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Our Ref: D09/14936

28 August 2009

Rob Hansen
Research Director
Environment and Resources Committee
Parliament House
Brisbane Qld 4000

Dear Mr Hansen

Inquiry into Energy Efficiency Improvements

Thank you for the opportunity to provide input to the Inquiry into Energy Efficiency Improvements. The attached submission has been prepared by the TransLink Transit Authority (TransLink) which is responsible for managing the public transport system in South East Queensland.

The submission contains:

- details on the contribution that public transport makes to energy efficiency;
- TransLink's energy efficiency program, including information on the busway network, high capacity vehicles, ticketing strategies and solar busway station;
- opportunities to further improve the energy efficiency of the network. Specific initiatives include additional bus priority measures, hybrid and lightweight bus designs, and investment in more solar powered bus stops and stations; and
- proposed methods by which both the state and federal governments can provide support for these initiatives. For example, through tax incentives for public transport use, tax credits for the purchase of fuel efficient vehicles, and development of a policy for use of solar power for bus facilities.

I hope that this submission will be of interest to you and the committee. If any further information is required, please do not hesitate to contact me on 3167 4073.

Yours sincerely

Robin Barlow
Director (Strategy and Planning)
TransLink Transit Authority

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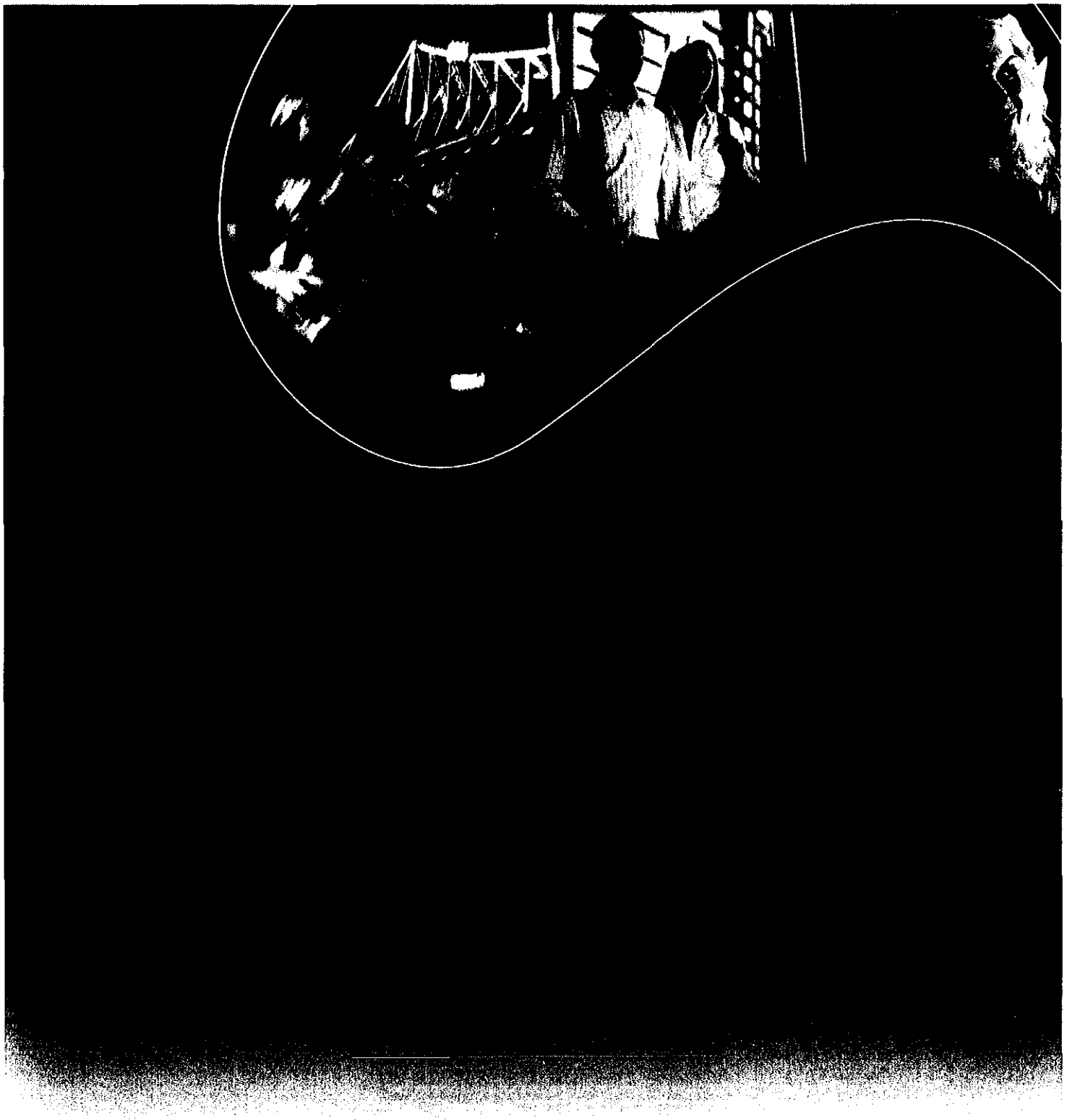

Environment & Resource Committee

Inquiry into Energy Efficiency Improvements

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Inquiry into Energy Efficiency Improvements

TransLink Transit Authority Submission

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1. Executive Summary

This submission has been prepared by the TransLink Transit Authority (TransLink), which is responsible for the management of the public transport system in South East Queensland. The recently released Senate Report 'Investment of Commonwealth and State funds in public passenger transport infrastructure and services', identifies the energy efficiency of public transport. This submission complements this report by outlining how public transport services deliver maximum outcomes from two key resources, being fuel and road space.

