant and the landlord and could also integrate community or council led education.

GEER's trials included:

- Home energy visits (HEVs): a personal visit to a person's home to discuss their energy usage, bills, tips, payment and support plans, provider offers and personalised attention.
- Major retrofits: involves installing new energy technologies to the dwelling such as insulation and replacement of large appliances (e.g., heating/cooling, hot water systems or refrigerators).
- Minor retrofits: involves installing or providing minor energy savings devices, such as replacement of lighting, draught sealing, or window coverings.
- In-home displays (IHD): provides a real-time measure of energy use in the home which can alert householders to usage, spikes and costs via a display or app.
- Energy efficiency information: providing information via brochures, pamphlets, workshops, or training.
- Digital engagement: involved using digital technologies to engage and/or communicate with households regarding energy efficiency, which may involve one-to-one or online communities.

²⁷ Australia Institute: Browne, B. & Schultz-Byard, N. (2021) Something new under the sun: Solar PV on South Australian rentals. <https://australiainstitute.org.au/wp-content/uploads/2021/01/P943-Something-new-under-the-sun-Web.pdf>

²⁸ GEER Australia (2017) Driving Change, <https://energyconsumersaustralia.com.au/wp-content/uploads/Driving-Change-What-caused-low-income-consumers-to-change-behaviour.pdf>

²⁹ GEER Australia (2017) Driving Change, <https://energyconsumersaustralia.com.au/wp-content/uploads/Driving-Change-What-caused-low-income-consumers-to-change-behaviour.pdf>

- Gamification: using gamification to encourage the practice of energy efficiency behaviours by stimulating participants in a fun way.³⁰

2.3 Energy Storage

2.3.1 Priorities and strategies.

Battery Storage capacity increases onsite before implementation DC and remote disconnection.

The Institute supports the prioritisation of battery storage in the SA emissions reduction trajectory. As noted in the Australian Sustainable Built Environment Council's 'Low Carbon, high performance' report (2016), battery storage provides an opportunity to ensure high performing buildings that are all electric, energy efficient and giving the 'NPV Positive'/financial return to the financiers of construction projects across all types of building typologies. They estimated by 2030 could deliver a little under \$20 billion in financial savings and which was comparable to 32,000 average homes³¹.

They further recommended Government should prioritise zero-carbon energy buildings through energy efficiency, fuel switching, zero emissions electricity and undertaking this will battery storage onsite, offsite and through the grid.

Alternative storage materials – Phase Change Materials (PCM) and alternatives

The SA Government should also seek further energy storage potential in the built environment with overseas studies of **water walls**³² in homes as an energy storage device (thermal mass) and **phase change materials** so that at the source of energy use in buildings, can also capture energy during daytime off-peak hours, and then release heat or coolth overnight, reducing the need an increase in appliances and mechanical interventions that by their nature consume finite resources. These two strategies are already active in Australia and have been proven to assist in the passive storage and release of heat/coolth in a high performing building fabric.

Although there are other innovative storage systems such as the very new **sand storage**³³ battery in Finland, there is considerable research needed before this is tested in Australia. Also, with the scarcity of sand being predicted due to concrete and cement manufacturing requiring it as a base element, it is potentially out of reach.

³⁰ GEER Australia (2017) Driving Change, <https://energyconsumersaustralia.com.au/wp-content/uploads/Driving-Change-What-caused-low-income-consumers-to-change-behaviour.pdf>

³¹ ASBEC (2016) Low Carbon, High Performance. Pg 10.

<https://www.asbec.asn.au/wordpress/wp-content/uploads/2016/05/160509-ASBEC-Low-Carbon-High-Performance-Summary-Report.pdf>

³² Wu, T. & Lei, C (2016) A review of research and development on water wall for building applications. <https://www.sciencedirect.com/science/article/abs/pii/S0378778815304448>

³³ ABC News (2023) World's first 'sand battery' can store heat at 500C for months at a time. Could it work in Australia? : <https://www.abc.net.au/news/science/2022-07-19/sand-battery-debuts-in-finland-world-first-heat-thermal-storage/101235514>

Storage scales and the community renewable energy systems facilitated by government.

