3 JULY 2015

Towards a clean energy economy:

ACHIEVING A BIOFUEL MANDATE FOR QUEENSLAND

Submission by Hon Bob Katter MP
Federal Member for Kennedy

Contents

Introduction

This document has been prepared as a public submission for the 'Towards a clean energy economy: achieving a biofuel mandate for Queensland'.

A number of public consultation sessions were held across Queensland and I personally attended the sessions in Mareeba, Innisfail, Ingham, Townsville and Brisbane.

As a long and vocal champion for ethanol, I thank the Minister and the Queensland Government for the opportunity to be involved in this consultation process.

This submission is structured in two parts (a) the case for ethanol and (b) mandating ethanol.

The case for ethanol sets out the strong reasons why Queensland needs ethanol – for public health, for fuel security, cheaper fuel for consumers, for industry development and for the environment.

The second section on mandating ethanol covers why a mandate is needed, why it needs to be set at 10%, the scale for introduction and lessons learnt on implementation from the NSW experience.

The Case for Ethanol

1.0 Health

Every country on earth that has moved to ethanol has done so due to population health factors.

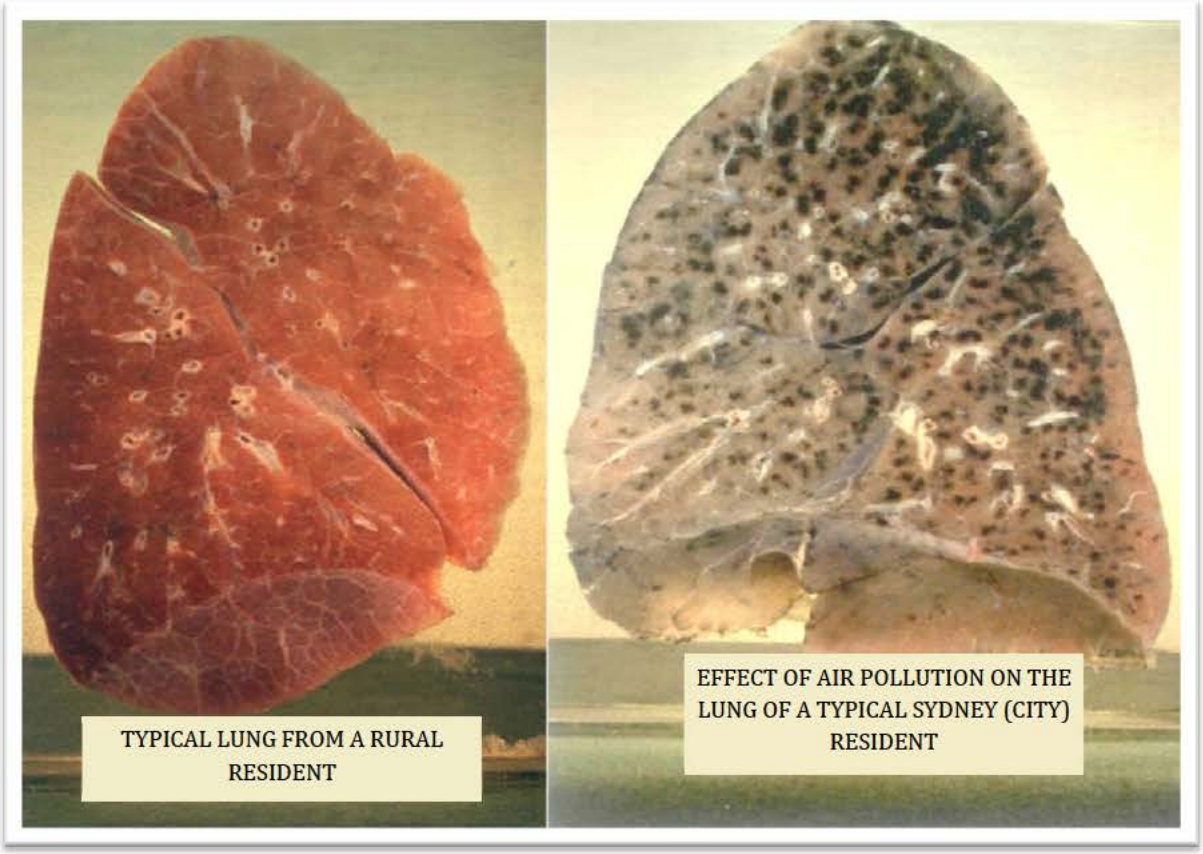
These include:

- Carciogenics in petrol
- Disease prevention – Australia's air pollution death toll is higher than fatalities from road accidents
- Health budget cost savings.

Carcinogenic

Petrol's carcinogenic effects were unequivocally delineated in American studies conducted mainly in California in the 1980's.[1] While these health dangers were well known, the American studies scientifically quantified the causal relationship. The following images show the effect of air pollution on a human lung – highlighting the extreme effect air pollution has on the human body.

[1] C. Arden Pope, et. Al, 'Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution' (2002) 287 *Journal of American Medical Association* 9.



Source: Professor Ray Kearney, *Residents Against Polluting Stacks Inc.* 2001

Professor Michale Moore assured Mr Katter that the two lungs as depicted here would not be unusual. A long term resident of Sydney would expect lung deterioration. Such would not be expected in a long term resident of a country town. Michael Moore in making this statement was the State Government appointed Chief Medical Scientist for Queensland.

Generally speaking, if a person moves from a country town, a Bendigo or a Tamworth to a Sydney, their chances of dying of lung/heart disease nearly double.

This is a direct result of "small particle" motor vehicle emissions and various carcinogenics in petrol (principally the aromatic hydrocarbons).

Tobacco: whilst the effect of small particles has been well known and well researched over a long period of time in tobacco, it took many years for this knowledge (and an historic legal verdict) to cause the world to understand the great dangers of smoking. We are, with motor vehicle emissions, dealing with a similar effect.

It wasn't until the American studies concluded and similar scientific results emanated out of São Paulo that science was provided with a before and after database.

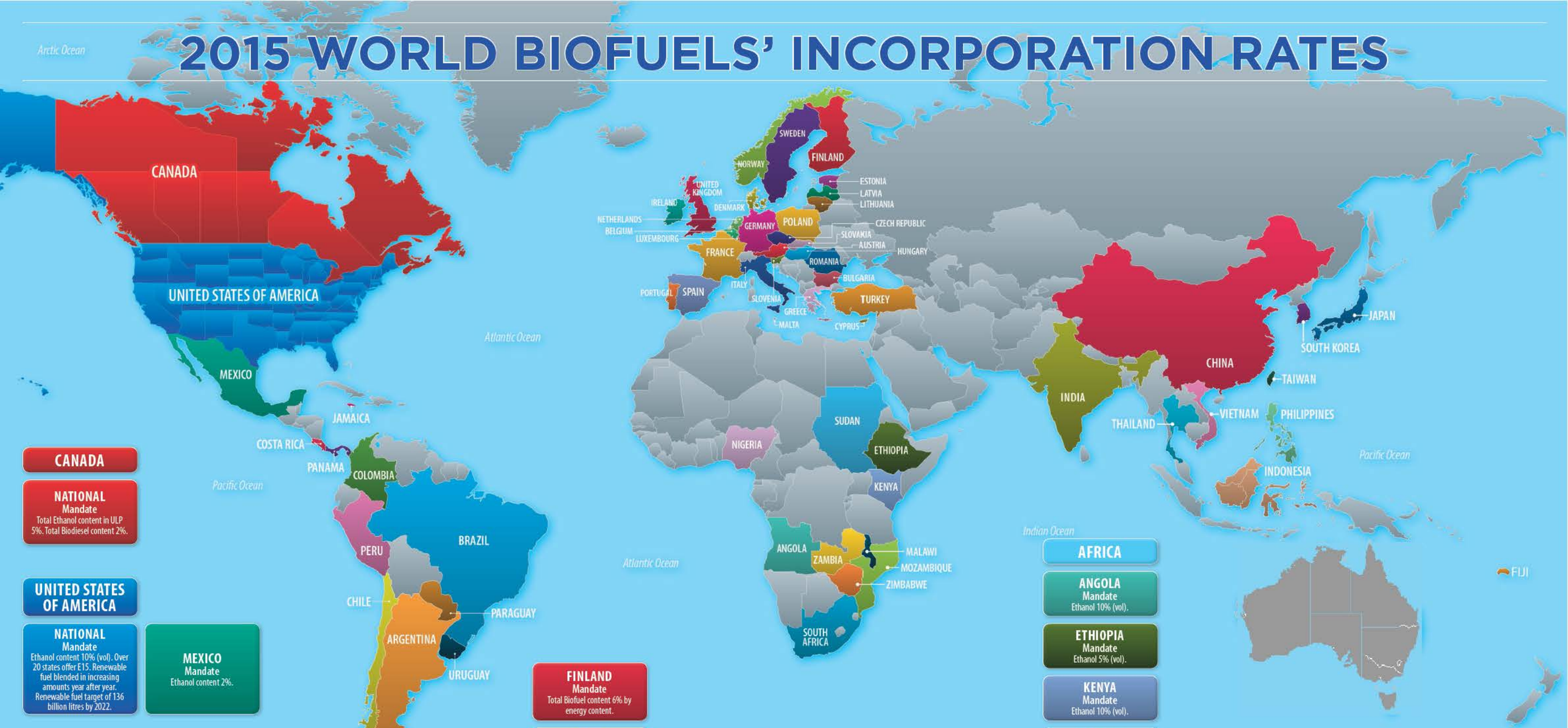
Two decades of 20% ethanol in São Paulo's motor vehicle fuels resulted in a very significant lowering of pollution levels and consequent lowering of health problems. From then on, every country in the world moved to mandatory ethanol and biodiesel levels in all motor vehicle fuels.

The map on page 20 shows that,[2] effectively, the only countries on earth not using ethanol / biofuels are Australia and Africa.[3]

[2] Except for the major oil producing countries.

[3] Whilst Australia is noted on the map, the percentage is too small to be recorded as a country using ethanol. Only one state in Australia has mandated ethanol and it has dwindled down to an insignificant level of 2.5%. And it is continuing to dwindle away due to a combination of exemptions and total failure of the Government to enforce the mandate.

2015 WORLD BIOFUELS' INCORPORATION RATES



CANADA

NATIONAL
Mandate
Total Ethanol content in ULP 5%. Total Biodiesel content 2%.

UNITED STATES OF AMERICA

NATIONAL
Mandate
Ethanol content 10% (vol). Over 20 states offer E15. Renewable fuel blended in increasing amounts year after year. Renewable fuel target of 136 billion litres by 2022.

MEXICO
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Ethanol content 2%.

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Ethanol 10% content (vol).

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Mandate
Ethanol content 27% (vol), Biodiesel 7% (vol).

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Mandate
E5 Ethanol and B5 Biodiesel.

COLUMBIA
Mandate
Ethanol content 10%.

COSTA RICA
Mandate
Ethanol content 7% (vol) and B20 Biodiesel.

JAMAICA
Mandate
Ethanol content 10% (vol).

PANAMA
Mandate
Ethanol content 5% (vol).

PARAGUAY
Mandate
Ethanol content 24% (vol).

PERU
Mandate
Ethanol content 8% (vol), Biodiesel 5% (vol).

URUGUAY
Mandate
Ethanol for 5% (vol), Biodiesel 2% (vol).

EUROPE

AUSTRIA
Mandate
Total Biofuel content 5.75% by energy content (3.4% for Ethanol content).

BELGIUM
Mandate
10% for Ethanol (vol).

BULGARIA
Mandate
Biofuels market share of 5.75% by energy content.

CYPRUS
Mandate
Total biofuel content 2.5% by energy content.

CZECH REPUBLIC
Mandate
Total Biofuels market share 5.75% based on energy content. Ethanol 4.1% (vol). Biodiesel 6% (vol).

DENMARK
Mandate
Total Biofuel content of 5.75% based on energy content.

ESTONIA
Mandate
Biofuels market share of 5.75% by energy content.

FINLAND
Mandate
Total Biofuel content 6% by energy content.

FRANCE
Mandate
7% biofuels market share by energy content. 7% for Ethanol (vol).

GERMANY
Mandate
Biofuels quota 6.25% increasing by 0.25% annually until 2015. Minimum obligation Ethanol 2.8% by energy content. Biodiesel 4.4% by energy content.

GREECE
Mandate
Total Biofuel content 5.75% by energy content.

HUNGARY
Mandate
Total Biofuel content 5.75% by energy content. Min 4.4% for Ethanol (vol).

ITALY
Mandate
Total Biofuel content 5% based on energy content.

IRELAND
Mandate
Total Biofuel content 6% based on energy content.

LATVIA
Mandate
Total Biofuel content 5.75% by energy content. 5% for Ethanol (vol).

LITHUANIA
Mandate
Biofuels 5.75% (vol).

LUXEMBOURG
Mandate
Biofuel content 2%.

MALTA
Mandate
Total Biofuel content 1.25% by energy content.

NETHERLANDS
Mandate
Min 3.5% for Ethanol (vol).

NORWAY
Mandate
Ethanol content 5% (vol).

POLAND
Mandate
Total Biofuel content 7.1% by energy content.

PORTUGAL
Mandate
Biodiesel content 6.75%, 5.5% for Ethanol (vol).

ROMANIA
Mandate
Total Biofuel 5% (vol). 6% for Ethanol (vol).

SLOVAKIA
Mandate
Total Biofuel content 5.75% by energy content. 3.2% for Ethanol (vol).

SLOVENIA
Mandate
Total Biofuel content 6.5%.

SPAIN
Mandate
Biodiesel 4.1% by energy and 3.9 for Ethanol.

SWEDEN
Mandate
Biodiesel 5% (vol) and Ethanol 5% (vol).

TURKEY
Mandate
2% Ethanol content by January 1, 2013. Increasing to 3% in 2014.

UNITED KINGDOM
Mandate
Biofuels 4.75% (vol).

AFRICA

ANGOLA
Mandate
Ethanol 10% (vol).

ETHIOPIA
Mandate
Ethanol 5% (vol).

KENYA
Mandate
Ethanol 10% (vol).

MALAWI
Mandate
Ethanol 10% (vol).

MOZAMBIQUE
Mandate
Ethanol 10% (vol).

NIGERIA
Mandate
Ethanol blend of 5-10%.

SOUTH AFRICA
Mandate
Ethanol 10% (vol).

SUDAN
Mandate
Ethanol 5% (vol).

ZAMBIA
Mandate
Ethanol 10%, Biodiesel 5% (vol).

ZIMBABWE
Mandate
Ethanol 10% (vol).

ASIA

CHINA
Mandate
10% Ethanol (vol) in nine provinces only.

FIJI
Mandate
Ethanol blend of 5-10%.

INDIA
Mandate
Ethanol mandate 5% content.

INDONESIA
Mandate
Ethanol 3% (vol), Biodiesel 10% (vol).

JAPAN
Mandate
3% Bioethanol mandate, currently reviewing option to increase to 10%.

PHILIPPINES
Mandate
Minimum Ethanol content of 10% total volume. E10 is mandated.

SOUTH KOREA
Mandate
Biodiesel 2% volume.

TAIWAN
Mandate
B1 Biodiesel mandate.

THAILAND
Mandate
Currently 5% (vol). Ethanol will be a compulsory 20% (vol) by 2016.

VIETNAM
Mandate
E5 Ethanol blending mandate.

AUSTRALIA

NEW SOUTH WALES
Mandate
6% ethanol content (vol).

NB: The NSW Mandate was introduced in 2011. The NSW Biofuels Act, Fuel Ethanol Mandate is 6% of the total Petrol sales. As at April 2015 total fuel ethanol sales equal 2.79%; well below the Mandate.

Health: Disease Prevention

"When you pour petrol in the river, fish die; when you pour ethanol in the river fish smile." [4]

Larry Johnson,
father of the Ethanol industry in the US,
in a TV interview in Australia

Australia's air pollution death toll is higher than fatalities from road accidents. … 'Each year, on average, 2,400 of the 140,000 Australians deaths are linked to air quality and [its related] health issues – much more than the 1,700 people who die on [Australian] roads. That's an average of a death every four hours. This number increases if long-term effects of air toxics on cancer are included':

Statement issued from the collaborative program on Atmospheric Health convened by the Commonwealth Department of Health 2004.[5]

'Vehicle emissions account for some 65 % of urban air pollution':

Professor Ray Kearney 2006, Department of Infectious Diseases and Immunology at the University of Sydney.

Whilst the adverse effects of motor vehicle emissions have been well known in medical science for a long time, it wasn't until the 16 year research project (undertaken principally in California) that this knowledge translated into remedial action.

The landmark study, conducted by America's most eminent scientists, was presented in the *Journal of the American Medical Association*, the most prestigious publication in the field of health and medicine in the world.

The study showed that *"Fine Particulate and sulphur oxide-related pollution were associated with all-cause, lung cancer, and cardiopulmonary mortality. Each 10-µg/m^3 elevation in fine particulate air pollution was associated with approximately a 4%, 6%, and 8% increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively."*[6]

[4] Ethanol is pure alcohol.
[5] CSIRO Medial Release, 2 March 2004, *Air Pollution Death Toll Needs Solutions.*
[6] C A Pope III, et al, 'Lung Cancer, Cardiopulmonary Mortality and Long-term Exposure to Fine Particulate Air Pollution' (2002) 287(9) *Journal of the American Medical Association* 1132.

ORIGINAL CONTRIBUTION

Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution

C. Arden Pope III, PhD
Richard T. Burnett, PhD
Michael J. Thun, MD
Eugenia E. Calle, PhD
Daniel Krewski, PhD
Kazuhiko Ito, PhD
George D. Thurston, ScD

Context Associations have been found between day-to-day particulate air pollution and increased risk of various adverse health outcomes, including cardiopulmonary mortality. However, studies of health effects of long-term particulate air pollution have been less conclusive.

Objective To assess the relationship between long-term exposure to fine particulate air pollution and all-cause, lung cancer, and cardiopulmonary mortality.

Design, Setting, and Participants Vital status and cause of death data were collected by the American Cancer Society as part of the Cancer Prevention II study, an ongoing prospective mortality study, which enrolled approximately 1.2 million adults in 1982. Participants completed a questionnaire detailing individual risk factor data (age, sex, race, weight, height, smoking history, education, marital status, diet, alcohol consumption, and occupational exposures). The risk factor data for approximately 500000 adults were linked with air pollution data for metropolitan areas throughout the United States and combined with vital status and cause of death data through December 31, 1998.

Main Outcome Measure All-cause, lung cancer, and cardiopulmonary mortality.

Results Fine particulate and sulfur oxide–related pollution were associated with all-cause, lung cancer, and cardiopulmonary mortality. Each 10-μg/m^3 elevation in fine particulate air pollution was associated with approximately a 4%, 6%, and 8% increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively. Measures of coarse particle fraction and total suspended particles were not consistently associated with mortality.

