Shifting Gears – Preparing for a Transport Revolution

Transport Industry Technology Readiness

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APPLIED

Australian Academy of Technology & Engineering

The Australian Academy of Technology and Engineering[1] is undertaking a major three-year (2018-2020) Australian Research Council Learned Academies Special Projects funded research project to examine the readiness of different Australian industry sectors to develop, adapt and adopt new and emerging technologies, with a horizon out to 2030. The transport sector is the first industry sector to be examined by the project.

Transport Industry Technology Readiness

The rapid advancement of digital technologies across all sectors of the global economy has resulted in an extraordinary period of change.

With Australia's geographic isolation and long distances between large urban centres, the transport sector will be one area that is both significantly disrupted and revolutionised by this technological transformation.
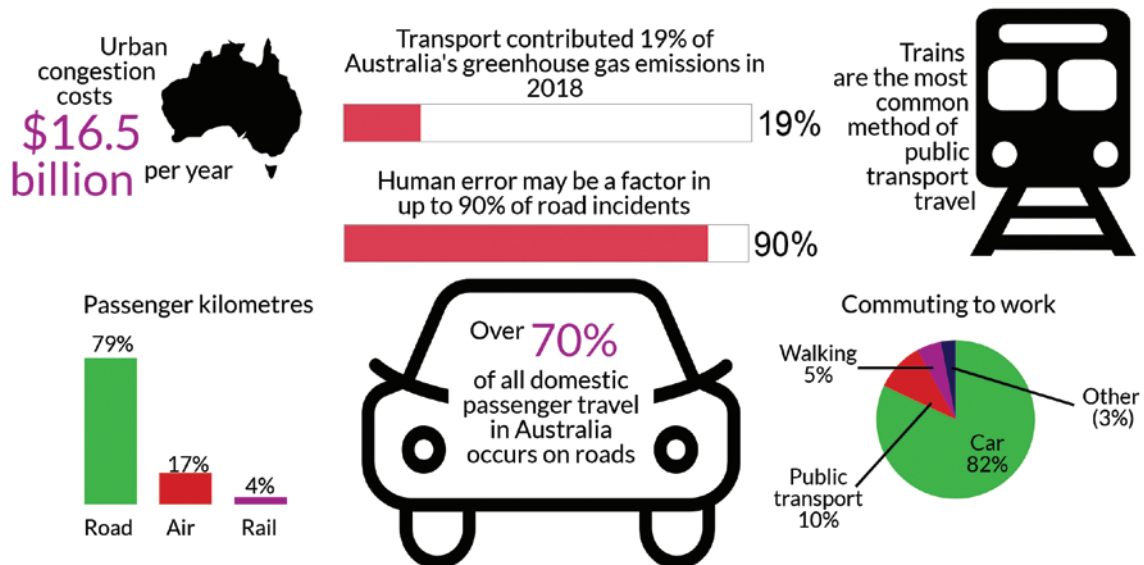
Failure to be prepared will risk in a decline in many aspects of our Australian way of life and society. For example, inadequate planning for population growth and the spread of urban centres could significantly impede the mobility of passengers and freight in both urban and regional areas. This could increase congestion and vehicle-related emissions, lead to a deterioration in health, safety and security, and negatively impact productivity and the cost of living.

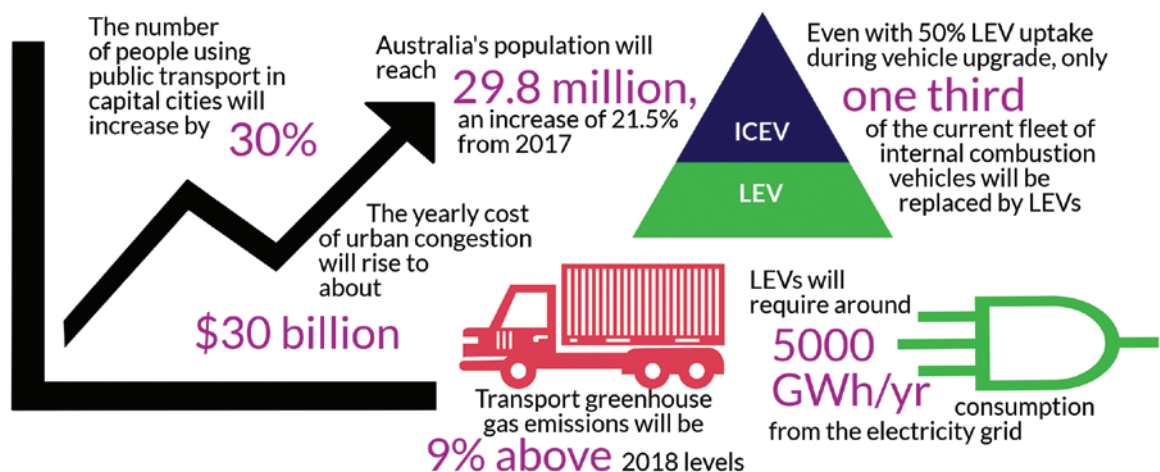In this early phase of the transition, it is critical that Australia identifies what

we want for our society, what action government and industry need to take, and how this will translate to a transport sector for the future.