The government can assist in planning for scaled battery storage systems onsite by applying a scalable factor for the predicted energy and feed in from buildings.

As per ASBEC's 'Unlocking the Pathway' Report undertook technical reviews with Delta Q that provided 3 scenarios. The second of which aligns to what the SA Government is undertaking which adopts an electrification and green hydrogen strategy. ASBEC's report noted 'for green hydrogen to compete economically with renewable electricity significant technological advances in hydrogen production, **storage** and distribution will be required.³⁴

This option however is also noted to need significant technological upgrades which the Federal government provided a first round of significant funding for in 2023. Storage capacity is required under this scenario.

Consumers central to deployment of operation and storage

With the predicted increase of solar and wind energy generation in SA, it is recommended that the government adopts a 'store and source' first approach. Enabling homeowners to have the opportunity to fully transition to off grid would be the best scenario and in line with current built environment regulatory projections which provide the electrical and other provisions in place during construction. This should be prioritised before oversizing systems to capture and distribute energy to the community.

2.4 Natural Gas

2.4.1 The role of natural gas during the transition.

Lessons from Every Building Counts by the GBCA and The Property Council.

The Institute aligns its recommendations with the GBCA and Property councils 'Every Building Counts' report (2023) highlighting that an electrification strategy should be sought as early as possible. In terms of residential and commercial buildings, it notes under the current 'business as usual' settings, there will be 2 million more homes being built using fossil and natural gases by 2040. The efficiency of these gas appliances is not greater than electrification of homes and as the report highlights, 'this is inconsistent with national goals for a net zero future and sustains unnecessary competition for limited renewable gas supplies³⁵.'

We may the recommendation that all new buildings in South Australia, to obtain energy from 100% renewable electricity. Like Hydrogen, natural gas as a resource should be reserved for the manufacturing sector that require it as part of their strategic trajectory to converting large emitters such as green steel, aluminium, and concrete to a quicker renewable operation, prior to them innovating methods to use Hydrogen to deliver products and materials.

Key sectors to concentrate natural gas during the transition, phasing out quickly.

Green Steel, Aluminium and Concrete industries currently are the main targets in manufacturing that require quicker transition to 100% renewable processes. Whilst these

³⁴ ASBEC (2022) [Unlocking the Pathway](#)

³⁵ Green Building Council of Australia & The Property Council (2023) [Every Building Counts](#).

sectors we acknowledge will be harder to transition immediately, we consider that the strategy planning from these sectors is not use CCS to bury remaining emissions.

The Institute strongly encourages the State Government to seek alternatives to CCS as it has been proven to be unreliable and in terms of ensuring that the state achieves its estimated reductions, cannot adequately assure the community that it can be done so by this means. CCS is used to bury the remaining carbon underground, there are limited examples where the targets for CCS have even been remotely achieved.

As part of a community that supports the rapid change for climate risk mitigation, we do support manufacturing by means of converting to 100% renewables as fast as possible, understand that the materials and constructions need to use some mined resources until technology develops, we wish however for the state government to adopt a reduction of emissions from the outset and proven deliverables prior to emissions offsetting and CCS.

2.5 Circular Economy

2.5.1 Green Industries and GBCA recommendations.

Lessons from Every Building Counts by the GBCA and The Property Council.

The Institute supports a higher level of inclusion of the circular economy (CE) in 'infrastructure and capital works programs' as recommended in the GBCA and Green Industries discussion paper to 'kick start circular economy opportunities and drive demand'³⁶.

As a large contributor to waste in the economy, the built environment sector needs to be supported by government to:

- adopt regulatory updates from the National Construction Code immediately upon release of each 3-year cycle.
- which will reduce the number of buildings requiring retrofit later
- reduce the number of materials that are required for replacement under a whole life cycle assessment
- adopt whole life assessment and disclosure of scope 1, 2 and 3 emissions in the building approval process and allowing the government transparency on the varying CE assets in the form of materials, by-products, and recycling potential to be included in their overall strategic planning.
- Already there are audits done on construction site waste. Making this mandatory and the process of disclosure as part of the development approval process would close the 'quantity' gap, and identify where resources are lost, supplied in surplus and then used on another job and provide transparency for property owners on what the whole life cycle assessment and scope emissions are.