This submission also outlines the current initiatives TransLink is putting in place to improve the energy efficiency of the public transport network. More specifically, this submission outlines the contribution of the:

- TransLink Network Plan;
- Busways;
- Busway stations;
- High-capacity vehicles; and
- *go* card and pre-paid ticketing strategies.

A number of opportunities for additional initiatives to further improve energy efficiency are also presented, including:

- Implementation of bus priority measures across the network;
- Investigation into hybrid and lightweight bus design;
- Implementation of a bus depot strategy to reduce 'dead running' or non-service trips; and
- Investigation into a solar powered bus stop program.

While TransLink is already progressing some of these initiatives, this submission presents a number of ways in which both the state and federal governments can support this work, including:

- Continued investment in public transport services and infrastructure to ensure this more energy efficient network can accommodate the forecast growth in demand and attract additional patronage to reduce car use;
- Investigating taxation changes to encourage the increased take-up of public transport services and reduce the car culture in the workplace;
- Providing support for bus priority measures across the network to improve the efficiency of peak period services, reduce passenger journey time and increase the attractiveness of public transport;
- Investigating tax credits for the purchase of fuel-efficient buses to reduce the relative cost of these models; and
- Developing a policy to support solar powered bus facilities (where appropriate) to support TransLink's investigation into, and implementation of a solar program.

2. Overview of the TransLink Transit Authority

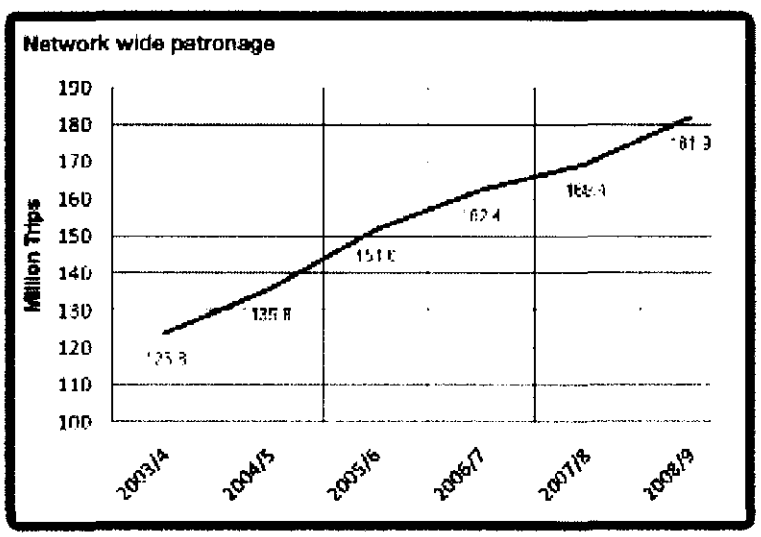
To meet the growing demand for public transport in South East Queensland, the state government established the TransLink Transit Authority (TransLink) as a statutory body on 1 July 2008[1]. TransLink is responsible for providing the best possible public transport services at a reasonable cost to the community and government.

To deliver on the Queensland Government's commitment, TransLink coordinates, integrates and manages all public transport services in the South East Queensland region. This involves:

- **Services**: planning, purchasing and managing the performance of bus, train and ferry services.
- **Infrastructure**: planning and overseeing the delivery of busways, bus stop/station and railway station upgrades and the development of Park n' Ride facilities.
- **Ticketing:** management of fares, integrated ticketing and the *go* card.
- **Customer Information and Service:** providing a single point of contact for customers, production and distribution of public transport information and introduction of new information technologies.

TransLink is managing a public transport system experiencing unprecedented growth. Since July 2004, there has been an increase of 46 million trips taken on buses, trains and ferries in the region. This equates to growth of 34% in just over four years.

Figure 1 –Public Transport Patronage in South East Queensland 2003/4 to 2008/9



While the influx of residents to South East Queensland has contributed to demand for public transport, the patronage experienced in South East Queensland has outstripped population growth by three to one[2]. This indicates the success of the numerous improvements implemented by TransLink over this time, including:

- The introduction of integrated ticketing – created a single ticket for travel across all modes on the TransLink network.
- The development of the busway network – provides passengers with a free-flowing congestion free ride.
- Introduction of new bus and train services – to meet demand for peak services and to ensure minimum standards are met across the region. For example, in February

[1] TransLink was originally established in 2002 as a division of Queensland Transport

[2] Based on population growth and patronage between 2004 and 2007. Office of Economic and Statistical Research. *Estimated resident population by statistical division and subdivision (pre-reform), Queensland, 1996 to 2007.*

2009 $6.8 million was invested in new bus and train services, providing for an additional 79,000 passengers per week.

- Implementation of high-frequency BUZ routes – provides customers with frequent and fast services.
- Delivery of Park n' Ride facilities – allows customers in low density areas (unable to sustain dedicated services) to access public transport services more conveniently.
- Upgrades to train stations – provides customers with safer and more comfortable waiting environments. Recent upgrades have occurred at Fortitude Valley, Indooroopilly, Brisbane Central, Fruitgrove, Ipswich and Petrie stations.

However, population growth in South East Queensland is expected to continue, placing further pressure on energy resources. TransLink has developed a network plan that will accommodate an expected doubling in public transport demand in 10 years. This will enable South East Queensland to become an 'economic power house' but with minimised fuel and other transport energy consumption. To achieve this, continued investment in public transport should factor in energy efficiency measures across the network, along with increasing services and coverage to meet demand.

