A2EP response to the Electricity and Energy Sector Plan discussion paper

May 2024

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Introduction

The Australian Alliance for Energy Productivity (A2EP) welcomes the opportunity to contribute to the Electricity and Energy Sector Plan discussion paper and acknowledges the importance of such work which will affect the prosperity of Australia for generations to come. We commend the Government's approach to receiving feedback and are available for further consultation to clarify our recommendations.

About the Australian Alliance for Energy Productivity

A2EP is an independent, member-based, not-for-profit organisation focused on improving the productivity of energy use and decarbonisation. We represent a broad range of members across manufacturing, research, consultants, equipment manufacturers, energy utilities and contractors. Through our member network we reach more than 1,000 of Australia's top manufacturers and energy users. Our members are listed in Appendix A.

We have worked with a diverse range of public, private and not-for-profit collaborators, including Climate-KIC Australia, the Institute for Sustainable Futures at the University of Technology Sydney, ClimateWorks Australia, CSIRO, the Energy Efficiency Council, RMIT University, the Australian Hydrogen Council, and numerous other industry associations, consulting and contracting firms and suppliers of products and services.

Our recent projects have spanned themes including renewable heating, Industry 4.0 solutions, bioenergy in general and anaerobic digestion in particular, on-farm energy productivity, flexible electricity demand and demand control and decarbonisation in practice. We've worked across the manufacturing, agriculture and transport sectors and more recently in commercial buildings.

A2EP is highly regarded for its stakeholder engagement and industry consultation. We're expert at facilitating information exchange. We have well established networks of people who work day-to-day in business, their industry associations and the people they rely on for information and support. More information is available at https://www.a2ep.org.au

From A2EP's work with feasibility studies and demonstration projects, we understand how energy is used and what it is used for with a special focus on renewable heating. We engage with businesses in conversations about how their sites work, how their organisations function and how decisions are made.

Energy productivity is essential to a just energy transition

A2EP is a long-standing advocate for better energy performance. Our view is that energy performance (or productivity) improvement enables the least cost pathway to hit net zero targets by first reducing energy demand and maximising the benefit from each unit of energy consumed. Energy productivity improvement is an essential contributor to increased renewable energy uptake as it reduces the amount of new infrastructure required and optimises what will be built.

Our work over recent years has focused on the 'how' of what needs to be done to achieve emission reduction targets, particularly in the manufacturing, agriculture and freight transport sectors. We believe that the potential for improved energy performance – driven by better equipment, digitalisation and integration, appropriate regulation and new business models – needs higher prioritisation by government. Energy productivity improvement is crucial to:

- maintain reliability of the services driven by energy
- optimise the cost of providing those services
- alleviate stress and risk in energy supply chains
- minimise CapEx and OpEx for energy-related infrastructure
- secure local manufacturing and jobs
- stabilising the grid to allow for more renewable generation
- facilitate the transition from natural gas
- reduce emissions

A2EP's concerns about the underlying assumptions in the Electricity and Energy Sector Plan discussion paper

The current discussion paper has a series of underlying assumptions which is contributing to sub-optimal resource allocation to the detriment of existing manufacturers and jobs in Australia. Our concerns relating to these assumptions are listed below.

A2EP is Australia's leading industry body for renewable heating in the commercial and industrial sectors

Energy used for heating in industry makes up 23% of total final consumption but is receiving far less attention from government policy when compared to electricity supply. A2EP estimates that more than 40% (>400 PJ) of this heating will be done through electrification.

