A roadmap to accelerate energy productivity in freight transport by 2030

AUSTRALIAN ALLIANCE FOR ENERGY PRODUCTIVITY

Background

The Australian Alliance for Energy Productivity (A2EP) is an independent, not-for-profit coalition of business, government and environmental leaders promoting energy efficiency, energy productivity and decentralised energy. A2EP aims to inform, influence and advance the effective use of energy in Australia.

A2EP leads a collaborative program of research, consultation, collaboration and advocacy. A2EP aims to double Australia's energy productivity by 2030 (from a 2010 baseline). Reaching this target is essential to boost general economic productivity, improve competitiveness and reduce greenhouse gas emissions.

A2EP has developed a series of roadmaps to guide change across the national economy and in key sectors: agriculture; manufacturing; mining; freight transport; passenger transport and the built environment. The original freight transport roadmap was developed in 2017 with input from an industry working group representing road freight, rail and shipping. It is available at a2ep.org.au. This is a summary and update of that roadmap. Both the original roadmap and this summary were co-authored by A2EP and sustainable transport consultants MOV3MENT. We welcome comments and contributions. And we welcome collaboration on action.

Improving energy productivity in freight transport will

- **Reduce operating costs, improve labour/capital productivity and improve profitability**
- **Reduce air pollution, noise pollution and congestion**
- **Reduce the need for infrastructure investment and maintenance**
- **Reduce fuel imports, improve energy security and independence**
- **Reduce greenhouse gas emissions.**

Energy and freight transport

> "Australia's freight systems are the lifeblood of our economy and way of life"
> *Transport and Infrastructure Council, DITCRD 2019*

Transport is a significant sector of the Australian economy. Passenger and freight transport together employ around 8.6% of Australia's workforce, and account for approximately 7.4% of 2015–16 GDP (ABS 2018). In addition to its employment and economic contribution, transport is a critical enabler of Australia's economic prosperity and way of life.

Freight transport includes the movement of all materials, equipment, products, food and energy (but not people) between the various stages and locations of the value-add process including extraction, production, storage, end-use, and waste disposal. It is essential in all supply chains including resources, energy, food, construction, and retail.

Freight transport is not a single, homogenous activity. It can be split into four 'modes' – road, rail, shipping and aviation – defined by the infrastructure requirements and the type and size of vehicles. Other segmentations can include the type of freight being moved (e.g. grain or fast-moving consumer goods); the vehicle's operating environment (e.g. urban pick-up and delivery, or long-haul interstate); or a focus on the entire supply chain in which the goods are being moved.

Two critical issues underpin the energy challenge for freight. The first is the freight task – how much stuff needs to be moved over what distance (measured in tonne-kilometres) – which indicates the level of activity or work in the sector. Figure 1 shows that the freight task for two of the surface transport modes (road and rail) is forecast to grow strongly to 2040 and beyond.

This projected growth intensifes a major issue for Australia's energy sector. Transport is already the biggest energy user in the Australian economy. While freight currently uses only around one-third of all transport-related energy, its demand is growing fast. Of all modes, road freight in trucks and light commercial vehicles already uses the most energy (around 85% of the total), and Figure 1 shows it will likely have the largest increase in task (nearly 55%). These factors suggest road freight should be a major focus to improve national energy productivity.

The second issue is that almost all energy used for transport in Australia comes from oil in the form of diesel, petrol or bunker oil (for shipping). Unlike most other sectors of the economy, transport has not diversified in any significant way into other fuels, despite viable alternatives from non-renewable sources (gas), renewable sources (biofuels), and technologies that can use both (electric, hydrogen). Figure 2 shows this heavy reliance on oil compared with other sectors of the economy. This is not the case in all countries: although the dependence on oil remains high globally, some countries have diversified their vehicle technology mix and their energy sources to some extent.

Importantly, the combination of more activity (a growing freight task) and reliance on a single fuel source means that energy use increases proportionally, unless the transport activity can be made more efficient.

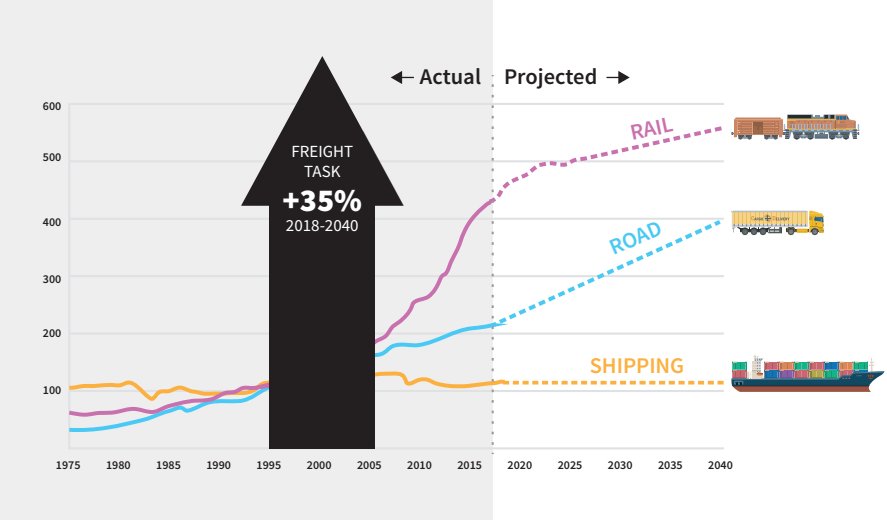

Figure 1: Projected growth in freight task by mode, Australia [source: DITCRD 2019]

