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TTG
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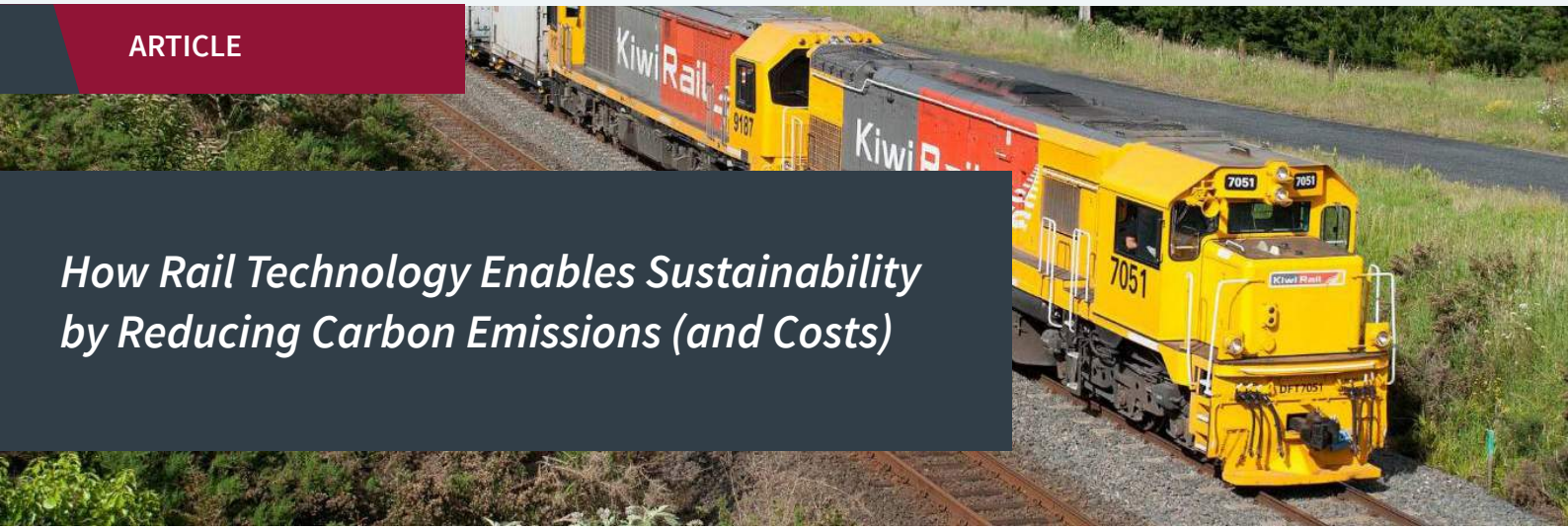
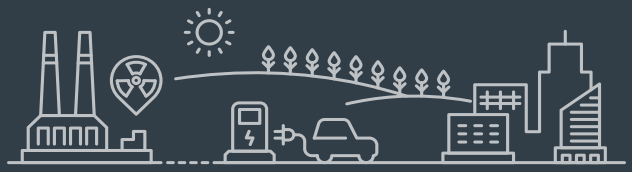


How Rail Technology Enables Sustainability by Reducing Carbon Emissions (and Costs)



With many countries committing to 2050 net-zero carbon emissions targets, industries are investigating how to minimise their carbon dioxide equivalent (CO_2-e) emissions to help meet this ambitious goal. Annual global CO_2-e emissions continue to rise, and as of 2019, were 36 billion tonnes - up from 22 billion tonnes in 1990[1].

Conceptual technologies, often either unproven or not fully developed, are sometimes mooted as the answer to reaching a zero-carbon economy.

However, while these conceptual technologies are being developed, there are innovative, proven solutions that are available today, tested by innovators and early majority companies, that significantly reduce CO_2-e emissions. These solutions incrementally reduce CO_2-e emissions, but when adopted pervasively across the market, result in a significant overall reduction.

