

Independent Pricing and Regulatory Tribunal

Ethanol mandate

Options to increase the uptake of ethanol blended petrol

Other — Final Report May 2015



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The Tribunal members for this review are:

Dr Peter J Boxall AO, Chairman Ms Catherine Jones Mr Ed Willett

Inquiries regarding this document should be directed to a staff member:

Matthew Edgerton (02) 9290 8414 Alexandra Sidorenko (02) 9113 7769

Independent Pricing and Regulatory Tribunal of New South Wales PO Box K35, Haymarket Post Shop NSW 1240 Level 15, 2-24 Rawson Place, Sydney NSW 2000 T (02) 9290 8400 F (02) 9290 2061 www.ipart.nsw.gov.au

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1 Executive summary

The Premier asked IPART to identify and assess the effectiveness of options to increase the uptake of ethanol blended petrol in NSW. After conducting targeted consultation with stakeholders and undertaking further analysis, we have identified three broad directions that the Government could take:

- Retain the status quo no additional costs would be incurred, and the current level of ethanol uptake would likely continue to gradually decline to about 2% by 2024-25.
- Conduct a consumer education campaign would likely increase ethanol uptake to some extent and achieve a net benefit for the NSW community, but would not achieve the 6% ethanol mandate. A consumer education campaign would be more effective if combined with price regulation of ethanol to deliver value for money for consumers.
- Implement costly measures to achieve the 6% ethanol mandate options to achieve the 6% mandate would come at a net cost to the NSW community and remove consumer choice. Such measures would need to be accompanied by price regulation of ethanol to ensure value for money for consumers. The following options could achieve the 6% mandate, but at a net cost to the NSW community, and the Government would need to consider any legal issues arising from these options:
 - require ethanol in almost all fuel grades up to a maximum of 10%
 - require wholesalers to purchase ethanol equal to 6% of their total NSW petrol sales, and
 - tighten the conditions for exemptions from the mandate and require all service stations to offer an ethanol blended product.

The *Biofuels Act* 2007 (NSW) (the Act) imposes an ethanol mandate on major fuel sellers, who must ensure that the volume of ethanol sold accounts for 6% of the total volume of petrol sold. The ethanol mandate was set at 6% in 2011 and has never been met. The proportion of ethanol to total volume of petrol sold has been declining in recent years and is currently about 3.2%.

The key barrier to increasing ethanol uptake is consumer aversion to ethanol blended petrol. Since the ethanol mandate was introduced in 2007, premium unleaded petrol (PULP) sales have increased by about 124% in NSW, the only Australian state with an ethanol mandate. In the rest of Australia, PULP sales increased by only 26% over the same period. Many consumers, with limited access to regular unleaded petrol, are willing to pay around 15 cents per litre (cpl) more for premium ethanol-free petrol compared with ethanol blended petrol.

The current exemptions and defences in the Act have rendered it ineffective in meeting the mandate. The Act exempts wholesalers and major retailers if they can demonstrate they took reasonable steps to comply with the mandate.

Consumers are currently averse to ethanol blended petrol, so major fuel sellers cannot reach the 6% ethanol mandate without reducing consumer choice. The only options that would singulary increase ethanol uptake to achieve the current 6% mandate are to include ethanol in almost all petrol. However, the cost of reducing consumer choice is high. Most options to increase ethanol uptake would increase the cost of an already expensive policy, with little economic gain for the NSW community. Further, measures to increase ethanol uptake by reducing consumer choice would strengthen Manildra Group's already substantial market power.

1.1 IPART's task

We were asked to assess the effectiveness of measures to increase the uptake of ethanol to achieve the 6% ethanol mandate. Specifically, IPART assessed the following measures:

- Broadening the mandate by:
 - changing the definition of retailers such that more are subject to the mandate
 - requiring all service stations to offer an ethanol blended product, phased in over a reasonable timeframe, and
 - requiring all service stations that sell more than a specific minimum annual volume of petrol to offer E10.¹
- Introducing premium ethanol blends:
 - requiring E10 to comply with the premium unleaded petrol standard, and
 - requiring all primary wholesalers to offer at least one premium ethanol blend petrol.

¹ E10 is regular unleaded petrol containing up to 10% ethanol.

We also assessed stronger enforcement options for the ethanol mandate, including the relative costs and benefits of such an approach. The terms of reference (TOR) requested we use earlier reviews of the ethanol mandate and discuss relevant Australian Government programs. The (TOR) for the review is at Appendix A.

1.2 Our approach to this task

Our objective is to identify and assess options to increase ethanol uptake, and we took the following approach:

- Step 1: determine the current barriers to increasing the uptake of ethanol
- Step 2: identify options to address the barriers in Step 1
- Step 3: assess if the options identified would increase ethanol uptake
- Step 4: conduct an analysis of the costs and benefits to the NSW community of options we assessed to increase ethanol uptake in Step 3.

1.3 Review process

For this review, we consulted with key stakeholders such as ethanol suppliers, petrol companies, industry bodies and government agencies. The key dates for the review are outlined in Table 1.1.

Table 1.1 Key dates for	the	review
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Milestone	Indicative date
Terms of reference received	15 January 2015
Final Report provided to the Premier	29 May 2015

1.4 Our analysis

1.4.1 Barriers to achieving the mandate

The requirement to replace regular unleaded petrol (RULP) with E10 was removed in 2012. Since then, the level of ethanol as a percentage of the total volume of petrol sold in NSW has declined from 4% to about 3.2% at the end of 2014. Since the introduction of the ethanol mandate in 2007, the sale of PULP has increased by about 124% in NSW. By contrast, PULP sales in the rest of Australia (where there are no ethanol mandates) increased by 26% over the same period. The evidence suggests consumers are averse to ethanol blended petrol, with many willing to pay an additional 15 cents per litre for premium ethanol-free petrol instead of E10. The Act requires volume fuel sellers to ensure ethanol accounts for 6% of their total petrol sales in NSW. Volume fuel sellers include primary wholesalers (those that sell fuel from an oil refinery or major shipping terminal) and major retailers (those that control more than 20 service stations, together the volume fuel sellers). However, primary wholesalers and major retailers do not fully control consumer demand, and about 39% of the service stations in NSW are controlled by volume fuel sellers.

The Act, in its current form, has been ineffective in ensuring volume fuel sellers meet the 6% ethanol mandate. Primary wholesalers and major retailers can obtain (and vary) an exemption to the ethanol mandate retrospectively, if they demonstrate they took reasonable steps to comply with the mandate.

Further, the current price of E10 does not represent value for money. Ethanol contains 31.6% less energy per litre than petrol and, on average, using E10 increases fuel consumption by about 3%. To make E10 competitive, it needs to be about 3% cheaper than RULP. The average price difference of 2.2 cpl (April to June 2014) means E10 is only about 1.5% cheaper than RULP.

1.4.2 Identifying options to increase ethanol uptake

We identified options to increase ethanol uptake that would address the demand, supply and other barriers:

- Demand: eg, increase demand through consumer information campaigns on compatibility of motor vehicles with ethanol blended products, and by converting the government motor vehicle fleet to flex-fuel vehicles.²
- Supply: eg, broaden the scope of the mandate to require more service stations to comply with the mandate, and increase the market penetration of ethanol by introducing premium ethanol blended petrol or by requiring ethanol in all petrol.
- Enforcement: eg, amend the Act to limit the circumstances for exempting volume fuel sellers.
- Price: eg, regulate the price of ethanol so ethanol blended petrol is priced competitively with ethanol-free petrol, and regulate Manildra Group's market power (in some form).
- Other: eg, change the definition of E10 to require a minimum of 9.5% ethanol. Currently, the required minimum ethanol content is 9%.

² Flex-fuel vehicles can take ethanol blended petrol up to 85% ethanol.

1.4.3 Assessing options to increase ethanol uptake

The only option that would singularly increase ethanol uptake to achieve the current 6% mandate is to include ethanol in almost all petrol. However, this would impose a net cost on the NSW community and remove consumer choice (in relation to choosing between ethanol blended and ethanol-free petrol). Most other options to increase ethanol uptake would also impose a net cost on the NSW community, but would not achieve the 6% mandate.

If the Government wishes to implement measures to increase ethanol uptake, we consider it prudent for the Government to also limit Manildra Group's market power, eg, by regulating the price of ethanol. Currently, Manildra Group is the only producer and dominant supplier of ethanol in NSW and adopting the measures outlined above would strengthen its market power. Further, there is currently little prospect of competition from imports under the Australian Government's concessionary excise arrangements for local ethanol producers.

Where a dominant supplier's market power is strengthened, then ultimately consumers may be worse off through paying higher petrol prices.

We used cost-benefit analysis to assess the options identified over 10 years (Table 1.2). The baseline scenario for the level of ethanol uptake at 2024-25, if no further actions are taken, is 2% of total petrol sales.³ For options that are likely to have a positive impact on ethanol uptake, we assessed the level of ethanol uptake as a proportion of total volume of petrol sold at 2024-25, if the options are implemented. The effects on ethanol uptake as outlined in Table 1.2 are **not additive**. However, our analysis in this report can provide an indication of whether a combination of options would likely achieve the current mandate.

³ Assuming the current trend continues, where volume fuel sellers reintroduce RULP at service stations.

Option	Ethanol/ total petrol sales ^a	PV of costs	PV of benefits	Overall NPV ^b
Status quo	2.0%	-	-	-
Supply side Option 1 – Broaden the mandate				
 Option 1a – Reduce the qualifying number of controlled service stations from 20 to 5^c 	Negligible			
 Option 1b – Require all service stations to offer an ethanol blended product 	3.0%	130	45	(85)
 Option 1c – Require all service stations that sell more than 3 million litres of petrol a year to offer ethanol blended product 	2.3%	41	15	(26)
 Option 1d – Require all stations offering two or more petrol grades to offer ethanol blended product 	2.8%	110	37	(73)
Option 2 – Introduce premium ethanol blends ^d				
 Option 2a – Require E10 blended in NSW to conform to PULP standard 	Negligible	-	-	-
 Option 2b – Require all primary wholesalers to offer at least one premium ethanol blend 	Negligible	-	-	-
Option 3 – Increase local supply competition by fast-tracking development approvals or other incentives ^e	Negligible	-	-	-
Option 4 – Reduce availability of ethanol-free petrol				
 Option 4a – Require ethanol in all fuel grades,(except diesel) up to a maximum of 10%ⁱ 	10.0%	1,490	301	(1,189)
 Option 4b – Remove all RULP and replace with E10ⁱ 	3.7%	145	76	(70)
 Option 4c – Require all wholesalers to purchase ethanol equivalent to 6% of their total petrol salesⁱ 	See options 4a or 4b, and/or 5j			
Demand side				
Option 5 – Consumer education campaigns	2.2%	5	61	56
Option 6 – Government motor vehicle fleet convert to flex-fuel vehicles.	2.3%	123	33	(90)
Enforcement				
Option 7 – Tighten the conditions for exemption and definition of reasonable steps ${\mbox{i}}$	2.6%	351	71	(280)

Table 1.2Summary of cost-benefit analysis (net present value \$ million,
\$2014-15)

Option	Ethanol/ total petrol sales ^a	PV of costs	PV of benefits	Overall NPV ^b
Option 8 – Increase penalties for non-compliance ^f				
 Option 8a – Set higher court imposed penalties 	Negligible	-	-	-
 Option 8b- Set volume based penalties for non-compliance 	Negligible	-	-	-
Price				
Option 9 – Regulate price of ethanol				
 Option 9a – Price based on energy parity value 	2.2%	258	259	2
 Option 9b – Price based on international benchmarks 	2.3%	413	412	(1)
 Option 9c – Regulate price charged by Manildra Group 	-	-	-	-
Option 10 – Set an ethanol target rather than a mandateg	Negligible	-	-	-
Option 11 – Blend E10 at 9.5% ^h	Negligible	-	-	-

a Proportion of ethanol to total volume of petrol sold at the end of 2024-25.

b Brackets indicate negative NPV (ie, a net cost). Totals may not add due to rounding.

c Negligible impact on ethanol uptake because small number of operators affected.

d Negligible impact on ethanol uptake because ethanol-free petrol would still be available, and customers are averse to ethanol blended petrol.

e Negligible impact on ethanol uptake because there is perceived regulatory uncertainty.

 $f\,$ Negligible impact on ethanol uptake because volume fuel sellers are able to seek exemptions from complying with the mandate.

 ${\bf 9}$ Negligible impact on ethanol uptake. Some stakeholders indicated they would provide less E10 without the mandate.

h Potential risk of breaching the 10% cap set under Australian fuel standards.

i Exemptions under the Act would be removed.

j Separate cost benefit analysis not conducted as likely impact covered under Option 4a / Option 4b / Option 5. **Source:** IPART analysis.

How the assessed options further the mandate's objectives

The ethanol mandate's stated objectives are to:

- further develop the ethanol industry in NSW
- create jobs that assist regional development
- support the development of an alternative transport fuels industry in NSW
- develop the advanced technologies and feedstock that will provide alternative liquid transport fuels for future generations.

The mandate was introduced in 2007, but Manildra Group remains the dominant supplier and only producer of ethanol in NSW and relatively few additional jobs have been created. During consultations, stakeholders advised further investment in the ethanol industry is unlikely while there is perceived regulatory uncertainty at state and federal levels.

If the Government decides to implement any of the measures we identified to increase ethanol uptake, this could give the ethanol and oil industries certainty that the Government will maintain the ethanol mandate. In turn, this decision may stimulate further development of the ethanol industry. However, the impact on the ethanol industry of implementing any single measure may be limited, given Manildra Group currently has enough capacity to meet the 6% mandate and most options do not achieve the 6% mandate on their own.

1.5 The structure of this report

This report is structured as follows:

- Chapter 2 provides background information on the review, including the regulatory framework.
- Chapter 3 sets out the current market conditions.
- Chapter 4 sets out the current barriers to achieving the ethanol mandate and options to address the barriers.
- Chapter 5 outlines our methodology for assessing the options to increase ethanol uptake.
- Chapter 6 discusses supply side options such as broadening the scope of the mandate.
- Chapter 7 discusses demand side options such as a consumer information campaign.
- Chapter 8 discusses enforcement options to increase ethanol uptake.
- Chapter 9 discusses options for regulating the price of ethanol.
- Chapter 10 discusses other options and a combination of options.

1.6 Our findings

Overall key findings

 Under the status quo (ie, no additional measures to increase ethanol uptake), ethanol would likely gradually decline to about 2% of petrol sales in NSW by 2024-25.

- The following options could achieve the 6% mandate, but they would result in a net cost to the NSW community and substantially reduce or remove consumer choice:
 - require ethanol in almost all fuel grades up to a maximum of 10%
 - require wholesalers to purchase ethanol equal to 6% of their total NSW petrol sales, and
 - tighten conditions for exemptions from the mandate and require all service stations to offer an ethanol blended product.
- Most other options to increase ethanol uptake would also impose a net cost on the NSW community and would not achieve the 6% mandate.
- A consumer education campaign would likely increase ethanol uptake to some extent and achieve a net benefit for the NSW community, but it would not achieve the 6% mandate.
 - A consumer education campaign should be accompanied by price regulation of ethanol, to enhance its effectiveness and ensure value for money for consumers.
- Any measure taken by the Government to further increase ethanol uptake should be accompanied by price regulation of ethanol, to ensure ethanol blended petrol delivers value for money for customers.

Current barriers

1	Th	ne key barriers to achieving the ethanol mandate are:	30
	_	Consumer aversion or uncertainty about ethanol blended products.	30
	_	Regular unleaded petrol continues to be available and the current small price difference between regular unleaded petrol and E10 means consumers may view E10 as not being value for money on an energy parity basis.	30
	-	Scope of the mandate is currently limited to primary wholesalers and major retailers operating more than 20 sites.	30
	-	The burden to meet the mandate is on primary wholesalers and major retailers, who do not fully control consumer demand.	30
	-	Primary wholesalers and major retailers are exempt from complying with the mandate if they can demonstrate they took reasonable steps.	30
_			

Supply side measures

2 Requiring almost all fuel to contain ethanol is the only option that would in isolation achieve the 6% ethanol mandate. However, this option imposes a net cost on the NSW community.

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3	Requiring wholesalers to replace regular unleaded petrol with E10 would increase ethanol uptake but would not achieve the 6% ethanol mandate, assuming ethanol-free petrol remains available and consumers' current preference for ethanol free petrol	46
		40
4	Broadening the scope of the mandate, through the following options, would not materially affect ethanol uptake in NSW:	47
	 reduce the qualifying number of controlled service stations from 20 to 5 	47
	 require all service stations to offer an ethanol blended product 	47
	 require all service stations that sell more than 3 million litres of petrol per year to offer an ethanol blended product 	47
	 require all service stations offering two or more petrol grades to offer an ethanol blended product. 	47
5	Broadening the scope of the mandate (per Finding 4) would result in net costs that range between \$26 million to \$85 million, in net present value terms.	47
6	Requiring wholesalers to purchase ethanol equal to 6% of their total NSW petrol sales allows wholesalers to determine their lowest cost means of increasing ethanol uptake. However, actual ethanol uptake may be less than 6% and if wholesalers have to sell excess ethanol at a loss, they may try to recoup these losses through higher petrol prices.	47
7	E10 blended in NSW to conform with premium unleaded petrol standards would not be effective in increasing the uptake of ethanol blended petrol. A premium ethanol blend would target a smaller proportion of the petrol market compared with the current E10 market and there would likely be low consumer demand if ethanol-free products are available.	47
8	Requiring all primary wholesalers to offer at least one premium ethanol blended petrol would not be effective in increasing the uptake of ethanol if retailers and consumers can choose ethanol-free products.	47
Der	nand side measures	
9	Introducing an information campaign on motor vehicles that are compatible with E10 could increase the uptake of ethanol. We estimate net benefits of about \$56 million in present value terms. The NSW Government and/or ethanol producers could fund an information campaign.	60
10	Requiring the NSW Government motor vehicle fleet to convert to flex-fuel vehicles could increase the uptake of ethanol. We estimate net costs of	
	about \$90 million in present value terms.	60

Enforcement measures

11	The current legislative regime has been ineffective in ensuring volume fuel sellers meet the 6% ethanol mandate:	67
	- Volume fuel sellers can obtain (and vary) an exemption retrospectively.	67
	 The 'reasonable steps' defence substantially reduces the risk of being successfully prosecuted. 	67
12	The mandate could be achieved if, first, all service stations have to comply with the mandate; and second, if the grounds for exemption and reasonable steps defence under the Act are largely removed.	67
13	The low financial penalties for a failure to comply with a minimum biofuel requirement do not provide sufficient incentives for volume fuel sellers to take further action to increase ethanol uptake.	67
14	We estimated the present value of net costs over 10 years of removing the 'reasonable steps' defence against prosecution and amending the grounds for an exemption to be \$280 million.	67
15	It is unlikely that there would be additional costs and benefits associated with increasing penalties for non-compliance with a minimum biofuel requirement, all else being equal, because the Act still provides exemptions for volume fuel sellers.	67
Pric	cing measures	
16	Manildra Group has substantial market power in the ethanol market with the ethanol mandate:	75
	 It is the only producer and dominant supplier of ethanol in NSW and volume fuel sellers must purchase ethanol to comply with the mandate. 	75
	- The price of ethanol in NSW is higher than the international market price.	75
	 Manildra Group's cost of supply is likely lower than its Australian competitors given its integrated production process, which includes using a waste product. 	75
	 There is little prospect of competition from imported ethanol in the foreseeable future, given the Australian Government's concessionary excise arrangements for local ethanol producers. 	75

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17	Regulating the price of ethanol, so the price of ethanol blended petrol delivers value for money for consumers, would likely have a small positive impact on the level of ethanol uptake. Further:	75
	 Setting the maximum price of ethanol such that E10 is at energy parity value with regular unleaded petrol would produce a net benefit of \$2 million in net present value terms. 	75
	 Setting the maximum price of ethanol with reference to an international benchmark would produce an estimated net cost of \$1 million in net present value terms. 	75
Oth	er measures	
18	Increasing the minimum ethanol content of E10 under the Act from 9% to 9.5% to increase ethanol uptake would increase the risk of E10 breaching the 10% ethanol content cap under Australian fuel standards.	81

2 Context for the review

This chapter provides an overview of ethanol blended petrol legislation in NSW and other jurisdictions within Australia. It outlines key provisions of the *Biofuels Act* 2007 (NSW) (the Act), the *Biofuels Regulation* 2007 (NSW) (the Regulation) and Australian Government excise arrangements. The chapter also provides an overview of renewable fuels policies in NSW and the rest of Australia.

2.1 NSW regulatory framework

2.1.1 Minimum ethanol requirement under the Act

Under the Act, volume fuel sellers (major retailers⁴ and primary wholesalers⁵) must ensure the volume of ethanol sold⁶ is not less than a specified percentage – currently 6% - of the total volume of all petrol sold by the seller in NSW over each quarter (ethanol mandate).⁷

When the Act was introduced in October 2007, the specified minimum ethanol percentage was 2%. At the time, the percentage was envisaged to increase to 10% over time.⁸ The minimum percentage then increased to 4% from 1 January 2010, and then 6% from 1 January 2011.⁹

⁴ A person who operates or controls the operation of more than 20 service stations: Act, s 4A.

⁵ Primary wholesaler refers to a fuel wholesaler who operates or supplies petrol or diesel fuel from any of the following facilities (whether or not in NSW) in connection with fuel wholesaling: a) an oil refinery; b) a shipping facility; c) a facility to which petrol or diesel fuel is shipped by pipeline from an oil refinery or a shipping facility; and d) a facility to which petrol or diesel fuel is supplied by pipeline from a facility referred to in (c): Act, s 4(1). A primary wholesaler also includes a fuel wholesaler who engages in the blending of ethanol

with petrol (whether or not in NSW) to produce petrol-ethanol blend and Chippen Holdings Pty Limited trading as Lowes Petroleum Service: Regulation, cl 4(1) and (3).

⁶ As ethanol blended petrol.

⁷ Act, s 6(1) and (2).

⁸ Biofuel (Ethanol Content) Bill 2007, Second Reading, The Hon. Tony Kelly http://www.parliament.nsw.gov.au/prod/parlment/hansart.nsf/V3Key/LC20070627047?ope n&refNavID=undefined, accessed 19 February 2015.

⁹ The minimum ethanol requirement of 6% was suspended until the end of 30 September 2011 by order under section 17(1) of the Act – NSW Government Gazette No 133 of 10 December 2010, p 5811 and No 66 of 1 July 2011, p 4667.

From 1 July 2012, the Act was to prohibit primary wholesalers from selling regular unleaded petrol unless the petrol is E10. However, the Government removed this requirement by enacted legislation in May 2012.¹⁰

2.1.2 Stated policy objective of the ethanol mandate

The ethanol mandate's stated objectives are to:

- further develop the ethanol industry in NSW
- create jobs that assist regional development
- support the development of an alternative transport fuels industry in NSW
- develop the advanced technologies and feedstock that will provide alternative liquid transport fuels for future generations.¹¹

2.1.3 Enforcing the ethanol mandate

The NSW Office of Biofuels – part of the NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) – administers the Act.

The legislative framework provides for:

- Court imposed penalties A maximum penalty of \$55,000 for a first offence and \$550,000 for any subsequent offence¹² can be applied for non-compliance with:
 - the ethanol mandate¹³
 - a partial exemption specifying a percentage that is less than the applicable minimum ethanol percentage¹⁴

(together, a minimum biofuel requirement)

- conditions to exemptions.¹⁵
- Penalty notices A penalty notice can be served on a volume seller with a prescribed penalty of \$5,500 for non-compliance with a minimum biofuel requirement.¹⁶

¹⁰ Biofuels Amendment Act 2012.

¹¹ Biofuels Amendment Bill 2012, Second Reading, The Hon. John Ajaka (Parliamentary Secretary) https://www.parliament.nsw.gov.au/prod/parlment/NSWBills.nsf/1d436d3c74a9e047ca256e 690001d75b/aa98e7675e7098f5ca2579a50020edcc/\$FILE/Biofuels%20Amdt%20-%20LC%202nd%20Read.pdf, accessed 3 February 2015.

¹² Crime (Sentencing Procedure) Act 1999 (NSW), s 17. Penalty units are multiplied by \$110.

¹³ Act, s 10(1).

¹⁴ Act, ss 10(1) and 15(4).

¹⁵ Act, s 15(3A).

¹⁶ Act, s 29 and Regulation, cl 10 and Schedule 1.

- 'Name and shame powers' The Minister for Resources and Energy may publish the names of volume fuel sellers that fail to comply with the Act, including the nature and extent of such failure.¹⁷
- Information gathering powers Volume fuel sellers report details of petrol sales to DTIRIS quarterly, eg.¹⁸

There have been no court proceedings instituted or penalty notices served to date under the Act. Further, historically all volume fuel sellers have been granted exemptions to the ethanol mandate (see Section 2.1.5).

2.1.4 Defences, exemptions and suspensions under the Act and Regulation

Defence to failure to comply

It is a defence to a prosecution for a failure to comply with a minimum biofuel requirement if a volume seller can prove it took **all** reasonable steps to comply with the ethanol mandate.¹⁹

Under the Regulation, taking **all** of the following actions constitutes taking reasonable steps:

- making all reasonable efforts (on a continuing basis) to secure sufficient ethanol or petrol-ethanol blend supplies
- taking all reasonable action to upgrade a volume fuel seller's infrastructure to enable it to distribute sufficient ethanol blended petrol (EBP)
- taking all reasonable action to ensure the availability of facilities to sell EBP at retail service stations controlled²⁰ by the volume fuel seller
- taking all reasonable action (on a continuing basis) to market EBP, and
- taking all reasonable action (on a continuing basis) to ensure all E10 sold by the volume fuel seller contains at least 9% ethanol.²¹

¹⁷ Act, s 14. However, the Minister must not publish information under this provision if (a) the information will reveal or is capable of revealing the total volume of petrol, ethanol, diesel fuel or biodiesel sold by a volume seller during any period, or (b) the Minister is of the opinion that the information is otherwise commercially sensitive: Regulation, cl 8.

