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The Secretary
Select Committee on Fuel and Energy
The Senate
PO Box 6100
Parliament House
CANBERRA ACT 2600

Dear Mr Cormann

Thank you for your letter of 15 July 2008 to the Minister for the Environment, Heritage and the Arts, the Hon Peter Garrett AM PM requesting submissions to the Select Committee on Fuel and Energy.

I am pleased to offer the following paper outlining this Department's view on the role of alternative fuels and the potential environmental impacts associated with their use as a transport fuel in Australia.

Alternative fuels have the potential to play an important role in expanding the range of transport fuels available in Australia and reducing our dependence on fossil fuels as a primary source of energy. However, to be beneficial to the environment and society more broadly the production and use of alternative fuel needs to be environmentally sustainable and reduce carbon emissions. The use of alternative fuel has the potential to impact on greenhouse gas emissions, air quality, and vehicle operability.

Yours sincerely

Dianna Wright
First Assistant Secretary
Environment Quality Division
September 2008

The role of alternative fuels to petroleum and diesel

Introduction

Approximately 97 per cent of all transport fuels supplied in Australia are petroleum oil-based. Australia has high vehicle use compared to other developed countries and uses vehicles with relatively high fuel consumption.

Greenhouse gas emissions from the transport sector in Australia have grown by 30 per cent between 1990 and 2006. This comprises approximately 13.7 per cent of total emissions of which almost 12 per cent comes from road transport emissions.

The transport sector is also the main contributor to urban air quality problems. National fuel quality standards and emissions standards for new vehicles have been put in place to reduce air pollution emissions from the transport sector. Resulting reductions will provide significant health benefits to the community, delivering an estimated AUD 3.4 billion in avoided health costs until 2020.

Alternative fuels have the potential to play an important role in expanding the range of transport fuels available in Australia and reducing our dependence on fossil fuels as a primary source of energy. However, to be beneficial to the environment and society more broadly the production and use of alternative fuel needs to be environmentally sustainable and reduce carbon emissions. The use of alternative fuel has the potential to impact on air quality, greenhouse gas emissions and vehicle operability.

The framework for assessing and managing the impacts of fuel, including alternative fuel use, is the *Fuel Quality Standards Act 2000* (the Standards Act).

A main objective of the Government's fuel standards policy has been to align Australian fuel quality with international best practice to ensure fuel is suitable for new vehicles with improved engine and emissions control technology.

The Standards Act imposes environmental standards on fuels that significantly reduce the amount of toxic pollutants in vehicle emissions, such as the levels of sulphur and aromatic compounds (particularly benzene), and particulates. However, overall air quality outcomes are dependent on the volume and toxicity of the specific fuels consumed.

Fuel Quality and Vehicle Compatibility

All fuel sold in Australia (whether produced domestically or imported) must comply with the national standards set out under the Standards Act. Appropriate information about the fuel must be provided when the fuel is supplied. The Department of Environment, Water, Heritage and the Arts (DEWHA) is responsible for developing fuel standards made under the Standards Act and ensuring compliance.

Fuel standards have been set for petrol, diesel, biodiesel, autogas (LPG), and for the ethanol that may be blended with petrol up to 10 per cent.

A fuel quality standard for biodiesel came into effect in 2003. The standard applies to biodiesel for use as a neat fuel or blend stock with diesel. The Australian Government has proposed to amend the diesel standard to allow up to five per cent volume of biodiesel to be blended with diesel with no labelling required http://www.environment.gov.au/atmosphere//fuelquality/publications/diesel-biodiesel-position-paper.html. Under the proposal blends containing more than five per cent volume biodiesel would be allowed to be supplied in the market under an approval process which could include conditions such as appropriate labelling. The Fuel Standards Consultative Committee is currently considering these proposals.

Ethanol has a fuel quality information standard (the Fuel Quality Information Standard (Ethanol) Determination 2003) that became effective on 1 March 2004. The ethanol labelling standard specifies the labelling requirements for ethanol-petrol blends sold in Australia.

