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ENERGY AND TRANSPORT SUBSIDIES IN AUSTRALIA

2007 Update

For Greenpeace Australia Pacific

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Institute for Sustainable Futures

UNIVERSITY OF TECHNOLOGY SYDNEY

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2007 Update

Final Report

For Greenpeace Australia Pacific

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Institute for Sustainable Futures

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Executive Summary

Background

Public debate over climate change, and how we should respond, has reached unprecedented levels in Australia. The energy and transport sectors are responsible for almost 70% of Australia's greenhouse gas emissions and emissions from these sectors continue to grow rapidly (AGO 2006a). It is in these sectors that responses to climate change are most urgently needed.

Emissions from energy and transport are high because of the use of fossil fuels – coal, oil and natural gas – to provide most of Australia's energy needs. One obvious response is to shift away from fossil fuels and towards renewable energy sources that do not generate greenhouse gas emissions, such as wind power, bioenergy and solar power. However, at present, the cost of many renewable energy technologies is significantly higher than the cost of energy derived from fossil fuel. The higher cost of renewable energy technologies acts as a major barrier to their widespread introduction in Australia.

At present, governments in Australia provide substantial financial support for the production and use of fossil fuels, through direct payments, favourable tax treatment and other actions. These subsidies keep the cost of fossil fuel energy artificially low and make it harder for renewable energy to compete. They distort energy markets, encourage greater use of fossil fuels, create higher levels of greenhouse gas emissions and improve the profitability of energy companies that produce or use fossil fuels. In an era when climate change response has become urgent, continuing to subsidise fossil fuel production and consumption is unacceptable.

This report provides an estimate of the size of subsidies to fossil fuels and renewable energy in the Australian energy and transport sectors during the 2005-06 financial year. It provides details on specific subsidies and offers recommendations on subsidy removal.

Energy and transport subsidies in Australia

An energy or transport subsidy exists where government action or inaction lowers the cost of production, raises prices received by producers, lowers prices paid by consumers or prevents full cost recovery for a service. Some subsidies involve direct payments from governments to businesses, but many subsidies are created indirectly through tax rules and government practices. There is no consolidated reporting of subsidies in the energy and transport sectors so most Australians have little knowledge of the true extent of government support for fossil fuels. This report attempts to provide that knowledge as a contribution to public debate on how to respond to climate change.

The research reported here identifies total energy and transport subsidies in Australia during 2005-06 of between $9.3 billion and $10.1 billion. The range in the estimates is due to uncertainty about the size of particular subsidies and differing assumptions used to deal with this uncertainty. However, both estimates are based on conservative assumptions.

Table ES1 shows how these subsidies are divided between the various fossil fuels and renewable energy, and how they are split across different sectors. More than 96% of the identified energy and transport subsidies provide support for fossil fuel production and consumption. Less than 4% of the identified subsidies provide support for renewable energy and energy efficiency. This effectively creates an uneven playing field for renewable energy, making it much more difficult to respond to climate change in the energy and transport sectors.

Sector	Support for fossil fuels 2005-06 ($m)				2005-06 GHG Emission Subsidy ($m)	2005-06 Perverse Subsidy ($m)	Support for renewable energy and energy efficiency 2005-06 ($m)
	Coal	Oil	Gas	Total			
Electricity	1,091-1,866	3	120	1,214-19,89	1,214-1,989	925-1,700	110-119
Other stationary energy	177-188	280-289	229-235	686-712	476	476	94-120
Transport	1	7,089	24	7,114	6,349	5,023	105
Total	**1,269-2,055**	**7,371-7,381**	**374-379**	**9,014-9,815**	**8,038-8,814**	**6,424-7,199**	**317-334**

Table ES1: Summary of the magnitude of identified subsidies to fossil fuels and renewable energy in the stationary energy and transport sectors.

Figure ES1 shows the disparity in subsidy support graphically and also shows their impact on greenhouse gas emissions. Fossil fuel subsidies can increase greenhouse gas emissions because they reduce the price of fossil fuel energy, which encourages greater use of fossil fuels and higher levels of greenhouse gas emissions. However, in some cases, fossil fuel subsidies can result in a net reduction in greenhouse gas emissions. For example, a subsidy to a coal-fired power station to improve the efficiency of the power station can reduce greenhouse gas emissions. Many of the subsidies that would increase greenhouse gas emissions are also likely to have an adverse economic impact – these subsidies are categorised as perverse. Figure ES1 shows that just over 70% of the identified fossil fuel subsidies are categorised as perverse, and about 90% per cent of the identified subsidies would increase greenhouse gas emissions. Only about 10% are likely to reduce greenhouse gas emissions.

As shown in Figure ES2, most of the identified fossil fuel subsidies occur in the transport sector; about 74% are transport subsidies, 18% are electricity subsidies and 8% are other stationary energy subsidies. In other words, road users are currently the greatest beneficiaries from fossil fuel subsidies in Australia. However, subsidies for non-transport energy use are still significant.

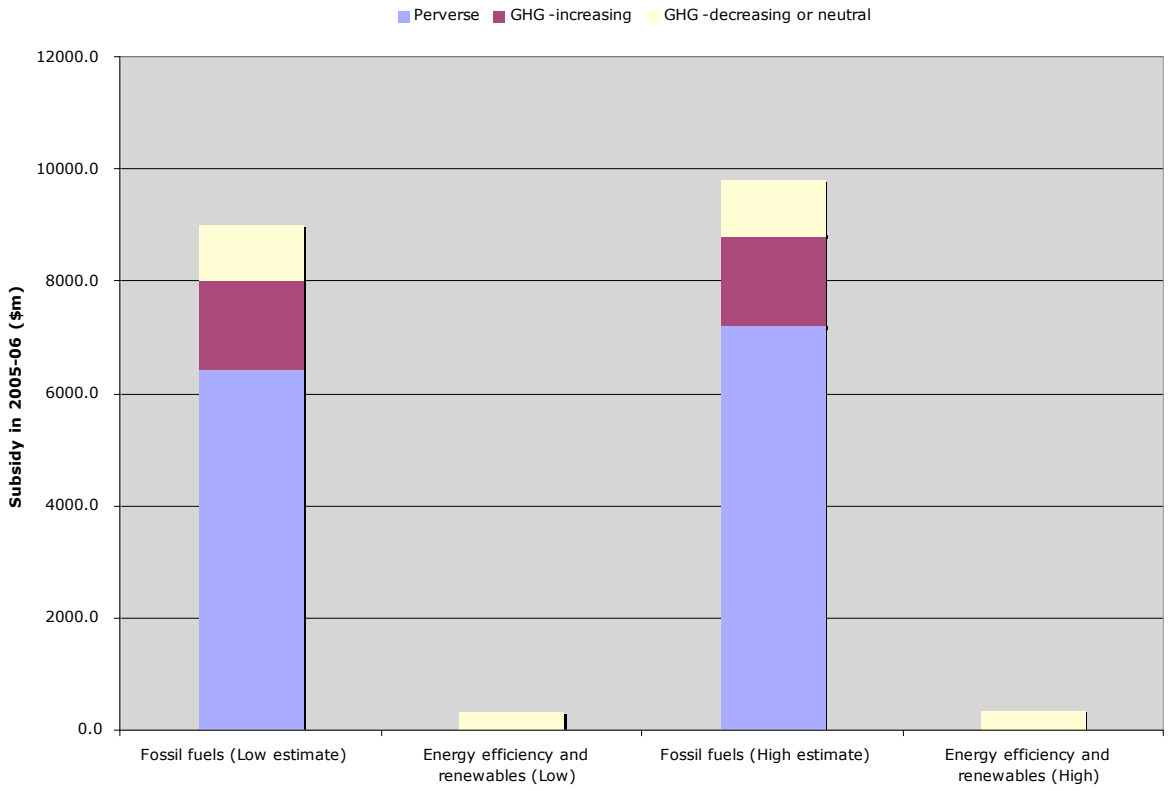

Figure ES1: Summary of the magnitude of identified fossil fuel and renewable energy subsidies.

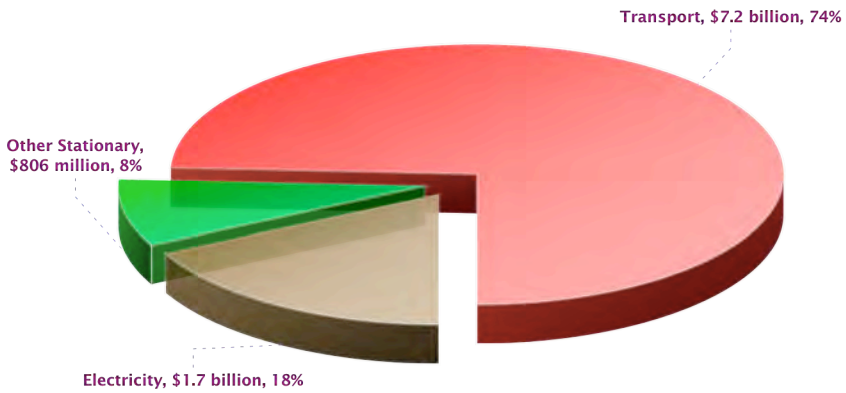

Figure ES2: Proportion of identified subsidies by sector.

Figure ES3 shows the proportion of the total subsidies that support production and consumption of different fuels. As would be expected given the size of the subsidies in the transport sector, most of the support (76%) is for production and consumption of oil and petroleum products. However, the coal industry also received substantial support of around $1.7 billion in 2005-06.

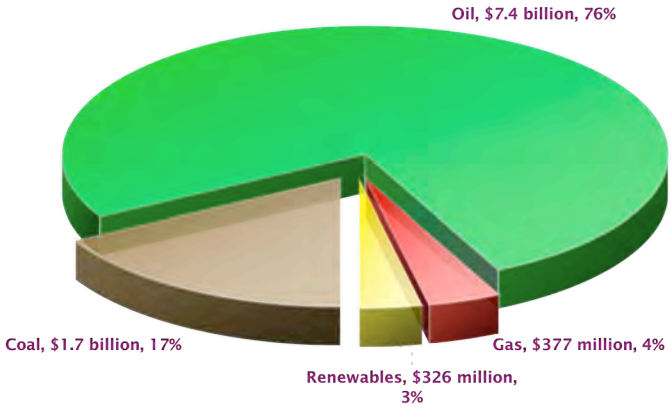

Figure ES3: Proportion of support for different fuels.

The road user deficit

The largest identified subsidy results from the failure of governments to capture sufficient revenue from the road network to cover the cost of maintaining the network and to achieve an appropriate rate of return. In other words, motorists do not pay as much to access and use the road network as they should. In 2005-06, the cost of providing the road network was $4.7 billion more than the revenue received from road users. This shortfall – the road user deficit – is a major subsidy in the transport sector.

The biggest source of revenue from road users is the Federal Government's fuel excise, which is a tax of 38 cents per litre included in the price of petrol. The Energy Grants Credits Scheme, which provided refunds on fuel excise for fuel used in specific on-road and off-road activities, was a major contributor to the road user deficit in 2005-06. The Energy Grants Credits Scheme reduced net fuel excise revenue by $3.5 billion in 2005-06, accounting for much of the observed road user deficit. Fuel excise revenue was reduced by a further $710 million in 2005-06 due to the exemption of alternative transport fuels (e.g. natural gas and LPG) from excise. This also contributes to the road user deficit.

A Fuel Tax Credits Scheme has now largely replaced the Energy Grants Credit Scheme. Under the new scheme, a wider range of activities and fuels are eligible for rebates on excise. As such, the size of the road user deficit is likely to increase in the future.

Other significant energy and transport subsidies

Figure ES4 gives an indication of the magnitude of some of the major identified subsidies, with the exception of the road user deficit. Low estimates are shown with solid blue bars and semi-transparent blue bars indicate high estimates. The range is due to uncertainty in the assumptions used to develop the estimates.

The largest of the subsidies is associated with the use of the statutory formula method for determining FBT on company cars. Currently, employees who are provided with a vehicle by their employer as part of their salary package do not need to keep a record of their business and personal use of the vehicle. Instead, they can use a special formula to calculate their tax liability. This formula assumes that the further a person drives in a year, the higher their business use of the vehicle and the lower their personal use. Their tax liability is based on their personal use, so there is a strong incentive to drive further each year to reduce the tax paid. This is a substantial subsidy that encourages higher consumption of petrol and creates a higher level of greenhouse gas emissions.

The next largest subsidy is associated with fuel subsidies at coal-fired power stations. There is evidence that coal-fired power stations pay much less for their fuel than the international market price. This indicates the existence of a subsidy to coal-fired power stations, amounting to between $450 million and $1.1 billion in 2005-06, depending on the assumptions used to calculate the subsidy. The subsidies received by several electricity generation companies with a large proportion of coal-fired generation in their portfolio appear to rival or exceed the profits made by those companies in 2005-06. In other words, government subsidies appear to be directly creating profits for coal-fired generators.

Further details on all subsidies are available in the body of the report.

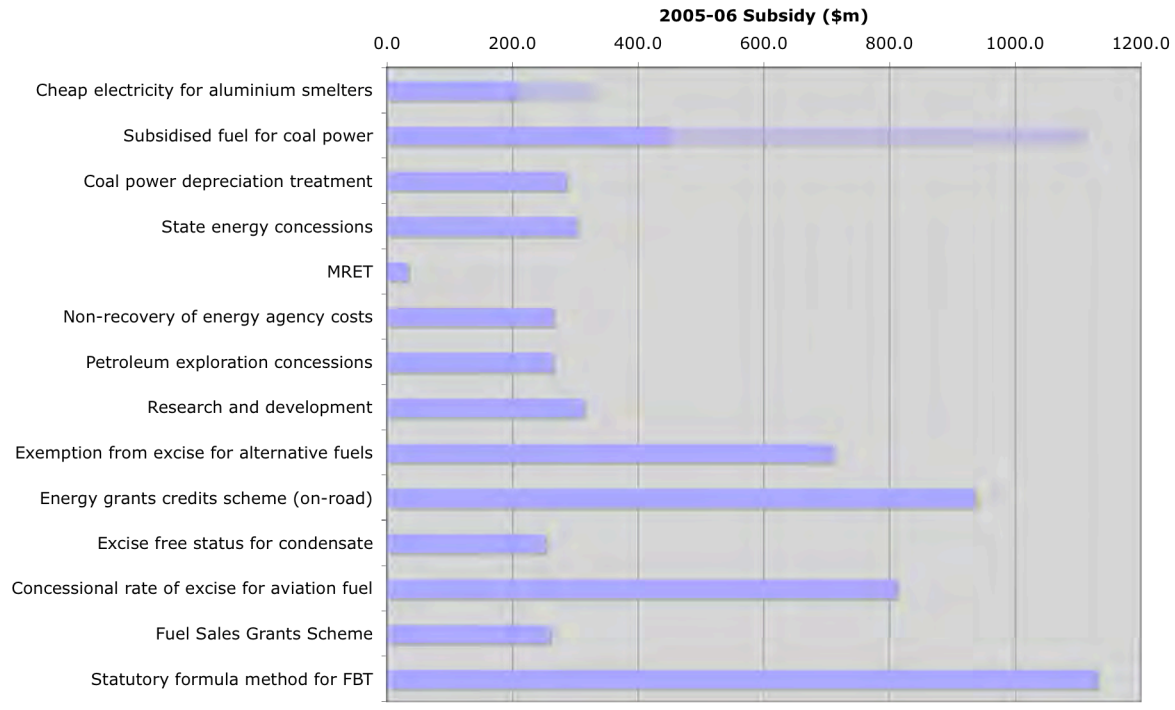

Figure ES4: Value of selected major subsidies in 2005-06.

Impact of subsidies on energy prices

Based on some simple calculations, removal of the identified subsidies in the electricity sector would increase electricity prices by about 0.5 cents per kilowatt hour or 3.9%. A price increase of this magnitude would be expected to lead to a fall in long-term electricity demand of about 1.4% and a reduction in greenhouse gas emissions of about 2.7 Mt CO_2-e.

In the transport sector, the identified subsidies reduce the price of petrol by about 38 cents per litre. This is very significant, given current petrol prices in Australia of around $1.20 per litre. Removal of a price distortion of this magnitude could make certain alternative fuels competitive with petroleum on cost. The 32% price increase associated with subsidy removal would be expected to correspond to an 18% reduction in petrol demand and an emission reduction of 12.5 Mt CO_2-e.

Subsidy removal

A clearer understanding of fossil fuel subsidies is of little use if not linked to a clear process for subsidy removal or reform. The Australian Conservation Foundation has proposed a national inquiry into environmentally damaging government programs and subsidies and environmental tax reform. Subsidies that support fossil fuel production and consumption would only be one of the areas examined (Krockenberger, Kinrade & Thorman 2000).

The inquiry could be established as a parliamentary inquiry. This would allow access to a much greater range of information than was available for the current research, provide greater resources for subsidy estimation and offer a possible link to an official process for subsidy removal. Government commitment to such an inquiry would be essential if its recommendations were to be successfully implemented.

An opportunity exists to shift existing subsidies from fossil fuels to renewable energy. Currently, the cost of climate change is not included in the price of fossil fuel energy. Subsidisation of renewable energy can be justified to offset the unpaid cost of climate change. Temporary subsidies to emerging industries of strategic importance are also justified until such industries can compete with more established industries. The public funds currently used to subsidise fossil fuel production and consumption could justifiably be used to subsidise the emerging sustainable energy industry, as establishment of this industry would constitute a public good.

It is crucial than any program of subsidy removal is sensitive to social impacts as well as economic and environmental impacts. For example, removal of fossil fuel subsidies in the transport sector would significantly increase fuel prices in a society that is car-dependent and, in many parts of Australia, has no viable alternative transport forms. Many households would have little choice but to pay higher fuel costs, bringing negative economic and social impacts. Subsidy removal, particularly in the transport sector, should only be pursued gradually, in tandem with programs that develop viable alternatives to fossil fuels.

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Abbreviations

4WD	Four-wheel drive vehicle
ABS	Australian Bureau of Statistics
AER	Australian Energy Regulator
AFCF	Alternative Fuels Conversion Program
AGO	Australian Greenhouse Office
AusAID	Australian Agency for International Development
Austrade	Australian Trade Commission
CNG	Compressed natural gas
COAG	Council of Australian Governments
CPI	Consumer Price Index
CRC	Cooperative Research Centre
DAFGS	Diesel and Alternative Fuels Grants Scheme
ECA	Export Credit Agency
ECITA Committee	Senate Environment, Communications, Information Technology and the Arts References Committee
EFIC	Export Finance Insurance Corporation
EGCS	Energy Grants Credits Scheme
EJIA	Energy Justice Initiative Australia
FBT	Fringe Benefits Tax
FSGS	Fuel Sales Grants Scheme
FTCS	Fuel Tax Credits Scheme
GDP	Gross domestic product
GGAP	Greenhouse Gas Abatement Programme
GHG	Greenhouse gas
GJ	Gigajoules
GST	Goods and Services Tax
GWA	George Wilkenfeld and Associates Pty Ltd
GWh	gigawatt hours
HCFC	Hydrochlorofluorocarbon

IEA	International Energy Agency
ISF	Institute for Sustainable Futures
LCT	Luxury Car Tax
LCV	Light commercial vehicle
LETA	Low Emission Technology and Abatement
LETDF	Low Emissions Technology Demonstration Fund
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
MMA	McLennan Magasanik Associates
MRET	Mandatory Renewable Energy Target
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NIEIR	National Institute of Economic and Industry Research
NTC	National Transport Commission
OECD	Organisation for Economic Co-operation and Development
PJ	petajoules
PMV	Passenger motor vehicle
PPFSS	Petroleum Products Freight Subsidy Scheme
PRRT	Petroleum Resource Rent Tax
R&D	Research and development
TES	Tax Expenditures Statement
UNEP	United Nations Environment Programme
UTS	University of Technology, Sydney
WST	Wholesale Sales Tax
WTO	World Trade Organisation

1 Introduction

Public debate over climate change, and how we should respond, has reached unprecedented levels in Australia. The energy and transport sectors are responsible for almost 70% of Australia's greenhouse gas emissions and emissions from these sectors continue to grow rapidly (AGO 2006a). It is in these sectors that responses to climate change are most urgently needed.

Emissions from energy and transport are high because of the use of fossil fuels – coal, oil and natural gas – to provide most of Australia's energy needs. An obvious response is to shift away from fossil fuels and towards renewable energy sources that do not generate greenhouse gas emissions. However, at present, the cost of renewable energy is significantly higher than the cost of energy derived from fossil fuel. This cost differential is hampering the transition from fossil fuels to renewable energy.