3. The contribution of public transport to energy efficiency

3.1 Efficient use of key resources

While public transport plays a vital role in economic, social and environmental sustainability, it also promotes efficient use of two key resources being fuel and road space.

With regard to fuel, public transport is an incredibly efficient means of transportation. As outlined in the Senate Report 'Investment of Commonwealth and State funds in public passenger transport infrastructure and services' (August 2009)[3], urban buses, trams and trains use about a fifth to half as much fuel as cars per passenger kilometre. This advantage is even greater in peak periods when the occupancy of buses and trains is higher, and that of cars is low.

Currently half of all motorised trips in the Brisbane Statisical Local Area between 7am and 9am are on public transport. This equates to 72,000 trips that may otherwise be made by car being made in more energy efficient buses and trains (equivalent to 56 full trains and more than 450 full buses). In this way, public transport is delivering much better outcomes for the resources consumed, in comparison to private vehicle transport.

The public transport network also optimises the use of existing road assets. Following the example above, if this amount of trips were to be taken in cars an additional 15 traffic lanes would be required into the CBD during the peak period (two hours). However, our public transport network can move this same number of people within the existing road space. It should also be noted that roads widened to accommodate peak period flows usually only operate at optimum capacity for three to four hours a day. This means that a relatively small return is gained for a large investment of funds and infrastructure.

For these reasons, the Senate Inquiry has found that public transport supports government policies to improve energy efficiency (p.17).

[3] The Senate, Rural and Regional Affairs and Transport References Committee, *Investment of Commonwealth and State funds in public passenger transport infrastructure and services*, August 2009, p.23.

3.2 Encouraging greater public transport use

As stated in the Senate report, the advantage delivered by public transport would be greater if there was more public transport use[4]. On this basis, individuals should be encouraged to use public transport as a travel option wherever possible. As outlined in the previous section, TransLink, through the state government has made public transport an attractive alternative to private car use, and is achieving patronage growth rates well in excess of population growth.

However, the Senate Inquiry has identified a number of ways in which the federal government can assist in this process. For example, the Australian government can:

- Consider re-instating funds 'Travelsmart' behaviour change programs which result in more people being informed of, and choosing to use either public or active transport options (Recommendation 1);
- Invest in public transport infrastructure projects that deliver community and economic benefits (Recommendation 4);
- Investigate options for tax incentives for public transport, particularly for those that encourage 'buy-in' by employers to promote sustainable transport options (Recommendations 5 and 6); and
- Revise the car FBT rules to reduce the encouragement of a car culture in the workplace (Recommendation 7).

The Transport References Committee was hesitant to support direct tax incentives for public transport, in favour of focusing attention on improving the quality of the services to attract more patrons. However, there is the opportunity for the state government to work with the commonwealth to deliver both:

- Employer funded public transport benefits; and
- Individual tax incentives.

Employer funded benefits

Section 5.53 of the Senate report states that support should be given to measures that encourage employer 'buy in' to promoting sustainable transport in their workplace. One way this is achieved in America is through the federal tax system, which provides the ability for employers to offer transport benefits to employees of up to $105 per month for public transport[5]. This benefit is exempt from fringe benefits tax, and is excluded from employee's gross income. The TransLink *go* card would facilitate such a scheme in South East Queensland, as (in the American example) employers could directly allocate funds to employees public transport smart cards.

There are two major benefits of employer funded transport benefits. The first is that businesses become an active driver of behavior change in the workplace. The second is that it provides employers with an additional mechanism to attract staff.

Individual tax incentives

There is also the opportunity to widen and increase salary sacrificing for public transport. At this time salary sacrificing for public transport is only available to public servants, and only for travel on Brisbane Transport and Queensland Rail services. The amount able to be salary sacrificed for public transport is also combined with electricity, with the maximum of both per annum limited to $1,300. Having public transport as a stand-alone item with the same threshold may be an opportunity to encourage more people to use public transport, and reward those who already invest in relatively more efficient transport options.

