Reducing New Zealand Transportation Emissions
Carbon Emissions

- Total Emissions: 70.6 megatons
- Transportation
  - 20% of total emissions – 14.12 megatons
  - 40% of the energy sector – 12.56 megatons from energy sector
Carbon Emissions cont.

Figure 1: New Zealand's total (gross) greenhouse gas emissions and net emissions under the UNFCCC from 1990 to 2009

- Green dotted line: Net emissions (including LULUCF)
- Blue solid line: Total emissions (excluding LULUCF)

Y-axis: MtCO$_2$ equivalent
X-axis: Years (1990-2008)
Transport Emissions

- Road transport: 90.6% of transport emissions (2014)

<table>
<thead>
<tr>
<th>EI001 Carbon dioxide equivalent emissions (kt of CO2-e) from domestic transport (road, rail, maritime, aviation)</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>12432</td>
<td>12677</td>
<td>12677</td>
<td>12578</td>
<td>12688</td>
<td>12797</td>
</tr>
<tr>
<td>Rail</td>
<td>166</td>
<td>145</td>
<td>155</td>
<td>155</td>
<td>150</td>
<td>159</td>
</tr>
<tr>
<td>Aviation</td>
<td>1037</td>
<td>1014</td>
<td>967</td>
<td>825</td>
<td>855</td>
<td>853</td>
</tr>
<tr>
<td>Marine</td>
<td>298</td>
<td>259</td>
<td>295</td>
<td>297</td>
<td>382</td>
<td>322</td>
</tr>
<tr>
<td>Total</td>
<td>13933</td>
<td>14095</td>
<td>14094</td>
<td>13856</td>
<td>14075</td>
<td>14131</td>
</tr>
<tr>
<td>Population (June)</td>
<td>4302.6</td>
<td>4350.7</td>
<td>4384</td>
<td>4408.1</td>
<td>4442.1</td>
<td>4510</td>
</tr>
<tr>
<td>Growth in emissions/capita from 1990</td>
<td>28%</td>
<td>28%</td>
<td>27%</td>
<td>24%</td>
<td>25%</td>
<td>23%</td>
</tr>
</tbody>
</table>
Graph showing EI001 Carbon dioxide equivalent emissions (kt of CO2-e) from domestic transport (road, rail, maritime, aviation)

EI001: CO2-e from domestic transport

Data source: MBIE
Transport Emissions by Fuel

- Personal vehicles (Petrol): 7,055 kt of CO2 emissions
  - 50.1% of transport emissions
Transport Emission Problems

- Harm to environment and human health
- 256 premature deaths/year contributed to vehicle emissions
- Social cost of $934 million NZD
- Vehicle emissions review timeline built around Australian timeline
Reduction Strategies

• Emissions Trading Scheme
  • Price on carbon emissions

• Electric Vehicles

• Alternative Fuels/Technologies
  • Biomass & landfill gas

• Heavy Vehicle Fuel Efficiency Program

• Fuel Economy
Electric Vehicles Program

• 64,000 vehicles by 2021 – double amount
• $1 million annually for a nation-wide electric vehicle information and promotion campaign over five years
• A contestable fund of up to $6 million per year to encourage and support innovative low emission vehicle projects
• Road User Charge exemption until 2% of vehicles
• Special vehicle lanes
• Beneficial tax depreciation rates on vehicles
New Zealand Well Suited?

- 80% of electricity is generated from renewable sources
- Target of 90 percent renewable electricity generation by 2025
  - Greater demand of vehicle emission reductions
- 230 volt system – faster charging
- 85% population has off street parking – overnight charging
- Low average commute distances
  - Well within the typical 150 km/charge for EV
EV Benefits

• 1,015 EV out of 3.1 million light vehicles
• Doubling purchase rate of EV’s over next 25 years can cut transport emissions by 7% by 2040
• Increased energy independence
  • Currently $9 billion NZD annually spent on oil imports
EV vs Petrol: Life Cycle Analysis

- 60% reduction in emissions for lifecycle
- 80% CO2 reductions in New Zealand – renewable energy
- 40% less cumulative energy demand
- 50% less photochemical matter pollution
- No tailpipe emissions – traffic pollution reduction
Switch to EV’s

• Average battery: 50 kWh charged once per day
• 3.1 million light vehicles
• 55,000 GWh per year for switch of all light vehicles to EV
New Zealand Energy Production

• Current Energy Use: 600 PJ
• Electricity Use: 39,000 GWh
• Room for expansion
  • South Island hydropower
  • Wave/tidal/current power
  • North Island geothermal
  • Increased on/off-shore wind installations
  • Hydrogen fuel cells?
Hydrogen Fuel Cell Potential

- Electrolytic production of hydrogen
- Zero vehicle emissions
  - Renewables used for production
- Potential use for heavy vehicles
  - Light vehicles transition to EV
- Use for transport beyond EV range
- Technology still developing and expensive
- Potential for further emissions reductions
Resources

- EGEE 420 – Course Notes