¹⁸ Act, s 11. See also Act, ss 19 and 20 regarding DTIRIS's information gathering powers to assist in: establishing whether the Act or Regulation has been contravened; and obtaining evidence, records or information about a matter that constitutes (or may constitute) a contravention of the Act or Regulation.

¹⁹ Act, s 10(2).

²⁰ Specifically, at those service stations at which the business of selling petrol or diesel fuel is controlled by the volume seller or at which the person who conducts that business leases or subleases the premises from the volume seller: Regulation, cl 7(d).

²¹ Act, s 10(3) and Regulation, cl 7. However, a volume seller is not prevented from proving that other actions taken by it constitute the taking of reasonable steps to comply with a biofuel requirement: Act, s 10(4).

Exemptions

The Minister can exempt a volume fuel seller from the ethanol mandate.²² The Minister, after considering the advice of the expert panel,²³ must be satisfied that **any** of the following circumstances exist and that the circumstances justify the exemption:

- ▼ It is uneconomical because of the price at which the volume fuel seller can reasonably obtain ethanol.²⁴
- The volume fuel seller has taken, is taking or will take all reasonable steps to comply with the ethanol mandate.²⁵
- Compliance with the ethanol mandate may result in a risk to public health or safety.²⁶
- The volume fuel seller demonstrates other extraordinary circumstances.²⁷

Suspending the ethanol mandate

The Minister can, after considering the advice of the expert panel, suspend the operation of the ethanol mandate²⁸ (or specify a percentage that is less than the applicable minimum ethanol percentage²⁹) if satisfied **any** of the following circumstances exist:

- It is uneconomical because of the price at which volume fuel sellers are reasonably able to obtain ethanol.
- It is uneconomical because of industry-wide ethanol shortages.
- It may result in a risk to public health and safety.
- It may have an adverse effect on the retail price of petrol for motorists.
- It may have an adverse effect on grain or food stock availability.
- It may substantially inflate grain or food stock prices.

²² Act, s 15(1). The Minister may also vary or revoke an exemption, after having considered the expert panel's advice: Act, s 15(7) and 15(8). The Minister may grant an exemption retrospectively: Act, s 15(5)(d).

²³ Act, s 15(2). The expert panel advises the Minister on proposed exemptions from the ethanol mandate, proposed suspension of the ethanol mandate and any other matters in connection with the operation of the Act as referred by the Minister: s 24(3). Section 24(1) specifies the membership of the expert panel.

²⁴ Act, s 15(1)(a).

²⁵ Act, s 15(1)(b). The Minister may have regard to whether the volume seller took the actions that would constitute 'the taking of reasonable steps' to comply with the ethanol mandate, as discussed under 'Defence to failure to comply': Act, s 15(1A).

²⁶ Regulation, cl 9(a).

²⁷ Regulation, cl 9(b).

²⁸ Act, s 17.

²⁹ Act, s 17(3).

- It may have a significant adverse environmental impact.³⁰
- It should be suspended for some other extraordinary reason.

2.1.5 Operating the exemption regime

The Minister issued³¹ guidelines to the expert panel on the approach to advising on applications for exemptions (Guidelines).³² The Guidelines, among other things, provide guidance on:

- whether the statutory grounds exist for the Minister to grant or vary an exemption from the minimum biofuel requirements in section 6 of the Act
- if the statutory grounds exist, whether the Minister should exercise discretion to grant or vary an exemption
- what partial exemption percentage(s) are appropriate, and
- what conditions might be applied to exemptions that may be granted.³³

Government policy is to consider exemptions for a specified period of up to three years only.³⁴

Volume fuel sellers applying for an exemption must provide a business plan that details planned future steps to achieve the ethanol mandate and defined milestones to deliver each action. The business plan must demonstrate a commitment to take all reasonable actions throughout the entire period of the proposed exemption.³⁵

The conditions of exemption generally require the volume seller to implement the business plan provided with the application and to provide quarterly progress reports.³⁶

³⁰ Act, s 17(1)(f). Specifically, on water availability or quality, soil fertility and health or biodiversity.

³¹ Act, s 24(4)(a).

³² Chris Hartcher MP, Exemptions Framework Mandatory Biofuel Requirements under the *Biofuels Act* 2007, 5 February 2013, p 5.

³³ Ibid.

³⁴ The Act provides for an exemption to be granted for an indefinite period until revoked: s 15(6).

³⁵ The covering letter to the Guidelines provide examples of proposed steps to be taken.

³⁶ Supra. Fn 31, p 5.

Table 2.1 lists partial exemptions granted to volume fuel sellers for the 2015 calendar year at 2 February 2015. BP, eg, received an exemption of 2.4% for April to June 2015, which means ethanol must account for 2.4% of its total petrol sales over this period.

Volume fuel seller	Jan to Mar 2015	Apr to Jun 2015	Jul to Sep 2015
BP	2.4%	2.4%	2.5%
Caltex	2.4%	2.2%	2.0%
Freedom	1.2%	1.2%	1.2%
Lowes			
Mobil	2.5%	2.5%	2.5%
Neumann			
Park	3.5%	3.5%	3.5%
United			
Viva	3.5%	3.3%	3.1%
Woolworths	4.0%	4.0%	4.0%
7-Eleven	3.0%	3.0%	3.0%

Table 2.1	Partial exemption percentages for ethanol granted in advance for
	2015

Note: As at 2 February 2015. If no figure is specified, no exemption had been granted at 2 February 2015. **Source:** http://www.resourcesandenergy.nsw.gov.au/energy-consumers/sustainable-energy/office-of-biofuels/biofuels-results, accessed 29 January 2015 and 25 March 2015.

2.1.6 Renewable biofuels policies

In September 2013, the NSW Government released the Renewable Energy Action Plan (the Plan)³⁷ to guide NSW's renewable energy development and to support the national target of 20% renewable energy by 2020.

The Plan includes a goal to attract and grow expertise in renewable energy technology. The stated actions to achieve this goal include:

- DTIRIS establishing a working group to develop an advanced bioenergy initiative supporting supply and demand for renewable transport fuels and power generation³⁸
- ▼ supporting research and development in advanced bioenergy applications in collaboration with Rural Climate Solutions at the University of New England.³⁹

³⁷ http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0010/475318/ Renewable-Energy-Action-Plan.pdf, accessed 9 February 2015.

³⁸ The Plan, Action 19, p 22.

³⁹ The Plan, Action 20, p 22.

2.2 Ethanol policy in other jurisdictions

No other states in Australia have an ethanol mandate.

The Queensland Government considered introducing an ethanol mandate as early as 2006, but suspended implementing its mandate in 2010 given uncertainty about the federal tax excise.⁴⁰ A private member's bill in 2014 to introduce an ethanol mandate also failed.⁴¹ More recently, a proposal for an ethanol mandate won bipartisan support in the Queensland Parliament.⁴²

Appendix B discusses ethanol policies in other countries.

2.3 Commonwealth policies

There is no federal mandate of ethanol in Australia.

However, there is legislation that:

- imposes a 10% cap on the concentration of ethanol for suppliers of E1043
- specifies a fuel quality standard for E85, a fuel blend consisting of 70% to 85% ethanol and petrol⁴⁴
- imposes a labelling standard for suppliers of E10⁴⁵ and E85⁴⁶
- regulates the conduct of wholesalers and fuel resellers involved in selling, supplying or purchasing declared petroleum products, such as unleaded petrol and EPB, to improve transparency in wholesale pricing and access to the relevant products⁴⁷
- imposes road vehicle emission standards for new motor vehicles.48

- ⁴⁴ Fuel Standard (Ethanol E85) Determination 2012 (Cth).
- ⁴⁵ Fuel Quality Information Standard (Ethanol) Determination 2003 (Cth). Service stations supplying ethanol blend petrol must clearly display one of the following 1) the words 'Contains up to x% ethanol' (where x is no less than the percentage of ethanol in the petrol); or 2) the words 'Contains y% ethanol' (where y is the percentage of ethanol in the petrol).
- ⁴⁶ Fuel Quality Information Standard (Ethanol E85) Determination 2012 (Cth). Service stations supplying E85 must clearly display either of the following words: 1) 'Contains 70–85% ethanol' and 'Not petrol or diesel'; or 2) 'Contains x% ethanol' and 'Not petrol or diesel' (where x is a number between 70 and 85).
- 47 Trade Practices (Industry Codes Oilcode) Regulations 2006.
- ⁴⁸ The standards are made under the Motor Vehicle Standards Act 1989 (Cth). See http://www.infrastructure.gov.au/roads/environment/files/Emission_Standards_for_Petrol_Cars_1972_2 018.pdf and http://www.infrastructure.gov.au/roads/environment/emission/, accessed 25 February 2015.

⁴⁰ Queensland Ministerial Media Statement, Treasurer and Minister for Employment and Economic Development, The Hon Andrew Fraser, 28 October 2010. http://www.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=72283, accessed on 9 February 2015.

⁴¹ Liquid Fuel Supply (Ethanol) Amendment Bill 2014, http://www.parliament.qld.gov.au/workof-assembly/bills-and-legislation/previous-bills-register/54th%20Parliament, accessed on 4 February 2015.

⁴² http://www.abc.net.au/news/2015-05-06/queensland-parliament-supports-ethanolmandate/6450450, accessed on 15 May 2015.

⁴³ Fuel Standard (Petrol) Determination 2001 (Cth).

2.3.1 Commonwealth excise and renewable biofuels policies

The Ethanol Production Grants Program (EPG) pays a grant to domestic ethanol producers of 38.143 cpl on road transport fuel.⁴⁹ Consequently, the 'effective' rate of excise on domestically produced fuel grade ethanol is zero.⁵⁰

However, the Australian Government announced it will cease the EPG on 30 June 2015. The fuel excise on domestically produced ethanol will also be reduced to zero from 1 July 2015 and then increased by 2.5 cpl per year for five years from 1 July 2016 until it reaches 12.5 cpl by 2020.⁵¹

Imported ethanol is subject to fuel excise of 38.143 cpl (before indexation).⁵² Ethanol is also subject to a 5% tariff if imported from countries other than those with a free trade agreement with Australia.⁵³

Appendix B (Table B.3) summarises other key Commonwealth renewable biofuel policies.

⁴⁹ Ethanol sold as road transport fuel is subject to excise duty at the same rate as petrol (38.143 cpl).

⁵⁰ http://www.business.gov.au/grants-and-assistance/energy-fuels/Ethanol-Production-Grants/Pages/default.aspx, accessed 29 January 2015.

⁵¹ Australian Government, Budget measures: budget paper no. 2: 2014–15, p 165.

⁵² https://www.ato.gov.au/General/New-legislation/In-detail/Indirect-taxes/Excise/ Reintroduction-of-fuel-excise-indexation/, accessed 19 February 2015.

⁵³ Australian Government, Budget measures: budget paper no. 2: 2014–15, p 165. http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Libr ary/pubs/rp/BudgetReview201415/Ethanol, accessed 17 February 2015. Australia currently has a free trade agreement with one other major ethanol producer, the United States.

3 Market conditions

The Act imposes an ethanol mandate on volume fuel sellers to ensure ethanol comprises 6% of their total volume of petrol sold. In this chapter, we set out background information on the ethanol and petrol market, including:

- market participants
- market share of different petrol products
- trends in the supply and demand of ethanol, and
- price of petrol products.

3.1 The petrol industry in NSW

The ethanol mandate is imposed on volume fuel sellers, comprising:

- Primary wholesalers
 - BP Australia Pty Ltd (BP)
 - Caltex Australia Ltd (Caltex)
 - Mobil Oil Australia Pty Ltd (Mobil)
 - Viva Energy Australia Ltd (Viva Energy)
 - United Petroleum Pty Ltd
 - Park Pty Ltd
 - Freedom Fuels Australia Pty Ltd
 - Neumann Petroleum (Puma Energy)
 - Lowes Petroleum Service.
- Major retailers Woolworths Limited and 7- Eleven Stores Pty Ltd.⁵⁴

Primary wholesalers supply nearly all of the petrol motorists in NSW purchase.55

⁵⁴ The major retailers purchase petrol from the primary wholesalers. Total petrol sales in NSW excludes sales of petrol by the primary wholesalers to the major retailers, to avoid double-counting.

⁵⁵ There are some sales of petrol in NSW that are sourced directly from interstate and not measured in the total petrol sales by volume fuel sellers. However, they are small amounts and mainly limited to the interstate border regions of NSW.

Figure 3.1 shows the general flow of petrol through the various sectors of the Australian petrol industry. It broadly applies to petrol flows through NSW, except NSW no longer has any refineries.

Figure 3.1 Flow of petrol through sectors of the Australian petroleum industry



Data source: ACCC, Monitoring of the Australian petroleum industry, December 2014, p 40.

A primary wholesaler will supply petrol (including E10) from its terminals to:56

- ▼ its company owned and company operated sites, franchisee sites, and independent branded sites, and
- independent distributors who will then supply to independent (non-branded) sites.⁵⁷

A primary wholesaler such as BP supplies petrol to BP controlled sites, where BP controls the products and pricing; and non-controlled sites (franchisees, independent branded sites, independents), where BP does not control the products or pricing. Under the Act, BP reports on the percentage of ethanol uptake for its total volume of petrol sales, including the sales to non-controlled sites.

⁵⁶ There are various terminals located throughout NSW – Banksmeadow, Kurnell, Parramatta, Silverwater, Botany, Newcastle and Port Kembla. Source: ACCC, *Monitoring of the Australian petroleum industry*, December 2014, Appendix D, p 168.

⁵⁷ DIB Group, eg, is a fuel distributor that purchases fuel from Mobil and then sells to various sites such as independent service stations.

There are other arrangements. Viva Energy, eg, supplies petrol to Coles Express sites, which are franchisee sites, but Viva Energy does not control the price of petrol at these sites. Similarly, Mobil sells fuel to 7-Eleven sites, which are independent sites that use the Mobil logo, but Mobil has no control over product or pricing.

There are currently about 2,000 service stations in NSW and about 39% of those are controlled by volume fuel sellers. Other service stations may be franchisees, independent branded sites or independent sites.⁵⁸

3.2 Supplying fuel grade ethanol

3.2.1 Australian supply capacity

Nearly all of the ethanol sold in E10 in NSW is sourced from Manildra Group. The ethanol is delivered to various terminals in NSW where it is blended with regular unleaded petrol.

There are currently three producers of fuel grade ethanol in Australia (Table 3.1):

- Manildra Group (Nowra, NSW) ethanol primarily produced from wheat (waste starch)
- Wilmar Sugar (Sarina, QLD) ethanol produced from molasses
- Dalby Bio-refinery (Dalby, QLD) ethanol produced from sorghum and other grain.

Manildra Group is currently the largest fuel grade ethanol producer in Australia and is capable of producing about 67% of Australia's current total supply capacity (Table 3.1).

⁵⁸ Confidential pers comm, 18 March 2015; confidential correspondence, February 2015.

	Location	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Manildra	Nowra, NSW	300	300	300	300	300	300	300
Wilmar	Sarina, QLD	60	60	60	60	60	60	60
Dalby	Dalby, QLD	90	90	90	90	90	90	90
Total existing		450	450	450	450	450	450	450
NQBEa	Ingham, QLD	N/A	N/A	N/A	30	60	60	60
BIYp	Junee, NSW	N/A	N/A	N/A	115	230	230	230
Dongmun Greentec	Deniliquin, NSW	N/A	N/A	N/A	N/A	55	110	110
Eagle Energy	Coleambally, NSW	N/A	5	5	5	5	5	5
Total planned		0	5	5	150	350	405	405
Total		450	455	455	600	800	855	855

 Table 3.1
 Australian ethanol production capacity (ML) 2014 to 2020

a North Queensland Bio-Energy.

b Biodiesel Industries Australia.

Source: APAC Biofuel Consultants, Australian Biofuels 2014-15, p 32.

According to APAC Biofuel Consultants (APAC), there is planned additional capacity of up to about 405 ML of fuel grade ethanol. If all new production comes on stream as planned, then total Australian ethanol production capacity could reach about 855 ML by 2020. However, unless the demand for fuel grade ethanol changes substantially, the planned ethanol production capacities will not be needed.⁵⁹

APAC notes some of these 'planned' fuel grade ethanol plants have been delayed, while other projects have been shelved for the time being, such as the Austcane project in the Burdekin region and the Agrifuels sorghum project at Childers, both in Queensland. No new greenfield ethanol plants have been constructed in Australia since 2009, when the Dalby plant was commissioned.⁶⁰

3.2.2 Supply from overseas

World ethanol production is dominated by the USA (58%) and Brazil (29%).⁶¹ Australia produces about 0.3% of total world ethanol output.⁶²

Currently, there is no supply of fuel grade ethanol from overseas markets into NSW. Further, imports are unlikely in the foreseeable future given the Australian Government's concessionary excise arrangements for local ethanol producers (Chapter 2).

⁵⁹ APAC Biofuel Consultants, Australian Biofuels 2014-15, p 33.

⁶⁰ Ibid, p 33.

⁶¹ Ibid, p 19.

⁶² Ibid, p 19.

In addition:

- The cost of transporting/shipping ethanol from overseas is likely to be relatively high.⁶³
- ▼ Ethanol storage facilities in NSW are currently limited and not geared to accept additional large cargo.⁶⁴

3.2.3 Retail sites selling ethanol blended fuel

About 55% of the service stations in NSW sell ethanol blended fuel as E10.⁶⁵ Within Sydney, around 500 service stations supply E10. However, recently the number of sites supplying E10 has been decreasing, especially the number of sites supplying E10 only. By contrast, the number of sites supplying RULP has risen since 2012 (Figure 3.2).

Figure 3.2 Number of sites selling RULP, E10 and E10 only in Sydney: July 2007 to October 2013



Data source: ACCC, Monitoring of the Australian petroleum industry, December 2013, p 54.

3.3 Demand for ethanol blended fuel

3.3.1 Trends in total petrol sales

Petrol sales in NSW fell 10% between 2007 and 2014 (Figure 3.3).

⁶³ IPART, Ethanol supply and demand in NSW – Final Report, March 2012, p 26.

⁶⁴ Confidential pers comm, 19 February 2015 and 26 February 2015.

⁶⁵ Confidential pers comm, 18 March 2015.



Figure 3.3 NSW Petrol/E10 market history (GL/quarter)

Data source: Confidential correspondence (Office of Biofuels).

3.3.2 Composition of petrol sales

As expected, E10 sales increased after the ethanol mandate was introduced in 2007. By the end of 2013-14, E10 accounted for about 33% of the total volume of petrol sold in NSW. Over the same period, PULP sales in NSW increased substantially and PULP accounted for about 40% of the total volume of petrol sold (Table 3.2).

Table 3.2	Composition of	petrol sales in NSW ^a ((2006 to 2014)
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	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
PULP	17%	17%	19%	22%	30%	35%	38%	40%
RULP	81%	77%	66%	57%	35%	29%	28%	28%
EBP (E10)	1%	6%	15%	21%	35%	36%	35%	33%

a Includes Australian Capital Territory sales.

Note: Numbers may not add to 100% due to rounding. Premium unleaded covers 95 & 98 Octane. **Source:** Australian Petroleum Statistics, Table 3B, and IPART calculations.

3.3.3 Trend in E10 sales

The volume of ethanol sold as a proportion of petrol sold by volume fuel sellers who are subject to the 6% ethanol mandate is low. Currently, demand for ethanol as a proportion of total petrol sold by volume fuel sellers is marginally above 3%, and the highest proportion achieved to date is only about 4%.

Figure 3.4 shows ethanol sales as a proportion of total petrol sales by volume fuel sellers in NSW from 2007 to 2014. It also shows changes to the ethanol mandate over time, from 2% when first introduced in 2007, increasing to the current level of 6% in 2011.

Figure 3.4 Demand for ethanol as a proportion of total petrol sales by volume fuel sellers in NSW



Data source: Confidential correspondence, February 2015.

Currently, ethanol supplies in Australia are sufficient to meet the 6% ethanol mandate in NSW. In 2013-14, ethanol production in Australia was around 450 ML and total ethanol demand was about 236 ML. NSW ethanol demand accounted for 82% (or 192 ML) of Australia's total ethanol demand in 2013-14. If volume fuel sellers met the NSW 6% ethanol mandate in 2013-14, NSW would have demanded 350 ML of ethanol, bringing total ethanol sales in Australia to 393 ML.⁶⁶

3.3.4 Ethanol demand in other jurisdictions

Ethanol blended petrol is available in all states and territories throughout Australia.

The Queensland Government intended to introduce an ethanol mandate of 5% in 2011 but abandoned it. However, increased awareness about the benefits and availability of EBP (given the planned introduction) resulted in a higher uptake of EBP in Queensland compared with other jurisdictions (excluding NSW).

⁶⁶ APAC Biofuel Consultants, Australian Biofuels 2014-15, p 32.

Ethanol uptake was about 1% of total petrol sold in Queensland in 2013-14. By contrast, ethanol uptake was about 0.2% of total petrol sold in Victoria, and for negligible amounts in remaining jurisdictions.⁶⁷ Table 3.3 shows the composition of petrol sales across Australia in 2013-14.

	NSW	VIC	QLD	SA	WA	TAS	NT
PULP	40%	22%	24%	18%	24%	19%	20%
RULP	28%	77%	67%	82%	76%	81%	80%
EBP (E10)	33%	2%	9%	0%	0%	0%	0%

 Table 3.3
 Composition of petrol sales across Australia, 2013-14

Note: Numbers may not add to 100% due to rounding. Premium unleaded covers 95 & 98 Octane. **Source:** Australian Petroleum Statistics, March 2015, Table 3C, and IPART calculations.

3.4 Proportion of vehicles that can use E10

We estimate about 85% of the registered vehicles in NSW that can take unleaded petrol are compatible with EBP. This estimate is based on Roads & Maritime Services' analysis of registered vehicles in NSW.⁶⁸ It represents an increase of 7 percentage points from 78% of unleaded petrol vehicles being compatible in 2008.⁶⁹

Around 70% of registered cars compatible with EBP would need to use E10 for ethanol to comprise 6% of petrol sales. Further, an increasing number of new vehicles are E10 compatible, which could improve ethanol uptake, if nothing changes.

⁶⁷ Australian Petroleum Statistics, March 2015, Table 3C, and IPART calculations.

⁶⁸ RMS, Ethanol-10 capability NSW vehicles capable of using E-10, February 2014, p 3 and IPART analysis.

⁶⁹ RMS, Ethanol-10 capability NSW vehicles capable of using E-10, February 2014, p 4.

3.5 Price of petrol products

Figure 3.5 shows the average price difference between E10 and RULP at monitored sites in NSW that offer both E10 and RULP. Over the past few years, the average price difference between E10 and RULP at these sites has been about 2 cpl, compared with 3 cpl in previous years.⁷⁰

Figure 3.5 Average price differentials between E10 and RULP across monitored locations (December 2007 to June 2014)



Note: Only prices at service stations that sell both RULP and E10 are included in the monitored locations. Measured in nominal terms by the ACCC.

Data source: ACCC, *Monitoring of the Australian petroleum industry*, December 2008 to 2014 and IPART calculations.

By contrast, E10 was about 13 cpl less than PULP 95 in Sydney in 2013-14 (a decrease of 0.2 cpl from 2012-13).⁷¹

⁷⁰ The average quarterly price of RULP over December 2007 to June 2014 varied from 114.5 cpl to 153.6 cpl.

⁷¹ ACCC, Monitoring of the Australian petroleum industry, December 2014, p 114.

4 Current barriers to achieving the ethanol mandate and options to increase ethanol uptake

In 2012, the NSW Government removed the requirement for E10 to replace RULP at petrol stations. Since then, the level of ethanol as a percentage of total volume of petrol sold in NSW declined from 4% to about 3.2% at the end of 2014. Further, since the ethanol mandate was introduced in 2007, PULP sales in NSW increased by about 124%, compared with 26% in the rest of Australia. The evidence suggests NSW consumers are averse to ethanol blended petrol.

In this chapter, we review the current impediments to achieving the ethanol mandate and identify options to address these barriers.

4.1 Findings

- 1 The key barriers to achieving the ethanol mandate are:
 - Consumer aversion or uncertainty about ethanol blended products.
 - Regular unleaded petrol continues to be available and the current small price difference between regular unleaded petrol and E10 means consumers may view E10 as not being value for money on an energy parity basis.
 - Scope of the mandate is currently limited to primary wholesalers and major retailers operating more than 20 sites.
 - The burden to meet the mandate is on primary wholesalers and major retailers, who do not fully control consumer demand.
 - Primary wholesalers and major retailers are exempt from complying with the mandate if they can demonstrate they took reasonable steps.
4.2 Current barriers to achieving the ethanol mandate

4.2.1 Consumer demand

The ethanol mandate demonstrates NSW consumers' aversion to E10. Often, NSW consumers must choose between E10 and PULP because RULP is not available. PULP sales in NSW grew by about 124% since the mandate was introduced in 2007. By contrast, PULP increased by 26% over the same period in the rest of Australia.⁷²

Further, feedback from consultations and recently granted exemptions to volume fuel sellers suggests ethanol sales as a proportion of petrol sales in NSW will keep falling, to account for less than 3% by the end of 2015.

Our consultations revealed:

- Some volume fuel sellers are actively re-introducing RULP and removing E10 at service stations. They reported some customers travel to competitor service stations that provide RULP.
- Consumers posted negative comments about E10 on volume fuel sellers' social media sites when sellers held promotional events such as providing E10 for free at particular sites.

A volume fuel seller also advised that petrol sales increased when it clearly presented it did not sell E10. Several newspaper articles reported this practice. Another volume fuel seller surveyed customers at its service stations over two years. The results suggested 34% to 55% of RULP customers did not purchase E10 because they either did not trust it or thought it was not good for their car.⁷³

Based on information provided as part of our consultation process, and assuming current market settings (eg, in relation to consumer preference and price), the level of ethanol sold will continue to decline as major retailers reintroduce RULP at sites. Major retailers seeking exemptions from the mandate argue that they are losing market share to retailers not subject to the mandate (who do not have to offer E10) because consumers can choose ethanol-free products.

4.2.2 The mandate's scope

The mandate's scope is limited, covering only primary wholesalers and major retailers with 20 sites or more. Currently, about 39% of the 2,000 service stations in NSW are controlled by volume fuel sellers.⁷⁴

⁷² ACCC, Monitoring of the Australian petroleum industry, December 2014, p 108.