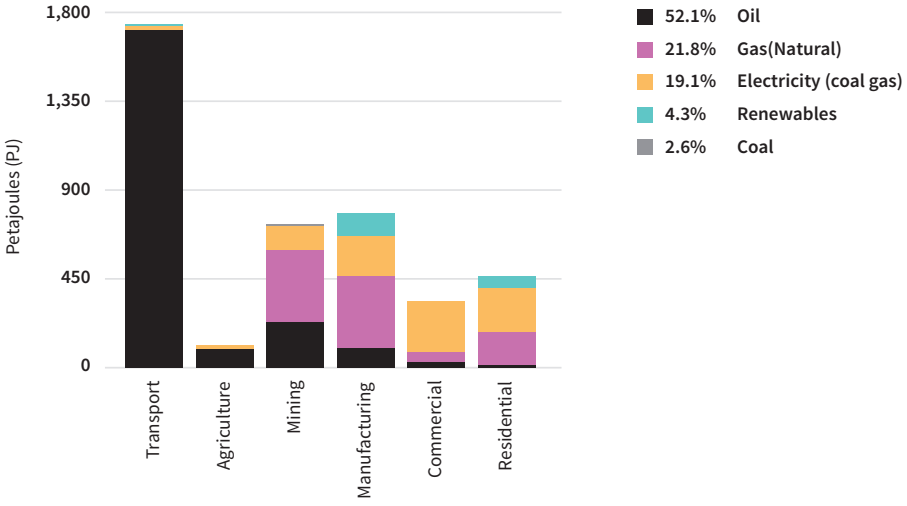

Figure 2: Final energy use by sector in Australia, 2017-18 [A2EP analysis using DoEE 2019 data]

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What is energy productivity?

Energy productivity is the economic value created per unit of primary energy consumed, or per unit of primary energy spend. Economy-wide energy productivity is generally measured as national gross domestic product (GDP) in millions of dollars divided by petajoules (PJ) of primary energy consumed across the economy. In freight transport, energy is basically the fuel used to move goods around the country, and the economic factor is the value of the sector to GDP or some surrogate measure.

So, the two core measures are:

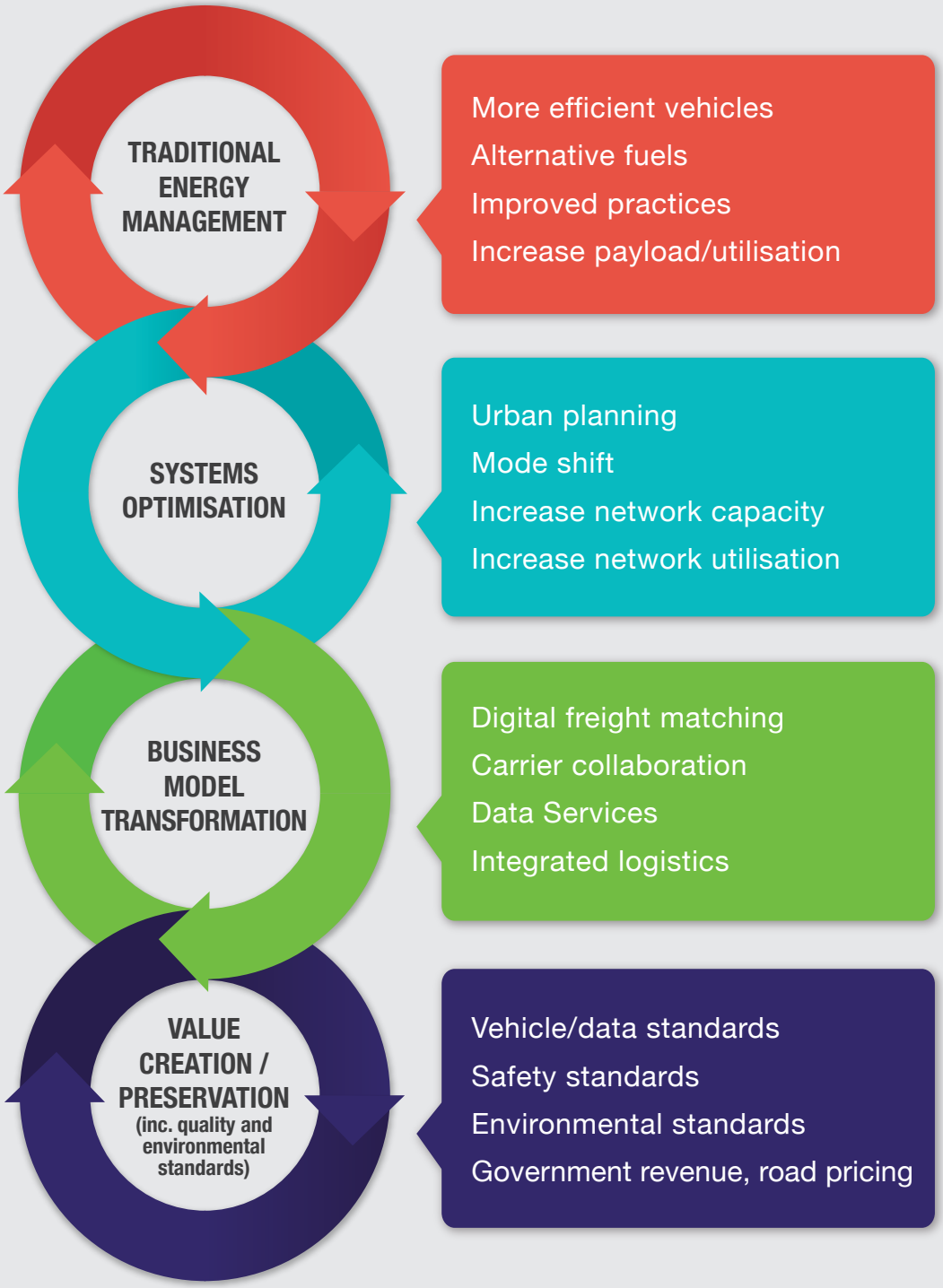
$$\frac{\text{VALUE OF OUTPUT (\$)}}{\text{PRIMARY ENERGY (GJ)}} \quad \text{and} \quad \frac{\text{VALUE OF OUTPUT (\$)}}{\text{COST OF ENERGY (\$)}}$$