Some of this cost differential is due to the existence of public subsidies that provide support for production and consumption of fossil fuels. These subsidies distort energy and transport markets in favour of fossil fuels and create barriers for adoption of renewable energy. They effectively reduce the price of energy derived from fossil fuels, encouraging greater use of fossil fuels and higher greenhouse gas emissions. In an era when climate change response has become urgent, continuing to subsidise fossil fuel production and consumption is unacceptable.

Earlier work identified specific energy and transport subsidies in Australia and estimated the total magnitude of subsidies to fossil fuels and renewable energy (Riedy 2002, 2003, 2005; Riedy & Diesendorf 2003). This publication provides an updated estimate of the magnitude of energy and transport subsidies in Australia, using data from the 2005-06 financial year. It identifies some additional subsidies.

The removal or redistribution of subsidies can potentially deliver economic and environmental benefits. In economic terms, removal of subsidies improves economic efficiency. Alternatively, funds used to subsidise fossil fuels could be used to support renewable energy, allowing industry development without net budgetary impacts. In environmental terms, removal of fossil fuel subsidies will, according to economic theory, result in higher fossil fuel prices and consequent reductions in fossil fuel demand. An International Energy Agency (IEA) study found that subsidy removal in eight non-OECD[1] countries could increase gross domestic product (GDP) of those countries by almost 1% and lower CO_2 emissions by 16% (IEA 1999).

Despite the earlier work, public awareness that taxpayer funds are being used to support fossil fuels is low. Many of the subsidies are hidden in budget papers, government reports and annual reports. Taxpayers have a right to know that public funds are being used to support fossil fuel production and consumption and to know the magnitude of this support in comparison to support for alternative energy sources. A recent poll by the Australian Research Group found that support for renewable energy in Australia is stronger than support for cleaning up fossil fuels (Climate Institute 2007). The current pattern of energy and transport subsidies revealed in this report does not reflect this support.

It is in the public interest to have full disclosure of how public money is being spent. This report is a contribution towards greater transparency on allocation of public funds to different energy sources.

[1] The OECD is the Organisation for Economic Co-operation and Development.

2 Understanding subsidies

This section provides a brief guide to understanding subsidies and outlines the approach used to define, identify and categorise subsidies in this report. Section 2.1 summarises previous work on energy and transport subsidies in Australia. Section 2.2 discusses subsidy definition and identification. Section 2.3 defines subsidy categories that are considered in this report.

2.1 Previous work on energy and transport subsidies

In 1996, the National Institute of Economic and Industry Research was engaged by the Commonwealth Department of Environment, Sport and Territories (now the Department of Environment and Heritage) to examine subsidies to the use of natural resources in Australia (see NIEIR 1996). Despite a lack of data, NIEIR estimated financial subsidies to the Australian energy and transport sectors at $1.995 billion (in 1994 dollars). However, NIEIR did not fully distinguish between subsidies to fossil fuels and subsidies to renewable energy, so their report did not allow a conclusion to be drawn about possible market distortion in favour of fossil fuels.

In November 2000, the Senate Environment, Communications, Information Technology and the Arts References Committee released the final report of its inquiry into Australia's response to global warming (ECITA Committee 2000). The report estimated direct fossil fuel subsidies at $2 billion per year, citing NIEIR (1996), but also identifed an additional $4 billion in indirect subsidies such as 'tax incentives, startup grants, preferential purchasing agreements for oil, and biased market structures' (ECITA Committee 2000, p.xxxvi). The report also identifies Commonwealth subsidies of $360 million per year for renewable energy programs (ECITA Committee 2000, p.xxxvi). While the source of these estimates is not stated, they are apparently derived from summation of specific subsidies reported to the inquiry in hearings and submissions. However, as discussed in Section 2.2, there is often inconsistency in the way subsidies are defined. The ECITA Committee made no attempt to ensure that all subsidy estimates reported to it were based on a consistent definition and benchmark, so the accuracy of the overall estimate was questionable.

Several Australian studies have provided estimates of specific energy and transport subsidies (Hamilton, Denniss & Turton 2002; Laird et al 2001; Turton 2002). Hamilton, Dennis and Turton (2002) considered environmental taxes and charges, Laird et al (2001) considered transport subsidies and Turton (2002) considered subsidies to aluminium smelters. None of these studies attempted a comprehensive overview of energy and transport subsidies. Nevertheless, their estimates of specific subsidies are valuable.

International studies on energy and transport subsidies do not disaggregate data sufficiently to identify the magnitude of Australian subsidies. The Earth Track web database (Earth Track 2007) provides information on government interventions in energy markets, including specific Australian data, but does not estimate the magnitude of the subsidies associated with these interventions.

In 2000, it was clear that existing work on energy and transport subsidies was either dated, partial or did not distinguish between subsidies to fossil fuels and subsidies to renewable energy. Therefore, the Institute for Sustainable Futures (ISF) at the University of Technology, Sydney (UTS) commenced research on energy and transport subsidies in Australia in an attempt to provide a more comprehensive and consistent estimate of these subsidies. The research has now been through several iterations:

- Riedy and Diesendorf (2003) was a first attempt at getting to grips with the size of subsidies to the fossil fuel industry in Australia
- A second version of the research used an improved definition and categorisation of subsidies to tighten the methodology for subsidy identification and estimation (see Riedy 2003)
- The third iteration of the research recalculated subsidies for the 2003-04 financial year and expanded the coverage of subsidies to include both fossil fuels and renewable energy subsidies (see Riedy 2005).

This report is a fourth iteration of the research, providing updated 2005-06 figures for subsidies identified previously, as well as estimates of new subsidies identified or implemented since 2003-04. One of the most important elements of any research on subsidies is to have a clear and consistent definition of what constitutes a subsidy. The next section discusses the approach to subsidy definition and identification in this research.

2.2 Subsidy definition and identification

2.2.1 Defining energy and transport subsidies

The International Energy Agency has developed a widely accepted definition of what constitutes an energy subsidy:

> [An energy subsidy is] any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers (UNEP & IEA 2002, p.9).

Expanding on this definition, a fossil fuel subsidy is any government action, concerning primarily the energy sector, that lowers the cost of fossil fuel production, raises the price received by fossil fuel producers or lowers the price paid by fossil fuel consumers. Similarly, a renewable energy subsidy is any government action that lowers the cost of renewable energy production, raises the price received by renewable energy producers or lowers the price paid by renewable energy consumers.

Some authors provide more specific subsidy definitions that are useful for identifying particular types of subsidy. In the transport sector, Porter (2003, p.75) finds that:

> A transport subsidy could be defined either in terms of the gap between government expenditures to transport systems and the revenues collected from those systems (cost recovery) or by the failure to internalise external costs and other marginal social costs (congestion, scarcity, accidents, operating costs) in a specific mode of transport.

Porter (2003) argues that the choice of definition depends on the issue being addressed. In part, the choice depends on whether financial subsidies or externalities are of interest. This distinction between financial subsidies and externalities is discussed in more detail in Section 2.2.3. As outlined there, this report is primarily concerned with financial subsidies and therefore uses Porter's first definition, based on cost recovery, to identify transport subsidies.

In summary, an energy or transport subsidy exists where government action or inaction lowers the cost of production, raises prices received by producers, lowers prices paid by consumers or prevents full cost recovery for a service. However, this understanding of a subsidy implies that there is a benchmark from which to measure deviations in costs and prices. The definition of this benchmark is discussed in the next section.

2.2.2 Defining the benchmark

The IEA subsidy definition implicitly conceptualises a subsidy as a deviation of costs or prices from some benchmark situation. De Moor (2001) notes that the choice of benchmark is crucial for accurate estimation of subsidies. Theoretically, the benchmark situation is that in which private welfare is maximised – an equilibrium state of Pareto optimality. Any deviation of prices from marginal private costs therefore implies a subsidy. In practice, the world market price is commonly used as the benchmark for identifying domestic subsidies for traded goods. Deviation of domestic prices from the world market price indicates the existence of a subsidy. For goods that are not traded, the price charged can be compared with the unit cost of production to identify whether cost recovery is occurring (de Moor 2001).

Australia trades black coal, oil and natural gas internationally, so any gap between the domestic and world market prices would be indicative of a subsidy for these fuels. Brown coal and renewable energy sources are not traded internationally so, for these fuels, prices could be compared to the cost of production to identify subsidies. However, while top-down comparison of domestic prices with world prices can indicate the presence of a subsidy, it does not facilitate identification of specific subsidies and the regulatory instruments or policies that support them. Further, data on fuel prices paid at specific facilities is difficult to obtain. This report therefore adopts a bottom-up approach to subsidy identification, using cost recovery as a benchmark. This approach allows identification of specific energy and transport subsidies in an Australian context, which is a prerequisite for subsidy reduction, redistribution or removal.

2.2.3 Financial subsidies and externalities

There are several reasons for the existing cost differential between fossil fuels and renewable energy. Fossil fuels have some important natural advantages, in terms of energy density and mobility, that are reflected in pricing. Coal, oil and natural gas are concentrated sources of energy that are relatively easy to collect, transport and utilise, whereas renewable energy sources are diffuse and, in some cases, require advanced technologies to capture and store (Hoffert et al 2002).

However, there are three important factors, unrelated to any natural advantage of fossil fuels over renewable energy, that could potentially create market distortion in favour of fossil fuels. The first two factors are historical and current patterns of subsidisation within the economic system that favour fossil fuels over renewable energy. These factors are **financial subsidies**. The third factor is the exclusion of various environmental and social costs of fossil fuel production and consumption from the economic system. These costs are treated as **externalities**. The distinction between financial subsidies and externalities is addressed in more detail below.

Financial subsidies are cost or price distortions that are included in existing accounting frameworks and affect energy prices in the market. They decrease the cost of energy production and/or consumption and therefore, assuming there is some price elasticity of

demand[2], will encourage an increase in the activity level of economic actors involved in the activities that are subsidised. When the activity that is subsidised is an environmentally disruptive one, such as fossil fuel production and consumption, financial subsidies will increase the degree of environmental disruption. Subsidies to fossil fuel production and consumption will prompt an increase in fossil fuel combustion and greenhouse gas emissions above the benchmark level. This report focuses primarily on financial subsidies.

Externalities are costs and benefits that are excluded from accounting frameworks and market prices. Negative externalities are costs that are not fully paid by the actors responsible for incurring the costs. The costs may be shifted to other specific actors, to the public, or to future generations. For example, the costs of climate change are not currently included in fossil fuel prices; they are borne by the global community and future generations. Since the actor producing or consuming the fossil fuels does not pay all costs, their level of activity is higher than it would be if all costs were included. That is, the failure to include all negative externalities in markets is a type of subsidy according to the IEA definition discussed in Section 2.2.1.

Estimates of externalities, such as the cost of climate change, are available from various sources. For example, the Stern Review on the Economics of Climate Change estimated that the externality associated with carbon emissions today is US$25-30/tonne CO_2 in a scenario in which emissions are stabilised at reasonably safe levels and as high as US$85/tonne CO_2 in a scenario of unmitigated climate change (Stern 2007). At Australia's 2004 rate of greenhouse gas emissions from the energy sector, this externality would amount to between A$12.3 billion and A$41.8 billion.

Clearly, an externality of this size would contribute significantly to the price differential between fossil fuels and renewable energy. There is a pressing need to incorporate this externality into market prices using market instruments such as emissions trading or carbon taxes. This report recognises the need to cost externalities as a key part of any climate change response. However, the primary purpose of the report is to determine whether financial subsidies also contribute significantly to the price differential between fossil fuels and renewable energy. Financial subsidies have received less attention but may contribute significantly to the size of the price differential between fossil fuels and renewable energy. Further, many of these subsidies may potentially be removed with minimal disruption.

2.2.4 Types of financial subsidies

This section describes six different types of financial subsidy that are relevant to the energy and transport sectors, drawing on de Moor (2001), IEA (1999), United Nations Environment Programme (2003) and World Trade Organisation (1999).

Direct financial transfer

Direct financial transfers include grants to producers and consumers and low-interest or preferential loans to producers (UNEP 2003, p.22). They can be implemented as explicit subsidies, rebates, grants, equity infusions or other payments. Direct financial transfers are usually the easiest type of subsidy to identify as governments usually report their existence and magnitude in annual budget papers. However, subsidies of this type may not be universally disclosed, or may be aggregated with other budget items, which can make identification difficult.

[2] The demand response prompted by a change in energy prices is generally inelastic, i.e. a given percentage increase in price results in a smaller percentage decrease in demand. However, there is still a demand impact.

Tax expenditure

A tax expenditure 'is a tax concession that provides a benefit to a specified activity or class of taxpayer' (Australian Government 2006d, p.1). Tax expenditures provide preferential tax treatment for particular entities. Preferential tax treatment may include tax credits, accelerated depreciation allowances on energy supply equipment or rebates or exemptions on royalties, sales taxes, producer levies and tariffs (UNEP 2003, p.22). In the energy and transport sectors, tax expenditure often takes the form of differential tax rates on different fuels or tax credits for specific actors (IEA 1999).

The complexity of the taxation system can make identification of subsidies implemented through tax expenditure difficult. Under the *Charter of Budget Honesty Act 1998*, the Australian Government publishes an annual *Tax Expenditures Statement* (TES) that estimates the budgetary impact of tax expenditures. This is the main source of information on tax expenditure subsidies for this analysis.

To estimate the cost of a tax expenditure to the public, a taxation benchmark needs to be identified against which favourable tax treatment can be assessed (Howard Pender, pers.comm., 2001). Any deviations from the benchmark are then defined as tax expenditures. The 2006 TES provides a detailed discussion of the appropriate taxation benchmark for Australia (Australian Government 2006d). The definition of a taxation benchmark requires a degree of judgement as to which aspects of the taxation system are intrinsic features of the system and which are deviations. Consequently, any proposed taxation benchmark is contestable. For consistency, this report follows the Australian Government's definition of the taxation benchmark, defining subsidies as any tax expenditures that create deviations from that benchmark.

However, the design of the tax system (i.e. the taxation benchmark) itself can encourage fossil fuel production or consumption. For example, Douglas (2002) identifies design features of the Australian taxation system that discourage expenditure on the environment; it is reasonable to expect that there are also design features that encourage fossil fuel use. Therefore, according to the IEA definition of a subsidy, the design of the tax system could create subsidies to fossil fuel production and consumption. Where appropriate, this report discusses design features of the tax system that may act as subsidies.

When considering subsidies that are administered through the taxation system, it is important to also consider any special taxes, such as resource rent taxes, that are imposed on fossil fuel producers and consumers. These special taxes can offset the impact of subsidies. According to the UNEP and IEA, most OECD countries more than offset any gross energy subsidies with special taxes and duties on fossil fuels (UNEP & IEA 2002).

Energy-related services provided directly by government at less than full cost

The public provision of goods and services below cost is a form of subsidy. Examples include direct government investment in energy infrastructure, energy-related services provided by publicly funded agencies and public contributions to research and development (R&D). This category of subsidies includes operation of public agencies and public infrastructure to achieve less than the normal rate of return on investment.

Infrastructure subsidies are often delivered as part of confidential commercial contracts between governments and private businesses, making them difficult to identify. Detailed examination of budget papers can reveal that particular public agencies are not recovering the cost of their services, however, it can be difficult to determine what proportion of that cost should be paid by particular groups, such as fossil fuel producers. Public contributions to research and development are easier to identify.

Capital cost subsidies

Capital cost subsidies include preferential loans (soft loans), loan or liability guarantees, debt forgiveness (de Moor 2001) and interest rate subsidies (IEA 1999). Complex financial arrangements and commercial protection of details of capital provision can make identification of these subsidies difficult. Provision of capital at less than market rates can be identified by comparing the actual cost of capital to the subsidised entity to the cost of capital for a comparable unsubsidised entity. Judgement is required to identify an appropriate benchmark.

Trade restrictions

Trade restrictions, such as quotas, technical restrictions and trade embargoes, raise the cost of production for entities outside the country applying the restrictions, thereby lowering the relative cost of production for domestic producers (UNEP 2003). The benchmark for identifying a trade restriction is usually defined as a global free trade economy. Some trade restrictions may serve an important public good purpose and are not always suitable for removal, at least in the short-term.

Energy sector regulation

Government regulation of the energy sector can create subsidies through demand guarantees, mandated deployment rates, price control, market access restrictions and procurement policies (de Moor 2001; UNEP 2003). For example, there may be a regulatory requirement to purchase a given amount of fuel from a specific source at a regulated price or price controls to promote supply and consumption of particular energy sources (IEA 1999). The benchmark for identifying these subsidies is usually defined as a free market economy. Again, it should be noted that energy sector regulation often serves an important public good purpose and subsidies of this type are not always suitable for removal.

2.2.5 The scope of this analysis

As noted in Section 2.2.3, the focus of this report is on domestic financial subsidies to energy and transport in Australia. Where appropriate, the report also discusses economic structural incentives that are not strictly subsidies, such as incentives resulting from the design of the taxation system.

The report is primarily concerned with the magnitude of net government support for fossil fuels and renewable energy. Consequently, while cross-subsidies that have no net impact on government spending are discussed, their magnitude is not usually estimated. Nevertheless, cross subsidies can also be an important source of market distortion in the energy and transport sectors.

The list of subsidies discussed in this report is not intended to be exhaustive. New subsidies are continually being implemented and identified and many subsidies may still be hidden due to lack of data.

To structure the report, subsidies are divided into categories based on the sector in which they apply. Section 3 considers subsidies for the generation and use of electricity, Section 4 discusses other stationary energy subsidies and Section 5 examines transport subsidies. It is not possible to perfectly divide subsidies according to these categories, as some subsidies provide support for multiple categories. Where this is the case, each subsidy is discussed in the first relevant section and the magnitude of the subsidy is allocated to different sectors as appropriate. Each of these sections considers both fossil fuel subsidies and renewable energy subsidies. For many subsidies, such as those for electricity generation, this requires

allocation of a portion of the subsidy to fossil fuels and a portion to renewable energy. Allocation methods are described in the relevant sections.

This report focuses on the stationary energy sector and road transport. It does not attempt a comprehensive review of all subsidies to all transportation modes. That is, there is no comprehensive consideration of subsidies to public transport, cycling or walking. Public transport is primarily fuelled by fossil fuels in Australia, so the exclusion of public transport from the analysis favours fossil fuels.

While the focus of this report is mainly on subsidies for energy and transport in Australia, it is important to recognise that the actions of the Australian Government can have a significant impact on greenhouse gas emissions outside Australia, through aid programs and support for exports and overseas projects. Aid and export subsidies are briefly discussed in Section 6.

The subsidy estimates in this report do not include the substantial costs associated with maintaining access to international petroleum fields and protecting shipping routes through military action. Koplow and Martin (1998) reviewed estimates of the annual cost to the United States of defending Persian Gulf oil supplies and found a range from $US10.5 to $US23.3 billion. Recent developments in Iraq would presumably have increased this cost. Although the Australian military presence in the Persian Gulf is much smaller, it is reasonable to assume that a portion of Australia's military spending could be justifiably allocated to the protection of oil supplies and shipping routes.

As a result of these exclusions, and the use of conservative assumptions throughout, the fossil fuel subsidy estimates in this report should be understood as lower-bound estimates.

2.3 Subsidy categories and removal priorities

According to economic theory, subsidies distort the operation of markets and therefore reduce economic efficiency. Advocates of free markets argue for the removal of all subsidies to allow markets to operate efficiently and effectively. However, as discussed in Section 2.2.3, markets do not always consider environmental and social objectives. Government intervention in markets in order to meet environmental and social objectives is justified. Subsidisation is one form that this intervention can take.

According to the UNEP and IEA (2002, p.19): 'Any subsidy can be justified if the gain in social welfare or environmental improvement that it brings exceeds the net economic cost'. Consequently, not all energy and transport subsidies should necessarily be removed, including some of those that support fossil fuel producers and consumers. Those subsidies that provide gains in social welfare or environmental improvement that are greater than their economic cost can justifiably be retained.

To determine which subsidies supporting fossil fuel production or consumption are candidates for removal, each identified subsidy has been categorised according to the scheme shown in Figure 1. The rectangle in Figure 1 denotes the boundary of the economic system; financial subsidies and structural incentives are internal to the economic system, whereas externalities are external to the economic system. The outer ring in Figure 1 denotes the boundary between fossil fuel subsidies that create deviations from the benchmark and structural incentives that are part of the benchmark, such as design features of the taxation system. Tax reform to remove structural incentives may be justified where it will improve economic efficiency, reduce greenhouse gas emissions and facilitate social equity.

