Review of VEET Studies

BROTHERHOOD OF ST LAURENCE

ENERGY EFFICIENCY COUNCIL

ENERGY EFFICIENCY CERTIFICATES CREATORS ASSOCIATION

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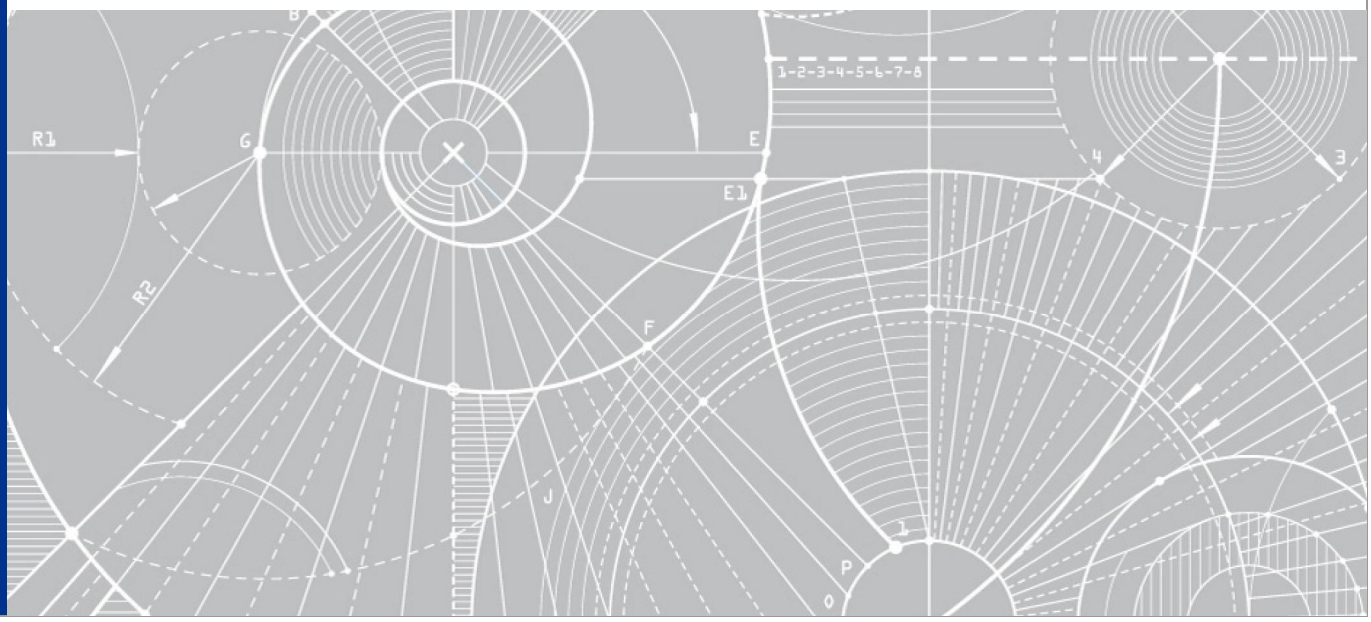

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Project manager:	Walter Gerardi
Author:	Walter Gerardi

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Floor 11, 452 Flinders Street
Melbourne VIC 3000
PO Box 312, Flinders Lane
T +61 3 8668 3000
F +61 3 8668 3001
www.jacobs.com

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Executive Summary

The Victorian Department of State Development, Business and Innovation (DSDBI) recently commissioned a review of the Victorian Energy Efficiency Target (VEET), which concluded that the costs of the VEET exceeded the benefits. This result differed with other studies on the VEET and similar energy efficiency certificate schemes, which found that benefits exceeded costs. Jacobs was commissioned to review the DSDBI's analysis to determine why it produced a different result to other studies.

All the studies on energy efficiency schemes have used conservative assumptions about scheme benefits, to ensure that the benefits were not overestimated. However, the current review adopted a number of assumptions that either led to higher costs or to lower benefits of the VEET relative to other studies. The impacts of these multiple assumptions interact, resulting in the recent study producing a negative net benefit for the VEET.

A key difference between the recent study and other studies is that it assumed lower growth in demand for electricity. Given recent changes in demand, this is a reasonable assumption, although due to uncertainty in the energy market, it might be suitable to assess multiple scenarios. The reduced demand would lead to reduced benefit from deferred capital expenditure on networks and generation.

Other assumptions that also reduced the benefits include:

- **Persistence** –Energy savings were assumed to last only last for around 10 years or less, but many of the appliance and activities may last longer than 15 years.

