Australian Institute of Architects

ACT Chapter

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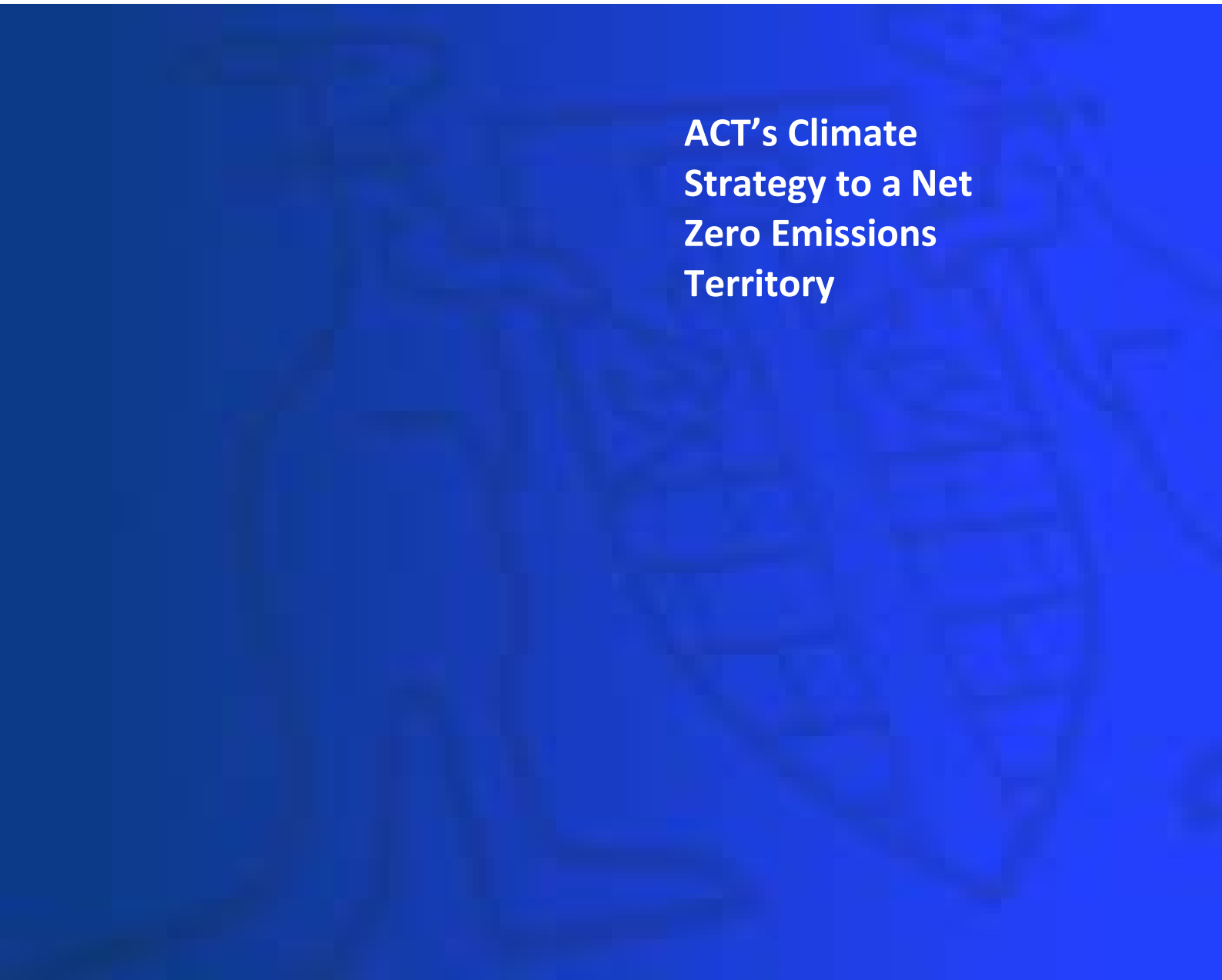
Submission to Director-General, Environment, Planning and Sustainable Development Directorate,



ACT's Climate Strategy to a Net Zero Emissions Territory

SUBMISSION BY

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PURPOSE

This submission is made by the ACT Chapter of the Australian Institute of Architects (Institute) to the ACT Government, Environment and Planning Directorate to provide comments on the Discussion Paper *ACT's Climate Strategy to a Net Zero Emissions Territory.*

Comments have been prepared by the ACT Chapter Sustainability Committee.