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[4] As above, p. 24

[5] http://www.irs.gov/irb/2006-47_IRB/ar05.html

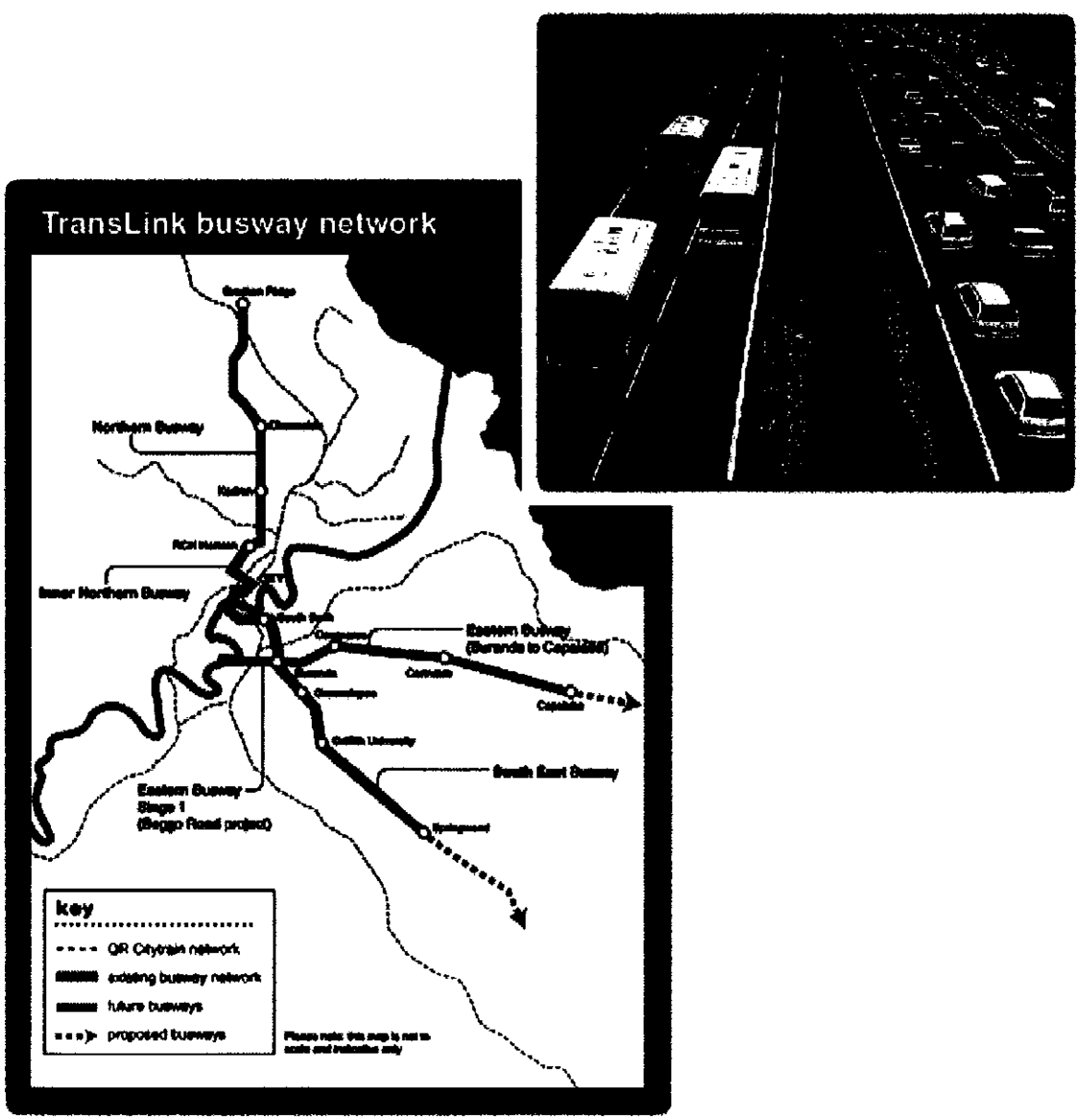
4. TransLink's current energy efficiency program

4.1 The Busway Network

The Queensland Government is delivering a unique busway network designed specifically to suit South East Queensland's public transport needs. Busways are dedicated roadways that separate buses from general traffic. They offer TransLink customers a congestion-free run on fast, frequent and reliable services.

Core sections of the busway network are in place, with the South East Busway and Inner Northern Busway already operational. The Boggo Road Busway and the first stage of the Eastern Busway were also opened in early August. As shown on the diagram below, on completion of the busway network, customers will be able to travel on a bus from one side of the city to the other without encountering congested roads.

Figure 2 –The TransLink busway network



Due to the significant benefits provided to customers, the busway network has experienced enormous success. The South East Busway (opened in 2001) records more than 40 million trips each year or about 3.5 million passenger journeys a month. This equates to this busway alone delivering more than 20 per cent of South East Queensland commuters to their destination. Some services on the Inner Northern Busway have also experienced a doubling of patronage levels since it opened in May 2008.

In addition to attracting people away from their cars, and providing a valuable service to passengers, they also play a vital role in ensuring energy efficiency of our public transport network. Research has shown that vehicles traveling on congested roads use twice the amount of fuel as those on free-flowing roads[6].

By taking buses out of congestion, busways cut fuel consumption on these buses by half.

While there are many variables affecting fuel consumption, this is largely due to:

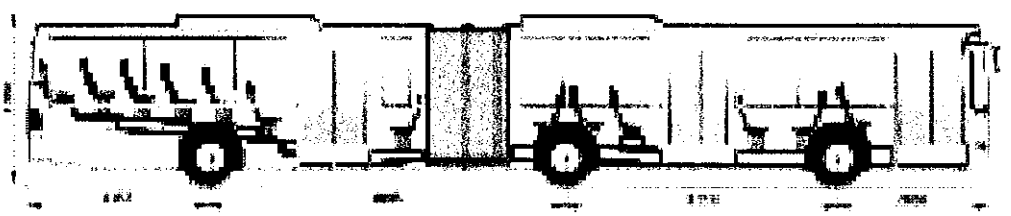
- Lower speeds in congestion – the lower the average speed, the more fuel is consumed during the journey. The lower speeds also contribute to increased travel time;
- The continual acceleration-deceleration associated with congestion and traffic lights on roads – this action burns more fuel.

The relative efficiency of busway services is evident in the new busway sections opened in August 2009. By creating a fast-flowing run, it has reduced travel time between the Eleanor Schonell Bridge and Buranda Busway Station by almost 10 minutes and cut out seven sets of traffic lights for buses. Taking the buses off the roads on this route also improves the fuel efficiency of the remaining traffic, as the left lane is not intermittently stopping behind a bus at each bus stop.

4.2 High-capacity vehicles

To add to the effectiveness of the busway network, TransLink is investing in higher capacity vehicles, which are more fuel-efficient. Two high-capacity, three door articulated buses are on order, the first to be delivered in December 2009, and the second in March 2010. These vehicles have capacity for 110 passengers, compared to a standard rigid vehicle of 69 passengers, an increase in capacity of 60 per cent.