The Australian Government capped the level of ethanol that can be added to petrol at 10 per cent in July 2003. Orbital Australia, a developer of engines and related technologies, published findings indicating that, at March 2006, only about 60 per cent of the Australian petrol fleet was compatible for use with E10 blends. The Federal Chamber of Automotive Industries (FCAI) state that most new and many older vehicle models can run on ethanol blended petrol (E5 and/or E10). The portion of the fleet compatible with E10 blends should increase due to vehicle fleet turnover. The composition of the Australian vehicle fleet changes each year through new car sales, which is estimated at approximately 7 per cent annually, and the retirement of unsuitable vehicles, which is estimated at approximately 4 per cent annually.

Alternative Fossil Fuels

LPG is the only alternative fuel with significant penetration in the Australian market and can, potentially, deliver reductions in greenhouse gas emissions compared to conventional fuel. However, in Australia the majority (>99 per cent) of LPG-powered vehicles are conversions of petrol engine models and generally do not deliver all of the potential environmental benefits. There are still some significant technical advances possible with LPG engines, including vapour and liquid injection systems, which can improve performance, however these technologies have not been widely adopted in Australia at this stage.

Natural gas, which is mainly methane (CH_4), can be used as a transport fuel either as Compressed Natural Gas (CNG) or Liquefied Natural Gas (LNG). In general, while CNG and LNG offer potential greenhouse gas benefits over petrol and diesel, it is important to note that methane is a powerful greenhouse gas. Engines and refuelling systems for natural gas vehicles must be carefully designed to avoid any gas escaping into the atmosphere to ensure the best possible environmental outcomes.

The overall greenhouse gas emissions from the production and use of natural gas will vary from state to state due to indirect emissions from the extraction, production and transportation of the gas. Since electricity is usually used to further compress or liquefy the gas for on-board storage for transport applications, this will add to the indirect emissions. These emissions will also vary depending on the source of the electricity used for liquefaction or compression of the natural gas.

Compressed natural gas (CNG) is a viable fuel particularly where it can be used in fleets with central refuelling facilities, e.g. transit buses. The large scale use of CNG in Australia would only be possible through significant commitment to refuelling infrastructure, vehicle development and improvements to engine and refuelling technologies.

Liquefied natural gas (LNG) in large trucks has similar potential environmental benefits to CNG but with smaller gas storage requirements. However, significant difficulties need to be overcome before it could be used widely in the heavy vehicle fleet due to a lack of available gas engine technology that would deliver air quality and greenhouse gas benefits over traditional diesel engines, and the need for extensive refuelling infrastructure. However, if these issues can be addressed its lower cost compared to diesel could provide a net economic advantage to fleet operators.

Alternative liquid fuel production methods, such as coal or gas to a liquid, can result in greater greenhouse gas emissions in the conversion process than is released in the extraction and refinement of petroleum for conventional transport fuel production. International studies[1] have shown that coal-to-liquid (CTL) technologies can have greater greenhouse gas lifecycle emissions than conventional fuels.

The technology to produce synthetic transport fuels from coal to liquids (CTL) and gas to liquids (GTL) has been known for some time and is already in use in some parts of the world. However, these synthetic fuel operations are still relatively new and face a number of significant development challenges, including the energy intensive nature of production and pollutant emissions to air and water.

Hydrogen and electric vehicles

Hydrogen has the potential to produce zero carbon based emissions; other emissions are water vapour and very low levels of nitrogen oxides which can be removed by vehicle emission technology. A number of trials of hydrogen fuel cell vehicles are occurring around the world. Significant technical challenges need to be overcome before it would be commercially feasible, including the development of affordable and efficient drive-trains and carbon neutral methods of producing and distributing the hydrogen fuel. Planning and safety regulations for large-scale hydrogen storage infrastructure would also need to be developed. There is broad agreement that hydrogen as a transport fuel is only likely to be an option in the long term, if at all.

Grid-connected electric vehicles (so called ‘plug-ins’) show promise, but until they can be recharged from renewable or carbon-neutral sources they will be net producers of greenhouse gases. The Australian Government is pursuing a range of renewable energy and low emissions technologies to reduce the emissions generated from the stationary energy sector to produce cleaner electricity which will help in this regard. Over time however, it is envisaged that electric and hybrid vehicles will, in conjunction with cleaner energy options, play a significant role in reducing Australia’s greenhouse gas emissions.

[1] Information is available from the US EPA fact sheet "Greenhouse Gas Impacts of Expanded Renewable and Alternative Fuels Use" http://epa.gov/otaq/renewablefue and from the DTI Technology Status Report on Coal Liquefaction, October 1999 at: http://www.dti.gov.uk/files/file18326.pdf.