At the time of this submission, the ACT Chapter President of the Institute is Philip Leeson.

The ACT Chapter Executive Director is Leanne Hardwicke.

INFORMATION

The Institute is the peak body for the architectural profession in Australia. It is an independent, national member organisation with around 12,000 members across Australia and overseas and represents around 320 individual architects representing small and large practices within the ACT.

The Institute works to improve our built environment by promoting quality, responsible, sustainable design.

The Institute exists to enhance the cultural, environmental and economic well-being of the community by:

- advancing contemporary practice and the professional capability of members, and
- advocating the value of architecture and architects

1. INTRODUCTION

The following comments are made by the Australian Institute of Architects, ACT Chapter, (the Institute) on behalf of its 320 members. The Institute is supportive of the initiative to reduce or eliminate the Territory's reliance on non-renewable and greenhouse emitting fossil fuels and appreciates the opportunity to provide comments and suggestions on ways in which the Territory can progress this strategy.

2. ARE THE INTERIM TARGETS APPROPRIATE?

The Interim targets are set at 50-60% reduction by 2025; 65-75% reduction by 2030; and 90-95% reduction by 2040. We offer the following general comments with respect to the inclusion of transport, the reliability of supply of renewable energy for peak periods, impact of the non-inclusion of scope 3 emissions, the impact of the move from gas to electricity for space heating and the future of the energy efficiency improvement scheme with regard to the ability to reach the interim targets.

To determine whether these targets are appropriate, it is necessary to examine how net emissions are calculated. The Institute sees an issue with the measurement of emissions inside a theoretical geographic island around the ACT. We believe that setting an aspirational goal to 100% carbon free operation could be misleading, particularly when the single major emissions class remaining after 2020 relates to transport.

Given the ACT's function as a regional commercial and administrative centre, a high proportion of cross border traffic occurs every day from residents commuting from NSW to work in the ACT. It would seem anomalous not to include these emissions in the total, or plan for transport systems that would reduce the emissions of frequent travel to and from the ACT[1].

Discussion of air transport and the development of a fast train link to Sydney and Melbourne would seem necessary as part of such considerations.

Development of electric vehicle infrastructure on the main arterial connectors to Sydney, Melbourne and the south coast of NSW would seem to be a sensible inclusion in the overall emissions policy.

The Institute would like to see a better definition of the term Net Zero Emissions. Without security of supply of renewable electricity at all times, 100% carbon free operations will not be achieved. The Territory must be able to either use surplus renewable electricity from elsewhere or be able to tap into stored renewable electricity during peak times. Buying cheap renewable wind power from South Australia and offsetting it against gas or coal power in peak times becomes an accounting activity that does not achieve the stated aims of 100% renewable energy use by the ACT.

We assume the premise for having a Climate Change Strategy and accounting for emissions is to direct policy and change behaviours. However, the non-inclusion of Scope 3 emissions may distort the market/outcomes and result in solutions that may not be the best on a country/global level. Examples of perverse outcomes could be:

- Lithium-Ion batteries are encouraged over local pumped hydro as their emissions are not counted, whereas the construction and upkeep of a local pumped hydro would be counted.

[1] Analysis of commuter numbers to the ACT from surrounding regions; Canberra's Influence on the Surrounding NSW Economic and Housing Markets; prepared by SGS Economics and Planning, 2015: http://www.planning.nsw.gov.au/~/media/3966DF5D2B0140CDAEE21D3416E2CC63.ashx

- Catching a bus to Sydney would be counted if the bus refuelled in the ACT, whereas flying a plane would not.
- Local recycling of buildings and materials would be discouraged as the emissions involved in recycling would be counted whereas bringing in new materials across the border would not.
- Imported materials and products with very high embodied energy/ transport miles may be prioritised even when their increased performance is only marginal. These materials and products would be prioritised because their marginal performance is counted whereas the embodied and transport energy is not.

Further development of the Australian Life-Cycle Index (Building Products Innovation Council) and requirement of assessment of life-cycle embodied energy for buildings and civil works should be made an inclusion into the overall emissions assessment.

Transitioning from gas to electricity for space heating, in conjunction with 100% renewable electricity supply, will make winter peak loads a significant issue. We believe that investment in local storage solutions such as pumped hydro should be a priority. Also a priority is the need to work with the other states to strengthen grid infrastructure and increase the size of interstate inter-connectors so that when there is surplus renewable energy from northern states, the Territory can import it for our winter heating.