³⁶ GBCA and Green Industries SA (2023) Circular Economy in South Australia's built environment. <https://www.greenindustries.sa.gov.au/resources/circular-economy-in-south-australias-built-environment>

2.5.2 Training needs for circular economy.

There is need to adopt the SA Governments Department of Mining and Energy Zero-Carbon Buildings training³⁷ more widely as a mandatory continuing professional development stream for the trades and those in the built environment. This should be integrated into the mandatory training under the CITB and be rolled out as core competencies for all trades, site supervisors, inspectors etc. It is anticipated that the Institute will also offer support the energy transition in education and advocacy to the wider construction sector.

Similarly, the Institute supports the circular economy training of its members, recently the SA Chapter has also organised circular economy field trips and CPD from the Regenerative Design Committee to Adelaide members and local councils.

2.5.1 Supply Chain risks and opportunities.

As the growth of the decarbonised community is delivered, we highlight the importance of maintaining integrity in the building fabric and health strategies as highlighted in the current NCC 2022 and future iterations. This career defining moment for some in the government planning a strategy that seeks to make substantial change and foundations from which there will be new materials and construction methodology innovated. There is some risk in lack of consultation with key sectors not communicating and working together to achieve a mutually beneficial outcomes, which could lead to more waste in the circular economy, or worse a strategy that ends in landfill.

For instance, rapid construction of petrochemical based structural insulated systems are closed cell materials, don't breathe by themselves and require a different occupational approach to ventilation. If not, they can end up in landfill and therefore we refer the government to the recommendations in our appendix of this document, and as submitted to the Building Ministers meeting in August 2023.

2.5.1 Green Manufacturing strategy development recommendations.

The transition to green steel, aluminium and concrete should be larger targets and inclusion for hydrogen technology as it limits its use of natural gas. The government should support the prioritisation of finite natural gas resources for these sectors, instead of mandating use of gas in the built environment. Gas should be not allowed in any new buildings, and the capabilities of manufacturing to innovative solutions to reaching 2030. We acknowledge that whilst our preference to use no or minimal resources from the planet, it is necessary to continuing mining and manufacturing in these sectors to innovate the products that are needed for electrification.

We also call for the immediate review of biobased, natural and 100% renewable carbon sequestering construction materials, including insulation such as Woodfibre which is already a by-product of existing manufacturing and as a material suitable for both retrofitting insulation to the large number of brick homes in Adelaide, and as a continuous external insulation, increase the energy efficiency and lower the condensation risk considerably. This sort of investment could be an enabler to SA being a large exporter of biobased construction materials Nationally. Also utilising existing and emerging skill sets which are similar in application to this product.

³⁷ Department of Mining and Energy, (2023) Net Zero Homes (NZEH portal)
<https://netzeroenergybuilder.com.au/netzero/welcome>

Carbon sequestration materials and manufacturing should also be a priority for the government as it would encourage the built sector, particularly residential, to become zero-carbon net energy and closer to zero-embodied carbon by 2030. This could be really defining for the economy in SA, as we've noted overseas particularly in the UK, this method is tried, tested, and performs so the supply chain has advanced education already that the state can tap into. They also can provide opportunity to regenerate biodiversity and lower heat island effect around the site of manufacturing and the suburbs which would be better insulated.

The scope of emissions derived from logistics and transports can also be converted to hydrogen and EV based solutions and with the ability for 'design for manufacture and assembly' methodologies already existing at these construction lumber sites, benefit the design and specification process with opportunities to produce most of the structure, insulation and cladding from the same region. Dramatically reducing the ecological and carbon footprint from interstate suppliers.

2.5.1 Energy Transition Recycling Strategy recommendations.

For the construction sector, the Federal Government's Residential Energy Efficiency Disclosure Initiative (REEDI) for existing buildings will likely not commence fully until 2025. Before then, there needs to be a firm plan to support the removal of various building products from existing buildings where the environment, condensation and air dynamics around the building do not support the same methodology for thermal comfort as the homes first life.