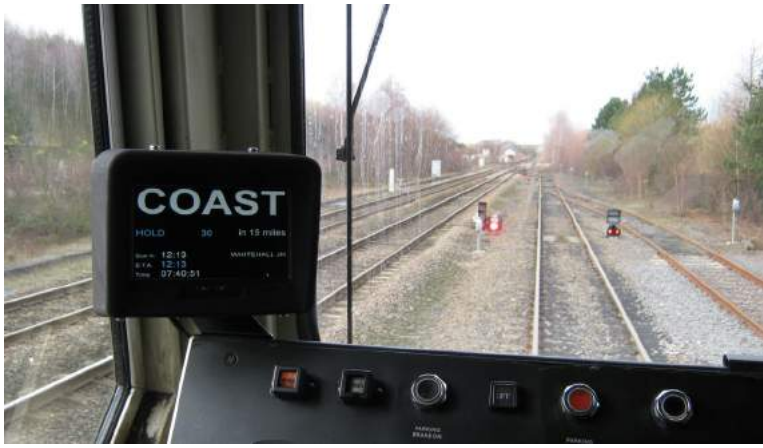
Rail transport, for both passengers and freight, is already one of the most efficient and least energy-intensive forms of transport available in the market. It provides the same or better levels of service than other transport modes, but with far lower energy use and emissions per Gross Tonne Kilometre (GTK) or passenger kilometre. Rail transports 8% of the world's passengers and 7% of global freight, yet only generates 2% of total transport energy demand[2].

However, operators can extend the advantages of rail transport by implementing existing technology to further increase efficiencies – thereby reducing costs and becoming even more environmentally friendly, helping meet net-zero global emissions targets.

What are Rail Driving Advice Systems?

Rail driving advice systems inform the train driver of the optimal travel speed that enables trains to arrive on time, whilst also using the least amount of energy. Railways around the world are now starting to implement C-DAS, which extend the capability of driving advice systems. C-DAS enables communication with a central control system that monitors train behaviour, and revises train schedules in real-time.

A leading C-DAS solution is Energymiser®, developed by TTG Transportation Technology, which is now part of the Modaxo collection of transport technology companies.



What is Energymiser®?

Energymiser® is award-winning C-DAS technology that provides real-time driver advice and performance reports for any kind of train – including diesel, electric, high-speed, freight, and heavy haul.

Energymiser® reinforces good driving behaviour and provides drivers information to make accurate and consistent driving decisions. It does not direct drivers on what to do – it simply provides advice based on track characteristics and the timetable.

This article examines how the implementation of more efficient train driving, using Connected Driver Advice Systems (C-DAS) technology, can significantly reduce CO_2-e emissions – while at the same time, providing significant fuel and energy use savings.