We note that at the last Energy Efficiency Improvement Scheme workshop, there was mention that when the ACT reaches 100% renewable electricity by 2020, there will be no requirement for the scheme in the future. This appears to ignore the fact that energy efficient buildings and building envelopes are by far the cheapest form of storage and peak avoidance as well as acting to decrease pressure on the grid infrastructure. As we move towards 100% renewable by 2020 there will be many buildings that are not energy efficient and an increased focus on energy efficiency in buildings would be more economical compared to pumped hydro and batteries.

The Institute would like more information on the coordination between ACT and NSW in terms of setting the Territory's interim goals. The Institute believes the interim goals to be sensible and well-timed to allow for complete transition by 2050, however, we believe the community would also benefit from knowing what their global emissions are, not just those emissions accounted for in the ACT.

3. REDUCTIONS FROM THE ENERGY SECTOR

Major improvements can be made in building construction industry and to the existing housing and commercial building stock to reduce energy use and emissions. While good steps were taken in the early years of self-government in the ACT, momentum for continuing improvement has greatly reduced. Inertia from the COAG processes that oblige the ACT to conform to nationally agreed energy efficiency standards under the provisions of the National Construction Code have been largely to blame, however, the decision in 2005 to remove consideration of building energy efficiency from Development Approval Assessment and place it in the later (less conceptual) Building Approval Assessment stage has had a retrograde impact on energy efficiency outcomes.

The NSW Government decided to implement the BASIX Sustainability Index (rather than adopt the Energy Efficiency section 3.12 of the residential code), and has been able to develop a much more comprehensive and effective scheme as a result. Section J of the commercial code has, on balance, been more easily implemented and consistently applied across the various state jurisdictions, having much more emphasis on deemed-to-satisfy compliance and use of model building comparison. Compliance for commercial buildings is generally achieved within the broader mechanical system design process, which happens as a matter of course in the overall design development.

Housing, while using the larger proportion of total energy (than commercial buildings), represents a more difficult problem for management of emissions. Use patterns are much more diverse than for other building types, as is the range of physical variants. The NatHERS system[2], which has provided the benchmark for assessing housing energy efficiency under the NCC provisions since 2003, has not changed the required level of compliance stringency since 2010. In the ACT, this equates to 165MJ/m^2/yr, or 6 stars on the NatHERS 10-star scale[3]. While unquestionably saving energy in comparison to the construction standards that prevailed pre-2000, the pass-level energy use is still quite high and represents an opportunity for significant improvement in emissions reduction, particularly given that most residential space heating still makes use of natural gas.

In 2009, the COAG National Strategy for Energy Efficiency (NSEE) was implemented with the stated aim of "accelerating energy efficiency improvements" and was structured with a 10 year time-frame, running through to 2020. The ACT has been a party to the NSEE, but deviates from the general NatHERS structure in terms of its mandatory disclosure scheme for residences at point of sale, and also in the way in which residential refurbishment and extensions are assessed as set out in the ACT Amendment 7 to the NCC.

While cognisant of the problems entailed in coordination with a nationally administered rating scheme, the ACT HERS scheme has a number of specific problems that are in need of urgent attention:

- The mandatory disclosure ratings use a scale that does not directly relate to the current NatHERS scale, being a six-star scale, not a 10 star scale. The software is also outdated and unsupported by its developers. This creates confusion in the public mind and leads to anomalous results where houses are often rated under two different systems.
- The system of construction checks that are enforced as part of the construction certification system does not have sufficient inspection points to allow inspectors to adequately assess whether all measures described in the NatHERS energy efficiency report are actually being successfully built in to each project. The mandatory pre-sheet inspection stage, for instance, has typically required plumbing and electrical services to be inspected, but in order for these to be done, insulation is generally delayed until after the inspections have taken place. Certifiers will generally rely on compliance documents provided by the insulation installer, which amounts to self-certification. Similarly, under-slab insulation is virtually never visible when the in-ground services and reinforcement checks are done. Unless architects are present to do independent contract compliance checks (a small minority of cases) many items connected with the building envelope quality remain without site checks.

[2] http://www.nathers.gov.au/about
[3] How the Rating Scale works: http://www.nathers.gov.au/owners-and-builders/star-rating-scale-overview

- The NatHERS system that is used for new house and extension compliance concentrates only on energy efficiency of the building envelope. Major heating and cooling equipment and appliances like water heaters, refrigerators, cookers, ovens, washing machines and dish-washers are not assessed as part of the system, as is done under the BASIX scheme.

