AUSTRALASIAN RAILWAY ASSOCIATION

Association Number A03958 | ABN 64 217 302 489

AUSTRALASIAN RAILWAY ASSOCIATION SUBMISSION

To the

Commonwealth Department of Industry, Science, Energy and Resources

On

Australia's Technology Investment Roadmap

The Industry

The Australasian Railway Association (ARA) is a not-for-profit member-based association that represents rail throughout Australia and New Zealand. Our members include rail operators, track owners and managers, manufacturers, construction companies and other firms contributing to the rail sector. We contribute to the development of industry and government policies in an effort to ensure Australia's passenger and freight transport systems are well represented and will continue to provide improved services for Australia's growing population.

The ARA and its members thank the Department of Industry, Science, Energy and Resources for the opportunity to provide a submission Australia's Technology Investment Roadmap.

Any questions regarding this submission should be directed to Natalie Currey, General Manager Supply Chain via ncurrey@ara.net.au or 0499 993 021.

Summary

The ARA recommends that investment in low emission technology needs to be paired with investment in low emission industries such as rail.

Freight rail and passenger rail have significant environmental benefits and investing in improved rail infrastructure would not only directly reduce rail's emissions, but also enable increased freight and passenger movements, leading to a reduction in road transport use to minimise overall transport emmissions.

Given rail transport's low-carbon credentials, it is becoming increasingly important that Australia works towards growing the use of this transport mode as part of a national strategy to combat climate change.

The Australian Rail Industry are keen to work with government to propose a long-term environmental solution for rail to enable it to contribute to achieving Australia's emissions reduction targets.

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The Role of Rail

Australia's transport energy efficiency and emissions intensity rates poorly against other economies in the world. The American Council for an Energy-Efficient Economy rates the world's 25 largest energy users for sectors including transportation. In 2018, Australia rated 20th out of the 25 for transportation[1].

Against this backdrop, the role of rail is critical to improving Australia's transport energy efficiency. Rail freight transport is around four times more energy efficient than road transport and two times more efficient for moving people. When transport demand is high, railway energy efficiencies are even higher.

The Green Transportation Alternative – Key Rail Stats[2],[3]

- Rail travel produces more than 40% less carbon pollution than road travel for each kilometre travelled.
- Each passenger journey made by rail instead of road generates benefits for society of between $3.88 and $10.64 by reducing congestion, accident and carbon costs.
- Every train full of commuters reduces carbon emissions costs by at least $16,640 per year.
- Rail freight produces up to 16 times less emissions than road freight.
- Moving a single container by rail instead of road can save over $340 in carbon costs for movements between Australia's major cities.

A prosperous rail sector is a crucial element of our economy, our future international competitiveness and our quality of life. The effective, safe and environmentally friendly movement of freight and passengers on rail takes on added importance when you consider the enormous growth in our cities, Australia's changing economy and the need to develop more socially responsible forms of transport.

Rail contains a significant environmental advantage over other forms of transport and investment in rail should continue to be encouraged as part Federal and State Government's commitments to reducing emissions. Whilst the benefits are clear, the sector continues to improve its environmental performance and invest in innovation and technologies aimed at reducing its environmental impact even further.

[1] https://www.aceee.org/portal/national-policy/international-scorecard

[2] https://www.bitre.gov.au/sites/default/files/publications/train_007.pdf

[3] https://ara.net.au/sites/default/files/u647/ARA-Deloitte_Value%20of%20Rail_full%20report.pdf

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Canberra Light Rail

Canberra's Light Rail network is a testament to public transport contributing to the sustainability goals, with a target of zero net carbon emissions in construction and operations achieved through design initiatives like solar panels on the roof of the light rail depot, solar powered lights and regenerative braking technology. Stage One of Light Rail achieved an Infrastructure Sustainability Council of Australia rating of 88 which places the project at the leading level of sustainability. This rating is achieved by:

- 100% of the electricity needed to power the light rail vehicles as well as the maintenance and administration building is renewable energy;
- rainwater is harvested from the track and re-used to water the trees and plants along the route;
- a reduction in the volume of concrete and steel required in the construction of track slab through the use of fibreglass reinforcing material rather than traditional steel reinforcement; and
- Canberra's light rail vehicles meet the most demanding eco design requirements with lightweight ecofriendly materials and subsequent end of life recycling materials.

Recycled Plastic Railway Sleepers – Metro Trains Melbourne

Metro Trains Melbourne are trialling a project where concrete rail sleepers will be replaced by placements made of recycled plastic – a composite of polystyrene and end of primary life agricultural plastics from regional Victoria.

Recycled plastic makes up approximately 85 per cent of the content of each sleeper. This includes both rigid and flexible plastics alongside polystyrene, combined with virgin materials carrying specific functions to enable the performance required.

One kilometre of sleepers will use approximately 64 tonnes of recycled plastic. The sleepers are also fully recyclable at the end of their life.