The Academy has identified sustainability and climate change, productivity, and health as the three key challenges that will need to be addressed within the transport sector over the next decade. Specifically, the transport sector will need to lower emissions, improve the efficient movement of people and freight, and reduce transport-related deaths and serious injuries. The deployment of connected and autonomous vehicles (CAVs), low and zero emission vehicles (LEVs), high frequency mass transport, and intelligent transport systems (ITS) are potential solutions to these challenges. These are outlined in **Figure 1**.
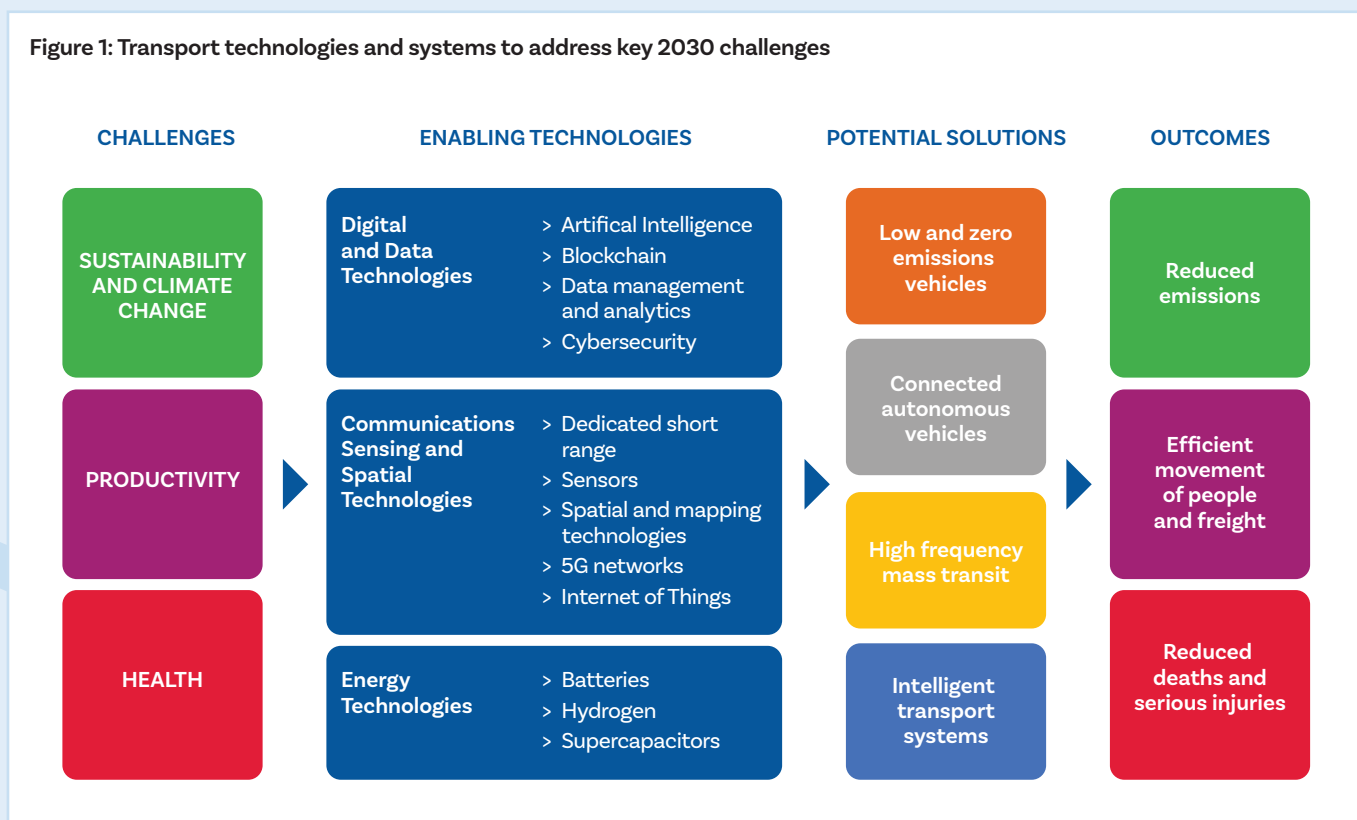
Australian urban transport