  Water use is not assessed, and also, alternative energy production installations, such as solar water heaters and PV electrical production equipment is not part of the assessment. These shortcomings are currently being addressed as a part of the CSIRO CEMP (Carbon Emissions Measurement Platform[4]) development program, and the ACT should support the completion of this new assessment tool and work towards its adoption, both for the ACT and across the other states.

Increasing building envelope efficiency for both residential and non-residential buildings is the low-hanging fruit of the emissions equation[5]. The cost of insulation and weather sealing is relatively cheap in comparison to the operational costs of paying for increased electricity or gas use over the service life of a building. The principles of passive solar design and construction are well tried and proven, but require more consistent regulation and higher standards of construction for the benefits to be fully realised. The German-derived Passive House design approach is also rapidly having an impact on the Australian market and shows real potential for producing energy efficiency benefits when lighter weight construction is used, thus making it applicable to housing retro-fit – one of the most difficult areas for implementation of energy efficiency improvement.

The least carbon intensive energy is the energy that is not used. This should be a guiding principle for future built environment development in the ACT, with rapid improvements to building envelope efficiency being a firm priority.

Gas vs Electricity

In 2014, the Grattan Institute released a well-researched study into gas use for space-heating, water heating and appliances – "*Gas at the Crossroads*"[6]. This research principally examined the economic trends affecting gas use and supply, and made a convincing case for reduction in domestic use in favour of electricity, based on the relative merits of export earnings against continuing domestic use with an artificially reduced price.

Further to the rapidly increasing price, largely being driven by international demand and the increasing costs of coal seam extraction, reliance on gas is still producing relatively large amounts of emissions, as the ACT Climate Policy discussion paper has shown. Extraction by non-traditional means, such as coal seam, has a much higher emissions profile than co-extraction from oil deposits. Combined with this, fugitive emissions from pipeline losses further reduce the efficiency of supply and combustion emissions.

[4] Carbon Emissions Measurement Platform: http://www.energyinspection.com.au/news/

[5] Benefits of building envelope efficiency: http://www.asbec.asn.au/research-items/bottom-line-household-impacts-building-code/

[6] Economics of gas use in the home and business: https://grattan.edu.au/report/gas-at-the-crossroads-australias-hard-choice/

Modern heat-pump technology can produce performance coefficients of almost 6 (and even over 6 when used in conjunction with ground-source heat recovery) and this level of efficiency (at rapidly decreasing cost) has made electrical energy a preferred option in recent years, particularly when combined with roof-top PV production.

The potential to reduce energy use to zero, or even run households on an energy positive basis is available now using current, commercially available technology with electrical energy use being offset by roof-top PV production.

The economics of taking this approach are contingent on some physical attributes of a building and site such as:

- Site size and shape
- Roof geometry and area being compatible for mounting PV cells, or having other practical locations where PV cells can be installed on a site
- The age and condition of the electrical system and wiring
- Whether rebates are available that reduce the effective gas tariff

The 2014 Alternative Technology Association Report "*Are We Still Cooking with Gas*"[7] covers many of the possible economic and emissions scenarios for new and existing householders who may be making a judgement on adopting new electrical appliances to replace gas appliances.

Making a transition from gas to electricity is the most difficult when considering the existing housing stock, and this is where the most concerted effort should be placed. Existing housing is also the numerically greater cohort in the ACT, thus offering the best potential for total energy and emissions reduction, and much of it is ageing and in variable condition. The successful Energy Efficiency Improvement Scheme, which has been operating in the ACT since 2012, provides a model for assisting the most vulnerable members of the community to make improvements to simple building envelope items and inefficient electrical appliances. This scheme could be expanded in the near/ medium term to include houses that are undergoing significant refurbishment and/or extension, thus giving some incentive to householders to take better advantage of their opportunity to improve the emissions profile of their property through the course of building work that would be happening in the normal course of events.

The scheme should also be developed so that rental properties are upgraded. Large, poorly insulated rental properties in the inner suburbs will increasingly be the largest emitters. Action should be taken to remove the split incentives between landlord and tenant. Consideration could be given to legislating a minimum standard of energy efficient building shell, hot water and space conditioning for all rental properties in combination with government incentives or no interest loans to landlords.