Other definitions of energy productivity can also be used, with a suite of measures best able to provide a complete picture accounting for changes in prices, differences in economic structures and resource endowments, amongst other factors

Energy productivity is therefore not simply energy efficiency by a different name, although efficiency is integral to the first of four key strategies that enhance energy productivity, as illustrated below. Beyond simple efficiency, there are other ways that better use of energy can create value for the company, industry sector, community and economy. These strategic areas are complementary.

[1.] *Energy in the form of electricity and gas may also be used to power warehouses and refrigerated stores in the full logistics chain, but they are not the focus of this paper.*

Improving energy productivity in freight transport



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Why is energy productivity important?

There is no question that the service, access and productivity enabled by freight transport is critical to the proper and prosperous functioning of the economy. However, the quantity and type of energy used in delivering that service is also important for several reasons.

- For the freight carrier, fuel is a major cost representing 10-30% of a road fleet's total operating costs
- From a community perspective, combustion of diesel is a major source of urban air pollution, leading to millions of dollars in community health-related costs and deaths each year
- Nationally, fuel imports exceed $25 billion each year to keep the fleet running
- There is also a global impact from the greenhouse gas emissions related to fuel combustion, with transport expected to be one of the main barriers to achieving the Paris emissions target.

On the issue of greenhouse gas emissions, Figure 3 shows that greenhouse gas emissions from all road freight vehicles have been growing for 25 years and are projected to continue growing strongly beyond 2030. This is the same time by which the Australian Government has set a target to reduce emissions by at least 26% (also shown on the graph) compared with 2005 levels, which is the baseline for the graph. These two realities are incompatible.

Improving energy productivity by reducing the amount of energy required to generate the same or more revenue leads to improvements in all the factors described above - lower costs, less fuel imports, reduced levels of air pollution, less climate impact and improved energy resilience.

Actual and projected growth in transport emissions 1990-2030, indexed against 2005