Figure 3 –An example of high-capacity articulated bus[7]



[6] Urban congestion – the Implications for Greenhouse Gas Emissions, Bureau of Transport Economics, 2000

[7] Source: www.volvo.com

In peak times on the busways, two high-capacity articulated vehicles can substitute for three rigid buses, a saving of running one standard rigid bus and its associated fuel consumption.

Efficiencies are gained by running larger but fewer and more modern buses.

These vehicles are designed to transfer as much power as possible from the engine and gearbox to the driven wheels, with minimal losses on the way. The gear changing systems themselves minimise internal losses, which contributes to lower fuel consumption. With the additional door on these vehicles, passengers will also be able to board and alight from the bus as quickly and conveniently as possible. This reduces the dwell time of the buses at busway stations or bus stops and thus fuel consumption while idling.

4.3 go card and pre-paid ticketing

Another way TransLink is seeking to reduce bus dwell time (and wasted fuel consumption) at stations and stops is through its ticketing products. The *go* card is TransLink's travel card that stores money so customers can travel seamlessly on TransLink bus, train and ferry services without having to buy a ticket. Customers simply touch on at the beginning of their journey and touch off at the end. The fare is automatically deducted from the card balance.

Popularity of the *go* card continues to grow with over 400 000 cards issued[8]. Almost one-third of all public transport trips are now taken using *go* card, growing to almost 50 per cent during peak times. Fares have been designed to both encourage and reward customers for adopting a more efficient ticket option. *go* card users have been saving between 20 and 35 per cent, compared to single paper tickets, whenever they travel on TransLink bus, train and ferry services and a further 50 per cent if they use their card more than 10 times per week.

To improve the efficiency of paper ticket transactions, TransLink has also implemented pre-paid ticketing on CBD busway stations during the morning and afternoon peak periods. During these times passengers must possess a ticket or TransLink *go* card to board services at the designated stations. A number of pre-paid only bus services have also been introduced to expedite the movement of high-demand services.

The introduction of go card and pre-paid ticketing has made a significant contribution to reducing dwell time and increasing fuel efficiency of TransLink bus services. For example, introducing pre-paid ticketing at the Cultural Centre Station during the afternoon peak saw a decrease in average bus dwell time at this station from 30.9 seconds to 21.7 seconds, a saving of 9.2 seconds per bus. With 471 buses passing through this station alone during the afternoon peak these savings translate to 72 minutes each weekday during the evening peak. This time saving becomes even more significant when the morning peak is taken into consideration. The compounded efficiencies gained at subsequent pre-paid stations along the route and across the network are enormous. Translink intends to pursue this strategy through implementing further pre-paid only stations and services across the network.

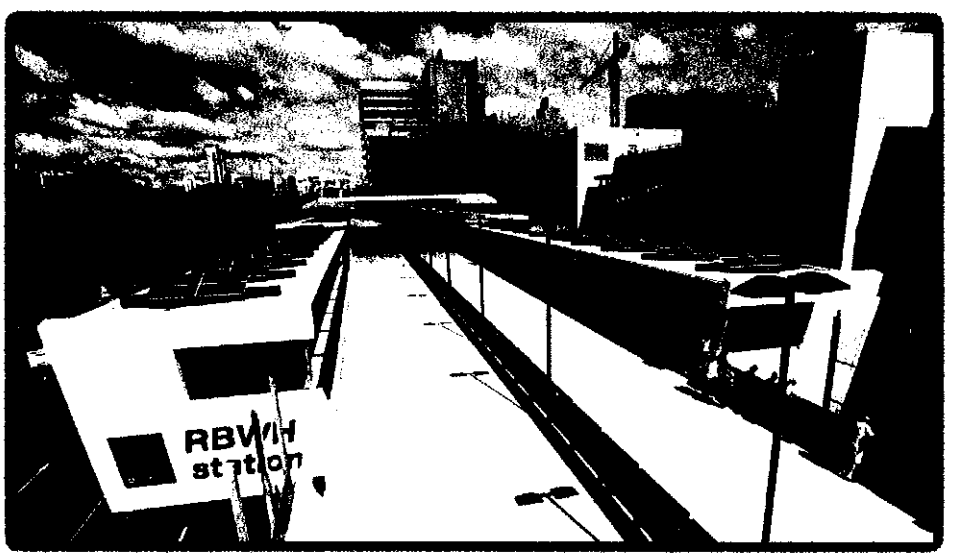
[8] As at 6th August 2009

4.4 Busway stations

TransLink busway stations are designed to provide customers with a safe, comfortable and accessible waiting facility, and to minimise the consumption of natural resources. Designs enable natural ventilation and lighting, rainwater harvesting, and the gardens contain drought-resistant plants. However, the next step towards energy efficiency has been taken with the Royal Brisbane and Womens Hospital (RBWH) Busway Station on the Northern Busway. This is the first busway station with solar generated power.

At this station, solar panels have been fitted to the platform roofs. Forty panels of 165 watts are fitted to each of the two platforms, delivering a maximum total output power of 13.2 kW.