All of the subsidies within the outer ring reduce the cost of producing or consuming fossil fuels. Economic theory indicates that a reduction in the price of fossil fuels will encourage

greater use of fossil fuels, and therefore greater greenhouse gas emissions. Most fossil fuel subsidies will therefore tend to be environmentally harmful and a case can be made for their removal on environmental grounds. However, in some cases, the negative environmental impact may be offset by other environmental gains. For example, the provision of government funding to fossil fuel producers for R&D constitutes a fossil fuel subsidy that reduces the cost to the fossil fuel producer of doing the R&D, and therefore reduces the total cost of fossil fuel production. The subsidy will act as a driver for higher greenhouse gas emissions. However, if the R&D is focused on emission reduction, then the net impact of the subsidy may be a reduction in greenhouse gas emissions below the benchmark level.

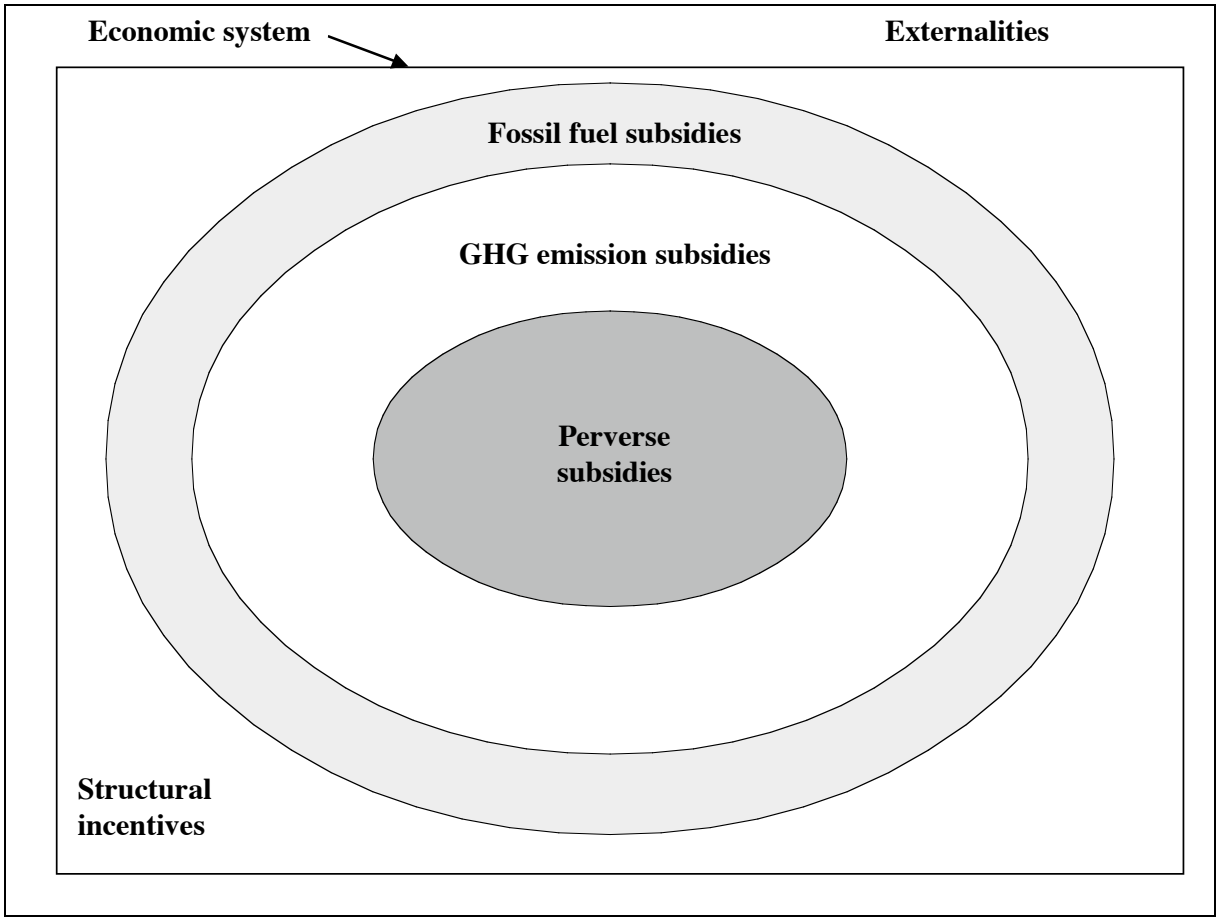

Figure 1: Categorisation system for fossil fuel subsidies and incentives.

The complete set of fossil fuel subsidies can therefore be divided into those that subsidise greater greenhouse gas (GHG) emissions and those that are likely to result in a net decrease in GHG emissions. In Figure 1, the second ring includes the fossil fuel subsidies that create a net increase in GHG emissions above the benchmark situation; these have been labelled **GHG emission subsidies**. In the area shaded light grey are those fossil fuel subsidies likely to create a net decrease in GHG emissions.

For many fossil fuel subsidies, the net effect on GHG emissions is relatively clear and identification of GHG emission subsidies is possible without detailed calculations or modelling. For other fossil fuel subsidies, the net effect is less certain. Pieters (2003) outlines a checklist for determining whether the removal of a subsidy will have significant environmental benefits. As a first attempt at identifying those fossil fuel subsidies that may be a priority for removal, this report applies the following questions from this checklist:

- Are there other policies in place that effectively limit the impact of the subsidy on total GHG emissions?
- Are more benign alternatives available now, or are they likely to be available in the future?
- Is the magnitude of the subsidy sufficient to have a significant impact on GHG emissions?

These questions help to identify fossil fuel subsidies that are likely also to be GHG emission subsidies. However, in some cases, the status of particular subsidies remains uncertain without detailed economic modelling or GHG emission calculations. This detailed analysis is beyond the scope of this report so, in some cases, subsidies have been categorised based on considered judgement.

The case for removal of GHG emission subsidies is clearly stronger than the case for removal of all fossil fuel subsidies. However, some GHG emission subsidies may meet other public objectives, such as regional development or employment; removal of such subsidies needs to be carefully considered against these other objectives. In addition, removal of some GHG emission subsidies may have a negative impact on social equity. Intelligent policy design is needed to ensure that any fuel price rises associated with subsidy removal do not exacerbate existing inequalities. For example, rebates or tax credits for low-income households are a policy option to counter the social impact of uniform fuel price rises. There may also be few current alternatives to fossil fuels in some applications, so GHG emission subsidies may need to be maintained while alternatives are developed. In other words, subsidy removal must seek a balance between environmental, social and economic objectives. Where the negative social or economic impacts of subsidy removal prove intractable, there may be a strong case for leaving a GHG emission subsidy in place.

Within the subset of GHG emission subsidies, there is a smaller group of **perverse subsidies**, shown inside the inner circle in Figure 1 (shaded dark grey). Myers and Kent (1998) define perverse subsidies as those that are detrimental to both the environment and the economy in the long run. In this report, their definition is extended to comprise subsidies that are detrimental to the environment, economy and *social equity* in the long run. Perverse subsidies have few redeeming features and are almost always suitable targets for removal on the grounds of improved economic efficiency, reduced environmental impact and/or improved social equity. This report attempts a preliminary categorisation of subsidies as perverse, using considered judgement rather than detailed modelling or policy analysis. Detailed analysis to confirm the categorisation of subsidies in this report would be an appropriate focus for further research. Further, a categorisation of a subsidy as perverse does not remove the need to carefully consider the design of any subsidy removal program to ensure that particular groups in society are not disadvantaged.

Using the categorisation shown in Figure 1, perverse subsidies are the highest priority for removal, as long as steps are taken to minimise any resulting social disruption. Removal of other GHG emission subsidies is a lower priority, but may be justified if the environmental gains that result are seen to outweigh the economic and social objectives met by the subsidy. This is a matter for public debate and depends on the weighting given to different

objectives. Fossil fuel subsidies that are not GHG emission subsidies are the lowest priority for removal.

3 Electricity subsidies

This section considers subsidies that support generation or use of electricity. In some cases, these subsidies provide support for electricity generated from a specific source, allowing direct allocation of the subsidy as a fossil fuel subsidy or renewable energy subsidy. In other cases, the subsidy is for use of electricity from the grid, which means that a proportion of the subsidy supports fossil fuels and the remainder supports renewable energy. In these cases, the subsidy has been divided in proportion to the average shares of each fuel in the primary energy consumed to provide Australian electricity generation. In 2005-06, coal was used to generate 78.9% of Australia's electricity, oil supplied 1.4%, natural gas supplied 14.9% and renewable energy supplied 4.8% (Cuevas-Cubria & Riwoe 2006).

Table 3, in Section 3.8, summarises the magnitude and categorisation of the electricity subsidies identified in this report. Research and development subsidies in the electricity sector are considered as part of the stationary energy estimates in Section 4.4.

3.1 Subsidised supply of electricity to aluminium smelters

The aluminium smelting industry is an electricity-intensive industry. Turton (2002) estimated that, in 1998-99, the industry consumed almost 15 per cent of all electricity used in Australia and generated about 5.9 per cent of Australia's total greenhouse gas emissions. Australian aluminium smelting has the highest GHG intensity in the world, due to its heavy reliance on coal-fired electricity (Hamilton 2004).

Turton (2002) provides a detailed analysis of the aluminium smelting industry in Australia, and internationally. He concludes that there is strong evidence that the aluminium smelting industry receives cheaper electricity than similar large industrial customers, as a result of long-term supply contracts negotiated with State governments attempting to attract industry to their State. This 'represents a subsidy if the prices are below those that would be paid in a freely competitive market, where electricity suppliers charge prices that reflect long-run marginal costs' (Turton 2002, p.11).

After reviewing the available evidence, Turton concludes that the annual subsidy for electricity use at the six existing Australian aluminium smelters is at least $210 million, and is likely over $250 million. In addition to electricity price subsidies, Turton's estimate includes the impact of the 1994 sale of the Gladstone Power Station by the Queensland Government (to a consortium headed by Comalco, majority owner of the adjacent Boyne Island smelter) at below market price. Professor Ian Lowe reported to the Joint Standing Committee on Treaties Inquiry into the Kyoto Protocol that the price was between half and two-thirds of the net value of the power station (Joint Standing Committee on Treaties 2000, p.254). This sale meets the definition of a subsidy, as it allows Comalco to either supply electricity to the Boyne Island smelter at below market prices or achieve higher earnings on its investment (Turton 2002).

A review of Turton's findings indicates that the assumptions are still largely valid and that the current subsidy in 2005-06 is likely of a similar magnitude. The estimated subsidy to the Victorian smelters (Portland and Point Henry) depends on the price of aluminium. The subsidy is at its maximum as long as the aluminium price remains below US$936 per tonne in 1982 dollars. This equates to about US$2,460 per tonne in 2005-06 dollars. The average aluminium price received by Alcoa (owner of the smelters) during 2005-06 was about US$2,325 per tonne (Alcoa 2007), so the subsidy would have still been at the maximum level identified by Turton during 2005-06.

Turton's estimates are sensitive to assumptions about the appropriate market price that a large industrial customer would pay for electricity in Australia. If market prices have fallen

since his estimate was developed, the subsidy would also decrease (as the prices paid by the smelters under long-term contracts would remain unchanged). However, data from the National Electricity Market Management Company (NEMMCO) indicates that average generation prices in the National Electricity Market (NEM) have remained stable or slightly increased since 2002 (NEMMCO 2007). In fact, Turton's assumption of a generator price of $24/MWh seems conservative compared to average pool prices of $37/MWh in NSW and $32/MWh in Victoria in 2005-06. While it is likely that generators would be willing to accept lower prices from large customers like smelters, Turton's assumptions still seem conservative compared to current pool prices. Raising the assumed generator price to $30/MWh would increase the estimated subsidy to $330 million.

The $3 billion Aldoga Aluminium Smelter proposed for construction in Gladstone also appears to have been offered substantial subsidies and concessions of about $100 million by the Queensland Government, the bulk of which comprised heavily discounted electricity supplies (Sydney Morning Herald 2001). These subsidies are not included in Turton's (2002) estimate.

Subsidies for electricity use by aluminium smelters reduce the economic incentive to invest in energy efficiency and therefore keep electricity consumption higher than it would be in the absence of subsidies. Electricity for Australia's smelters is supplied by black coal generation (NSW and Queensland), brown coal generation (Victoria) and hydroelectric generation (Tasmania). Turton (2002) attributes $15 million of the $210 million subsidy to the Bell Bay smelter in Tasmania, which uses renewable energy. Consequently, the estimated subsidy for fossil fuel consumption is at least $195 million and more likely $232 million based on Turton's estimates (assuming the Bell Bay subsidy rises proportionally to $18 million in Turton's higher estimate). At an assumed generator price of $30/MWh, the subsidy would increase to $24 million for renewable energy and $306 million for fossil fuels (coal).

Given that they reduce the economic incentive for energy efficiency improvement, it is reasonable to conclude that these subsidies are GHG emission subsidies. Analysis by Turton (2002) indicates that they are also perverse subsidies, as their removal would provide an overall benefit to the Australian economy. However, as these subsidies are implemented through long-term electricity supply contracts, options to remove them in the short-term are limited. For example, electricity supply contracts for the Portland and Point Henry smelters in Victoria run until 2016 (Turton 2002).

It is interesting to consider the impact of these subsidies on the profitability of the aluminium industry in Australia. Globally, Alcoa had an average profit over 2005 and 2006 of US$1.74 billion (Alcoa 2007). The estimated subsidy to Alcoa in Australia (owner of the Portland and Point Henry smelters) over the same period was $155 million. On these figures, the subsidy accounted for 6.7 per cent of Alcoa's global profit. This is a very significant taxpayer contribution to the profits of a multinational company.

3.2 Subsidies for coal-fired generation

In 2004, an energy economist undertook a detailed analysis of subsidies to coal-fired generation as part of his Masters research at the University of New South Wales (Birch 2004). A summary of his analysis is posted on the website of the Energy Justice Initiative Australia (EJIA 2007). The original analysis was part of a Masters research project and the economist has provided the authors of this report with an extract from his thesis.

Birch found that electricity generation costs for Australian coal utilities were significantly less than international costs. He found that the total weighted average cost of electricity generation for four utilities – Macquarie Generation, Delta Electricity, CS Energy and

Stanwell – was 1.36 cents/kWh. By comparison, coal-dominated utilities in the United States paid 1.37-2.44 cents/kWh for fuel alone in 2002, which accounts for only about 40-50% of their total costs (Birch 2004).

To explain this difference, Birch examined fuel costs and depreciation charges in more detail.

3.2.1 Fuel costs

Birch found that coal-fired electricity generators pay much less for their coal than the international market rate. Coal-fired generators do not reveal their fuel costs. However, private disclosures to Birch indicated weighted average costs in the order of $1/gigajoule (GJ) in NSW and $1.17/GJ in Queensland for black coal (Birch 2004). Birch also obtained costs for brown coal in Victoria, however these are not relevant as brown coal is not traded internationally.

Using Birch's figures and data on black coal consumption in NSW and Queensland in 2004-05 (Cuevas-Cubria & Riwoe 2006), the weighted average fuel cost for black coal in Australia would be $1.08/GJ. Birch estimated the exportable value of Australian thermal coal in 2001-02 at $1.41/GJ, based in part on private disclosures. This was comparable to the IEA's estimate that OECD generators paid $1.40/GJ for their coal (Birch 2004).

The precise reasons for the discrepancy between the price paid by Australian generators for their black coal and the price that could be obtained on the export market are unclear. However, Birch reported, based on private conversations, that government intervention has ensured the provision of coal to generators at discounted rates. This would constitute a subsidy.

At the time of Birch's calculation, the subsidy amounted to 33 cents/GJ. In 2005-06, consumption of black coal for electricity generation in Australia was projected to be 1,355.4 petajoules (PJ) (Cuevas-Cubria & Riwoe 2006). This would constitute a total subsidy of about $450 million per year.

However, since 2001-02, export prices for coal have increased substantially, to about $66 per tonne (IEA 2006). This would give an exportable value for Australian thermal coal of $2.23/GJ. Assuming the prices paid by generators have not changed, which might be the case under long-term contracts, the current subsidy could be as high as 82 cents/GJ. This would constitute a total subsidy of $1.1 billion per year.

Clearly, the magnitude of the subsidy is very dependent on the assumed fuel price paid by Australian coal-fired generators, which is derived from a small number of private disclosures. As a result, this subsidy estimate is an example of one that could be substantially improved by holding an independent inquiry into energy and transport subsidies that would be able to obtain and summarise commercial-in-confidence data from energy utilities. This idea is discussed in more detail in Section 7.3.

Whatever the actual size of this subsidy, it appears that it has a significant impact on the profitability of coal-fired generation in Australia, as two examples will demonstrate. Macquarie Generation, which operates the Liddell and Bayswater coal-fired power stations, earned a before-tax profit of $267.1 million in 2005-06. The Liddell and Bayswater power stations consume approximately 13 million tonnes of coal per annum. Based on the figures above, the annual fuel subsidy to Macquarie Generation is between $122 million and $304 million. That is, most if not all of Macquarie Generation's 2005-06 profit was attributable to subsidisation of its fuel costs.

CS Energy operates the Callide and Swanbank coal-fired power stations, which consume about 7 million tonnes of coal per year. The fuel subsidy to CS Energy would be between $66 million and $164 million. In 2005-06, CS Energy earned a before-tax profit of $80.9 million. Again, it is likely that CS Energy would have operated at a loss if the subsidy had been removed in 2005-06.

3.2.2 Depreciation charges

Birch also examined depreciation charges and found a weighted average of 0.23 cents/kWh for the three coal utilities that disclosed sufficient data (Delta Electricity, CS Energy and Stanwell). The weighted average cost of buying coal-fired plant for these three utilities was $220 per kW (Birch 2004), compared to a current international market cost of more than $1,300 per kW (NEA & IEA 2005).

Some of this difference is due to the age of the power stations and the results of inflation (construction costs would have been lower in the past). However, Birch found that some was also due to changes in the accounting of the original cost of the assets at the time of deregulation. In theory, the original cost of the assets should increase over time due to additional capital works and enhancements. The current value, incorporating depreciation, may decrease but the original cost should not. Birch found that, in the case of Macquarie Generation and Delta, the devaluation of assets by governments at the time of deregulation constituted a subsidy of $189 per kW. This equates to a generation subsidy of 0.2 cents/kWh (Birch 2004).

In 2005-06, electricity generation from black coal was about 141 TWh (Cuevas-Cubria & Riwoe 2006). Assuming that similar devaluation of assets occurred across Australia, this would amount to a subsidy of $283 million. This subsidy is not a result of direct actions by present governments. Instead, it is brought about by the lingering impact of concessions made by governments during deregulation of the electricity sector.

Both the fuel cost and depreciation subsidies are GHG emission subsidies because they lower the cost of coal-fired generation, encouraging greater use of coal power and greater generation of GHG emissions. The subsidies are also perverse because they distort the electricity market and act as barriers to the uptake of new generation technologies.

These depreciation subsidies would further reduce the profitability of coal-fired generation. If they were removed, coal-fired generators would need to raise their prices to maintain profits, making other energy sources more competitive.

3.2.3 Collie coal-fired power station

The ready availability of coal from state mines for use in generating electricity may also have contributed to the construction of coal-fired power stations when other options would have been more economic. In Western Australia, the State Government supported the construction of the Collie coal-fired power station although the official (Harman) committee recommended that a gas-fired power station would have been cheaper. The total additional discounted (eight per cent discount rate) cost in 1990 dollars is estimated at $170 million and would be even greater if additional costs of greenhouse gas emissions were considered (OECD 1997). The value in 2005-06 of this one-off subsidy has not been estimated.

3.3 The Low Emissions Technology Demonstration Fund

The Low Emissions Technology Demonstration Fund (LETDF) is an Australian Government program announced in 2004. It provides up to $500 million, through competitive grants, to support the commercial demonstration of technologies with the potential to deliver large-scale greenhouse gas emission reductions in the energy sector. The LETDF is designed to leverage an additional $1 billion from the private sector, as grant recipients must contribute their own funds on a 2 to 1 basis.

To date, the LETDF has allocated funds to six projects, as shown in Table 1. Five of the six projects support fossil fuel production or consumption, with total funding of $335 million. Only one of the projects supports renewable energy, with funding of $75 million. That is, fossil fuels receive 82 per cent of the total funds allocated under the LETDF to date.