Conclusion Long-term exposure to combustion-related fine particulate air pollution is an important environmental risk factor for cardiopulmonary and lung cancer mortality.

JAMA. 2002;287:1132-1141 www.jama.com

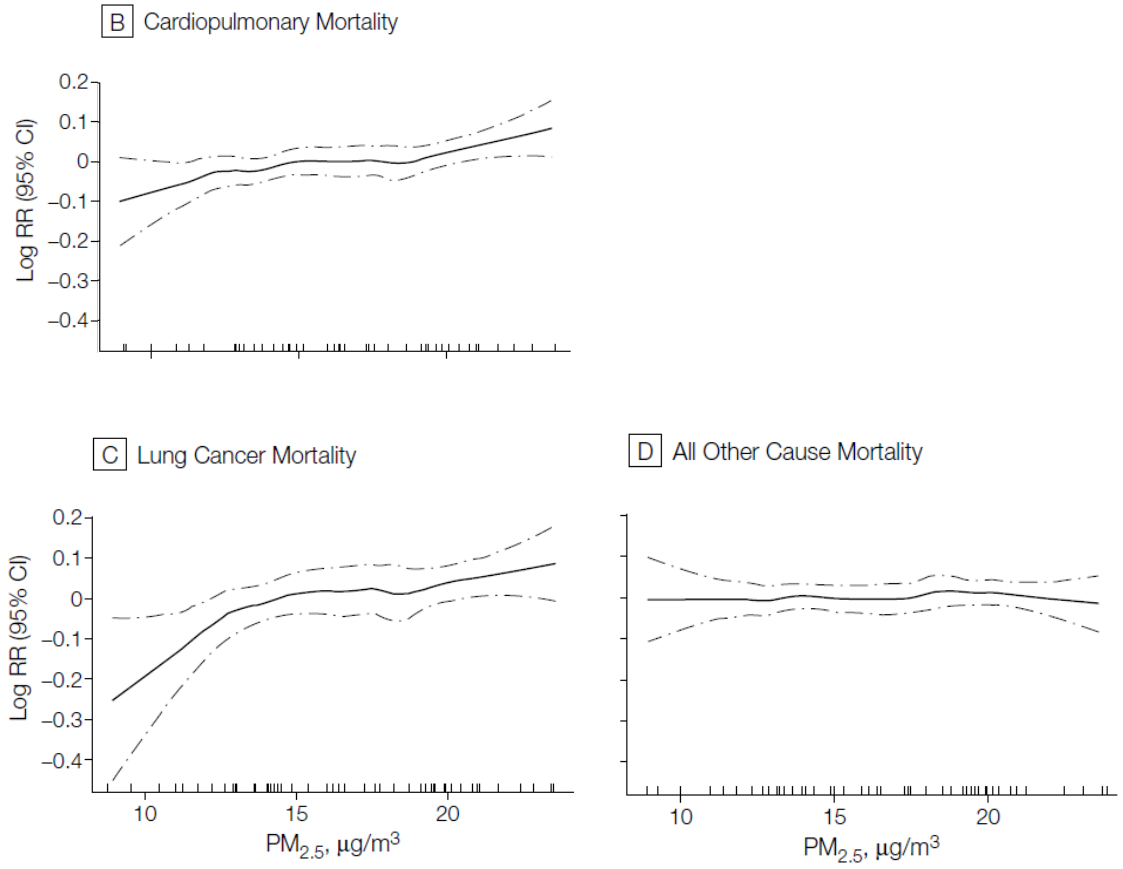
BASED ON SEVERAL SEVERE AIR pollution events,[1-3] a temporal correlation between extremely high concentrations of particulate and sulfur oxide air pollution and acute increases in mortality was well established by the 1970s. Subsequently, epidemiological studies published between 1989 and 1996 reported health effects at unexpectedly low concentrations of particulate air pollution.[4] The convergence of data from these studies, while controversial,[5] prompted serious reconsideration of standards and health guidelines[6-10] and led to a long-term research program designed to analyze health-related effects due to particulate pollution.[11-13] In 1997, the Environmental Protection Agency adopted new ambient air quality standards that would impose regulatory limits on fine particles measuring less than 2.5 μm in diameter ($PM_{2.5}$). These new standards were challenged by industry groups, blocked by a federal appeals court, but ultimately upheld by the US Supreme Court.[14]

Although most of the recent epidemiological research has focused on effects of short-term exposures, several studies suggest that long-term exposure may be more important in terms of overall public health.[4] The new standards for long-term exposure to $PM_{2.5}$ were originally based primarily on 2 prospective cohort studies,[15,16] which evaluated the effects of long-term pollution exposure on mortality. Both of these studies have been subjected to much scrutiny,[5] including an extensive independent audit and reanalysis of the original data.[17] The larger of these 2 studies linked individual risk factor and vital status data with national ambient air pollution data.[16] Our analysis uses data from the larger study and

Author Affiliations: Brigham Young University, Provo, Utah (Dr Pope); Health Canada, Ottawa, Ontario (Dr Burnett); University of Ottawa, Ottawa, Ontario (Drs Burnett and Krewski); American Cancer Society, Atlanta, Ga (Drs Thun and Calle); and New York University School of Medicine, Tuxedo, NY (Drs Ito and Thurston).
Corresponding Author and Reprints: C. Arden Pope III, PhD, Department of Economics, Brigham Young University, 142 FOB, Provo, UT 84602 (e-mail: cap3@email.byu.edu).

Source: C A Pope III, et al, 'Lung Cancer, Cardiopulmonary Mortality and Long-term Exposure to Fine Particulate Air Pollution' (2002) 287(9) *Journal of the American Medical Association* 1132.

Figure 2. Nonparametric Smoothed Exposure Response Relationship



Vertical lines along x-axes indicate rug or frequency plot of mean fine particulate pollution; $PM_{2.5}$, mean fine particles measuring less than 2.5 µm in diameter; RR, relative risk; and CI, confidence interval.

Source: C A Pope III, et al, 'Lung Cancer, Cardiopulmonary Mortality and Long-term Exposure to Fine Particulate Air Pollution' (2002) 287(9) *Journal of the American Medical Association* 1132.

These **graphs contain** the unassailable reality that fine particulate exposure over a protracted period of time **doubles** lung cancer and cardiopulmonary mortality (where a certain density, super fine particles, is reached).

Künzli, et al (2000)[7] in a major study in Austria, France and Switzerland, stated inter alia that ***air pollution caused 6% of total mortality*** or more than 40,000 attributable cases per year: (Source: Künzli 2000). The Künzli study continues:-

Traffic pollution accounted for more than 25,000 new cases of chronic bronchitis (adults); more than 290,000 episodes of bronchitis (children); more than 0.5 million asthma attacks; and more than 16 million person-days of restricted activities.[8]

Professor Ray Kearney, in a submission to the Prime Minister, stated that:

"Exhaust pollution including coarse, fine and ultra-fine particles, gaseous irritants, and polycyclic aromatic hydrocarbons (PAH's) either alone or in combination, are known to be associated with, for example:

- Inflammatory lung diseases e.g., asthma, bronchitis and alveolitis;
- Increased cardio-vascular disease;
- Risk for exercise-induced heart damage;
- Limited blood flow and increased blood clotting;
- Increased mucous production and airway hyper-responsiveness;
- 1/5 lung cancer deaths (USA) and accelerated tumour growth;
- **Premature death;**
- Symptoms of anaemia e.g., tiredness, headaches, fatigue and shortness of breath;
- Low birth weight and small head circumference of neonate;
- Intra-uterine growth retardation (for each 10 nanogram PAH's /M^3 increase);
- Certain leukaemia's e.g., from exposure to benzene;
- Loss in productivity, absenteeism from work and school;
- Increased sensitivity to bacterial products in airways; and
- More severe common viral asthma"

Sickness and the Health Budget

Sickness-care costs caused by motor vehicle emissions increase a nation's health budget.

In France, 2/3 of health care costs due to pollution resulted when levels of pollution were below the national standard for Particulate Matter (PM), less than 10 micrometre in diameter, i.e., when PM_{10} of <50µg/M^3/24 hours.[9]

[7] N, Künzli, et al, 'Public-health Impact of Outdoor and Traffic-related Air Pollution: a European Assessment' (2000) *Lancet* 356 (9232), 795-801.
[8] Ibid.
[9] Professor Ray Kearney, *2013 Federal Senate Standing Committee Inquiry: 'The Impacts on Health of Air Quality in Australia* (2013).

The Australian AMA has made their position very clear:-

"AMA President, Dr Mukesh Haikerwal, has today written to the Government's Biofuels Taskforce detailing the AMA's support for the mandatory use of ethanol in petrol in the interests of protecting and improving human health.

Dr Haikerwal said the AMA wants to see the biofuels debate in Australia shift from economic issues to human health issues. ...
We are equally passionate about the impact of vehicle emissions on human health and we would encourage governments to pursue responsible measures to reduce emissions.
The AMA considers the use of biofuels such as ethanol in petrol as a positive move.
In our opinion, there is incontrovertible evidence that the addition of ethanol to petrol and biodiesel to diesel will reduce the deaths and ill-health associated with the emissions produced by burning those fuels," Dr Haikerwal said.
According to the AMA's submission to the Biofuels Taskforce, there are three components of present vehicle emissions that have been shown to damage human health:

- *the particulates (particularly PM 2.5);*
- *the aromatic component (polycyclic aromatic hydrocarbons); and*
- *the gaseous irritants such as ozone (O3) and nitrous oxide (NO2).*

The AMA believes that the following interventions would reduce the negative health impacts:

- *introduction of mandatory biofuel blends (petrol with 10% ethanol and diesel with 20% biodiesel)*
- *reduction of highly toxic aromatics such as benzene in petrol."*

Media Release: 'AMA Backs Mandatory Use of Ethanol in Petrol on Health Grounds', 27 July 2005.

In 2005 the NSW AMA pleaded with the Government over ethanol:-

"AMA (NSW) is backing the introduction of ethanol in fuel as a practical way to reduce air pollution and improve the health of city dwellers.

After reviewing scientific and mecial research, the association has made a submission to the Prime Ministerial Taskforce on Biofuels in support of supplementing fossil fuels with ethanol and other biofuel blends.

AMA (NSW) President Dr John Gullotta said the disgusting brown pall that often lingers on the Sydney skyline is ample evidence that air pollution is a serious problem that must be addressed. ...

Ethanol has been successfully used in Brazil, Canada and the US for more than 20 years and their petrol companies proudly promote the ethanol content of fuel."

Media Release: 'AMA (NSW) Pleads with Federal Government Over Ethanol', 27 July 2005

The graphs produced by the research team (page 45, above) contains the unassailable reality that fine particulate exposure over a protracted period of time shows a doubling of lung cancer and cardio pulmonary mortality where a certain density, super fine particles, is 'reached'.
From 2002 forward with the very notable exceptions of Australia and the African countries, almost every country on earth has moved to mandatory levels of ethanol in all motor vehicle fuels.

The super-fine particulate, the cause of most of this health danger, overwhelmingly is produced by motor vehicle emissions and result from the failure of motor vehicle fuels to achieve proper adequate combustion.

Ethanol (and other biofuels) is 32% oxygen. Petrol contains no oxygen. The explosion that drives a motor vehicle engine occurs where the petrol droplet is in contact with oxygen in the air; with an ethanol droplet the explosion takes place throughout the entire droplet in a nanosecond. This delivers great power in at hyper speed.

But of course Ethanol is used by V8 supercars worldwide to deliver a great power advantage over conventional fuels. The V8 super racing cars are fuelled on pure ethanol. This much better burn dramatically reduces the super-fine particulate that currently emanates from motor vehicle emissions. V8 supercars are after power, of course, the better combustion with ethanol provides this much needed extra power.

Image: Speedcafe.com

Super-fine particulate is extruded, coated with and contaminated with the petrol carcinogens, most of them being aromatics,[10] benzene, toluene are just two of many carcinogens contained in petrol, in fact one of the PAH's is the most commonly used carcinogen to induce cancers in laboratory experiments with rats.

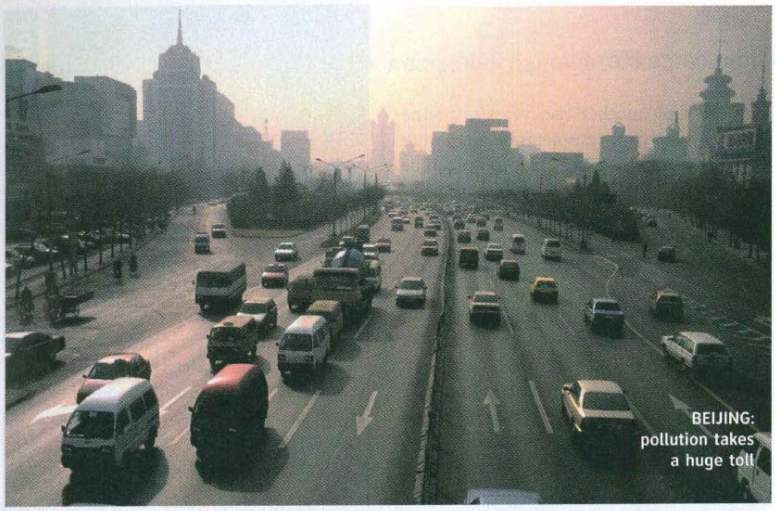
Not only does the super-fine particulate clog up lungs, and heart blood-ways but in addition there is a coating effect that therefore results in a lethal double whammy.

Image: destination360.com

Channel Nine's 60 Minutes program recently did a report on São Paulo, the cleanest city in the world (CCTW), and arguably the biggest city in the world in population (it contains more people than the entire population of Australia. Over 23 m people live in São Paulo). **São Paulo is the cleanest city on earth, because 60% of its motor vehicle fuel is ethanol.**

[10] (PAHs) Polycyclic aromatic Hydrocarbons.

***New Scientist* Magazine:**



BEIJING: pollution takes a huge toll

Stuart Franklin/Magnum

Big city killer

If the cigarettes don't get you the traffic pollution will

UP TO a fifth of all lung cancer deaths in cities are caused by tiny particles of pollution, most of them from vehicle exhausts.

That's the conclusion of the biggest study into city pollution to date, which tracked half a million Americans for 16 years. It suggests the impact is far greater than feared.

The study is important because it followed individuals, says British expert Roy Harrison of the University of Birmingham, allowing the researchers to separate the effects of smoking and pollution. "In the past, we have often just compared urban areas and rural areas. But more people smoke in cities, and it is difficult to compensate for that."

The research focused on particles less than 2.5 micrometres in diameter, known as PM2.5s. These fine particles are thought to kill by lodging deep in the lungs. The researchers found that the long-term death rate from lung cancer rose by 8 per cent for every 10-microgram increase in the average concentration of PM2.5s per cubic metre. The increased risk is comparable with the risks to long-term passive smokers.

Typical PM2.5 levels in the US are 20 micrograms in Los Angeles and 16 micrograms in New York—the limit set in 1997 by the Environmental Protection Agency is 15 micrograms. British levels are similar, though one PM2.5 monitor at Marylebone Road in London records an average of 32 micrograms. "I'd say London has a special problem because of the high proportion of diesel fumes," says George Thurston of New York University, co-leader of the study.

The implications are bleakest for developing countries. In heavily polluted cities such as Beijing or Delhi, particulate levels average over 300 micrograms and most of this is probably PM2.5s. **Fred Pearce**

More at: *The Journal of the American Medical Association* (vol 287, p 1132)

Source: Fred Pearce, 'Big City Killer' (2002) 2333 New Scientist.

This is why all of the world has moved to ethanol.

Chart overleaf - Source: *Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants United Nations Environment Programme, 'Time to Act: to Reduce Short-lived Climate Pollutants' (19 June 2014).*

Effects on Public Health

Air pollution, a preventable risk

SLCPs, particularly O_3 and BC and co-pollutants, which are important parts of PM2.5 air pollution, are harmful to human health. Globally, PM2.5 is the leading environmental cause of poor health and premature death.

PREMATURE DEATHS YEAR 2010

GLOBALLY, **AIR POLLUTION** IS RESPONSIBLE FOR:

- **3,500,000** From **indoor** PM2.5 pollution
- **3,200,000** From **outdoor** PM2.5 polution
- **150,000** From **ozone** pollution

DISEASES DUE TO:

- PM2.5 AIR POLLUTION
- O_3

- Heart attacks
- Strokes, heart disease
- Congestive heart failure
- Lung cancer
- Chronic bronchitis
- Asthma
- Emphysema
- Scarred lung tissue
- Low birth weight

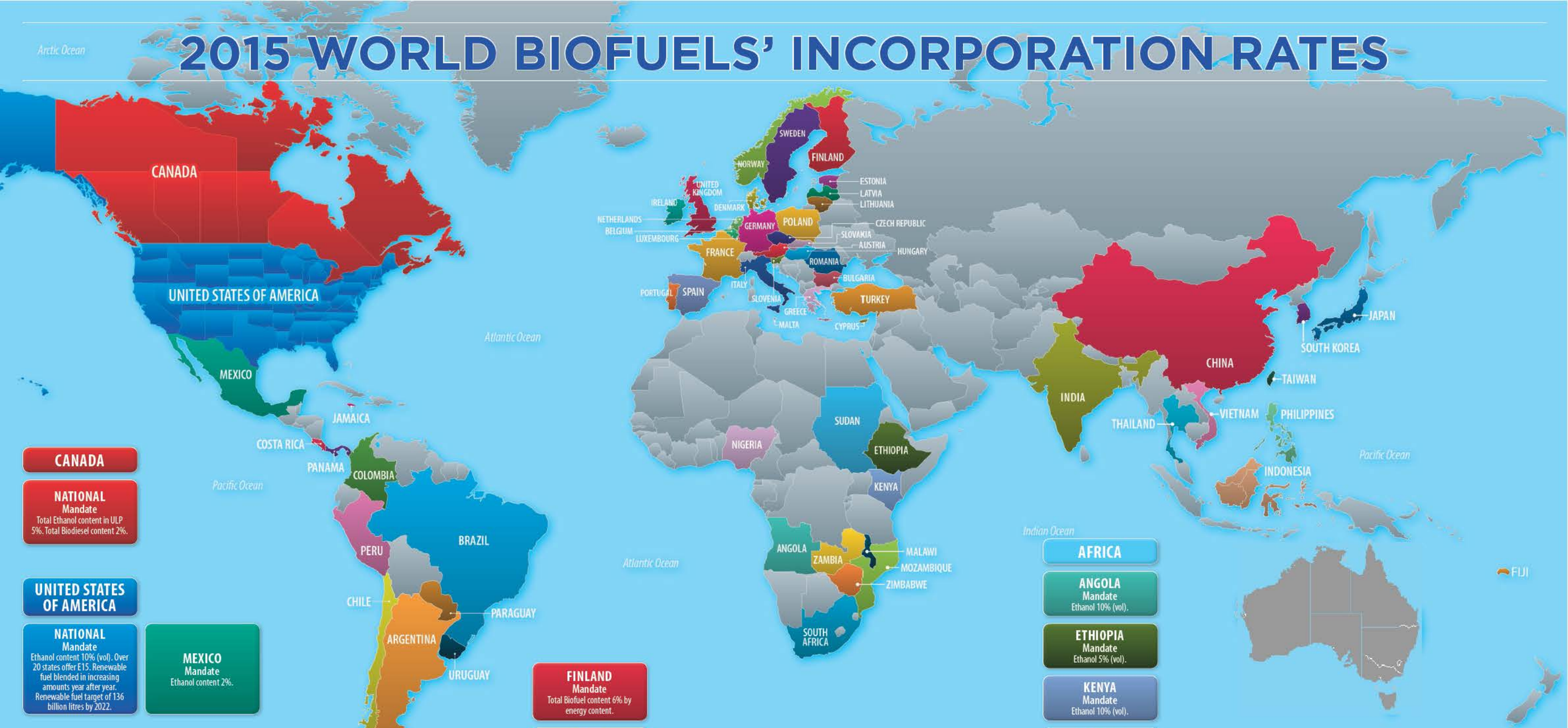
Approximate share of **premature deaths from AIR POLLUTION**

year 2010

Globally, **air pollution** is the **2nd leading risk factor** for the global burden of disease in 2010, behind high blood pressure, and together with **tobacco smoking,** including second hand smoke.