Urban congestion costs **$16.5 billion** per year

Transport contributed 19% of Australia's greenhouse gas emissions in 2018 — 19%

Human error may be a factor in up to 90% of road incidents — 90%

Trains are the most common method of public transport travel

Passenger kilometres
- 79% Road
- 17% Air
- 4% Rail

Over **70%** of all domestic passenger travel in Australia occurs on roads

Commuting to work
- Walking 5%
- Other (3%)
- Car 82%
- Public transport 10%

At current rates, by 2030:

The number of people using public transport in capital cities will increase by **30%**

Australia's population will reach **29.8 million**, an increase of 21.5% from 2017

The yearly cost of urban congestion will rise to about **$30 billion**

Even with 50% LEV uptake during vehicle upgrade, only **one third** of the current fleet of internal combustion vehicles will be replaced by LEVs

ICEV
LEV

Transport greenhouse gas emissions will be **9% above** 2018 levels

LEVs will require around **5000 GWh/yr** consumption from the electricity grid

Sources: AEMO, ABS, BITRE, Coalition for Urban Transitions, Department of Infrastructure, Department of the Environment and Energy, U.S. Department of Transportation.

1. The Australian Academy of Technology and Engineering is an independent think tank that comprises the leaders in the fields of technology and engineering, who gain Fellowship to the Academy in a highly competitive process. The Academy is one of Australia's four national Learned Academies, but uniquely our 900-strong Fellowship come from industry, government and research organisations, as well as academia. Our Fellowship develops trusted, informed and visionary views to persuade decision-makers to implement the most progressive policies on the development of technology for the betterment of Australia and its people.

Figure 1: Transport technologies and systems to address key 2030 challenges

CHALLENGES	ENABLING TECHNOLOGIES	POTENTIAL SOLUTIONS	OUTCOMES
SUSTAINABILITY AND CLIMATE CHANGE	**Digital and Data Technologies** > Artificial Intelligence > Blockchain > Data management and analytics > Cybersecurity	Low and zero emissions vehicles	Reduced emissions
PRODUCTIVITY	**Communications Sensing and Spatial Technologies** > Dedicated short range > Sensors > Spatial and mapping technologies > 5G networks > Internet of Things	Connected autonomous vehicles / High frequency mass transit	Efficient movement of people and freight
HEALTH	**Energy Technologies** > Batteries > Hydrogen > Supercapacitors	Intelligent transport systems	Reduced deaths and serious injuries

To gauge Australia's readiness to address these challenges, and to provide context for Australia's readiness to develop, adopt or adapt to the pending changes by 2030, the Academy has analysed each of these potential transport solutions against five readiness indicators:

> infrastructure readiness
> skills availability
> social readiness
> economic and commercial feasibility
> policy and regulatory readiness

The readiness scale is outlined in **Table 1**, and the results of the analysis are provided in **Table 2**.

The report's analysis was informed by research and targeted consultations with transport stakeholders from industry, government and research across Australia. The development of this analysis was overseen by a Steering Committee comprising Fellows of the Academy and transport experts.

The Academy's findings indicate that the Australian transport sector is least prepared in terms of:

> **Infrastructure readiness:** with respect to low and zero emission vehicles, high frequency mass transit and intelligent transport systems

> **Skills availability:** with respect to low and zero emission vehicles, connected autonomous vehicles and high frequency mass transit

Our analysis also shows that Australia is performing well on a number of readiness indicators and is well placed to capitalise on the coming technology revolution. However, with technology developing at a rapid pace and competitor countries investing and acting strategically, Australia needs to ensure we also make smart, strategic decisions to keep pace with the technological frontier.

This report provides an opportunity for government, industry and research organisations to develop and plan for future urban environments based on the transport needs and mobility patterns of Australian communities. The report is intended to inform governments to enable smart, adaptable regulation and provide funding and incentives where appropriate, and to inform industry and research organisations to build practical research agendas to address the questions that remain about our likely transport future.

To achieve the desired outcomes within the transport sector by 2030, the Academy makes the following key policy recommendations to support emerging transport technologies. The Academy has also highlighted future research opportunities to address the challenges the transport sector will face in the decade to come.