Project	Details	Funding ($million)
Chevron – The Gorgon CO_2 Injection Project	Natural gas extraction with carbon capture and underground storage	60
CS Energy – Callide A Oxy-fuel Demonstration Project	Black coal power with carbon capture and underground storage	50
Fairview Power Project – Zero Carbon from Coal Seams	Gas power station with coal seam injection of carbon dioxide	75
Solar Systems Australia – Large Scale Solar Concentrator	Solar photovoltaic power station using concentrated sunlight	75
International Power – Hazelwood 2030 A Clean Coal Future	Drying of brown coal before power generation with pilot carbon capture and underground storage	50
HRL Limited – Loy Yang IDGCC project	Integrated drying gasification combined-cycle power station using brown coal	100
TOTAL		**410**

Table 1: Projects funded under the Low Emissions Technology Demonstration Fund.

The LETDF is a new funding program and the grants were only announced in 2006-07. As such, this new subsidy is not included in the 2005-06 subsidy estimates in this report. However, it is noted here as a major new subsidy to fossil fuels, albeit one that seeks to reduce the greenhouse intensity of fossil fuel generation. It is indicative of the strong support for so-called "clean coal" technologies by the Australian Government, at the expense of renewable energy.

The enthusiasm for "clean coal" is shared by the Federal Labor party, which announced on 25 February 2007 that, if elected, it will establish a National Clean Coal Fund providing an additional $500 million for fossil fuel technologies. The Federal Labor Party would also provide an additional $25 million over four years to the CSIRO for research and development on "clean coal" technologies. With the LETDF and/or the National Clean Coal Fund, it appears that the subsidisation of electricity generation from fossil fuels is set to increase substantially in 2006-07 and subsequent years.

3.4 State energy concessions

State governments provide various energy concessions and payment assistance schemes for particular household customer groups, including concession card holders (e.g. people in receipt of aged-pensions or unemployment benefits), people in country areas, financially disadvantaged groups and people using home life-support equipment (see Table 2 for a summary). The subsidies are delivered as a discount or rebate on energy bills; most apply to electricity use but some also apply to natural gas use. By reducing the total cost of energy to particular householder groups, they provide an incentive to those groups to use more electricity than they otherwise would. As shown in Table 2, the subsidies total almost $300 million per year.

State/Territory	Subsidy	Annual Value 2005-06 ($m)	Source
New South Wales	Life Support Rebate Scheme	2.7	NSW Treasury (2006)
	Pensioner Energy Rebate Scheme	79	
	Energy Account Payments Assistance	9	
	Administration payments	0.9	
Victoria	Mains Electricity Concession	58.7	Estimates drawing on Victorian Government (2005a; 2005b; 2006)
	Mains Gas Concessions	39.4	
	Non-Mains Concessions	1.9	
	Utility Relief Grants	3.2	
Queensland	Electricity Rebate Scheme	59.4	Queensland Government (2006b)
	Electricity Life Support Scheme	0.5	
South Australia	SA Energy Concession	28.1	Estimate drawing on Government of South Australia (2005)
Western Australia	State Government Energy Rebate Seniors Air Conditioner Rebate	3.1	Department of Treasury and Finance (2006)
	Life Support Equipment Electricity Subsidy	1	
Tasmania	Healthcare and electricity concession Pensioner electricity concession Heating allowance rebate Life support discount	13	Tasmanian Government (2006)
Australian Capital Territory	Energy concession	0.9	ACT Government (2004)
Northern Territory	Pensioner concessions	<1	Estimate based on information on Power and Water Authority website
TOTAL ($M)		299.5	

Table 2: Estimate of state energy supply subsidies for pensioners, financially disadvantaged users and users in remote areas.

Of the $299.5 million in subsidies identified in Table 2, approximately $211.1 million provides a discount on electricity bills, while the remaining $88.4 million provides a discount on natural gas bills.[3] The electricity subsidy can be further divided between fuels based on the average generation mix in 2005-06. On this basis, the subsidy of $299.5 million provides $166.5 million for coal generation, $3 million for oil generation, $119.8 for natural gas generation and $10.2 million for renewable energy generation.

The fossil fuel subsidies are GHG emission subsidies, as they encourage greater energy use and discourage energy efficiency improvement. However, these subsidies are not necessarily perverse, as they meet the social objective of assisting disadvantaged householders with the cost of essential services. However, a better environmental outcome (and possibly a better economic outcome) could be obtained by using some portion of the current subsidy funds to improve energy efficiency in the target households. Using the funds for installation of efficient showerheads, shading, blinds and insulation could potentially reduce GHG emissions while still meeting the social objective of reducing the total cost of electricity bills for the target groups.

3.5 Electricity pricing structures

Electricity pricing structures can create market distortions that impact on the amount of electricity consumed, the mix of fuels used to supply that electricity and, consequently, the GHG emissions from electricity generation. Although the electricity sector in Australia has been deregulated and opened to competition, governments continue to regulate electricity pricing to various degrees. The Australian Energy Regulator (AER) sets revenue caps for transmission network service providers. State authorities, such as the Independent Pricing and Regulatory Tribunal in NSW, regulate pricing of electricity distribution and retail services. Where these regulatory activities lower the cost of production, raise the price received by producers or lower the price paid by consumers, a subsidy may exist.

3.5.1 Network price regulation

It is recognised that network price regulation in the National Electricity Market (NEM) has created barriers to the uptake of distributed energy, renewable energy and energy efficiency (MCE SCO 2006). Specifically, distribution network pricing structures do not reward the use of distributed generation and demand-side response as alternatives to network augmentation and ways of reducing network losses. Further, network pricing structures do not provide location-based incentives for installation of distributed and renewable energy in areas where the network is constrained. Network connection costs for distributed and renewable energy may also be prohibitive.

These barriers are created by government regulation. However, they only constitute a subsidy if they result in a rise in the price received by energy service suppliers or a reduction in the price paid by consumers. There is ample evidence that cost-effective opportunities to improve energy efficiency and reduce demand are not being adopted (MMA 2004; SEDA 2002). To the extent that government regulation is creating barriers to these opportunities, it is preventing the uptake of lower cost energy options, increasing the overall cost of energy and, consequently, increasing the price that energy businesses can charge. This constitutes a subsidy.

[3] Some of the concessions are available for both electricity and natural gas. Where this is the case, the subsidy has been split between electricity and natural gas using the relative proportions of electricity and natural gas in final energy consumption for each state, from Cuevas-Cubria & Riwoe (2006).

There have been several recent examples of this subsidy in action. Regulators allowed TransGrid and Energy Australia to construct the MetroGrid electricity network augmentation project in Sydney despite the existence of cheaper demand management alternatives (TransGrid & Energy Australia 2000). Another example is TransGrid's proposed Wollar to Wellington electricity line, approved by the NSW Department of Planning in December 2006. The Total Environment Centre estimates that the line has a $24-39 million economic disbenefit and is more expensive than demand management alternatives (TEC 2003).

Beyond these examples, estimating the annual magnitude of this subsidy is very difficult. First, estimating the cost-effective potential of energy efficiency and distributed energy requires numerous assumptions that are open to debate. McLennan Magasanik Associates (MMA) estimated the net present value of a national energy efficiency target at $2.5 billion to $6.6 billion, depending on the size of the target and the method of implementation (MMA 2004). This gives some idea of the magnitude of the unrealised opportunities in the energy market. However, it is not clear how significant the role of government regulation is in preventing uptake of this cost-effective potential. Many other barriers exist that are not directly attributable to governments, such as lack of experience with the technologies.

As a result, this report does not provide an estimate of the subsidy associated with network price regulation, other than to note that it might be in the range from several hundred million dollars to billions of dollars per year. This subsidy would act to increase greenhouse gas emissions by favouring centralised coal-fired generation over distributed renewable energy, cogeneration and energy efficiency.

3.5.2 End user pricing

The structure of end user pricing can create cross-subsidies that distort the electricity market by raising prices above costs for specific customers and lowering prices below costs for other customers. These cross-subsidies are in addition to the net subsidy discussed above. Cross-subsidies occur when prices do not vary sufficiently with time and location to reflect the real cost of providing electricity at that time and location.

There are two main factors that cause the cost of providing electricity to vary with time. First, changes in the availability of generation equipment can cause pool prices in the NEM to change. If a power station unexpectedly breaks down at a time when demand for power is high, the prices charged by generators will increase. This increases the cost to the retailer of providing electricity at that time. Second, the cost of providing electricity at peak times is higher than at non-peak times. This is because the cost of electricity includes the cost of building a network with sufficient capacity to service peak demand. The peak capacity may only be reached for a few hours per year but the network needs to be sized to provide this capacity. The time available to recover the incremental cost of the network falls as peak demand is approached, so the cost of electricity at these times goes up.

Currently, most consumers pay less than the cost of electricity at peak times and more at off-peak times. This can lead to behaviour that increases GHG emissions. For example, it has been estimated that owners of air conditioners are subsidised by non-owners in the NEM by an amount of $300-500 million per year (GWA 2004). This subsidy occurs because air-conditioners contribute disproportionately to peak demand. This network cost is hidden because it is averaged across all small consumers. If air-conditioner owners paid the true cost, it is likely that many would seek to reduce their use, thereby reducing electricity demand and greenhouse gas emissions.

The Council of Australian Governments is seeking to address this type of cross-subsidisation by committing to the progressive national roll out of 'smart' electricity meters

from 2007, allowing the introduction of time of use pricing (COAG 2006). Time of use pricing should help to reduce this cross subsidy.

The cost of providing electricity also varies with location. Customers that are further from generation sources require longer transmission networks to provide their electricity, which raises the cost of supply. Usually, urban customers pay slightly more than the true cost of supply, and rural customers pay less. The likely result is that rural customers will use more electricity than they otherwise would, and urban customers may use less. In terms of total electricity consumption and GHG emissions, the net effect may be minimal. However, if rural customers paid the true cost of electricity generation, renewable forms of electricity generation with higher costs would be better able to compete with fossil fuel generation in those areas. Cross subsidisation would therefore seem to put renewable energy at a disadvantage, although it can be defended on the basis of equity and regional development objectives.

The cost of supply also varies with location due to network congestion. In any electricity network, some parts of the network will be approaching their peak demand capacity and others will be underutilised. The marginal cost of electricity supply is higher in congested areas than non-congested areas, as the cost of network augmentation needs to be included. Where prices do not vary with location, customers in uncongested areas subsidise those in congested areas. This cross-subsidy could potentially be addressed using congestion pricing, where price varies depending on the load and the proximity to a network constraint. As with the urban and rural consumers discussed above, the net impact on GHG emissions is probably minimal.

It is certainly possible to remove cross-subsidies using time of use pricing and congestion pricing. Improved end-user pricing could provide better signals for electricity users to reduce their total consumption through energy conservation and energy efficiency. Better pricing structures could also encourage load-shifting behaviour, which can reduce peak demand and the need for network augmentation. However, any program to remove cross-subsidies needs to consider social justice issues and recognise that electricity is an essential service that needs to be priced at affordable levels for all customers.

3.6 The Mandatory Renewable Energy Target

The Mandatory Renewable Energy Target (MRET) legislation creates a legal liability on wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9,500 gigawatt hours (GWh) of renewable energy per year by 2010. There is a non-indexed penalty for non-compliance of $40/MWh (or $57/MWh pre-tax). The MRET therefore distorts the electricity market in favour of renewable energy sources over fossil fuels.

However, apart from the administration costs for the scheme, the MRET is not funded from taxpayer revenue; it is funded by the wholesale purchasers of electricity, who have the choice of paying the $40/MWh penalty or adopting cheaper renewable energy options. Ultimately, the cost of the scheme is passed on to electricity customers in tariffs or retailers in purchasing requirements. Consequently, it is not immediately clear whether the MRET constitutes a subsidy. It does raise the price received by energy producers but it also increases the price paid by energy consumers. This situation is similar to the situation created by network price regulation (see Section 3.5.1). For consistency, this report defines the MRET as a subsidy.

The cost of the administration of MRET by the Office of the Renewable Energy Regulator in 2005-06 was $2.8 million (DEH 2006). Under the interim targets for the MRET, wholesale electricity purchasers were required to generate an additional 800 GWh during 2005 and

1,100 GWh during 2006, giving an approximate requirement for the 2005-06 financial year of 950 GWh. The price for Renewable Energy Certificates during 2005-06 was about $30/MWh (Rossiter 2006). This constitutes an approximate subsidy to renewable electricity of $28.5 million in 2005-06. As noted above, this is a customer and retailer funded subsidy, not a taxpayer-funded subsidy. The total subsidy, including administration, was $31.3 million.

3.7 Other electricity support programs

The Environment Budget Statement (DEH 2005) provides details of other support programs for energy efficiency and renewable energy funded by the Australian Government in 2005-06. These include:

- $1.65 million for the Renewable Energy Equity Fund (half of the total support – the remainder is included in Section 4.9)
- $5.4 million for the Photovoltaic Rebate Program
- $1 million for the Renewable Energy Commercialisation Programme (half of the total support – the remainder is included in Section 4.9)
- $28.8 million for the Renewable Remote Power Generation Program
- $0.8 million for action on energy efficiency
- $0.6 million for the Solar Cities programme
- $3.7 million for the Energy Efficiency Opportunities program through the Department of Industry, Tourism and Resources
- Approximately $11 million for the Renewable Energy Development Initiative (half of the total support - the remainder is included in Section 4.9)
- $0.3 million for the Renewable Energy Action Agenda.

This gives a total of $53.3 million in support for energy efficiency and renewable energy in the electricity sector.

3.8 Magnitude of electricity subsidies

Table 3 summarises estimates of the magnitude of public electricity subsidies discussed in the sections above. Cross-subsidies are not shown.

Subsidy	Support for fossil fuels 2005-06 ($m)	Support for renewables 2005-06 ($m)	Subsidy Category	
			GHG Emission?	Perverse?
Subsidised supply of electricity to aluminium smelters	195-306	15-24	Yes	Yes
Coal power – fuel costs	447-1,111	-	Yes	Yes
Coal power – devaluation of assets	283	-	Yes	Yes
State energy concessions	289.3	10.2	Yes	No
Electricity network price regulation	not estimated	not estimated	Yes	Yes
Mandatory Renewable Energy Target	-	31.3	No	No
Other electricity support programs	-	53.3	No	No
CATEGORY TOTALS ($m)	**1,214-1,989**	**110-119**	**1,214-1,989**	**925-1,700**

Table 3: Summary and categorisation of electricity subsidies.

4 Other stationary energy subsidies

This section considers subsidies in the stationary energy sector, excluding those already discussed for the electricity sector. These subsidies support actors involved in exploration, mining, processing, distribution and direct consumption of fossil fuels or renewable energy. Where these subsidies support production, they reduce the cost of producing energy, and therefore allow producers to either charge less for energy, or derive increased investment returns from their activities. Where these subsidies support consumption, they reduce the cost of consuming energy, and will therefore tend to increase consumption above the unsubsidised level. Both production and consumption subsidies tend to increase the amount of energy consumed above benchmark levels. Table 7, in Section 4.10, summarises the magnitude and categorisation of the other stationary energy subsidies identified in this report.

4.1 Greenhouse Gas Abatement Program

The Greenhouse Gas Abatement Program (GGAP) is a major Australian Government competitive funding program, providing funding for projects that will provide quantifiable additional abatement of greenhouse gas emissions in Australia. The program guidelines state that funds are allocated on merit to projects that provide cost-effective, large-scale greenhouse gas abatement. Funds were fully allocated by 2006 and are due to be fully paid by 2013.

Table 4 summarises identified funding allocations made under GGAP, according to the industry and project supported. Some of the funding directly subsidises energy producers or consumers. The coal power industry has been awarded a total of $20.5 million for improving thermal efficiency at a coal-fired power station and pre-drying brown coal to reduce GHG emissions. This is clearly a fossil fuel subsidy, but is not a GHG emission subsidy, as it will reduce GHG emissions from the beneficiary power stations. Similarly, $58.5 million was allocated to capture and use coalmine waste gas. Again, this is a fossil fuel subsidy but not a GHG emission subsidy, as the money is being used to capture and use methane that would otherwise be directly emitted to the atmosphere.

Industry	Projects	Funding ($m)
Coal power	Improve thermal efficiency at a coal-fired power station	5
	Pre-drying of brown coal through Mechanical Thermal Expression	15.5[4]
	Sub-total	*20.5*
Mine waste gas	Capture and use of coalmine waste gas (methane) to generate electricity (five separate projects)	58.5
Metals	Increase energy efficiency of an alumina refining plant	11
	Replace oil with natural gas at an alumina refinery	7
	Waste heat power generation at a nickel plant	2.1
	Sub-total	*20.1*
Cogeneration	Establishment of natural gas fired cogeneration (combined heat and power) plants	26
Ethanol	Production of ethanol from sugar mill byproducts	7.4
	Replacement of petrol with an ethanol/petrol blend	8.8
	Sub-total	*16.2*
Transport	Program to reduce car reliance	6.4
	Cargo Sprinter	7
	WA Travel Smart	3
	Sub-total	*16.4*
Hydrochlorofluorocarbon (HCFC)	National certification program for HCFC recovery	3.7
	Destruction of synthetic gases from refrigeration	0.28
	Sub-total	*4*
Total		**161.5**

Table 4: Allocation of funding under GGAP showing industry beneficiary.

[4] This figure includes $2.2 million from the Victorian Government.

A nickel operation received $2.1 million to capture and use waste heat, which is an energy efficiency subsidy. The aluminium industry received $11 million to assist with energy efficiency improvements and $7 million to replace oil with natural gas at an alumina refinery. The latter payment is a fossil fuel consumer subsidy, as it reduces the cost to the alumina refinery of consuming natural gas. The cogeneration industry received $26 million for establishment of gas-fired cogeneration plants. This funding is a direct expenditure subsidy to natural gas consumers. However, neither of these fossil fuel subsidies are GHG emission subsidies, as gas is being used to replace fuel sources with a higher emissions intensity than natural gas. The ethanol industry received $16.2 million. This is a subsidy for renewable energy production. Funding was also provided for programs to increase use of public transport and rail freight; these are transport sector subsidies, considered in Section 5.8.

In total, $112 million of the total $161.5 million has been allocated to projects that at least partially support fossil fuel producers or consumers, although none of these subsidies are GHG emission subsidies. A further $29.2 million has been allocated to energy efficiency improvement and support for renewable energy (ethanol). While the fossil fuel subsidies delivered through GGAP should not necessarily be removed, the extent to which such a major GHG abatement program supports fossil fuel industries over renewable energy industries needs to be highlighted. These subsidies are indicative of a strong focus on short-term GHG abatement and end-of-pipe solutions, rather than the deep long-term GHG reductions that renewable energy can deliver.

The allocated funding is paid gradually over time, so the annual subsidies are significantly lower than the figures above. The 2005-06 budget for GGAP was $13.3 million. Assuming the proportions of the annual budget supporting fossil fuels and energy efficiency/renewable energy are the same as the proportions of the total funds allocated, the annual subsidies are about $9.2 million and $2.4 million respectively. The remaining $1.7 million supports either transport of HCFC emission reduction.

4.2 Non-recovery of public agency costs

Public agencies in Australia provide basic geological information, databases and other information and management services to fossil fuel exploration and production companies at nominal costs. The main public agencies involved in the provision of information and support to the fossil fuel industry are Geoscience Australia (formerly the Australian Geological Survey Organisation), the Department of Industry, Tourism and Resources and government energy departments in each Australian State and Territory. NIEIR (1996) concludes that non-recovery of agency costs incurred in supporting the fossil fuel industry is effectively a subsidy to the coal, oil and gas industries in Australia. However, this report argues that the practice only constitutes a subsidy if the service provided clearly benefits a particular group, and not others. Where this is the case, it may be appropriate to recover the full costs of the service from the beneficiaries. In other cases, support may be more generally available, and will not constitute a subsidy to fossil fuels.

Where subsidies are deemed to exist, they will reduce the costs incurred by fossil fuel production companies and act to increase the activity levels of fossil fuel production companies above what they would otherwise be. This, in turn, allows a lower price to be charged for fossil fuels and is therefore likely to increase GHG emissions above the unsubsidised level. Subsidies of this type can therefore be categorised as GHG emission subsidies. By spreading costs across taxpayers, rather than allocating them to the specific beneficiaries, these subsidies also reduce economic efficiency and therefore act as perverse subsidies. These subsidies would be an appropriate target for gradual removal, with increased revenue tied to development of alternative fuels.