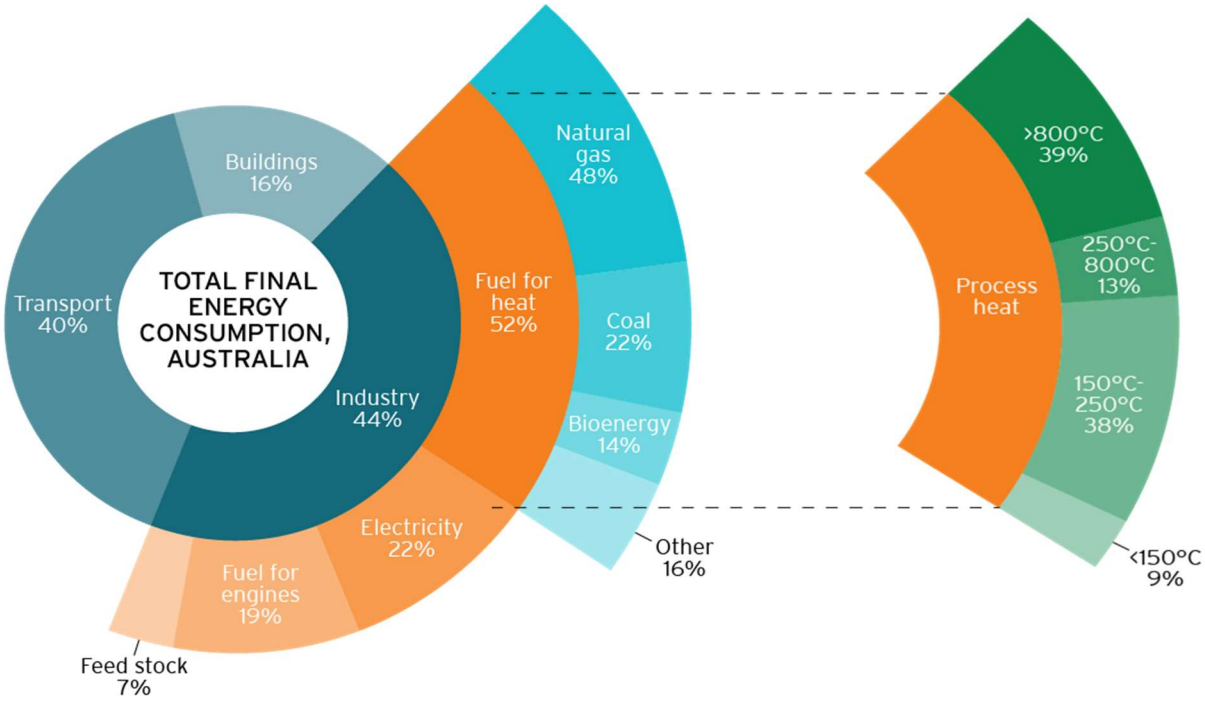

Figure 1: breakdown of industrial process heat in the context of total final energy use in Australia. Source: ITP et al 2019, Renewable energy options for industrial process heat

1. AEMO Draft 2024 ISP modelling of industrial electrification needs urgent updating

Following A2EP's national boiler mapping study and subsequent modelling we have concluded that the estimate in AEMO's Draft 2024 Integrated System Plan (ISP) for electrification of industry is grossly under-estimated when using CSIRO's multi-sector energy modelling under the step-change scenario, which estimates ~70 TWh (40 TWh in Western Australia and ~30 TWh for National Electricity Market connected areas) for industry heating and transport. A2EP modelling estimates that renewable heating alone (i.e. excluding industrial transport) will account for approximately 116 TWh of additional renewable electricity demand on a BAU basis. Underestimating the demand will result in poor resource planning for renewable energy generation, transmission and distribution which will jeopardise local manufacturing jobs and create delays to reaching government targets.

A2EP's estimate of future process heating technology mix with current trajectories is shown in Figure 1. An additional requirement for ~419 PJ of electrification should be noted. If biomass, such as sugar cane bagasse, were diverted to production of higher value-add products such as sustainable aviation fuel then the electrification requirement would be >10% higher.