CCAC

2015 WORLD BIOFUELS' INCORPORATION RATES



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LATVIA
Mandate
Total Biofuel content 5.75% by energy content. 5% for Ethanol (vol).

LITHUANIA
Mandate
Biofuels 5.75% (vol).

LUXEMBOURG
Mandate
Biofuel content 2%.

MALTA
Mandate
Total Biofuel content 1.25% by energy content.

NETHERLANDS
Mandate
Min 3.5% for Ethanol (vol).

NORWAY
Mandate
Ethanol content 5% (vol).

POLAND
Mandate
Total Biofuel content 7.1% by energy content.

PORTUGAL
Mandate
Biodiesel content 6.75%, 5.5% for Ethanol (vol).

ROMANIA
Mandate
Total Biofuel 5% (vol). 6% for Ethanol (vol).

SLOVAKIA
Mandate
Total Biofuel content 5.75% by energy content. 3.2% for Ethanol (vol).

SLOVENIA
Mandate
Total Biofuel content 6.5%.

SPAIN
Mandate
Biodiesel 4.1% by energy and 3.9 for Ethanol.

SWEDEN
Mandate
Biodiesel 5% (vol) and Ethanol 5% (vol).

TURKEY
Mandate
2% Ethanol content by January 1, 2013. Increasing to 3% in 2014.

UNITED KINGDOM
Mandate
Biofuels 4.75% (vol).

AFRICA

ANGOLA
Mandate
Ethanol 10% (vol).

ETHIOPIA
Mandate
Ethanol 5% (vol).

KENYA
Mandate
Ethanol 10% (vol).

MALAWI
Mandate
Ethanol 10% (vol).

MOZAMBIQUE
Mandate
Ethanol 10% (vol).

NIGERIA
Mandate
Ethanol blend of 5-10%.

SOUTH AFRICA
Mandate
Ethanol 10% (vol).

SUDAN
Mandate
Ethanol 5% (vol).

ZAMBIA
Mandate
Ethanol 10%, Biodiesel 5% (vol).

ZIMBABWE
Mandate
Ethanol 10% (vol).

ASIA

CHINA
Mandate
10% Ethanol (vol) in nine provinces only.

FIJI
Mandate
Ethanol blend of 5-10%.

INDIA
Mandate
Ethanol mandate 5% content.

INDONESIA
Mandate
Ethanol 3% (vol), Biodiesel 10% (vol).

JAPAN
Mandate
3% Bioethanol mandate, currently reviewing option to increase to 10%.

PHILIPPINES
Mandate
Minimum Ethanol content of 10% total volume. E10 is mandated.

SOUTH KOREA
Mandate
Biodiesel 2% volume.

TAIWAN
Mandate
B1 Biodiesel mandate.

THAILAND
Mandate
Currently 5% (vol). Ethanol will be a compulsory 20% (vol) by 2016.

VIETNAM
Mandate
E5 Ethanol blending mandate.

AUSTRALIA

NEW SOUTH WALES
Mandate
6% ethanol content (vol).

NB: The NSW Mandate was introduced in 2011. The NSW Biofuels Act, Fuel Ethanol Mandate is 6% of the total Petrol sales. As at April 2015 total fuel ethanol sales equal 2.79%; well below the Mandate.

2.0 Fuel Security

"When goods don't cross borders then guns will"

Von Clusewitz 'On War'

Australia has become reliant on fuel imports:

- Australian stocks could be as low as 34 days
- Other developed countries including the US and Japan mandate a 150 day

- Without ethanol and with closing refineries, Australia is reliant on importing

Australia has limited stored liquid fuel supply

In February 2015 Federal Department of Industry and Science officials admitted they do not know how many days worth of fuel is stored in Australia and estimated it might be

Other developed countries have a mandated 150-day minimum fuel supply in storage

storage levels.

Australia imports 91 per cent of fuel as refined petrol after refineries were closed down

History tells us wars are fought of fuel security

Australia was at war with Indonesia in 1964 over the oil resources of Borneo and Sarawak. There are few years between 1964 and 2015 in which Australia has not been involved in a war directly or indirectly to protect our oil supply lines.

Japan went to war in 1941 because America cut off her oil supply.

The European war was basically a thrust by Hitler to the oil fields. The key and deciding battle in the war was Stalingrad – gateway to the oilfields. The North Africa campaign was (not about the Libyan Desert) a thrust to the world's oil supply, the Middle East and the Caucasus.

Spend in Australia; don't send it overseas

Northern Australia has over three quarters of Australia's water run-off. It has the resources to be one of the major sources of motor vehicle fuels and clean electricity into the foreseeable future. Fuels that are clean, renewable, and have by-products **that will, in a country like Australia, "dramatically increase food production".**

[11] Heath Aston, *Doubts over Australia's fuel security as bureaucrats admit not knowing reserves,* Sydney Morning Herald, February 6 2015

North Qld can produce all of the Nation's 18,000 mglts of motor vehicle fuel requirements:[12]

Upper Burdekin - UBurIS	1300 mglts
Lower Burdekin - existing industry converted to eth	800 mglts
Gilbert River – 2 schemes the size of Burdekin falls & Hells Gates	2500 mglts
Mitchell River – 3 schemes the size of B falls and Hells Gates	6000 mglts
Existing sugar industry in N. Qld (excluding B. Falls, incl. Mareeba ext)	3500 mglts
STaDS and NQBE schemes on the Herbert River	1000 mglts
Bradfield Scheme incorp. Finders R. projects and/or Cooktown Irri	3000 mglts
Total Ethanol (per annum)	**18,100 mglts**

40% of Australia's ethanol will undoubtedly come, as it does in America, from corn and other grains. But if it was needed to be produced from North Qld, this could be done with ease.

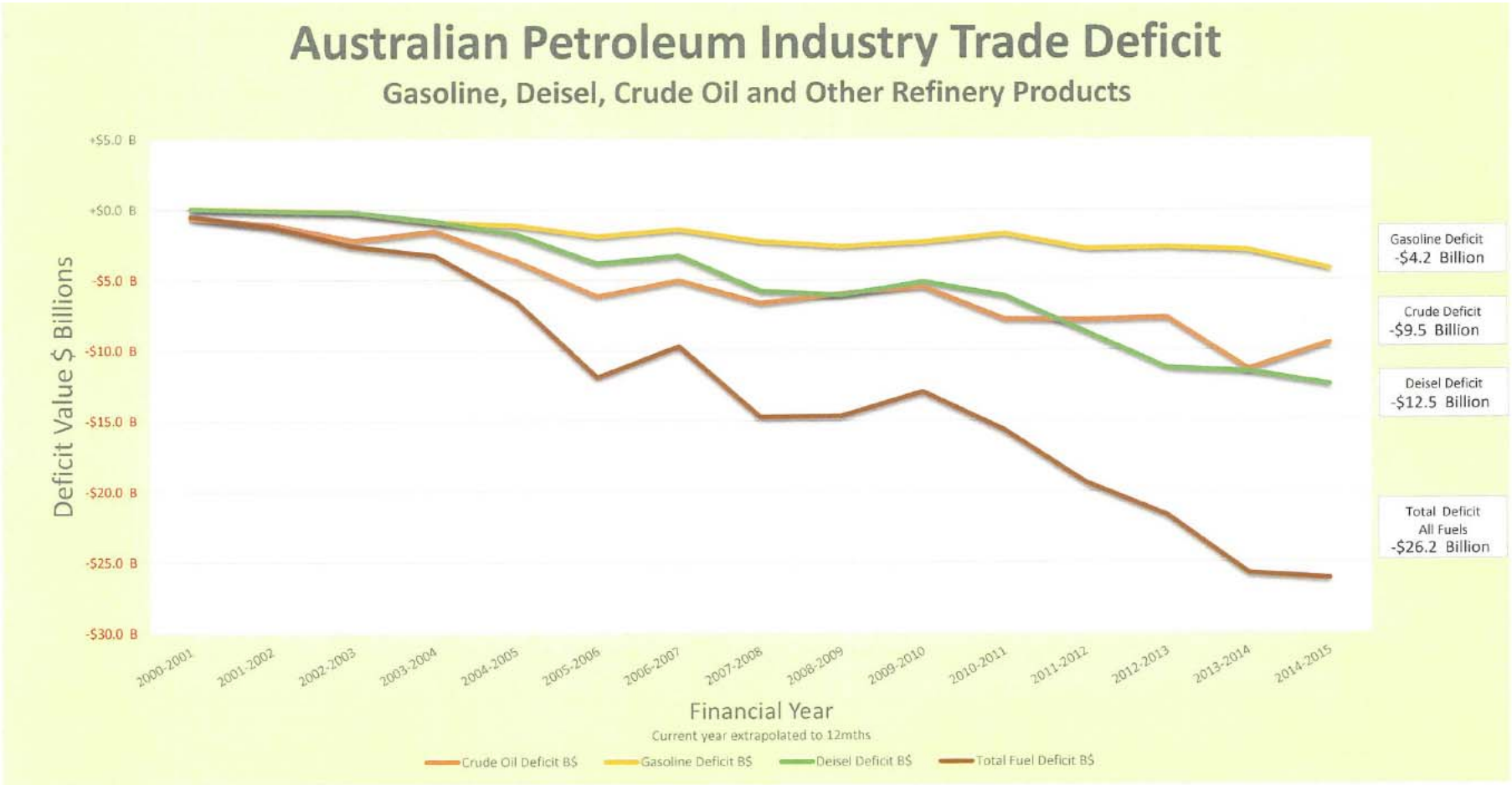
In **2002** Australia sent **$1b** overseas to buy oil.

In **2014** Australia sent **$25b** overseas to buy oil.

Australia: is it better to send $25,000m per year to the Middle East and other oil producing countries or to send $25,000m per year into the economy of rural Australia?

[12] Although for a host of reasons almost 30% of the nations of this 18,000 mglts will come from the grains industry. There is a further 15,000 mglts of diesel consumption in Australia. Significant proportion of this can come from new technologies which blend much more effectively with ethanol as an extender to diesel.

Australian Petroleum Industry Trade Deficit, 2000-01 to 2014-15



** Data provided by Dept of Science and Industry as at April, 2015*

Report Generated 11-Jun-2015

	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Gasoline	+$0.1 B	-$0.1 B	-$0.2 B	-$0.9 B	-$1.1 B	-$1.9 B	-$1.4 B	-$2.3 B	-$2.6 B	-$2.3 B	-$1.7 B	-$2.8 B	-$2.7 B	-$2.9 B	-$4.2 B
Deisel	+$0.1 B	-$0.1 B	-$0.2 B	-$0.8 B	-$1.8 B	-$3.8 B	-$3.3 B	-$5.8 B	-$6.1 B	-$5.1 B	-$6.1 B	-$8.7 B	-$11.3 B	-$11.5 B	-$12.5 B
Total Fuel Deficit	***-$0.5 B***	***-$1.2 B***	***-$2.6 B***	***-$3.3 B***	***-$6.6 B***	***-$11.9 B***	***-$9.7 B***	***-$14.7 B***	***-$14.7 B***	***-$12.9 B***	***-$15.7 B***	***-$19.4 B***	***-$21.7 B***	***-$25.8 B***	***-$26.2 B***

Current Situation

Australia has small and declining fuel stocks. Australia's combined dependency on crude and fuel imports for transport has grown from approximately **10% in 2002** to over **90% in 2014**.[13] Currently there is no plan to stop our dependency growing to 100% or to halt the further decline of our fuel security.

Source: NRMA, Australia's Liquid Fuel Security Part 2 (February 2014) 4.

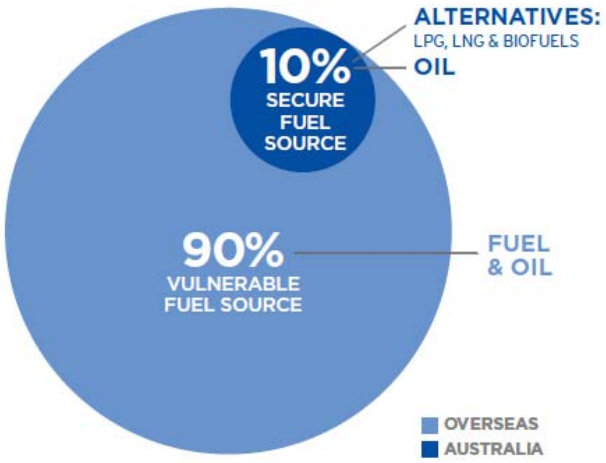
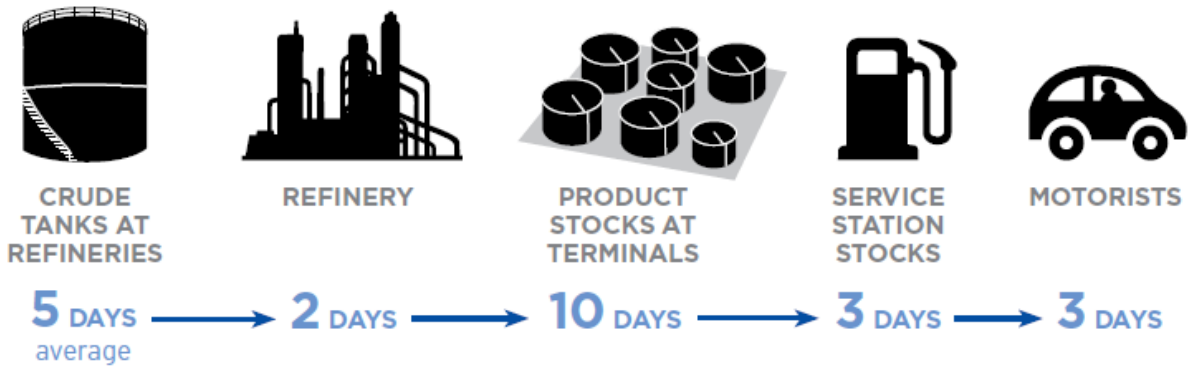


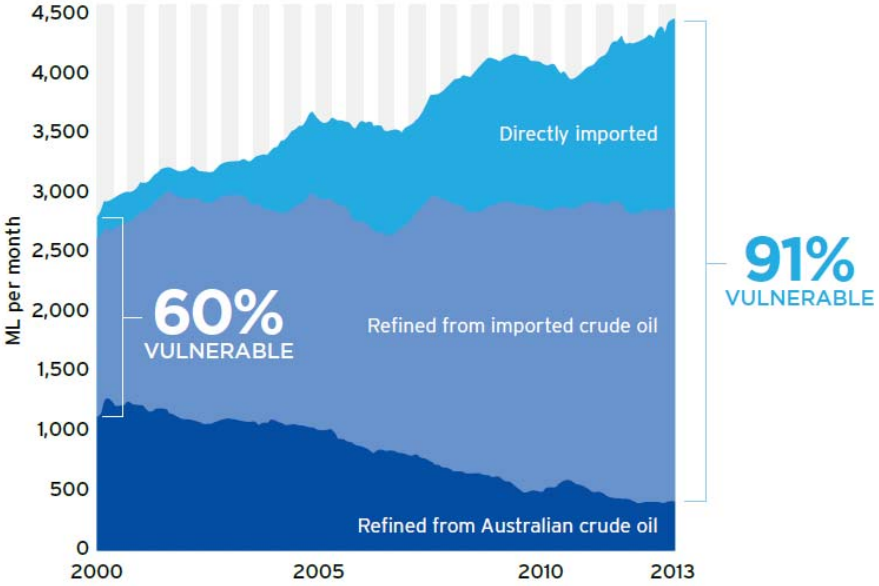
Figure 2: Fuel sources today

The below diagram shows Australia's low liquid fuel stockholdings – about three weeks of total stocks of oil and refined liquid fuels (as at 2014):



Source: NRMA, Australia's Liquid Fuel Security Part 2 (February 2014) 4.

[13] NRMA, *Australia's Liquid Fuel Security Part 2* (February 2014) 3 citing *Australian Petroleum Statistics*, Table 2 and Table 4, BREE 2014.



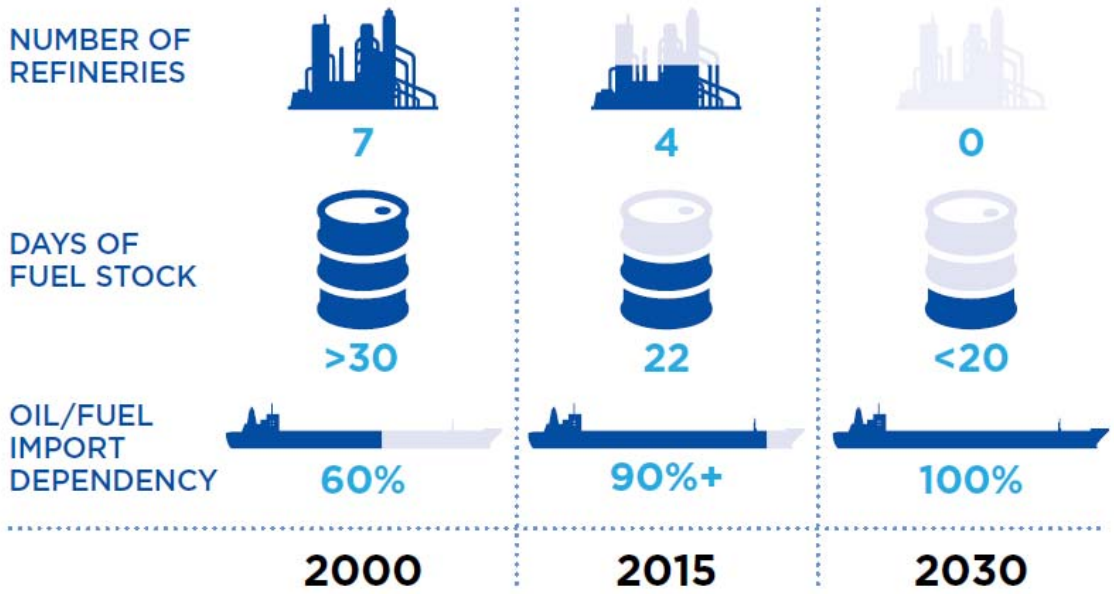
Breakdown of Australia's liquid fuel sources; declining local supplies and increasing imports of fuel products.[14]

Source: NRMA, Australia's Liquid Fuel Security Part 2 (February 2014) 8

Current Projection

At the current rate, Australia is moving towards a situation where by 2030 it could have:

- No refiners;
- Less than 20 days of liquid fuel; and
- 100% imported liquid fuel dependency.[15]



Source: NRMA, Australia's Liquid Fuel Security Part 2 (February 2014) 4.

