

# Hybrid and Electric Technology (Road and Rail)

The report from the Australian Low Carbon Transport Forum “Greenhouse Gas Abatement Potential of the Australian Transport Sector” (CSIRO, 2012) found that the greatest abatement option for reducing emissions by the year 2050 is through the implementation of electric and (plug-in) hybrids. They estimate that with full roll out of electric vehicles for light transport purposes could reduce emissions by 36 MtCO<sub>2</sub>e in Australia alone. Of course this will depend on the electricity generation mix that is used to charge these vehicles.

## Battery

Developments in battery technology will have a serious impact on the up take of electric vehicles throughout the industry. At present battery technology has not advanced far enough to allow a greater penetration of the Australian freight industry.

To travel 100km alone entirely through electric propulsion would require a battery weighing several hundred kilograms in a medium heavy truck. To achieve longer travel lengths requires more batteries which due to the increased weight makes these journeys unfeasible for modern trucks.

## Hybrid Technology

For heavier trucks however hybrid drive trains is one technology that is touted for its future emission reducing potential.

Although currently only available for certain vehicles, hybrid technology will likely enjoy a more significant Australian market share in the coming few years. More readily available in the US and Europe, hybrids provide impressive cost and emission savings for specific applications in freight vehicles.

Plug in hybrid electric vehicles are powered by a combination of petroleum based or alternative fuels as well as electric power delivered from its battery that is charged from the electricity grid. The vehicle will use its battery to power the vehicle and then switch to its internal combustion engine once the electric battery has been drained. Regenerative braking allows the battery to be partially recharged.

Due to their ability to recapture energy from braking and their ability to shut off the engine while idle, hybrid drive trains are a promising way to reduce emissions especially in urban settings where a vehicle is expected to make many stops in delivering its load.

With increasing battery capacity, the more beneficial hybrids will become to the freight industry as the amount of fuel required for work is reduced. It has been estimated that hybrid heavy trucks have the ability to reduce their fuel consumption by as much as 34% in the city and as much as 7% on highways when compared to diesel heavy trucks (Muster, 2000, p.13). Currently Toll who have been utilizing hybrid trucks on its Fosters Heathwood site since 2009 finds that their hybrid vehicles are 20 per cent more fuel efficient than their diesel equivalent in urban driving, while also offering better power and torque (Toll ,2013)

Due to the general weight of freight in the average truck and distances it travels, the full fleet roll-out of electric vehicles will be hindered until better advancements in battery technology comes along. While electric may be suitable for a small percentage of freight task delivery, currently it looks like the wider implementation of hybrid technology is one certain way that freight forwarders can look to reduce their emissions and reduce fuel expenses.

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## Electric Locomotives

For future locomotive procurement, both hybrid and gas-powered trains provide the potential for major gains in fuel efficiency and pollution reduction, with developments and trials of these technologies already underway.

Electrification of rail lines offers reduction in emissions when the electricity is sourced from cleaner sources than diesel. Due to the current Australian electricity generation mix and higher efficiency of electric locomotives, they already have the ability to reduce emissions than standard diesel-powered locomotives.

Electric powered locomotives have an advantage over diesel powered locomotives in that they are cheaper to buy and cheaper to run. However rollout is limited by the high capital costs it takes to electrify rail lines.

One issue with diesel powered locomotives is that kinetic energy created from braking is wasted and overall efficiency is reduced. Despite being available for the previous few decades regenerative braking is a technology that can be utilized to reduce the amount of energy required from the electricity lines to power a train. In electric railways electricity produced from regenerative braking is fed back into the supply system.

## Hybrid Locomotives

Where high capital costs make the electrification of long distant freight routes unfeasible, hybrid locomotives look to be the rail industry's solution to reducing emissions. Hybrid locomotives use a combination of diesel and electricity stored in on-board batteries to power their loads. Hybrid technology allows an on-board rechargeable energy storage system to be placed between the power source and the traction system connected to the wheels, which allows surplus energy to be collected through regenerative braking. The energy storage device uses batteries, super capacitors and flywheels to increase locomotives efficiency.

General Electric is developing hybrid technology for locomotives. GE states that these locomotives will deliver an additional 15% reduction in fuel consumption and a 50% reduction in emissions (General Electric Company, 2010).

Due to the longevity of locomotives, newer more efficient locomotives will be slower to be rolled out within the industry. However higher oil prices as well as government incentives may fasten entire fleet roll out. The procurement of new locomotives brings with it a host of technological developments that deliver fuel consumption savings of 8-10%. This results in substantial returns for assets where fuel is 60% of the lifecycle cost. Where new locomotives are compliant with US emission standards, dramatic improvements in emissions of other pollutants can also be expected. The very high capital cost of locomotives means procurement is relatively insensitive to policy. Healthy demand for rail services from new and existing routes can underpin these large purchases.