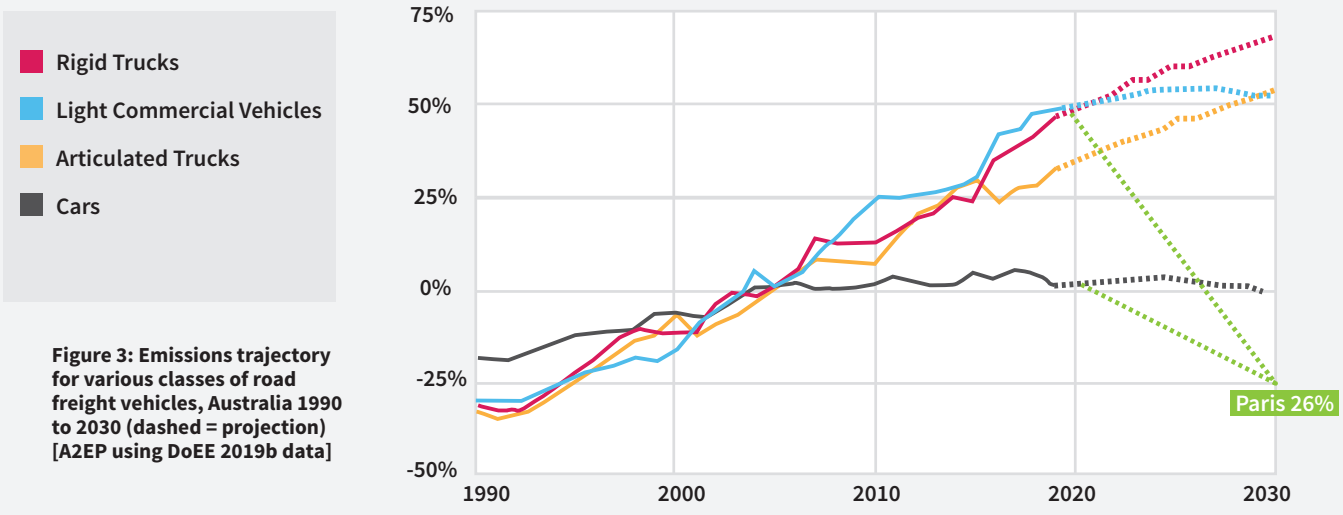


Figure 3: Emissions trajectory for various classes of road freight vehicles, Australia 1990 to 2030 (dashed = projection) [A2EP using DoEE 2019b data]

Progress has been slow

Other major economies are well ahead of Australia in increasing energy productivity. Not only is the mean economic value per unit of energy consumed by the Group of 20 (G20) countries higher than for Australia, so too is the G20 average improvement in energy productivity. Australia must act now to keep pace so that it avoids entrenching competitive disadvantage whilst G20 peers accelerate away.

Tracking the recent history of energy productivity in Australian road transport reveals a worrying trend. Using the GDP contribution of the road transport sector as a whole across a six-year period and dividing by the energy it used shows that energy productivity changed very little over that time. From 2011 to 2013 there was around 13% improvement, but that improvement had deteriorated by 2016 (the last year for which economic data is available), such that the 2016 result was only around 7% better than 2011, as shown in Figure 4. Figure 5 also shows that the energy intensity of road freight overall has barely changed in the last 15 years, despite increased use of high productivity vehicles.

[2.] *The Australian Bureau of Statistics Experimental Transport Satellite Account (ABS 2018) provides an estimate of GDP contribution by the transport sector. However, this is not disaggregated between passenger transport and freight transport, nor by different modes of freight or different types of vehicles. For this reason, total transport contribution to GDP was used along with total energy used.*

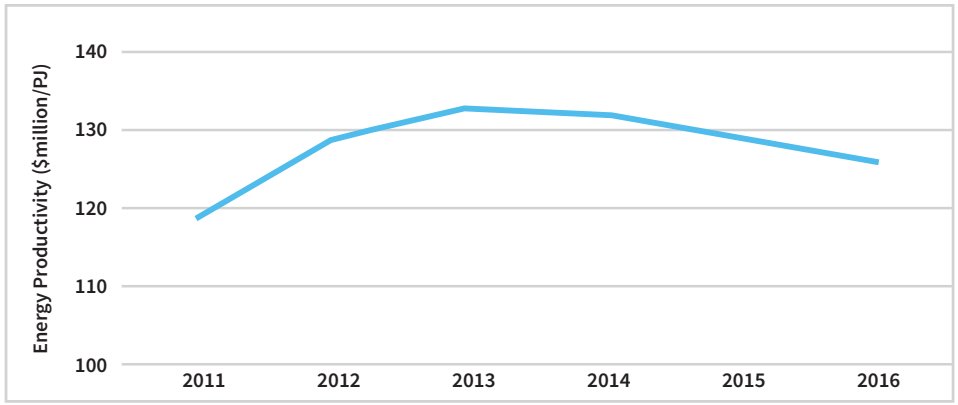


Figure 4: Energy productivity of road freight in Australia, 2017-18 [A2EP analysis using ABS 2018 and IEA 2019 data]

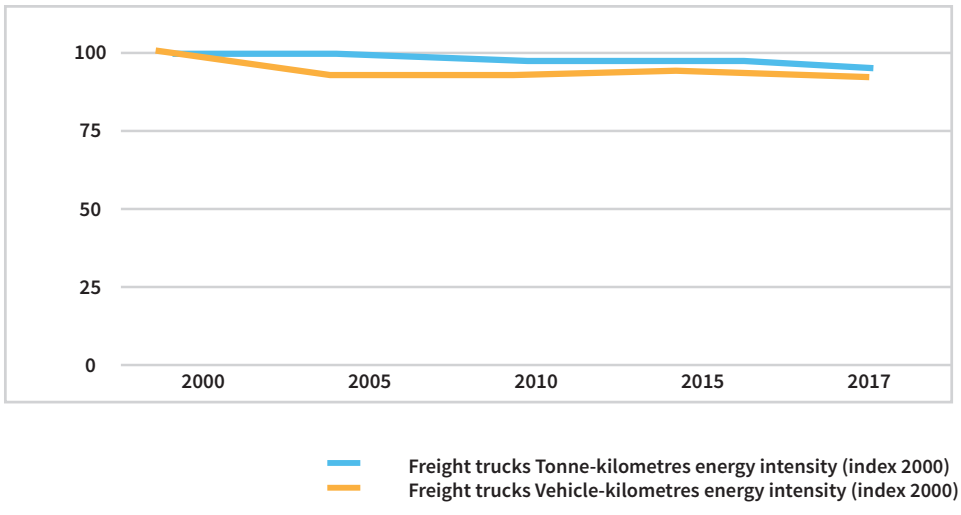


Figure 5: Road freight energy intensity in Australia indexed against Year 2000 [A2EP analysis using IEA 2019 data]

Why a roadmap?