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Opportunities in Rail

Rail is already energy efficient and green, but there are still opportunities to improve rail's environmental performance and energy intensity through a range of measures, from lighter and more advanced vehicles and improved vehicle/track interactions to more efficient engines and regenerative braking. In the long-term rail offers the possibility of close to zero emissions transport, when rail transport is powered by alternative fuels from renewable sources.

Specific areas of opportunity include:

1. High-efficient digital signalling and traffic management – both in urban and main line rail – can drive lower energy consumption while simultaneously expanding capacity.
2. The future for low-density lines is autonomous, electric and lightweight. Autonomous trains transform the economics of rail operation by eliminating the need for fixed lineside signalling.
3. Advanced onboard sensors provide obstacle detection and accurate positioning, optimising safety and capacity. Meanwhile, lightweight catenary-free rolling stock minimises overall cost and reduces wear and tear on the infrastructure.
4. Digital technology provides rail businesses with many different energy saving options. These range from in-cab driver assistance systems to full Automatic Train Operation (ATO). Both metro and main line ATO systems are designed with energy savings in mind.
5. Automatic Train Supervision (ATS) systems, meanwhile, can be configured to optimise regenerative braking opportunities. Further efficiencies can be achieved via Traffic Management Systems (TMS) that coordinate traffic flows and make it possible to capture the regenerative braking energy of trains.
6. TMS also optimises capacity, improves schedule frequency and eliminates wasteful stop-start cycles – reducing energy consumption and keeping emissions to the minimum. The recent establishment by the Deputy Prime Minister of an industry-led group that will investigate the introduction and roll-out of the Advanced Train Management System (ATMS) is evidence of Government's increasing recognition of this.
7. Fuel efficiency, including the high costs of an electrified rail network and rising diesel prices as well as climate protection and noise reduction has been driving innovation in the rail industry with a focus on alternative fuel sources.

   Investment in hydrogen train research and development has been signficant in recent years across the globe. With the phasing out of diesel cars and trains in some countries (the UK has a ban on diesel by 2040), there is a focus in the rail industry to replace diesel trains on non-electrified lines with hydrogen. In the rail sector, you cannot travel long distances with clean energy outside of hydrogen. Hydrogen would contribute to a de-carbonised transport sector, and is a key factor for integrating the engergy consuming sectors (Building, Transport, Power). Hydrogen is as enabler to decarbonise rail networks and reduce reliance on fossil fuels such

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as diesel. There is opportunity to also combine hydrogen re-fuelling stations for trains, buses and commercial vehicles. Hydrogen can be injected into the existing national gas supply network to substitute a portion of the nautal gas already today and Australian has an abundance of sunshine, with solar farms a key source of energy for hydrogen production is readily available. Hydrogen powered trains began service in Germany in 2018. Indeed, the potential of hydrogen as a fuel source for rail transportation is recognised in the Federal Government's National Hydrogen Strategy.

Fast Rail

High speed or even Faster Rail is an environmentally friendlier alternative to air travel for high demand corridors such as between Canberra and Sydney, and between Sydney and Melbourne. Well connected cities and regions can take the congestion and pressure off our larger cities and mean that opportunities can be distributed across wider population. Investment in faster rail services allow people to live in our regions and improve productivity and sustainability. Fast rail is not just another infrastrucutre project, but a catalyst for technological change and innovation in the transport sector.

Rail Manufacutring Cooperative Research Centre R&D Projects

The Rail Manufacutring Cooperative Research Centre (RMCRC) formed in 2014 and which wraps up at the end of June 2020, focused its research programs on three areas: Power & Propulsion, Materials & Manufacturing (which focuses on the maintenance and durability of the track and rail rolling stock), and Design, Modelling & Simulation. A number of the RMCRC's projects have real commercial opportunities, with six new technologies likely to yield commercial returns in the next two years. Successful projects of note include:

- Supercapacitor control systems are being developed and prototyped by CRRC and CSIRO, with active trials to occur next year. This energy management system has the potential to replace overhead electricity lines and could possibly overhaul current light rail power systems.
- Composite brake discs developed by CRRC and CSIRO, with full prototypes currently being built and tested and the initial results proving very promising;
- Trial of Dwell Track on the Sydney Trains network. Dwell Track is a passenger information system developed by UTS and co-funded by Downer, which can track and analyse passenger congestion. In the first iteration of the technology, the RMCRC focused on building a system for use on train platforms. The technology was awarded a CRC Association "Excellence in Innovation Award" at its 2019 conference and more recently has been tested in real time at Wynyard Station;
- TrainDNA project between the Centre, Downer and Deakin University. Downer has a pre-existing monitoring system that comes with their newest Warratah trains. The research conducted through RMCRC's collaboration has been to develop algorithms that can monitor this data in real time and flag any potential issues. The ability to not only identify current faults, but to also predict potential issues before they occur, has the capacity to create

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significant savings for both operators and service providers and furthermore assist in reducing the number of rail operation disruptions due breakdowns and equipment failures.