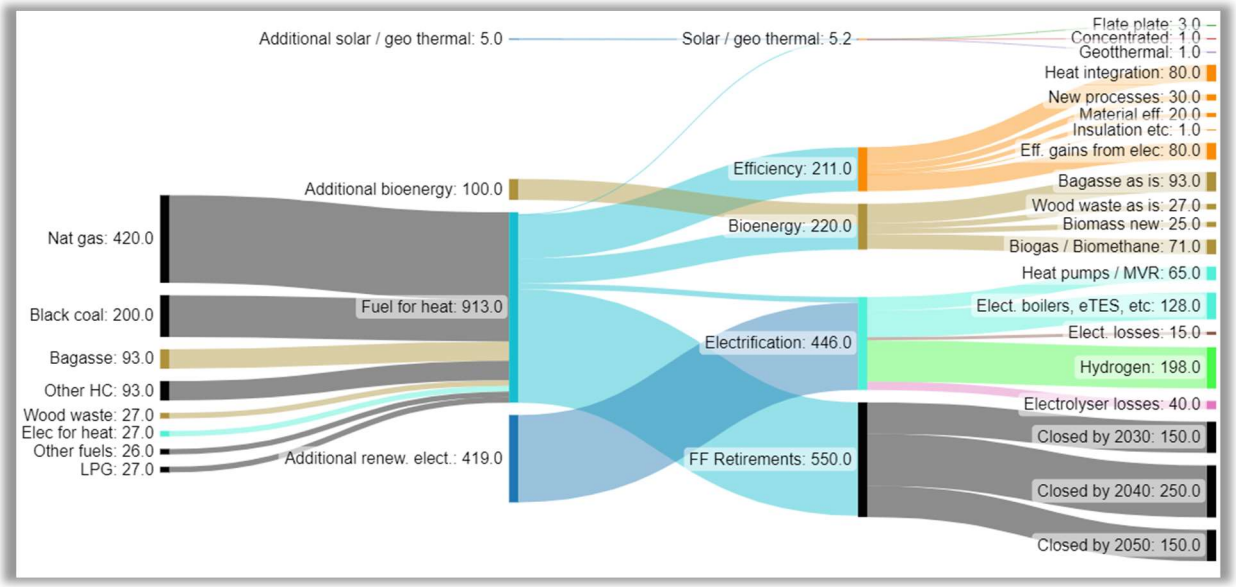

Figure 2: A2EP's modelling for future heating needs in Australia to 2050, BAU case, current policy settings trajectory.

2. The speed of the electrification roll-out is being overestimated

Similar to the underestimation of industrial electrification potential, the assumption of transmission from renewable energy zones (REZs) to be built in 2027/2028 to allow 82% renewables target to be met are likely incorrect. A2EP consultation sees a consensus view of more like 70% renewables being met by 2030 which means replacing natural gas with direct electrification of heating will not provide a decarbonisation result until after 2030 when using grid-based emission factors for Victoria, New South Wales and Queensland.

Furthermore, the current wait times for grid studies are reducing the appetite for behind the meter solar PV investments.

3. The potential of bioenergy for renewable heating (and transport) is grossly under-estimated and the assumption of delivery via the existing gas network is reducing the opportunity

Bioenergy is a major untapped resource as highlighted in *Australia's Bioenergy Roadmap* (ARENA, November 2021) which identifies 2,600 PJ of theoretical energy potential or more than 65% of Australia's final energy demand.

The assumptions are that biogas needs to be upgraded to biomethane (which adds $5 to $10/GJ) and needs to be distributed by the existing network (which adds a further $2 to $10/GJ). These assumptions greatly reduce the estimated opportunity for bioenergy. In reality, biogas can be piped directly to nearby industrial users with minimal upgrading at an economical rate.

Furthermore, we note the general exclusion of biomass as a potential contributor to a low carbon future in the energy transition, especially for renewable heating as noted by the lack of reference to this option in the discussion paper and other government modelling (such as the Victorian Gas Substitution Roadmap).

Barriers to transforming Australia's electricity and energy sector

Below we have listed a number of the barriers that we see as impeding the improvement of Australia's electricity and energy sector.

1. Lack of data on heating demands, bioenergy feedstocks and waste heat

Australia's renewable heat transformation will require extensive modelling and planning however the data for these exercises is currently not available. Lacking data is also supporting poor resource allocation such as the inflated expectation of hydrogen's role in decarbonising process heating.