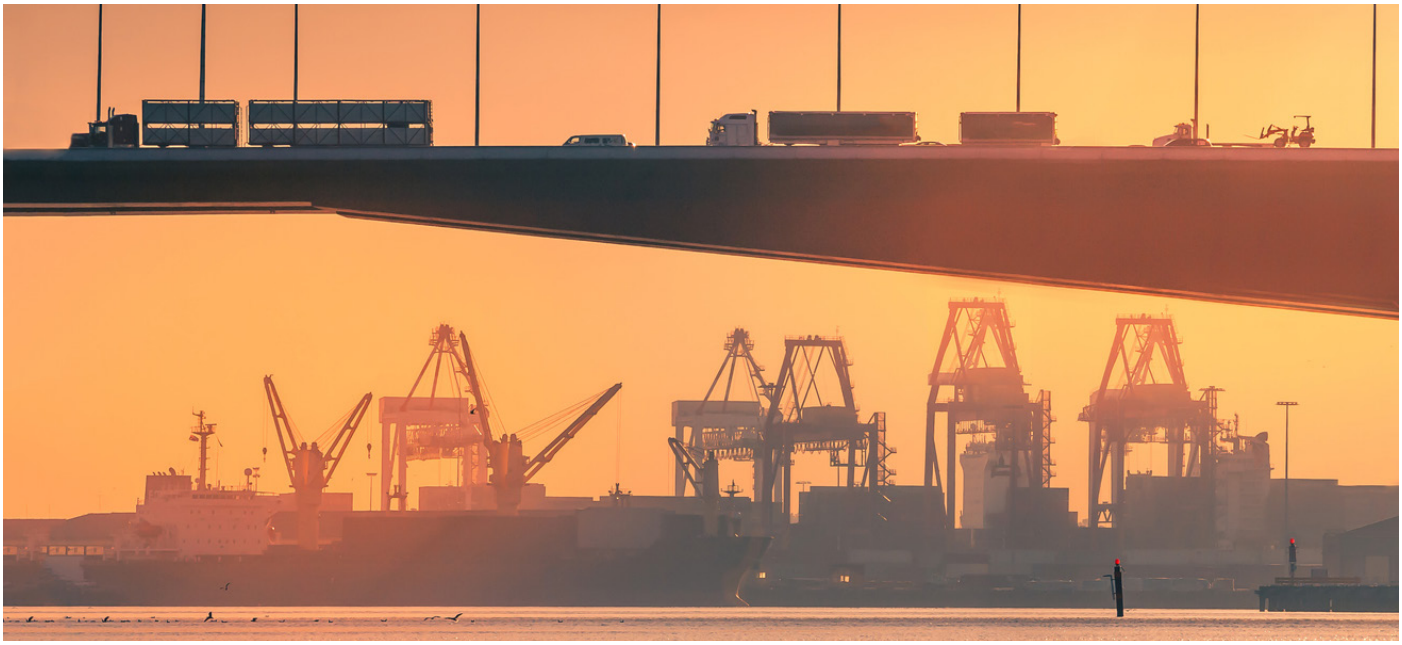
A roadmap is a great analogy for the long-term process of doubling energy productivity. For any long and complex journey, we need to know: where we are now (a starting point against which progress can be tracked); where we need to go (the destination); and what are the best pathways between where we are and where we need to be.

Since the release of the original A2EP freight transport roadmap in 2017, governments and industry have applied a concerted and coordinated focus on how to meet the growing freight task, including significant planning and investment in infrastructure, information and heavy vehicle road reform. Examples, among many others, include:

- National Freight and Supply Chain Strategy (NFSCS) and its supporting National Action Plan
- Associated State Implementation Plans supporting the NFSCS
- New freight and ports strategies in Victoria, NSW, Queensland and WA
- Establishment of Freight Australia and Freight Victoria as coordinating agencies for freight issues
- Launch of the Freight Data Hub in NSW and an equivalent National Freight Data Hub
- Progressing the National Policy Framework for Land Transport Technology, and its associated Action Plan
- Establishment of a Low and Zero Emission Vehicle working group under COAG Transport and Infrastructure Council
- Electric vehicle strategies in most states, and a national plan under development
- The National Hydrogen Strategy with most states developing their own similar documents
- Ongoing developments under the Heavy Vehicle Road Reform process, led by COAG TIC
- Changes to the Heavy Vehicle National Law (HVNL) affecting productivity
- Consultation and new legislation for Road Vehicle Standards (RVS)
- Additional consultation by the Ministerial Forum on Vehicle Emissions on efficiency, pollution and fuel standards
- The 2017 Review of Climate Change Policies.

Yet, despite the significant research and analysis underpinning these and other developments in transport policy, energy and emissions barely register in the actions they prescribe – certainly none that bring the two issues together and none that suggest the required level of urgency for change. An increased focus on safety across multiple portfolios is understandable. However, trying to improve productivity and its multiple industry benefits, without any focus on energy, is like an elite athlete focussing only on training without considering what they eat.