- **Reduction in fixed electricity costs** – It was assumed that variable generation costs were avoided. However, reducing energy demand could also lead to a reduction of fixed generation costs (if more plant are mothballed as a result of wholesale price reductions resulting from the VEET) and possibly a reduction or deferral of network investment (in regions where demand is still growing at the regional level).

- **Operating and maintenance cost savings** – The analysis did not included the reduction in operating and maintenance costs that result from the installations of energy efficiency products and activities, such as LED lighting.

- **Greenhouse emissions** – The value from reducing greenhouse emissions were not included. Reducing greenhouse gas emissions can bring substantial benefits. A sensitivity analysis was conducted using a carbon price based on European Union Emission Trading Scheme prices. However, these prices are likely to be an underestimate of the social cost of carbon emissions.

Applying an alternative set of assumptions, the potential additional benefits of the VEET scheme are shown in Table 1. With the alternative assumptions, the scheme delivers a net benefit to the economy under all scenarios except the highest VEET target (5.4 Mt per annum) at the high discount rate.

The results of the analysis are indicative only and need to be verified through a more thorough analysis.

Table 1: Indicative estimates of additional benefits of VEET

	Discount rate 3.5%			Discount rate 7.0%		
Annual target, Mt CO2e	2.0	2.7	5.4	2.0	2.7	5.4
DSDBI net economic benefit, $M	-174	-260	-711	-184	-270	-715
Potential additional benefits, $M						
Savings persist beyond 10 years	46	60	129	23	31	66
Benefits of carbon abatement	211	258	463	143	179	319
Fixed generation cost reductions	62	97	132	52	77	102
Avoided customer operating costs	13	23	92	17	32	126
Potential net economic benefit, $M	157	179	105	52	48	-102

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to examine recent studies of benefits and costs of the Victorian Energy Efficiency Target (VEET) scheme and why the results of the studies may differ from other studies of VEET and like schemes in accordance with the scope of services set out in the contract between Jacobs and the Brotherhood of St Laurence, Energy Efficiency Council and Energy Efficiency Certificates Creators Association (the Client Group). That scope of services was developed with the Client Group.

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1. Introduction

The Department of State Development, Business and Innovation (DSDBI) conducted a review of the VEET Scheme. Three studies were completed for the review: Two benefits cost studies assessing the benefits and costs of the VEET to date and the continuation of the VEET from 2015 to 2017; and a Business Impact Assessment (BIA). In this paper these reports are collectively referred to as 'The BIA reports'.

The BIA reports broadly concluded that the costs of the VEET exceeded the benefits. This conclusion is different to other recent studies on the costs and benefits of the VEET and similar energy efficiency certificate schemes, which have found that benefits exceeded costs. Given that the recent studies and other studies all used conservative assumptions for the benefits of these schemes, these differences warrant investigation.

The Brotherhood of St Laurence, Energy Efficiency Council and Energy Efficiency Certificate Creators Association engaged Jacobs to undertake a review of the recent studies by DSDBI and determine the cause of the different conclusions to other studies on the costs and benefits of energy efficiency certificate schemes. Jacobs' review is focussed on the findings of the business case and on the assumptions used in the benefit cost analysis. The approach deployed is the standard methodology deployed for undertaking benefit cost studies in Australia, so there are no comments on the method. Section 2 of the review focuses on the market failure arguments. Section 3 focuses on the assumptions used in the benefit cost studies.

2. Review of market failure arguments

The BIA reports include an analysis of the reasons why there exists an energy efficiency gap – the purported gap between actual energy use and the energy use that would occur if the most efficient and economic appliances and processes are used. There are two potential sources for this gap: the presence of market failures and behavioural constraints such as bounded rationality.

2.1 Market failure

On market failure they examined the following:

- Information gaps. The report provides a balanced assessment of the existence of information gaps. The report concludes there is qualitative evidence for the existence of information gaps, but there is little quantitative evidence[1]. This generally concurs with the findings of the international literature on the extent of the information problem.
- Split incentives: The BIA reports noted some qualitative support for the split incentive problem but stated there is not much quantitative evidence for the split incentive problem in the Victorian and Australian context. This conclusion differs significantly from reports by the International Energy Agency, the Report of the Prime Minister's Task Group on Energy Efficiency and the Garnaut Review.

  The BIA reports only quote one study by Gabriel et al. (2010) that found little or no evidence to support the problem of split incentives based on the fact that contrary to expectations "owners occupiers pay more for energy" than renters[2]. However, the higher energy use by homeowners of itself does not disprove the existence of a split incentive problem as renters may pay lower bills for a range of reasons and if the split incentives were overcome then renters' bills could be even lower. In addition, Gabriel et al (2010) caution that "there are critical gaps in data that need to be addressed".