[14] Ibid.
[15] Ibid.

Moving Forward

The United States has dramatically improved its fuel security. In 2005 in the United States, 60% of petroleum products were imported, however, that was **reduced to 33% in 2013** as a result of increased domestic crude supplies, shale oil production and ethanol production—'imports would have reached 41% without ethanol'.[16] The United States Renewable Fuels Association's 2013 Ethanol Industry Outlook calculated that, from 2005 through 2012, ethanol increased from 1% to 10% of gasoline supply.

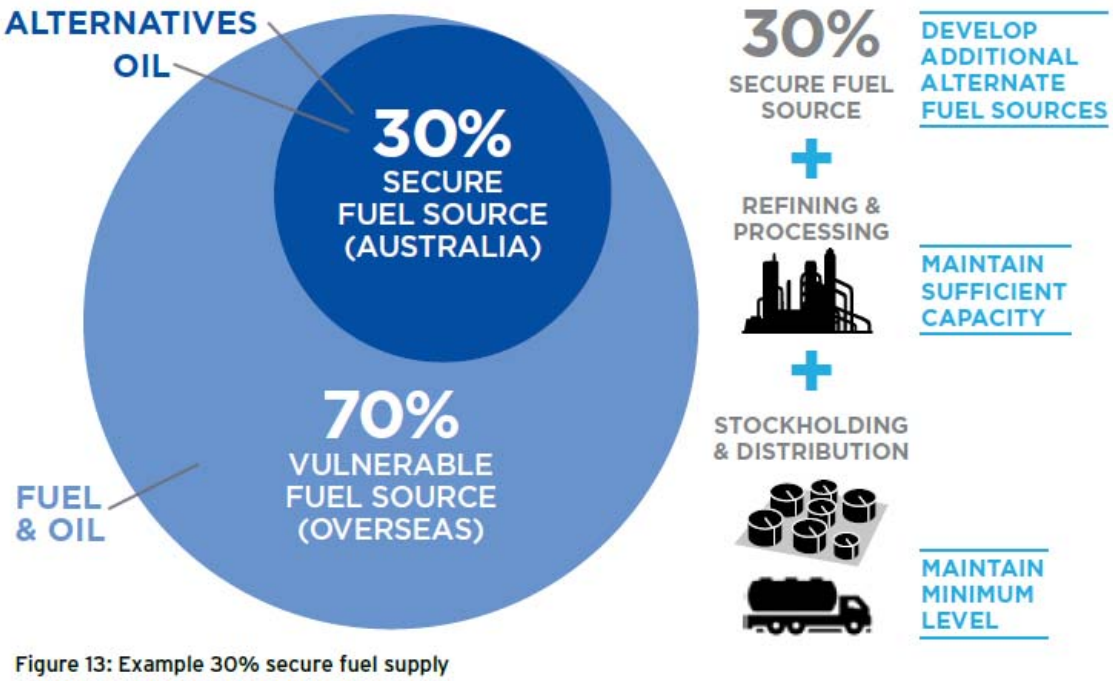


Figure 13: Example 30% secure fuel supply

Source: NRMA, Australia's Liquid Fuel Security Part 2 (February 2014) 4.

In Australia, more than 30% of domestic transport energy demand can be met by secure supplies.[17] This would ensure basic services could function in Australia in the event of a major and sustained liquid fuel supply disruption. The remaining 70% would be supplies by the market and subject to normal commercial market forces and supply risks. The 30% should comprise 10% Australian-sourced oil and 20% from Australian-sourced alternative fuels including biofuels: *Source NRMA ALFF Part 2, citing the Jamison Report.*

[16] U.S. Department of Energy referring to the Renewable Fuels Association, *2014 Ethanol Industry Outlook,* < http://www.ethanolrfa.org/pages/annual-industry-outlook>.

[17] NRMA, *Australia's Liquid Fuel Security Part 2* (February 2014) 16 citing the Jamison Report <www.mynrma.com.au/about/jamison-report.htm>.

3.0 Price of Petrol vs Price of Ethanol

The following figures show the average price of fuel in 2014:

Brazil (in Australia dollars)[18]	**91c per litre**
United States (in Australia dollars)[19]	**83c per litre**
Australia[20]	**149c per litre**

Alcool is 85% ethanol. In 2007, when the above photograph was taken, Alcool cost 74c per litre (in Australian dollars). At the same time, Australian's were paying 154c per litre for petrol.

[18] Alternative Fuel Price Reports, ending April 2015, and the US Energy Information Administration, US Department of Energy.
[19] Ibid.
[20] Australian Institute of Petroleum, Annual Retail Price Data, http://www.aip.com.au.

Whilst ethanol has a higher cost of production than oil, oil producers are entitled to claim and do claim, economic rent for expiration and development, amortisation as it is the dwindling resource and for the insecurity of supply. On a number of occasions the opec countries have cut-off the restricted supply of oil to the world market causing huge losses to the oil companies.

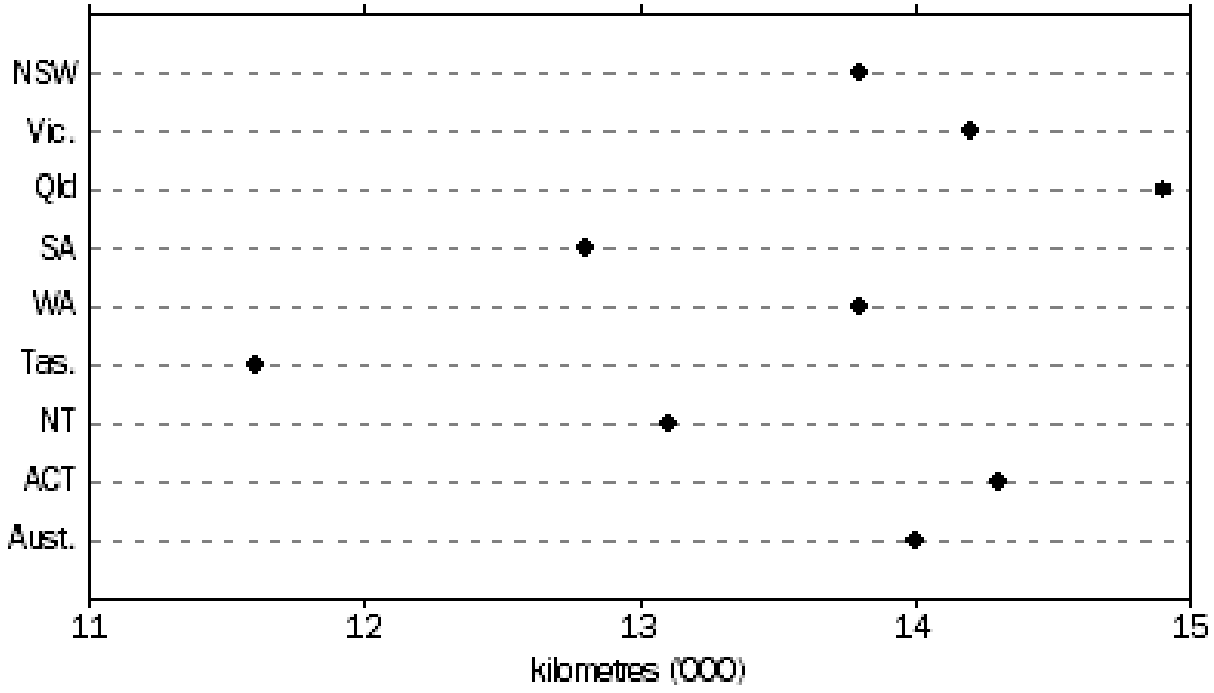
Undoubtedly, the half-a-dozen companies that supply most of the world's oil secure a benefit flowing from this very small concentration of market power. There are other fairly complex issues in price structures, particularly in Australia, that will always result in ethanol being sold at the bowser much more cheaply than petrol and being available to the bowser at a cheaper price than petrol. Such complexities will not be dealt with in this report.

Many countries in the world petrol is punitively taxed in an effort to force people to use public commuter transportation.

Kilometres Travelled

The 16.6m motor vehicles in Australia travel an estimated 232,453m kilometres with an average of 14,000 kilometres per vehicle. Vehicles registered in Qld travel the highest number of average kilometres: 14,900.[21]

Average kilometres travelled, Motor vehicles by state/territory of registration **-** Year ended 30 June 2012:



Source: Australian Bureau of Statistics (2013), *Survey of Motor Vehicle Use , Australia 12 months ended 30 June 2012*, < http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0>.

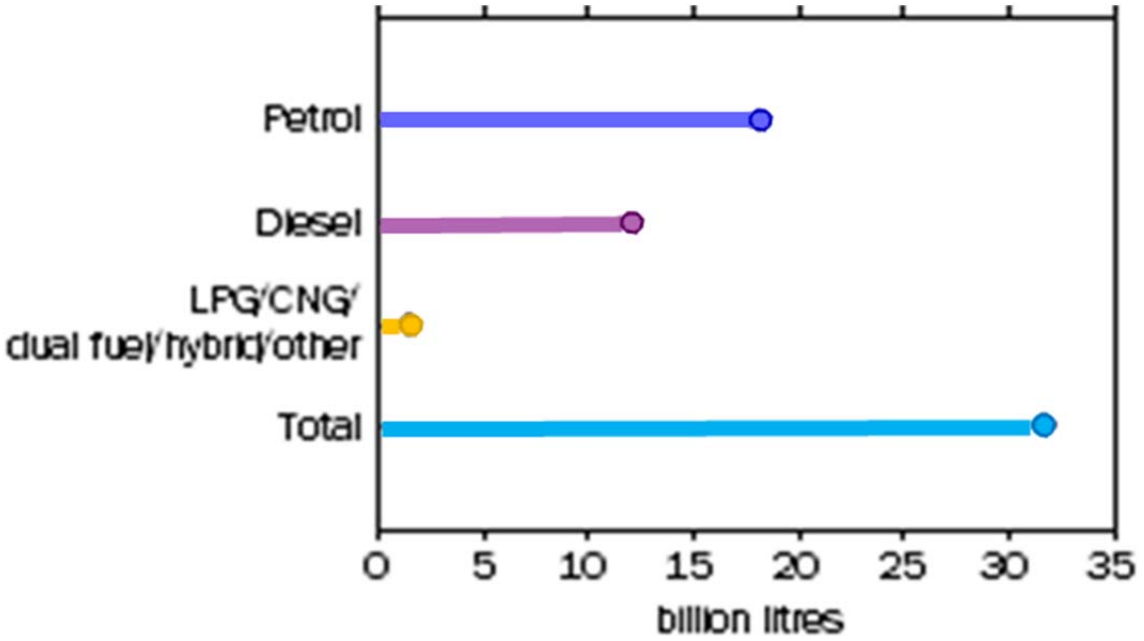
[21] Australian Bureau of Statistics (2013), *Survey of Motor Vehicle Use , Australia 12 months ended 30 June 2012*, < http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0>.

Fuel Consumption

In 2012, Australia's motor vehicles consumed 31,839 million litres (mglts) of fuel:[22]

Petrol	= 57.3%	=18m mglts
Diesel	= 37.7%	=12m mglts

Total Fuel Consumption: Type of fuel - Year ended 30 June 2012:



Source: Australian Bureau of Statistics (2013), *Survey of Motor Vehicle Use , Australia 12 months ended 30 June 2012*, < http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0>.

The average rate of fuel consumption for all motor vehicles in 2012 was 13.7 litres per 100 kilometres, average fuel consumption then per vehicle per year is 1,918 litres.[23]

For every litre of petrol used, 2.3 kilograms of carbon dioxide (CO_2) is released into the atmosphere. Therefore, 4411 kilograms CO_2 is emitted per vehicle per year.

[22] Australian Bureau of Statistics (2013), *Survey of Motor Vehicle Use , Australia 12 months ended 30 June 2012*, < http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0>. One megalitre is one million litres; m mglts is one million megalitres.

[23] 0.137 litres x average kilometres travelled: 14,000. See Australian Bureau of Statistics (2013), *Survey of Motor Vehicle Use , Australia 12 months ended 30 June 2012*, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0>.

Benefits of ethanol-blended fuels

- Ethanol contains 31 % oxygen.[24] Adding oxygen to fuel results in more complete fuel combustion, reducing harmful tailpipe emissions;
- Ethanol displaces the use of toxic petrol components – PAH[25] (e.g. benzene is a carcinogen known to cause leukaemia). Most PAH's are carcinogenic;
- Ethanol is a renewable fuel, typically produced from fermented plant matter – it is natural;
- Ethanol-blended fuels account for 12 %[26] (and growing) of all automotive fuels sold in the United States; and
- Ethanol-blended fuels reduced the C02-equivalent greenhouse gas emissions by approx. 3.6 million tons in the USA in 2001. i.e., equivalent to removing 520,000 cars from roads.
- Removing lead (banned in the 1980s for health reasons) resulted in a fall in the Rated Octane Number ("RON") to restore RON aromatics and/or MTBE was added. Aromatics are carcinogenic and MTBE so dangerous to health it has been banned in the United States.
- The American Lung Association of Metropolitan Chicago credits ethanol-blended reformulated petrol with reducing smog-forming emission in the city by 25 % since 1990; and
- Ethanol reduces particulate emissions, especially fine particulates that pose a health threat to especially children, senior citizens and individuals suffering from respiratory ailments.

Advantages to using ethanol-blends

- Reduction in small particulate emissions as a result of ethanol oxygenating giving a much better burn resulting in a qualitative reduction in small particulate emissions thereby significantly reducing mortality and disease resulting from small particulate and the many carcinogens and reduction in many carcinogens in petrol;
- Self-sufficient in motor vehicle fuels:- independence from reliance on imported oil;
- Extends Australia's dwindling domestic supply of light crude petroleum used to produce transportation fuels;
- Expanded market opportunity for Australian farmers;
- Rural economic development;
- Displaces dangerous components in petrol, such as benzene;
- Ethanol is made from renewable resources, whereas petroleum comes from limited fossil energy sources;

[24] The ethanol molecule consists of 2 carbon atoms (carbons atomic mass 6), 6 hydrogen atoms (hydrogen atomic mass 1), oxygen 1 atom (oxygens automic mass is 8) so 8/26ths is by weight 31%.
[25] Polycyclic Aromatic Hydrocarbons.
[26] As at 2003.

- Cleaner environment (lower carbon monoxide and smog-causing emissions)
- Cleaner burning engines;
- Improved vehicle performance; and
- Ethanol fuel shows better performance in reducing volatile organic chemicals (VOCs), and PAHs (benzene, tolulene …) and butadiene, relative to petrol.
  PAHs are needed to achieve acceptable rated octane numbers (RON). RON levels can be obtained by replacing carcinogen TAHs with benine ethanol.

Experience with biodiesel

Again quoting Professor Kearney:-

- Emission reduction for particles, CO and gaseous hydrocarbons but increases in oxides of nitrogen (NOx);
- In particulate emissions, the insoluble fraction (coarse mode) decreases while the soluble fraction (fine mode) increases with a net reduction in total PM. The soluble fraction can be reduced by using oxidation catalysts;
- Biodegradation of biodiesel is much faster than for diesel fuel;
- Studies show that, for greenhouse emissions, biofuels substantially outperform fossil fuels (but to a lesser extent) gas fuels;
- Biodiesel has significantly less ecotoxicity than diesel and ideal for sensitive rural areas;
- Biodiesel fuel has a biomodal distribution of fine particles with a 30% reduction in the 0.05 and 0.1µm diameter particles, but remained the same for larger and smaller particles;
- Recent studies showed biodiesel can reduce emissions of particulate matter by 47%; and
- USA EPA report verified a 67% reduction in unburned hydrocarbons and a 48% reduction in CO_2 levels with pure biodiesel (B100). Smaller reductions (12%) were obtained with 20% biodiesel and 80% petrodiesel.

4.0 Industry

Grains Industry

On the American example there is a 16% benefit to the grains industry.

There is an estimated 2000 grains growers in Queensland. Comparatively, there probably wouldn't be more than 4-5 dozen commercial lot feeders in Queensland and half of those would be corporates – arguable many of them foreign owned.

Opposition from lot feeders is because no doubt, it will significantly increase grain prices.

Of the top three grain farmers – one is in administration, one has formally requested administration; and in the top 20 grain farmers there is another being foreclosed upon and sold up. Whilst there would be many others, these farmers have received significant publicity.

The benefits for the grains industry and growers are very clear. Grain ethanol, a quarter of its income, arguably a third is from dried distillers grain (DDG). This DDG, combined with grass cut into hay after rain (grass grows again immediately so there is no loss in grazing), provides a high powered lot feeder regime extremely cheaply.

This is the advantage America cattleman enjoys over Australia and is an additional market opportunity to the estimated 2000 grain growers in Queensland.

Sugar Industry

There is a 25% benefit for the sugar industry, based on the Brazilian experience.

Average prices for petrol over the last 15 years – have delivered $420 a tonne equivalent price in Brazil for the 2/3 of their crop that goes into the ethanol stream. In Australia, all of our sugar cane goes into the sugar stream and the average price has only been $340 per tonne. Clearly the Brazilians can cross subsidise, whilst Australia without any ethanol stream, has a industry which continues to disintegrate.

Under the Free Trade Agreement mills can be manned by Chinese. Our farmers will have to sell out of get out of sugar, leaving Queensland reverting to a corporate plantation industry again, manned by Chinese and Wilmar the dominant operator in Queensland/Australia.

Without ethanol it is very hard to see how there is an economic future for Queensland.

Every city on the coast from Maryborough north, with an exception of Gladstone and Rockhampton, has their economies underpinned by sugar and that most certainly includes Townville and Cairns; as well as the more obvious Bundaberg, Innisfail and Ayr.

Beef Industry

Possibly the biggest benefit may well be to the reeling beef industry.

The American beef industry access dried distillers grain. In fact America last year is reported to have exported 100 million tonne of dried distillers grain. It's 3 times more nutritious than conventional gain (it has had the starch removed).