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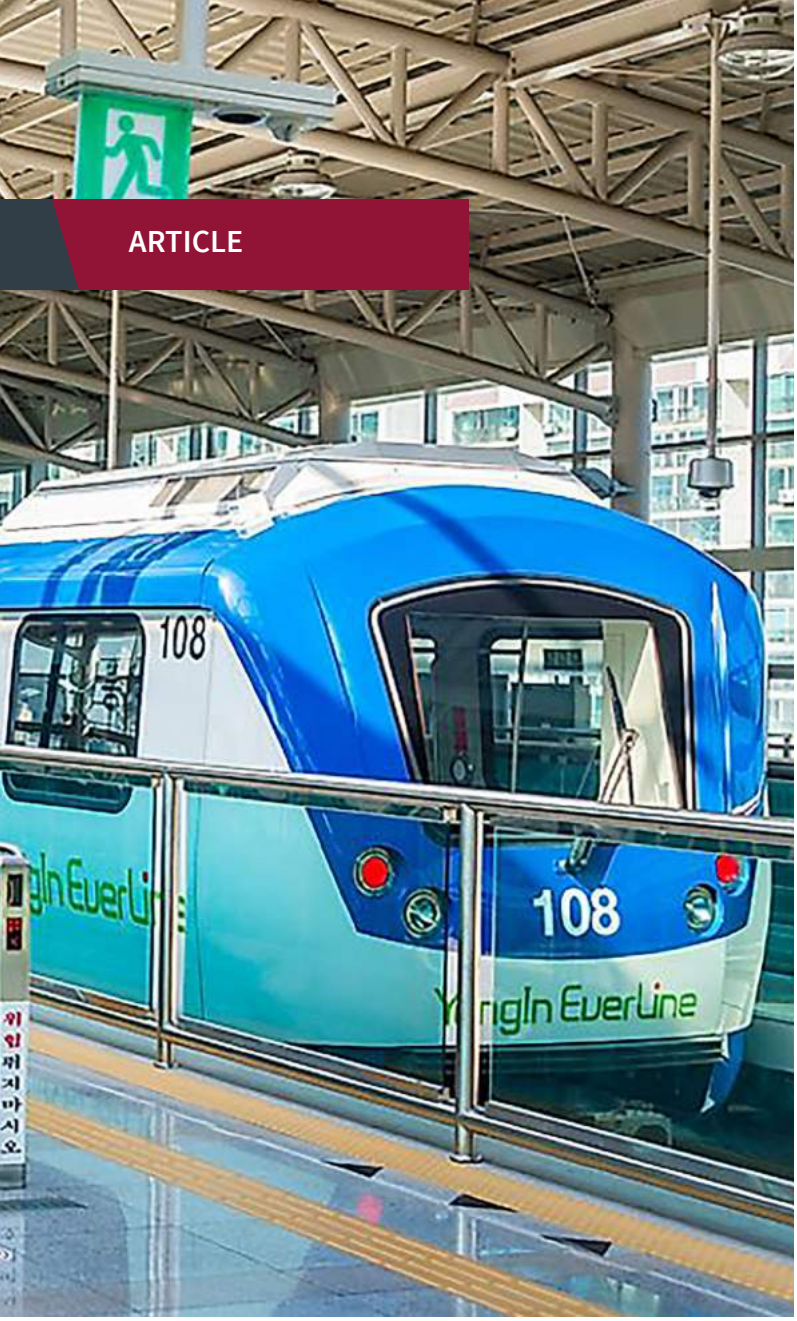


Essentially, Energymiser® reduces energy consumption and CO_2-e emissions while improving on-time arrivals. It automatically optimises a train journey to minimise the energy required to complete that journey.

Energymiser® prepares journey data, temporary speed restrictions, and optional timetables and adapts to actual conditions throughout each unique rail journey. Energymiser® does not save energy by simply slowing trains down; it generates and continuously adjusts an optimal profile throughout a trip.

Energymiser® saves energy by using the following four driving modes:

Power - accelerating with full power on steep inclines.

Hold Speed - *holding at speeds less than the speed limit.*

Coast - *slowing down for flat routes or steep declines.*

Brake - *decelerating for stopping or slowing down a steep decline.*

Energymiser® also increases rail capacity utilisation, as well as reducing train and track maintenance costs as it minimises over-speeding and braking. It also integrates with other technology and complements critical safety systems. Energymiser® can also be interfaced to autonomous train operations.

Is C-DAS/Energymiser® Proven Technology?

Energymiser® is proven, Australian-developed technology that has been implemented globally. It has been installed on over 8,000 train and driver applications across 80,000 kilometres of track in ten countries and four continents. Energymiser® can be retrofitted or integrated for any train type and does not involve extensive configuration or large-scale capital investment.

The technology already delivers sustainability improvements to leading world-class railways, including SNCF in France, KiwiRail in New Zealand, and key operators in the United Kingdom, including Arriva, Abellio and First Group. It is also used or is user ready on trains in Europe, Australia, Africa, and Asia.

What are the Potential Carbon Reductions and Fuel/Energy Savings?

Extensive Energymiser® trials and simulation studies have been conducted globally. Results have shown there is a proven ability to make significant fuel use, energy, and CO_2-e emissions reductions by simply enabling more efficient train driving.