Whilst it is hoped at the point of retrofit that the existing building structure is still intact and does not contain rotting members due to poor construction, air sealing and condensation, we expect that this will not be the case.

2.6 Energy

2.6.1 Community, social, environmental and government related challenges during the energy transition.

We believe that there is a larger need for consideration to the health and ecological effects of mining activities for all materials and manufacturing. The SA Green Paper highlights by example, 12 times the current increase in magnetite production in less than 7 years, starting with an increase from today's 2.5 million tonnes to 5 million (2 times) tonnes by 2026. This figure is staggering and although understandably this is good for jobs growth, there is a larger mitigation measure that needs to occur for public health.

As SA is a dry climate, often our dust storms also bring with its elements of chemicals and pesticides from regional lands where manufacturing is the largest. In terms of magnetite and other key minerals, this also can affect the quality of soils and agriculture as demonstrated in multiple media and publications. Such as the ABC News article identifying the hazards of dust born particles of the NSW Central West, Gold Mine³⁸. We feel it is important for the government to consider contaminants not only around these mines, but also through the logistical channels that service central Adelaide manufacturing.

³⁸ <https://www.abc.net.au/news/2021-07-31/lung-linings-are-wet-mine-s-dust-report-raises-alarm/100332652>

The education done by the United Nations on global health pollutants is detailed in its guidance. It notes the pollutants can be airborne, are caused by accident or unintentionally allowing them into the environment, pollute soils through diffuse and point source contamination³⁹. This causes issues with humans, but also with wildlife and biodiversity pockets that are essential to reducing urban heat effects. As climate change itself also is a risk to agriculture, soils and biodiversity, there is need to have additional caution if the SA Government commits to scaling up manufacturing and mining to the degrees needed to support growth towards 2030.

The GBCA and Property Council also highlight in the 'Every Building Counts' report (2023)⁴⁰ the need also for government to 'reduce' by building with 'lower upfront emissions' from the outset. Designing out the need for manufacturing of certain materials and finite resources. This also supports reviewing the ESG strategies and Environmental Management Plans from key mining corporations from the outset, ensuring development of supporting workforces and communities are supported for better buildings able to eliminate particles, gases and the like from the air, soil, and water. We only need to look at the history of oil refineries and the large amount of benzene emitted to neighbouring suburbs and the lifelong, sometimes endocrine disrupting chemicals that can health related issues such as cause cancers⁴¹.

The SA Green Paper notes the increase of workers expected to be needed from manufacturing sectors including the GFG Alliance at Whyalla. There should be a mandate for minimum thermal, energy, and airtightness performance to reduce the number of contaminants inside accommodation. Also, from a portability and prefabrication sense, the rapid construction of workers accommodation could also positively impact the supply chain if there is proper consideration of these thermal, air and sealing minimum requirements and the products to achieve them. The portability of them can also be advantageous in terms of washing off contaminants, if necessary, under an adequate environmental management plan.

2.6.1 Energy Transition Investment Framework.

The Institute supports recommendations from the GBCA and Property Council (2023) and ASBEC (2021) Reports which outline an overarching recommendation to Local, State and Federal Governments⁴². This recommendation should form the basis of the SA Government development of a framework that also nationally aligns to tools and targets being developed in other jurisdictions.

2.6.1 Green Mining and Processing Strategy.

The EPA SA cites the National Pollutant Inventory which demonstrates 70% of pollutants in SA are from domestic emissions in metropolitan Adelaide. The other 30% they cite as being from manufacturing and regions surrounding this which experience soil dust pollution, airborne and dust hosted pollution, smoke particles with bushfires and smoke during winter to heat buildings. Also, the natural air dynamics around buildings and urban infrastructure can fluctuate and then cause a build-up of these pollutants and inability for air to clear due to

³⁹ United Nations (2021) [Global assessment of soil pollution](#):

⁴⁰ GBCA and Property Council (2023) Every Building Counts.

⁴¹ United Nations (2021) [Increased cancer risk for petroleum industry workers and people living near plants: New UN Study](#).