The regeneration of Queensland's dying rural towns. Without ethanol this results in a dramatic reduction in quality of life - rugby league folds, netball folds, tennis folds, the swimming pool closes for most of the year, the high school in many cases vanishes, leaving children without secondary education (most parents cannot afford boarding school).

Queensland Economy

The economy of Queensland is underpinned by coal, cane, cattle, copper, gold and aluminium trailing behind. Every one of these industries is in serious trouble. The quadrupling of electricity and gas prices and the huge increase in competition in the coal industry (Indonesia is now the biggest exporter of coal, Mongolia is coming on stream this year) has seen the coal industry struggle.

As stated above our sugar industry is faltering – a mill closing every two years.

Cattle and the failure of three wet seasons in the north has set the industry back 10 years. Most cattlemen in a very parlous situation. The live cattle and high currency Federal Government polices both will continue to impose economic pain upon this industry for at least another 7-8 years.

Copper has been disastrously hit because of a quadrupling of both electricity and gas prices. Kagara zinc, the second biggest zinc producing corporation has declared insolvency and closed operations, as has Century Mine. Whilst Mt Isa struggles to keep its copper stream operating under the combined handicap of a quadrupling of electricity and gas prices.

An ethanol mandate will drive an ethanol industry in Queensland which will not only create new jobs and development opportunities, but will give the above industries a profitable future.

5.0 Environment

Ethanol in fuel and for electricity generation reduces the $C0_2$ emissions into the atmosphere.

CO2 Emissions

Whilst people may question global warming, what is certain, is that atmospheric CO_2 is increasing exponentially. This, it may be argued, is good for life on land **but not in the sea.** Here there are serious consequences for (particularly the bottom end of) our ocean's food-chain.

The shells of crustacean are calcium carbonate, a substance that is alkaline. Alkalinity emanates from pH levels. Such pH levels are threatened by increased atmospheric CO_2. CO_2 in water has an acidifying effect, i.e., it lowers pH levels, thereby inhibiting the growth of shellfish.

Minute shellfish cannot be seen even with a magnifying glass and comprise much of the bottom of the ocean's food-chain. Clearly a threat, however remote, is real and is serious. 23 studies provide the empirical evidence making an unassailable and empirical case that there is a problem. Whilst not immediate it is real and it is serious.

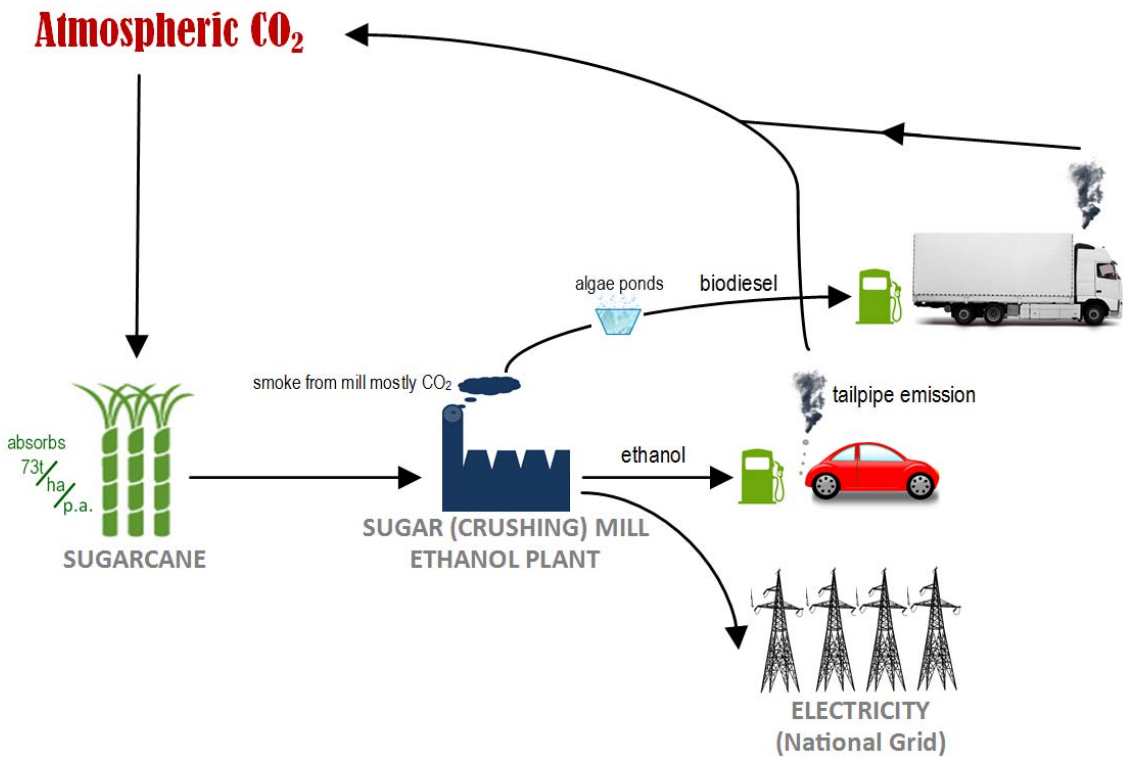
Nearly **300m tonnes** of Australia's 536m tonnes of CO_2 emissions comes from electricity (almost 200m tonnes) and transport (almost 100m tonnes).

CO2 Cycle

1. Every hectare of cane absorbs 73 tonnes of CO_2 ever year.
2. The sugar cane is harvested and sent to the mill using biodiesel as fuel.
3. The energy required to run the mill comes from electricity generated at the mill.
4. All emissions–smoke is bubbled into microbial water ponds where the microbes turn the CO_2 and H_2O into Biodiesel. This diesel is then used and emitted as CO_2 into the atmosphere.
5. The mill produces ethanol which similarly goes through a petrol bowser into a motor vehicle and emitted as CO_2 into the atmosphere.
6. The hectare of sugar cane in turn pulls the CO_2 back down again.

CO_2 from petrol goes up and stays up.
CO_2 from ethanol goes up and then is pulled down.

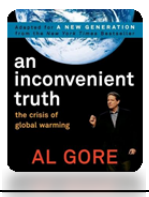
CO_2 from coal-fired electricity goes up and stays up.
CO_2 from (ethanol) "co-generated" electricity goes up and then is pulled down.



Run-off

The increased use of microbial – natural soil enrichment dramatically reduces chemical fertiliser requirements.

The rotting of cane trash blanket occurs when harvesting cane tops are left on the ground. With new mill design, half of these cane tops are taken back to the mill. But there is still significant CO_2 emissions from the trash blanket. Half the trash blanket however is only 6.15 tonnes per hectare by weight.[27] It has a role in inhibiting Nitrogen run off on to the Great Barrier Reef. Charters Towers has a large diatomaceous earth, quarry, and plant which will further trap nitrogen, fertilizer, for use by the sugar cane plant. This low run-off profile from the Cape River Basin should ensure negligible run-off profile.



In his book *An Inconvenient Truth*[28] Al Gore clearly indicates, as his first answer for the CO_2 vices, the use of ethanol.

[27] Calculated on the national average yield of sugarcane per hectare in 2013: 82 tonnes per hectare x 15% cane trash: Australian Bureau of Statistics, *Agricultural Commodities, Australia - Crops* (2012-2013).
[28] Al Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It* (2006, Rodale Press) 137.

6.0 Ethanol Mandate

Why mandate at all?

History in other countries around the world has shown that without a mandate, the large oil companies will not include ethanol in the fuel supply.

It is naive in the extreme to think that oil companies that make their money out of oil, will sell ethanol because State Government thinks it is a good idea.

Why 10% mandate?

Queensland needs a 10% mandate to have an impact on new jobs and a benefit to new and sustained development in regional Queensland.

A 10% mandate is not being done to the benefit of private operates; it is being done of the benefit of people in Queensland.

Any shortfall in capacity from current operators will be filled by smaller plants which will open to fulfil the 10% mandate. These are arguably shovel read now. Little benefit will accrue to Queensland unless this occurs – creating new jobs and industry in regional Queensland.

Without a 10% mandate there will be no new jobs or industry in regional Queensland.

Implementation

Timeframes and targets

% Mandate	Timeframe
5%	**1 July 2016**
10%	**1 July 2017**

Implementation – lessons learnt

The lessons learnt from the NSW experience tell us in Queensland we need to ensure the following when mandating ethanol:

- Location of ethanol bowers in the petrol stations must be in prominent locations that the public can visibly see and easily access.
- Enforcement –ensuring fuel supplies have 10% in all products.
- Mandated in all fuel products – not just basic ULP. Ethanol must be in every fuel product offered – basic ULP through to premium ULP.

7.0 Appendices

Appendix 1: NRMA Report

Australia's Liquid Fuel Security Part 2

A report for NRMA Motoring & Services

Prepared by John Blackburn AO
February 2014

About the author

Air Vice-Marshal John Blackburn AO (Ret'd)

John retired as Deputy Chief of the Royal Australian Air Force in 2008. His RAAF career included being an F/A-18 fighter pilot, test pilot, Head of Policy Guidance and Analysis and Commander of the Integrated Air Defence System in Malaysia. He is now a consultant in the fields of Defence and National Security.

He is Deputy Chair of the Kokoda Foundation Board and the Deputy Chair of the Williams Foundation Board. He holds a Master of Arts and a Master of Defence Studies.

In February 2011 the Kokoda Foundation published John's report *Optimising Australia's Response to the Cyber Challenge*, which he co-authored with Dr Gary Waters. In February 2013 NRMA Motoring & Services published his report *Australia's Liquid Fuel Security*.

Contents

Executive Summary

This report is the second in a series commissioned by NRMA Motoring & Services and authored by John Blackburn AO. Both reports address Australia's liquid fuel security and the growing risks in our fuel supply chain and suggest remedial action.

The first report, *Australia's Liquid Fuel Security*, was published in February 2013. It revealed the little known fact that Australia has small and declining fuel stocks – about three weeks' worth of oil and refined fuels. The report highlighted the reasons for our oil dependence; explained the risks to our liquid fuel supply chain; pointed out the impact on our way of life of a severe supply interruption; and made recommendations for improvements.

This follow-up report addresses four key questions:

1. How much more serious could the problem get?
2. Why has no action been taken to date?
3. What can we do about it?
4. How can we initiate action on a fuel security plan?

Australia's combined dependency on crude and fuel imports for transport has grown from around 60% in 2000 to over 90% today.[1] In an ever-changing world, we need a plan to stop our import dependency growing to 100% in the future if we are to have an acceptable level of fuel security. Since the first report was published, another likely Australian refinery closure has been announced; the political instability in some Middle Eastern countries has worsened; our net import fuel stockholdings have declined; and the domestic supply of a special type of fuel required by the Australian Navy (F44) has come under threat.

If a scenario such as a confrontation in the Asia-Pacific region were to happen, our fuel supplies could be severely constrained and we do not have a viable contingency plan in place to provide adequate supplies for Australia's essential, everyday services and for our military forces.

1 Adapted from Australian Petroleum Statistics Table 2 and Table 4, BREE 2014.

Figure 1: Australia's low liquid fuel stockholdings

Much of the analysis required to address the risks described in this report has already been conducted and the right expertise exists across Government, business and in academia to devise a solution. However, the coordination and cooperation across these areas of expertise has been lacking.

The primary information sources that Governments use to understand our energy security are the periodic National Energy Security Assessment and the Energy White Paper. In the past, they have both placed a strong emphasis on ensuring market structure and delivery at the expense of considering the consequences of unlikely but highly detrimental supply disruptions.

We should expect clear assurances from our Government that we have sufficient Australian-controlled sources of fuel to support essential needs in the event of overseas supply interruptions. Given the lack of publicly-owned fuel stocks, the lack of reporting on industry stocks and the very limited public analysis of supply chain risks, it is difficult to see how our new Government could currently provide us with that assurance. Past Governments do not appear to have had a Plan B.

The good news is that we can do something to improve our fuel security. We do not need to accept our current trajectory, nor do we need to aspire to return to our position of 15 years ago. Instead, we should recognise that the world is changing and balance economic reality with our security needs.

This report recommends a comprehensive response to our growing import fuel dependency that considers a full range of plausible scenarios and assesses the contribution to be made by changes to both demand and supply sides of the liquid fuel delivery chain. This will entail a holistic look at what drives demand for transport; the technologies and energy sources that are used; the efficiency of these technologies; and alternative fuel supply and storage options.

This report also examines the feasibility of improving our liquid fuel security. It concludes that an increase of secure fuel supply (Australian sourced and refined) from 10% to 30%, for example, would be feasible. Components contributing to a more secure liquid fuel supply could include:

- Mode shifting, such as transporting freight by rail rather than road and supporting increased use of public transport;
- Improved efficiency of vehicles;
- Expansion in the number and use of electric and fuel cell vehicles;
- Alternative sources of liquid fuels such as biofuels; and
- Increased liquid fuel stockholdings.

Recommendations

Developing a cost-effective plan to reverse Australia's growing liquid fuel security problem should be possible, but will require a much more comprehensive analysis than has been the case so far.

For the 2014 National Energy Security Assessment and the 2014 Energy White Paper, this report recommends a greater degree of involvement and ownership of the assessment process by agencies experienced in national security risk analysis, and greater consultation with business and consumer groups. This approach will give both these core documents a depth that has been missing in previous years.

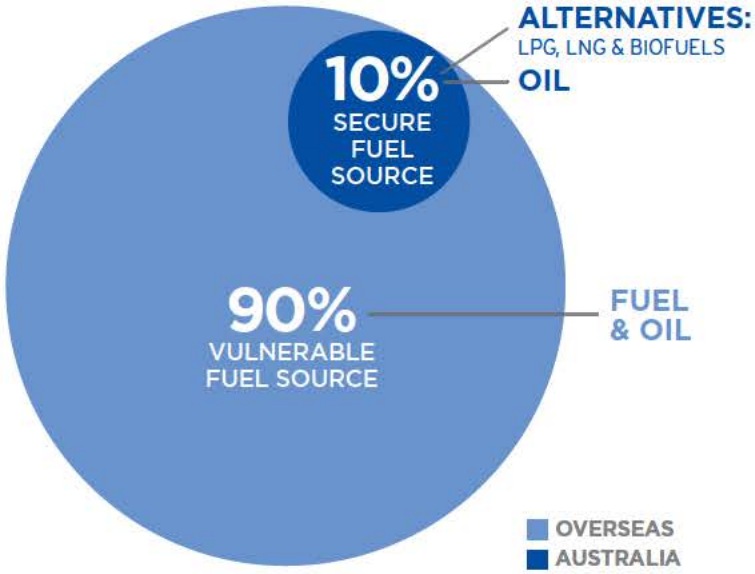


Figure 2: Fuel sources today

Introduction

There is no public Government policy on maintaining a minimum level of oil refining capacity in Australia. Since 2000, our dependence on imported liquid fuel and oil for transport has grown from around 60% to over 90% of our transport fuel demand. There is no plan to stop our dependency growing to 100% or to halt the further decline of our fuel security.

The implications of this situation are serious and affect all Australians. To support a public debate on this important subject, NRMA Motoring & Services[2] has commissioned a series of reports authored by Air Vice-Marshal John Blackburn AO (Ret'd) that discuss the issues involved and put forward recommendations for change.

The first report, *Australia's Liquid Fuel Security*[3] concluded there are several problems with our liquid fuel security:

- Australians are heavily dependent on energy imports, with over 90% of domestic transport liquid fuels being sourced from imported oil or refined oil products;
- Our transport system and, in turn, our society is almost wholly oil dependent – we are at risk if we experience supply chain interruptions or a reduction in the availability of affordable oil supplies in the future;
- We have very small consumption stockholdings in Australia – about three weeks of total stocks of oil and refined liquid fuels as shown in Figure 1; and
- While our 'just in time' oil and liquid fuel supply chains work well under normal circumstances or under small scale or short duration interruptions, the resilience of the supply chains and associated infrastructure under a wider range of plausible scenarios has not been assessed.

Furthermore, Australia faces ongoing changes to our liquid fuel security situation. In the 12 months since the first report was published:

- Another Australian refinery sale and potential closure has been announced;
- Tensions have risen further in the Middle East;
- Australia's reported levels of net import liquid fuel stockholdings have declined by 11 days (a 16% reduction); and
- The Department of Defence has been advised that at least one military-specific type of liquid fuel (F44) is unlikely to be refined in Australia as of mid-2014.[4]

2 The NRMA has a history of pioneering advocacy across a range of issues affecting its Members. Ensuring Australia's liquid fuel security is one such issue.

3 Australia's Liquid Fuel Security, 28 February 2013 www.mynrma.com.au/about/fuel-security.htm

4 Department of Defence DGSL/OUT/2013/186 dated 5 Jul 13 www.ret.gov.au/energy/energy_security/reporting/Documents/MPDR2013-Department-of-Defence.pdf

Australia is moving towards a situation where by 2030 we could have:

» No refineries;

» Less than 20 days of liquid fuel; and

» 100% imported liquid fuel dependency.

Following publication of the first report in this series, the NRMA held a series of workshops and interviews to further explore the liquid fuel security issue.

Representatives from Government, industry, business and the wider community addressed four key topics:

» Australia's worsening liquid fuel security problem;

» Why no action has been taken to date;

» What we can we do about it; and

» Initiating a liquid fuel security plan.

This report explores these issues and proposes actions to address the risks. The actions need broad-based public support, as they will require Government intervention. Some may involve public investment, which may impact on the cost of liquid fuel for consumers.

The measures address risks to our liquid fuel security and national resilience that we may face in the future.

The Australian people must decide if they are worth investing in now.