⁷³ Confidential pers comms, 18 February 2015. The sample size was relatively small - about 50 customers.

⁷⁴ Confidential pers comm, 18 March 2015; confidential correspondence, February 2015.

Primary wholesalers and major retailers are required to meet the ethanol mandate, but they do not fully control consumer demand. Primary wholesalers (if they do not own and operate retail sites) do not control retailers' choice of product or pricing and therefore have limited effect on consumer demand. Many major retailers reduced the supply of RULP since the mandate was introduced, but often consumers choose PULP over E10.

The Act exempts volume fuel sellers from complying with the mandate if sellers can demonstrate they took all reasonable steps to comply with the mandate (Chapter 2).

4.2.3 Price differential between E10 and RULP

The price differences between E10 and RULP are generally small (currently about 2.2 cpl), giving consumers little reason to choose E10. The small price difference could mean consumers view E10 as not being value for money. Ethanol contains 31.6% less energy per litre than petrol and, on average, using E10 increases fuel consumption by about 3%.⁷⁵ To make E10 competitive, it needs to be about 3% cheaper than RULP. The average price difference of 2.2 cpl (April to June 2014) means E10 is only about 1.5% cheaper than RULP.

4.3 Options for increasing ethanol uptake

We identified options to increase ethanol uptake that would address the demand, supply and pricing issues discussed in Section 4.2 as set out below:

Supply side measures (Chapter 6)

- Broaden the ethanol mandate Increase the number of service stations that must comply with the mandate. Currently, retailers with 20 service stations or more must comply with the mandate.
- Introduce premium ethanol blends Increase market penetration by offering an ethanol blend premium product, particularly given the recent uptake of PULP.
- Increase local supply competition Fast-track development approvals to increase the number of domestic suppliers of ethanol. Currently, there is only one ethanol supplier in NSW and two in Queensland.
- Require ethanol in all fuel (except diesel) Increase ethanol consumption by reducing or eliminating consumer choice.
- Require wholesalers to replace RULP with E10 Remove the availability of RULP and reduce consumer choice.

⁷⁵ NSW Trade & Investment, *E10 fuel economy*, 2015 http://www.resourcesandenergy.nsw.gov.au/energy-consumers/sustainable-energy/officeof-biofuels/e10-fuel-economy, accessed 31 March 2015.

 Require all wholesalers to purchase ethanol volume equivalent to 6% of total fuel sales.

Demand side measures (Chapter 7)

- Improve consumer education Change consumer preferences by providing clear information on compatibility of motor vehicles with E10, in consultation with industry bodies and car manufacturers.
- Convert the government motor vehicle fleet to flex-fuel vehicles Increase ethanol uptake because flex-fuel vehicles run on ethanol blended petrol containing 85% ethanol (E85).

Enforcement measures (Chapter 8)

- Tighten the conditions for exemptions and definition of reasonable steps Reduce the ability of volume fuel sellers to obtain exemptions from complying with the mandate.
- Set higher penalties for non-compliance Increase incentives to encourage volume fuel sellers to purchase ethanol blended products. Penalty notices are currently set at \$5,500 and court imposed penalties are capped at \$55,000 for a first offence and \$550,000 for a subsequent offence.

Price measures (Chapter 9)

- Set the maximum price of ethanol to energy parity value with RULP Under a Ministerial Guideline, the Biofuels Expert Panel could recommend exemptions for volume fuel sellers from complying with the mandate if the price of ethanol is more than 70% of the import parity price of RULP (including freight, insurance, wharfage, import duty and excise).
- Set the maximum price of ethanol to an international benchmark A lower price of ethanol (and assuming a consequent lower price of E10) could stimulate demand for ethanol blended products.
- Regulate the price of ethanol produced by Manildra Group (the dominant domestic ethanol supplier) – A price regulator could determine the maximum price of ethanol produced by Manildra Group, based on Manildra Group's efficient costs.

Other measures (Chapter 10)

- Set an ethanol target rather than a mandate The price of ethanol could reduce if volume fuel sellers do not have to purchase ethanol to meet the mandate. Lower prices could in turn drive higher demand for EBP.
- Blend E10 at 9.5% Change the definition of E10 to require a minimum of 9.5% ethanol. Currently, the minimum ethanol content under the Regulations is 9.0%.

 Convert the NSW Government bus fleet to run on 100% ethanol – This option does not relate to the current mandate, which relates to ethanol as part of ethanol blended petrol sold by volume fuel sellers.

Figure 4.1 illustrates the ethanol market and the point where each option could mitigate the current barriers.

Figure 4.1 Measures to increase ethanol uptake, by type and point of application



5 Assessment methodology

The TOR asked us to assess the effectiveness of measures to reach the 6% ethanol mandate, including the direct and indirect costs to the NSW Government, consumers and businesses of implementing these measures.

In this chapter, we set out our methodology to assess options to increase ethanol uptake. As a first step, we determined if the option is likely to increase ethanol uptake. If so, then we proceeded to a cost-benefit analysis.

5.1 Framework for assessment

We adopted a 3-step approach to assess the potential options to achieve the 6% ethanol mandate. First, we conducted a preliminary assessment of the level of ethanol uptake 'before and after' an option is implemented. 'Before' meant the current level of ethanol uptake (3.2% as of December 2014). We ran a hypothetical scenario, assuming all changes required under a particular option were implemented instantaneously, to see the effect on ethanol uptake ('after'). Then we compared the end ('after') position of ethanol uptake with the start ('before') position.

If the option did not appear to materially increase the level of ethanol uptake, it did not progress to the second stage of a full cost-benefit analysis. Step 2 involved a cost-benefit analysis of the options that passed step 1.

Step 3 presented our findings from steps 1 and 2. Figure 5.1 presents our framework for assessing the options. Our approach to the cost-benefit analysis is outlined in the following section.

We also considered a combination of options to see whether, as a package, they were likely to increase the uptake of ethanol to reach the 6% mandate (Chapter 10).



Figure 5.1 Framework to assess the potential options

5.2 Cost-benefit analysis

To establish the likely impact of measures aimed at reaching the 6% mandate, we evaluated the direct and indirect costs to the NSW Government, consumers and businesses of implementing such measures. We assessed each option by conducting a cost-benefit analysis (CBA).

The CBA told us whether an option delivers net benefits to NSW. We evaluated impacts on different groups within NSW, both direct and indirect, and considered impacts in the short and medium term. We calculated the net present value (NPV) of the stream of benefits and costs to the NSW community, converting all impacts into 2015 value dollar terms. We discussed the qualitative benefits and costs if we couldn't fully quantify impacts.

Appendix C lists our baseline assumptions and inputs.

-	-	
Group	Sub-group	Impacts to consider
Producers of ethanol – supply		 Producer surplus (profits) Market share Effect on competition
Volume fuel sellers – supply intermediary	Currently subject to the mandate	 Market share Cost of compliance (replacing tanks and infrastructure) Cost of interruption/closure Administrative (time) costs Cost of responding to NSW Government enforcement action Cost of penalties for failure to comply with a minimum biofuel requirement
	New volume fuel sellers that would be subject to the mandate under a specific option	 Cost of compliance (replacing tanks and infrastructure) Cost of interruption/closure Administrative (time) costs
Motor vehicle industry and services		 Additional costs to deliver the option
Consumers (demand)	Private ground transport (motorists)	 Consumer welfare loss/gain (from switch)
	Business transport	 Loss of convenience (from business closure)
	Maritime/recreational boating	 Technical suitability/loss of value
	Non-transport personal	 Technical suitability/loss of value
	Non-transport business (eg, farm machinery, pumps)	 Technical suitability/loss of value Multiplier effect for business uses
NSW Government		Cost of implementationCost of enforcing compliance
Broader NSW community	Greenhouse gases abatement (GHG, mostly CO ₂)	 Impact of CO₂ abatement
	Health impacts	 Health impacts of volatile organic compounds (VOCs) and particulate matter (PM_{2.5})
	Regional development	 Effect on regional employment
	Alternative fuels policy	 Effect on other biofuels (2nd generation)
	Broader environment	 Pollution (ie, fertiliser load in surface water)
	Fuel supply security	 Reduction of reliance on imports
	Food security	 Prices and availability of domestic animal feedstock

Table 5.1 Impacts considered for CBA of options

We relied on some relevant earlier studies and applications to develop our CBA approach (Appendix C).

5.2.1 Methodology and assumptions for CBA

We adopted the NPV approach with a 10-year time frame and a discount rate of 7%,⁷⁶ and conducted sensitivity analyses for discount rates in the 4% to 10% range.

Baseline

We assessed the costs and benefits of each option against a 'business as usual' base case, or a baseline.

The base year for analysis is 2014-15, and all dollar impacts are reported in constant \$2014-15 unless specified otherwise. We extrapolated the current trend of ethanol uptake to derive the starting point at 30 June 2015 of 3.1%.⁷⁷ The baseline scenario extends for 10 years, from 2015-16 to 2024-25. It assumes the current mandate continues to be enforced under the current exemption procedures, the current market trends prevail and the level of ethanol uptake drops to 2% of total NSW petrol consumption by 2024-25.

We explored options to increase ethanol uptake, discussed in Chapter 4, by building relevant scenarios. In our scenario analysis, we made assumptions about the time path for changes in the distribution of consumer preferences (ie, the composition of petrol sales), and forecast the additional demand for ethanol.

We tested the sensitivity of our results to the input assumptions by producing a range of scenarios (low, medium and high). The low scenario used the lowest estimate of benefits versus the highest estimate of costs. The high scenario compared the highest estimated benefits with the lowest costs. The medium scenario analysis rested on the medium estimates of benefits and costs, and is reported in the body of this report. The low to high ranges are presented in Appendix C.

We focused on the costs and benefits accruing to NSW residents (except for the impacts of CO_2 reductions as discussed below). We considered the effect on the NSW Government, but not on the Australian Government (ie, the Ethanol Production Grant program and the fuel excise were outside the scope of our CBA).

In the following section, we discuss the impact of increasing ethanol uptake on different community groups considered in our analysis.

⁷⁶ NSW Treasury, NSW Government guidelines for economic appraisal, TPP 07-5, July 2007, p 52.

⁷⁷ Volume of ethanol to volume of petrol sold.

5.2.2 Key costs

Loss in consumer surplus

In all scenarios, consumers switching from any petrol blend (considered to be close substitutes for the switching consumers in this analysis) to a higher priced option (eg, from RULP to PULP) is a movement along the demand curve for the switching consumers. These movements to a higher priced product are a consumer welfare loss (or a loss in consumer surplus) and are represented by the dark shaded area in Figure 5.2.

When the price increases from P_0 to P_2 (eg, because the consumers switch from RULP to PULP to avoid E10), the switching portion of the demand is facing the higher price for the same product (petrol).⁷⁸ These consumers lose the shaded area $P_0P_2D_2D_0$ under the demand curve. We assume other consumers (ie, those previously demanding E10 and PULP) are unaffected by the switch, holding the relevant prices for them constant.





⁷⁸ For simplicity of presentation, we discuss these two separate switches as movements along the same demand curve, using the energy adjusted prices of substitute products. Appendix Table C.1 discusses energy adjustment factors used in the analysis.

We assumed different price elasticities for different scenarios. In scenarios where we modelled changes to the relative sales volume of different petrol types (while keeping relative prices of petrol types constant), we calculated the change in consumer surplus as the direct saving or loss to the switching consumers, based on the new energy adjusted price applied to the equivalent fuel quantity adjusted for energy efficiency. For these scenarios, we assumed low own-price elasticity of aggregate demand for petrol (between -0.01 and -1).⁷⁹

In the options where we assessed the impact of price regulation on ethanol uptake (Chapter 9), we allowed for a higher own-price response of the demand for E10 (own-price elasticity from -2 to -5), and also for the higher degree of substitution between RULP and E10 (cross-price elasticity from 0.5 to 2) (Chapter 9 and Appendix Table C.1).

Existing volume fuel sellers

Most existing volume fuel sellers already incurred the costs necessary to distribute E10. There are additional costs to the volume fuel sellers under the option that tightens exemption grounds and requires exempt sites to comply (Appendix C).

New or proposed volume fuel sellers

New sites brought under the mandate as part of the supply side options will incur the same type of costs as those already incurred by current volume fuel sellers.

Currently, many of the older tanks used by rural and regional stations are not suitable to store ethanol. Ethanol is hygroscopic, which means it attracts water.⁸⁰ Petrol is stored in underground fuel storage tanks, which typically contain some water. For tanks containing ethanol-free fuel, any water would collect at the bottom of the tank, where it could be detected and removed.⁸¹ For tanks containing EBP, the water may not collect on the bottom of the tank but rather be absorbed by the ethanol. Traditional water detection and removal methods would not work for tanks containing EBP.

⁷⁹ Short-run own-price elasticity of demand for petrol was estimated to be in the range of -0.01 to -1.36, with a mean of -0.26 (see Appendix Table C.1 for discussion and sources).

⁸⁰ Advanced Motor Fuels, http://www.iea-amf.org/content/fuel_information/ fuel_info_home/ethanol/e10/ethanol_properties, accessed 26 March 2015.

⁸¹ Reid, K. (2010), Ethanol Blended Fuels, Presentation at Biofuels & LD Session National Tanks Conference, Tuesday, September 21, 2010. 22nd National Tanks Conference and Expo Westin Hotel Boston Waterfront, Boston, Massachusetts, September 20-22, 2010, http://www.neiwpcc.org/tanks2010/presentations/Tuesday%20Presentations/Reid%20Biofu els%20%20LD%20Session%20Tuesday.pdf accessed 21 May 2015.

As the water is absorbed by the ethanol blended fuel, phase separation can occur.⁸² When ethanol becomes saturated with water, it drops out of the fuel and collects at the bottom of the tank. Some tanks and components may be incompatible to higher concentrations of ethanol. Prolonged exposure to phase separation can damage tank materials and other components (eg, sealants, lining etc).⁸³

Service stations would need to replace some older tanks that are close to the end of their usable life.

We assumed the cost to refurbish an underground tank to make it E10 suitable ranged from \$12,500 (the low estimate) to \$200,000 (the high estimate) per tank; the medium estimate was \$40,000 per tank (Appendix Table C.1).

Some smaller stations may decide to shut down and exit the business, given the costs of replacing tanks. We did not quantify the costs of business closure, because we assumed another retailer in the area picked up this business. However, we calculated additional costs to customers of losing convenience depending on the scenario, as discussed below.

Consumers – loss of convenience

If we modelled new volume fuel sellers brought under the mandate in our scenario as shutting down rather than incurring the additional costs to convert, we estimated the costs to customers of time lost in additional travel, and fuel costs to travel additional distance to refuel. Appendix C discusses the assumptions. We used the Better Regulation Office estimate of time costs.⁸⁴

Ethanol incompatibility - maritime, farm machinery and small appliances

Hygroscopic properties of ethanol make it unsuitable for use in marine applications.⁸⁵ We estimated the costs arising to recreational boating from options that modelled making ethanol-free fuels unavailable. We modelled loss of value of small engine appliances requiring ethanol-free fuel, as well as estimated number of other machinery requiring such fuel, as costs of ethanol incompatibility (Appendix C).

⁸² See eg, US EPA (2009). Weaver, J.W., S.A. Skaggs, D.L. Spidle, G.C. Stone. "Composition and Behavior of Fuel Ethanol." EPA 600/R-09/037, p 23.

⁸³ Ibid.

⁸⁴ Better Regulation Office, Guidelines for estimating savings under the red tape reduction target, February 2012, p 15.

⁸⁵ Advanced Motor Fuels, http://www.iea-amf.org/content/fuel_information/ fuel_info_home/ethanol/e10/ethanol_properties, accessed 26 March 2015; and Marine Retailers Association of the Americas, MRAA Issues Action Alert on Ethanol, 15 January 2014, http://www.mraa.com/news/152726/MRAA-Issues-Action-Alert-on-Ethanol.htm, accessed 26 March 2015.

Government

There are administrative and enforcement costs to the Government resulting from expanding the mandate. We assumed the Government incurs a constant cost of \$1,100 per year per additional station when extending the mandate (Appendix C).

There are also direct costs of funding specific measures under the options (eg, an education campaign). We discuss these costs in the relevant scenario analyses.

5.2.3 Key benefits

Producer surplus - ethanol producers

The major benefits of measures to increase ethanol uptake would accrue to the NSW producer of ethanol.

There is a large degree of uncertainty associated with estimating the magnitude of producer surplus accruing to the ethanol producers. We calculated the net producer surplus in proportion to the expansion of ethanol output (in ML per year). In our analysis, the NSW ethanol producer accrued all producer surplus, on the assumption it is the least cost ethanol supplier.⁸⁶ The profits earned by the producer are represented by the shaded area in Figure 5.3. The shaded area equals the share of total revenue over and above the average cost curve, ie, the profit.

Our estimates of margins earned by ethanol producers range from 5 cpl⁸⁷ (low) to 50 cpl⁸⁸ (high) with 30 cpl used in the medium scenario analysis. We tested the sensitivity of our net benefits calculations to this range in producer profits (Appendix C).

⁸⁶ We consider this assumption is reasonable given its economies of scale and scope and lower transportation costs relative to interstate producers.

⁸⁷ Bureau of Resources and Energy Economics (BREE), *An assessment of key costs and benefits associated with the Ethanol Production Grants program - Report for the Department of Industry,* February 2014, p 13, based on the wheat (and not wheat starch waste) as feedstock.

⁸⁸ DTIRIS estimates.



Figure 5.3 Producer surplus

Producer surplus - volume fuel sellers

Our analysis focuses on the costs and benefits to the NSW community. We note there are currently no petrol producers in NSW, so there is no loss in producer surplus to NSW from an increase in the uptake of alternative sources of fuel.

We assumed volume fuel sellers within NSW apply the same margin to the petrol products they sell. We modelled any changes in costs volume fuel sellers incurred from increased ethanol uptake directly in each option. We replaced the quantity of RULP withdrawn as part of the scenario analysis with the energy equivalent quantity of PULP and E10 (in partial equilibrium analysis, keeping the price of those products, and price differentials, constant).

If RULP is withdrawn, there may be additional benefits to volume fuel sellers from an increase in the total amount of fuel demanded by consumers who switch to E10, due to its lower energy content. At the same time, there may be potential loss of volume from other consumers who switch from RULP to PULP. Given the lack of reliable estimates of the market average of these changes, we assumed these changes cancel out, with no net impact on the volume fuel sellers' producer surplus as a result of changes in E10 sales.

Unless stated otherwise, our analysis focuses on the producer surplus earned by ethanol producers only.

5 Assessment methodology

Gain in consumer surplus

In all scenarios, consumers switching from any petrol blend (considered to be close substitutes for the switching consumers in this analysis) to a lower priced option (eg, from PULP to E10) is a movement along the demand curve, with the lower (energy-adjusted) price of the product increasing consumer welfare. The light shaded area in Figure 5.2 represents the resulting gain in consumer surplus.

Greenhouse gases abatement (GHG)

Biofuels have been promoted for their renewability and lower carbon footprint compared with traditional fuels. Australia's National Greenhouse Gas Inventory guidelines rate the carbon dioxide (CO₂) emissions from ethanol combustion (including that produced from molasses, wheat and sorghum) at zero, because CO₂ released during combustion is recycled by the growth cycle of the feedstock.⁸⁹ However, there are small levels of other GHG emissions, such as methane and nitrous oxide, associated with ethanol blended petrol combustion. In the aggregate, combustion of ethanol replacing petrol improves the CO₂ balance and reduces GHG emissions.

The estimated benefits of GHG abatement, under a lifecycle assessment, from replacing RULP with E10 ranged from \$4,591 (low) to \$38,727 (high), with a medium value of \$11,477, per ML of additional ethanol.

Health impacts - air quality (particulate matters and other)

Health benefits accruing from replacing petrol with ethanol in transportation fuels are predominantly due to reducing particulate matter (PM).⁹⁰ However, estimates depend on the size of the particulate matter under consideration (eg, $PM_{2.5}$ vs PM_1). There are other substances that are produced during the ethanol combustion process such as Volatile Organic Compounds (VOCs), ozone and ethanol released to the atmosphere through incomplete combustion. The overall effect on air quality therefore must be carefully evaluated.

⁸⁹ See Bureau of Resources and Energy Economics (BREE), An assessment of key costs and benefits associated with the Ethanol Production Grants program - Report for the Department of Industry, February 2014, p 17; Department of Environment GHG inventory methods at http://ageis.climatechange.gov.au/, accessed 24 March 2015.

⁹⁰ Beer, T, Carras J. et al, 'The health impacts of ethanol blend petrol', *Energies* 2011, 4(2), pp 352-67, p 365.

We analysed a range of scenarios from expanding the ethanol output, ranging from mildly negative impacts on air quality based on the US data,⁹¹ to positive impacts on air quality and therefore health (based on Australian studies).⁹² Our estimated benefits are lower when E10 replaces PULP (Appendix Table C.1).

Regional employment

We did not quantify the impact on regional employment from additional or reduced ethanol production. Manildra Group is currently the only supplier of ethanol in NSW. Manildra Group has an integrated production process and ethanol is produced from waste starch from their other products. It also has excess production capacity, with the current production capacity at 300 ML of ethanol per year (Chapter 3).

Energy security

We did not quantify energy security effects in our analysis. At present, the relatively small scale of the ethanol industry in NSW and the limited availability of flex-fuel vehicles means any effects on energy security are likely to be negligible.

Food security

We did not quantify food security effects in our analysis. At present, there does not appear to be any substantial impacts on NSW agricultural food and feedstock prices given the scale of the ethanol industry in NSW. However, if the production of ethanol expands substantially, international experience suggests feedstock prices may rise in the long term.⁹³

Environmental impacts

Currently, there are no discernible negative environmental externalities that are not controlled by the relevant Environment Protection Licences Manildra Group holds, given the scale of the ethanol industry in NSW. However, international (in particular, US) experience demonstrates there may be some environmental effects (eg, increased fertiliser load in rivers), as the area for growing feedstock crops expands.⁹⁴

⁹¹ EPA, Renewable Fuel Standard Program (RSF2) Regulatory Impact Analysis, US Environmental Protection Agency, February 2010, p 5.

⁹² Beer, T, Carras J. et al, 'The health impacts of ethanol blend petrol, *Energies* 2011, 4(2), pp 352-67, p. 365; PAE Holmes, *Methodology for valuing the health impacts of changes in particle emissions – Final report –Report to NSW EPA*, February 2013; MMA, *Cost-benefit analysis of implementing Stage 2 Vapour recovery – Report to Department of Environment and Climate Change (NSW)*, June 2008.

⁹³ Bureau of Resources and Energy Economics (BREE), An assessment of key costs and benefits associated with the Ethanol Production Grants program – Report for the Department of Industry, February 2014, p 15.

⁹⁴ EPA, Renewable Fuel Standard Program (RSF2) Regulatory Impact Analysis, US Environmental Protection Agency, February 2010, p 5.

6 Supply side measures

The TOR requires us to examine measures to increase the uptake of fuel grade ethanol in NSW. Specifically, we were asked to examine supply side options including broadening the mandate and introducing premium ethanol blended petrol. We also assessed other supply side options such as increasing local supply competition and requiring ethanol in all fuels.

First, we examined the potential effectiveness of each measure in increasing ethanol uptake in NSW. Second, we conducted a cost-benefit analysis of options that seemed to increase ethanol uptake to determine their net economic costs or benefits to NSW.

Given the current consumer preference for ethanol-free petrol, options that broaden the scope of the mandate or increase the market penetration of ethanol would not have a material impact on ethanol sales, if consumers can choose ethanol-free products. Increasing local supply competition is unlikely, given the only ethanol producer in NSW has substantial excess capacity. Removing RULP from the market would initially result in an increase in ethanol uptake, before declining due to consumer aversion to ethanol blended petrol.

The option to include ethanol in all fuel would potentially increase ethanol uptake to between 6% and 10% of all petrol sales, based on current demand. However, the costs to implement this measure are substantial and would require a lengthy implementation period.

6.1 Findings

- 2 Requiring almost all fuel to contain ethanol is the only option that would in isolation achieve the 6% ethanol mandate. However, this option imposes a net cost on the NSW community.
- 3 Requiring wholesalers to replace regular unleaded petrol with E10 would increase ethanol uptake but would not achieve the 6% ethanol mandate, assuming ethanol-free petrol remains available and consumers' current preference for ethanol-free petrol.

- 4 Broadening the scope of the mandate, through the following options, would not materially affect ethanol uptake in NSW:
 - reduce the qualifying number of controlled service stations from 20 to 5
 - require all service stations to offer an ethanol blended product
 - require all service stations that sell more than 3 million litres of petrol per year to offer an ethanol blended product
 - require all service stations offering two or more petrol grades to offer an ethanol blended product.
- 5 Broadening the scope of the mandate (per Finding 4) would result in net costs that range between \$26 million to \$85 million, in net present value terms.
- 6 Requiring wholesalers to purchase ethanol equal to 6% of their total NSW petrol sales allows wholesalers to determine their lowest cost means of increasing ethanol uptake. However, actual ethanol uptake may be less than 6% and if wholesalers have to sell excess ethanol at a loss, they may try to recoup these losses through higher petrol prices.
- 7 E10 blended in NSW to conform with premium unleaded petrol standards would not be effective in increasing the uptake of ethanol blended petrol. A premium ethanol blend would target a smaller proportion of the petrol market compared with the current E10 market and there would likely be low consumer demand if ethanol-free products are available.
- 8 Requiring all primary wholesalers to offer at least one premium ethanol blended petrol would not be effective in increasing the uptake of ethanol if retailers and consumers can choose ethanol-free products.

6.2 Summary of cost-benefit analysis

Table 6.1 summarises our assessment of supply side options. Apart from the option of adding ethanol to almost all fuel (Option 4a), none of the other options would singularly increase ethanol uptake to 6% of the total volume of petrol sold. All options would impose a net cost on NSW. We did not conduct a cost-benefit analysis on options to introduce premium ethanol blended petrol, because it is unlikely to increase ethanol uptake.