  The BIA reports do not mention quantitative data from the Australian Bureau of Statistics that supports the existence of split incentives in Victoria nor the extensive international literature on the presence of split incentives (not all in support of its existence) which provides much stronger quantitative and qualitative evidence of its existence[3].

  The IEA (2007)[4] also undertook case studies to examine the impact of principal agent problems such as split incentives, including a case study on vending machines in Australia. The study found potential savings arising from overcoming the principal agent problem of between near negligible to 30% of entity energy use. The magnitude of the potential depended on the end market and appliances being examined, with larger savings attributable to the residential sector and smaller savings in the commercial sector.
- Access to capital: The report dismisses the notion of capital market failures and cites evidence for the lack of access of capital being due to other reasons as opposed to capital constraints. They provide examples of empirical studies to back their assertion that high upfront costs are the main barrier as opposed to capital market failure without noting that the same studies could also be interpreted as further evidence of information gaps.

The report does not examine a number of other issues identified by stakeholders that result in sub-optimal investment in energy efficiency, including distortions in energy market rules and regulations. These issues have been identified in the AEMC (2012)[5] and Commonwealth of Australia (2002)[6], *Council of Australian Governments Energy Market Review 'Towards a Truly National and Efficient Market*' ('The Parer Report').

[1] In a couple of places, there is mention of evidence that consumers cite high upfront costs as the major reason for not purchasing energy efficiency and that this evidence somehow negates the importance or presence of information gaps. However, the statements on costs have to be into context since the information gaps is more likely over the purported benefits to the consumer of energy efficient adoption.
[2] M. Gabriel, P. Watson, R. Ong, G. Wood and M Wulff (2010), *The environmental sustainability of Australia's private rental housing stock*, Australian Housing and Urban Research Institute Positioning Paper No. 125
[3] See for example K. Gillingham, M. Harding and D. Rapson (2012), "Split incentives in residential energy consumption", *The Energy Journal*, 33 (2), pp 37 – 62.
[4] See IEA (2007), *Mind the Gap – Quantifying Principle Agent problems in Energy Efficiency*, Paris
[5] Australian Energy Market Commission (2012),*Power of Choice - Stage 3 Demand Side Participation Review, **Sydney***
[6] Commonwealth of Australia (2002), *Towards a Truly National and Efficient Market*, Council of Australian Governments Energy Market Review ('The Parer Report'), Canberra

The report in recognising there could be legitimate market failures does not have much discussion of the policies to overcome market failures. The report does include a discussion of some alternatives to VEET and recognises these do not overcome all the failures. This suggest there could be a qualitative and quantitative discussion of whether the VEET is a better instrument for overcoming these market failures than the other policy measures discussed. There is a large body of literature in support of white certificate schemes as a viable instrument, when designed properly for overcoming a range of market failures[7]. In Australia, there was a significant body of work undertaken for the PM Task Group on Energy Efficiency (conducted in 2011) which was not cited in the discussion of market failures in the report.

The report states that there is not enough quantitative evidence for the presence or otherwise of the market failures in the Victorian and Australian context. A logical recommendation flowing from this conclusion is to invest in more studies to fill data gaps on market failures.

2.2 Behavioural factors

The report generally does not make any conclusions on behavioural factors such as bounded rationality other that perhaps dismiss it on the grounds that there is not enough empirical support for its existence as opposed to patterns of behaviour that are a result of "rational economic processes". However, while there have been limited studies on bounded rationality in energy use in Australia, there have been significant international studies on bounded rationality in and outside the context of energy use. There is wide range of qualitative evidence including in the PM Task Group report (cited in the BIA in this context) and the IEA for bounded rationality.

Given the international evidence, the lack of Victorian studies is not evidence for the lack of bounded rationality in Victoria. The international evidence could have been considered and applied in the Australian context.

Finally, it should be noted that bounded rationality does not mean being economically irrational but that rather the rational economic process is bounded.

2.3 Other matters

The report makes the statement that "GHG (greenhouse gas externalities) are not a market failure that is being addressed through this BIA." But even though GHG emission reduction is not an objective of the VEET scheme, it is still a potential co-benefit and this should be included in an analysis of benefits and costs especially where there is some uncertainty around whether national targets will be achieved by proposed national mitigation policy settings.