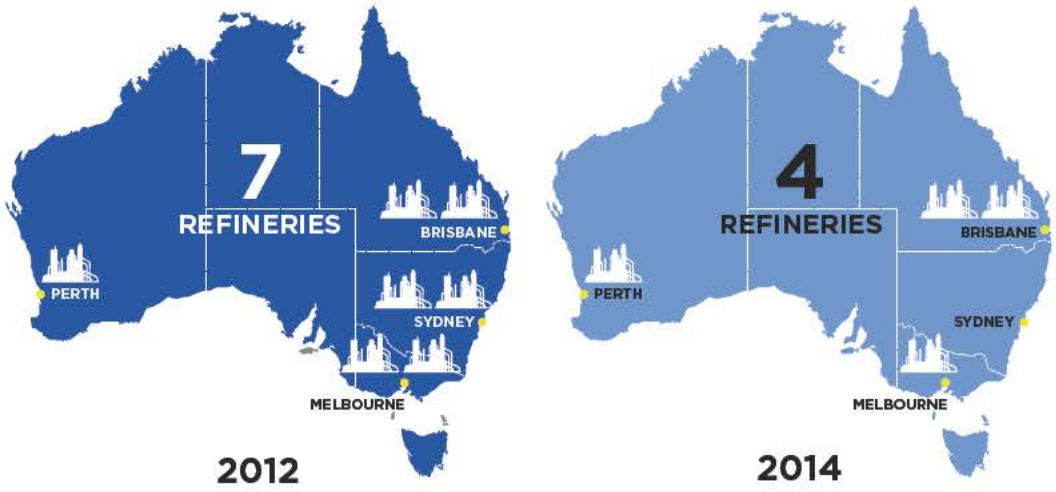


Figure 3: Decline in Australian refineries

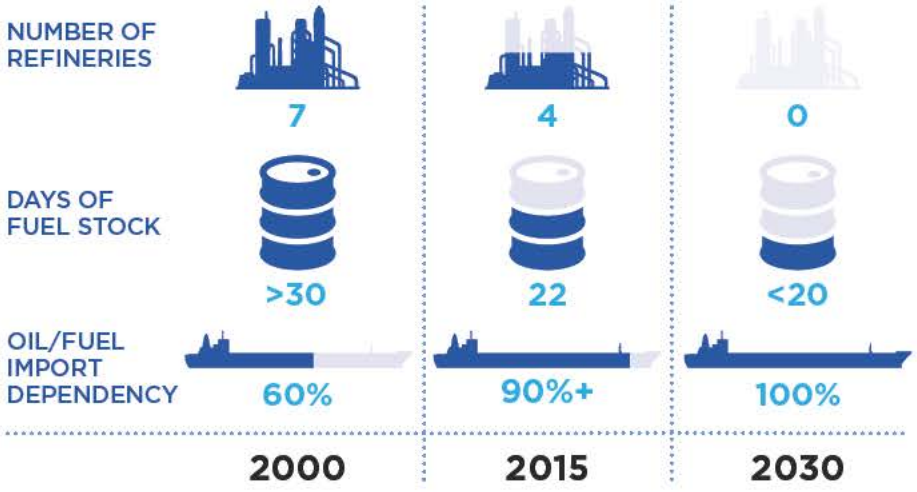


Figure 4: Projected Australian fuel production and stockholding decline

Australia's worsening liquid fuel security problem

Australian liquid fuel refining industry has been shrinking for some years due to a series of factors including increasing domestic costs and the cost of upgrading ageing refineries.

This decline is accelerating. By 2014, local refinery closures mean that total Australian refinery capacity will have declined 28% in just two years

There is also the high probability of the closure of Shell Geelong refinery when Shell exits the oil refining business in Australia in 2014. This refinery produces specialist aviation fuel types for Defence and commercial aircraft; Shell describes it as "the leading provider of aviation fuels, representing 1000 flights per day".[5] If the Geelong refinery closes, we will experience a loss of refining capacity in Australia of 42% over two years as illustrated in Figure 3.[6]

Without Government action, the remaining refineries are unlikely to be competitive with regional liquid fuel suppliers in the future and could close over the next decade.

Figure 4 illustrates the loss in Australia's liquid fuel production and storage capacity since 2000 and projects the possible loss through to 2030. In 2000, our combined dependency on crude and fuel imports was around 60% of our needs.[7] It is now in excess of 90%. If we have no refineries in Australia by 2030, our import dependency will rise to 100% as all fuel products will have to be fully imported.

With no refineries we will not be able to refine any Australian sourced oil and will be completely dependent on imports. There is currently no government policy to avoid this outcome.

Our dependence on imported liquid fuel is increasing

We have two sources of liquid fuel: those from Australian territory that are relatively secure, and those from overseas that are largely from reliable markets, but have some security vulnerabilities for supply.

Unfortunately, not all the oil produced in Australia can be refined in Australia due to the configuration of our refineries. Over the last 13 years, as our oil production has declined and imports have grown, there has been a rapid decline in Australia's capability to produce its own transport fuels. Australian refinery closures that have been announced, and the further significant changes anticipated in Australia's refinery industry,[7] will likely result in further erosion of our national production capability.

A breakdown of our liquid fuel sources is illustrated in Figure 5. As previously stated, around 90% of our transport liquid fuels are sourced from potentially vulnerable imported oil and refined fuel products. Alternative liquid fuels – including renewable energy – have yet to reach significant market share or commercial viability in most cases.

With a high dependence on imports, an important question is: who owns the refineries that we will increasingly depend on and how could they influence the availability of liquid fuel imports in times of future regional instability?[8]

We could ask similar questions regarding the ownership and reliability of oil and fuel shipping companies; there are no Australian owned commercial oil/fuel tankers.

5 www.shell.com.au/aboutshell/who-we-are/shell-au/operations/downstream.html

6 Australia's Liquid Fuel Security, February 2013, p8 www.mynrma.com.au/about/fuel-security.htm

7 Article, BP, Shell Assets on the Block, Australian Financial Review 7 Jan 2014.

8 For example, the SRC Jurong Island Refinery in Singapore is 50% owned by Chinese companies.

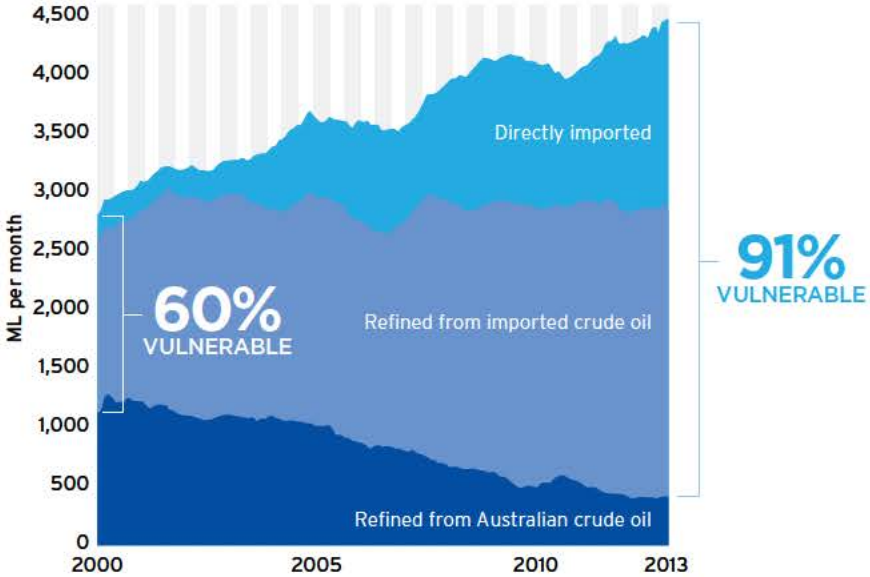


Figure 5: Declining local supplies and increasing imports of fuel products[9]

Figure 6: Fuel supply infrastructure in decline

Given the majority of our refined liquid fuels are sourced from Singapore,[10] we should assess refinery ownership implications in Australia's liquid fuel supply across a range of feasible scenarios. In the event of regional conflict, or even conflict over trade or political positions, the ownership of refineries and shipping companies could be important factors in the willingness of refinery and shipping company owners to supply liquid fuel to Australia.

Supply chains are shrinking

The way the world works continues to change. Since the 1980s, commercial supply chains have been redesigned to reduce overhead costs. Companies have relocated production and manufacturing capabilities, embraced just-in-time inventory management and introduced lean manufacturing techniques.

These trends have impacted our liquid fuel supply infrastructure of import facilities, refining, stockholding and distribution elements. The oil and fuel companies operating in Australia have optimised their supply chains and have effective just-in-time delivery of oil and liquid fuel stocks that minimise overhead and production costs.

While such supply chain changes are economically logical and in the interest of company shareholders, the collective actions of market players have resulted in increased overall risk. Such changes can reduce resilience and can introduce new and often unrecognised risks. These new risks are often described as 'systemic risks' because they result from how a system changes as a whole when parts of the system are changed in an uncoordinated manner.

Figure 6 illustrates the components of our supply infrastructure and highlights the likely reductions in both refining capacity and stockholding if we keep doing business as usual and continue to shrink our refinery industry.

Stockholdings are declining

Australia is consistently the only one of the 28 member countries that fails to meet its International Energy Agency (IEA) 90-day net oil import stockholding level. In February 2013, *Australia's Liquid Fuel Security* noted that Australia had only 71 days of net import oil holdings as at April 2012.[11] This equated to an estimated 23 days of real oil and liquid fuel stocks in-country.

By May 2013, Australia's reported levels of net import liquid fuel stockholdings had declined a further 11 days to 60 days: a 16% reduction in seven months,[12] as illustrated in Figure 7.

9 Adapted from Australian Petroleum Statistics Table 2 and Table 4, BREE 2014. **10** The Australian Institute of Petroleum report, Maintaining Supply Reliability in Australia, September 2013, p7 notes that in 2012-13, 53% of petroleum products were imported from Singapore, 18% from Korea and 12% from Japan.

11 Australia's Liquid Fuel Security, February 2013, p9 www.mynrma.com.au/about/fuel-security.htm
12 www.iea.org/netimports.asp?y=2013&m=05

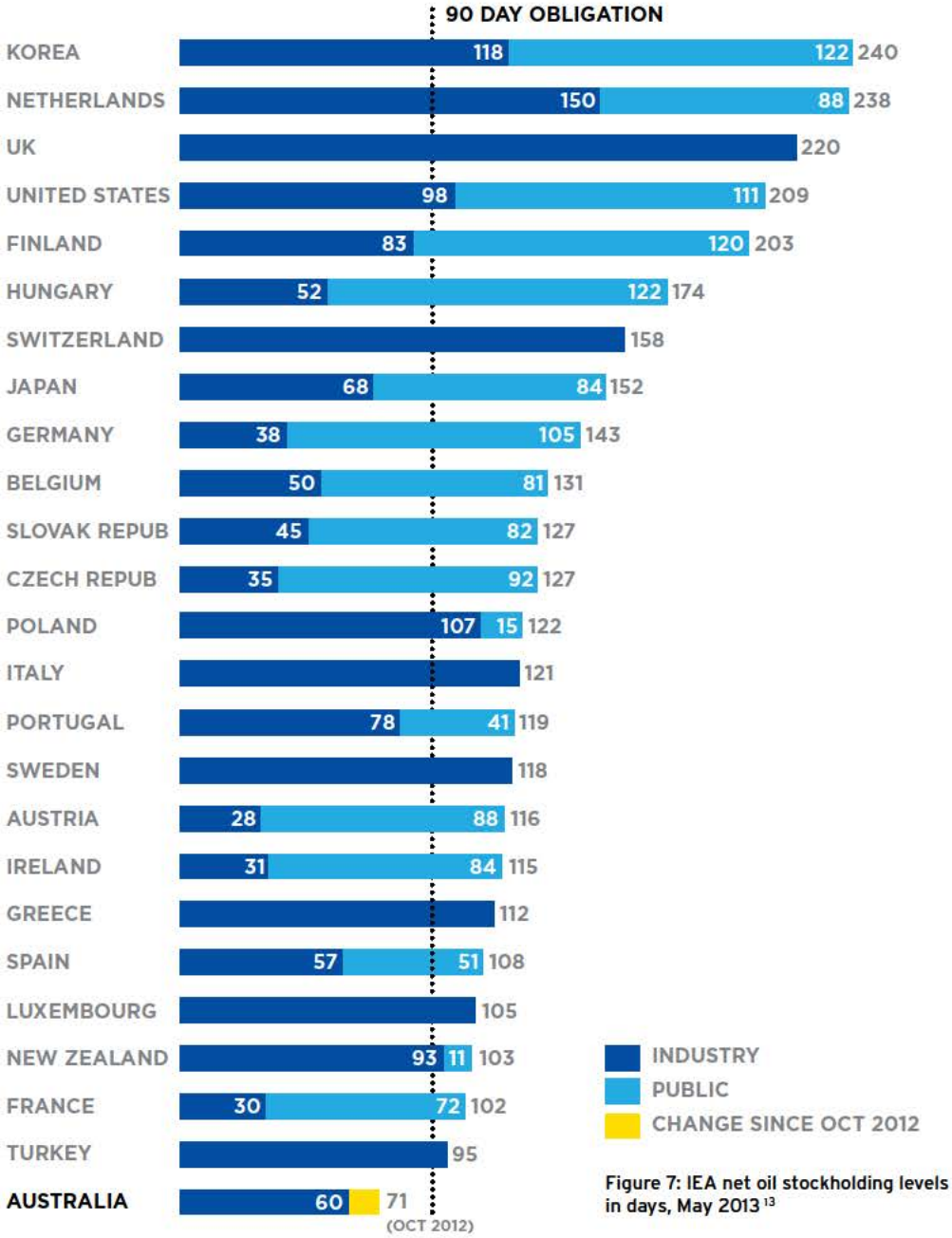


Figure 7: IEA net oil stockholding levels in days, May 2013 [13]

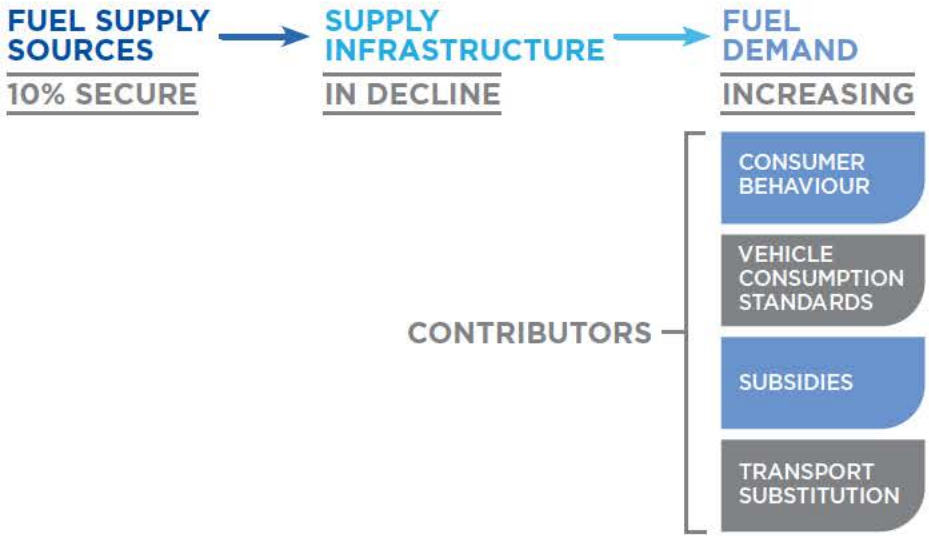


Figure 8: Fuel demand

Demand is increasing

Australia's liquid fuel demand is increasing rapidly, driven by business growth and the contribution of a range of factors relating to consumer and government actions around how we live, travel and consume (see Figures 5 and 8).

IEA membership obliges Australia to have a demand restraint program for reducing national oil consumption by up to 10%.[14] There is little evidence of our compliance with this requirement.

What does this mean for Australians?

While Australia's refining capacity is being reduced and our liquid fuel supply chain is in decline, demand is increasing. This is clearly not sustainable.

If we eventually have no oil refineries, we will join Luxembourg as the only other IEA member country without an oil refining capacity. This would be like being 100% dependent on imported food – a situation Australians would be likely to find unacceptable. A 100% dependency on imported liquid fuel should also be viewed as unacceptable.

Such a lack of capacity puts at risk our national security and lifestyle should there be a major event that impacts our liquid fuel supply chain. The potential impact is spelled out in the next section of this report.

The IEA has suggested that Luxembourg should swiftly implement a plan to improve the security of its oil supply.[15] We have the opportunity to address Australia's liquid fuel security before we join Luxembourg.

13 Australia's Liquid Fuel Security, February 2013, p9 amended by May 13 IEA data www.mynrma.com.au/about/fuel-security.htm

14 www.iea.org/countries/membercountries/

15 www.iea.org/countries/membercountries/luxembourg/

What is the impact of a declining refining industry?

Increased liquid fuel imports

As our refining industry shrinks, Australia will be obliged to import an increasingly large percentage of our transport liquid fuels as refined products from overseas refineries. This will lead to an increase in risk to fuel security.

Loss of refining abilities

The impact of losing all our oil refineries would be the complete loss of any future capability to refine Australia's own oil supplies. We would no longer have any liquid fuel supplies that could be considered secure, and we would lose the option to resurrect some or all of our local liquid fuel supply chain as part of a solution to a crisis.

Defence implications

The closure of the Shell Geelong refinery would result in a major reduction in Australian production of specialist aviation fuels. This will make us even more reliant on overseas refineries to be willing to supply liquid fuel for our airlines and military forces. The Department of Defence has also been advised that the F44 fuel necessary for all ship-based helicopters is unlikely to be refined in Australia as of mid-2014.[16] As a result, the Australian Defence Forces may not be able to operate helicopters from Naval ships, including our new amphibious ships, without the tacit approval of foreign refineries.

Refinery by-products more expensive

The loss of the refining industry in Australia would also raise concerns about the impact on other industries that depend on the local production of refinery products other than liquid fuels. Petrochemical feedstocks and petrochemicals are by-products of our refining industry. The cost and complexity of having to fully import existing refinery by-products should not be underestimated.

Broader supply chain risks

The risks discussed in this report are not just in the supply chain for liquid fuels. There are other risks to many aspects of our daily lives because the services and supplies we rely on, and their associated supply chains, are reliant on imports. Examples for food and pharmaceutical supplies were discussed in the previous Liquid Fuel Security report.[17] These supply chains are vulnerable to the impact of a major disruption that means shortages of essential items would be likely.

Stockholdings reduced further

A Department of Industry (formerly Department of Resources Energy and Tourism) report[18] analysing the impact of the loss of refineries in Australia suggests the level of liquid fuel stockholdings in Australia would reduce from 23 days to less than 20 days if oil refinery numbers were reduced to zero and replaced by import depots.[19]

The report states that being fully dependent on imports would have *'... a significant impact on the International Energy Agency (IEA) reported stocks and therefore security in terms of its IEA measure.'*[20]

What does this mean for Australians?

As long as normal market conditions persist, we will continue to receive the services and supplies we depend on. However, there are several potential scenarios impacting the liquid fuel market that could dramatically change our daily lives.

These scenarios have been considered by many other countries and businesses and by our own security agencies but they have been discounted in the analysis of our nation's energy security conducted by past Governments as discussed in the following section.

16 Department of Defence DGSL/OUT/2013/186 dated 5 Jul 13 www.ret.gov.au/energy/energy_security/reporting/Documents/MPDR2013-Department-of-Defence.pdf

17 Australia's Liquid Fuel Security, February 2013, pp6-7.

18 National Energy Security Assessment (NESA) Identified Issues: Competitive Pressures on Domestic Refining, 29 June 2012 www.ret.gov.au/energy/energy_security/national_energy_security_assessment/Pages/NationalEnergySecurityAssessment.aspx

19 NESA Identified Issues: Competitive Pressures on Domestic Refining, 29 June 2012, p22. **20** ibid.

The need for a new approach

Consider the unlikely

In reviewing potential scenarios and the impact of refinery closures on Australia's liquid fuel security, the Department of Industry NESA report concluded the following:

'*... there could be scenarios that are more severe such as war in the Middle East, war in the Asia Pacific region, disruption of shipping lanes or disruption to key refining centres in the Asia Pacific region. In this case the markets may not operate normally and the impact on the supply chains would need to be considered.*'[21]

While the report notes that extreme scenarios '*... are things that Governments need to consider ...*',[22] such scenarios were not included in the then Department of Resources Energy and Tourism 2011 Liquid Fuels Vulnerability Assessment (LFVA) that supported the 2012 Energy White Paper.[23]

It is clear that past Governments have been of the view that our energy security can be reliant on market forces without Government intervention on the supply side.