Figure 4 –Solar panels on the RBWH Busway Station



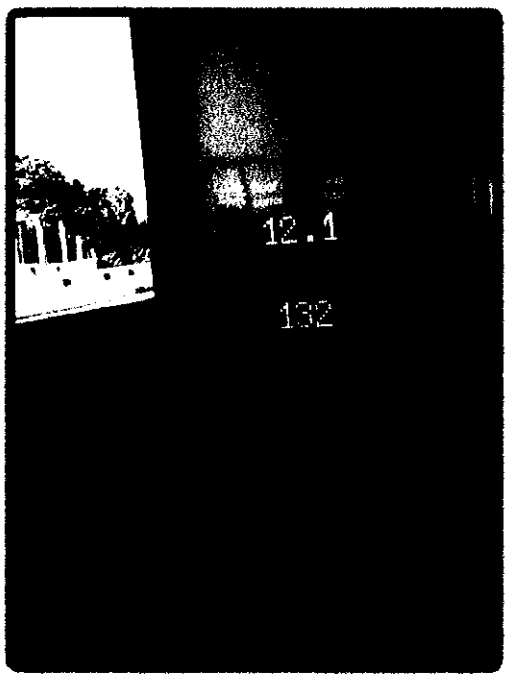
The solar system at the RBWH station is directly connected to the electricity supply grid, offsetting the power used by the station and feeding back to the grid any excess. For example, the stations peak power demand is approximately 50 kW. With the 13.2 kW generated by the solar system, energy consumption is reduced by 26 per cent.

In the off-peak the station is able to save almost 100 per cent of energy consumption.

During this time the power demand is only 15 kW, and the solar peak output is 13 kW. This off peak value is quite typical of a sunny day between 9am and 3pm where almost all station lighting is off and the solar panels are running at 100 per cent capacity.

This station also features Environmentally Sustainable Design (ESD) signs on the platforms to display to the public the solar power being generated from the panels, monthly accumulated harvested water used and multimedia messages. In this way, TransLink customers become more informed and involved in our energy efficiency initiatives.

Figure 5 –Environmentally Sustainable Design (ESD) Signs at RBWH Busway Station



5. Opportunities to improve energy efficiency

5.1 Improving fuel efficiency of services

Bus priority and High Occupancy Vehicle lanes

TransLink is currently working with other government agencies to identify opportunities to improve the efficiency of our bus services. As discussed in section 4.1, expediting bus movement to reduce travel time contributes to significant fuel efficiency of these services and, due to the reduced travel time has the additional benefit of attracting increased patronage. The Senate Inquiry into investment in public transport has also noted that[9]:

> **bus priority measures are important to make public transport congestion-free and improve reliability, and are considered worthy of significant investment.**

To this end investigations are occurring into the implementation of further measures to speed up buses and limit the negative effects of traffic congestion on buses, for example:

- Bus priority measures across the network - These include dedicated bus lanes, bus queue jumps, and bus priority signals at traffic lights. These measures both improve average speed across the journey and reduce bus dwell time; and
- High Occupancy Vehicle (HOV) lanes – transit lanes open to all vehicles carrying more than a specified number of occupants. This includes private cars and buses. These lanes are crucial on major arterial roads where buses do not have access to a busway, and there is heavy congestion during peak periods. Examples in Brisbane are T2 and T3 lanes.

[9] The Senate, Rural and Regional Affairs and Transport References Committee, *Investment of Commonwealth and State funds in public passenger transport infrastructure and services*, August 2009, p.33

The contribution that HOV lanes make to public transport efficiency became evident when a HOV lane was removed from Coronation Drive in March 2007. Morning peak period journey times were found to double, increasing by approximately 6 minutes over a 3km stretch.

However, research into HOV lanes also shows that these lanes are very difficult to police, which can reduce their overall effectiveness. For example, one study found that the violation rate on the HOV lane on Lutwyche Road was consistently as high as 33%[10]. This compromises the credibility and integrity of the lane, and reduces its overall effectiveness. For this reason it is recommended that Brisbane invest in targeted, stronger bus priority measures, especially in the CBD during peak times where buses share the road with cars. It is much easier to enforce bus only lanes than T2 or T3 lanes, and bus only lanes would significantly decrease travel time for buses, and in turn help to attract more people to buses as they become an even more efficient transport option.

TransLink is currently working with the Department of Transport and Main Roads to develop strategies for providing bus and HOV priority across South East Queensland. Part of TransLink's contribution to this work was an assessment of the minutes of delay buses are estimated to experience on the network. This factor will be used to select locations for bus priority measures.

Depot strategy

'Dead running' is the term used to describe bus travel that does not carry passengers. This usually occurs between the bus depot or refueling facility and the start or end of the bus route. In this way dead running represents energy spent for little productive outcome. To further enhance the fuel efficiency of our bus network, TransLink is currently developing a depot strategy. The aim of this strategy is to optimise the location of depots and reduce wasted road travel. Implementation of the depot strategy is expected to save 6.8 million kilometres of depot-based dead running per year.

Implementation of the depot strategy alone would enable TransLink to run the same services, with 37 percent less road travel and fuel use.

5.2 Bus design

There are currently two bus designs being used in Australia that provide opportunities to further improve the fuel efficiency of the TransLink fleet. These are:

- Diesel-electric hybrids; and
- Lightweight bus designs (including monocoque or single shell designs).

[10] Bauer, Joshua and McKellar, Cameron and Bunker, Jonathan M and Wikman, John (2005) High occupancy vehicle lanes - an overall evaluation including Brisbane case studies.

Diesel-electric hybrid buses

Hybrid-electric buses combine the benefits of diesel engines and electric motors and are configured to obtain improved fuel economy[11]. Some of the advanced technologies typically used by hybrids include:

- Regenerative Braking. The motor functions as a generator, converting energy normally wasted during braking into electricity, which is stored in a battery until needed by the electric motor.
- Electric Motor Drive/Assist. The electric motor provides additional power to assist the engine in accelerating, passing, or hill climbing. This allows a smaller, more efficient engine to be used.
- Automatic Start/Shutoff. Automatically shuts off the engine when the vehicle stops and restarts it when the accelerator is pressed. This prevents wasted energy from idling.