The actions in this roadmap therefore restate some of the priorities outlined previously where opportunities remain unfulfilled. It also updates some actions where further research has shown that addressing barriers could accelerate progress. Ultimately, the roadmap is successful if it helps policymakers, the community and others outside the sector to understand how new technologies, organisational practices, alternative fuels and good planning could potentially contribute to accelerating energy productivity in freight transport by 2030.



Improvement is an opportunity, not a threat

Notwithstanding the lack of recent progress, energy productivity has a positive story in the freight sector. The 2017 roadmap modelled the potential fuel savings from implementing the most cost-effective energy productivity measures (see page 3) based on input from the industry working group and past research. At the time it estimated that energy intensity could be improved by 19–33% (MJ/t-km basis) with supportive policy, or 2-3 times the historical business-as-usual (BAU) rate of improvement. This could be considered an estimate of the 2030 technical potential under supportive policy.

Applying an average 25% improvement across all modes and assuming 5% mode shift between road-rail and rail-shipping, the result shown in Figure 6. This change represents $5 billion in annual fuel savings alone by 2030. Broadly speaking, it means that simple efficiency improvements could potentially offset the escalation of fuel costs and emissions that might otherwise be expected from a growing freight task - if there are policies to support improvements. This is based purely on energy savings ignoring additional benefits from reduced congestion, health costs, investment and employment, improved resilience, emissions reductions, business profitability, and energy security.

It may seem counter-intuitive that this level of energy saving would go unrealised by an industry like transport – after all, most businesses would say they are very focussed on reducing their costs. However, this can be explained by the effect of various market failures and barriers to adoption.

Barriers to improvement

As noted earlier, freight transport is not a single homogenous activity, and some of the barriers affecting uptake of energy productivity in road freight are different to those in shipping and rail. This is as much a factor of industry structure (size of operators, market power/control) as it is the kind of freight being moved and customers served, the type of vehicles/ vessels being used, the different business models, barriers to entry, and the policy/regulatory environment.

At the operator level, many of the barriers can be broadly classified under common groups, including:

- Prevailing investment paradigms (e.g. expectation of short payback in road freight)
- Split incentives (customers often pay for fuel)
- Information barriers and complexities
- High capital costs and constrained access to capital (especially for the many micro/small businesses in road freight)
- Immature market and lack of confidence in new technologies (uncertainty of savings)
- Unpriced externalities (there is no cost for emitting greenhouse gases, air pollution or noise)

Within governments, responsibility for transport-related energy and emissions may also be lost between the silos of different agencies or the jurisdictional responsibilities of federal, state and local government. The issues relate to vehicles, fuels, energy and infrastructure, which means there may not be a clear responsibility for one agency or overlapping responsibility. This complexity slows both recognition and progress. It also highlights the need for increased coordination across agencies or, ideally, creation of a single authority to plan, implement and monitor progress.

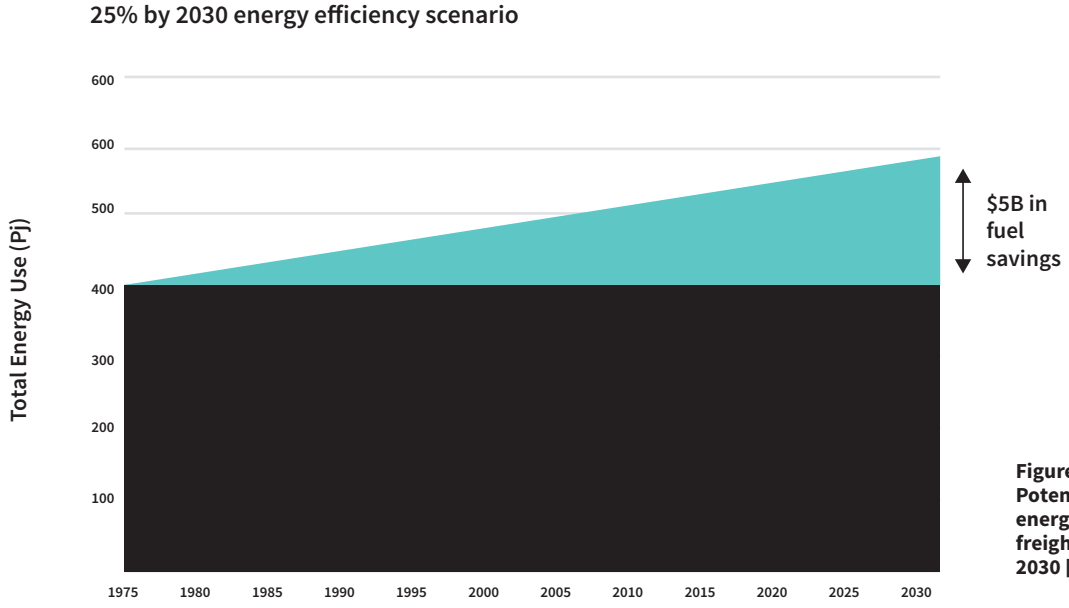


Figure 6
Potential fuel savings from energy productivity across freight transport modes by 2030 [A2EP 2017]