Biofuels

The challenges associated with the development of sustainable biofuels are widely known. Biofuels do not necessarily provide clear and unambiguous environmental and climate benefits as their impact depends, *inter alia*, on the feedstock and production methods used.

There can be both positive and negative impacts from biofuel production and use. Life-cycle impacts will depend upon the local environmental conditions, feedstock used, land-use changes (esp. deforestation), the nature of the energy and other resource inputs (e.g. water) used in biomass production, transportation, and processing, as well as distribution and blending procedures. Effective policy approaches will be those that take account of specific national and regional circumstances.

Key sources of greenhouse gas emissions from biofuel production are land conversion, mechanisation and fertilizer use at the feedstock production stage and the use of non-renewable energy in processing and transport. The impact of land use change can be significant. When land with high carbon content, such as tropical forest or peat land, is converted to grow biofuels the carbon balance is negative and these carbon debts can take decades to repay. Systems that use organic waste and residues from agriculture and forestry, or perennial energy plants on degraded land, offer high potential for greenhouse gas emissions savings.

The risk to biodiversity from biofuels is associated primarily with land-use change, for example, when natural forests are converted for feedstock production the loss of biodiversity may be significant. A further concern is the introduction of invasive species for biofuel production.

Many first generation feedstocks (such as sugar, palm oil and corn) are highly water intensive and increased production could affect downstream water quality through run off of fertilizers, agrochemicals and due to soil erosion. These impacts would depend on the farming techniques employed.

Where second generation perennial bioenergy feedstock crops replace annual crops, the permanent cover and root formation may help to improve soil management and reduce soil erosion.

Second Generation Biofuels

Biofuels can be derived from first and second generation production methods. First generation biofuels are generally produced through a one-step process such as fermentation, while second generation biofuels are produced using biochemical or thermochemical processes. Several new technologies are under development to produce second generation biofuels, including hydrotreatment/hydrolysis, biomass-to-liquids (BTL), and pyrolysis/thermal conversion processes (TCP)**.**

In Australia, based on its small-scale and first-generation production methods, any environmental and greenhouse gas advantages of domestically produced biofuels over fossils fuels are likely to be marginal. The impacts of any growth in the industry would depend on the nature and extent of that growth, taking into account lifecycle impacts.

Second generation biofuels have the potential to offer significant greenhouse gas benefits over current production methods. For example, cellulosic second generation biofuels are made from a wide variety of plant materials or non-food based feedstocks and energy crops. Second generation biofuels include, ethanol, biodiesel, methanol, butanol, ethers and cyclic ethers.

Second generation processes result in a higher yield per hectare because they utilize the entire plant, and use non-edible plants that have a high biomass density. Second generation biofuels, in the longer term, have the potential to offer lower cost to producers and consumers compared to first generation biofuels.

Although not yet commercially available in Australia, considerable advances have been made in developing production facilities in Europe and United States. In 2008, the first industrial scale biomass-to-liquid (BTL) plant opened in Germany by Choren Industries. The second generation biofuel refinery, will produce 18 million litres of BTL diesel from wood residues, sufficient to fuel 15,000 vehicles each year. The same company plans to set up a second plant with an annual production capacity of 250 million litres (54.9 million gallons). By 2020, Choren Industries aims to run 10 to 15 of BTL plants that would reduce carbon dioxide emissions by over three million tons (2.7 million tons) a year.

Choren Industries claim that compared to fossil diesel, BTL diesel reduces life cycle CO_2 emissions by up to 90 per cent. BTL diesel is virtually free of aromatics and sulphur, with significantly lower emission of carbon monoxide and hydrocarbons, as well as nitrogen oxides and particulates.

Summary

There are promising alternative fuels on the horizon that have the potential to provide low carbon, environmentally sustainable transport fuel from renewable sources.

The *Fuel Quality Standards Act 2000* (Standards Act) regulates the quality of fuel supplied in Australia in order to reduce pollutants and harmful emissions, and facilitate the adoption of better and more efficient operations of engines. The Standards Act will also ensure appropriate information about the fuel is provided when the fuel is supplied.

It is important for the environment to ensure alternative fuels are produced sustainably.