Option	Ethanol/ total petrol sales ^a	PV of costs	PV of benefits	Overall NPV ^b
Option 1 – Broadening the mandate				
 Option 1a – Reduce the qualifying number of controlled service stations from 20 to 5 	Negligible (declines to 2.0%)			
 Option 1b – Require all service stations to offer an EBP 	3.0%	130	45	(85)
 Option 1c – Require all service stations that sell more than 3 million litres a year to offer EBP 	2.3%	41	15	(26)
 Option 1d – Require all service stations offering two or more petrol grades to offer EBP 	2.8%	110	37	(73)
Option 2 – Introduce premium ethanol blends				
 Option 2a – Require E10 blended in NSW to confirm to PULP standard 	Negligible			
 Option 2b – Require all primary wholesalers to offer at least one premium ethanol blend 	Negligible			
Option 3 – Increase local supply competition by fast-tracking development approvals or other incentives	Negligible			
Option 4 – Reduce availability of ethanol-free petrol				
 Option 4a – Require ethanol in all fuel grades (except diesel) up to a maximum of 10% 	10%	1,490	301	(1,189)
 Option 4b – Remove all RULP and replace with E10 	3.7%	145	76	(70)
 Option 4c – Require all wholesalers to purchase ethanol volume equivalent to 6% of their total fuel sales 	See options 4a or 4b, and/or 5			

 Table 6.1
 Summary of cost-benefit analysis (NPV \$ million, \$2014-15)

 ${\bf a}\,$ Proportion of ethanol to total volume of petrol sold at the end of 2024-25.

 ${\boldsymbol{b}}$ Brackets indicate negative NPV (ie, a net cost). Totals may not add due to rounding.

6.3 Broadening the ethanol mandate

Under the Act, primary wholesalers and major retailers (ie, those that control 20 or more service stations) must meet the 6% ethanol mandate (volume fuel sellers). Currently, volume fuel sellers control an estimated 39% of the service stations in NSW.⁹⁵

Broadening the mandate to require more service stations to offer E10 could increase the availability and uptake of ethanol in NSW. Some stakeholders argued achieving the mandate required a 'level playing field'.⁹⁶ Some volume fuel sellers are reintroducing RULP at their controlled sites because they are concerned about losing market share to retailers that do not have to comply with the mandate (these sites continue to offer RULP). The literature also supports these claims, with motorists choosing not to use a particular station and switching to a station nearby where the comparable product is offered at a lower price.⁹⁷

Retail operators that have a large throughput but operate less than 20 sites are also currently excluded from the mandate.

Broadening the mandate would increase ethanol uptake, but it could also adversely affect the financial sustainability of smaller retail operators. Many sites operate with very slim profit margins (sometimes as low as \$46,000 per year).⁹⁸ Some of these sites have tanks that are over 25 to 30 years old, with the owners choosing to exhaust their useful life, rather than replace the tanks when run down.⁹⁹ These sites may close more quickly if the NSW Government imposes a program that requires tank replacement.

Under the current exemptions regime, extending the mandate to smaller operators could also increase the number of exemption applications and therefore increase overall compliance and enforcement costs.

⁹⁵ Confidential pers comm, 18 March 2015; confidential correspondence, February 2015.

⁹⁶ Confidential pers comm, 16 February 2015 and 17 February 2015.

⁹⁷ The station level demand for petrol was found to be elastic (the estimated own price elasticity between -6.2 and -18.8), see Wang Z., 'Station level gasoline demand in an Australian market with regular price cycles', *The Australian Journal of Agricultural and Resource Economics*, 53(4), October 2009, pp 467-83. However, the literature is consistent in evaluating the aggregate demand for petrol as inelastic; see Chapter 9 for discussion of own-price elasticity of demand for petrol (gasoline).

⁹⁸ Confidential pers comm, 26 February 2015.

⁹⁹ Confidential pers comm, 16 February 2015.

6.3.1 Options

We assessed the following options to broaden the mandate (including options outlined in the TOR):

- Option 1a Change the definition of major retailers to include those controlling 5 or more stations.
- Option 1b Require all stations to offer EBP.
- Option 1c Require all stations selling more than 3 million litres of petrol per year to offer EBP.
- Option 1d Require all stations offering two or more petrol grades to offer EBP.

Under Option 1c, we chose a volume of 3 million litres as the threshold, accounting for the Office of Environment and Heritage's approach to the Vapour Recovery (VR) program. The VR program requires stations to install vapour recovery technology for new and existing stations.¹⁰⁰ The VR program gives petrol stations 7 years to introduce the technology, which allows most petrol stations to coincide their upgrades with a scheduled major refurbishment.

The thresholds proposed under Options 1a and 1d are also aimed at excluding smaller retail operators who may face financial hardship if they have to bring forward infrastructure upgrade or replacement costs to comply with the mandate.

6.3.2 Likely impact on ethanol uptake

Table 6.2 summarises the likely level of ethanol uptake (as a proportion of total volume of petrol sold) from implementing each 'broadening the mandate' option. It also identifies issues associated with implementing each option. Most options to broaden the mandate would increase ethanol uptake, but if implemented in isolation, no option reaches the 6% ethanol mandate.

¹⁰⁰ Existing stations with sales throughput of between 0.5 ML and 3.5 ML per year must meet VR1 standards only. Stations with throughput above 12 ML must meet more stringent VR2 standards. Stations with throughput between 3.5 ML to 12 ML per year have until 1 January 2017 to comply with VR2 standards. VR2 standards are estimated to cost between \$60,000 and \$450,000 per station depending the size of the station and whether it coincides with a major refurbishment. http://www.epa.nsw.gov.au/air/petrolvapour.htm, accessed on 30 March 2015.

Option	Impact on ethanola	Issues	
Option 1a – Reduce the qualifying number of controlled stations from 20 to 5	Negligible (declines to 2.0%)	 Moves to a more level (competitive) playing field Retailers that control a small number of sites but have high sales volume would be excluded, eg, this option would not capture an operator with one site but high throughput Additional financial burden on smaller retailers, eg, to convert or add tank/pump infrastructure Businesses can divest sites to avoid the mandate. Legislation may mitigate this issue 	
Option 1b – Require all stations in NSW to offer an EBP	3.0% Potentially affects about 800 stations not currently offering E10	 Establishes a level (competitive) playing field across NSW Potential closure of stations which cannot afford conversion or additional infrastructure Capacity of stations to offer multiple products may be limited Potential loss of consumer choice High enforcement costs (ie, to process exemptions) 	
Option 1c – Require all stations in NSW that sell more than 3 million litres per year of petrol to offer EBP	2.3% Potentially affects about 200 metropolitan stations not currently offering E10	 Moves to a more level playing field, particularly in the metropolitan area Excludes over 600 sites that sell below 3 ML per year Additional financial burden on smaller retailers to convert or add tank infrastructure Sales volume reporting is not readily available May need to take an average of historical sales at a certain date May create a disincentive for smaller stations to grow beyond 3 ML per year 	
Option 1d – Require all stations that offer two or more petrol grades to offer EBP (ie, if offering two grades, one must be E10)	2.8%	 Moves to a more level playing field Number of product offerings may not be a good indicator of likely financial viability Reduction in consumer choice Additional financial burden on smaller retailers to convert or add tank infrastructure Potential closure of stations that cannot afford conversion or additional infrastructure 	

 Table 6.2
 Summary of options for broadening the mandate

 ${\bf a}\,$ Proportion of ethanol to total volume of petrol sold at the end of 2024-25.

6.3.3 Cost-benefit analysis

The options to broaden the mandate would increase the current ethanol uptake, so we conducted a cost-benefit analysis to assess the cost effectiveness of the options.

The major costs from broadening the mandate are:

- ▼ The cost of tank replacements or upgrades Cost estimates range from \$12,500 to \$20,000 per tank to clean, maintain and install signage, up to \$200,000 for full tank replacement.
- ▼ Loss of consumer surplus Customers switch from RULP to PULP to avoid EBP and consequently pay higher prices for fuel. This loss ranges from \$25 million under Option 1c, to \$85 million under Option 1b.

The benefits from increased ethanol uptake (Chapter 5) relate mainly to increased producer surplus, reduced particulate matter pollution and reduced GHG emissions.

The net cost of these measures over 10 years is between \$26 million to \$85 million in net present value terms.

Overall, none of the options to broaden the mandate would deliver a net benefit if implemented in isolation. Appendix C provides further details of the costbenefit analysis.

6.4 Introducing a premium ethanol blended product

The volume of PULP sold in NSW increased by 124% since the ethanol mandate was introduced. PULP now represents 40% of the petrol market. To increase the market penetration of ethanol, the TOR asked us to consider the effectiveness of introducing a premium EBP.

Premium unleaded petrol in Australia must meet certain criteria under the Fuel Standard (Petrol) Determination 2001. The differentiating standards between RULP and PULP are the Research Octane Number, Motor Octane Number and the sulphur content. Box 6.1 explains the technical requirements.

Box 6.1 Australian fuel standards for petrol products

The differentiating parameters between premium and regular grade petrol under the Australian fuel standards are:

- Research Octane Number (RON) and Motor Octane Number (MON) measure a fuel's resistance to auto-ignition, which can cause engine knock and a loss of fuel economy. The RON measures the fuel at low engine speeds, while the MON measures the fuel under load and at higher engine speeds.
- Sulphur content occurs naturally in crude oil and if not removed in the refining process it will contaminate refined fuel. Sulphur has a large impact on vehicle emissions because it forms toxic gases on combustion in the engine and affects the efficiency of vehicles' catalytic converters.

Specifically under the Australian fuel standards:

- PULP: minimum RON of 95, MON of 85, and sulphur content of no more than 50 parts per million (ppm).
- RULP: minimum RON of 91, MON of 81, sulphur of 150 ppm.

Adding ethanol of about 10% to RULP to create E10 produces fuel with RON of about 94 to 95 and MON of about 83 to 84. That is, adding ethanol to petrol affects RON more than it does MON. E10 does not meet the Australian fuel standards for PULP, given its lower MON rating. E10 blended in NSW may sometimes have sulphur levels below 50ppm due to the quality of petrol obtained overseas and imported into NSW, but a sulphur level below 50ppm is not guaranteed.

Source: ACCC, *Monitoring of the Australian petroleum industry*, December 2014, p 90; Fuel Standard (Petrol) Determination 2001, pp 3-4.

6.4.1 Options

Under the TOR, we assessed introducing premium ethanol blends to increase ethanol consumption in NSW. Specifically:

- Option 2a Require E10 blended in NSW to conform with the PULP standard.
- Option 2b Require all primary wholesalers to offer at least one premium EBP.

Under both options, volume fuel sellers would be free to offer other types of petrol including RULP and various ethanol-free PULP.

E10 could be converted to meet the minimum PULP standards by:

- Choice 1 Importing petrol with 92RON, 84MON, and sulphur 50ppm so it achieves the minimum PULP standards when blended with ethanol.
- Choice 2 Taking existing PULP of 95RON and blending it with 10% ethanol.¹⁰¹
- Choice 3 Taking an even mix of 91RON and 95RON to blend with 10% ethanol.¹⁰²

Under Choice 1, petrol with minimum standards of 92RON, 84MON and sulphur content of no more than 50ppm is considered a boutique product that is not regularly sold by refineries overseas. Stakeholders commented such a boutique product would command a premium, and have a similar price as existing premium 95RON petrol.¹⁰³

An ethanol premium blend product would contain less energy than PULP and could use about 3% more fuel (similar to E10 compared with RULP).¹⁰⁴ Assuming the existing margins on PULP and ethanol are maintained, a premium ethanol blend under Choice 2 and 3 could be about 2% cheaper than PULP, similar to the retail price difference between RULP and E10.¹⁰⁵ In other words, a premium ethanol blend may not be priced competitively. To make an ethanol premium blend competitive with PULP, it may need to be about 3% cheaper than PULP.

¹⁰¹ Stakeholders also commented *proprietary* (branded) premium petrol is marketed to contain certain qualities. If E10 had to conform to PULP standards, it is unlikely that primary wholesalers would mix their *proprietary* premium petrol with ethanol, because they could not guarantee the specific qualities of their premium proprietary petrol. So wholesalers may need to introduce another premium product.

¹⁰² This option was suggested by a stakeholder in submission to the Office of Biofuels consultation paper in 2014.

¹⁰³ One stakeholder suggested a 93RON stock could be used, but noted it would have a similar price to the existing premium 95RON stock.

¹⁰⁴ NSW Trade & Investment, *E10 fuel economy*, http://www.resourcesandenergy.nsw.gov.au/energy-consumers/sustainable-energy/officeof-biofuels/e10-fuel-economy; accessed 31 March 2015.

¹⁰⁵ As an example, if RULP was 149.7 cpl and E10 was 147.5 cpl then the implied ethanol price (cpl) is 127.7 (calculated as 90% x 149.7 + 10% x (ethanol or E100) = 147.5).

Under Choice 2, if PULP95 was 11.6 cpl more expensive than RULP ie, 161.3, then PE10 would be 157.9 cpl (calculated as 90% x 161.3 + 10% x 127.7). However, this means that PE10 would only be 3.4 cpl less expensive when it would need to be about 5.3 cpl less expensive for energy parity (ie, about 3.3% cheaper than the PULP95 fuel used).

Under Choice 3, the blend-stock to use for mixing with ethanol would be about 155.5 (even mix of RULP and P95). This would lead to a PE10 price of 152.7 cpl, which would be only 2.8 cpl less expensive, rather than an estimated 5.0 cpl under energy parity.

6.4.2 Likely impact on ethanol uptake

Under Option 2a (ie, require E10 to conform to the PULP standard), if volume fuel sellers continue to offer ethanol-free premium products alongside an ethanol premium blend, ethanol uptake is unlikely to increase materially given:

- consumer aversion to ethanol (chapters 3 and 4)
- the price of the ethanol premium blend may not be competitive compared with ethanol-free PULP, and
- the ethanol premium blend may compete with only 20% of the market
 - the PULP market share in NSW is 40%, and about half of the market (20%) is attributable to non- proprietary brands.¹⁰⁶

One volume fuel seller offered premium ethanol blended fuel but withdrew these products.¹⁰⁷ There was little consumer demand even though the seller priced its 95RON ethanol blended petrol less than the 95RON fuel to account for energy parity.¹⁰⁸

Similarly, Option 2b (requiring all primary wholesalers to offer at least one premium ethanol product) is unlikely to materially increase ethanol uptake:

- Retailers do not have to offer the premium EBP at their service stations.
- Retailers are unlikely to offer premium EBP because consumer demand is likely to be low.

Neither Option 2a or Option 2b were likely to materially increase ethanol uptake, so we did not conduct cost-benefit analysis on these options. However, if volume fuel sellers are required to only sell an ethanol premium blend (Option 2a), then the existing infrastructure for E10 could be used to offer the new product. Therefore, Option 2a would not impose substantial additional costs (assuming a boutique base stock is not used). Similarly, under Option 2b, volume fuel sellers could use existing blending infrastructure without incurring substantial additional costs.

¹⁰⁶ Australia Petroleum Statistics, Table 3C, December 2014.

¹⁰⁷ Confidential pers comm, 25 February 2015.

¹⁰⁸ Confidential pers comm, 25 February 2015.

6.5 Increase local supply competition

Currently, there are three ethanol producers in Australia, with several approved/planned bioethanol projects in the pipeline (Chapter 3). The Australian ethanol production market is highly concentrated, with a Herfindahl-Hirschman Index (HHI) of 5,022 as of 2014.¹⁰⁹ If all of the planned production capacity is commissioned by 2020, total additional supply will rise by 405 ML per year. The national industry HHI will improve to about 2,330, which is just below the 'highly concentrated' mark.¹¹⁰

Domestic ethanol producers are protected from competition from imported ethanol because domestic producers receive a rebate from the fuel excise (currently in the form of the Ethanol Production Grant). In NSW, Manildra Group faces little competition from Queensland producers. Manildra Group likely has a lower cost structure than its competitors because of its economies of scale and scope (it produces ethanol from waste starch, a waste product from its flour, gluten and sugar production processes). Primary wholesalers purchasing ethanol for the NSW market would also face higher transportation costs if they purchased from Queensland producers.

We considered whether encouraging new entry in NSW would bring about increased competition, and potentially lower prices for fuel-grade ethanol. There are three ethanol projects in the pipeline for NSW, with a combined production capacity of 345 ML per year. The largest of the new projects, Biofuels Innovation Australia (BIA) in Junee NSW (230 ML per year capacity), submitted a planning application in 2013 but remains in the development stage.¹¹¹ The Dongmun Greentec project in Deniliquin NSW (110 ML per year capacity, wheat feedstock) is also in the early planning stage.¹¹² The Eagle Energy ethanol plant in Colleambally NSW (5 ML per year capacity, crop waste feedstock) was approved in 2013.

The NSW Government could fast-track development approvals for ethanol projects. Biofuels projects are also eligible to receive government support through the NSW Government Regional Industries Investment Fund (RIIF), established to promote economic growth in regional NSW. Grants under the RIIF program are competitive and are based on cost-benefit analysis.¹¹³

 ¹⁰⁹ IPART analysis based on APAC Biofuel Consultants, *Australian Biofuels* 2014-15, p 32. The HHI is a measure of market concentration calculated as a sum of the squares of the market shares of the firms in the relevant market. See ACCC, *Merger Guidelines*, November 2008, pp 36-7.
 ¹¹⁰ Initial

¹¹⁰ Ibid.

¹¹¹ APAC Biofuel Consultants, Australian Biofuels 2014-15, pp 32-3.

¹¹² See http://dongmungreentec.com.au/?cat=17, accessed 25 March 2015.

¹¹³ NSW Trade & Investment, Regional Industries Investment Fund, http://www.trade.nsw.gov.au/business-and-industry-in-nsw/assistance-andsupport/regional-industries-investment-fund, accessed 4 March 2015.

However, measures to encourage new entrants are unlikely to be effective when there is currently excess capacity from existing producers. In 2013-14, ethanol producers sold about 192 ML, which is below the nameplate capacity of 300 ML per year of the Manildra Group, Australia's largest and NSW's only ethanol producer. Queensland based ethanol suppliers also had excess capacity in 2013-14. Further, stakeholders commented that regulatory uncertainty at the state and federal levels does not encourage new suppliers to enter the market.¹¹⁴

We consider measures to increase local supply competition are unlikely to increase ethanol uptake, so we did not conduct a cost-benefit analysis of this option.

6.6 All fuels sold in NSW to contain ethanol (except diesel)

Given the lack of demand for EBP, the 6% ethanol mandate could be achieved by requiring all fuel sold in NSW, including premium blends, to contain ethanol (except diesel), up to a maximum of 10%. However, this option imposes substantial costs on all wholesalers and site operators to upgrade or invest in new infrastructure. It also imposes costs on users of ethanol-free petrol to convert to diesel or EBP (Section 6.6.2). It would also require a long transitional period and a consumer information campaign to notify the public of the changes.¹¹⁵

As with other options discussed in this paper, the Government would need to consider any legal issues arising from this option.

6.6.1 Likely impact on ethanol uptake

If all petrol sold by volume fuel sellers has 10% ethanol content, maximum ethanol uptake would be 10%. The timing depends on the transitional period stakeholders had to become ethanol compatible.

6.6.2 Cost-benefit analysis

We estimated the major costs of requiring all fuel in NSW to contain ethanol:

- It would cost about \$68 million to make all remaining petrol tanks in NSW compatible for ethanol.
- ▼ New ethanol production facilities could cost between \$50 million and \$150 million.
- It could cost \$1,257 million to replace or upgrade marine engines, farm machinery, lawn mowers, cars and other machinery that are not compatible with EBP.

¹¹⁴ Confidential pers comm, 16 February 2015.

¹¹⁵ Under this option, the information campaign would inform the public of the upcoming change, not address motorists' aversion towards ethanol. Therefore, it has a limited scope compared with the public education campaign discussed in Chapter 7.

The major benefit is a \$240 million producer surplus to ethanol producers.

Overall, a 10% mandate has an estimated present value of net costs over 10 years of about \$1,189 million. Appendix C provides further details of our cost-benefit analysis.

6.7 Wholesalers to replace RULP with E10

The Government could require all RULP sold by primary wholesalers in NSW to be E10 (reversing the then Premier's decision in January 2012 to remove the requirement). More service stations would offer E10, therefore increasing ethanol uptake.

This option needs a reasonable transitional period for stations to replace or upgrade infrastructure to offer E10. Some operators may lose market share, as service stations along the north and south borders of NSW compete with interstate stations not subject to the mandate.

Some non-motorists who cannot use E10, such as marine users, will also be financially disadvantaged if they have to use ethanol-free PULP.

The Government would need to consider any legal issues arising from this option (as with other options discussed in this paper).

6.7.1 Likely impact on ethanol uptake

RULP sales are currently 28% of the total volume of petrol sold in NSW. The current consumer aversion to EBP means not all current RULP users will convert to E10 (chapters 3 and 4).

Given current E10 sales account for 33% of total volume of petrol, this option could increase ethanol uptake to 3.7% by 2024-25.

6.7.2 Cost-benefit analysis

Replacing RULP with E10 imposes additional costs on small businesses. Costs could range from \$12,500 to \$20,000 per site for sites requiring tank cleaning, minor maintenance and signage. Some sites could incur costs of up to \$200,000 for tank replacement. For some sites, it may be uneconomical to upgrade.

Removing RULP from all stations would also increase the cost of fuel for many households who cannot use E10 fuel for their vehicles. These consumers would need to purchase premium fuel at greater cost.

The benefits from increased ethanol uptake (Chapter 5) include increased producer surplus from increased sales of ethanol (\$60 million), health benefits from reduced particulate matter pollution (\$13 million) and reduced GHG emissions (\$2 million).

This option has an estimated net cost over 10 years of \$70 million in present value terms, driven largely by the loss of consumer surplus in paying higher prices for PULP, costs of infrastructure conversion and depot infrastructure costs. Appendix C provides further details of the cost-benefit analysis.

6.8 All wholesalers required to purchase ethanol volume equivalent to at least 6% of total fuel sales

Currently, volume fuel sellers must ensure the volume of ethanol sold is at least 6% of the total volume of fuel sold in NSW each quarter. Alternatively, the Act could be changed so all wholesalers must purchase ethanol volume (each quarter) equal to at least 6% of their total fuel sales (in the last quarter) in NSW, and report each quarter.

Under this option, wholesalers would not be able to obtain exemptions from purchasing ethanol equal to 6% of their total petrol sales. It gives wholesalers an incentive to maximise ethanol sales. Wholesalers may implement some of the other options discussed in this report to sell the purchased ethanol, eg, by including ethanol in all fuel (except diesel), or by removing RULP and/or contributing to a coordinated consumer education and marketing campaign. Therefore, we did not conduct a separate cost-benefit analysis for this option.

Depending on the measures wholesalers take, this option may have a limited effect on ethanol uptake as current consumer demand for EBP is low. Further, wholesalers may sell any excess ethanol to overseas or interstate markets to minimise their loss. If wholesalers sell ethanol at a loss, they may try to pass on the loss to consumers as higher petrol prices.

If wholesalers do nothing to increase the uptake of ethanol (ethanol uptake remains at our assumed baseline of 2% at the end of 2024-25) and sell the excess ethanol overseas, they could incur losses of about \$120 million. This loss is the additional transportation costs to sell ethanol overseas or interstate and the lower international market price for ethanol compared with the domestic price.¹¹⁶

If the Government decides to implement this option, consideration should be given to requirements for the source and end-use (or point of sale) of ethanol, given the policy objectives of the current mandate.

¹¹⁶ This calculation is based on transportation costs of 17 cpl, excise costs after 5 years being 12.5 cpl, plus a price discount range of 0 to 15cpl. The additional litres of ethanol sold are multiplied by these costs to produce the estimated loss wholesalers would incur by selling this stock outside NSW.

7 Demand side measures

Consultations revealed consumer aversion towards EBP is a major impediment to increasing ethanol uptake. Evidence suggests consumers in NSW are switching to premium fuel grades to avoid E10 (Chapter 4).

This chapter discusses how to address consumer aversion towards ethanol blended petrol through a public education campaign. We also discuss how the NSW Government could increase the ethanol uptake by converting the Government motor vehicle fleet to flex-fuel vehicles.

7.1 Findings

- 9 Introducing an information campaign on motor vehicles that are compatible with E10 could increase the uptake of ethanol. We estimate net benefits of about \$56 million in present value terms. The NSW Government and/or ethanol producers could fund an information campaign.
- 10 Requiring the NSW Government motor vehicle fleet to convert to flex-fuel vehicles could increase the uptake of ethanol. We estimate net costs of about \$90 million in present value terms.

7.2 Summary of cost-benefit analysis

A public education campaign could increase ethanol uptake to 2.2% by 2024-25 from a business as usual baseline of 2%, if it reduces consumer aversion towards EBP (Table 7.1). We estimated net benefits of about \$56 million, mainly accruing to consumers. Converting the NSW Government motor vehicle fleet to flex-fuel vehicles would result in a net cost, given motor vehicle replacement and infrastructure conversion costs.

Option	Ethanol/ total petrol sales ^a	PV of costs	PV of benefits	Overall NPV ^b
Option 5 – Public education campaign	2.2%	5	61	56
Option 6 – Government motor vehicle fleet to use ethanol (E85)	2.3%	123	33	(90)

 Table 7.1
 Summary of cost-benefit analysis (NPV \$ million, \$2014-15)

a Proportion of ethanol to total volume of petrol sold at the end of 2024-25.

b Brackets indicate negative NPV (ie, a net cost). Totals may not add due to rounding.

7.3 Public education campaign

Before 2004, there was no requirement to label the ethanol content of petrol.¹¹⁷ Stakeholders commented that widely publicised allegations of motor vehicle damage by petrol containing up to 30% ethanol damaged consumer confidence.¹¹⁸ Anecdotal evidence suggests some consumers are still concerned about adverse effects of ethanol on cars. Some volume fuel sellers indicated volumes of petrol sold increased substantially once they removed ethanol from their sites.¹¹⁹

Stakeholders also noted mechanics often advise consumers that ethanol is not good for cars, regardless of whether the car is ethanol compatible (with ethanol content up to 10%). Further, the mechanics apprenticeship courses at TAFE do not include a fuel education component.¹²⁰ Stakeholders advised that a course on fuel that explains the details of ethanol as a fuel source has been developed and TAFE intends to include it as part of the apprenticeship course.