'*Our liquid fuel security is expected to remain high because of our access to reliable, mature and highly diversified international liquid fuel supply chains.*'[24]

The report goes on to say:

'*In some of these scenarios it is clear that Australia will be losing some supply security in the case of a complete shutdown of its refining industry. However, those scenarios are quite unlikely and would not have been true for any of the global disruptions seen over the past thirty years.*'[25]

This statement is surprising as it assumes the way the world functions has not changed and will not change in the future. This approach is contrary to how most security analysis is conducted, where unlikely, but significant, impact scenarios are fully considered.

As a Deloitte Risk Management Study points out: '*Some of the greatest value losses (in business) were caused by exceptional events such as the Asian financial crisis, the bursting of the technology bubble, and the September 11th terrorist attacks. Yet many firms fail to plan for these rare but high impact risks.*'[26]

It is apparent that in some cases, both companies and Governments avoid contemplating the unlikely – or the unpalatable.

Improve transparency

The Australian Institute of Petroleum (AIP) has stated '*The current levels of commercial stockholdings reflect a considered assessment of the operating conditions throughout the supply chain and the risks more likely to be encountered by major fuel suppliers.*'[27]

There is currently no mandated requirement to report stock levels in Australia[28] and there are no public stocks – the limited stocks are held in industry supply chains and the public does not know how much is in stock at any point in time. Having low or no confidence in the level of stockholdings and in the ability of industry to manage supply interruptions is a problem for Australian businesses and consumers.

To provide some context, in late 2012 supplies of diesel ran out in North West Victoria during harvest time, just two days after a refinery

21 NESA Identified Issues: Competitive Pressures on Domestic Refining, 29 June 2012, p27. **22** Ibid p28. **23** ACIL Tasman Liquid Fuels Vulnerability Assessment report, October 2011.

24 2012 Energy White Paper, p53.
25 NESA Identified Issues: Competitive Pressures on Domestic Refining, 29 June 2012, p30.

26 Deloitte Risk Management Study, Disarming the Value Killers, 2005, p6.

27 Australian Institute of Petroleum report, Maintaining Supply Reliability in Australia, September 2013, p15. **28** The Government is considering introducing mandatory reporting as of 2015.

incident in Geelong. Given there are known peaks in supply demand at the end of each calendar year,[29] this incident does not build public confidence regarding the fuel industry's management of the liquid fuel supply chain. Perhaps the fuel industry's risk assessment for its business needs is not the same as a risk assessment for the wider community.

For security reasons, we should not reveal publicly what percentage of our critical liquid fuel demands could be met from Australian sources. This information encompasses, for example, our essential services and military forces.

However, we should expect a clear assurance from our Government that we have sufficient Australian-controlled liquid fuel sources to support our Defence forces and essential services if overseas supply is interrupted. Given the limitations on publicly owned liquid fuel stocks, reporting on industry stocks and supply chain risk analysis, it is difficult to see how our Government could provide us with that assurance.

Accept responsibility

When talking about severe disaster scenarios, the Department of Industry NESA report says: '*In discussions with industry … it was agreed it was only in these extreme (very low probability) circumstances that there may be an impact from a smaller refinery industry in Australia. The companies indicated that these are the sorts of circumstances that companies would not plan for rather they are things that Governments need to consider …*'.[30]

Despite the concerns identified in this liquid fuel security report, none of the oil and fuel companies is acting irresponsibly or negligently. They are operating responsibly in the interests of their shareholders.

From discussions with senior fuel company executives and from the Department of Industry NESA report, it is clear these companies see their responsibility as being reliability of supply, not security of supply. In other words, they seek to provide their customers with a reliable supply of liquid fuel products within a normal range of market conditions. This protects their market share and their brand and is clearly sensible.

However, it is not their responsibility to assure the security of supply in a wider range of circumstances such as the types of scenarios discussed in the Department of Industry NESA report. It is the responsibility of our elected Government.

What does this mean for Australians?

If a scenario such as a confrontation in the Asia-Pacific region were to eventuate, our liquid fuel supplies could be severely constrained. We do not have a viable contingency plan in place for this event. As the first Australia's Liquid Fuel Security report highlights, if this happens then Australians will suffer food shortages, will not have adequate access to medical services or pharmaceutical supplies, will not be able to get to work and, if the problem lasts for more than a few weeks, many will no longer have work to go to. It is that serious.

The fuel companies are not responsible for addressing these types of risks and past Governments do not appear to have taken on the responsibility either.

Meanwhile, Australians are not told about these changes and have no say in what level of risk is acceptable for their businesses, themselves and their families.

29 Australian Institute of Petroleum report, Maintaining Supply Reliability in Australia, April 2008, p10 – '*However, there are demand spikes (particularly at the end of each year) as a result of harvest time, holidays and Defence Department requirements.*'

30 NESA Identified Issues: Competitive Pressures on Domestic Refining, 29 June 2012, p28.

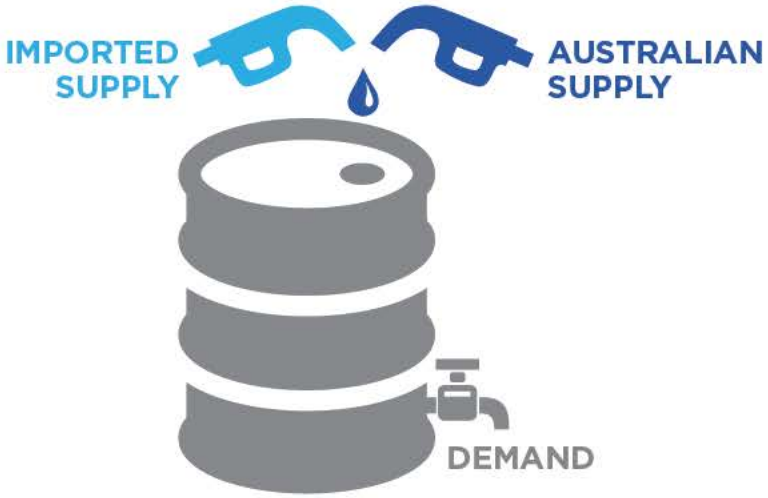


Figure 9: The Storage Tank Question

Why no action has been taken to date

Daunting complexity

Many recent reports and studies have dealt with alternative fuels and energy challenges. Studies such as the NRMA-commissioned Jamison reports[31] contain excellent analysis and make sound recommendations. However, little action to tackle our struggling liquid fuel supply chain appears to have resulted. Why?

The answer seems to be that there is no simple solution: it is a complex, interlinked set of problems that need to be addressed systemically rather than in a piecemeal fashion.

The main questions posed by some politicians are: *'How much extra storage capacity is required, what will be the cost per litre of fuel to pay for it and will Australians be willing to pay?'*

Unfortunately, while increased storage is part of the solution, it is by no means the complete answer. As Figure 9 illustrates, we still need a secure supply of liquid fuel to fill our national 'storage tank.' In other words, we need to think about the hoses that feed the tank (supply) and the tap draining the tank (demand) as well as the storage tank.

Over-reliance on market forces

Because the liquid fuel security problem is complex, past Governments have relied on market forces to address the issues. There is also significant pressure from large business groups to prevent market intervention by Government.

It is true that Government interventions can be counter-productive in many parts of the markets, preventing action being taken to address risks. However, there is an alternative view that where market forces cannot deal with a particular market failure scenario, Government intervention may be vital.

Providing market subsidies is one example. Transport fuel tax credits[32] are viewed by some as market incentives that perpetuate the use of fossil fuels and limit opportunities for alternative fuels to become financially viable in the market.

Markets may learn from failure. However, when it comes to threats to our way of life and national security, we need to anticipate risks and, where necessary, lead markets to pre-adapt in order to improve our national resilience.

Recent reports[33] of potential changes in ownership of oil and fuel import, refining and distribution networks in Australia give rise to concerns regarding future market behaviour. Will the market behaviour of private equity firms, consortia and superannuation funds differ from long-established market behaviour of the oil and fuel majors?

If we can see a risk to supply emerging then it is our national responsibility to address it and not just to wait for the markets to respond. They may respond too late.

Other Government priorities

In a recent speech, Professor Robert Hill, the former Minister for Defence and Minister for the Environment, discussed the contrasting priorities of the United States of America and Australia with respect to national energy policies.[34] In essence, he said energy security and domestic energy supplies are among the highest priorities for the United States of America Government, with energy exports a second priority that is subject to licensing.

By contrast, past Australian Governments have placed energy exports as a high priority, exporting as much as possible. They have relegated domestic energy security to a

31 Jamison report www.mynrma.com.au/about/jamison-report.htm

32 Where heavy vehicle users are refunded fuel excise costs minus a road user charge.

33 Article, BP, Shell Assets on the Block, Australian Financial Review 7 Jan 2014.

34 National Business Leaders' Forum on Sustainable Development, 27 June 2013, Parliament House Canberra.

lesser priority that the market will take care of.

With such a contrasting approach, it is not difficult to see why little action has been taken to date in Australia. It is also interesting to compare Australia with smaller countries such as Norway, which retains part Government ownership of the refining industry and mandates minimum stockholding levels.

Lack of coordination

Much of the analysis necessary to address the risks described in this and the previous liquid fuel security report[35] has already been conducted. This expertise, which exists across Government, business and in academia, could be applied to reduce Australia's liquid fuel security risks. Unfortunately, it appears the coordination and cooperation between these experts may be lacking in some areas.

We need a mechanism that brings together this knowledge and provides a venue for discussion, debate and decision-making and – more importantly – results in a willingness to act.

Low public awareness

As previously stated, for security reasons, it is not wise for the Government to release precise details about, for example, how much liquid fuel our Defence Forces have in reserve.

However, there is plenty of robust data around the impact of having low or no Australian oil refining capabilities on the country as a whole. Given the importance of an assured liquid fuel supply to our economy and way of life, a public debate about the issues around liquid fuel security would be a positive step towards encouraging our Government to build an action plan.

What does this mean for Australians?

Australia's oil refining industry is in severe decline and could be non-existent by 2030.

Supply risks are unlikely to be addressed until there is a significant supply failure because:

- Past Governments have relied on market forces rather than direct action;
- the complexity of the systemic changes required; and
- a lack of public discussion on the subject.

So the question we should be asking our Government and ourselves is: is this situation in the interest of our country and our citizens?

If the answer is no, then is it important enough to make sure we retain some refining capability in Australia so we keep the ability to meet a proportion of our liquid fuel needs from Australian-controlled sources?

Waiting for a catastrophic failure before acting could result in damage to our security, our economy and our way of life. And the longer we wait to act, the fewer options we will have.

35 Australia's Liquid Fuel Security, February 2013. www.mynrma.com.au/about/fuel security.htm

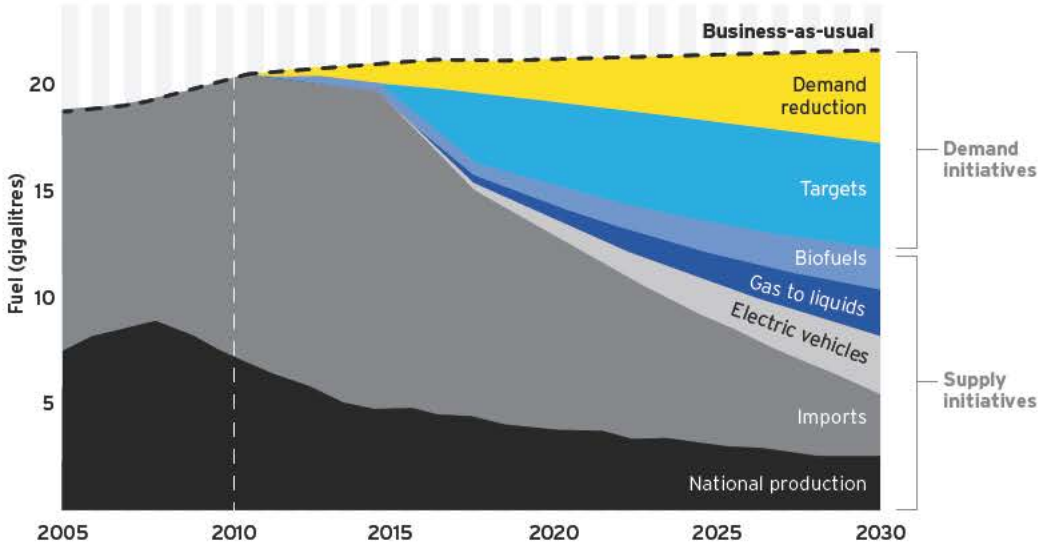


Figure 10: Proposed contribution of demand reduction, targets and alternative fuels to a reduction in import dependency

What we can do about it

The good news is that Australians can do something to improve our liquid fuel security. The bad news is that the solutions are not simple, not free, and not understood, as most Australians have no visibility of the growing risks to supply.

It is important we view liquid fuel security as a challenge where economic and security aspects are considered together to make sure decisions taken in one area do not produce unintended consequences in the other. An economic plan without security is as bad as a security plan that is not economically viable.

So, what could we do in Australia and how could we go about implementing a solution? In general, we should seek diversity in both supply and demand in order to limit our liquid fuel security risks. Such diversity should include Australian sources of liquid fuel, not just diversity of international sources.

We should:

- Reduce our national liquid fuel demand by adopting measures around fuel efficiency, public transport and alternative fuels.
- Decide whether we want a proportion of our liquid fuel supply to be secure: if so, how much and for what purpose?
- Determine the least costly way of achieving this level of security, considering both demand and supply related initiatives.
- Institute measures to assure the appropriate secure sources of supply and ensure that sufficient refining, processing and storage capacity is retained in Australia to provide a secure source-to-consumer supply chain for a portion of our liquid fuel demands.

Reducing demand

The first step in addressing our liquid fuel security at least cost should be considering measures to reduce liquid fuel demand. These would deliver positive outcomes for Australians in terms of reduced energy costs and could reduce the need for costly solutions to address supply security.

An excellent discussion of the issues associated with demand reduction is in the NRMA-commissioned Jamison report *Fuelling Future Passenger Vehicle Use in Australia*.[36] Figure 10, sourced from the Jamison report, illustrates how demand reduction would be an essential component of a liquid fuel security solution.

A comprehensive discussion of Figure 10, related to demand reduction targets, is also contained in the report.

Unfortunately, Governments have taken no action to implement its recommendations over the past three years.

These recommendations include:

- Increasing fuel efficiency standards, use of electric vehicles and use of public transport.
- Rebalancing modes of transport: given the greater energy efficiency of rail transport, it is concerning to realise that only 5% of the north-south freight on the east coast of Australia is by rail. The remainder is largely carried by the trucking industry, which benefits from the transport fuel tax credits scheme but has a higher energy consumption per kilometre, resulting in a higher overall liquid fuel demand. A reform of the fuel excise system could in time both reduce demand and encourage investment in alternative fuels and transport modes.

36 www.mynrma.com.au/images/About-PDF/Jamison-Group-Fuelling-Future-Passenger-Vehicle-Use-in-Australia-February2010.pdf, pp45-57.

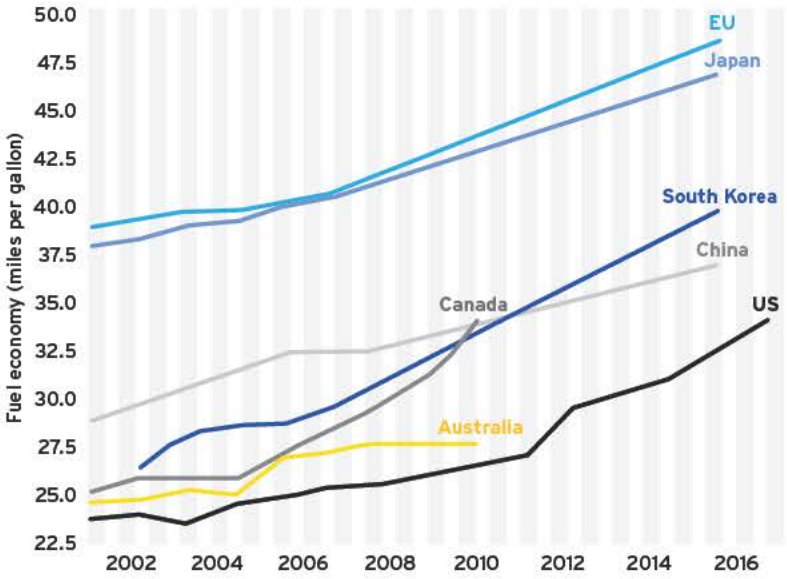


Figure 11: Comparison of actual and projected average fuel economy for new passenger vehicles

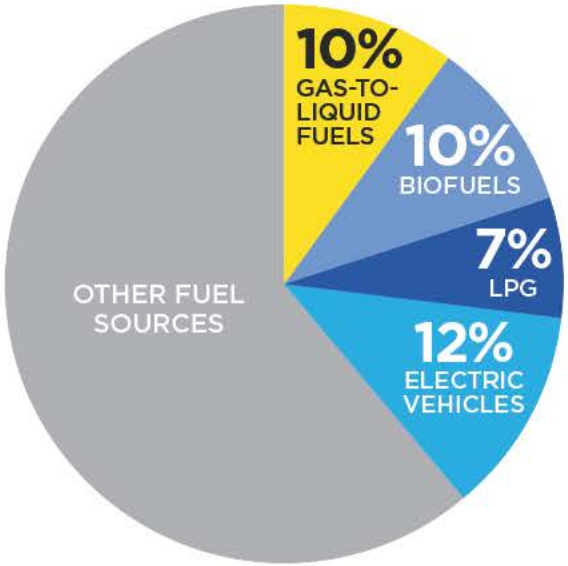


Figure 12: Jamison Group estimate of 2030 transport alternative fuel sources

A reduction in demand through increased use of public transport would be ideal but difficult to convince consumers, who value the independence of their cars.

A reduction in demand through improved car fuel consumption levels would appear much easier to achieve. Figure 11 compares the actual and projected corporate average fuel economy for new passenger vehicles.[37] The graph highlights Australia's poor vehicle efficiency performance compared with other nations, suggesting that significant improvements are technically achievable.

Mandatory fleet fuel economy targets could significantly reduce fuel demand over time.

Improving our liquid fuel security

It is reasonable to assume Australians want some degree of liquid fuel security. The question is: how secure do we want to our liquid fuel supply to be? The percentage of liquid fuel security we need and can afford must be the result of extensive analysis and informed debate.

100% security would mean energy independence. While the United States may aspire to this, it is fantasy for Australia given current technologies, energy sources and economic realities. As at 2013, our fuel security is in the order of 10% of supply and decreasing.