Bridging the gap with technology

While 25% improvement in energy efficiency by 2030 appears a long way short of the doubling target, it is important to remember that economy-wide energy savings are just half of the equation. Added economic value is just as important. On that front, the transport sector is perhaps more likely than any other to benefit from the productivity effect of technology disruption over the coming decade. Freight transport will see fundamental changes in the way goods are moved, where they are moved, who moves them, and the energy source for that movement. These disruptions include:

- Increasing urbanisation
- Shift to renewable energy
- Vehicle electrification
- Connectivity and intelligent transport systems
- Automation
- Business model transformation

The individual effect of these disruptors on energy productivity is highly uncertain. For example, autonomous vehicles could either reduce or increase congestion (affecting energy productivity), while at the same time greatly reducing fleet operating costs. Similarly, a survey of business leaders found more than three quarters of them believe one connected car can generate ten times the revenue stream of a conventional “dumb” vehicle, with data fuelling new business revenue streams. The combined effect of several such disruptors is therefore highly speculative but may produce a significant increase in the value added by the freight transport fleet when viewed through the lens of energy productivity.

Accelerating energy productivity: Breaking down barriers

The original A2EP freight transport roadmap identified around 70 opportunities supported by the freight industry working group, bundled under seven key pathways. These have been distilled further in the recommendations below to target particularly those barriers that are understood to constrain progress the most – information complexity, high capital costs, an immature market and technology uncertainty.

1. Develop an integrated transport energy transition strategy.

Responsibility: Collaboration between Commonwealth, state governments, industry, academia

Set an emissions target or technology/fuel targets to support energy diversification and reduced fuel imports. This will spur investment in alternative fuels, vehicle technology, and energy productivity, as well as reducing emissions, pollution and freight costs.

2. Implement efficiency standards or ratings for new vehicles.

Responsibility: Commonwealth Government

Fuel-efficiency or CO_2 standards have driven high levels of energy productivity improvement in most markets around the world. They are also considered one of the lowest cost measures to reduce emissions. The situation is more complex for heavy vehicles, but standards or ratings are also possible.

2.1 Implement fuel efficiency / CO_2 standards for light commercial vehicles

2.2 Accelerate introduction of Euro VI for heavy vehicles

2.3 Develop and implement standards and/or a rating for heavy vehicles

2.4 Align complementary measures and incentives to support best performing vehicles (link action 6)

3. Build energy productivity knowledge, skills, and data.

Responsibility: Industry, NGOs, governments (supporting).

Energy analysis and fuel switching is more complex in transport than in other sectors. Yet knowledge of energy productivity opportunities is generally quite low, with significant gaps in energy-related knowledge and data. Lack of trusted information is a significant barrier.

3.1 Develop a green freight program in line with G20 commitment

3.2 Support fuel and technology trials and disseminate results

3.3 Aggregate efficiency information, tools and calculators in a central portal

3.4 Establish independent testing and accreditation to support case studies

3.5 Collate and publish better freight activity and energy data for tracking progress

3.6 Support skills and knowledge training for fleet managers, drivers, suppliers

4. Promote and support mode shift.

Responsibility: Industry and government

Moving freight via rail is at least four times more energy efficient than via road, with a proportional reduction in carbon emissions and road congestion.

4.1 Investment in rail to support higher productivity, reduce passenger-freight conflict, and increase competition (e.g. double stacking)

4.2 Consider mode shift incentives for non-time-critical freight

4.3 Greater collaboration between supply chain partners and promotion of rail options for freight

5. Enable wider use of high productivity freight vehicles.

Responsibility: NHVR, Local and state government

Australia has one of the most productive truck fleets in the world due to the increasing use of high productivity freight vehicles (HPFVs). However, the complexity of approvals for vehicles and routes means the process can be slow.

5.1 Increased support for local government in conducting route assessments (e.g. use of automated access decisions)

5.2 Better community education to demonstrate benefits

5.3 Expansion of HPFV categories on major interstate routes

5.4 Eligibility for incentives available to low-emission vehicles (link to 6)

6. Incentives to support highly efficient or low emission vehicles and fuels.

Responsibility: All levels of government, ARENA, CEFC

While fuel efficiency standards can raise the minimum level of efficiency in new vehicles, there is a need to recognise and support adoption of the most efficient vehicles and alternative fuels.