Poorly organised and presented data of bioenergy feedstocks (eg waste biomass, food processing waste etc) at National Maps (nationalmap.gov.au) is leading to poor resource allocation and prioritisation of bioenergy as a energy vector.

2. Too much focus on renewable energy supply, not enough on renewable energy demand and usage

Government policy and programs have rightly focussed on kick-starting the renewable electricity industry but now need to rebalance this focus to support the industries that will use a large portion of renewable electricity. For example, when electrifying heating systems, thermal batteries need to be incorporated with the initial designs to ensure the new heating system is ready to load-flex with variable electricity supply to optimise network utilisation and renewable energy storage.

3. Too much focus on renewable electricity supply resulting in neglect of bioenergy and energy demand opportunities

Australia's current energy policy greatly favours renewable electricity production, resulting in neglect of other valuable renewable resources, such as landfill gas, wastewater biogas, biogas from other organics (e.g. agricultural residues, food waste, etc.), waste biomass (saw dust, etc.), solar thermal energy and geothermal energy.

As an example, the more than 20 PJ of biogas generated in Australia is currently flared or used to generate renewable electricity that competes with, rather than complements, solar PV and wind production (note Figure 3 in Appendix B showing no correlation between electrical production from biogas and solar PV production). Australia would greatly benefit from biogas resources being directed to help decarbonise manufacturers and support the Australian Government's 'Future Made in Australia' plan. As reported in the RACE for 2030 "B5: Opportunity Assessment, Anaerobic digestion for electricity, transport and gas" Australia has potential to annually produce 371 PJ of biogas[1] which would be sufficient to decarbonise industry that cannot easily electrify.

4. Barriers for industry to decarbonise heating via electrification and bioenergy

The agriculture, commercial, industrial and freight transport sectors face numerous barriers to electrification or pursuing bioenergy projects, namely

- Industry awareness of the possible renewable heating solutions and configurations.
- Poor availability of bioenergy feedstocks (e.g. waste biomass, food processing waste, etc.) as the current data at National Maps (nationalmap.gov.au) is very poorly organised and presented.
- Poor economics for first-movers due to innovation risks.
- High initial capital costs for new equipment (and existing equipment still having several years before being fully depreciated).
- Difficulty in accessing data to understand electrical capacity limitations.
- Uncertain costs for electrical upgrades.
- High costs for electrical upgrades which can be ten times the base heating project cost.
- Long wait times for grid studies (18 months) and high costs (~$800,000) when wanting to connect a new solar PV project to the grid.
- Long wait times for electrical upgrades, for example, more than 18 months for an on-site transformer upgrade (owned by distributed network service providers (DNSPs)
- Consultant capability and capacity to guide energy users on the correct path for an economic and practical transition to decarbonise heat:
    - Knowledge of different technology options and when/where to apply them
    - Design knowledge on new renewable heating technologies (such as heat pumps, electrode boilers, biomass boilers, thermal energy storage, etc.)
    - Innovative or imaginative methodology to overcome space and electrical constraints
    - Possession or access to reasonably current and accurate equipment purchase and installation costs
- Resource availability for the owner or facility manager and their knowledge to support the capture of data and studies for renewable heat
- Capital availability to execute projects.

[1] Race for 2030, 'Onsite anaerobic digestion for power generation and natural gas/diesel displacement' (2023)

Each of these is reducing confidence and momentum to decarbonise industrial heat through electrification or bioenergy.