The Jamison report shows that more than 30% of domestic transport energy demand can be met by secure supplies[38] as illustrated in Figure 12. That is, 30% of our transport supply would be secure from source through to delivery. This would ensure basic services could function in Australia in the event of a major and sustained liquid fuel supply disruption.

The remaining 70% would be supplied by the market and subject to normal commercial market forces and supply risks.

30% is a realistic goal for Australia. However, the Jamison report goals for 2030 may not be achieved because of the failure of past Governments to act in time.

What could a 30% secure supply look like?

A partially secure liquid fuel supply implies:

- Sufficient Australian sources of liquid fuel to meet essential needs;
- A matched level of refining and processing in Australia; and
- A level of stockholdings of liquid fuel to allow for foreign fuel supply interruptions, as illustrated in Figure 13.

These would need to be continually monitored and adjusted over time to remain in balance with our changing liquid fuel demand. None of these elements is currently specified in our Energy Policy.

To achieve 30% liquid fuel security at least cost we would need to implement a balanced portfolio of initiatives that:

- Reduce the demand for liquid fuels;
- Develop additional alternative fuel sources to complement the existing oil produced in Australia;
- Ensure sufficient refining and processing capacity is maintained in Australia to process the secure liquid fuel sources; and
- Ensure liquid fuel stockholdings levels in Australia do not drop below the level necessary to support a secure supply chain.

37 www.wri.org/resources/charts-graphs/comparison-actual-and-projected-corporate-average-fuel-economy-new-passenger

38 www.mynrma.com.au/images/About-PDF/Jamison-Group-Fuelling-Future-Passenger-Vehicle-Use-in-Australia-February2010.pdf, pp 14-17.

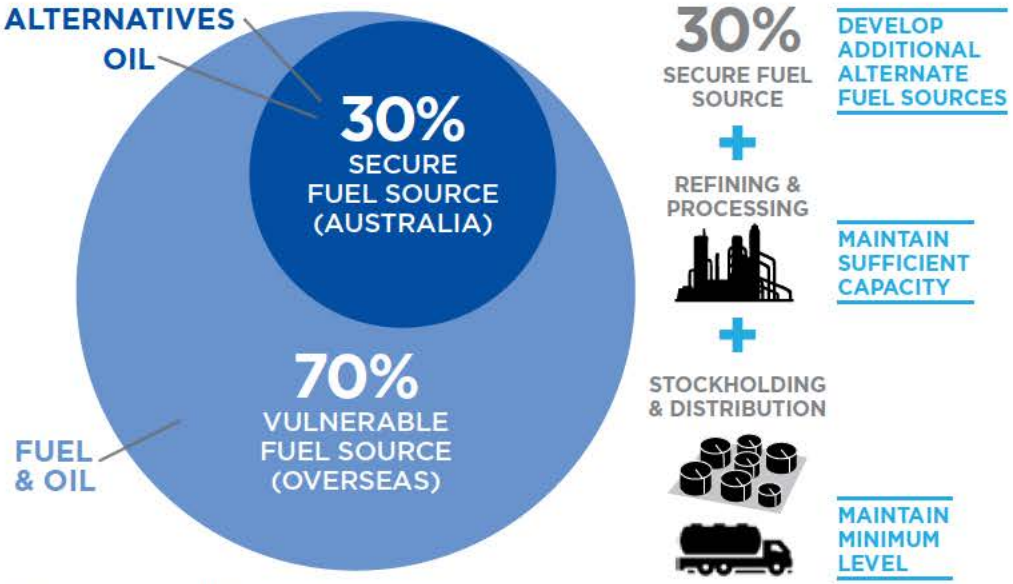


Figure 13: Example 30% secure fuel supply

The 30% could, for example, comprise 10% from Australian-sourced oil and 20% from Australian-sourced alternative fuels. These alternative fuels could include:

- Biofuels;
- Gas (LPG/LNG[39]/CNG);
- Gas-to-liquid from conventional and non-conventional sources;
- Coal-to-liquid fuels (in the longer-term); and
- We could also support the increased use of electric transport options.

While this approach sounds relatively straightforward, it would not be easy to achieve. A number of challenges would need to be addressed. These include:

- **Affordability of secure alternative liquid fuel sources:** The percentage of alternative liquid fuel sources would need to increase over time. However, there are currently issues of viability for many of these sources in the Australian market from either a cost or an environmental perspective.
- **Lack of feedstock:** The Jamison report estimated that biofuels could meet 10% of our liquid fuel needs by 2030.[40] However, a lack of affordable feedstock for large scale production of biofuels could be a limiting factor, particularly where farmers obtain higher financial returns for food crops.
- **High gas prices:** High regional gas prices are forecast to drive up domestic gas prices significantly in the next few years.[41] Without market intervention such as domestic gas supply reservation, gas-sourced liquid fuels may not be a financially viable alternative fuels source for Australia. This is a policy tightrope that must be walked with great caution.[42] The Jamison report estimated that 10% of our liquid fuel needs could have been met by gas-to-liquid sourced liquid fuels by 2030 had past Governments taken action in 2011.[43]
- **Slow LPG vehicle uptake:** LPG fuels could meet a greater percentage of transport liquid fuel demands; the Jamison report estimated that LPG could satisfy 7% of our liquid fuel needs by 2020.[44] However, the uptake of LPG vehicles has been slow due to poor consumer perceptions. The planned increase of the LPG excise by 2014 could further impact the uptake.[45]
- **Environmental issues:** Gas-to-liquid and coal-to-liquid fuels processes are in use internationally but there are concerns regarding water consumption and environmental emissions associated with some conversion processes. The CSIRO is researching an environmentally acceptable coal-to-liquid conversion process.[46]
- **Adjustment of market subsidies to enable commercially viable alternative fuels:** Businesses developing biofuels are concerned about excise levels and subsidies and their impacts on other liquid fuel types. For example, Virgin Australia has said that current production grants for renewable/bio-diesel may improve margins for that product and disincentivise biojet production. In other words, in an environment of uneven biofuel

39 LNG as an alternative transport fuel is also on the new Federal government's agenda. The Coalition's Policy for Resources and Energy (September, 2013) lists as one of its 14 points 'Support Development of Logistics Systems for LNG as a Transport Fuel'. www.nationals.org.au/Portals/0/00_Election_00/Coalition%20 2013%20Election%20Policy%20-%20Energy%20and%20 Resources%20-%20Final.pdf **40** www.mynrma.com.au/images/ About-PDF/Jamison-Group-Fuelling-Future-Passenger-Vehicle-Use-in-Australia-February2010.pdf, p 51. **41** This is in contrast to the gas markets in the United States, where Government policies (and existing infrastructure) have resulted in a domestic gas price that is currently 25% of some Asian markets. **42** The risk of market controls is that they may prevent international investment in the gas production infrastructure, which in turn could lead to gas price increases. **43** www.mynrma.com.au/images/About-PDF/Jamison-Group-Fuelling-Future-Passenger-Vehicle-Use-in-Australia-February2010.pdf, p51. **44** Ibid, pp36-37. **45** Ibid, pp50-51. **46** If such a process were feasible, Australia's extensive coal resources would make coal-to-liquids an attractive alternative fuel option in the longer term but an unlikely candidate in the next decade.

subsidies, producers will utilise available feedstocks for bio-diesel fuel production that has higher product margins because of existing production grants.[47]

» **Availability of adequate refining/ processing capacity in Australia:** As is the case with conventional oil refining, the production of biofuels (e.g. synthetic aviation fuel) depends on a refining or processing capacity of some sort.[48]

» **Australian production costs:** A common view is that the growth in cost of production in Australia has made our industry non-competitive in this region. Our production costs and productivity will need to be addressed as an essential part of a national liquid fuel security program. To date we have seen much blame apportionment but little concrete action.

» **Adequacy of our supply infrastructure:** The lack of consumer delivery infrastructure for non oil based fuels (e.g. electric vehicle charging points) severely limits the adoption of such transport modes. These forms of transport could make a significant contribution to reducing our demand for oil and increasing our energy security. The Jamison report concluded that using electric vehicles based on renewable energy could result in a 12% reduction in liquid fuels demand by 2030.[49]

» **Skills shortages:** According to industry body Engineers Australia,[50] future demands for infrastructure to support the import, refining and distribution of liquid fuels highlights a growing concern related to the lack of sufficient numbers of engineers graduating from Australian universities to meet the growing skills demand. With projected engineer graduation rates of less than 50% of market demand, Australia's dependence on imported skilled workers will increase. This is a national vulnerability that extends well beyond the issue of the infrastructure needed for liquid fuel security.

» **No stockholding policy:** While the issue of stockholding is prominent in any debate on liquid fuel security, in reality it is only a part contributor. Current analysis appears to be wholly focused on achieving IEA mandated stockholding level obligations, bearing in mind that Australia is the only IEA member country that does not meet these obligations. Unfortunately, merely meeting our IEA obligations will not address the optimum storage levels that we need.[51] Australia exports a significant amount of oil that cannot be processed in our refineries as they are currently configured. This 'improves' our IEA stockholding position but does nothing to assist our domestic liquid fuel security position. A stockholding policy should mandate stockholdings that are tailored to location and potential demand and should be accompanied by a mandated stockholding reporting regime.

What does this mean for Australians?

There is a way to address our liquid fuel security without being extreme. We don't need to keep everything as it is or return it to what it used to be. We need to be sensible and balance economic reality with our security needs.

A small amount of Government intervention could be the best compromise between market forces and market control. Without the issues being discussed and the options analysed, we are likely to have our lives shaped by commercial forces largely out of our control. There is an opportunity here for the creation of a new industry in Australia based on production of oil alternatives.

47 http://ussc.edu.au/ussc/assets/media/docs/other/130226_LCF_Boyd.pdf, p9. **48** http://ussc.edu.au/ussc/assets/media/docs/other/130226_LCF_VanEwijk.pdf, p6.

49 www.mynrma.com.au/images/About-PDF/Jamison-Group-Fuelling-Future-Passenger-Vehicle-Use-in-Australia-February2010.pdf, p33.

50 Engineers Australia is the national forum for the advancement of engineering and the professional development of its members.

51 IEA stockholding is calculated by dividing the amount of commercial fuel and oil stocks in the country by the average daily amount of imports minus the average daily rate of oil exports.

Initiating a liquid fuel security plan

As with most difficult problems in life, if you get the right people together and they cooperate, solutions can often be found. There is already relevant research, analysis and expertise in Australia, but much of it is in Government, industry and academic silos that do not coordinate or cooperate with each other.

A potential mechanism for broadening the necessary discussion and debate is the planned 2014 National Energy Security Assessment (NESA) and the 2014 Energy White Paper. The last NESA was conducted in 2011 as a precursor to the 2012 Energy White Paper.

This approach will only work if we examine the shortcomings of the last NESA and Energy White Paper and make sure we address them in the next versions.

The 2011 NESA

This assessment considered the key influences on the supply of energy in Australia in the short, medium and longer terms.

The people we consulted when writing this report concluded that the 2011 NESA did not adequately address the concerns of a number of agencies outside the then Department of Resources Energy and Tourism and that the Department did not employ a sufficiently diverse set of scenarios to conduct the risk analysis.

Given these concerns regarding the lack of depth of past NESAs, a greater degree of involvement and ownership of the NESA process by agencies experienced in national security risk analysis is warranted.

The 2014 NESA

SCOPE: To assess the risks to our oil and liquid fuel supply chains, the 2014 NESA should include a broader risk assessment of Australia's liquid fuel supply vulnerabilities. It should encompass the whole of the liquid fuel supply chain, including import and refining infrastructure and critical supply linkages, both in the public and private sectors. It should examine the supply chain risks in peacetime and in conflict scenarios. It should also be accompanied by appropriate risk mitigation strategies that are incorporated in an update to the Energy White Paper.

PARTICIPANTS: If the 2014 NESA is to be more comprehensive than the last, it needs to be developed cooperatively by a wide range of Government agencies in addition to the Department of Industry. These should include

IT IS CRITICAL TO REMEMBER THAT ANY CHANGES WE MAKE TO OUR ENERGY MIX IN ORDER TO IMPROVE OUR FUEL SECURITY SHOULD NOT BE AT THE EXPENSE OF CLIMATE OR ENVIRONMENT FACTORS. OTHERWISE WE WILL MERELY SUBSTITUTE ONE POTENTIAL CRISIS FOR ANOTHER.

the Attorney-General's Department, Department of Transport, Department of Agriculture Food and Fisheries and Department of Defence. The process should also involve greater participation by business and consumer groups.

OWNERSHIP/TIMING: Ideally, the next NESA will not be the product of the Department of Industry but a product of the Department of the Prime Minister and Cabinet. This would ensure greater integration of expertise across Government and industry and raise the profile of the whole enterprise. A broader-based NESA analysis should provide comprehensive input into the White Paper and support the development of strategies to address liquid fuel security concerns such as those outlined in this report. However, the NESA is unlikely to be completed before the planned publication of the next Energy White Paper in September 2014. This inversion of the NESA and the White Paper timing should result in a White Paper update in 2015, if warranted by the NESA findings.

The 2014 Energy White Paper

Formulating a least cost approach to liquid fuel security by considering a balanced portfolio of demand-side and supply-side responses is a task that could sensibly be addressed in the 2014 Energy White Paper.[52]

The White Paper should also incorporate the 2010 Jamison report proposal for a National Transport Fuels Strategy, which recommended addressing the following key issues:[53]

- Increased liquid fuel demand related to our growing population, economic growth and community aspirations;
- Diminishing national oil production;
- Global competition for oil;
- Potentially higher prices in the face of diminishing resources and rising international demand;
- Balance of trade and payments;
- Low probability but very high impact threats to security of supply;
- Public health issues related to vehicle emissions;
- Limitations to greenhouse gas emissions; and
- Co-benefits and possible conflicts between the future of the wider energy sector and other industries in Australia.

Five years after the first Jamison report was published, the recommendations are as valid and urgent as at the time of publication. In 2014, the lack of progress in the areas highlighted is concerning.

A climate and environment caution

The use of alternative fuels and renewable energy sources should result in significant environmental benefits. Conversely, a shift to non-conventional oil and gas, utilising controversial extraction methods such as fracking, is the subject of much debate. While this report does not address the environmental and climate aspects of the liquid fuel security issue, it is critical to remember that any changes we make to our energy mix in order to improve our liquid fuel security should not be at the expense of climate or environment factors.

Otherwise we will merely substitute one potential crisis for another.

52 The Department of Industry has announced that the next Energy White Paper should be published in September 2014.

53 www.mynrma.com.au/images/About-PDF/Jamison-Group-Fuelling-Future-Passenger-Vehicle-Use-in-Australia-February2010.pdf, p68.

Conclusion

This report has examined four topics:

1. Australia's worsening liquid fuel security problem: Our dependency on imported liquid fuel and oil to fulfil our transport needs has grown from 60% in 2000 to over 90% now. By 2030, it could be 100% and we don't have a plan to stop this happening. If a scenario such as a confrontation in the Asia-Pacific region were to eventuate, our liquid fuel supplies could be severely constrained and there is no viable contingency plan for making sure we can get supplies for essential services and our military forces. We should expect clear assurances from our Government that we have sufficient Australian-controlled sources of liquid fuel to support our essential needs in the event of overseas supply interruptions. Given the lack of publicly owned liquid fuel stocks, the lack of reporting on industry stocks and the very limited public analysis of supply chain risks, it is difficult to see how our Government could currently provide us with that assurance.

2. Why no action has been taken to date: The liquid fuel security problem is dauntingly complex and there has been an over-reliance by past Governments on market forces to address liquid fuel supply issues. There is also a low level of community awareness due to a lack of information, and significant pressure from large business groups to prevent Government intervention in the marketplace. While markets learn from failure, when it comes to our national liquid fuel security we need to anticipate risks and, where necessary, lead the markets to pre-adapt and improve our resilience.

3. What we can do about it: The good news is that we can do something to improve our liquid fuel security. We can move beyond a 'just in time' supply chain to a 'just in case' supply chain. We don't need to accept our current trajectory, nor do we need to aspire to return to our position of 15 years ago. We need to be sensible and balance economic reality with our security needs. A small measure of Government intervention could be the best compromise between market forces and market control. Such actions will require broad based public support as they will need some investment and may have a small impact on the cost of liquid fuel for the consumer. Australians will need to decide if the risks we may face in the future are worth the investment now in improving our national resilience.

4. Initiating a liquid fuel security plan: Action is possible but it will require the involvement of the Australian public in an issue that is vitally important to all of us. With community support we can prompt political action to address emerging liquid fuel security concerns. Much of the analysis necessary to address the risks has already been conducted and the right expertise exists across Government, business and in academia. However, the coordination and cooperation across these areas of expertise appears to be lacking. One possible mechanism for this broadened discussion and debate is the 2014 National Energy Security Assessment and the next Energy White Paper. Given the lack of depth of past National Energy Security Assessments, a greater degree of involvement and ownership of the assessment process by agencies experienced in national security risk analysis as well as business and consumer groups is warranted.

Without discussing these issues and analysing the options, we are likely to have our lives shaped by commercial forces largely out of our control. It is not too late for us to ensure the debate and discussion take place.

Recommendations

In order to assess and address the risks to our liquid fuel supplies:

The 2014 National Energy Security Assessment (NESA) should:

- Include a broader risk assessment of Australia's liquid fuel supply vulnerabilities that encompasses the whole of the liquid fuel supply chain, including import and refining infrastructure and critical supply linkages, in the public and the private sectors, as well as the demand for liquid fuels;
- Examine the supply chain risks in both peacetime and conflict scenarios; this examination should be accompanied by the development of appropriate risk mitigation strategies that are incorporated in an update to the Energy White Paper in 2015;
- Be developed cooperatively by a wide range of Government agencies in addition to the Department of Industry, including the Attorney-General's Department, Department of Transport, Department of Agriculture Food and Fisheries and Department of Defence;
- Involve greater participation by business and consumer groups; and
- Be led by the Department of the Prime Minister and Cabinet to ensure greater integration of expertise across Government and industry and a raised profile for the topic.

The 2014 Energy White Paper should:

- Contain strategies to address emerging fuel security concerns such as those outlined in this report;
- Provide detail to the Australian public as to how the Government will ensure we have sufficient Australian-controlled sources of liquid fuel to support our military forces and essential services in the event of overseas supply interruptions;
- Deliver a National Transport Fuels Strategy as recommended in the 2010 Jamison report; and
- Be reviewed in 2015 to cater for any significant changes in the energy security assessment that are identified in the 2014 NESA process.

ACRONYMS

AIP – Australian Institute of Petroleum

CNG – Compressed Natural Gas

CSIRO – Commonwealth Scientific and Industrial Research Organisation

IEA – International Energy Agency

LFVA – Liquid Fuel Vulnerability Assessment

LNG – Liquid Natural Gas

LPG – Liquid Petroleum Gas

NESA – National Energy Security Assessment

NRMA – National Roads and Motorists' Association