There are, of course, also public agencies that support renewable energy and energy efficiency and do not fully recover the costs of this support. In these cases, a subsidy to renewable energy or energy efficiency exists. The sections below identify public sector agencies and departments that provide effective subsidies to companies in the stationary energy sector and estimate the magnitude of those subsidies using budget statements and annual reports.

4.2.1 Geoscience Australia

The total appropriation for Geoscience Australia in the 2005-06 federal budget was $107.4 million (Australian Government 2006a). The Geoscience Work Program for 2006-07 lists 66 projects, of which eleven provide direct support for petroleum exploration (Geoscience Australia 2006). These projects include the provision of technical advice to the petroleum industry, as well as research and mapping aimed at better understanding petroleum resources. Assuming an equal budget allocation for each project, the total budget allocation to projects that support the petroleum industry is about $17.9 million. Some of the other projects may also provide support for fossil fuel exploration, however, they equally provide support for other mineral exploration and other purposes. For example, other programs may involve geological mapping, which will subsequently be used by multiple industries. These projects are appropriately funded out of general revenue, as is the case at present.

The estimated subsidy includes a specific project on geological storage of greenhouse gas with a 2005-06 budget of $0.6 million (DEH 2006).

4.2.2 Department of Industry, Tourism and Resources

NIEIR (1996) estimated that the Department of Primary Industries and Energy (a predecessor to the DITR) provided advice and administration support worth $30 million to the energy sector in 1994-95. This figure does not include funding for R&D. Budget papers for 2005-06 indicate that DITR had a total administered appropriation from government of $1,314 million (Australian Government 2006a). The budget papers do not provide sufficient information to estimate how much of this budget supports fossil fuel producers and consumers. This report therefore uses two alternative methods to converge on an estimate of the subsidy associated with DITR administrative support and advice for the fossil fuel industry.

The first method is to allocate a proportion of NIEIR's original subsidy estimate to fossil fuels and then update this to 2005-06 dollars. As 95 per cent of Australia's primary energy is derived from fossil fuels, it is reasonable to assume that 95 per cent of the DITR support went to fossil fuels. This gives a subsidy of $28.5 million per year in 1994-95 dollars, or about $37.9 million per year in 2005-06 dollars.

Another approach is to examine the organisational structure of DITR, assume that total budget funding is allocated evenly between functional units, and identify the units that specifically support fossil fuels. DITR is divided into divisions, each of which has a number of subordinate branches or groups. Based on the organisational chart for DITR as of 19 February 2007, the total funding of $1,314 million is split between 52 branches or groups. Four branches within the Resources Division and four branches within the Energy and Environment Division would routinely provide advice and support to fossil fuel producers and consumers. However, most of these branches provide general support to the energy industry and not just to the fossil fuel industry. Only the Offshore Resources Branch, the Mining Industry Branch and the Fuels and Uranium Branch appear likely to provide targeted support to the fossil fuel industry. As these three branches also provide support to mineral industries and other fuels, I have assumed that half of the funding for these

branches directly supports fossil fuels. Assuming equal allocation of funding across the 52 branches or groups, the subsidy to fossil fuel producers is $37.9 million in 2005-06.

The subsidy estimates resulting from the two different approaches are identical. In the absence of better data, this report estimates the subsidy from non-recovery of DITR costs at $37.9 million. The estimated subsidy includes a specific program to develop regulations for carbon dioxide capture and geological storage, budgeted at $0.5 million in 2005-06.

4.2.3 State departments

Table 5 provides estimates of unrecovered costs for state energy departments. These estimates are derived from analysis of energy department annual reports, budget papers and strategic plans. Where cost recovery was practised, recovered costs have been removed from the estimates. In addition, state department budgets were adjusted to take into account subsidies already identified in other sections, such as the concessions discussed in Section 3.4.

The subsidy estimates include any direct subsidies to fossil fuels or renewable energy (including energy efficiency) identified from the document review. The estimates also include a portion of department staff and operating expenses equal to the proportion of departmental programs that were judged to directly support fossil fuels or renewable energy. As it was often difficult to determine funding for specific programs that support fossil fuels or renewable energy, it was generally assumed that all major programs within a department were funded equally and the subsidy was then estimated by applying the proportion of programs supporting fossil fuels or renewable energy to the total departmental appropriation from government. As a result, subsidy estimates listed in Table 5 are indicative only. Detailed state-level analysis would be required to improve these estimates.

State/Territory	Agencies	Current FF Estimate ($m)	Current RE Estimate ($m)
New South Wales	Department of Primary Industries	16.8	-
	Energy Savings Fund		10.9
	Subsidies for sustainable energy		1.2
Victoria	Department of Infrastructure	10.2	0.5
	Department of Primary Industries	26.7	-
	Department of Sustainability and Environment	-	13.7
Queensland	Department of Natural Resources, Mines and Water	40	-
	Department of Energy	3.3	3.3
Western Australia	Office of Energy	13.4	14.2
	Department of Industry and Resources	18.5	-
South Australia	Department of Primary Industries and Resources	10.4	-
	Department of Transport, Energy and Infrastructure	3.8	5
Tasmania	Department of Infrastructure, Energy and Resources	-	1.1
Northern Territory	Department of Business, Industry and Resource Development	14.8	-
Australian Capital Territory	Department of Urban Services	-	-
TOTAL		157.7	49.8

Table 5: Estimates of State and Territory energy department costs not recovered in 2005-06.

4.3 Petroleum exploration tax concessions

Tax concessions for petroleum exploration subsidise increased levels of exploration and production and keep costs lower than they would otherwise be. This allows petroleum companies either to keep the price of petroleum fuels below the benchmark level or receive a greater return on their investment. Tax concessions for petroleum exploration comprise a GHG emission subsidy. The following special deductions (from company tax) are available for companies involved in petroleum exploration and development activities:

- Immediate deduction of petroleum exploration and prospecting expenditures
- Until 30 June 2001, capital expenditure on certain petroleum transport facilities can be deducted in equal instalments over ten years, after that date such expenditure will be deducted over the effective life of the asset
- Immediate deduction of capital and current environment protection expenditures (except for plant subject to depreciation) on pollution control or waste management
- Immediate deduction of certain mine-site rehabilitation costs including expenditure associated with the removal of offshore platforms (DITR 2006).

In addition, from 29 March 2004, petroleum exploration companies receive a 150 per cent uplift on pre-appraisal exploration expenditure conducted in the first term of an exploration permit in a designated frontier area (Australian Government 2006d). No estimate of the value of this tax expenditure is available, although it is identified in the 2006 Tax Expenditures Statement (Australian Government 2006d).

The tax expenditure associated with capital expenditure deductions for petroleum transport facilities is estimated at $20 million for 2005-06 (Australian Government 2006d). The tax expenditure associated with the concessions for pollution control, waste management and environment protection expenditures is estimated at $4 million for 2005-06 (Australian Government 2006d). The other tax concessions are recognised as tax expenditures in the Tax Expenditures Statement (TES), but estimates of their value are not available.

Earlier TESs give an indication of the possible value of tax expenditures associated with deductibility of mineral and petroleum exploration costs. The 1995-96 TES estimated that the deduction of capital expenditures associated with prospecting or exploration by general and petroleum miners would result in a tax expenditure of $370 million in 2000-01 (Department of the Treasury 1997). This is the last year in which the value of the tax expenditure is reported. Although there have been some changes in the rules for deductions, this figure should still provide a reasonable estimate of the tax expenditure. DITR staff have provided similar estimates of the tax expenditure (Bill Layer, pers.comm., September 2000). In 2005-06 dollars, the tax expenditure equates to $473 million.

In 2005-06, total mineral and petroleum exploration expenditure in Australia was $2.5 billion, comprising $1,241 million for minerals and $1,262 million for petroleum (ABS 2006b). Assuming the impact on company tax is split in the same proportion, and the figure above for the tax expenditure is accurate, additional company tax revenue of $238 million could be earned if petroleum exploration costs were not deductible. This is a rough estimate of the tax expenditure associated with the deductibility of petroleum exploration costs.

Adding the $24 million identified above gives a total tax expenditure associated with tax concessions for petroleum exploration of $262 million. However, it is not immediately clear whether this is a subsidy to fossil fuels, as it must be considered in the context of overall petroleum taxation and charging. As well as the normal taxation arrangements applying to all companies, petroleum production projects are subject to a Petroleum Resource Rent Tax

(PRRT). The PRRT is applied at a rate of 40 per cent of a project's taxable profit, as a means of providing the 'Australian community with a fair and reasonable return from the development of non-renewable petroleum resources' (DITR 2006, p.27). The PRRT collected $1.991 billion in revenue in 2005-06 (Australian Government 2006c). The states also impose resource taxes on fossil fuels, so it is clear that petroleum production companies are being taxed by a significantly larger amount than they are subsidised.

If resource taxes are not included in the taxation benchmark, then petroleum exploration and production companies experience a large excess tax burden, or negative subsidy, compared to other companies. The deductibility of petroleum exploration expenses from company tax would then be a reasonable way to relieve this excessive tax burden. On the other hand, the rationale for the PRRT and other resource taxes is the allocation of a fair share of the profit associated with development of a public non-renewable resource to the public. On this basis, resource taxation is something quite different to company taxation and can justifiably be included in the taxation benchmark, as part of the design of the taxation system. Indeed, this is the approach taken in the TES (Australian Government 2006d). According to the subsidy definitions discussed in Section 2.2, the deductions available to petroleum exploration companies are tax expenditures, and therefore constitute a subsidy to fossil fuel producers.

This subsidy acts as a GHG emission subsidy by keeping oil prices lower than they would otherwise be. By lowering the cost of oil exploration below benchmark levels, the subsidy encourages investment in oil exploration at the expense of alternatives. This reduces market efficiency, masking price signals that could encourage a shift to alternative energy sources. Given that petroleum is a finite resource, it is important to allow the market every opportunity to develop alternatives. As such, it is reasonable to categorise this subsidy as perverse.

Although the subsidy is perverse, it must be recognised that petroleum remains vital to Australia's economic performance and that petroleum alternatives have not yet been deployed on a significant scale. Sudden removal of the subsidy could have a negative impact on Australia's balance of payments and indeed on social equity for low-income households that have little alternative but to pay higher fuel prices. If this subsidy were to be removed, it would need to be done gradually, with transfer of funds to the development of petroleum alternatives and measures to protect vulnerable households.

4.4 Research and development

In 1994, Australian governments provided $180 million for energy R&D, of which only $27 million (15 per cent of the total) funded renewable energy and energy efficiency applications (NIEIR 1996). These figures include not only direct expenditure on energy R&D but also the value of research-related tax deductions in 1994. Expenditure by private companies on R&D can be claimed as a deduction against company tax at a concessional rate of 125% of expenditure.

While Australian governments have increased funding for renewable energy R&D in recent years, it appears that fossil fuel R&D continues to receive the major proportion of government funding support. To check whether the situation has changed significantly since NIEIR released its report in 1996, the sections below provide a review of current funding for the Australian Cooperative Research Centre (CRC) program and the CSIRO. The subsidy estimates developed in this section cover all stationary energy use, including electricity generation.

4.4.1 CRC funding

CRCs bring together researchers from universities, government and the private sector to research specified topics over a period of years. CRCs involved in R&D that wholly or partially benefits stationary energy industries are listed in Table 6, along with the value of their public funding in 2005-06. Notably, none of the CRCs supports renewable energy. Funding for the Australian CRC for Renewable Energy ceased on 30 June 2003 and no CRC focused on renewable energy has been funded since that time. As shown in Table 6, three CRCs with total government funding of $7.2 million per year were involved in research and development that supported fossil fuels in 2005-06.

CRC	Government Funding 2005-06 ($m)
Coal in Sustainable Development	2.1
Greenhouse Gas Technologies (CO2CRC)	3.1
Clean Power from Lignite	2.0
TOTAL	7.2

Table 6: CRCs involved in research and development that wholly or partially benefits the fossil fuel industry in 2005-06.

4.4.2 CSIRO funding

Another example of the imbalance in R&D funding is evident in Australian Government funding allocated to the CSIRO, Australia's flagship research organisation. In 2003-04, the Australian Government allocated $569 million to the CSIRO, including $75 million for sustainable minerals and energy (Australian Government 2004). The allocation for sustainable minerals and energy was divided between Energy Technology, Exploration and Mining, Minerals and Petroleum Resources divisions and the Energy Transformed Flagship research program. Estimates of the proportion of the sustainable minerals and energy funding that directly supports fossil fuels and renewable energy were developed based on a review of CSIRO's Annual Report (CSIRO 2003a), Strategic Plan (CSIRO 2003b) and website (CSIRO 2004). The analysis concluded that, in 2003-04, government R&D support delivered through the CSIRO amounted to about $21.5 million per year for fossil fuels and $5.7 million per year for renewable energy.

It was not possible to update this analysis for 2005-06, due to changes in the information reported through the CSIRO website.

4.4.3 Total R&D subsidies

Total expenditure on energy resources and energy supply R&D in Australia in 2004-05[5] was $1,075 million (ABS 2006d). Based on ABS figures, governments provided about $197 million of this R&D funding in 2004-05 (ABS 2006d), or $204 million in 2005-06 dollars. Additional government research funding is provided through tax concessions for business R&D. In 2005-06, these tax expenditures amounted to $465 million in total (Australian Government 2006d). In 2004-05, about 10.6 per cent of total business R&D expenditure was allocated to the energy resources and energy supply sectors (ABS 2006d). Assuming the tax concessions were taken up by businesses in the same proportion, the tax expenditure for stationary

[5] Data for 2005-06 is not yet available.

energy R&D would amount to an additional $49 million. This gives a total of $253 million in government R&D funding for the stationary energy sector.

Assuming the split of R&D funding between fossil fuels and renewable energy estimated for CSIRO in 2003-04 is typical, the fossil fuel subsidy from R&D funding would be about $200 million and the renewable energy subsidy would be about $53 million. Given that the other major Australian research program considered above – the CRC program – allocates no funding to renewable energy, this may be an overestimate of renewable energy R&D funding. Taking the average of the proportion of funding allocated to fossil fuels and renewable energy by the CRC program and CSIRO, the respective subsidies would be $226 million and $27 million.

The fossil fuel subsidy estimated here is not necessarily a GHG emission subsidy. Many of the R&D programs supporting fossil fuels are aimed directly at reducing the environmental impact of fossil fuel production and consumption, while others will improve efficiency of fossil fuel use and will indirectly reduce GHG emissions. While there are strong arguments for allocating a greater proportion of total funding to renewable energy and energy efficiency, R&D to reduce the greenhouse signature of fossil fuel use remains vital in the short- to medium-term.

4.5 Direct subsidies to fossil fuel development projects

4.5.1 Stuart Oil Shale Project

The Stuart Oil Shale Project in Queensland received a series of direct subsidies from the Australian and Queensland Governments. The project aimed to process a major oil shale deposit located near Gladstone to produce medium shale oil and naptha in approximately equal fractions. The project was granted a rebate on excise tax for up to 600,000 barrels per year of gasoline produced from oil shale until 2005 (Greenpeace Australia 2001; SPP/CPM 2001). At an excise rate of 37.5 cents per litre, this exemption could potentially be worth $35.8 million per year. Actual production in 2003 was 422,280 barrels before the proponents of the project went into receivership in late 2003. The subsidy would therefore have been worth $25.2 million in 2003. Shale oil from the project is also exempt from Queensland Government royalties, which normally amount to 10% of the wellhead value. At an average sale price of $52 per barrel in 2002 (SPP/CPM 2001), and 2003 sales of 422,280 barrels, this exemption was worth another $2.2 million.

Production at the plant ceased in 2004 and the future of the project remains uncertain. There was no subsidy in 2005-06. However, the subsidy is noted here in case the project is reactivated in the future.

Stage 1 of the Stuart Project received a grant of $7 million from the Commonwealth Government for research and development (SPP/CPM 2001). The previous estimate of total annual R&D support for fossil fuel projects includes grants like this one, so it is not added to the subsidy total to avoid double counting. It has also been reported that the Queensland Government provided $11 million to construct a dedicated bulk liquid tanker berth for the project (Queensland Greens 2001). As a one-off payment, this subsidy is also excluded from the 2005-06 subsidy estimates listed in Table 7.

4.5.2 Tasmanian Natural Gas Project

In January 2004, Powerco received a payment of $8 million from the Tasmanian Government for the Tasmanian Natural Gas Project, which is providing gas reticulation for industrial and residential customers. A further payment of $18.4 million was provided in May 2005 as an advance on Stage 2 of the project (Powerco 2006). These subsidies are not included in the estimates in Table 7, as they did not take place during 2005-06.

4.6 Energy Grants Credits Scheme: off-road component

Until 30 June 2006, the Australian Government's Energy Grants Credits Scheme (EGCS) provided grants for fuels used in specified on-road and off-road activities. From 1 July 2007, the EGCS was substantially replaced by a new Fuel Tax Credits Scheme (see Section 5.17). However, for the 2005-06 subsidy estimates, the EGCS remains relevant.

This section considers the off-road component of the EGCS and Section 5.7.1 considers the on-road component. The off-road component of the EGCS comprised a rebate for customs or excise duty paid on diesel or 'like fuels' (e.g. fuel oil) used in specified off-road activities, such as mining, agriculture, rail transport and electricity generation. Excise duty is collected for fuels produced in Australia and customs duty is collected for fuels imported into Australia. The customs and excise duty rate is 38 cents per litre for most fuels. In 2004-05, the cost of the off-road component of the EGCS was $2.51 billion and of the on-road component was $902 million (ATO 2006). The total cost of the ECGS in 2005-06 was $3,536 million (Australian Government 2006a). Assuming the same proportions went to the on-road and off-road components in 2005-06 as in 2004-05, the off-road component in 2005-06 was $2.6 billion.

Offsetting this amount slightly is the payment of excise on fuel oil, heating oil and kerosene that is used as a fuel but not used as a fuel in internal combustion engines. The benchmark excise rate for these fuels is zero, however they were subject to an excise of 7.557 cents per litre during 2005-06 (Australian Government 2006d). This excise could be claimed back through the ECGS, resulting in a net zero excise. The amount of excise collected on these fuels in 2005-06 was $90 million (Australian Government 2006d), so the net payments for the off-road component of the ECGS were $2.51 billion.

However, according to the definitions in Section 2.2, this is not a direct subsidy. The rationale for the off-road component of the EGCS is that off-road use of diesel fuel should be exempt from excise as the revenue collected through excise is used to fund roads, which are not used by off-road users. In addition, competing end-use energy sources such as natural gas and electricity are not subject to excise duty, so the rebate is a way of avoiding subsidisation of these other sources (NIEIR 1996). NIEIR concluded, and this report concurs, that the off-road component of the EGCS (then known as the Diesel Fuel Rebate Scheme) should not be seen as a financial subsidy (NIEIR 1996).

The off-road component of the ECGS does, however, reduce the net amount of fuel excise collected by the Australian Government, and this has implications for cost-recovery from road users. The ECGS is a major reason for the shortfall in income received from road users in Australia, which is discussed in more details in Section 5.4. It should also be noted that the off-road component of the ECGS is likely to increase in the future under the new Fuel Tax Credits Scheme, as discussed in Section 5.17.

Although the off-road component of the ECGS is not a subsidy according to the definitions in this report, this does not mean that the price of diesel used for off-road applications adequately reflects environmental and social externalities associated with its use. Further, a large proportion of the ECGS is paid to mining activities that will increase greenhouse gas

emissions. In 2004-05, the coal mining sector received $309 million in payments from the ECGS. Oil and gas extraction received a further $7 million (ABS 2006c). This means that fossil fuel mining received 12.6 per cent of the off-road component of the ECGS in 2004-05. For the coal mining sector, this amounts to 6.2 per cent of operating profit, before tax (ABS 2006c). Clearly, the ECGS is a very significant source of support to the coal mining industry in Australia.

4.7 Take or pay contracts

Australian governments have supported several major fossil fuel development projects in Australia through the negotiation of **take or pay** contracts. These contracts shift a proportion of the risk involved with major development projects from the developer to the customer by obligating the customer to pay for a specified quantity of the energy, whether or not that quantity is actually consumed. Where the customer is a government, this guarantee of purchase constitutes a subsidy.

In Western Australia, the then State Electricity Commission entered into a take or pay contract to buy gas from Woodside Petroleum to assist the development of the North West Shelf natural gas reserves. The Victorian Government was previously involved in a take or pay contract with Edison Mission Energy to take electricity from the Loy Yang B power station, in addition to take or pay contracts to purchase large volumes of natural gas.

