



National Secretary  
Mr Chris Venn-Brown FIEAust CPEng

Engineering House  
11 National Circuit  
BARTON ACT 2600

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### **Supplementary submission re Energy Efficiency and Summary**

The Railway Technical Society of Australasia (RTSA) is a technical society of Engineers Australia. It has over 800 members and has made frequent submissions to Government. The RTSA supports the 8 page supplementary submission (DR 127) to the present inquiry by Dr Philip Laird of the University of Wollongong with the support of the CRC in Railway Engineering and Technologies.

The RTSA would specially draw attention to the higher average energy efficiency of rail in moving passengers and freight, and supports the expression of energy efficiency in terms of passenger or tonne (for freight) kilometres per Mega Joule (MJ). The use of Mega Joules of primary energy (Full Fuel Cycle – or FFC) gives a scientific basis for comparing energy use from different sources. Frequently quoted conversion factors include 41.77 MJ (FFC) per litre of diesel, and for older black coal fired power stations with an efficiency of 30 per cent, 1 kilowatt hour is equivalent to 12 MJ.

Assuming 12 MJ per kWh (FFC) is the average across all power supplies for electric rail traction (with new coal power stations, hydro power and gas less than this average and Victoria's brown coal fired power stations more), data in Table 2 shows a total of 581 Gigawatt hours used for electric traction of freight trains. Combining this with the use of 609 million litres of diesel and one litre of diesel equivalent to 41.77 MJ (FFC), all freight trains used a total energy of 32.4 PJ during 2002-03.

To obtain the energy efficiencies for 2002-03 for rail and road in order to update energy efficiencies for earlier years given in the primary submission (#1) further information is needed. This is provided in Table 1 which extends the data given in Table 1 of submission DR 127. Using rail traffic task data from Table 2 we obtain the average energy efficiency (FFC) for rail freight in Australia (2002-03) at about 4.9 net tkm/MJ.

Energy efficiencies for bulk rail freight, non-bulk freight and various forms of road freight are given in Table 2 along with energy efficiency for various passenger modes.

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**TABLE 1 TRANSPORT ENERGY USE - RAIL AND ROAD:2002-03**

| <b>RAIL</b>               | Diesel<br>Million litres (ML) | Electricity<br>GigaWatt hours | Energy (FFC)<br>PetaJoules |                            |
|---------------------------|-------------------------------|-------------------------------|----------------------------|----------------------------|
| <b>Freight</b>            |                               |                               |                            |                            |
| Bulk                      | 459.2                         | 566.6                         | 26.0                       |                            |
| Non Bulk                  | 149.9                         | 14.7                          | 6.4                        |                            |
| Total                     | 609                           | 581                           | 32.4                       |                            |
| <b>Passengers</b>         |                               |                               |                            |                            |
| Urban                     | 13.9                          | 1104                          | 13.8                       |                            |
| Non-Urban                 | 459.2                         | 24                            | 2.5                        |                            |
| Total                     | 53.1                          | 1128                          | 16.3                       |                            |
| <b>ROAD</b>               |                               |                               |                            |                            |
|                           | Petrol<br>ML                  | Diesel<br>ML                  | LPG<br>ML                  | Energy (FFC)<br>PetaJoules |
| <b>Freight</b>            |                               |                               |                            |                            |
| Light Commercial Vehicles | 2277                          | 1395                          | 603                        | 159.3                      |
| Rigid Trucks              | 43                            | 2128                          | 14                         | 90.9                       |
| Articulated Trucks        | -                             | 3161                          | -                          | 132.0                      |
| <b>Passengers</b>         |                               |                               |                            |                            |
| Passenger Vehicles etc    | 15,327                        | 771                           | 1184                       | 632.1                      |
| Motorcycles               | 83                            | -                             | -                          | 3.1                        |
| Buses                     | 22                            | 452                           | 48                         | 21.0                       |

Reference ARA (2004) Australia Rail Industry Report 2003 (overlooking the use of 250 tonnes of coal) ABS SMVU data and Bus Industry Confederation (2003) Transport Facts. Conversion factors for primary energy (FFC) from Apelbaum Consulting Group Australian Transport Facts 1998 are one litre of diesel = 41.77 MJ, one litre of petrol = 37.0 MJ and one litre of LPG etc is 27.8 MJ.

**TABLE 2 LAND TRANSPORT TASKS AND ENERGY EFFICIENCY: 2002-03**

| <b>FREIGHT</b>            | billion tonne kms    | Net tonne km per MJ     |
|---------------------------|----------------------|-------------------------|
| <b>Rail</b>               |                      |                         |
| Bulk                      | 136.2                | 5.24                    |
| Non bulk                  | 21.9                 | 3.40                    |
| Total                     | 158                  | 4.88                    |
| <b>Road</b>               |                      |                         |
| Articulated trucks        | 115.66               | 0.88                    |
| Rigid Trucks              | 30.41                | 0.33                    |
| Subtotal                  | 146                  | 0.66                    |
| Light Commercial Vehicles | 6.71                 | 0.04                    |
| <b>PASSENGERS</b>         |                      |                         |
|                           | billion passenger km | Net passenger km per MJ |
| <b>Rail</b>               |                      |                         |
| Urban                     | 8.8                  | 0.64                    |
| Non-urban                 | 2.36                 | 0.94                    |
| <b>Road</b>               |                      |                         |
| Buses                     | 19.7                 | 0.94                    |
| Passenger Vehicles        | 167                  | 0.26                    |
| Motorcycles               | 1.5                  | 0.49                    |

Reference ARA (2004) Australia Rail Industry Report 2003 (overlooking the use of 250 tonnes of coal) ABS SMVU data, Bus Industry Confederation (2003) Transport Facts, and Table 1.

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The energy efficiencies given in Table 2 (and in Rail CRC data previously supplied to the Commission) for rail and road freight demonstrate the energy saving nature of rail, and the ability of rail, in some freight situations, to use electric traction. Rail also has a higher average energy efficiency than private passenger motor vehicles and also has an flexibility to use electricity as opposed to oil. This also assists in reducing air pollution in Australia's four largest cities.

G.C. Venn Brown FIEAust CPEng  
RTSA National Secretary