- condition-based monitoring projects including the development of battery control systems for use with the latest battery systems for extending maintenance cycles, modelling wheel bearing wear and determining the best maintenance practices, and developing weld modelling software to assist in improving the quality of welding in rail manufacture.

Smart Rail RouteMap

The Smart Rail RouteMap (**attached**) developed by the Australian rail industry in 2019 is a strategic framework to support the adoption and deployment of digital and communication technologies and maps a series of objectives and initiatives to address key challenges for the rail sector over the next 30 years, through which next generation rail technologies can be integrated and supported efficiently in the Australasian rail environment. The Smart Rail routemap identified priority areas in which the Government can support the rail sector in further investment and facilitate collaborateive partnerships to develop new innovative technologies.

There is great opportunity for Australia to set itself up as a high-technology developer in the rail sector and to create more job opportunities. This could include Innovation hubs, or Centres of Excellence to support not just local manufacturing but global manufacturing organisations. There's great research capability in Australia, and many are keen to invest in Australian innovation when facilitated and supported.

Barriers

Research and Development (R&D) is a crucial component of innovation and a key factor in developing new competitive advantages. R&D contributes to innovation, improved productivity and, ultimately, to jobs creation and economic growth. Yet, investment in R&D in Australia remains relatively low compared to other OECD countries. The Australian rail sector has lagged in the adoption of new technologies. This has been partly constrained by existing procurement processes.

It is crucial governments support R&D and commercialisation activities to promote continued investment in the rail industry and the transport sector more broadly. Local suppliers must be encouraged to embark on R&D or invest in new technologies that make our supply chain more effective. The benefits of doing so is clear: more efficient operations that generate new opportunities for growth and environemtnal sustainability.

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The current uncertainty and risk related to international supply chains as a result of COVID-19 highlights the importance of reliable, local capability and, in turn, the importance of investment in R&D to identify and maintain areas of competitive advantage for Australian industries.

With significant capital expenditure planned in the rail industry over the next 10 years, a cohesive approach to R&D and technology development, supported by government incentives, will be crucial to maximising efficiency and productivity gains. However, there is currently a disconnect between planning, action, support and adoption when it comes to investment in these areas.

A number of key barriers that hinder the development and adoption of innovative technologies, specifically in rail, are highlighted in the following phases:

R&D

- Fragmented R&D – poor coordination across respective organisations, limited knowledge sharing, lacking economies of scale
- Long development with uncertain returns – limited appetite for prospective, game-changing research
- Decentralised data, limited sharing and collaboration across design experiments

Commercialisation

- Funding gap to support commercialisation of research.
- Risk averse buyers – tendency of Purchasers to adopt global customers proven technologies before Australian innovations.
- Lack of national coordination limits economies of scale – the full scale of benefit cannot be achieved by one buyer alone

Manufacuturing

- High labour costs, and low cost international competition
- Distance to export markets
- Skills constraints in advanced manufacturing
- Lack of economies of scale

Procurement and Adoption

- Uncertain and lack of standardised procurement processes for industry with high bid costs, long and contested procurement timeframes
- Fragmented rail market limits investment capacity with few purchase events beyond the initial major build
- Fragmented rail standards create fragmented markets
- Risk averse nature of purchasers
- protracted and counterproductive type approval process

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To faciltiate the uptake of new technologies in the transport sector, the government has a leading role, given its investment and market failure in the transport sector.

The transport system is riddled with market failures, especially externalities, sunk costs and coordination failures, this means that strong policy signals and government financial assistance are necessary to drive low emission technology adoption in the sector, including:

- In freight transport, the costs generated by large long-distance trucks are not passed through fully to users. There is a widely recognised case for mass-distance-location charging to be introduced, as in other countries, to correct this market failure.
- Direct public investment is required in major rail infrastructure (such as rail track and associated works and equipment) which suffers from all three forms of market failure. Support for private and public investment in areas such as signalling and control systems, advanced modal interchanges and other forms of coordination is required. There is also a need for the development and implementation of standards for rolling stock and infrastructure to improve transport system performance.
- To modernise Australia's rail system, massive investment will be necessary by operating companies, whether public or private, and by firms in supplier industries. Given market failures, public initiatives in the form of R&D support programs and enhanced depreciation allowances for certain classes of expenditure are necessary.
- Support to repower or replace its oldest locomotives, develop energy use management tools and advanced braking systems, as well as explore alternative fuels.
- The process of reversing the dramatic modal shift to road that took place over 1945-85, and of modernising the Australia rail industry, will be a long term one requiring sustained action. It would involve the majority of Australia's non-bulk freight movements outside capital cities occurring in modern, highly efficient trains; a significant share (20-25%) of all passenger kilometres travelled in Australia being by rail; and the overall rail system being electrified and/or increasingly powered by renewable energy.
- Environmental regulations can be unnecessarily burdensome and differ between jurisdictions. There is benefit in reviewing and harmonising where possible to reduce the red tape burden and streamline industry's compliance costs

Attachments:

Smart Rail RouteMap

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