Extension of the Large Scale Photovoltaic Rebate Scheme

The Large Scale PV Rebate Scheme has principally been aimed at commercial installations in its roll-out to date, however, an opportunity exists for possible extension into neighbourhood schemes that could serve otherwise difficult housing stock in older suburbs where refurbishment options for the building fabric may be limited and availability of space for individual mounting of PV systems is restricted.

[7] Sustainability of using gas vs electricity: http://www.ata.org.au/news/are-we-still-cooking-with-gas/

Some examples of neighbourhood-scale PV installations have been installed in the ACT region (e.g., Mt. Majura Solar Farm) and this principle could be extended to allow for subsidised neighbourhood-scale generation sited at, for instance, neighbourhood parkland, roadway median strips and verges in situations where elevated arrays could be practically fixed in place. A solar resource mapping exercise would be a logical step towards exploring this option.

Carbon Budget

In the past twenty years, much effort has been expended in developing systems to accurately assess implied energy use relating to building envelope characteristics, and, to an extent, total house resource use (BASIX, Accurate Sustainability and BersPro Appliance Energy Tools, NABERS Home Energy Explorer among others). To date, the thrust of these tools has been to produce comparative rating scores for the purposes of achieving compliance with legislated energy use, and water use targets.

A wealth of data has been collected, and to some extent, the systems have been analysed for their effectiveness in use. For example, the Evaluation of the 5 Star Energy Efficiency Standard for Residential Buildings undertaken by CSIRO, 2011- 2014[8].

When deciding on the next step in a path to true Zero Energy use in buildings, it would seem logical to explore how carbon budgeting could be introduced into the rating system to convert the existing score-based output into realistic emissions data. At present, information relating to occupancy assumptions and use patterns are kept hidden from view in the program output that is made public to building owners and purchasers, but this need not be the case. It is a relatively easy procedure to allow for assessment software to be used for accurate predictive emissions reporting, which could, in turn, be used to produce carbon budgets for any house or building that passed through the rating process[9].

Appliance energy, heating and cooling equipment, ancillary equipment, such as irrigation and pool pumps, and energy production equipment such as PV, wind and micro-hydro could all be included in the overall assessment and matched against a pre-determined budget. Incentives could be given to meet the budget limits through mechanisms such as rates reductions or payments of commercially appropriate tariffs for electricity production and feedback to the grid.

Such methods would be well suited to integration into the electric vehicle transport network as it emerges, with its related requirement for carbon neutral electrical power for an expanding charging network.

4. EMISSIONS FROM TRANSPORT

The built form and planning of the ACT has always presented problems for the efficient operation of a public transport system. The current bus system is well-managed and efficient within the limits within which it operates. It is, however, handicapped to a great extent by the decentralised nature of the city plan, which has always been configured with private automobile transport as the presumed best option.

[8] CSIRO report into the effects of stringency change in NatHERS from 3.5 stars to 5 stars: https://industry.gov.au/Energy/Documents/Evaluation5StarEnergyEfficiencyStandardResidentialBuildings.pdf

[9] Net Zero Emissions Homes – An Industry Framework: http://asbec.asn.au/files/121213%20ASBEC%20Industry%20Roadmap%20-%20FINAL.pdf

The low density structure of the city has many benefits in terms of its capacity to contribute to micro-climate control, air quality, maintenance of habitat for native fauna and social and psychological benefits associated with living in an urban forest. The Living Infrastructure Plan, as outlined in the February 2018 information paper, is a necessary step in managing and consolidating the ACT urban forest and open spaces and should be commended and supported by the community.

The Institute has previously supported the general principal of densification of the city along corridors defined by the existing town centres and the major arterial roadways joining the centres. This process is now well under way, and has general community support because of the need to provide more housing choices for a younger population at more affordable prices. The quality of the higher density housing has, up to this point, been patchy, but this will no doubt improve with time and increasing familiarity with the typology and its potential problems.

Increasing density by itself will not solve the over-arching transport emissions problem however, as the city will always have a major suburban component away from the town centres and planners will increasingly need to cope with commuters from outlying satellite centres – predominantly the Queanbeyan/Googong/Bungendore region (with the many rural subdivisions like Weetalabah, Royalla and Wamboin) and the Yass Valley region. Thousands of commuter trips from these areas occur every day, and given the nature of the regional expansion, and search for lower cost housing in outer lying locations, this level of commuter transit is only likely to become greater over time.