Table 1: Readiness Indicator scale

	Not ready	More work still required			Ready
Readiness scale	○ (empty)	◔ (quarter)	◑ (half)	◕ (three-quarter)	● (full)

Table 2: Readiness Indicators

	Infrastructure readiness	Skills availability	Social readiness	Economic and commercial feasibility	Policy and regulatory readiness
Low and zero emissions vehicles	◔	◔	◕	◑	◕
Connected autonomous vehicles	◑	◔	◑	◑	◑
High frequency mass transit	◔	◔	◕	◑	◑
Intelligent transport systems	◔	◑	◕	◑	◑

Recommendation 1: Implement mechanisms to drive a widespread shift towards low emission transport options

The Academy recommends that the Commonwealth Government implement policies to reduce vehicle emissions and to encourage the rapid and widespread uptake of LEVs. This should be driven by the following mechanisms:

> A national target and associated regulatory mechanism to drive the uptake of LEVs in Australia

> Public and private corporations to be incentivised to use LEVs as fleet vehicles

> Industry should lead ambitious uptake of LEVs by ensuring that vehicles imported into Australia meet stringent standards for emissions, supported by government vehicle emission standards

These mechanisms will need to be accompanied by efforts in the energy sector to ensure that LEVs are powered by low emission energy sources, in the context of our national emissions reduction target.

Research priorities

> What impact will the uptake of LEVs have on Australian emissions, under various plausible scenarios?

> How can we ensure that EVs have a neutral to positive impact on the electricity grid?

> How will the costs and benefits differ between privately owned LEVs and shared fleet ownership models?

Recommendation 2: Provide a framework to regulate new transport technologies

The Academy recommends that an adaptive regulatory framework be established to provide guidance to the transport sector to help shape future transport systems.

> Australian governments should introduce flexible and adaptable legislative and regulatory frameworks that can keep pace with the global technology frontier, to ensure that Australia becomes, and remains, a key competitive player in the global market of advanced transport technologies

> The Council of Australian Governments (COAG) should set nationally consistent standards and regulations to facilitate the uptake of productivity-enhancing technology. For example:

– The development of a consistent regulatory approach for transport technologies and infrastructure, such as standards for charging infrastructure and connections for LEVs, standards for data sharing and data privacy, and the selection of standards for V2X communications based on global standards

– Standards on data aggregation and availability, where this would offer an avenue to insight for the market and consumers. Standards should specify which data should be collected, the situations in which it needs to be shared in real-time and post real-time, and what can be shared for forensic purposes, particularly for key platforms (for example, from CAVs and ITS)

Research priorities

> Where are international best practices found within the transport sector, and what lessons can be transferred to Australia?

> What is the best approach to a whole-of-government, integrated transport systems view involving industry, technology providers, infrastructure planning and education and training?

Recommendation 3: Develop and adapt transport technologies to an Australian setting

It is essential that Australia does not miss out on the benefits of technology because it does not yet meet the needs of our unique geography and climatic conditions. Transport technologies that are developed or adapted to an Australian setting have the potential to create the greatest impact.

> The Commonwealth and state governments should establish competitive grants programs that encourage the trial of transport technologies that can be adapted to geographical or climatic conditions unique to Australia

> State, territory and local governments should plan for, and adapt to, future changes to Australia's vehicle fleet by undertaking integrated land use and transportation planning through coherent and consistent policies that take into account likely network use changes from new technologies

Research priorities

> In terms of prioritising the early adoption of transport technologies to improve Australia's readiness within the transport sector, where should the greatest emphasis be placed, on what transport technologies should Australia be early adopters of, and why?

> To what extent and in what situations are Australian climatic and topographical conditions so unique as to warrant special technological adaptations?

> What are the likely impacts of new transport technologies on population distribution?

> What are the obstacles to the use of productivity-enhancing transportation solutions, from the provision of technologies by firms to consumer adoption decisions, and how can they be overcome?

> What are the drivers and impediments to the application of data and digital science to the transportation sector? How can the former be accelerated and the latter moderated?

Recommendation 4: Prepare the workforce for the transition to future transport models

To prepare the workforce for the disruption of new transport technologies, workers must be supported to develop STEM skills and obtain the qualifications, skills and training to adapt to changing roles and tasks.

> State and territory departments of education should strengthen the content and teaching of science, technology, engineering and mathematics (including digital and data technologies, design, and engineering principles) during upper primary and compulsory secondary schooling to encourage students to pursue university and VET courses in these areas

> Universities and VET institutions, in collaboration with industry, should provide and promote course options that

will assist Australia's current and future workforce to develop the skills required to meet the demands of the future transport sector. These may include, but not be limited to, skills in data analysis and modelling, city planning, software development, geospatial technologies, network and data security, logistics, skilled trades, transport data administration and project management

Research priorities

> What are the skills requirements to meet future transportation needs, and how do these map on to existing incentives, provision, and accreditation processes? How should any gaps be addressed?