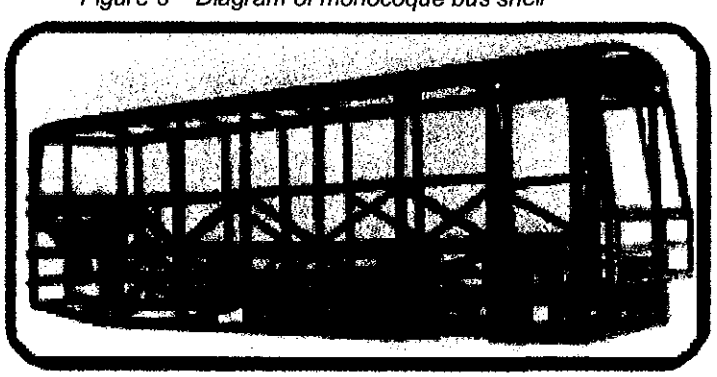
While trials of hybrid vehicles have been successful overseas, it is vital that these designs are tested within the specific transport environments in which they will be used. Road surfaces and gradients, speeds and climate all impact upon the extent to which the hybrid buses will deliver improved fuel efficiency.

A number of tests are being conducted on hybrid buses in Australia. For example in Melbourne, two hybrid-electric buses will be tested on suburban routes in a trial jointly funded by the Victorian and federal government. Initial estimates for this trial suggest this hybrid technology will provide a saving of around 20 per cent on fuel and greenhouse gas emissions compared to a conventional diesel bus[12]. A trial of a hybrid diesel-electric bus also will be undertaken in north Queensland where impacts of climate on the efficiency and effectiveness of the buses will be evaluated. TransLink will evaluate the results of the trials before considering inclusion of hybrid vehicles in its fleet strategy.

Lightweight bus designs

Many bus manufacturers are moving towards lightweight bus designs in order to both reduce road wear and improve fuel efficiency. A key example of this is monocoque design, which means "a single shell". In this design the body of the bus doubles as the chassis to create a unique single structure which significantly decreases the weight of the vehicle.

Figure 6 – Diagram of monocoque bus shell[13]



The Queensland based BusTech company is producing a lightweight vehicle which comprises a stainless steel frame, polycarbonate panels and plastic components to decrease weight and fuel consumption. This vehicle delivers weight reductions of 12% or

[11] Source: www.fueleconomy.gov/feg/hybridtech.shtml
[12] Source: Sydney Morning Herald, June 28 2009
[13] www.coronabus.in

1.5 tonnes without compromising strength or safety[14]. These vehicles are currently in operation across Queensland, however the relative fuel efficiency of these vehicles will be evaluated on a larger scale in New South Wales, with 70 to join the Sydney busway network. Statistics on fuel economy suggest that for every 10 per cent weight reduction, fuel economy improves by seven per cent[15]. On this basis, these vehicles could deliver over eight percent in fuel savings.

Barriers to take-up of fuel-efficient vehicles

At the present time, operators of bus services in the TransLink network are responsible for the purchase of new vehicles. While TransLink provides guidelines to encourage the purchase of more fuel-efficient models, this is currently hampered by the relative on-going cost of these vehicles. For example, more efficient bus models generally have smaller engines, and so the up-front costs can actually be cheaper, sometimes by around $20,000. However these smaller engines sustain greater levels of wear, requiring potentially two rebuilds during the life of the vehicle. This is a costly process, and is one reason why many operators continue to purchase the less efficient vehicles with larger engines. Up-front or on-going tax credits may be one way to reduce the opportunity cost for the purchase of more fuel-efficient vehicles. An example can be seen in the tax system established in America.

The federal government in America provides incentives for adopting fuel-efficient behaviours. The website www.fueleconomy.gov is a joint initiative of the U.S. Department of Energy and Environmental Protection agency, and outlines the three key benefits of fuel efficiency, being to:

- Reduce climate change
- Reduce the costs of oil dependency
- Increase energy sustainability.

To support citizens in this endeavour, the federal government offers one-off income tax credits for the purchase of hybrid, electric and alternative fuel vehicles. These benefits range up to $4000 for the more expensive alternative fuel vehicles. Many states also offer tax credits or exemptions from sale and use tax for fuel-efficient or alternative fuel vehicles.

Such a scheme of tax credits or exemptions could be beneficial to encourage the uptake of such vehicles in Australia. Upfront tax credits may reduce the relative costs for more efficient vehicles and thus encourage their take-up.

5.3 Solar powered stops and stations

Throughout the TransLink network there are over 13,000 bus stops[16] and 143 train stations. Power at these facilities is essential for lighting to ensure passenger safety, provide customer information and to comply with the Disability Discrimination Act. While solar panels are already in place at 69 bus stops across the network[17], TransLink is currently analysing costs and benefits associated with both grid and solar options for new stops and shelters, and those requiring upgrade. Use of solar power would provide the additional benefits of reducing energy consumption and contributing to environmental sustainability. Further investigation is required on the feasibility of solar power for train stations.

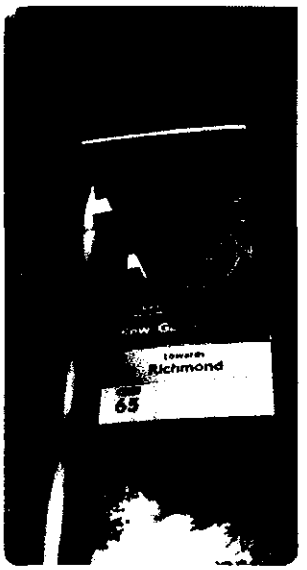
[14] www.goldcoast.qld.gov.au/attachment/edmp/is2_bustech.pdf
[15] Source: www.fueleconomy.gov/feg/lightweight.shtml
[16] Separate platforms at busway stations and interchanges are counted as separate stops.
[17] Four of these are on the Sunshine Coast, with the remainder in the Brisbane City Council area.