A2EP's recommendations for readying Australia's electricity and energy sector to enable a prosperous low-carbon economy

1. Data capture and modelling to inform commercial and industrial sector planning

Australia's transition to renewable, decarbonised industrial heat (which is critical for meeting net zero targets) will require extensive modelling and planning, however, the data for these exercises is currently not yet available. This lack of data (replaced by assumptions) has resulted in supporting poor resource allocation, such as the significantly inflated expectation of hydrogen's role in decarbonising process heat. We see the following measures as essential for ensuring an accurate estimate and allowance for the renewable heat transition:

1. Data capture for boilers across the industrial and commercial sectors to inform AEMO's ISP, gas substitution plans and sector transformation plans.
2. Renewable heating modelling to determine a likely trajectory for change.
3. Support for thermal energy data capture (steam and hot water) with sub-metering programs.
4. Tracking the speed of connection/electrical upgrades/grid studies to ensure adequate performance from Australia's DNSPs.
5. As noted in the report by Danfoss "The world's largest untapped energy source: Excess Heat"[2], waste or excess heat represents and enormous opportunity. Reporting of waste or excess heat emissions to the environment through the National Greenhouse and Energy Reporting (NGER) Scheme will help identify then utlise this energy source
6. Tracking and publication of tariff structures to incentivise middle of the day energy usage.
7. Establish a national register of biomass residues to allow matching of supply and demand (similar to that recently established by the NSW Government).

2. Rebalance focus energy supply and demand by prioritising demand-side energy productivity with nationwide kick-starter programs

Government programs can provide urgency and industry awareness to kick-start activities that improve energy productivity. Below is one such example, along with suggestions for more similar programs.

The NSW Government successfully ran a program to improve the performance of compressed air systems (CAS) for manufacturers at more than 150 sites. The program delivered excellent results for manufacturers and kick-started on-going operational and maintenance improvements for

[2] Danfoss "The world's largest untapped energy source: Excess Heat (2023)

CAS. Results achieved are detailed in Table 1.

Table 1: Median results from the NSW Government's compressed air audit program

MEDIAN OUTCOME PER SITE	
Compressed air system sizes (kW)	125
Number of compressors	2
% of electricity use by CAS	16%
Electricity cost for CAS ($/year)	$89,500
System efficiency (kW/m³/min)	9.5
% air loss to leaks	27%
Cost of leaks ($/year)	$20,000
Total energy costs savings identified ($/year)	$50,067
Total energy cost savings	56%
Payback time for all measures (years)	0.5

Elements for such successful programs are:

- Competence building and comprehensive knowledge sharing throughout the program.
- Publications that support best practice in terms of methodology and technology applications[3] [4].
- Consideration of load-flexing opportunities.
- Short term intervention.
- Secure on-going industry change
- Develop competence and capacity of supply chains

Future programs can be developed to further support energy productivity improvement in areas such as:

1. **Industry 4.0 solutions** – for low cost data capture, machine learning controls etc
2. **Power factor correction units** - which have the ability to improve network performance by >10%.
3. **Variable speed drive (VSD) upgrades** – which have the ability to reduce power consumption at food and beverage manufacturing sites by 2% to 5%.
4. **Pumping efficiency audits** – impeller optimisation (done with VSD upgrade program)
5. **Designing for material efficiency** – which has the ability to reduce the quantity of materials used in construction by 10% to 20%.
6. **Control system upgrades** – which can reduce standby loads and enable compressor optimisation.
7. **Heat recovery upgrades** – heat recovery projects for oil coolers, compressor coolers, desuperheaters, processes and flue gases.
8. **Steam system optimisation** – by recovering condensate returns and flash steam heat
9. **Insulation upgrades** – by using a 'valve-cosy' and installing pipe lagging, etc.

Programs that promote and support the above measures have the ability to kick-start an energy

[3] A2EP Compressed Air Systems, Emerging Efficiency Improvements and Alternative Technologies: Review, background research and examples (2020)
[4] A2EP Compressed air systems: Sealing up a productive manufacturing future for NSW (2021)

productivity mindset through industry which looks to maximise the value add for each gigajoule of energy used.

3. Set renewable heating and load flexing targets then support with policy and programs

Renewable heating in Australia is currently at 14% (mainly from sugar cane bagasse) but has the potential to be more than 30% by 2030. Securing further progress on renewable heating and addressing this large part of Australia's emissions requires commitment through a renewable heat target. Following further data capture on Australia's boiler, burners and bioenergy feedstocks, A2EP recommends setting a target for renewable heating for 2030, 2040 and 2050.