More recently, the Tasmanian Government (through Hydro Tasmania) has underwritten the development of the Basslink project by entering into a contract in which Hydro Tasmania pays a facility fee to National Grid, and National Grid pays Hydro Tasmania the trading revenue from energy transfers through Basslink between Tasmania and Victoria and vice versa. The Tasmanian Government has also underwritten the Duke gas pipeline through a take or pay contract (Blakers 2003). In 2005-06, payments under the Basslink Services Agreement, the Basslink Facility Fee Swap and the Gas Pipeline Capacity Agreement totalled $90.2 million (Hydro Tasmania 2006). The revenue to Hydro Tasmania from energy transfers is unclear, but is unlikely to have offset these payments in 2005-06, since Basslink only opened in the final quarter of the financial year.

These various contracts lower the cost of large energy development projects by reducing the risk faced by the developer. As take or pay contracts are invariably commercial in confidence it is not possible to reliably estimate the size of the subsidy associated with existing contracts. In the case of Basslink, it is also unclear whether the subsidy will act as a GHG emission subsidy. The Basslink project links the Tasmanian electricity grid and its predominantly renewable energy sources to the NEM. This could facilitate greater development and use of Tasmania's renewable energy resources by providing access to a much larger market. Alternatively, it could result in significant importation to Tasmania of lower cost electricity generated using fossil fuel, thereby reducing use of renewable energy. As it is unclear whether the Basslink subsidies will support fossil fuels or renewable energy (most likely they will support both), this subsidy has not been included in the estimates in Table 7.

4.8 Low Emission Technology Abatement initiative

The Low Emission Technology and Abatement (LETA) initiative was introduce by the Australian Government to encourage small-scale technologies that reduce energy demand and emission intensity, in business, industry and local communities. LETA has four sub-programmes:

- Strategic Abatement
- Renewables
- Fossil Fuels
- Geosequestration: Monitoring Pilot Project.

Spending on LETA in 2005-06 was $2.2 million. Based on the sub-programmes above, half has been identified as a fossil fuel subsidy and half as a renewable energy subsidy.

4.9 Other renewable energy support programs

The Environment Budget Statement (DEH 2006) provides details of other renewable energy support programs funded by the Australian Government in 2005-06. These include:

- $1 million for the Renewable Energy Commercialisation Programme (half of the total support – the remainder is included in Section 3.7)
- $1.65 million for the Renewable Energy Equity Fund (half of the total support – the remainder is included in Section 3.7)
- Approximately $11 million for the Renewable Energy Development Initiative (half of the total support - the remainder is included in Section 3.7).

4.10 Magnitude of other stationary energy subsidies

Table 7 summarises other stationary energy subsidies and identifies those fossil fuel subsidies that are GHG emission subsidies and perverse subsidies.

Subsidy or Incentive	Support for fossil fuels 2005-06 ($m)	Support for renewables 2005-06 ($m)	Subsidy Category	
			GHG Emission?	Perverse?
Greenhouse Gas Abatement Program	9.2	2.4	No	No
Geoscience Australia – non-recovery of costs	17.9	-	Yes	Yes
DITR – non-recovery of costs	37.9	-	Yes	Yes
State energy departments / agencies – non-recovery of costs	157.7	49.8	Yes	Yes
Special company tax deductions for petroleum exploration	262.3	-	Yes	Yes
Research and development	200-226	27-53	No	No
Low Emission Technology and Abatement	1.1	1.1	No	No
Other renewable energy support programs	-	13.7	No	No
CATEGORY TOTALS ($m)	**686-712**	**94-120**	**476**	**476**

Table 7: Summary and categorisation of other stationary energy subsidies.

5 Transport subsidies

This section focuses primarily on subsidies for road transport users. It takes a cost recovery perspective to estimate the magnitude of the road user subsidy in Australia, arguing that road users should pay the full cost of that use. This section considers subsidies for other transportation modes (e.g. aviation and public transport) in passing, where there are evident fossil fuel or renewable energy subsidies, but does not attempt a comprehensive estimate of these subsidies.

Subsidies for road transport users do not automatically encourage production or consumption of fossil fuels. Rather, a subsidy that reduces the cost to motorists of road transport will encourage increased use of the road network (in terms of total vehicle kilometres travelled). Theoretically, vehicles using the road network could use any one of a variety of fuels, fossil or renewable. If all vehicles used renewable fuel sources, then subsidies for road transport users would not encourage increased use of fossil fuels and would not raise GHG emissions above the benchmark level.

In practice, Australian road vehicles are almost entirely reliant on fossil fuels. In 2005-06, the only fuels making a significant contribution to total road transport energy use were LPG (5.6 per cent of the total), natural gas (0.1 per cent of the total) and other petroleum products (94.3 per cent of the total); use of renewable fuels was negligible (Cuevas-Cubria & Riwoe 2006). Even so, this does not automatically mean that any subsidy for road transport use is also a direct subsidy to fossil fuel use. Some of the road transport subsidy may improve access to the road network for users that would otherwise be unable to use the system. While this could be expected to increase total fossil fuel consumption, the effects of congestion due to the greater number of road users could actually keep fossil fuel consumption stable, or even decrease it. The larger number of users would each travel less to avoid congestion. Further, subsidies for R&D may improve road transport efficiency, creating a net reduction in GHG emissions. This report will consider whether particular subsidies are GHG emission subsidies in the sections below.

Sections 5.1 to 5.6 report on an analysis of the structure of the road taxation and charging system, undertaken to identify the magnitude of the road user deficit – the difference between the cost of providing and maintaining the road network and the revenue obtained from road users. Section 5.7 identifies specific government actions that contribute to the road user deficit identified in Section 5.6. Sections 5.8 to 5.17 discuss additional road transport user subsidies not included in the estimate of the road user deficit. Finally, Section 5.18 summarises the magnitude of transport subsidies considered in this research.

5.1 Is the road user deficit a subsidy?

As noted above, the road user deficit is the difference between the total cost of providing and maintaining the road network and the revenue collected from road users. The largest source of road-related revenue is the Federal excise on petroleum products and crude oil, which raised $14.07 billion in 2005-06 (Australian Government 2006b). The excise adds 38 to 40 cents to the cost of each litre of fuel used by road users.

Some policy makers argue that fuel excise is a general revenue-raising measure that should not be linked to the level of road funding. For example, this was the conclusion of an independent Fuel Tax Inquiry established by the Australian Government in 2002 (Fuel Taxation Inquiry Committee 2002). Other authors adopt a user-pays perspective, arguing that fuel excise revenue should be directly allocated to road funding (e.g. Pender 1999). Pender (1999) surveys the various government taxes on vehicle ownership and use and distinguishes between economic charges and taxes. He argues that revenue collected by

governments that accounts for road network costs and social costs is effectively a charge; any revenue collected above that amount is a tax. Pender argues, and this report takes the same position, that the Federal fuel excise has the economic characteristics of a road user charge, whatever its stated aims. That is, from an economic perspective, road users experience fuel excise as a charge for their road use rather than a contribution to general taxation revenue.

Pender also distinguishes between revenue from access charges and revenue from usage charges. Access charges in Australia include import tariff revenue on vehicles, Goods and Services Tax (GST) on purchase of vehicles, state registration fees and stamp duty. Usage charges include federal fuel excise and GST on fuel and other consumables (tyres, oil, parts etc).

According to the subsidy definitions in Section 2.2, road users experience a subsidy if total government revenue from road access and usage charges is less than the total public cost of establishing and maintaining the road network. That is, road users experience a subsidy if road charges are not set high enough to cover costs (or the road user deficit is positive). As total distance travelled on roads is sensitive to user charges (Pender 1999), any subsidy will increase the total distance travelled above the benchmark level and hence increase GHG emissions. If total revenue exceeds the total costs, then there is an excess tax on road use and no subsidy exists.

This definition of the road user deficit as a subsidy is consistent with neo-classical economic theory and the objective of competitive neutrality between transport modes in a market system. Alternatively, the road network may be treated as a public good, in which case there are arguments for using general revenue to partially fund road transport. However, this argument is difficult to sustain in light of the huge negative externalities associated with road transport, including accident costs, congestion, air and noise pollution and GHG emissions. Hamilton et al (2002) estimate these costs amount to $30 billion per annum in Australia. The next section examines the costs of the road network in more detail.

5.2 Market costs and externalities

NIEIR (1996) and Pender (1999) identify the following costs associated with establishment, operation and maintenance of the road network:

- The capital cost of road network infrastructure provision
- Road network maintenance costs
- Depreciation of road network infrastructure
- Health and ecological costs of local air pollution associated with vehicles
- Costs of climate change associated with greenhouse gas emissions from the road network
- Loss of aesthetic values
- Disruption of landscape and wildlife
- The cost of accidents (both direct hospital and medical costs and the cost of lost productivity)
- Costs of increased noise
- Time costs of congestion.

Theoretically, in a free market system, charges for road access and use should cover all of these costs, while also ensuring a normal rate of return on the road network assets (land and infrastructure). In practice, some of these costs are very difficult to estimate in monetary terms and have traditionally been classed as externalities.

Previous estimates of the size of the road user deficit in Australia vary significantly due to differing choices of which costs to include and varying methods used to estimate the value of these costs (e.g. Diesendorf 2002; Hamilton, Denniss & Turton 2002; Industry Commission 1994; Laird et al 2001; NIEIR 1996; Pender 1999). Among authors of previous estimates, there is little dispute that road users should pay the capital cost of road infrastructure expansion and the recurring cost of road maintenance. Further, the road network and the land on which it is sited is a capital asset that should be required to earn a normal rate of return on investment (NIEIR 1996; Pender 1999). Most of the authors accept that road users should be charged at a sufficient rate to provide this return on investment.

There is less agreement on which environmental and social costs should be included. Most estimates treat the cost of climate change induced by greenhouse gas emissions from vehicles as an externality. Given the difficulty of estimating the cost of climate change, this exclusion is understandable. Most estimates also exclude the health costs associated with vehicle emissions. As this report is focused on financial subsidies, it also excludes climate change and health costs.

However, some estimates include the cost of noise pollution, the time costs of traffic congestion and the property damage and medical/hospital costs of two-car accidents. As these costs can be estimated (with difficulty), it may be reasonable to include them in the total cost of the road network. The next section reviews previous estimates of road user subsidies in Australia with a particular focus on their treatment of the various costs associated with the road network.

5.3 Previous estimates of the road user deficit

Table 8 summarises previous estimates of the road user deficit in Australia and identifies some of the reasons for variation between the different estimates. Clearly, as noted above, there is substantial variation between the different estimates. While the subsidy estimate by Laird et al (2001) is arguably the most comprehensive in terms of the range of external costs included and the geographical coverage, Pender's (1999) estimation method is the most sound given the discussion of benchmarks in Section 2.2.2.

Pender argues that identifying the magnitude of the subsidy to road users is not as simple as subtracting total road user revenue from an estimate of the total cost of the road network. Instead, it is necessary to compare the treatment of road users against an appropriate benchmark, defined as 'the tax treatment of private activity plus an allowance for the social costs generated by vehicle use' (Pender 1999, p.31). Pender develops accounts for a hypothetical privatised road authority to facilitate comparison with the benchmark. His approach is consistent with the subsidy definitions in Section 2.2. Pender used data for 1994-95 and found a small excess tax on road users. There have been substantial changes to road taxation since that time. Therefore, in the next two sections, this report applies Pender's method to develop an updated estimate of the magnitude of the road user subsidy in Australia.

Source	Annual Subsidy ($m)[1]	Comments
Diesendorf (2002)	4,800 to 5,900	The estimate is for 1996, for Sydney only. It includes costs of land used for private parking, infrastructure, rolling stock, operations and maintenance. Heavy vehicles determined the construction and maintenance costs of major roads and cars determined the costs of local roads.
Submissions to Industry Commission (1994) report on urban transport	-800 to 10,000	Various estimates were provided in submissions, with varying choice of costs to include and varying methods employed to estimate particular costs, especially congestion costs.
Laird et al (2001)	8,000 to 19,000	The date of the estimate is unclear, although it is likely for 2001. It includes road system costs, road crash costs (partially recovered through insurance premiums), other health impacts and impact of FBT arrangements. The high figure includes road congestion costs; the low figure excludes these costs. The road user deficit is calculated as total costs minus total revenue.
NIEIR (1996)	1,200	The estimate is for 1994 in 1994 dollars. It includes the cost of damage to the road network that requires maintenance and capital return on infrastructure and land under infrastructure. It does not include costs of congestion or noise. It is unclear whether the maintenance cost included an allowance for network augmentation.
Pender (1999)	-100	The estimate is for 1994-95 in 1994-95 dollars. It includes road maintenance costs, the cost of capacity expansion and a return on investment for road infrastructure. Pender uses hypothetical road authority accounts to facilitate comparison of road user charges with an appropriate taxation benchmark.

Notes:

1. A negative number in this column constitutes an excess tax; a positive number constitutes a subsidy.

Table 8: Summary of previous estimates of the road user deficit in Australia.

5.4 Road user revenue

It is a relatively straightforward matter to estimate the revenue from road users, as most of the data is available in budget papers and regular reports. The different revenue components are discussed below; they are summarised in Table 9.

5.4.1 Tariff revenue

In 2005-06, the tariff rate for most imported passenger motor vehicles (PMVs) was 10% of the customs value. The tariff rate for imported four-wheel drive vehicles (4WDs), light commercial vehicles (LCVs) and most other road vehicles was 5% of the customs value. Total revenue from customs duty on passenger motor vehicles was $1,258 million in 2005-06 (Australian Government 2006b). Road users experience this tariff as an increase in the price paid for imported cars above what they would pay if free trade in motor vehicles were permitted.

5.4.2 GST and Luxury Car Tax

In his calculation of total road user charges, Pender included an excess component of the Wholesale Sales Tax (WST), which was abolished when the GST was introduced in 2000. The excess WST component was calculated relative to a 10 per cent GST, chosen as the benchmark for fair consumption tax treatment. Pender's rationale was that the WST fell relatively heavily on road users compared to other taxpayers and that a broad-based GST would provide fairer tax treatment. The current 10 per cent GST is a broad-based consumption tax that meets Pender's criteria for a fair consumption tax benchmark and is included in the taxation benchmark in the TES (Australian Government 2006d). Under the current GST, motorists are taxed at the same rate as other taxpayers. The GST does not, therefore, constitute a road user charge.

Before the GST was introduced, a higher rate of WST applied to luxury cars. To preserve government revenue, a Luxury Car Tax (LCT) was introduced. In 2005-06, revenue from the LCT was $320 million (Australian Government 2006b). This constitutes an access charge for road users.

5.4.3 Motor vehicle registration and licence revenue

Pender estimated registration fees, collected by State governments, at $2.2 billion ($1.8 billion for cars and $0.4 billion for trucks). Current figures for registration fees and stamp duty on motor vehicle registrations and transfers are available from the Commonwealth Grants Commission (Commonwealth Grants Commission 2007). For 2005-06, heavy vehicle registration fees and taxes were $665 million, light vehicle registration fees and taxes were $3.15 billion and stamp duty on motor vehicle registrations and transfers was $1.92 billion (Commonwealth Grants Commission 2007). Total state revenue from these sources was $5.74 billion in 2005-06. Heavy vehicles can also choose to register under the Federal Interstate Registration Scheme, which collected $4 million in registration charges in 2005-06 (Australian Government 2006a). The Commonwealth Grants Commission does not provide an estimate of licence fees; licence fee revenue was estimated at $320 million to $463 million based on data on the proportions of different sources of motor vehicle revenue in 2003-04, which is the most recent year for which data is available (BTRE 2006). The variation in the estimates is a result of differing assumptions about which components of revenue is representative of how the other components would have grown. To ensure the estimate of the road user deficit is conservative, the high estimate of $463 million is used in this report.

5.4.4 Federal fuel excise

Total Federal fuel excise collected from petroleum products and crude oil in 2005-06 was $14.07 billion (Australian Government 2006b). However, this figure includes excise returned to on-road and off-road users of fuel through the EGCS. A total of $3.536 billion was returned through the ECGS in 2005-06 (Australian Government 2006a). Therefore, the net fuel excise collected in 2005-06 was $10.534 billion.

An additional $524 million of Australian Government fuel excise is returned through the Queensland Fuel Subsidy Scheme, which aims to keep fuel prices in Queensland at the lower levels that existed before the Federal Government took over all petrol taxes (Queensland Government 2006a). When this figure is removed, net fuel excise collected from road users was about $10.01 billion in 2005-06.

5.4.5 Road tolls

Pender does not include an estimate of toll revenue. Based on the most recent revenues figures from the BTRE (for 2003-04), toll revenue in 2005-06 would be between $800 million and $1,157 million (BTRE 2006). As with the licence fee estimates in Section 5.4.3, the variation depends on assumptions about which components of revenue are representative of the growth in overall revenue. Again, the high estimate ($1,157 million) is taken to ensure a conservative estimate of the road user deficit.

5.4.6 Parking fees

Parking fees collected by local governments are another source of revenue from road users. It is difficult to arrive at an estimate of the annual magnitude of these fees, as numerous councils across Australia hold the required data. The work by Diesendorf (2002), which considers the value of land used for parking, indicates that the fees charged for parking are very unlikely to compensate for the lost opportunity cost of the land provided for parking. This analysis excludes both parking fees and the value of land used for parking from this analysis, while noting that inclusion of these costs and benefits would tend to increase the magnitude of the road user deficit. As such, the estimate of the road user deficit is a conservative one.

5.4.7 Summary of road user revenue

Table 9 summarises the estimates of revenue from road users in Australia for 2005-06. The total revenue was $18.991 billion.

Revenue Source	Value ($m 2005-06)
Vehicle import tariffs	1,258
Luxury car tax	320
Heavy vehicle registration fees and taxes	665
Light vehicle registration fees and taxes	3,150
Stamp duty on motor vehicle registrations and transfers	1,920
Federal Interstate Registration Scheme	48
Licence fees	463
Net fuel excise	10,010
Toll revenue	1,157
TOTAL	**18,991**

Table 9: Sources of revenue from road users in Australia, 2005-06.

5.5 Determining appropriate revenue

Pender's hypothetical privatised road authority is subject to regulation and must abide by the regulator's decisions. The regulator makes decisions regarding road network improvement and capacity expansion. The road authority incurs expenses associated with road maintenance and any capacity expansion directed by the regulator. As a private entity, it must also pay state land tax on the 'single dwelling residential use' value of land under roads in urban areas (Pender 1999). In addition, the road authority must pay the state a normal rate of return on the value of the land under roads and the written down value of road materials.

To cover these expenses, the road authority is allowed to establish a charge for access to the road network and a charge related to the distance travelled on the road network. Pender also argues for the establishment of congestion, accident and noise levies, set by the regulator, as a component of the road authority's revenue. His intention is not that these levies will cover the full costs of congestion, accidents and noise, which are currently treated as externalities. Rather, they provide a way of structuring the total road user revenue so that it begins to reflect some of the social costs of road use. The structure of road user charges is certainly important, but it is the total required revenue that is of most interest for estimating the road user deficit. The sections below estimate the magnitude of the hypothetical road authority's expenses so that the appropriate level of revenue can be determined and compared to the actual revenue from Section 5.4.

5.5.1 Road maintenance and capacity expansion costs

The National Transport Commission (NTC) provides the most recent information on total government expenditure on road maintenance and road network expansion. In 2004-05, government spending on rural and urban arterial roads amounted to $4.856 billion (NTC 2006), or $5.011 billion in 2005-06 dollars. In 2003-04, government spending on rural and urban local roads was $4.359 billion (NTC 2006), or $4.608 billion in 2005-06 dollars.

Therefore, estimated total annual road spending for 2005-06 is about $9.619 billion, assuming road spending has grown at the same rate as the Consumer Price Index (CPI) between 2003-04 and 2005-06.

5.5.2 Land tax

Pender's hypothetical road authority must pay state land tax at 1.5% on the 'single dwelling residential use' value of land covered in tarmac in urban areas (Pender 1999). Land tax rates vary from state to state and with the value of the land. Based on a review of land tax rates across Australia, a land tax rate of 1.7 per cent (the rate that currently applies in NSW) seems more representative of current land tax rates than Pender's assumption. However, to be conservative, the land tax rate of 1.5 per cent has been retained.

In 2005-06, the total value of residential land in Australia was $1,574 billion and the average value per person was $76,863 (Commonwealth Grants Commission 2007). Based on an average household size in 2004 of 2.5 persons (ABS 2006a), the average residential land value in Australia in 2005-06 would be about $192,157. However, this assumes that all households are single residential households. In fact, about 80% of dwellings were separate houses in 2004 and a further 8.3% were semi-detached. The remaining 11.2% were in multi-residential buildings (ABS 2006a). This means that the average number of people living on a particular piece of residential land is actually higher than 2.5, which means that the average residential land value would be higher than the figure above. However, to ensure a conservative estimate of the road user deficit, the above estimate is reasonable.