6.1 Set target for low emission vehicle and fuel uptake (link to 1)

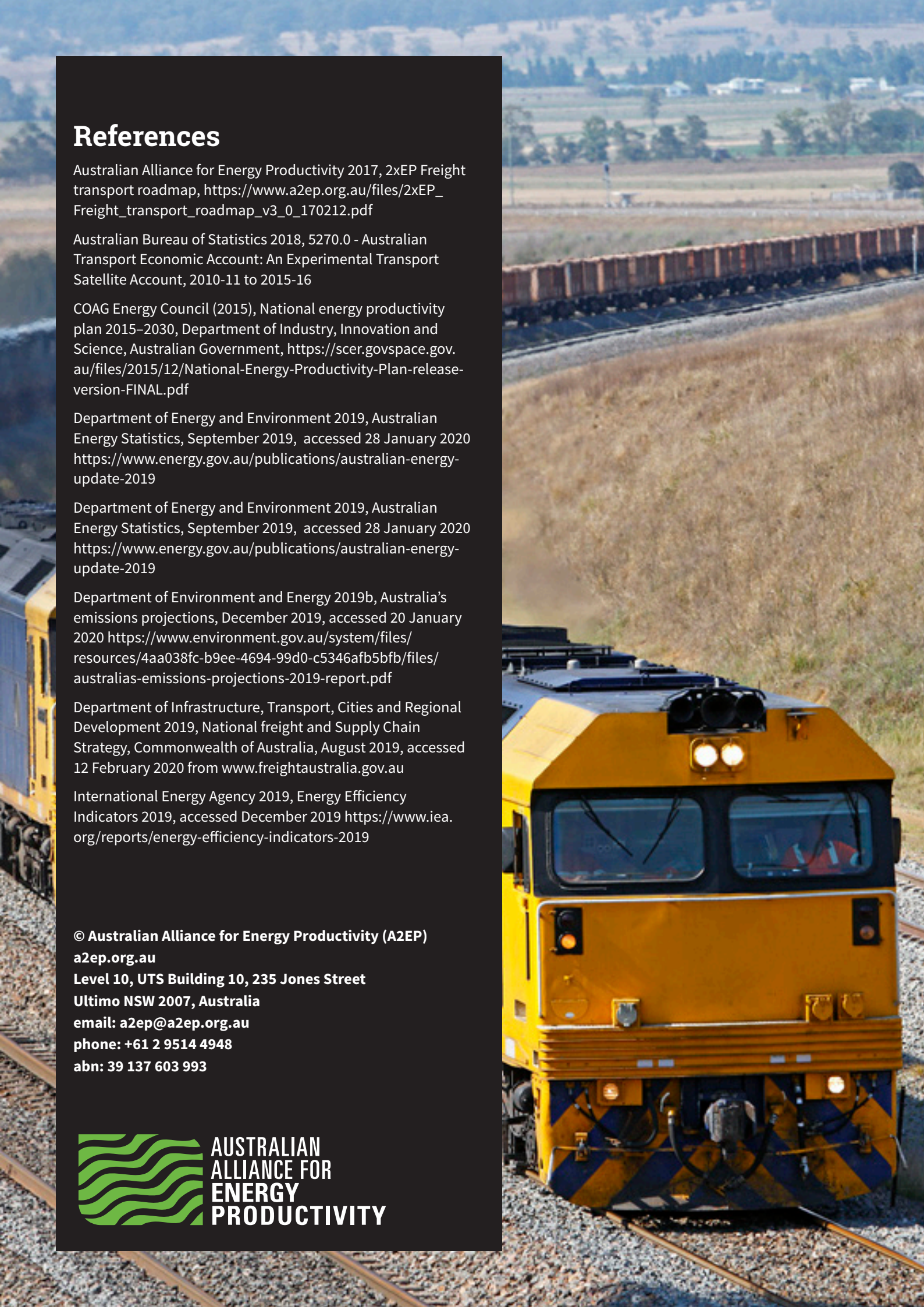
6.2 Realign vehicle registration fees based on emissions level or rating (fee-bates)

6.3 Contestable grants to support early stage investment in electric, hydrogen, other low carbon fuels

6.4 Finance or subsidise fleet audits to identify opportunities for fuel efficiency (as provided to other sectors)

6.5 Establish urban clean air zones with either restricted access or differentiated fees

6.6 Consider tax offsets, accelerated depreciation, duty reduction for low carbon/renewable fuels or other support measures



References

Australian Alliance for Energy Productivity 2017, 2xEP Freight transport roadmap, https://www.a2ep.org.au/files/2xEP_Freight_transport_roadmap_v3_0_170212.pdf

Australian Bureau of Statistics 2018, 5270.0 - Australian Transport Economic Account: An Experimental Transport Satellite Account, 2010-11 to 2015-16

COAG Energy Council (2015), National energy productivity plan 2015–2030, Department of Industry, Innovation and Science, Australian Government, https://scer.govspace.gov.au/files/2015/12/National-Energy-Productivity-Plan-release-version-FINAL.pdf

Department of Energy and Environment 2019, Australian Energy Statistics, September 2019, accessed 28 January 2020 https://www.energy.gov.au/publications/australian-energy-update-2019

Department of Energy and Environment 2019, Australian Energy Statistics, September 2019, accessed 28 January 2020 https://www.energy.gov.au/publications/australian-energy-update-2019

Department of Environment and Energy 2019b, Australia's emissions projections, December 2019, accessed 20 January 2020 https://www.environment.gov.au/system/files/resources/4aa038fc-b9ee-4694-99d0-c5346afb5bfb/files/australias-emissions-projections-2019-report.pdf

Department of Infrastructure, Transport, Cities and Regional Development 2019, National freight and Supply Chain Strategy, Commonwealth of Australia, August 2019, accessed 12 February 2020 from www.freightaustralia.gov.au

International Energy Agency 2019, Energy Efficiency Indicators 2019, accessed December 2019 https://www.iea.org/reports/energy-efficiency-indicators-2019

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