Currently Australia's energy demand does not correlate to emissions or cost, i.e. demand is inelastic to these factors so has little correlation with the availability of renewable energy. Australia also needs to set load-flexing targets for the commercial and industrial sectors to encourage matching of electricity demand to renewable electricity production. Such targets need to be daily and seasonal to reflect to greatly variable availability of renewable energy.

4. Support a renewable heating and load-flexing industry body

Finally, the Government should support industry bodies to focus on renewable heating and load flexing to ensure there is a collective voice from industry to inform policy decisions and create eco-systems for development and then continuous improvement of supply chains and manufacturing. Such bodies should not replace existing businesses that provide services in these areas, rather the bodies would create industry-wide platforms for networking and sharing of best practices.

Thank you for the opportunity to contribute to Australia's energy and electricity future. We welcome the opportunity to discuss this submission with the Government.

Jarrod Leak

Chief Executive Officer

Australian Alliance for Energy Productivity

26 April, 2024

Appendix A – A2EP Members

INDUSTRY LEADERS

INDUSTRY SUPPORTERS

PARTNERS

Appendix B – Supporting data

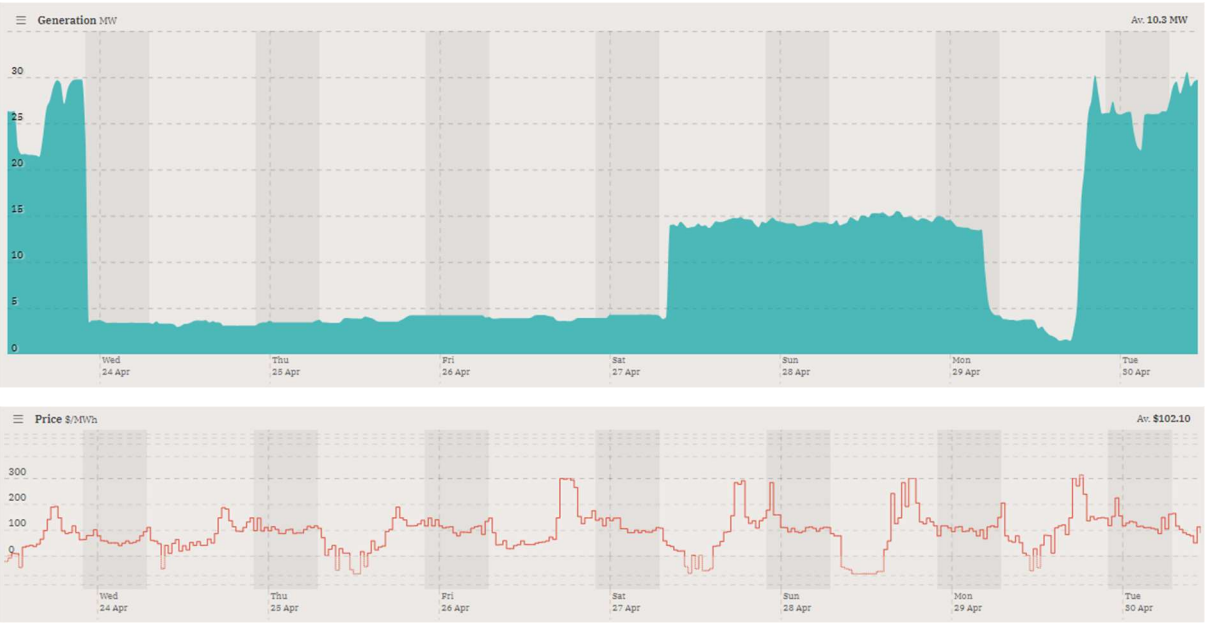

Figure 3: Electricity generation from bioenergy (LFG) in NSW showing no correlation between cost (solar PV production) and output. Source opennem.org.au