It is also reasonable to assume that land values in urban areas will be higher than the Australian average. ABS data on the value of dwellings indicates that the median value of dwellings in capital cities is about 13 per cent higher than the Australian average (ABS 2007). Assuming that land values are also 13 per cent higher gives an average urban residential land value of about $217,777 for 2005-06.

To provide a further check on this estimate, average land values that are publicly available have been obtained. Values were not available free of charge for most capital cities, however the average land value for metropolitan Sydney in 2005-06 was $522,159 and for Brisbane in 2007 was $225,000. These values indicate that the above estimate is likely to be conservative.

In 2003, the total lane length of urban arterial roads was 39,853 km and of urban local roads was 181,056 (Austroads 2005). This gives a total urban lane length of 220,909 km. These are the most recent available figures for road lane length. Assuming, after Pender, that average lane width is 3 metres, the total urban road area is about 0.66 billion square metres. Assuming, also after Pender, that the average urban lot size is 1,000 square metres[6], the area under the urban road network is equivalent to 662,727 urban residential properties. Applying the land value derived above and the assumed land tax rate of 1.5 per cent, total land tax payable by the hypothetical road authority is about $2.165 billion.

5.5.3 Normal rate of return

By valuing land allocated to the urban road network at its alternate use of single dwelling residential, Pender estimated the value of the urban road network at $88 billion and the rural road network at $63 billion. These figures include the written-down value of the tarmac and other materials in the road network. The road authority is required to pay the state a 5 per cent real pre-tax return on the value of the road network. Using the figures

[6] This is higher than most of the sources reviewed during preparation of this report and therefore gives a conservative estimated of the number of properties that could fit on land under the urban road network.

above, Pender's estimate of the size of this payment in 1994-95 was $7.6 billion (Pender 1999).

In this report, Pender's estimate of the value of land under the urban road network has been updated using the figures discussed above for calculation of land tax. The value of land under the urban road network comes to $144.3 billion in 2005-06.

It is unlikely that the value of land under the rural road network has increased at the rate observed in urban areas. Therefore, this report takes Pender's estimate of the value of the rural network and updates it to 2005-06 dollars, giving a value of $84 billion.

In 2000, Austroads (2000) estimated the 1997 written down value of road infrastructure (roads and bridges), excluding land value, as $59.106 billion. In 2005-06 dollars, this amounts to $75.5 billion. Pender's estimate of the value of the rural road network includes the value of the tarmac and other materials in the road network. Therefore, it is only necessary to add the value of urban road infrastructure to the estimates above. About 13.4% of the total lane-kilometres in Australia are in urban areas (Austroads 2005). Assuming the value of the road network is distributed in the same way, the value of the urban road network is about $10.117 billion.

Thus, the total value of the road network, including the value of land under the network, is $238.4 billion. At a 5 per cent rate of return, the hypothetical road authority needs to achieve an annual return of $11.9 billion on its road assets.

5.5.4 Summary of hypothetical road authority expenditure

Table 10 summarises the components of the hypothetical road authority's expenditure for 2005-06. The road authority must earn $23.7 billion per year to cover the cost of road network maintenance and expansion and payments to State Governments of land tax and a 5 per cent rate of return on road and land assets.

Expenditure Item	Value ($m 2005-06)
Road maintenance and capacity expansion costs	9,619
Land tax payable	2,165
Rate of return required	11,900
TOTAL	**23,684**

Table 10: Hypothetical road authority expenditure items for 2005-06.

5.6 The road user deficit

A conservative estimate of the total revenue requirement for the hypothetical road authority in 2005-06 is $23.684 billion. Actual income from road users in 2005-06, from Section 5.4, was $18.991 billion. Thus, an updated estimate of the road user deficit is $4.7 billion. For comparison, Pender found an excess tax of $100 million on motorists in 1994-95. The change from an excess tax to a significant subsidy partly reflects changes in taxation arrangements since 1994-95, including abolition of the WST, reductions in fuel excise and suspension of fuel excise indexation. The significant increase in urban land value since the time of Pender's estimate also has an impact. Road user charges have failed to keep pace with increases in the value of land under the road network (reflected in the land tax and rate of return on assets) and increases in expenditure on the road network.

The subsidy to road users reduces the cost of using the road network below what it would be in the benchmark case. Pender notes that the stock of vehicles does not appear to be sensitive to the cost of accessing or using the road network, so a subsidy to road users is unlikely to have much impact on the number of vehicles in Australia. However, the distance travelled is sensitive to distance-related costs (such as fuel price). This means that a subsidy to road users will tend to increase the distance travelled by road users and hence the GHG emissions (as road transport in Australia is almost entirely reliant on fossil fuels). It is reasonable to conclude that the road user deficit is a GHG emission subsidy, as long as fossil fuels remain the primary energy source for road transportation.

Subsidisation of road users is economically inefficient, as it prevents optimal use of the road network and other transport networks. In addition it will tend to increase congestion, accidents and noise, all of which have substantial economic costs. The Bureau of Transport Economics (BTE) estimated a congestion cost in Australia's major urban areas of $12.8 billion dollars per year (BTE 2000b). The estimate was based on the value of excess travel time and other resource costs, such as fuel use, incurred by the actual traffic in comparison to free-flow conditions. Another report by the BTE conservatively estimates the cost of road crashes in Australia at $15 billion per year (BTE 2000a). The estimate of the road user deficit developed here does not include any of these costs, or the costs of climate change, which are currently treated as externalities. Additional revenue from road users could be used to fund the development of sustainable fuels and transport alternatives that have fewer negative externalities.

The next section considers some of the specific government actions that contribute to the road user deficit. Subsequent sections will consider additional road user subsidies that are not included in the estimate of the road user deficit.

5.7 Specific actions included in the road user deficit

Some of the government actions that contribute to the road user deficit can be explicitly identified. These actions are discussed below. These do not constitute additional subsidies; they are included in the estimate discussed in Section 5.6.

5.7.1 Energy Grants Credits Scheme: on-road component

Section 4.6 discussed the off-road component of the EGCS. This section discusses the on-road component, formerly known as the Diesel and Alternative Fuels Grants Scheme (DAFGS). The on-road component of the EGCS provided grants for use of diesel, CNG, LPG, liquefied natural gas (LNG), ethanol and biodiesel used in road transport by heavy vehicles. The scheme provided particular support for use of these fuels by primary producers. The cost of the on-road component of the EGCS was $902 million in 2004-05 (ATO 2006). The total cost of the ECGS in 2005-06 was $3,536 million (Australian Government 2006a). Assuming the same proportions went to the on-road and off-road components in 2005-06 as in 2004-05, the on-road component in 2005-06 was $936 million. This is a direct financial subsidy to the use of diesel and alternative fuels for road transport in Australia. However, this subsidy is included in the estimate of the road user deficit in Section 5.6, as the fuel excise revenue considered in deriving the estimate is net of EGCS payments.

The proportion of this subsidy that supports fossil fuels is uncertain. Some proportion of the subsidy supports renewable fuels such as ethanol and biodiesel. However, the volume of diesel, LNG and CNG consumed in Australia is much higher than that of renewable fuels. In 1997-98, consumption of diesel was roughly three times the consumption of LNG/CNG, with other alternative fuels having much smaller consumption rates (ABS 2001). A conservative assumption is that 90 per cent of the DAFGS funding is taken up by fossil fuel

users and 10 per cent by renewable fuel users. This amounts to a fossil fuel subsidy of about $842 million and a renewable energy subsidy of about $94 million.

It is likely that the fossil fuel subsidy is a GHG emission subsidy. While combustion of diesel, LNG and CNG generates lower emissions than combustion of an equivalent amount (based on energy content) of petrol, it is unlikely that the EGCS is stimulating fuel switching from petrol. It is more likely that existing users of diesel and alternative fuels will instead be encouraged to drive more by the lower net prices for the fuels. This will result in GHG emissions above the benchmark level.

The intent of the EGCS is to reduce the cost of fuel to businesses, particularly in rural and regional areas. This is linked to objectives of regional development and economic growth. It is difficult to determine whether this subsidy should be categorised as perverse. By supporting regional and rural development, the subsidy may improve social equity (between rural and urban areas). Further, by reducing the cost of a business input (fuel), it may stimulate economic activity. However, it is possible that the money allocated to this subsidy could stimulate more economic growth if used for other purposes, such as support of renewable energy. Further, the objectives of regional development and economic growth could equally be met through funding that is not tied to fuel consumption. On the balance of evidence, this report classifies the on-road component of the EGCS as perverse because it distorts the value of a finite resource, reducing the scope for innovation in development of alternatives.

The on-road component of the ECGS is likely to increase in the future under the new Fuel Tax Credits Scheme, as discussed in Section 5.17. This will act to increase the size of the road user deficit.

5.7.2 Exemption from excise for alternative fuels

Alternative transport fuels, including liquefied petroleum gas (LPG) and compressed natural gas (CNG), are currently exempt from excise duty. According to the 2006 TES, the benchmark rate of excise for these fuels, based on their energy content, is 25 cents per litre (Australian Government 2006d). The current exemption therefore constitutes a tax expenditure, valued at $710 million in 2005-06 (Australian Government 2006d).

According to ABARE statistics, consumption of CNG for transport in 2005-06 was very small, at about 0.9 PJ compared to LPG consumption of 58.7 PJ (Cuevas-Cubria & Riwoe 2006). Therefore, essentially the entire tax expenditure of $710 million is a subsidy for consumption of LPG. This subsidy is included in the estimate of the road user deficit, as it constitutes foregone fuel excise revenue that should be collected from road users.

The AGO commissioned reports looking at the life cycle emissions associated with different transport fuels used by light and heavy vehicles (Beer et al 2000; Beer et al 2004). They found that LPG and CNG had fewer GHG emissions over the full life cycle than the diesel typically used in heavy vehicles and the petrol typically used in light vehicles. On this basis, the subsidy to alternative fuels in the transport sector is not a GHG emission subsidy. That is, a portion of the total road user deficit equal to $710 million is not a GHG emission subsidy.

5.7.3 Higher rate of excise levied on high sulphur diesel

To encourage the use of ultra low sulphur diesel in Australia, the Australian government raised the excise rate on other diesel (by 2 cents per litre during 2005-06). The 2006 TES defines the excise rate on ultra low sulphur diesel as the benchmark for fuel excise. Consequently, the higher rate of excise levied on high sulphur diesel is reported as a negative tax expenditure of $90 million in 2005-06 (Australian Government 2006d). This

negative tax expenditure actually reduces the size of the total road user deficit discussed in Section 5.6, as it increases the amount of excise collected from road users.

5.8 Greenhouse Gas Abatement Program

The Greenhouse Gas Abatement Program, discussed in Section 4.1, provided support for three projects in the transport sector:

- The National Travel Behaviour Change program, which aims to reduce the impact of car use by encouraging walking, cycling, public transport and ride sharing
- CRT's Cargo Sprinter, a freight rail technology
- The Western Australian Travel Smart households program, which aims to reduce car use and promote active transport and public transport.

The support for the Cargo Sprinter project and support for public transport in the other two programs acts as a fossil fuel subsidy, as public transport is predominantly fuelled by fossil fuels. Support for active transport is really a subsidy to energy efficiency, as it reduces the energy intensity of transport.

Using the assumptions discussed in Section 4.1, the total transport subsidy was worth about $1.4 million in 2005-06. Half has been allocated to fossil fuels and half to renewable energy/energy efficiency.

5.9 Research and development

Total expenditure on transport R&D in Australia in 2004-05[7] was $202 million (ABS 2006d). Based on ABS figures, governments provided about $49 million of this R&D funding in 2004-05 (ABS 2006d), or $51 million in 2005-06 dollars. Additional government research funding is provided through tax concessions for business R&D. In 2005-06, these tax expenditures amounted to $465 million in total (Australian Government 2006d). In 2004-05, about 1.8 per cent of total business R&D expenditure was allocated to the energy resources and energy supply sectors (ABS 2006d). Assuming the tax concessions were taken up by businesses in the same proportion, the tax expenditure for transport R&D would amount to an additional $8.4 million. This gives a total of $59.4 million in government R&D funding for the transport sector.

The proportion of this funding supporting fossil fuel production and consumption is uncertain, but likely to be high, as fossil fuels supply almost all energy requirements in the transport sector. As with the stationary energy sector, the proportion of total R&D funding supporting renewable energy is likely higher than the current contribution of renewable energy to total transport energy requirements. This report assumes that 90 per cent of total transport R&D funding supports fossil fuels and 10 per cent supports renewable energy, which is a similar proportion to that observed in the stationary energy sector but with slightly greater emphasis on fossil fuels. That is, $53.4 million supports fossil fuels and $6 million supports renewable energy. The fossil fuel subsidy is not a GHG emission subsidy, as much of the R&D focuses on reducing the environmental impact of transport or improving its efficiency.

[7] Data for 2005-06 is not yet available.

5.10 Excise free status for condensate

Condensate is a product of the petroleum industry that was granted excise free status in 1977. According to the 2006 TES:

> Condensate produced in a State or Territory, or inside the outer limits of the territorial sea of Australia, or marketed separately from a crude oil stream, or in the North West Shelf project area is exempt from the crude oil excise (Australian Government 2006d).

The value of this tax expenditure in 2005-06 is estimated at $250 million (Australian Government 2006d) and this constitutes a subsidy for fossil fuel consumption. This subsidy is additional to the road user deficit, because the tax expenditure reduces PRRT rather than fuel excise.

Condensate is primarily used in motor vehicles and the tax expenditure is therefore likely to increase GHG emissions above what they would otherwise be. It also has a perverse impact on economic efficiency. However, as it is possible that this product might be wasted if it were subject to excise, caution must be exercised in contemplating removal of the subsidy.

5.11 Concessional rate of excise for aviation fuel

Aviation gasoline and aviation turbine fuel are subject to a lower rate of excise than unleaded petrol and diesel. The tax expenditure was $810 million in 2005-06 (Australian Government 2006d). This tax expenditure is a GHG emission subsidy, as it reduces prices of air travel and air freight below the benchmark level. This encourages both modal switching towards air transport and additional trips. Since air transport is the most greenhouse-intensive mode of transport per kilometre (IPCC 1999), both additional trips and modal switching towards air transport would increase GHG emissions above the benchmark level. The subsidy is additional to the road user deficit because it is not associated with road use.

Deciding whether this subsidy is perverse is more difficult. If the subsidy were removed, aviation companies would have little choice but to pass the cost increase on to consumers in ticket and freight prices; there are no real alternatives to the use of aviation fuel for air travel. The result would be modal switching back to land transport and non-transport alternatives (e.g. video conferencing) and a reduction in total trips. This is not necessarily a good economic outcome; economies rely on exchanges, so a reduction in the number of trips and an increase in travel time (on land transport) could have a negative economic impact. Further investigation would be necessary to determine whether removal of this subsidy would increase overall economic efficiency. For now, it is not classified as perverse.

5.12 Fuel Sales Grants Scheme

The Fuel Sales Grants Scheme (FSGS) pays grants to fuel retailers and distributors of petrol and diesel in regional and remote areas of Australia. It was established to prevent rises in regional fuel prices as a result of the implementation of the GST in Australia. The cost of the FSGS was $257 million in 2005-06 (Australian Government 2006a). This is a direct subsidy to retailers of fossil fuels, which must be passed on to consumers as a condition of the grant.

As the FSGS reduces the price of fuel in regional and rural areas, it encourages greater consumption of fuel in these areas, and hence greater GHG emissions. It is reasonable to conclude that the subsidy is a GHG emission subsidy. However, the subsidy is not necessarily perverse, as it is a relatively efficient way to achieve the government's stated objective of preventing fuel price rises in the targeted regions. As for the on-road component of the EGCS, the driving objective of the FSGS is regional and rural economic development. This objective could be equally met without tying the funding to fuel consumption.

5.13 Petroleum Products Freight Subsidy Scheme

The Petroleum Products Freight Subsidy Scheme (PPFSS) was a national subsidy scheme that provided assistance to offset the cost of freighting eligible petroleum products to remote Australian places. The PPFSS finished on 30 June 2006. The PPFSS acted to benefit purchasers in those places by reducing the freight component of the purchase price of fuel. The PPFSS covered automotive distillate, motor spirit, aviation gasoline and aviation turbine fuel. In 2005-06, the subsidy was worth $3.5 million (Australian Government 2006a) The subsidy is a GHG emission subsidy as it reduces the cost of petroleum products in regional areas to below the unsubsidised level, and thereby encourages greater fuel consumption. It is also perverse, because it distorts the real market price for supplying petroleum products to remote areas.

5.14 Cleaner Fuels Grants Scheme

The Cleaner Fuels Grants Scheme was introduced in September 2003 to provide grants for licensed excise manufacturers and importers of eligible cleaner fuels. The scheme was established to offset the excise and customs duty payable on alternative fuels. Under the scheme, cleaner fuels include biodiesel, premium unleaded petrol with less than 50 mg/kg of sulphur and ultra low sulphur automotive diesel. The value of this subsidy in 2005-06 was $13 million (Australian Government 2006a).

To the extent that the scheme supports use of biodiesel instead of other fuels, it is supporting a renewable energy source and reducing net GHG emissions. However, the support for petrol and diesel will act to increase GHG emissions. The size of the grant to each fuel in 2005-06 is not clear, so it has been assumed that the grant was split evenly between the three fuels. This constitutes a fossil fuel subsidy of $8.7 million and a renewable energy subsidy of $4.3 million. The subsidy is not perverse, as it supports cleaner fuel use.

5.15 Tax benefits for cars provided by employers

Employers that provide vehicles or other benefits for use by employees in Australia are liable for Fringe Benefits Tax (FBT). Two methods may be used to calculate liability for FBT: the operating cost method and the statutory formula method. The operating cost method was used to calculate only 7 per cent of employee contributions associated with motor vehicle fringe benefits in 2004-05 (ATO 2006). It requires a logbook to be kept to determine actual operating costs and the actual proportion of the time that the car is in private use. The benefit to which FBT applies (the taxable value) is then equal to the private fraction of the actual vehicle operating costs as determined from the logbook.

The statutory formula method determines the taxable value to which FBT applies by multiplying the purchase value of the vehicle by a statutory percentage that varies with total distance travelled by the car during the year. The greater the distance travelled, the lower is the taxable value. This method accounted for 93 per cent of employee contributions associated with motor vehicle fringe benefits in 2004-05 (ATO 2006). The method assumes that the greater the distance travelled by the vehicle, the lower the proportion of private use and hence the lower the fringe benefit to the employee. This acts as a clear incentive to drive further and hence to consume more fuel and generate more GHG emissions.

The Australian Government recognises that the use of the statutory formula provides a concession to taxpayers and therefore includes an estimate of the financial impact of this arrangement in the 2006 TES. The tax expenditure associated with the application of the statutory formula to value car benefits was estimated at $1,130 million for 2005-06 (Australian Government 2006d). As this tax expenditure encourages employees to drive

further, it is a GHG emission subsidy. The subsidy does not appear to be tied to any specific government objective, other than to simplify record keeping for employees with company cars. This objective could be met without encouraging greater driving. As the subsidy distorts the true cost of driving, and its objectives can be met in other ways, it is categorised as a perverse subsidy.

5.16 Alternative Fuels Conversion Program

The Alternative Fuels Conversion Program (AFCP) assists vehicle owners and manufacturers to trial new engine technologies and fuels, including hybrid engines, natural gas, LPG and hydrogen. Government funding for the AFCP was $0.9 million in 2005-06 (DEH 2006). The AFCP supports the use of fuels that generate fewer life cycle GHG emissions than the diesel fuel that is typically used in heavy commercial vehicles and buses. Therefore, this subsidy is not a GHG emission subsidy. It is, however, a subsidy for fossil fuel use.

5.17 The Fuel Tax Credits Scheme

From 1 July 2006, a new Fuel Tax Credits Scheme (FTCS) largely replaced the Energy Grants Credits Scheme. The new scheme introduces several changes that will impact on the size of the off-road and on-road subsidies to fossil fuels. From 1 July 2006, eligible on-road activities are no longer subject to metropolitan boundary restrictions. This will increase the range of eligible on-road activities, reduce net fuel excise and increase the size of the road user deficit. In addition, fuel tax credits are now available for use of petrol on-road in large vehicles, for electricity generation and for non-fuel business use. These changes will act to increase the size of the road user deficit and the off-road subsidy.