KiwiRail, New Zealand's largest rail transport operator, services approximately 4,000 kilometres of track. Since Energymiser® was installed on the freight fleet, it has enabled a 10% reduction in fuel costs. Between 2015 and 2020, KiwiRail saved approximately 17 million litres of diesel, worth tens of millions of dollars.

Annual carbon emissions are down 15% from 272,345 CO_2-e tonnes in 2015/16, to 230,036 CO_2-e tonnes in 2019/20[3]. KiwiRail has also reduced its annual energy usage by 39 GWh.

SNCF is France's national state-owned railway and includes the signature high-speed service, the TGV. SNCF uses 9 TWh of electricity in France annually, or 3% of all electricity consumed in France[4]. SNCF installed Energymiser® on all TGV trains to achieve energy consumption savings of up to 10%.

Current energy expenditure directly related to TGV trains is around €200 million annually, down from €220 million, from an overall SNCF energy budget of €1.3 billion[5]. When the system is fully rolled out, SNCF expects to save millions off their electricity bill annually, and a significant reduction in CO_2-e emissions.

Energymiser® has already achieved 6% to 10+% energy savings for passenger and coal trains in the United Kingdom, where it is the C-DAS market leader on a congested rail network. Energymiser® has also provided 8.9% energy savings for long and heavy iron ore trains in Africa, and 10+% for freight trains in Australia, the United Kingdom and India[6]. These energy savings translate into similar CO_2-e reductions.

For electric trains, the cost of electricity and electricity grid reliability are key issues for rail operators. While energy-efficient, they have a significant impact on national electricity supply systems. Electricity costs typically increase during high demand periods, and there are substantial opportunities for railways to increase profitability by reducing their energy use during these times.

Additionally, in many countries, baseload power is normally provided by the cleanest generators, with older and less-efficient generators only used during periods of peak demand. Reducing energy demand in peak times can further reduce emissions as these least energy-efficient generators are taken offline.

Depending on the type of rail operation, the payback period for an Energymiser® implementation is approximately one to three years, which is a fast return on investment.

What are the Potential Global Carbon Emission Reductions?

Globally, transport accounts for almost 25% of all greenhouse gas emissions. Of this, rail accounts for 3% of transport emissions[7],[8], [9]. Overall, rail accounts for approximately 270 million tonnes CO_2-e per year.

If used globally on every single locomotive, assuming a conservative 10% reduction, Energymiser® could reduce rail carbon emissions by over 27 million tonnes CO_2-e per year.

> ***This reduction in carbon emissions is equivalent to planting over 450 million trees that sequester carbon for 10 years or taking 5.8 million cars off the road[10].***

These calculations demonstrate that energy use efficiency measures, such as Energymiser®, can significantly decrease the carbon footprint of rail transport, without requiring large scale capital investment.

Why Isn't Every Rail Operator Using C-DAS?

Historically, some barriers can delay new technology like Energymiser® from being widely adopted – such as government regulations and requirements, electricity market conditions, and reluctance to adopt new technology in a complex operating environment. Today, driver assist technology is now expected as part of new operations and is usually specified as a key tender requirement.

In New Zealand, KiwiRail has shown that these organisational and cultural barriers can be overcome by bringing all parties to the table to discuss the long-term economic and environmental benefits. In 2013, KiwiRail conducted a three-month trial on a freight line in the North Island.

After the promised fuel reduction target of 10% was demonstrated, the decision was made to implement Energymiser® across the entire fleet[11].

KiwiRail enlisted senior train drivers to champion the system, which is now installed in all of KiwiRail's 180 locomotives. Over 350 train drivers have successfully received training on how to use Energymiser®. There is even scope to include C-DAS in training and simulation programs for train drivers, so they are familiar with the system before operating locomotives in the real world.