An information campaign in NSW should consider the lessons from Queensland (Box 7.1). As a first step, market research could determine the type of customers averse to ethanol and their reasons, to target the consumer education campaign. Ideally, a consumer education campaign would also:

- Inform and provide confidence to motorists about the safety and compatibility of E10 with their vehicles, based on robust and widely accepted factual evidence.
- Explain E10 is not a completely new fuel but a blend using existing RULP.
- Inform consumers about the availability of E10 at service stations and the current level of E10 uptake.¹²¹

¹¹⁷ http://www.environment.gov.au/topics/environment-protection/fuel-quality/standards/ ethanol-e10, accessed 17 March 2015.

¹¹⁸ Australian Government Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, p 11.

¹¹⁹ Confidential pers comm, 25 February 2015.

¹²⁰ Confidential pers comm, 16 February 2015.

¹²¹ Given 33% of all petrol sales in NSW is E10, E10 is currently being safely used by a substantial number of consumers.

- Include industry participants such as mechanics, vehicle service agents and vehicle manufacturers.
- Include broad information dissemination, potentially including television and radio advertising, pamphlets distributed to service centres, repair shops and petrol stations. Social media could be explored as a potentially more cost effective communication medium.

It is possible consumers' aversion to ethanol is too entrenched and mechanics and service dealers may not actively participate. So an information campaign may not increase ethanol uptake.

Box 7.1 Queensland's consumer education campaign

In Queensland, a 2-year information campaign (costing \$2.28 million) ran from January 2006 to December 2007. The campaign ran before the planned mandate was introduced (which did not eventuate) and when the availability of E10 was low. The campaign involved disseminating information through:

- teams in cars labelled with 'ethanol' and '+e' going out to service stations and speaking with consumers as they filled up with petrol
- local radio advertisements
- ▼ billboards
- information on a Queensland government website
- distributing ethanol labelled caps and information bags
- promotions at events such as the Ekka, Brisbane Motor Show, Indy or the Cairns Auto Spectacular
- certain loyalty reward programs from particular oil companies.

The campaign targeted areas where ethanol blended petrol was available. It did not include blanket coverage promotions such as TV advertisements.

Ethanol as a percentage of petrol consumed increased from about 1% to about 2.5% by the end of the campaign and this was before the planned mandate of 5%. Only about 8% of outlets offered E10 at the start of the campaign.

Market research conducted after the campaign indicated:

- people were still unsure about whether ethanol blended fuel is safe for their vehicle
- motorists wanted car manufacturers and the Royal Automobile Club of Queensland (RACQ) to assure them ethanol is safe to use
- consumers and stakeholders suggested increased advertising, including television advertising, to raise awareness of EBP and encourage uptake
- lower pricing, clear messages about engine safety, the environmental benefits and endorsements from car manufacturers and RACQ would support uptake.

Source: Deborah Wilson Consulting Services, *Biofuels Market Research*, April 2008; http://www.aph.gov.au/binaries/hansard/senate/commttee/s9407.pdf, p 78, accessed 31 March 2015. The campaign could be funded by:

- the NSW Government given it is a government mandate and the stated policy objectives of the mandate, and/or
- ethanol producers given they benefit from an increase in ethanol uptake.

Stakeholders suggested it is unlikely volume fuel sellers will voluntarily contribute financially, although they may support an ethanol education campaign.

An education campaign will have a greater chance of success if spread over a period of time. The Queensland campaign was conducted over two years, with limited scope and coverage. NSW may require a longer education campaign, given the increased scope and coverage, and the higher value mandate.

In addition, an education campaign may be more effective if it were to be accompanied by some form of price regulation (ie, to ensure that E10 is sold at an energy parity price to RULP). For our analysis, we did not assume RULP customers would switch to E10 following a consumer education campaign, given E10 is currently more expensive when energy differences between the two fuel types are taken into account. However, an energy parity price for E10 may encourage additional ethanol uptake from current RULP customers who are price sensitive.

7.3.1 Likely impact on ethanol uptake

Since the introduction of the ethanol mandate in NSW, sales of PULP in NSW have increased substantially relative to the rest of Australia. Currently, PULP represents about 40% of petrol sales in NSW, whereas in other jurisdictions it represents about 22%.¹²² We have assumed that the higher uptake of PULP in NSW is mainly due to consumer aversion to E10.¹²³

We assumed that a public education campaign would be effective in switching about 10% of the volume of petrol purchased by customers who are unnecessarily purchasing PULP (which we assumed to be the proportion of consumers purchasing PULP in NSW above those in the rest of Australia). This could result in a maximum ethanol uptake of about 2.2% by 2024-25 (Appendix C). Our conservative assumption of 10% effectiveness is based on consideration of feedback from stakeholders who did not have great success in substantially increasing the uptake of E10 through campaigns¹²⁴ – although we note the

¹²² Australian Petroleum Statistics, Table 3B, and IPART calculations.

¹²³ Since 2007, volume fuel sellers have replaced a large number of RULP with E10 at service stations. Due to consumer aversion, customers have been largely choosing PULP over E10, where RULP has been unavailable. We also note that some of the additional uptake in PULP is due to about 13% of cars currently not compatible with E10.

¹²⁴ Confidential pers comm, 16 February 2015.

campaigns were limited and did not involve a wide range of industry participants.¹²⁵

7.3.2 Cost-benefit analysis

A public information campaign has an estimated net benefit of about \$56 million over 10 years in net present value terms.¹²⁶ This result mainly reflected benefits flowing to:

- Consumers no longer paying a premium for PULP because they are no longer averse to ethanol (for consumers whose cars are ethanol compatible) – about \$42 million. At times, consumers could be paying up to 16 cpl more for PULP rather than purchasing E10.^{127, 128}
- ▼ Producers of ethanol, from an increase in the sale of ethanol (about \$15 million).

We assumed a public information campaign cost of \$5 million, based on:

- Queensland's limited information campaign, which cost about \$2.28 million, and
- previous NSW Government expenditure for education campaigns (some of which cost up to \$7.4 million, eg, Drink Drive Plan B).¹²⁹

If there is no change in consumers' attitude towards EBP, then a public education campaign would result in net costs (ie, the costs of the campaign).

Also, this option would be less effective if service stations continue to reintroduce RULP.

Appendix C provides further details of our cost-benefit analysis.

¹²⁵ Stakeholders have noted that the volume fuel sellers and mechanics etc need to be actively participating for an information campaign to have a greater effect. Confidential pers comm, 16 February 2015, 19 February 2015.

¹²⁶ In our analysis we focus on the costs and benefits accruing to NSW residents, and note that there are no petrol producers in NSW (see Section 5 for further assumptions). We also assume wholesalers earn the same margin on different fuel types. Consideration of the wider impacts beyond NSW could include a producer loss from consumers switching from PULP to E10.

¹²⁷ Based on an indicative average between PULP95 and PULP98 over 2013-14 (ACCC, *Monitoring of the Australian petroleum industry*, December 2014, p 108 and p 178).

¹²⁸ We assumed E10 requires 5% more fuel than PULP (medium scenario). Therefore, consumers gain about 8 cpl when switching from PULP to E10. For producer surplus, we assumed a benefit of 30 cpl of ethanol (medium scenario). Therefore an additional litre of E10 provides a producer surplus benefit of 3 cents. Thus the benefits accruing to consumers from no longer unnecessarily purchasing PULP are about 2.8 times that of producers.

¹²⁹ http://www.advertising.nsw.gov.au/sites/default/files/downloads/page/campaigns_ half_yearly_fy14152.pdf & information from previous years' listings, accessed 31 March 2015.

7.4 Convert government motor vehicle fleet

The NSW Government can try to increase demand for ethanol by converting the Government motor vehicle fleet to flex-fuel vehicles.

The current NSW Government target is that 5% of the government passenger fleet will be hybrid, plug in hybrid electric or electric vehicles by December 2015.¹³⁰ The NSW Motor Vehicle Policy (MVP) already prescribes the use of ethanol blended petrol in all government fleet vehicles where practicable, available and cost effective.

7.4.1 Likely impact on ethanol uptake

There are over 25,000 government fleet vehicles managed by StateFleet (a part of the NSW Office of Finance and Services) and used by NSW Government departments.¹³¹ Petrol-fuelled vehicles receive fuel cards specifically for consumption of E10.¹³² Petrol consumption by government fleet vehicles is estimated to be around 13 ML per year, with the maximum consumption of ethanol of 1.3 ML per year.

If flex-fuel vehicles become available in Australia, at a reasonable cost, the ethanol consumption would receive a boost. Changes to the car industry mean it is likely all new cars will be imported to Australia. Depending on the source countries for such imports, flex-fuel vehicles might be more available at a reasonable, or even at no additional cost. Flex-fuel vehicles run on an 85% ethanol blend (E85). Replacing the Government department motor vehicle fleet with flex-fuel vehicles would increase ethanol consumption by 15 ML per year, and increase ethanol uptake to 2.3%, by 2025.

Currently, Government departments must justify the need for new and replacement vehicles. The Government's motor vehicle policy encourages departments to choose the most cost-effective and environmentally friendly vehicle for the normal transport task.¹³³ Flex-fuel vehicles might not be the most cost-effective solution because they have high fuel costs (due to increased fuel consumption) and higher maintenance costs.

¹³⁰ NSW Government, Motor Vehicle Policy for New South Wales Government Agencies, version 13, 14 April 2014,

https://www.statefleet.nsw.gov.au/sites/default/files/alerts/pdf/Motor%20Vehicle%20Polic y%20for%20NSW%20Government%20agencies%20-%20V13%20-%2014042014.pdf, accessed 5 March 2015.

¹³¹ StateFleet (2015), About Us, https://www.statefleet.nsw.gov.au/about-us, accessed 31 March 2015.

¹³² NSW Government, Motor Vehicle Policy for New South Wales Government Agencies, version 13, 14 April 2014, cl. 8.7,

https://www.statefleet.nsw.gov.au/sites/default/files/alerts/pdf/Motor%20Vehicle%20Polic y%20for%20NSW%20Government%20agencies%20-%20V13%20-%2014042014.pdf, accessed 5 March 2015.

¹³³ Ibid., cl. 8.10.

7.4.2 Cost-benefit analysis

Converting the NSW Government motor vehicle fleet to flex-fuel vehicles has a present value of net costs of about \$90 million over 10 years (Appendix C). This result reflects mainly costs accruing to:

- volume fuel sellers, to develop and expand the E85 distribution network (currently offered by a very small number of stations)
- Government:
 - to procure flex-fuel vehicles at a cost additional to that of a standard vehicle
 - to cover higher operating and maintenance costs of flex-fuel vehicles, and potentially their lower resale value, and
 - higher ongoing fuel costs (although this depends on the price of ethanol for blending in E85).

The benefits will flow to:

- ethanol producers, from an expanding market for their product, and
- ▼ the broader community, as health benefits from improved air quality and reduced GHG emissions.

We assumed additional costs to procure flex-fuel vehicles of between \$0 and \$2,000 per vehicle, and additional service costs of between \$500 and \$1,000 per vehicle per year. We assumed one fifth (or 2,500) of the motor vehicle fleet are replaced each year, and all replacement vehicles are flex-fuel.

We modelled expansion of the stations offering E85 from 10 to 400 by 2025, costing \$200,000 per station.

Some cost scenarios may produce net benefits, especially if there is a substantial discount on E85 fuel compared with RULP.

This option may take longer to implement, given the underlying market conditions and engine technologies. It also ignores the potential for new, higher fuel efficiency technologies such as next generation hybrids. The option should be evaluated against the broader portfolio of transport policies and against the opportunity cost of government spending.
8 Enforcement measures

The TOR asked us to assess the costs and benefits of enforcement measures to increase the ethanol uptake. Under the Act, volume fuel sellers must ensure ethanol comprises 6% of their petrol sales.

The Act, in its current form, has been ineffective in ensuring volume fuel sellers meet the mandate. Volume fuel sellers can obtain (and vary) an exemption to the ethanol mandate retrospectively, if they demonstrate that they took reasonable steps to comply with the mandate. In addition, the current level of financial penalties for non-compliance provides little incentive for volume fuel sellers to take further action to increase ethanol uptake.

We consider measures to limit the circumstances for exempting volume fuel sellers from complying with the mandate would only be effective in increasing ethanol uptake if all service stations must comply.

8.1 Findings

- 11 The current legislative regime has been ineffective in ensuring volume fuel sellers meet the 6% ethanol mandate:
 - Volume fuel sellers can obtain (and vary) an exemption retrospectively.
 - The 'reasonable steps' defence substantially reduces the risk of being successfully prosecuted.
- 12 The mandate could be achieved if, first, all service stations have to comply with the mandate; and second, if the grounds for exemption and reasonable steps defence under the Act are largely removed.
- 13 The low financial penalties for a failure to comply with a minimum biofuel requirement do not provide sufficient incentives for volume fuel sellers to take further action to increase ethanol uptake.
- 14 We estimated the present value of net costs over 10 years of removing the 'reasonable steps' defence against prosecution and amending the grounds for an exemption to be \$280 million.
- 15 It is unlikely that there would be additional costs and benefits associated with increasing penalties for non-compliance with a minimum biofuel requirement, all else being equal, because the Act still provides exemptions for volume fuel sellers.

8.2 Summary of cost-benefit analysis

We estimated the costs would outweigh the benefits of amending the Act to limit the circumstances for exempting volume fuel sellers (Option 7). Volume fuel sellers would need to upgrade or replace infrastructure at all sites and there may be additional enforcement costs. In isolation, increasing the amount of penalties for non-compliance with the mandate would not affect the level of ethanol uptake – volume fuel sellers could still obtain an exemption.

Option	Ethanol/ total petrol sales ^a	PV of costs	PV of benefits	Overall NPV ^b
Option 7 – Tighten the grounds for exemption and remove the 'reasonable steps' defence	2.6%	351	71	(280)
Option 8 – Increase the penalties for non-compliance	Negligible	-	-	-

 Table 8.1
 Summary of cost-benefit analysis (NPV \$ million, \$2014-15)

a Proportion of ethanol to total volume of petrol sold at the end of 2024-25.

b Brackets indicate negative NPV (ie, a net cost). Totals may not add due to rounding.

8.3 Amend the grounds for an exemption and remove the 'reasonable steps' defence against prosecution

The Act, in its current form, is not effective in ensuring volume fuel sellers fully meet the 6% ethanol mandate. Volume fuel can obtain (and vary) an exemption to the ethanol mandate retrospectively, if they can demonstrate they took all reasonable steps to comply with the mandate.

Examples of reasonable steps include (see Chapter 2):

- making all reasonable efforts (on a continuing basis) to secure sufficient ethanol or petrol-ethanol blend supplies
- taking all reasonable action to upgrade a volume fuel seller's infrastructure so it can distribute sufficient EBP
- taking all reasonable action to ensure the availability of facilities to sell EBP at retail service stations the volume seller controls¹³⁴
- ▼ taking all reasonable action (on a continuing basis) to market EBP, and
- ▼ taking all reasonable action (on a continuing basis) to ensure all E10 the volume seller sells contains at least 9% ethanol.¹³⁵

¹³⁴ Specifically, at those service stations at which the business of selling petrol or diesel fuel is controlled by the volume seller or at which the person who conducts that business leases or subleases the premises from the volume fuel seller: Regulation, cl 7(d).

¹³⁵ Act, s 10(3) and Regulation, cl 7. However, a volume seller is not prevented from proving other actions it took constitute taking reasonable steps to comply with the Ethanol Mandate: Act, s 10(4).

The Act must be changed if it is to be more effective in enabling the 6% ethanol mandate to be fully met. First, all service stations must comply with the mandate; and second, the exemption grounds and reasonable steps defence under the Act must be largely removed.

Volume fuel sellers control about 39% of service stations in NSW (Chapter 4).¹³⁶ Unless all service stations have to comply, volume fuel sellers cannot meet the 6% ethanol mandate.

This section discusses the potential amendments to the Act to achieve the mandate.

8.3.1 Option

The exemption grounds and the reasonable steps defence under the Act means volume fuel sellers can obtain exemptions from complying with the mandate. The Act could be amended to limit grounds for exemptions:

- Infrastructure is not compatible with EBP However, volume fuel sellers must convert infrastructure within seven years. The time period would be calculated as of the date of the amendments.
- Interstate supply to retail service stations –Retail service stations that are supplied directly from interstate terminals or depots (that do not offer EBP) are exempt, because it is uneconomical to source supply from a terminal or depot that offers EBP.
- Risk to public health or safety.
- Extraordinary circumstances eg, a natural disaster. This defence would not include, eg:
 - removing E10 for sale at a service station and replacing it with RULP to compete with nearby service stations
 - a lack of consumer demand for EBP.

The level of partial exemption any volume fuel seller receives would reflect how much the above criteria affected the seller's ability to achieve the mandate. Further, a seller could not obtain and vary exemption retrospectively.

The Act could also be amended to include the following mitigating factors, which a Court would account for in determining the level of penalty for contravening a minimum biofuel requirement:

- the size of the contravening volume fuel seller, and
- whether there have been repeated contraventions.

¹³⁶ Confidential pers comm, 18 March 2015; confidential correspondence, February 2015.

This option removes the 'reasonable steps' defence to prosecution from not meeting a minimum biofuel requirement.

8.3.2 Likely impact on ethanol uptake

We estimated that removing the 'reasonable steps' defence against prosecution and amending the grounds for an exemption could result in ethanol accounting for 2.6% of petrol sales across all the volume fuel sellers by 2024-25 (Appendix C). We assumed volume fuel sellers would remove RULP from all controlled sites to comply with the mandate, as a minimum. However, as the mandate cannot be achieved by removing RULP alone, volume fuel sellers may take more far-reaching actions such as removing RULP completely or blending ethanol in almost all petrol. These options are discussed separately in the report (Option 4a and Option 4b).

8.3.3 Cost-benefit analysis

The major costs of implementing this option (Appendix C) include:

- The cost to volume fuel sellers of upgrading or replacing infrastructure at controlled service stations and depots. We estimated costs to be \$9 million. The cost of upgrading regional depots is about \$500,000 per site (Appendix C).
- The loss suffered by consumers (who have an aversion to EBP) from switching from RULP to PULP or additional travel costs to find a service station that offers RULP. We estimated these costs to be \$134 million.
- The costs of investigations and legal proceedings by government and volume fuel sellers if the volume fuel seller did not comply with a minimum biofuel requirement. We estimated these costs to be \$79 million.

The benefits from increased ethanol uptake (Chapter 5) relate mainly to increased ethanol producer surplus, reduced particulate matter pollution and reduced GHG emissions. We estimated benefits of about \$71 million.

The qualitative benefits of implementing this option include:

- It gives volume fuel sellers clear guidance about the grounds for obtaining an exemption.
- It gives Courts explicit guidance on the mitigating factors to account for in determining the level of penalty to impose. By contrast, the current 'reasonable steps' defence requires a large degree of judicial interpretation.

As discussed previously, it is unlikely that limiting the ability of volume fuel sellers to seek exemptions, without extending the mandate to all retailers, will effectively increase ethanol uptake. We estimated the present value of net costs over 10 years to be \$280 million for this option. Appendix C provides further details of our cost-benefit analysis. Appendix C also outlines an alternative scenario where we assume volume fuel sellers offer E10 at all sites, but do not remove RULP. We estimated net costs of \$49 million, in present value terms, for that option.

8.4 Increase penalties for non-compliance with a minimum biofuel requirement

The Act currently prescribes low financial penalties for non-compliance with the ethanol mandate:

- ▼ The maximum Court imposed penalty for non-compliance is \$55,000 for a first offence and \$550,000 for a subsequent offence.
- ▼ There is provision for a penalty of \$5,500 under a penalty notice for non-compliance.¹³⁷

Low financial penalties may not be sufficient to compel volume fuel sellers to comply with the mandate.¹³⁸ Linking the size of the penalty to the benefit gained from non-compliance could overcome the problem if the potential benefit gained is large.¹³⁹

¹³⁷ See Chapter 2.

¹³⁸ The Australian Law Reform Commission (ALRC) reviewed Federal civil and administrative penalties and found that for civil penalties for breaches of economic regulation, deterrence is the primary, if not the only, rationale for imposing penalties: ALRC, *Principled Regulation: Federal civil and administrative penalties in Australia*, ALRC Report 95, March 2003 at [25.4].

¹³⁹ The ALRC found that linking the quantum of a penalty to the financial benefit obtained may be insufficient if the gains are very large: ALRC, *Principled Regulation: Federal civil and administrative penalties in Australia*, ALRC Report 95, March 2003 at [26.81].

Regulatory regimes in Australia and overseas can impose high civil penalties, eg:

- The maximum penalty for breaching certain consumer protection provisions (including unconscionable conduct, and misleading and deceptive conduct) as set out in the Australian Consumer Law is \$1.1 million for a body corporate.¹⁴⁰
- The maximum penalty for particular restrictive trade practices (including misuse of market power) in Australia is the greatest of the following:
 - \$1 million
 - three times the value of the benefit obtained by the body corporate (and any other body corporate related to the body corporate) that is reasonably attributable to the contravention, and
 - 10% of the annual turnover of the corporation during the period of 12 months ending at the end of the month in which the contravention occurred.¹⁴¹
- The ACCC may issue an infringement notice for \$66,000 as an alternative to instituting proceedings where it has reasonable grounds to believe, among other things, that a listed corporation has contravened certain consumer protection provisions regarding unconscionable conduct, unfair practices provisions including false or misleading representations, and certain product safety and product information provisions.¹⁴²
- ▼ Under the United States Renewable Fuel Standard,¹⁴³ the United States Environmental Protection Agency may issue a notice to a person that has, among other things, failed to acquire sufficient renewable identification numbers to meet its renewable fuel volume obligation. The agency can impose a civil penalty of up to \$32,500 (USD), for every day the entity is in violation, and the amount of economic benefit or savings resulting from each violation.¹⁴⁴

¹⁴⁰ Competition and Consumer Act 2010 (Cth) (CCA), Sch 2, s 224.

¹⁴¹ CCA (Cth), s 76.

¹⁴² CCA (Cth), s 134(C).

¹⁴³ Transportation fuel sold in the US must contain a minimum volume of renewable fuel to reduce greenhouse gas emissions and the use of petroleum fuels. Renewable fuel producers and importers generate renewable identification number (RINs) for each gallon of renewable fuel. Refiners and importers must acquire RINs to show compliance with the standard. http://www2.epa.gov/enforcement/air-enforcement, accessed 3 March 2015.

¹⁴⁴ http://www.ecfr.gov/cgi-bin/ retrieveECFR?gp=1&SID=87bcf241d3aed3fe1531017152225e1f&ty=HTML&h=L&n=pt40.17.80& r=PART%20-%20se40.17.80_1580#se40.17.80_11163, accessed 25 March 2015.

8.4.1 Options

We considered options to increase the current level of financial penalties, as an incentive for volume fuel sellers to comply with the mandate:

- Option 8a Increase the maximum Court imposed penalty for noncompliance
- Option 8b Replace the current prescribed penalty amount under a penalty notice with a penalty amount that is calculated based on the number of litres that a volume fuel seller is short of the ethanol mandate.

Increased court imposed maximum penalty

Accounting for other regulatory regimes, the Government could increase the maximum court imposed penalty to (regardless of whether it is a first or subsequent offence) the greater of:

- ▼ \$1 million, or
- if the Court can determine the level of benefit (including any economic or financial benefit) that a volume seller obtained by failing to comply with the ethanol mandate, 3 times that total value.

If the Government implements this option, we suggest the Office of Biofuels develop guidelines, in consultation with volume fuel sellers, for penalty-related settlements and the factors to account for in reaching a penalty figure to put to the courts.¹⁴⁵ This could include:

- whether the volume seller cooperated with the Office of Biofuels
- the nature and extent of the contravening conduct
- the circumstances in which the conduct occurred
- the size of the contravening volume fuel seller, and
- the volume fuel seller's actions to comply with the mandate.

Volume based penalty

We considered a penalty of two cents for every litre that a volume fuel seller is short of the ethanol mandate. For the 2014 calendar year, we estimated volume fuel sellers would have received penalty notices of close to \$3 million under this regime, if they were non-compliant (ie, in the absence of exemptions to the mandate).

¹⁴⁵ The ALRC recommended regulators develop and publish guidelines about how they will negotiate and agree penalty-related settlements and the factors they will account for in reaching a penalty figure to put to the courts: ALRC, *Principled Regulation: Federal civil and administrative penalties in Australia*, ALRC Report 95, March 2003 at [29.49].

8.4.2 Likely impact on ethanol uptake

Increasing the penalty regime under the Act in isolation would not increase ethanol uptake. The exemption regime and 'reasonable steps' defence would mean volume fuel sellers have limited incentive to take further action to increase ethanol uptake.

8.4.3 Cost-benefit analysis

Because volume fuel sellers would not have sufficient incentive to take further action to increase ethanol uptake, there are unlikely to be additional costs and benefits from increasing the penalties regime alone.

9 Pricing measures

The current small price difference between E10 and RULP means consumers may not see E10 as a value for money option. Notionally, E10 must be about 3% cheaper than RULP for it to be a cost effective choice for consumers. Currently, E10 is only about 1.5% cheaper.

We considered options for regulating the price of ethanol, given the price of E10 affects consumer demand. Further, we consider Manildra Group has substantial market power, as the only producer and dominant supplier of ethanol in NSW, with no prospect of competition from imported ethanol.

9.1 Findings

- 16 Manildra Group has substantial market power in the ethanol market with the ethanol mandate:
 - It is the only producer and dominant supplier of ethanol in NSW and volume fuel sellers must purchase ethanol to comply with the mandate.
 - The price of ethanol in NSW is higher than the international market price.
 - Manildra Group's cost of supply is likely lower than its Australian competitors given its integrated production process, which includes using a waste product.
 - There is little prospect of competition from imported ethanol in the foreseeable future, given the Australian Government's concessionary excise arrangements for local ethanol producers.
- 17 Regulating the price of ethanol, so the price of ethanol blended petrol delivers value for money for consumers, would likely have a small positive impact on the level of ethanol uptake. Further:
 - Setting the maximum price of ethanol such that E10 is at energy parity value with regular unleaded petrol would produce a net benefit of \$2 million in net present value terms.
 - Setting the maximum price of ethanol with reference to an international benchmark would produce an estimated net cost of \$1 million in net present value terms.