The new scheme also requires diesel motor vehicles to meet environmental criteria and claimants of more than $3 million in fuel tax credits to be members of the Greenhouse Challenge Plus program. These changes could slightly reduce the size of subsidies but will not be enough to offset the increases discussed above.

Further changes are due from 1 July 2008, when petrol will become more widely eligible for fuel tax credits in off-road use. These changes will also act to increase the size of the off-road subsidy.

5.18 Magnitude of transport subsidies

Table 11 summarises transport subsidies and identifies those fossil fuel subsidies that are GHG emission subsidies and perverse subsidies. Total fossil fuel subsidies amount to $6.9 billion, whereas total renewable energy subsidies amount to $104 million.

Subsidy or Incentive	Support for fossil fuels 2005-06 ($m)	Support for renewables 2005-06 ($m)	Subsidy Category	
			GHG Emission?	Perverse?
General Transport Subsidies				
Greenhouse Gas Abatement Program	0.7	0.7	No	No
Research and development	53.4	6	No	No
Road Transport Subsidies				
Road user deficit	4,599	94	Yes	Yes
Includes Energy Grants Credits Scheme (on-road)	842	94	Yes	Yes
Includes exemption from excise for alternative fuels	710	-	No	No
Includes higher rate of excise levied on high sulphur diesel	-135	-	No	No
Excise exemption for condensate from petroleum industry	250	-	Yes	No
Fuel Sales Grants Scheme	257	-	Yes	No
Petroleum Products Freight Subsidy Scheme	3.5	-	Yes	Yes
Cleaner Fuels Grants Scheme	8.7	4.3	Yes	No
Availability of statutory formula method for FBT on employer-provided cars	1,130	-	Yes	Yes
Alternative Fuels Conversion Program	0.9	-	No	No
Aviation Transport Subsidies				
Concessional rate of excise for aviation fuel	810	-	Yes	No
CATEGORY TOTALS ($m)	**7,114**	**105**	**6,349**	**5,023**

Table 11: Summary and categorisation of transport subsidies.

6 Aid and export subsidies

The Australian Governments activities in relation to overseas aid, exports and investment have the potential to create subsidies for fossil fuel production and consumption overseas. The subsidy estimates in this report only include subsidies for energy and transport in Australia. However, a brief review of possible aid and export subsidies is provided below.

In 2004-05, the Australian Agency for International Development (AusAID) provided $26.2 million in overseas aid for energy generation and supply projects and a further $2.4 million for energy manufacturing (AusAID 2006). Most of the support was for energy policy and administrative management and the amount specifically supporting fossil fuels and renewable energy is not clear. However, given the prevalence of fossil fuels in the Australian and global energy supplies, it is likely that most of the policy and administrative support was effectively support for fossil fuels.

The Export Finance Insurance Corporation (EFIC) is the Australian Government's Export Credit Agency (ECA). It supports exports and overseas investments by Australian businesses through provision of finance, finance guarantees, insurance and bonding facilities. In a 2004 report, AID/WATCH and the Minerals Policy Institute found that, over 11 years, EFIC supported coal exports and fossil fuel infrastructure to the value of $7.6 billion, while supporting only $67 million in renewable energy exports and investment over the same period (AID/WATCH & MPI 2004).

In 2005-06, EFIC supported the export of coal mining equipment from Australia to Russia through guarantee of a loan for $17.3 million by the purchaser (EFIC 2006). No other support for energy production and consumption was evident from a review of EFIC's Annual Report.

The magnitude of the energy subsidy provided by EFIC would be much smaller than these figures. EFIC becomes involved in projects and exports when the risk is too high for commercial entities. The subsidy provided by EFIC is not the value of the exports and investment it supports – it is the value of the insurance and guarantees it provides. The authors are not qualified to assess the value of these products and the magnitude of the energy subsidy, however it is clear that the annual subsidy value would be less than the figures above. Nevertheless, EFIC has supported and continues to support fossil fuel production and consumption overseas.

The Australian Trade Commission (Austrade) is a statutory agency that supports Australian businesses to enter into export markets. Austrade administers Export Market Development Grants, providing financial assistance to businesses for export promotion. Austrade's activities have the potential to act as a subsidy for energy and transport activities. However, insufficient information was available from a brief review of Austrade's website and Annual Report to estimate the size of any subsidy.

7 Discussion and conclusions

This final section of the report summarises the subsidy estimates (Section 7.1), draws out conclusions about the impact of subsidies on the relative costs of fossil fuels and renewable energy (Section 7.2) and discusses subsidy removal (Section 7.3).

7.1 Summary of subsidies

Table 12 summarises identified subsidies to fossil fuels and renewable energy in the stationary energy and transport sectors. It is immediately clear that fossil fuels receive substantially more support across all the sectors considered.

Total energy and transport subsidies are between $9.3 billion and $10.1 billion. Of these, $9.0 billion to $9.8 billion support fossil fuel production and consumption, while $317 million to $334 million support renewable energy or energy efficiency. Support for renewable energy and energy efficiency is only about 3.1 to 3.6 per cent of the total level of identified subsidies. Figure 2 shows the disparity in subsidy support graphically.

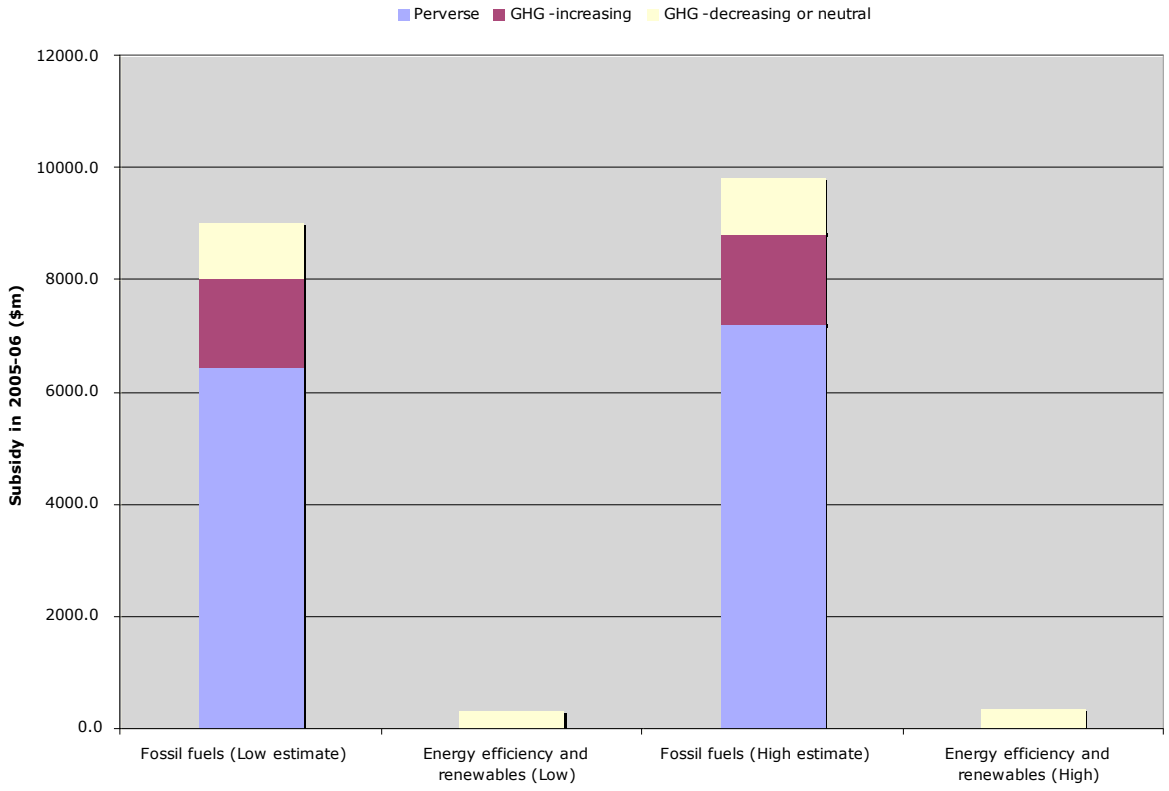

Figure 2: Summary of the magnitude of identified fossil fuel and renewable energy subsidies.

Sector	Support for fossil fuels 2005-06 ($m)				2005-06 GHG Emission Subsidy ($m)	2005-06 Perverse Subsidy ($m)	Support for renewable energy 2005-06 ($m)
	Coal	Oil	Gas	Total			
Electricity	1,091-1,866	3	120	1,214-19,89	1,214-1,989	925-1,700	110-119
Other stationary energy	177-188	280-289	229-235	686-712	476	476	94-120
Transport	1	7,089	24	7,114	6,349	5,023	105
Total	**1,269-2,055**	**7,371-7,381**	**374-379**	**9,014-9,815**	**8,038-8,814**	**6,424-7,199**	**317-334**

Table 12: Summary of the magnitude of identified subsidies to fossil fuels and renewable energy in the stationary energy and transport sectors.

Figure 2 also shows the proportion of the total fossil fuel subsidies that would increase GHG emissions and the proportion that are perverse. About 89 to 90 per cent ($8.0 billion to $8.8 billion) would increase GHG emissions and 71 to 73 per cent ($6.4 billion to $7.2 billion) are classified as perverse.

As shown in Figure 3, most of the identified fossil fuel subsidies occur in the transport sector; about 74 per cent are transport subsidies, 18 per cent are electricity subsidies and 8 per cent are other stationary energy subsidies.

Figure 4 shows the proportion of the total subsidies that support production and consumption of different fuels. As would be expected given the size of the subsidies in the transport sector, most of the support (76%) is for oil and petroleum products.

Figure 5 gives an indication of the magnitude of some of the major identified subsidies, with the exception of the road user deficit. The largest of these subsidies is associated with the use of the statutory formula method for determining FBT on company cars, although fuel subsidies to coal-fired power may rival this if the high estimate of this subsidy is accurate.

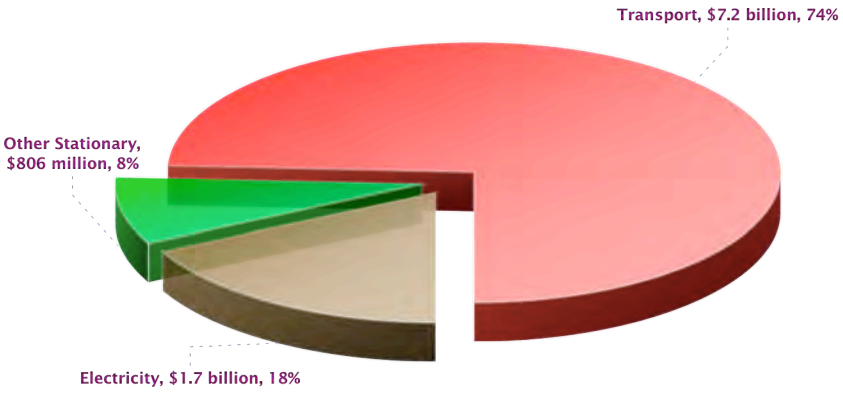

Figure 3: Proportion of identified subsidies by sector.

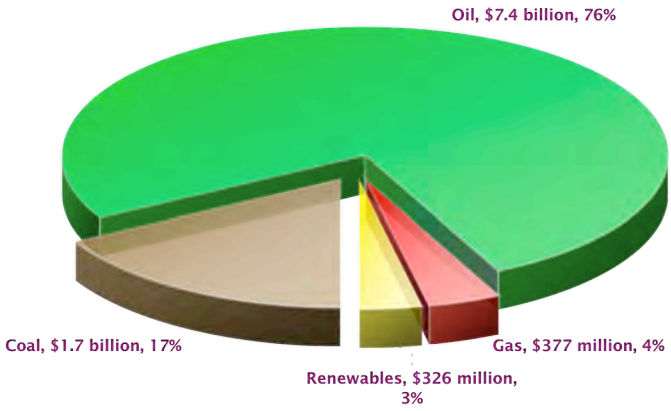

Figure 4: Proportion of support for different fuels.

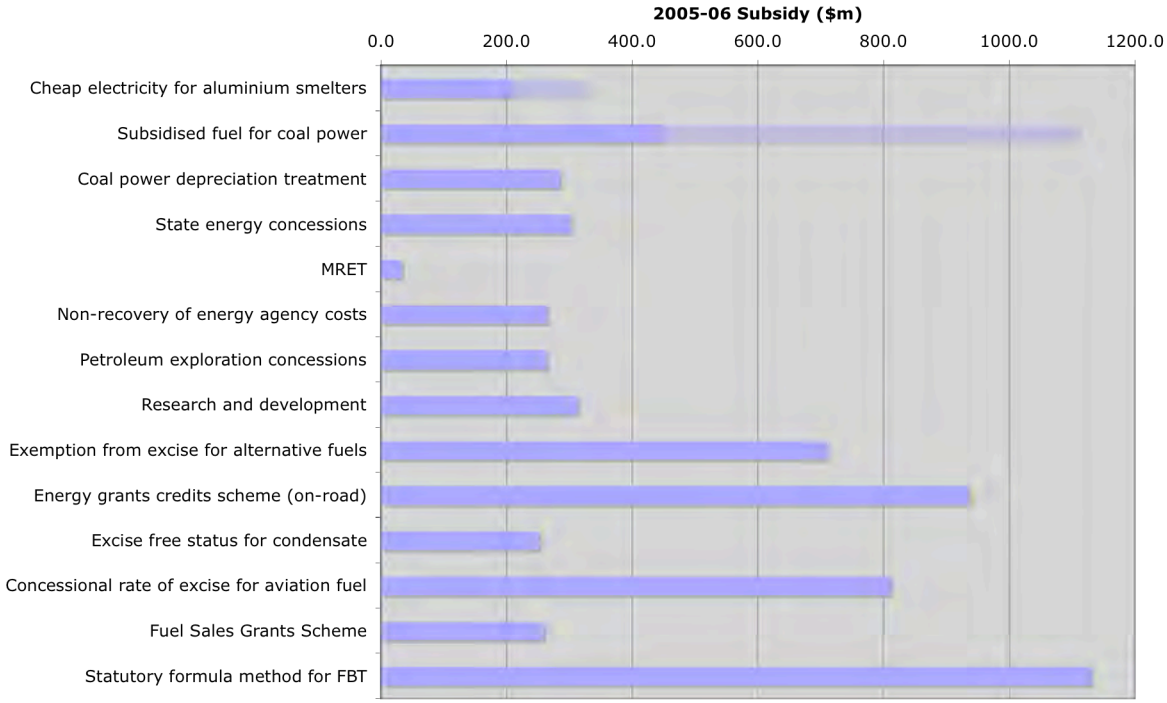

Figure 5: Value of selected major subsidies in 2005-06.

7.2 Impact on the relative costs of fossil fuels and renewable energy

The total identified renewable energy subsidies, across the stationary energy and transport sectors, amounted to between 3 and 4 per cent of the total energy and transport subsidies. Renewable energy fares best in the stationary energy sector, where it receives between 12 and 15 per cent of the total subsidies. In the transport sector, renewable energy receives about 1.4 per cent of total subsidies. The discrepancy between fossil fuel and renewable energy subsidies is certainly sufficient to distort the price of fossil fuels relative to renewable energy.

Some simple calculations help to illustrate the impact of existing fossil fuel subsidies on energy prices and GHG emissions. These calculations are only meant to be indicative – detailed analysis of the impact of individual subsidies, taking into account specific subsidy removal mechanisms, would be necessary to provide more accurate impact assessment. Based on figures from ABARE, electricity generation from fossil fuels was about 236,778 GWh in 2005-06 (Cuevas-Cubria & Riwoe 2006). Dividing the total fossil fuel subsidy in the electricity sector by the total generation gives a price distortion of $5.13 per MWh. For comparison, the cost differential between coal-fired power and wind power in Australia is about $40 to $50 per MWh.

NIEIR (2004) reports a long-run price elasticity of electricity demand in the NEM of –0.35. Assuming an average electricity price at the customer of 13 cents per kWh ($130 per MWh), subsidy removal would increase prices by about 3.9 per cent and long-term electricity demand would fall by only 1.4 per cent. Based on Australia's 2004 National Greenhouse Gas Inventory (AGO 2006a), this would correspond to an emission reduction of 2.7 Mt CO_2-e. For comparison, the projected emission reduction from existing measures in the stationary energy sector in 2010 is 35.5 Mt CO_2-e (AGO 2006b). The GHG emission reduction associated with subsidy removal in the electricity sector is small, but significant.

In the transport sector, road transport consumes about 28.9 GL of petroleum products each year (Cuevas-Cubria & Riwoe 2006). Therefore, the total fossil fuel subsidy in the road transport sector creates a price distortion of about 38 cents per litre or 1.05 cents per MJ. This *is* significant, given current petrol prices in Australia of around $1.20 per litre. Further, according to Australian Government estimates of the costs of different fuels (DPMC 2004, p.91), a price distortion of this magnitude could make certain alternative fuels competitive with petroleum on cost. At that time, petroleum cost about 1 cent per MJ, whereas biodiesel cost from 1 cent to 2.4 cents per MJ, methanol cost from 2.2 to 3.5 cents per MJ and ethanol cost from 2.6 to 3.7 cents per MJ (DPMC 2004, p.91). If the fossil fuel subsidies were removed and petroleum prices rose by 1.05 cents per MJ, biodiesel would become competitive.

The long-run price elasticity of demand for petrol is –0.58 (AGO 1999). Thus, the 32 per cent price increase associated with subsidy removal would correspond to an 18 per cent reduction in petrol demand. Based on Australia's 2004 National Greenhouse Gas Inventory (AGO 2006a), this would correspond to an emission reduction of 12.5 Mt CO_2-e. Although this is a significant reduction, its achievement would depend on the details of subsidy removal and the availability of renewable transport alternatives. At present, it is more likely that consumers would have no choice but to absorb most of the price increase.

This report does not attempt to estimate the price or emission impact of other stationary energy subsidies, as they are spread across many different fuels. However, based on the size of the subsidy and the total stationary energy consumption, the expected price impact would be closer to that observed in the electricity sector than that observed in the transport sector.

The impact of subsidy removal in the electricity and other stationary energy sector is unlikely to be sufficient to provide significant impetus for development of the renewable energy industry, although it could certainly provide assistance when combined with other measures. However, subsidy removal in the transport sector has significant potential as a mechanism to aid the development of an alternative transport fuel industry. These benefits of subsidy removal are in addition to any improvements in economic efficiency and reductions in GHG emissions that might result. A large proportion of the transport subsidies (73 per cent) are categorised as perverse, which means that their removal should deliver both economic and environmental benefits. Nevertheless, subsidy removal requires careful planning and attention to social equity if these benefits are to be captured.

7.3 Subsidy removal

A clearer understanding of fossil fuel subsidies is of little use if not linked to a clear process for subsidy removal or reform. The Australian Conservation Foundation has proposed a national inquiry into environmentally damaging government programs and subsidies and environmental tax reform. Subsidies that support fossil fuel production and consumption would only be one of the areas examined (Krockenberger, Kinrade & Thorman 2000).

The inquiry could be established as a parliamentary inquiry. This would allow access to a much greater range of information than was available for the current research, provide greater resources for subsidy estimation and offer a possible link to an official process for subsidy removal. Government commitment to such an inquiry would be essential if its recommendations were to be successfully implemented.

For any government contemplating subsidy removal or reform, the question of what to do with the newly available funds arises. Rather than returning the funds to general revenue, an opportunity exists to shift existing subsidies from fossil fuels to sustainable energy systems, incorporating energy efficiency and renewable energy. Such subsidisation can be justified to offset the unpaid social and environmental costs of competing fossil fuel technologies. Temporary subsidies to emerging industries of strategic importance are also justified until such industries can compete with more established industries. The public funds currently used to subsidise fossil fuel production and consumption could justifiably be used to subsidise the emerging sustainable energy industry, as establishment of this industry would constitute a public good. Given evidence that fossil fuel technologies have benefited from at least $40 billion in subsidies since World War Two (ECITA Committee 2000, p.158), it is quite reasonable to provide corresponding support for sustainable energy.

It is crucial than any program of subsidy removal is sensitive to social impacts as well as economic and environmental impacts. For example, removal of fossil fuel subsidies in the transport sector would significantly increase fuel prices in a society that is car-dependent and, in many parts of Australia, has no viable alternative transport forms. Many households would have little choice but to pay higher fuel costs, bringing negative economic and social impacts. Subsidy removal, particularly in the transport sector, should only be pursued gradually, in tandem with programs that develop viable alternatives to fossil fuels.

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