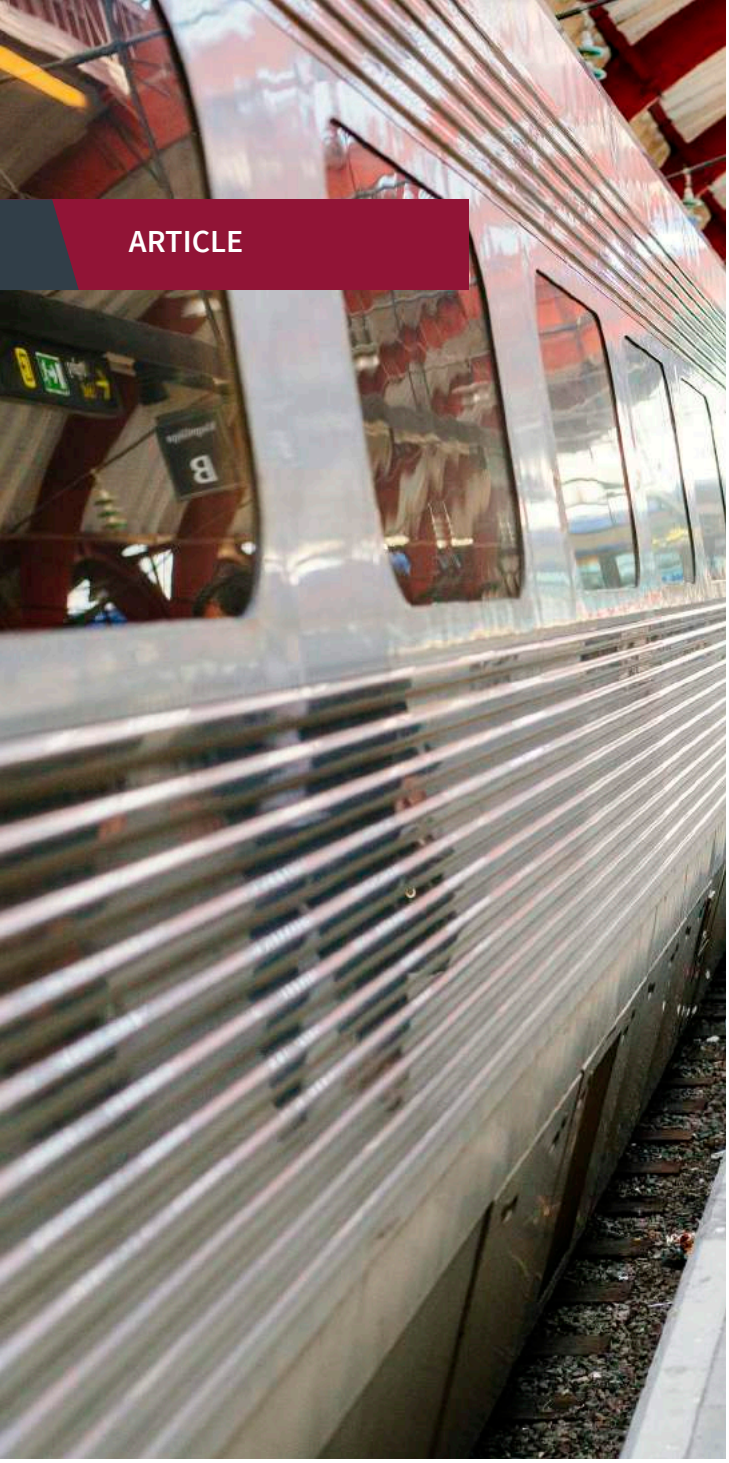
Conclusion

When considering how to practically reduce CO_2-e emissions, there are tools and solutions already available that can make a tangible impact right now.

These proven examples, like Energymiser®, show major environmental benefits can be achieved, with the added advantage of cost savings and service improvements.

Energymiser® can enable efficiencies that help rail operators reduce fuel or electricity use (usually a rail operator's largest expense), reduce CO_2-e emissions, and improve on-time performance simultaneously.

This all supports the most efficient form of transport, rail, becoming even more sustainable – making rail transport a more attractive and affordable investment.



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TTG
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Trapeze Group works with public transport agencies and their communities to develop and deliver smarter, more effective public transport solutions. For more than 25 years we have been *Here for the Journey*, evolving with our customers around the world to help them move people from point A to Z and everywhere in between.

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