The only practical solution to reducing emissions from these sources is to tackle the problem at its source and convert the transport fleet to low/zero emissions fuel sources over the period under consideration for this policy. Australia (and the ACT is no exception) has been relatively slow, by international standards, to adopt vehicle electrification. Important starts have been made in establishing a charging network in the ACT over the past 5 years, but much more could be done with well-targeted planning and administration.

In West Australian, the Royal Automobile Club, in co-operation with various local governments, has recently finalised plans to open an "electric highway" linking Perth along the main coastal highway to Augusta in the far south-west. This route is one on the region's major tourist pathways, taking in the Margaret River winery region and other popular attractions[10]. The ACT could benefit in many ways from a similar infrastructure project aimed at building up an electric charging network to cover the Sydney-Canberra, Canberra-Melbourne route, along with the much-used Kings Highway route joining Canberra with the south coast regions of NSW. The Barton Highway connection to Yass would also be an essential inclusion.

Within Canberra, the beginning of an electrified public transport system is presently occurring with construction of the Light Rail system from Gungahlin to Civic Centre, and this can only benefit the city as it extends to cover more of the town centres.

Attention needs to be given to planning for renewable energy supply to the electrification infrastructure, as it is only with this step that the long-term emissions reduction benefits of vehicle electrification will be realised. Electric vehicles can also play a critical role in the overall renewable energy storage task by providing a ready source of thousands of batteries which will inevitably have spare capacity when considered as a single storage entity.

[10] RAC Electric Highway from Perth to Augusta: https://rac.com.au/about-rac/advocating-change/sustainability/electric-highway

5. EMISSIONS FROM WASTE

At present, the methane production from the Mugga Lane landfill site is burned in an internal combustion generator in order to produce electricity. The process is much more efficient and productive than simply leaving the waste methane to escape into the atmosphere because the combustion products from the generator (CO_2) are twenty times less influential than methane in terms of greenhouse heating potential. It is also valuable in terms of electricity production. However, because the process is continuous, significant emissions still result.

Rather than follow the present path of methane to electricity and CO_2 conversion, another much less emissions intensive pathway is available by using steam-methane reformation or partial oxidation in order to produce hydrogen, which can, in turn, be used in hydrogen fuel cells to produce virtually zero emissions electricity. Both of the above processes still produce some CO_2 as a product of the reactions, however the quantity is much less than that produced by direct combustion of the methane.

Further to this, current research is indicating great potential for elimination of associated CO_2 by-product in hydrogen production. Two such processes currently being tested are:

- Gas separation membrane reactors as developed in Spain by a consortium consisting of the Institute of Chemical Technology, Valencia Polytechnic University and Superior Council of Scientific Investigations. This is a single step process which isolates the (much smaller) CO_2 by-product for storage and sequestration[11].
- A revised form of a process called methane cracking has been developed by researchers at the Karlsruhe Institute of Technology in Germany. This process has the potential to virtually eliminate CO_2 from the hydrogen production through use of molten tin columns in a reactor that separates out the carbon from the methane into a solid form powder.[12]

Low-carbon methods of hydrogen production are well worth investigation due to their potential to produce completely clean combustible fuel for use in fuel cells, and also for their potential to convert methane, one of the major greenhouse gases, into a much less harmful product.

With regard to another critical waste treatment subject - removal of plastic waste from the ecosystem, the French Company Atlantique Polymeres Valorization has had considerable impact over recent years in expanding recycling plants across Europe that effectively re-use many types of soft plastic, in addition to the traditional sources, for recycling and re-use in a variety of building products and industrial design materials[13]. The ACT could benefit by carefully examining options and implementing similar re-manufacturing and up-cycling processes for plastic waste.

6. CONCLUSION

The Institute congratulates the ACT government in taking steps to reduce emissions and build a sustainable, prosperous and healthy future for the ACT and our region.

[11] Development of Gas Separation Membrane Reactor: https://www.sciencedaily.com/releases/2017/12/171208171749.htm

[12] Methane cracking – hydrogen from Methane without CO_2: https://newatlas.com/hydrogen-production-methane-without-co2/40502/

[13] APV Plastics Recycling: http://apvrecycling.com/

The Institute is grateful for the opportunity to present its views on the ACT climate strategy.
If you would like further information on any aspect of this submission or on related matters, please contact the ACT Chapter Executive Director, Leanne Hardwicke on (02) 6121 2010 or email: leanne.hardwicke@architecture.com.au

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