9.2 Summary of cost-benefit analysis

We estimated small net benefits from regulating ethanol prices. The overall effect on ethanol uptake would be small, accompanied by a large welfare transfer from producers to consumers.

All existing E10 consumers would benefit from lower prices, plus we estimated an additional demand response to the change in the relative price of E10. Price regulation could result in ethanol uptake of about 2.2% to 2.3% by 2024-25.

We estimated a small net impact from regulating the price of ethanol, from net costs of about \$1 million to net benefits of \$2 million in net present value terms (Table 9.1). We did not conduct a cost-benefit analysis of setting the maximum price of ethanol produced by Manildra Group, because we did not have enough information on Manildra Group's costs of production. Further, the costs and benefits are likely to be similar to Option 9a and Option 9b.

Option	Ethanol/ total petrol sales ^a	PV of costs	PV of benefits	Overall NPV ^b
Option 9 – Regulate price of ethanol				
 Option 9a – Price based on energy parity value 	2.2%	258	259	2
 Option 9b – Price based on international benchmarks 	2.3%	413	412	(1)
 Option 9c – Regulate price charged by Manildra Group 	-	-	-	-

Table 9.1 Summary of cost-benefit analysis (NPV \$ million, \$2014-15)

a Proportion of ethanol to total volume of petrol sold at the end of 2024-25.

b Brackets indicate negative NPV (ie, a net cost). Numbers do not add up due to rounding.

9.3 Set maximum price for ethanol

As discussed in Chapter 4, the current price difference between RULP and E10 (about 2 cpl) does not fully account for the lower energy content of E10. To make E10 a 'value for money' option for consumers, the price of E10 needs to be about 3% cheaper per litre than RULP.

Under the Act, volume fuel sellers can be exempt from the mandate if they cannot obtain ethanol at an economic price. However, the Act does not establish the level of economic price.

Currently, Manildra Group is the only ethanol producer in NSW. Further, there is no prospect of it facing meaningful competition from imports in the foreseeable future given the Australian Government's fuel excise policy. These factors, combined with the mandate, means Manildra Group could have substantial market power.

We understand the price of ethanol as negotiated between Manildra Group and primary wholesalers does not reflect Manildra Group's cost of production. Instead, it is based on either the wholesale Terminal Gate Price (TGP)¹⁴⁶ or Mean of Platts Singapore 95¹⁴⁷ for RULP.

Regulating the price of ethanol could ensure volume fuel sellers can obtain ethanol at a price that allows E10 to compete on price with RULP, thereby increasing consumer demand. Further, regulating the price of ethanol could remove monopoly rents, if any.

We do not consider there would be legal impediments to the NSW Government regulating the price of ethanol.

9.3.1 Options

We considered the following options for regulating the price of ethanol:

- Option 9a Set an economic price of ethanol under the Act so the price of E10 would be 3% cheaper than RULP.
- Option 9b Set the maximum price of ethanol based on an international benchmark.
- Option 9c Set the maximum price of ethanol produced by Manildra Group at its efficient costs.

¹⁴⁶ The TGP is the price at which full tanker loads of fuel are sold to wholesale customers from seaboard terminals on a spot basis. The minimum amount that can be purchased is 35,000L. The TGP does not include added services such as business support, freight, branding or wages for staff employed at service stations. TGP is determined by the amount the terminal paid to buy the fuel from the refinery, the margin needed to cover the cost and profit requirements of the terminal operator and taxes, including federal excise and GST. Australian TGP is closely linked to the Singapore benchmark price of petrol, which is typically around 95% of TGP. The remaining 5% of TGP reflects insurance, a quality premium for Australian fuel standards, local wharfage and terminal costs and a small wholesale marketing margin (where competitively possible). http://www.aip.com.au/pricing/facts/Facts_About_Petrol_Prices.htm, accessed 30 March 2015.

¹⁴⁷ The average of a set of Singapore-based oil product price assessments published by Platts, a division of McGraw Hill Financial.

Set a maximum economic price for ethanol under the Act

The Government could define the economic price of ethanol under the Act as 'a level that would result in E10 being approximately 3% cheaper than RULP at the pump'. A 3% price differential between RULP and E10 would account for the lower energy content of E10 compared with RULP. The expert panel could use a Ministerial Guideline to determine whether or not to recommend an exemption.

This option effectively sets the maximum price that volume fuel sellers would be obliged to pay for ethanol. The expert panel, when assessing applications for exemptions by volume fuel sellers, could also account for whether the price of E10 is 3% cheaper than RULP.

An economic price may lead to the undersupply of ethanol. If market conditions, such as low oil prices, mean ethanol could not be supplied at a price that allowed E10 to be at least 3% lower than RULP, then volume fuel sellers would be exempt from purchasing ethanol. Similarly, when oil prices were high, there would be no incentive to sell ethanol any lower than the set price differential.

Set a benchmark price for ethanol based on an international price

The current international ethanol price (largely driven by the US supply market) is around 55 cpl.¹⁴⁸ Though US production is driven by corn feedstock (as opposed to wheat feedstock), the ethanol produced is the same. The US price benchmark can be treated as a proxy for import competition that would potentially occur if the Ethanol Production Grant and concessional excise arrangements for domestic ethanol producers were removed (Chapter 2). The volatility of the price of ethanol, if based on an international benchmark, would need to be considered. We understand the domestic average floor price of ethanol sold by Manildra Group is higher than the international market price.¹⁴⁹

Set the maximum price of ethanol produced by Manildra Group

We consider evidence suggests the Manildra Group has substantial market power in the ethanol market:

- It is the only producer and dominant supplier of ethanol in NSW and volume fuel sellers must purchase ethanol to comply with the mandate.
- The price of ethanol in NSW is higher than in the international market.

¹⁴⁸ IPART calculations based on Bloomberg, DL1 Generic 1st ethanol CME futures, average for December 2014, converted to AUD.

¹⁴⁹ Confidential pers comm, 16 February 2015.

- Manildra Group's cost of production is likely lower than its Australian competitors because of its likely economies of scale and scope (it produces ethanol from a waste product).¹⁵⁰
- ▼ There is little prospect of competition from imported ethanol in the foreseeable future, given the Australian Government's concessionary excise arrangement for local ethanol producers.

Regulating Manildra Group's price requires detailed information on its cost of production, which is not publicly available.

Setting a maximum price based on Manildra Group's costs of production is unlikely to promote new entry or allow current suppliers in Queensland to compete (Manildra Group's current dominant position and its integrated production process means it has likely lower costs of production compared with its competitors).

9.3.2 Likely impact on ethanol uptake

Regulating the price of ethanol is likely to have a limited impact on ethanol uptake. We estimated ethanol uptake of about 2.2 to 2.3% at the end of 2024-25. We analysed:

- the response from current E10 customers using a range of price elasticity from -2 to -5, and
- the response from RULP customers using a range of cross-price elasticity from 0.5 to 2.

There is limited direct evidence on the price elasticity of E10 and the degree of substitution between E10 and RULP. Appendix C presents research underlying our price elasticity estimates.

In the NSW context, some consumers are willing to pay about 15 cpl more for PULP than for E10, when faced with a choice between E10 and PULP. These consumers would require a substantially higher discount to the price of E10 to induce them to use ethanol blended fuel. Even if the cost of ethanol input to E10 was set to zero, a discount of this magnitude would not be achievable.

¹⁵⁰ Quirke, D, R. Steenblik and B. Warner, Biofuels – at what cost? Government support for ethanol and biodiesel in Australia, Global Subsidies Initiative, April 2008, p 26. Cowman Stoddart Pty Ltd, Environmental Assessment Report, Proposed ethanol production upgrade including proposed odour reduction and waste water treatment measures for existing Shoalhaven Starches operations, August 2008, p 32.

9.3.3 Cost-benefit analysis

We analysed the costs and benefits of regulating the price of ethanol to allow the price of E10 to be at energy parity value with RULP (Option 9a), and setting the price of ethanol at the international price of ethanol (Option 9b). We did not conduct a cost-benefit analysis of setting the price of ethanol produced by Manildra Group, because we do not have sufficient information on Manildra Group's costs of production, and the costs and benefits are likely to be similar to Option 9a and Option 9b.

We estimated a net benefit of about \$2 million in net present value terms from setting the price of ethanol at energy parity value with RULP (Option 9a) and a net cost of \$1 million in net present value terms from setting the price of ethanol to an international benchmark (Option 9b).

The major costs of regulating the price of ethanol (Appendix C) include:

- ▼ The loss of producer surplus on the baseline quantity of ethanol supplied to the market, due to a lower price of ethanol. We estimated costs between \$244 million (Option 9a) and \$386 million (Option 9b).
- The costs of implementing and administering the price regulation by the Government. We estimated these costs to be \$14 million (both Options 9a and 9b).

The major benefits of implementing a price regulation option (Appendix C) include:

- A gain in consumer surplus, because current E10 consumers can purchase E10 at a lower price. We estimated benefits between \$244 million (Option 9a) and \$386 million (Option 9b).
- ▼ A gain in consumer surplus from additional demand in response to price. We estimated benefits between \$7 million (Option 9a) and \$17 million (Option 9b).
- A gain in producer surplus through extending demand in response to price. We estimated benefits of about \$3 million under Option 9a.
- A loss in producer surplus of about \$13 million under Option 9b.
- GHG abatement benefits of around \$1 million (both Options 9a and 9b).
- Health benefits, estimated to be between \$5 million (both Options 9a) and \$8 million (Option 9b).

10 Other measures and combinations of measures

In this chapter, we look at other potential measures to increase ethanol uptake, including changing the current minimum blending requirement, changing the mandate to a government policy and introducing a broader policy target including the NSW bus fleet.

Finally, we also look at a combination of measures to achieve the 6% ethanol mandate (because the only option that would singularly increase the ethanol uptake to the 6% mandate removes consumer choice by including ethanol in almost all petrol). However, because most options in isolation would impose a net cost to NSW, combining measures to achieve the 6% ethanol mandate would also impose a net cost on the NSW community. Further, to achieve the 6% mandate, combining measures would also substantially reduce consumer choice.

10.1 Findings

18 Increasing the minimum ethanol content of E10 under the Act from 9% to 9.5% to increase ethanol uptake would increase the risk of E10 breaching the 10% ethanol content cap under Australian fuel standards.

10.2 An ethanol target instead of a mandate

A 6% ethanol **target** can be a government policy, rather than a legislated **mandate**. Without the mandate, any stations for whom the opportunity cost of supplying ethanol instead of another petrol grade is too great, may not distribute ethanol. To avoid this, ethanol producers would have to reduce the price of ethanol to a point at which it becomes economically beneficial for wholesalers to purchase it. Any price pass-through would need to increase demand sufficiently to compensate ethanol producers for the opportunity cost of continuing to supply ethanol.

Alone, this option would not increase the distribution of E10 in NSW, because existing sellers who do not offer E10 would still have little incentive to invest in upgrading infrastructure, unless demand reached a point where it is economic to do so.

Some stakeholders indicated they would provide less E10 without a mandate. Some indicated they would continue to supply E10 in specific areas where it made sense financially based on local demand. However, it is reasonable to assume that without a mandate, overall consumer access to E10 fuel would decrease.

10.3 Blend E10 at 9.5%

An option to increase the ethanol uptake could be to increase the minimum ethanol content under the *Biofuels Regulation* 2007 from 9% to 9.5%.¹⁵¹

Under the Australian fuel standards, the maximum ethanol content for petrol is capped at 10% and hence there is a range between 9% to 10% at which primary wholesalers can target their ethanol mix.¹⁵² We understand most primary wholesalers set their target blend rate between 9.5% to 9.7% ethanol, and so most primary wholesalers are already targeting the possible option of increasing the minimum ethanol content to 9.5%.¹⁵³

Current in-line blending infrastructure can have inaccuracies of up to 0.5%, and so for a target rate of 9.7% some loads can test below 9.7% (eg, 9.2%) and, at times, above 9.7% (eg, 9.9%).¹⁵⁴ We understand there is measurement error in the standard test (ASTM D4815) for ethanol content eg, a test of a sample of ethanol blended petrol could produce results that differ by up to 0.85% in ethanol content.¹⁵⁵

If the minimum ethanol content is increased to 9.5%, then primary wholesalers would have to target a higher blend rate, greater than the current typical target rate of between 9.5% to 9.7%, to ensure all E10 met the minimum standard. However, this increases the risk of their E10 breaching the 10% ethanol cap, given measurement error.

We consider the current minimum standard of 9% to be reasonable, given most primary wholesalers already target at least 9.5% ethanol content in their E10, and there is a risk of measurement error in the standard test for ethanol.

¹⁵¹ Clause 7(f) of the *Biofuels Regulation* 2007.

¹⁵² Fuel Standard (Petrol) Determination 2001, p 4.

¹⁵³ Confidential correspondence, February 2015.

¹⁵⁴ Confidential correspondence, February 2015.

¹⁵⁵ Confidential correspondence, February 2015.

10.4 Broader policy target – Run government buses on 100% ethanol

An option for increasing ethanol uptake in NSW is to change the government bus fleet so these buses run on pure ethanol (E95). This option does not relate to the current mandate because the mandate applies to ethanol blended petrol sold by volume fuel sellers. But if implemented, this option could materially increase the level of ethanol consumed in NSW.

Public buses service the most congested and most densely populated cities in NSW. Given there are health benefits from using ethanol as a transport fuel, the policy would have the maximum benefit in large cities such as metropolitan Sydney and the Newcastle area.

There are several successful examples of using ethanol in city buses, most notably the Stockholm city bus program, where all inner city bus lines were converted to run on renewable fuels. The program saved 35 ML of diesel fuel per year and reduced net carbon dioxide emissions by up to 90% compared with a conventional diesel-powered bus. Melbourne conducted a pilot project.

Ethanol powered buses in Stockholm use a diesel engine modified to run ED95 – pure hydrous ethanol supplemented with a proprietary ignition improver. This fuel type is not available in Australia, and the Australian Government would need to develop a new fuel standard to allow this fuel to be used in Australia.

In NSW, metropolitan bus services are outsourced by Transport for NSW (TfNSW). The contract between TfNSW and the private operators prescribe the rules of operation and the environmental standards for the operator's bus fleet.¹⁵⁶ Operators bid to TfNSW on total operating costs.

To procure new buses, the operator must provide its proposed program for new buses to TfNSW when the contract commences. The approval for payment of a new bus is at TfNSW's discretion. All new buses must be supplied, manufactured or purchased by or from the Bus Procurement Panel, unless advised otherwise in writing by TfNSW.

Given the degree of control TfNSW exercises, and the Bus Procurement Panel in particular, in approving new buses, it may be feasible to impose a specific fuel requirement as part of the bus specification. However, the service contracts are tendered for a fixed price, and the operator's incentives are to minimise the running costs of the fleet.

¹⁵⁶ TfNSW Sydney Metropolitan Bus Service Contract (SMBSC), cl. 14.1. http://www.transport.nsw.gov.au/sites/default/files/b2b/bus/sydney_metropolitan_bus_se rvice_contract_and_attachment_a_-contract_details.pdf accessed 10 March 2015.

10.4.1 Likely impact on ethanol uptake

In 2014, TfNSW had over 4,700 bus contracts, travelling an estimated 237 million kilometres. Most of these buses were powered by diesel.

The buses have an asset life of 25 years, with about 190 buses being replaced each year on average. If these buses were replaced by E95 compatible vehicles, they would require up to 59 ML of ethanol per year, resulting in a 3.2% uptake of ethanol by 2025, if it was counted towards the mandate.

10.4.2 Cost-benefit analysis

We estimated an option to convert public contract buses to pure ethanol could deliver net benefits, but the medium scenario produces net costs of \$9 million and the range is very wide (from a positive net present value of \$63 million to a negative net present value of \$101 million). Given the level of uncertainty about many parameters and inputs, we cannot recommend this option without additional expert evaluation.

The benefits would flow to:

- ethanol producers from expansion of the market for their product, and
- the broader community in the form of health benefits due to improved air quality and reduced GHG.

The costs would accrue to:

- Government:
 - to procure E95 buses at greater costs than standard diesel buses
 - to cover higher operating and maintenance costs of ethanol buses
 - higher ongoing fuel costs (however, this depends on the price of ethanol for blending in E95 and the price of the ignition improver)
 - potentially higher depreciation (not quantified).
- Bus operators to develop the E95 depot infrastructure.

Our estimate assumed additional costs to procure ethanol buses of between \$5,000 and \$30,000 per bus, and the additional service costs of between \$500 and \$1,000 per bus per year. We assumed 4% (or 190) of the contract buses are replaced each year, and all replacement buses are ethanol powered.

We modelled updating the bus depot infrastructure to offer E95 from one to 20 depots by 2025, at a cost of \$600,000 per depot.

Under this option, centralised government tendering of ethanol might be considered to achieve the best price of ethanol. Net results are sensitive to the price of ethanol. If the price of ethanol is low enough compared with diesel, additional fuel costs might turn into fuel benefits. In this scenario, we assumed E95 is available at 20% discount to diesel, producing net costs of \$9 million in net present value terms (Appendix C).

This option might also require additional expert evaluation of the longer term effects of public buses on air quality and road safety. The benefits of the option might be eroded by new, cleaner diesel engines or hybrid technologies for the heavy vehicle fleet. Increased demand for ethanol in the longer term might contribute to higher feedstock and food prices. In addition, the option should be evaluated against the broader portfolio of transport policies, accounting for the opportunity cost of government spending.

10.5 Combination of measures

Our analysis showed the only options that would singularly achieve the 6% ethanol mandate would involve removing consumer choice – ie, include ethanol in almost all fuel (Option 4a). Further, apart from the option of a consumer education campaign, all options are likely to result in a net cost to the NSW community.

If the Government pursues measures to achieve the 6% mandate, it could implement a combination of measures that:

- broadens the scope of the mandate so all service stations must offer EBP (Option 1b), and
- limits the ability of volume fuel sellers to obtain an exemption (Option 7).

This combination of measures means fuel sellers, including all wholesalers and retailers, must take far-reaching action to ensure 6% of petrol sold is ethanol, which may include removing RULP or including ethanol in almost all petrol, as there is limited ability for fuel sellers to obtain an exemption. Under this combination of measures, wholesalers and retailers would be able to determine, at least to some extent, their least cost means of achieving the mandate.

Our analysis suggested combining Option 1b and Option 7 would impose a net cost on the NSW community.

If the Government pursues any measure discussed in this report that may increase ethanol uptake and therefore may strengthen Manildra Group's market power (eg, measures to remove or reduce consumer choice), we consider it prudent for the Government to regulate the price of ethanol.

If a dominant supplier's market power is strengthened, then ultimately consumers may be worse off through paying higher petrol prices.

Appendices

A | Terms of reference

NSW

Premier of New South Wales Minister for Western Sydney Minister for Infrastructure

IPART D18 838 Doc No File No

Dr P J Boxall, AO Chairman Independent Pricing and Regulatory Tribunal PO Box Q290 QVB Post Office NSW 1230

n Jan

Dear Dr Boxall

I write in relation to the Independent Pricing and Regulatory Tribunal undertaking an assessment of measures the Government could take to meet the requirement under the Biofuels Act 2007 for a volume fuel seller to sell a volume of ethanol that is not less than 6% of total petrol sales by that seller in NSW.

RECEIVED

JAN 2015

Reference: A1039594

0 9 JAN 2015

Please find enclosed a reference under section 9 of the *Independent Pricing and Regulatory Tribunal Act 1992* for the Tribunal to undertake this assessment.

If your officers wish to discuss this matter they should contact Jane Mallen-Cooper, Director, Resources and Land Use Branch, Productivity and Sustainability Group, Department of Premier and Cabinet on 9228 4260.

Yours sincerely

NN

MIKE BAIRD MP Pkemier

GPO Box 5341, Sydney NSW 2001 = P: (02) 9228 5239 = F: (02) 9228 3935 = www.premier.nsw.gov.au

Terms of Reference

I, Mike Baird, Premier, pursuant to Section 9 of the *Independent Pricing and Regulatory Tribunal Act 1992*, approve the Independent Pricing and Regulatory Tribunal (IPART) entering into an arrangement with the Department of Premier and Cabinet to provide services to the Department that are within IPART's area of expertise.

The *Biofuels Act 2007* imposes an ethanol mandate on major fuel sellers ('volume fuel sellers') who must ensure that ethanol blended fuel accounts for 6% of their total petrol sales in NSW. The overall 6% target has never been reached and a range of reviews have been carried out to look into reasons behind the shortfall and the costs and benefits of the policy, including a review by IPART in 2012.

In early 2014 the NSW Government undertook targeted consultation on two broad options for increasing ethanol consumption in NSW. These were to broaden the mandate by imposing a direct obligation on additional retailers and requiring ethanol to be added to 95 grade (premium) fuel.

The services to be provided by the Tribunal are:

- An assessment of the two broad options for increasing ethanol consumption in NSW that were the subject of this limited earlier consultation, namely:
 - 1. Broadening the ethanol mandate by:
 - Amending the definition of major retailers so that more retailers are subject to the mandate, or
 - · Requiring all service stations to offer an ethanol blended product, or
 - Requiring service stations that sell more than a specified minimum annual volume of petrol to offer E10.
 - Introducing premium ethanol blends by:
 - Requiring E10 blended in NSW to conform with the Premium Unleaded Petrol (PULP) standard or
 - Requiring all primary wholesalers to offer at least one premium ethanol blend petrol.
- An assessment of the opportunity for stronger enforcement of the mandate, and the costs and benefits of such an approach.
- An assessment of any other measures the government could take, singly or in combination, to increase the uptake of ethanol in NSW.

This assessment should have particular regard to the likely effectiveness of a measure (or a combination of measures) in reaching the 6% target and the direct and indirect costs to the NSW Government, consumers and businesses of implementing such a measure.

The assessment should make use of previous investigations into the ethanol mandate in NSW and other inquiries as the Tribunal sees fit and have regard to the impact of relevant Australian Government programs.

The Tribunal is to provide the final report to the Premier in May 2015 and is not required to 6.7 consult with the public. The final report will be made publicly available.

B Other jurisdictions

B.1 Global biofuels market overview

- Liquid biofuels met about 2.3% of global transport fuel demand 2013. The total of 116.6 billion litres included:
 - ethanol world production of 87.2 billion litres
 - biodiesel production of 26.3 billion litres.¹⁵⁷
- Actual share of ethanol was much higher countries with strong support for bioethanol (eg, 10% of gasoline transport fuels in USA, and above 40% of light vehicle fuel in Brazil).¹⁵⁸
- World ethanol production increased in 2013 by 6% after two years of decline. Overall, investment in new biofuel plant capacity continued to decline from its 2007 peak.¹⁵⁹
- World top producers and consumers of ethanol North America, followed by Latin America:
 - USA (corn feedstock) and Brazil (sugarcane feedstock) account for 87% of the global total
 - USA a major exporter of ethanol (in 2013, 2.4 billion litres exported to Canada, the Philippines, United Arab Emirates, Brazil, Mexico, and Peru).¹⁶⁰
- Largest producers and consumers of biodiesel Europe.

¹⁵⁷ REN21, Renewables 2014 Global Status Report, 2014, Table R4, p 109.

¹⁵⁸ REN21, *Renewables 2014 Global Status Report*, 2014, p 34 and de Gusmao Dornelles, R., *Case study 2: Deregulating ethanol market – Experience of establishing a free market*, Ministry of Energy (Brazil), presentation, Copenhagen, May 20-22, 2014, p 7.

¹⁵⁹ REN21, Renewables 2014 Global Status Report, 2014, p 18.

¹⁶⁰ Ibid, p 34.

B.2 International biofuels policies and mandates

- ▼ Biofuels market has been driven by the specific biofuels policies. In 2013, there were:
 - biofuel mandates in 63 countries
 - broader renewable energy policies in 138 countries, and
 - renewable energy targets in 144 countries.
- In 2013, a number of countries revised existing policies and targets, including retroactive changes, to improve policy efficiency and reduce economic costs of policies supporting the renewables sector.¹⁶¹
- Some existing blend mandates were strengthened. However, in some countries support for first-generation biofuels was reduced due to environmental and social sustainability concerns.
- Additional options in the transport areas included increasing the number of vehicles fuelled with biomethane and electricity from renewable sources.¹⁶²

¹⁶¹ REN21, 2014, p 14. ¹⁶² Ibid.

	· ·
Country	Mandate
Argentina	E5 and B10
Australia	E6 and B2 in New South Wales ^b
Belgium	E4 and B4
Brazil	E20 and B5 ^c
Canada	<i>National:</i> E5 and B2 <i>Provincial:</i> E5 and B4 in British Columbia; E5 and B2 in Alberta; E7.5 and B2 in Saskatchewan; E8.5 and B2 in Manitoba; E5 in Ontario
China	E10 in nine provinces
Indonesia	B2.5 and E3
Malaysia	B5
Philippines	E10 and B5
South Africa	E2 and E5 as of October 2015
South Korea	B2.5
Thailand	E5 and B5
United States	<i>National:</i> The Renewable Fuels Standard 2 (RFS2) requires 136 billion litres (36 billion gallons) of renewable fuel to be blended annually with transport fuel by 2022. The RFS for 2013 was reduced to 49.21 billion litres (13 billion gallons).
	<i>State:</i> eg, E10 in Missouri and Montana; E10 in Hawaii; E2 and B2 in Louisiana; B4 by 2012, and B5 by 2013 (all by 1 July of the given year) in Massachusetts; E10 and B5, B10 by 2013, and E20 by 2015 in Minnesota.
Vietnam	E5

 Table B.1
 Examples of national and state / provincial biofuel blend mandates, 2013^a

^a In this table, E10 denotes the mandate to increase the use of ethanol to 10% (of either volume or energy). Similarly, B10 stands for the mandate for biodiesel.

b E5 mandate in QLD discussed but not proceeded. Current NSW ethanol mandate is equivalent to E6.

c Recent liberalisation of the ethanol market and revision of the mandate - see

http://www.iea.org/etp/tracking/biofuels/ and de Gusmao Dornelles, *Case study 2: Deregulating ethanol market* – *Experience of establishing a free market*, Ministry of Energy (Brazil), presentation, Copenhagen, May 20-22, 2014, http://www.ieabioenergy.com/wp-content/uploads/2014/05/P04-Deregulating-ethanol-market-experienceof-establishing-a-free-market-Dornelles.pdf

Note: The Philippines' B2 mandate is set to be raised to B5 following approval from the National Biofuels Board. Mexico has a pilot E2 mandate in the city of Guadalajara. The Dominican Republic has targets of B2 and E15 for 2015 but has no current blending mandate. Chile has targets of E5 and B5 but has no current blending mandate. Fiji approved voluntary B5 and E10 blending in 2011 with a mandate expected. The Kenyan city of Kisumu has an E10 mandate. Nigeria has a target of E10 but has no current blending mandate.