⁴² GBCA and Property Council (2023) Every Building Counts. Local, State and Federal Editions. and ASBEC Trajectory for Low Energy Buildings

insufficient air travel. The Institute supports transitioning away from all internal wood and gas heaters which largely contribute to indoor airborne pollutants⁴³ for housing, and alternative non-petrochemical or fossil fuel-based infrastructure as soon as possible.

The EPA SA also notes that 'Australia is the second highest emitter of sulphur and nitrogen oxides per capita of OECD Countries, and that globally 6.5 million deaths are contributed to air pollution.

2.7 Built Environment

2.7.1 Residential sector.

SA Building Ministers Meeting on the NCC 2022 implementation and recommendations for science and health-based targets from the Australian Institute of Architects.

The Institute has provided this document in the appendix 1 to ensure it is in line with the submission issued to the Hon Minister Champion in August.

2.7.1 Commercial sector.

GBCA, Green Star and NABERS.

[NABERS Embodied Carbon Paper submission](#) by the Institute supports the development of a Nationally recognised and applied tool that covers energy and embodied carbon.

The NABERS tools also provide a renewable energy indicator and there is also growing requirements for mandatory disclosure.

It is recommended that the Government, should adopt a structured mandatory minimum of buildings to reach a Green Star or NABERS Rating. Due to the flexibility of Green Star, there are even fit out strategies and options for the adaptive re-use space.

2.8 Transport

2.8.1 Hydrogen and electrification of transport

Whilst the sector of transport is high relevant to the Institute, we make no recommendations other than has afore been mentioned in this submission. That is relating to a state-based inventory or tracking means to start ensuring the decision-making process for specification and sourcing of materials, products and vetting of ESG measures of suppliers are managed centrally by the government.

We also support measures to implement more walkable neighbourhoods and utilisation of electrified public transport to ensure there is less need for building owners to need a vehicle. This approach also supported by 'Every Building Counts'⁴⁴.

⁴³ Environmental Protection Authority SA (2018) [Pollution Sources](#).

⁴⁴ Green Building Council of Australia & The Property Council (2023) [Every Building Counts](#).

2.9 Final trajectory and recommendations summary

The Institute and SA Chapter would like to encourage review of the appendix documents attached to this submission, of which recommend a pathway for the built environment and implementation of the NCC for South Australia. Our alignment to ASBEC, GBCA and Property Council Reports is made evident in our calls for electrification and energy efficiency as priorities for our sector and those supply chains that service us.

APPENDIX 1

2.10 Science and health targets in South Australia’s residential sector: “don’t leave health to a game of chance”.

file name: AIA SA Chapter _ Science based targeting for residential housing

APPENDIX 2

2.11 AIA SA Chapter – submission to the trajectory for NCC LHD

AIA SA Chapter _ Submission to the trajectory for NCC LHD _Final

GLOSSARY

DER -	Distributed Energy Resources
PV -	Photo Voltaic (solar)
FiT -	Feed in Tariff
EV -	Electric Vehicles
DC -	Direct current
AC -	Alternating Current
CCS -	Carbon, capture and storage
MW -	Megawatts
GHG -	Green house gas
Pj -	Petajoules – one petajoule is 10 ¹⁵
Kt -	Kilo-tonne
CLT -	Cross Laminated Timber
XPS-	Extruded Poly Styrene (foams)
EPS -	Expanded Poly Styrene (foams)
EEC -	Energy Efficiency Council
ASBEC -	Australian Sustainable Built Environment Council
ESG -	Environmental, Social and Governance
GBCA -	Green Building Council of Australia
NABERS -	National Australian Built Environment Rating System
AEMO -	Australian Energy market Operator
NCC -	National Construction Code
ABCB -	Australian Building Codes Board
CITB -	Construction Industry Training Board
EPA -	Environmental Protection Authority
DTS -	Deemed to Satisfy Method (compliance)
VURB -	Verification method (compliance)
GEER -	Group of Energy Efficiency Researchers
REEDI -	Residential Energy Efficiency Disclosure Initiative
NatHERS -	The Nationwide House Energy Rating Scheme
NPV -	Net present value
CE -	Circular Economy
CPD -	Continuing Professional Development