Bus stops

Connecting bus stops to grid power can involve a lengthy wait and significant expense. On this basis the expanse of bus stops in the network provide an opportunity to implement a solar bus stop program, similar to that undertaken in London.

Transport for London has implemented a solar system for 3,500 bus stops which features a curved canopy with two Light Emitting Diodes built into the underside of the canopy to light the bus stop flag sign after dark. The bus stop timetable has a constant dusk till dawn low level of illumination with a 'bright-up on demand' touch button feature that glows blue in the dark attracting the passengers' attention[18].

Figure 7 – Solar powered bus stop in London



Bus shelters

For those bus stops with shelter facilities, there is also the potential to install or upgrade to solar power. Cities around the world are investing in solar power to reduce energy consumption and greenhouse gases. A prime example can be found in San Francisco[19].

Figure 8 – Solar powered bus shelter in San Francisco

In the San Francisco bus shelters, the solar panels power lights and information systems, and the shelter structure itself is made from steel consisting of 60-70 percent recycled material. The LED lights being used consume about 74.4 watts, making them four and half times more efficient than fluorescent lighting in the old shelters. Any excess energy generated goes back into the grid. While each shelter cost approximately USD$30,000, an agreement was made with an advertising company to fund the cost of installation and maintenance, in return for exclusive advertising rights.

[18] Source www.zetasolar.com/bus_stop_lighting.html
[19] http://www.gmita.gov.uk/downloads/file/1011/item_07_solar_powered_bus_shelters

Costs and benefits to take-up of solar powered bus facilities

In 2007 the Greater Manchester Passenger Transport Authority undertook extensive testing and evaluation of solar options for its bus shelters.

The main benefits of using solar powered shelters were noted to be:

- **electricity consumption and costs**
- **savings in cost and time needed for grid connection**
- **reduced climate change gas production**
- **improved public/stakeholder image.**

These benefits and associated costs were then quantified in a report (extract on the following page), which shows the economic and environmental payback from solar powered systems. For those shelters with difficult connections to conventional electricity, the up-front cost of solar power installation may be almost cost neutral, with the added benefit of significant reductions in greenhouse gases. However, for those shelters that could readily be connected to main power, there is a price premium to be paid for future-proofing these facilities. As shown in figure nine, this can be approximately £1,000 or AUD$2,000 per shelter. Note that the carbon savings shown in figure 9 below are based on Manchester daylight hours (approximately 3.8 hours). In Queensland our average daylight hours are almost double (7.4 hours) and so significantly greater savings could be expected.

Figure 9 – Costs and benefits of solar powered bus shelters (Manchester, 2007)[20]

Costs and benefits per shelter are as follows:

Costs	**£**	**Benefits**	**£**
Additional capital cost[1] (per 40 and 80) over lifetime of shelter[2]	1,800 to 2,000	United Utilities connection	£750 typical, £2,000 maximum
Battery cost per year[3]	£22	Electricity costs per year	£25
Additional maintenance costs	0	Programme time savings (average time to obtain UU connection)	6 to 8 weeks
		Carbon savings[4]	

[1]Costs supplied by Trueform December 2006. These are expected to reduce, as solar shelters increasingly become a mainstream 'off the shelf' purchase.
[2]Assumed shelter life of 25 years.
[3]Each shelter is supplied with nine batteries, which are estimated to last 3 to 5 years. Assuming an average life of four years, this gives an annual cost for battery replacement of £22 per year.
[4]Based on Greater Manchester daylight hours, solar saves 525.6KwH per shelter, equating to 0.266 tonnes CO_2 per year. Per- Sterm Report DfT suggests a price of £70 per tonne CO_2.

To support any implementation of a solar bus stop and shelter program, what is required from government is a policy to support this endeavor. If Queensland would like to follow in the footsteps of London and San Francisco, then a statement of intent to invest in more energy efficient alternatives would be of assistance. In addition, to support this intent, funds to invest in the solar shelter program would be required.

[20] http://www.gmita.gov.uk/downloads/file/1011/item_07_solar_powered_bus_shelters

Conclusion

The Senate Inquiry into public transport investment has acknowledged that public transport plays a vital role in supporting policies to improve energy efficiency. This submission has shown how the TransLink Transit Authority, through the state government, has encouraged a greater take-up of public transport services, has taken action to improve energy efficiency, and continues to look for ways to improve the energy efficiency across the network.

Through the busway network, high-capacity vehicles and ticketing strategies, TransLink is effectively reducing the travel time and dwell time of buses, which directly contributes to greater fuel efficiency for bus trips. In addition, solar powered busway stations, such as the Royal Brisbane and Womens Hospital Station are able to deliver the same service to passengers with less energy consumption, while at the same time informing customers about the energy efficiency of the station.

Both federal and state governments have the opportunity to support TransLink in making the public transport network even more energy efficient, through:

- Continuing to invest in public transport services and infrastructure to ensure that the network will support the forecast demand growth;
- Offering increased tax incentives for the use of public transport;
- Supporting installation of bus priority measures across the network;
- Offering tax credits for the purchase of fuel efficient buses; and
- Developing a policy for implementation of solar powered bus facilities.