Sources: REN21, *Renewables 2014 Global Status Report*, 2014, Table R18, p 131. Specific descriptions of biofuels mandates for selected countries can be found in von Lampe, M. et al., 'Fertiliser and Biofuel Policies in the Global Agricultural Supply Chain: Implications for Agricultural Markets and Farm Incomes', OECD Food, Agriculture and Fisheries Papers, No. 69, 2014, OECD Publishing, Table 3, p 16.

http://dx.doi.org/10.1787/5jxsr7tt3qf4-en. Biofuels policy database for OECD countries is available at http://www.oecd.org/tad/agricultural-policies/support-policies-fertilisers-biofuels.htm#BiofuelPolicy

B.3 United States

The US Renewable Fuel Standard (RFS) scheme (Box B.1) explicitly recognises four types of biofuels, with four volumetric targets set separately for each year, resulting in percentage targets presented in Table B.2.

The Renewable Identification Number (RIN) accounting system ensures compliance with RFS scheme requirements. RINs are created by biofuels producers, and have to be surrendered by the obligated parties to demonstrate compliance with the biofuels targets.

The US system works on the national level (RINs are tradeable within the US), and is supplemented by various state and local level programs (eg California Low Carbon Fuel).

Table B.2US Renewable Fuel Standards, 2010-2014 (as a proportion of a
refiner's or importer's gasoline and diesel volume)

	2010	2011	2012	2013	2014
Cellulosic biofuel	0.004%	0.003%	0.002 - 0.01%	0.004%	Not
Biomass- based diesel	1.10%	0.69%	0.91%	1.13%	finalised
Advanced biofuel	0.61%	0.78%	1.21%	1.62%	
Renewable fuel	8.25%	8.01%	9.21%	9.74%	

Note: The 2012 data is Proposed standard.

Source: IPART analysis based on the following sources by year: for 2010 - FR v 75 No 58, 26 March 2010, p 14675; 2011 – FR Vol 75 No 236 December 9, 2010, p 76793; 2012 - EPA Proposes 2012 Renewable Fuel Standards and 2013 Biomass-Based Diesel Volume, p 3; 2013 - FR Vol 78 No 158 August 15, 2013, p 49798.

Box B.1 US Renewable Fuel Standard (RFS) scheme

Policy instruments and scope

- RSF1 created under the Energy Policy Act 2005:
 - established the first renewable fuel consumption mandate, feedstock and GHG emission requirements
 - required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012
 - starting in 2013, also required that the total volume of renewable fuel to contain at least 250 million gallons of fuel derived from cellulosic biomass.
- RSF2 extended under the Energy Independence and Security Act 2007 (EISA):
 - to include diesel; the target increased from 9 billion in 2008 to 36 billion gallons by 2022.
 - four separate categories of renewable fuels established, with a separate volume mandate and a specific lifecycle GHG emission threshold (renewable fuel, advanced biofuel, biomass-based diesel, and cellulosic biofuel). See Table B.2.
 - existing biofuels capacity and the capacity that already commenced construction are exempt (grandfathered) from the 20% lifecycle requirement.

Administration

Administered by the US Environmental Protection Agency (EPA).

Obligated parties

Any refiners that produce (or importer that imports) gasoline or diesel fuel within (into) the 48 contiguous states or Hawaii during a compliance period.

Compliance

- The Renewable Identification Number (RIN) accounting system ensures compliance for both credit trading and for compliance demonstration.
- RINs are assigned by renewable fuel producers to each gallon of qualifying renewable fuel that they produce. Facilities generating RINs are registered.
- Obligated parties must determine their renewable volume obligations (RVOs) at the end of year based on volume of production, and must demonstrate compliance with their RVOs in an annual report (2 months after the end of the calendar year).

Implications in 2014

- Inadequate domestic supply of renewable fuel and RINs, due both to ethanol "blendwall" constraints (inability to sell more ethanol within E10 blending limit), and limitations on the production of non-ethanol blended petrols like biodiesel.
- Shortage of RINs likely leading to the reduced domestic production of gasoline and diesel and higher fuel prices.

Sources: FR Vol 75 No 58, 26 March 2010, pp 14673 - 14677; The American Petroleum Institute (API) and the American Fuel & Petrochemical Manufacturers (AFPM) petition to the Administrator, 13 August 2013.

B.4 Brazil

The success of the Brazilian ethanol program was due to several factors including political, historical and economic.

Initially the Brazilian government sought to prop up the domestic sugar industry by purchasing the surplus sugar to produce ethanol. This policy began to prosper during the oil crisis of 1973, where the cost of a barrel of oil increased from \$2.90 per barrel to \$11.65 per barrel.¹⁶³ The oil crisis prompted the Brazilian Government to accelerate the production of ethanol through Decree 76,593 in 1975. This decree was the beginning of the current ethanol industry in Brazil. Policies to expand production continued into the 1980s and 1990s.

Subsequently, the Brazilian Government sought to increase the consumption of ethanol in two main ways:

- Mandates for mixing ethanol with gasoline The mixture of ethanol in the gasoline increased gradually to approximately 10%, which required small changes in the existing motors.
- Price controls The Government set the price of ethanol paid to producers at 59% of the selling price of gasoline (more than twice the cost of imported gasoline).¹⁶⁴

The Brazilian Government gradually removed the price controls and subsidy paid to ethanol producers until the price paid to ethanol producers was similar to the cost of gasoline in the international market in 2002. Between 2003 and 2009, the mandated percentage of ethanol in gasoline fluctuated between 20% and 25%.¹⁶⁵ The mandate was to increase to 27.5% in February 2015, but it is unclear whether this has come into effect.¹⁶⁶

The mandate fluctuated over time largely due to movements in both the price of petroleum and the price of sugar. Producers received substantial subsidies to maintain a high level of ethanol production during periods when the price of sugar was high or the price of petroleum was low relative to ethanol.

B.5 Australian Commonwealth policies

Table B.3 summarises relevant Australian Government policies and grants.

¹⁶³ The *Energy Independence and Security Act of 2007* requires a 20% reduction in lifecycle GHG emissions for and renewable fuel introduced at new facilities, a 50% reduction to be classified as biomass-based diesel or advanced biofuel and a 60% reduction to be classified as cellulosic biofuel. Source: EPA, EPA lifecycle analysis of greenhouse gas emissions from renewable fuels, February 2010, pp 1-2.

¹⁶⁴ Goldemberg J., Advanced biofuels and bioproducts, 2013, Chapter 2, pp 15-6.

¹⁶⁵ de Gusmao Dornelles, Case study 2: Deregulating ethanol market – Experience of establishing a free market, Ministry of Energy (Brazil), presentation, Copenhagen, May 20-22, 2014, slide 14.

¹⁶⁶ See Bloomberg business website http://www.bloomberg.com/news/articles/2014-09-03/brazilian-senate-approves-higher-ethanol-mandate, accessed 31 March 2015.

Scheme	Description	Costs	Volumes	Comments
Australian Renewable Energy Agency (ARENA)	ARENA has approximately \$2.5 billion in funding to: fund renewable energy projects; support research and development activities; and support activities to capture and share knowledge.	\$30m has been committed or spent under the Emerging Renewables Program.		Biofuel projects funded include Licella, Muradel (algae fuel demonstration scale plant), Sugarcane Begass, Curtin University (converting mallee into bioenergy), and James Cook University (macro-algae fuel optimisation)
Cleaner fuel grant scheme (CFG)	Biodiesel importers and producers receive a 38.143 cpl grant for domestic production and imports that meet the Australian Biodiesel Standard, effectively making domestic produced and imported biodiesel 'excise free'.	2013-14 = \$91.2 million 2012-13 = \$44.3 million 2011-12 = \$30.9 million 2010-11 = \$31 million	2013-14 = 239 ML 2012-13 = 116 ML 2011-12 = 81 ML 2010-11 = 78 ML + 3 ML renewable	Volumes of biodiesel imports and domestic production are increasing. This grant is scheduled to cease in June 2015, to be replaced by concessional excise. Excise would be reduced to zero from 1 July 2015 and then increased for five years from 1 July 2016 until it reaches 19.1 cpl before indexation (which represents 50% of the energy content equivalent rate). ^a The excise equivalent customs duty for imported biodiesel will continue to be taxed at the full energy content equivalent tax rate of 38.143 cpl (before indexation). ^b
Ethanol production grants program	A grant of 38.143 cpl paid to Australian ethanol producers for every litre of fuel grade ethanol they produce and enter into the Australian supply chain for blending with petrol, effectively making domestic produced ethanol 'excise free'	2013-14 = \$90.1 million 2012-13 = \$108 million 2011-12 = \$115 million 2010-11 = \$125 million	2013-14 = 236 ML 2012-13 = 284 ML 2011-12 = 302 ML 2010-11 = 326 ML	This grant is scheduled to cease in June 2015 to be replaced by concessional excise. Excise on domestically produced ethanol will also be reduced to zero from 1 July 2015 and then increased by 2.5 cpl per year for five years from 1 July 2016 until it reaches 12.5 cpl (before indexation). ^c Imported ethanol is subject to excise equivalent customs duty at 38.143 cpl (before indexation ^d) and for imports from countries other than the US, a value duty of

Table B.3 Summary of key biofuel policies and grants – Australian Commonwealth

Scheme	Description	Costs	Volumes	Comments
				5%. e
Fuel tax credit	Full fuel tax credit for fuel tax (excise or customs duty) included in the price of fuel used for business activities in: machinery; plant; equipment; and heavy vehiclesf			For blends of biodiesel and diesel that are invoiced as B5 or B20, the effective fuel tax is calculated as if the fuel is entirely diesel. For E10, the effective fuel tax is calculated as if the fuel is entirely petrol. For E85, the effective fuel tax is calculated on the petrol portion only.9 The amount of fuel tax credits for biodiesel and ethanol acquired for use in eligible business activities is reduced by any applicable grant or subsidy. This includes CEG and EPG
Dumping duty on imports of biodiesel from US	Since 2011, a dumping duty of about 18 cpl applies to imports of biodiesel from USA.	2013-14 = nil (est) 2012-13 = \$2.0 million (est) 2011-12 = \$1.7 million (est)	2013-14 = nil 2012-13 = 11.3 ML (ABS) 2011-12 = 9.6 ML (ABS)	Calculated by applying 18 cpl on biodiesel imports from US. There were no imports from US in 2013-14. We understand this anti-dumping duty will expire by 2015. ^h

a APAC Biofuel Consultants, Australian biofuels 2014-15, October 2014, p 31.

b http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/BudgetReview201415/Ethanol, accessed 19 February 2015; Australian Government, *Budget measures: budget paper no. 2: 2014–15*, May 2014, p 218.

^c Australian Government, Budget measures: budget paper no. 2: 2014–15, May 2014, p 165.

d https://www.ato.gov.au/General/New-legislation/In-detail/Indirect-taxes/Excise/Reintroduction-of-fuel-excise-indexation/, accessed 19 February 2015.

e Australian Government, Budget measures: budget paper no. 2: 2014-15, May 2014, p 165.

http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/BudgetReview201415/Ethanol, accessed 17 February 2015.

f The only fuels that are not eligible are: aviation fuels (aviation gasoline and aviation kerosene); fuels used in light vehicles of 4.5 tonnes gross vehicle mass (GVM) or less, travelling on public roads; fuel acquired but not used because it was lost, stolen or otherwise disposed of; and some alternative fuels, such as ethanol or biodiesel that have already received a grant or subsidy.

9 https://www.ato.gov.au/Business/Fuel-schemes/In-detail/Fuel-tax-credits---for-GST-registered-businesses/Eligibility/Fuel-tax-credits---fuel-blends/?page=2, accessed 19 February 2015.

h APAC Biofuel Consultants, Australian biofuels 2014-15, October 2014, p 22.

Sources:

All entries unless otherwise indicated: APAC Biofuel Consultants, *Australian biofuels* 2014-15, October 2014, Table 5.1, p 42; ARENA - http://arena.gov.au/speech_presentation/ presentation-by-ivor-frischknecht-ceo-arena-at-the-biofuels-association-of-australia-annual-conference/, accessed 12 February 2015; Fuel tax credit - https://www.ato.gov.au/Nonprofit/Expenses-and-purchases/In-detail/Fuel-tax-credits/Fuel-tax-credits-for-business/?page=4#About_fuel_tax_credits, https://www.ato.gov.au/Business/Fuel-schemes/In-detail/Fueltax-credits--for-GST-registered-businesses/Eligibility/Fuel-tax-credits--fuel-blends/?anchor=Fuel_tax_credits_other#Fuel_tax_credits_other, accessed 12 February 2015. C Cost-benefit analysis

Table C.1 Cost-benefit analysis: key inputs and assumptions

		• •
Parameter	Assumption	Rationale / source
Base year	2015	
Time horizon, years	10	
Discount factor	7%	NSW Treasury, NSW Government guidelines for economic appraisal, TPP 07-5, July 2007, p 52.
Energy equivalence E100	68.40%	Based on Bureau of Resources and Energy Economics (BREE), <i>An assessment of key costs and benefits associated with the Ethanol Production Grants program - Report for the Department of Industry</i> , February 2014, p 15.
Consumer surplus		
discount RULP-E10, cpl (\$2015)	2.2	ACCC, Monitoring of the Australian petroleum industry, December 2014.
premium RULP-PULP, cpl (\$2015)	14.0	ACCC, Monitoring of the Australian petroleum industry, December 2014.
Price RULP, cpl (\$2015)	149.7	ACCC, Monitoring of the Australian petroleum industry, December 2014.
Energy adjusted discount – switching from RULP to E10, cpl (\$2015)	-2.53	Based on ethanol having energy equivalence of 68.4% of that of petroleum (see BREE 2014).
Energy adjusted discount – switching from PULP to E10, cpl (\$2015)	2.3 to 11.0 (midpoint 8.3)	 The range accounts for diverse industry views. The lower end of the range is derived from PULP having greater fuel efficiency than E10 of between 3.2% (ethanol having energy equivalence of 68.4% of that of petroleum) to 8.5% (based on driving test results http://www.drive.com.au/motor-news/ethanol-put-to-the- test-e85-v-e10-v-premium-unleaded-20110205-1ahgx.html).
		 For our mid-point we assumed E10 requires 5% more fuel to travel the same distance as using PULP.
		 Information suggests no difference between PULP and RULP for cars recommended/designed to operate on RULP: http://www.carsguide.com.au/car-advice/regular-premium-or-ethanol-which-petrol-is-best-for-me- 31347#.VT86tyGqpBc; http://www.mynrma.com.au/motoring-services/motorserve/tips/motorserve- fuel.htm).
		 There are a range of factors that can affect fuel efficiency such as the make of car, driving conditions and where the petrol has been refined (can result in different fuel quality eg different sulphur levels).
Energy adjusted discount – switching from RULP to PULP, cpl (\$2015)	5.3 to 14.0	Derived by removing the lower energy content of E10 of 3.2% compared with PULP from our estimated range of relative fuel efficiency between PULP and E10, 3.2% to 8.5%, established above. The derived range of greater fuel efficiency of PULP compared with RULP, for cars recommended/designed to operate on RULP, is between 0% to 5.3%.

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Cost-benefit analysis

Parameter	Assumption	Rationale / source
Own-price elasticity of E10	- 3 (range from -2 to -5)	 Aggregate demand for petrol: Meta-analysis of elasticities based on more than 350 studies conducted to 1998 have found the short run own-price elasticity of demand for petrol in the range of 0 to -1.36, with a mean of -0.26 and a median of -0.23. More recent studies confirm the values in the -0.03 to -0.09 range. (Hughes J.E., Knittel C.R., and Sperling D., <i>Evidence of a shift in the short run price elasticity of gasoline demand</i>, NBER Working Paper No. 12530, September 2006, p 4; Small K.A. and Van Dender K., <i>Long run trends in transport demand, fuel price elasticities and implications of the oil outlook for transport policy</i>, OECD Discussion Paper No. 2007-16, p 16. Baranzini A and Weber S., <i>Elasticities of gasoline demand</i>, Energy Policy 2013, vol. 63, pp 674-80; Espey M., 'Gasoline demand revisited: an international meta-analysis of elasticity for E10 using NSW data is -0.01 (Noel M. and Roach T., <i>Regulated and unregulated almost-perfect substitutes: Aversion effects from a selective ethanol mandate</i>, Department of Economics, Texas Tech University, Lubbock, Texas, 31 March 2014, p 23).
		 Options modelled without price change: For all options other than Option 9a and Option 9b, the final shares of fuels were modelled directly based on the scenario assumptions about the switching consumers. Relative prices of the fuels were kept constant.
		 Options modelled with price change: For Option 9a and Option 9b, we allowed for a higher own-price response of the demand for E10, and also for the higher degree of substitution between RULP and E10. We modelled the price response of demand for E10 in the range of scenarios regarding cross-price elasticity of demand for RULP with respect to changes in the price of E10 (from 0.5 to 2).
		• Range of own-price elasticity: Under the assumption of constant elasticity substitution (CES) utility function, we tested the demand response for E10 allowing for the own-price elasticity of up to -5 (for the methodology on estimating cross-price elasticities, see eg, Tarr D., 'A note in obtaining estimates of cross-elasticities of demand', Bureau of Economics, Federal Trade Commission, Working Paper No. 153, May 1987, pp 4-5). Demand based on the CES function satisfies the property %change(Q _i /Q _j)/%change(Pi/Pj) = constant. More technically, for the fuel demand system under the CES functional specification, dln(Q _{RULP} /Q _{E10})/dln(P _{RULP} /P _{E10})=E is constant; cross-price elasticity of RULP with respect to the price of E10 is $\epsilon_{RULP,E10}$ =(E-1)s _{E10} , own-price elasticity of E10 is $\epsilon_{E10,E10}$ =-E+(E-1)s _{E10} , where s _{E10} is the expenditure share of E10 in the fuel consumption basket (see eg Ramskov J. and Munksgaard J., <i>Elasticities – a theoretical introduction</i> , 2001, p 11.)
Cross-price elasticity of RULP with respect to changes in price of E10	1 (range from 0.5 to 2)	 Substitution between fuel types: Most of the existing literature pertains to Brazil and US, where market penetration of fuel ethanol is high and in E85 form, used in the flex-fuel vehicles. The range of cross-price elasticity between gasoline and ethanol was estimated at between 0.48 and 2.7 to 3.5 (Alves D. and da Silveira Bueno R.D.L., 'Short run, long run and cross-elasticities of gasoline demand in Brazil', <i>Energy Economics</i>, 2003, 25(2), pp 191-9; Anderson S., <i>The demand for ethanol as a gasoline substitute</i>, NBER Working Paper 16371, September 2010, p 29).

Parameter	Assumption Rationale / source
 Switch from RULP to E10 in response to price: We modelled the switch from RULP to E10 in response to price. We modelled the switch from RULP to E10 in response to changes in price of E10. While the literal directly address the substitution between RULP and E10, the above studies suggest the price of substitution in response to change in relative prices. There is also evidence in the switching between gasoline and ethanol by a median consumer occurs over a wider range variation, suggesting that there is substantial consumer heterogeneity in the choice of fuel. implications are that switching away from gasoline would require significant price discounts voluntary adoption of ethanol (Salvo A. and Huse C., 'Consumer choice between gasoline ethanol', February 2011, mimeo). 	
	 Scenario values: Based on the NSW evidence of increased sale of PULP once RULP became less available, and with the price of PULP in excess of 15 cpl compared with E10, we accepted somewhat lowe values of the cross-price elasticity (low 0.5, medium 1 and high 2) of RULP with respect to the price of E10
Net producer surplus (ethanol producers)	
Producer surplus, cpl low (\$2015)	5 Based on Bureau of Resources and Energy Economics (BREE), An assessment of key costs and benefits associated with the Ethanol Production Grants program - Report for the Department of Industry, February 2014, p 15.
Producer surplus, cpl medium (\$2015)	30 Calculated as mid range.
Producer surplus, cpl high (\$2015)	50 Based on confidential correspondence to IPART, February 2015.
GHG abatement benefits per ML E100	
GHG abatement benefits (\$2015), per ML ethanol, \$ low	4,591 We considered the international price of carbon based on the EU emissions trading scheme. As of April 2015, the price of generic first emissions (ICE Futures Europe Commodities) is Euro 7.09/ tCO2, or A\$10/ tCO2. At these prices, the abatement benefit on a LCA basis is \$4,591/ML (see discussion of medium scenario below on the LCA of GHG emissions).
GHG abatement benefits (\$2015), per ML ethanol, \$ medium	11,477 Based on the LCA of the GHG emissions, and using Manildra's published estimate of GHG intensities from http://www.manildra.com.au/community/ea_ethanol/Annex_NGreenhouse_Gas.pdf. For our analysis we used Manildra's published estimate of gross emission intensity from ethanol production (following upgrade to 300 ML per year capacity) of 1.09 tCO2-e/kl or 1,090 tCO2-e/ML. Without the LCA assessment, 1 ML of ethanol displacing RULP sales results in 1,549 tCO2-e savings in emissions. Accounting for additional LCA emissions during the production process, the net savings in emissions are 459 tCO2-e per ML of ethanol. Applying the price of carbon of A\$25/ tCO2, the abatement benefits on a LCA basis is \$11,477/ML

C Cost-benefit analysis
Parameter	Assumption	Rationale / source
GHG abatement benefits (\$2015), per ML ethanol, \$ high	38,727	Based on Bureau of Resources and Energy Economics (BREE), <i>An assessment of key costs and benefits associated with the Ethanol Production Grants program - Report for the Department of Industry</i> , February 2014, p 18. Calculated using the carbon price of \$25/tonne of CO2 equivalent.
Health benefits		
Health benefit, (\$2015), per ML ethanol, switch from RULP to E10, \$ low	14,755	Calculated based on EPA, <i>Renewable Fuel Standard Program (RSF2) Regulatory Impact Analysis</i> , US Environmental Protection Agency, February 2010, p. 5.; Beer T, Carras J. et al, 'The health impacts of ethanol blend petrol', <i>Energies</i> 2011, 4(2), pp 352-67, p. 365, and PAE Holmes, <i>Methodology for valuing the health impacts of changes in particle emissions – Final report – Report to NSW EPA</i> , February 2013; MMA, <i>Cost-benefit analysis of implementing Stage 2 Vapour recovery – Report to Department of Environment and Climate Change (NSW)</i> , June 2008.
Health benefits per ML ethanol, switch from RULP to E10, \$ medium	67,132	Calculated based on EPA, <i>Renewable Fuel Standard Program (RSF2) Regulatory Impact Analysis</i> , US Environmental Protection Agency, February 2010, p. 5.; Beer T, Carras J. et al, 'The health impacts of ethanol blend petrol', <i>Energies</i> 2011, 4(2), pp 352-67, p. 365, and PAE Holmes, <i>Methodology for valuing the</i> <i>health impacts of changes in particle emissions – Final report – Report to NSW EPA</i> , February 2013; MMA, <i>Cost-benefit analysis of implementing Stage 2 Vapour recovery – Report to Department of Environment and</i> <i>Climate Change (NSW)</i> , June 2008.
Health benefits per ML ethanol, switch from RULP to E10, \$ high	150,200	Calculated based on EPA, <i>Renewable Fuel Standard Program (RSF2) Regulatory Impact Analysis</i> , US Environmental Protection Agency, February 2010, p. 5.; Beer T, Carras J. et al, 'The health impacts of ethanol blend petrol', <i>Energies</i> 2011, 4(2), pp 352-67, p. 365, and PAE Holmes, <i>Methodology for valuing the health impacts of changes in particle emissions – Final report –Report to NSW EPA</i> , February 2013; MMA, <i>Cost-benefit analysis of implementing Stage 2 Vapour recovery – Report to Department of Environment and Climate Change (NSW)</i> , June 2008.
Health benefit , (\$2015), per ML ethanol, switch from PULP to E10, \$ low	0	There may be no material health benefits if consumers switch from PULP to E10, due to RULP (the blend stock used in E10) containing higher sulphur levels than PULP (the Australian fuel standards for PULP is sulphur of no more than 50ppm and for RULP, no more than 150ppm). However, the actual sulphur content of E10 sold in NSW can vary considerably depending on where the blend stock, RULP, has been sourced overseas. Given the variability of sulphur levels in E10 in NSW, we used a range of \$0, if E10 contains higher sulphur levels than PULP, \$50,000 as a conservative medium estimate based on health benefits that can arise when switching from RULP to E10 (see section above), and \$150,200 if E10 has sulphur levels that meet PULP standards (see section above).
Health benefits per ML ethanol, switch from PULP to E10, \$ medium	50,000	See explanation above.
Health benefits per ML ethanol, switch from PULP	150,200	See explanation above.

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Cost-benefit analysis

Parameter	Assumption	Rationale / source
to E10, \$ high		
Cost of E10 retrofitting/replacement		
Low, \$ per tank (\$2015)	12,500	Based on confidential submission to IPART, 11 March 2015.
Med, \$ per tank(\$2015)	40,000	Based on confidential submission to IPART, 17 February 2015.
High, \$ per tank (\$2015)	200,000	Based on confidential submission to IPART, 25 February 2015.
\$ per depot (\$2015)	500,000	Based on confidential submission to IPART, 3 February 2015.
Value of time		
Employed time, \$2015 per	52.4	
hour		Better Regulation Office, <i>Guidelines for estimating savings under the red tape reduction target</i> , 2012, p 15. Time cost of \$27.70 per hour adjusted for employment on-cost factor 1.75 and adjusted for inflation CPI June on June 2011-12 to 2014-15 of 1.08.

Time cost to individual,

\$2015 per hour

29.9 As above, without on-cost factor.

Table C.2	Other references

Торіс	Reference
Cost-benefit analysis	Australian Government Department of the Prime Minister and Cabinet, <i>Cost-benefit analysis guidance note</i> , 1 July 2014; NSW Treasury, <i>NSW Government guidelines for economic appraisal</i> , Office of Financial Management, Policy & Guidelines Paper, 07-5, July 2007.
Cost-benefit analysis	Australian Government Department of Finance and Administration, <i>Handbook of cost-benefit analysis</i> , January 2006; Boardman E.A., Greenberg D.H., Vining A.R. and Weimer, D.L., <i>Cost-benefit analysis concepts and practice</i> , 3rd edition, 2006, Pearson Prentice Hall.
Transport emissions	Bureau of Transport and Regional Economics (BTRE), <i>Health impacts of transport emissions in Australia: economic costs</i> , BTRE Working Paper 63, 2005.
Environmental benefits	National Environment Protection Council, Draft variation to the national environment protection (ambient air quality) measure – Impact Statement, July 2014.
Environmental benefits	Orbital and CSIRO for the Department of the Environment, Water, Heritage and the Arts, Evaluating the health impacts of ethanol blend petrol, June 2008.
Environmental benefits	Australian Government Department of Sustainability, Environment, Water, Population and Communities, <i>Fuel Quality</i> Standard: Ethanol (E85) Automotive Fuel – Regulation Impact Statement, February 2012.

Table C.3 CBA of Option 1b – Require all service stations to offer EBP

Outcomes (to 2025)							
Additional stations brought under the mandate	 703 • Based on 166 additional stations that only offer one petrol grade and not currently offering E10, and assume 50% close due to costs imposed (therefore 83 stations added), and the volume from closed stations transfers to other stations. Also based on 619 additional rural and metro stations not currently offering E10. 						
Additional ethanol, ML per year (max)		51 ▼ Ass stati Mult year	uming 50% ons with thr iplied by ave at rural sta	demand for E10 at rural stations with two petrol grades, 20% demand at rural ee petrol grades and 33% demand at metro stations with three petrol grades. erage sales of 1.5 ML per year at rural stations with two petrol grades, 2.5 ML per tions with three petrol grades and 3 ML per year at metro stations.			
Additional ethanol, ML cumulative (to 2025)		199					
Target achieved by 2025	3.	0%					
Benefits \$m, PV \$2015	low	medium	high	Explanation			
Producer surplus	6	36	59	 Based on profits of between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1) 			
GHG benefit	1	1	5	 Based on per ML benefit as per Table C.1 			
Health benefit	2	8	18	 Based on per ML benefit as per Table C.1 			
Total benefits	8	45	82				
Costs \$m, PV \$2015	low	medium	high				
Capital cost to convert tanks	6	14	41	 Costs to upgrade/replace all remaining infrastructure at service stations for ethanol compatibility 			
Consumer surplus – loss from switching from RULP to PULP	36	85	110	 Costs to consumers of switching from RULP to PULP due to consumer aversion to E10 			
Consumer surplus – loss from switching from RULP to E10	30	30	30	 Net result of customers switching from RULP to E10 due to lower energy efficiency 			
Government administrative costs	1	1	1	 Cost to administrate under the mandate is about \$1,000 per additional station 			
Total costs	73	130	182				
Net present value \$m, \$2015	- 174	-85	-8				

Outcomes (to 2025)								
Additional stations brought under the mandate	186	186 ▼ Based on 186 metro stations not currently offering E10						
Additional ethanol, ML per year (max)	17	 Assuming 33% demand at metro stations with three petrol grades. Multiplied by average sales of 3 ML per year at metro stations 						
Additional ethanol, ML cumulative (to 2025)	66	 Total cumulative increase in sales of ethanol compared with baseline scenario 						
Target achieved by 2025	2.3%	 Net of incre 	ased sal	es combined with baseline trends				
Benefits \$m, PV \$2015		medium	nedium high Explanation					
Producer surplus	2	12	20	 Based on profits between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1) 				
GHG benefit	0	1	2	 Based on per ML benefit as per Table C.1 				
Health benefit	1	3	6	 Based on per ML benefit as per Table C.1 				
Total benefits	3	15	27					
Costs \$m, PV \$2015	low	medium	high					
Capital cost to convert tanks	2	5	25	 Costs to upgrade/replace infrastructure at service stations for ethanol compatibility 				
Consumer surplus – loss from switching from RULP to \ensuremath{PULP}	11	25	32	 Costs to consumers of switching from RULP to PULP due to consumer aversion to E10. 				
Consumer surplus – loss from switching from RULP to $\ensuremath{E10}$	10	10	10	 Net result of consumers switching from RULP to using cheaper E10 is negative due to energy efficiency loss. 				
Government administrative costs	1	1	1	 Cost per additional station is approx. \$1,000 to administrate under mandate 				
Total costs	23	41	68					
Net present value \$m, \$2015	-66	-26	4					

Table C.4 CBA of Option 1c – Require all service stations that sell more than 3 million litres of petrol a year to offer EBP

Table C.5 CBA of Option 1d – Require all stations offering two or more petrol grades to offer E10

Outcomes (to 2025)						
Additional stations brought under the mandate	619	▼ B	ased on 61	9 a	additional rural and metro stations not currently offering E10	
Additional ethanol, ML per year (max)	41 • Assuming 50% demand for E10 at rural stations with two petrol grades, 20% demand rural stations with three petrol grades and 33% demand at metro stations with three petrol grades. Multiplied by average sales of 1.5 ML per year at rural stations with two petrol grades, 2.5 ML per year at rural stations with three petrol grades and 3 ML per year at metro stations.					
Additional ethanol, ML cumulative (to 2025)	163 • Total cumulative increase in sales of ethanol compared with baseline scena					
Target achieved by 2025	2.8%	• N	let of increa	se	d sales combined with baseline trends	
Benefits \$m, PV \$2015	low mee	dium	high	E	xplanation	
Producer surplus	5	30	49	•	Based on profits between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1)	
GHG benefit	0	1	4	•	Based on per ML benefit as per Table C.1	
Health benefit	1	7	15	•	Based on per ML benefit as per Table C.1	
Total benefits	7	37	67			
Costs \$m, PV \$2015	low mee	dium	high			
Capital cost to convert tanks, NPV (\$2015)	5	13	37	•	Costs to upgrade/replace infrastructure at service stations for ethanol compatibility.	
Consumer surplus – loss from switching from RULP to PULP	30	71	92	•	Costs to consumers of switching from RULP to PULP due to consumer aversion to E10.	
Consumer surplus – loss from switching from RULP to E10	25	25	25	•	Net result from consumers switching from RULP to cheaper E10 is negative due to energy efficiency loss	
Government administrative costs	1	1	1	•	Cost per additional station is approx. \$1,000 to administrate under mandate	
Total costs	61	110	154			
Net present value \$m, \$2015	-147	-73	6.2			

Outcomes (to 2025)					
Additional stations brought under the mandate All 1		II 1,978 stations			
Additional ethanol, ML per year (max)	417				
Additional ethanol, ML cumulative (to 2025)		1,413			
Target achieved by 2024		10%			
Benefits \$m, PV \$2015	low	medium	high	Ex	planation
Producer surplus	39	240	412	•	Based on profits between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1)
GHG benefit	4	9	32	•	Based on per ML benefit as per Table C.1
Health benefit	10	51	124	•	Based on per ML benefit as per Table C.1
Total benefits	52	301	568		
Costs \$m, PV \$2015	low	medium	high		
Infrastructure costs (service stations and primary wholesalers)	93	168	243	•	Costs to upgrade/replace all remaining infrastructure at service stations and depots for ethanol compatibility. Assumes \$50 million to \$150 million range of costs for additional 100 ML production capacity, as current production capacity is not sufficient to meet 10% mandate.
Consumer surplus - loss from switching to ethanol blends	1	61	120	•	Cost to consumers of switching to ethanol blended fuels (RULP to E10) net of gains to consumers unnecessarily purchasing PULP who would now purchase E10 and not a premium ethanol blend.
Enforcement and compliance costs	2	3	3	•	Additional costs to business and government for all fuel sellers to report against the mandate.
Non-ethanol compatibility conversion/replacement costs	838	1,257	1,677	•	Cost for converting/replacing the engines of farm machinery, marine engines and cars. Petrol lawnmowers assumed to be replaced with electric ones.
Total costs	935	1,490	2,044		
Net present value \$m, \$2015	-1,992	-1,189	-367		

Table C.6 CBA of Option 4a – Require all petrol to have 10% ethanol mandate (except diesel)

Table C.7 CBA of Option 4b - Remove RULP

Outcomes (to 2025)								
Additional stations brought under the mandate		703 🗸	 Based on 167 additional one-fuel stations not currently offering E10, of which 50% close to costs imposed (therefore 83 stations added). Also based on 619 additional rural and metro stations not currently offering E10. 					
Additional ethanol, ML per year (max)		 Assuming 50% demand for E10 at rural stations with two petrol grades, 20% demand at rural stations with three petrol grades and 33% demand at metro stations with three petrol grades. Multiplied by average sales of 1.5 ML per year at rural stations with two petrol grades, 2.5 ML per year at rural stations with three petrol grades and 3 ML per year at metro stations. We also assumed volume from one-fuel stations is 1 ML per year and that the volume from closed stations transfers to two-fuel stations in surrounding areas. 						
Additional ethanol, ML cumulative (to 2024)		335						
Target achieved by 2024	3.7%							
Benefits \$m, PV \$2015	low	medium	high	Explanation				
Producer surplus	10	60) 100	 Based on profits between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1) 				
GHG benefit	1	2	2 8	 Based on per ML benefit as per Table C.1 				
Health benefit	3	13	30	 Based on per ML benefit as per Table C.1 				
Total benefits		76	6 137					
Costs \$m, PV \$2015	low	medium	high					
Capital cost to convert tanks	6	14	41	 Costs to upgrade/replace infrastructure at additional service stations for ethanol compatibility 				
Consumer surplus – loss from switching to PULP	33	78	8 101	 Costs to consumers of purchasing petrol that is less energy efficient ie purchasing E10 instead of RULP, and the remaining customers who choose to pay more for PULP instead of using E10 				
Consumer surplus – loss from switching from RULP to E10	50	50	50	 Net result from consumers switching from RULP to cheaper E10 is negative due to energy efficiency loss 				
Other costs	2	2	2 2	Costs to convert depots to store E10				

C Cost-benefit analysis

Costs \$m, PV \$2015	low m	nedium	high
Government administration costs	1	1	1 Administration cost per additional stations is estimated at \$1,000
Total costs	92	145	195
Net present value \$m, \$2015	- 179	-70	45

Table C.8 CBA of Option 5 - Public education campaign (assuming 10% effectiveness)

Outcomes (to 2025)								
Additional ethanol, ML per year (2025)	9	 9 We assumed the NSW PULP market share (around 40%) is mainly higher than the rest of Australia (around 22%) because of consumer aversion to E10 based on imperfect information. We assumed that if the information campaign is 10% effective, then this 1.8% difference (18% x 10%) represents the total number of potential consumers that would switch. We assumed that with the campaign, PULP demand reduces to a level broadly in line with other states (maintaining assumption of 10% effectiveness), and then begins to increase again in line with the natural growth in the rest of Australia. We assumed for indicative purposes that the 1.8% difference (per above) will be achieved as follows: after the first year 10%, second year 30%, third year 70%, fourth year 100%. We estimated E10 levels would decrease at a slower rate compared to our baseline, initially decreasing to about 28% of total petrol sales (straight after the campaign ending) and then gradually decline to about 22%, in line with the proportionate decline in RULP market share in the rest of Australia, by 2025. E10 comprising 22% of total petrol sales in NSW translates to about 77 ML. In our analysis of all options in this report we focus on the costs and benefits accruing to the NSW community and note that there are no petrol producers in NSW (see Section 5 for further assumptions). We also assume wholesalers earn the same margin on different fuel types. A consideration of the wider impacts beyond NSW could potentially include a producer loss from 						
Additional ethanol, ML cumulative (to 2025)	77							
Target achieved by 2025	2.2%							
Benefits \$m, PV \$2015	low	medium	high	Explanation				
Producer surplus	3	15	25	 Based on profits between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1) 				
Consumer surplus – gain from switching from PULP to E10	12	42	55	 The gain to motorists of not unnecessarily purchasing PULP due to aversion to ethanol. We used a range (2.3 cpl to 11 cpl) to account for different possible fuel efficiencies between PULP and E10. 				
GHG benefit	0	1	2	 Based on per ML benefit as per Table C.1 				
Health benefit	0	3	8	 Based on per ML benefit as per Table C.1 				
Total benefits	15	61	90					

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Cost-benefit analysis

Outcomes (to 2025)				
Costs \$m, PV \$2015	low	medium	high	
Education campaign	2	5	6	 The potential costs of an education campaign ranging from \$2 million to \$7 million in actual costs. This range includes any administrative costs.
Total costs	2	5	6	
Net present value \$m, 2015	8	56	88	

Outcomes (to 2025)								
Additional ethanol, ML per year (max)		15.3 🔻	Assuming sta vehicles conv complete the	Assuming state fleet petrol vehicles are replaced with flex-fuel vehicles, with 2,500 vehicles converting per year from a fleet of 12,500 petrol vehicles. Five years to complete the conversion				
Additional ethanol, ML cumulative (to 2025)		131.5	·					
Target achieved by 2025		2.3%						
Benefits \$m, PV \$2015	low	medium	high	Explanation				
Producer surplus	4	27	44	 Based on profits between 5 cpl to 50 cpl and the additional ethano purchased each year (as per Table C.1) 				
GHG benefit	0	1	3	 Based on per ML benefit as per Table C.1 				
Health benefit	1	6	13	 Based on per ML benefit as per Table C.1 				
Total benefits	6	33	61					
Costs \$m, PV \$2015	low	medium	high					
Capital cost	0	18	35	 Procurement of flex-fuel vehicles at a cost greater than for standar vehicles, between \$0 and \$2,000 per vehicle, 2,500 vehicles converting per year from a fleet of 12,500 petrol vehicles. Five yea to complete the conversion. 				
Capital costs to upgrade to E85 distribution	55	55	55	 We modelled expansion of the stations offering E85 from 10 to 400 by 2025, at a cost of \$200,000 per station. The costs of updating distribution depots have not been considered and are additional substantial costs. 				
Additional service costs	11	37	74	 The additional service costs are between \$500 and \$1,000 per vehicle per year. 				
Additional fuel costs	14	14	14	 The additional fuel costs depend on the price of ethanol. Assume ethanol is sold at 20% discount to E10. 				
Total costs	80	123	178					
Net present value \$m, 2015	-172	-90	-19					

Table C.10	CBA of Option 7 – Tighten the grounds for exemption and remove the reasonable steps defence (assume RULP
	phased out from all controlled sites)

Outcomes (to 2025)							
Additional stations brought under the mandate	70	 The 70 sites estimates the total number of controlled service stations that would need to be upgraded to be EBP compatible within 7 years. 					
Additional ethanol, ML per year (max)	30.6	 We estimated 38 of the 70 sites have average petrol sales of 5 ML per year and the remainder sell 3.6 ML per year. There are 297 controlled service stations that currently offer E10 and RULP. Of these sites, we estimated 57 sites have average petrol sales of 5 ML per year and the remainder sell 3.6 ML per year. We assumed all volume fuel sellers phase out RULP from year 2 onwards. We did not adjust the average petrol sales for the sites for the likely loss of market share that would result from phasing out RULP. 					
Additional ethanol. ML cumulative (to 2025)	271.2	p					
Target achieved by 2025	2.6%						
Benefits \$m, PV \$2015	Low	medium	high	Explanation			
Producer surplus	9	55	93	 Based on profits between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1) 			
GHG benefits	0	1	4	 Based on per ML benefit as per Table C.1 			
Health benefit	1	6	14	 Based on per ML benefit as per Table C.1 			
Savings in enforcement costs	5	8	11	 Savings in enforcement costs relate to less time required to assess exemption applications given new limited exemption grounds. 			
Total benefits, PV (\$2015)	16	71	121				
Costs \$m, PV \$2015	low	medium	High				
Capital cost to convert tanks	6	7	10	 We estimated 38 of the total number of controlled sites required to be upgraded would need to replace the tanks under all scenarios. The remainder would be able to retrofit the tanks under the low and medium scenarios (replace under the high scenario). 			
	2	2	2	- We estimated 6 denots would need to be ungraded			

C Cost-benefit analysis

Costs \$m, PV \$2015	low	medium	High	
Consumer surplus – loss from switching from RULP to PULP	53	134	177 • Co co	osts to consumers of switching from RULP to PULP due to nsumer aversion to E10
Consumer surplus – loss from switching from RULP to E10	114	114	114 ▼ Ne E1	et result of consumers switching from RULP to using cheaper 10 is negative due to energy efficiency loss
Marketing costs	8	15	23 ▼ W re:	e assumed the marketing costs do not affect consumer sistance to E10.
Enforcement costs	52	79	105 ▼ Co co vo a (ea	osts of NSW Government in conducting investigations, instituting ourt proceedings and Court hearings. Also includes cost by olume seller in responding to investigation and defending itself in Court hearing. We assumed each volume seller is taken to Court ach year.
Total costs	235	351	432	
Net present value \$m, 2015	-416	-280	-114	

Outcomes (to 2025)							
Additional stations brought under the mandate		70 ▼ See Table C.12					
Additional ethanol, ML per year (max)		9.5 • Ass	 Assume all sites that offered RULP and PULP would offer E10, RULP and PULP 				
Additional ethanol, ML cumulative (to 2025)	e	9.2					
Target achieved by 2025	2.	.2%					
Benefits \$m, PV \$2015	low	medium	high	Explanation			
Producer surplus	2	13	22	 Based on per ML benefit as per Table C.1 			
GHG benefit	0	1	2	 Based on per ML benefit as per Table C.1 			
Health benefit	1	3	7	 Based on per ML benefit as per Table C.1 			
Savings in enforcement costs	5	8	11	 Savings in enforcement costs related to less time required to assess exemption applications given new exemption grounds 			
Total benefits	9	25	42				
Costs \$m, PV \$2015	low	medium	High				
Capital cost to convert tanks	6	7	10	▼ See Table C.12			
Depot infrastructure costs	2	2	2	 See Table C.12 			
Consumer surplus - loss from switching from RULP to PULP	12	29	37	 Costs to consumers of switching from RULP to PULP due to consumer aversio to E10 			
Consumer surplus – loss from switching from RULP to E10	11	11	11	 Net result of consumers switching from RULP to using cheaper E10 is negative due to energy efficiency loss 			
Marketing costs	8	15	23	▼ See Table C.10			
Enforcement costs	7	10	13	 Costs of NSW Government conducting investigations, and volume fuel sellers in responding to these investigations. We assumed each volume seller is investigated each year. 			
Total costs	46	75	97				
Net present value \$m, 2015	-89	-49	-5				

Table C.11CBA of Option 7 (alternative scenario) - Tighten the grounds for exemption and remove the reasonable steps defence
(but assume no phasing out of RULP)

Table C.12 CBA of Option 9a - Regulate price of ethanol based on energy parity

Outcomes (to 2025)							
Additional ethanol, ML per year (2025)	9	 9 Medium estimate range between 6 and 17 ML per year of ethanol, depending on the cross-price elasticity of RULP to E10 price (low 0.5, medium 1 and high 2). Implied own-price elasticity of E10 under CES specification is between -2 and -5, with -3 in the medium scenario. See Table C.1 for additional discussion. We assumed no substitution from PULP to E10 in response to price. Apply a reduction of 2.6 cpl (in constant \$2015) to the price of E10 to achieve energy parity with RULP (total price difference is 4.8 cpl). Additional ethanol uptake calculated from own-price effect on demand for E10, and cross-price effect on PLUP for end of the price of E10 to achieve in the price of E10 to price effect. 					
Additional ethanol, ML cumulative (to 2025)	118	 Medium estimat 	e, range	be	tween 73 and 210 ML		
Target achieved by 2025	2.2%	 Medium estimat 	e, range	be	tween 2.1% and 2.3%		
Benefits \$m, PV \$2015	low	medium	high	Е	xplanation		
Producer surplus - gain from extended demand	-10	3	32	•	A decrease in price of 2.6 cpl of E10, corresponds to 26 cpl reduction in producer profits (discussed in Table C.1). Gains are derived on the additional amount of ethanol demanded in the scenario analysis.		
Consumer surplus - gain from price response of demand for E10	4	7	11	•	Based on the additional demand for E10 due to the own-price effect and a cross-price effect.		
Consumer surplus - gain for existing E10 customers	244	244	244	•	All baseline E10 customers receive benefits of lower prices. The gain is offset by an identical loss in producer surplus.		
GHG benefit	0	1	5	•	Based on per ML benefit as per Table C.1		
Health benefit	1	5	20	•	Based on per ML benefit as per Table C.1		
Total benefits, PV (\$2015)	239	259	313				
Costs \$m, PV \$2015	low	medium	high				
Producer surplus - loss on existing demand for E10, NPV (\$2015)	244	244	244	•	Price regulation extracts the profits of 26 cpl of the baseline amount of ethanol supplied by the producers. This loss is offset by the gain to the existing consumers of E10.		
Additional costs to the Government to implement the regulation	7	14	21	•	Costs to collect information and enforce compliance. Scenario assumption is low \$1 million, medium \$2 million, and high \$3 million per year (in \$2015).		
Total costs	251	258	265				
Net present value \$m, 2015	-25	2	62				

Table C.13	CBA of Option 9b	- Regulate price o	f ethanol based o	on international	benchmark
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Outcomes (to 2025)							
Additional ethanol, ML per year (2025)	15	 Medium estimate range between 9 and 27 ML per year of ethanol, depending on the cross-price elasticity of RULP to E10 (low 0.5, medium 1 and high 2). Implied own-price elasticity of E10 under CES specification is between -2 and -5, with -3 in the medium scenario. See Table C.1 for additional discussion. We assumed no substitution from PULP to E10 in response to price. Apply a reduction of 4.1 cpl (in constant \$2015) to the price of E10, to achieve pricing of ethanol at the level of domestic price of the US corn-based ethanol (modelled as 55 cpl in \$2015, based on Bloomberg, DL1 Generic 1st ethanol CME futures, average for December 2014, converted to AUD). Total price difference between RULP and E10 as a result of this option is 6.3 cpl. Additional ethanol uptake is calculated from own-price effect on demand for E10, and cross-price effect on RULP from change in the price of E10 relative to RULP. 					
Additional ethanol, ML cumulative (to 2025)	187	 Medium est 	imate, r	ange between 115 and 333 ML			
Target achieved by 2025	2.3%	 Medium est 	imate, r	ange between 2.2% and 2.5%			
Benefits \$m, PV \$2015	low	medium	High	Explanation			
Consumer surplus - gain from price response of demand for E10	11	17	28	 Based on the additional demand for E10 due to the own-price effect and a cross-price effect 			
Consumer surplus - gain for existing E10 customers	386	386	386	 All baseline E10 customers receive benefits of lower prices. The gain is offset by an identical loss in producer surplus. 			
GHG benefits	0	1	8	 Based on per ML benefit as per Table C.1 			
Health benefit	1	8	32	 Based on per ML benefit as per Table C.1 			
Total benefits, PV (\$2015)	398	412	454				
Costs \$m, PV \$2015	low	Medium	High				
Producer surplus - loss from extended demand	- 19	13	26	 A decrease in price of 4.1 cpl of E10 corresponds to 41 cpl reduction in producer profits (discussed in Table C.1). Gains are derived on the additional amount of ethanol demanded in the scenario analysis. 			
Producer surplus - loss on existing demand for E10, NPV (\$2015)	386	386	386	 Price regulation extracts the profits of 41 cpl of the baseline amount of ethanol supplied by the producers. This loss is offset by the gain to the existing consumers of E10. 			
Additional costs to the government to implement the regulation, NPV (\$2015)	7	14	21	 Costs to NSW Government of collecting the required information and compliance enforcement. Scenario assumptions low \$1 million, medium \$2 million, high \$3 million per year (in \$2015). 			
Total costs	374	413	433				

Net present value \$m, 2015

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-35

Outcomes (to 2025)							
Additional ethanol, ML per year (max)		59.2 ▼ Assuming diesel contract buses are replaced with E95 vehicles, with 190 bus procured each year for 10 years. By 2025 half of the buses are converted to e					
Additional ethanol, ML cumulative (to 2025)		325.8					
Target achieved by 2025		3.2%					
Benefits \$m, PV \$2015	Low	medium	high	Explanation			
Producer surplus	10	62	103	 Based on profits between 5 cpl to 50 cpl and the additional ethanol purchased each year (as per Table C.1) 			
GHG benefits	1	2	8	 Benefits due to the additional ethanol usage (as per Table C.1) 			
Health benefits	3	14	31	 Health benefits due to the additional ethanol usage (as per Table C.1) 			
Total benefits	14	78	142				
Costs \$m, PV \$2015	Low	medium	high				
Capital cost to convert buses to E95	7	13	40	 Procurement of ethanol buses at a greater cost than standard buses, between \$5,000 and \$30,000 per bus. 190 buses converted per year from a fleet of 4,767 diesel buses. By 2025, half of the buses are converted to ethanol. 			
Capital costs to set up E95 depots	8	8	8	 We modelled expansion of the bus depots offering E95 from 1 to 20 by 2025, at the cost of \$600,000 per depot. 			
Additional service costs	3	5	7	 The additional service costs are between \$500 and \$1,000 per bus per year. 			
Additional fuel costs			0.4	 The additional fuel costs are calculated based on the energy equivalent fuel consumption. The magnitude depends on the price of ethanol. If low enough compared with diesel, fuel costs might turn to fuel benefits. In this scenario, 			
Total costs	61 70	61	61	we assumed E95 is available at 20% discount to diesel.			
I OTAI COSTS	79	87	116				
Net present value \$m, 2015	- 101	- 9	63				

Table C.14 CBA of Option 12 – Broader policy target - government buses to run on ethanol (E95)

Note: Costs and benefits may not add to totals due to rounding.

C

C Cost-benefit analysis