[7] See IEA (2007), *Mind the Gap – Quantifying Principle Agent problems in Energy Efficiency*, Paris

3. Review of Benefit Cost Studies

3.1 Findings of the study

The BIA reports included two benefit cost studies. The first study looked at the benefits and costs of the actual energy savings achieved through the VEET from 2009 to 2014. The second study examined the potential cost and benefits from the VEET for three potential targets for the VEET for the period 2015 to 2017.

The benefit cost study used a standard methodology for estimating the benefits and costs of an energy efficiency program.

Some concerns on the approach include:

- The benefit cost study relied on cost and annual energy savings estimates provided by DSDBI. There is little information available on how these assumptions were derived and so it is difficult to evaluate the veracity of these assumptions.
- There was little sensitivity analysis performed especially on the magnitude of the cost and energy savings, which would have been useful given the extent of uncertainties faced.

The studies generally found that the social benefits exceeded the costs. This contradicts the previous VEET RIS and other studies conducted for other proposed and actual schemes in Australia. The other studies have generally found that an optimal target for energy efficiency is around 4% to 5% of total energy consumption (the net benefits were generally lower for targets above and below this range). The targets being considered in the VEET Benefit Cost Studies were generally less than 4% and considerably less than 4% for the two lower targets. Whilst other studies showed net benefits for lower (percentage) targets, the current study found that none of the targets achieved net economic benefits.

Examining the current and past reports, the analysis of benefits in the BIA differs from other studies in some key ways.

First, the BIA studies did not include the value of carbon savings, in contrast to all other studies. Simply incorporating a modest carbon co-benefit could result in the scheme delivering a net benefit to the economy.

Second, estimates of other benefits are lower than other studies due to assumptions around reduced demand for energy and the persistence of energy savings. On the former, the BIA assumes significantly lower levels of demand and demand growth than previous studies for Victoria for the period to 2030 and beyond. A portion of the benefits in previous studies came from deferring investment in generation and network assets. As a result of the subdued growth in demand, there is a large surplus of generation and less need for expansion in the transmission and distribution network. Hence in the current study there is no benefit attributable to the deferred investment in infrastructure.

Third, the BIA assumes a much higher cost for purchasing energy efficient appliances and processes compared to previous studies. The assumptions behind the BIA's cost estimates have not been released and so it is not possible to determine how these cost estimates have been arrived at.

3.2 Review of assumptions affecting benefits

Many of the assumptions used in the BIA regarding the benefits of the scheme are similar to previous studies, but there are some areas where further work or sensitivity analysis could have been performed.

3.2.1 Additionality

In the study of the VEET over 2009 to 2014, there are some anomalies in the assumptions used:

- Calculated energy savings were reduced to derive what was referred to actual energy savings. Actual energy savings were calculated to be around 48% of calculated (in the regulations) energy savings. The reduction was due to the presence of additionality, the rebound effect and measurement errors. But as the “actual” energy savings was still a derived estimate, then sensitivities could have been performed with lower reductions. In particular, additionality was seen to be a problem but given that elsewhere in the

report it was stated that a high proportion of low income households took up options under the VEET it is possible for this income group there is no additionality[8]. Further, the report in its discussion of capital market and information failures mentions how "upfront costs" were a significant barrier to uptake and this would suggest that additionality could be small.

- Further, a previous study by the department even suggest that additional energy savings were made as a result of the VEET as people learnt about energy efficiency[9]. The study cited survey results that indicate substantial behavioural changes in a significant number of households as a result of the scheme that led to further reductions in energy use.
- Rebound was assumed to be 5%. However, there is no benefit attributed to this rebound (presumably higher energy use occurred for a reason and this provided additional consumer surplus[10]).

3.2.2 Persistence

Persistence of the energy savings is a major issue with undertaking benefits and costs of energy efficiency policies. If you examine the tables showing what appliances are assumed to make up the three targets, around 65% (for the lower target) to 75% (for the higher target) of the certificates created where from appliances and processes that have potential lives greater than 15 years. And yet by 2030, the actual savings are assumed to be about 20% of the peak savings suggesting a very sharp decline.

Additionally, they did not evaluate the benefits of savings beyond 2030. Past studies have shown that benefits beyond can be important, but presumably the low levels of persistence in the current study supports the notion that benefits after 2030 would be low especially after discounting.

Jacobs have assessed an alternative assumption on persistence. In this alternative it was assumed that the savings were to reduce no further than 65% to 75% of maximum savings. The savings were also assumed to persist until 2040. It was assumed that the principle benefit of this saving was avoided fuel generation costs, valued at approximately $18/MWh. The additional benefit was around $1 million per annum to $8 million per annum for the 2.0 Mt target, $1 million per annum to $10 million per annum for the 2.7 Mt target and $2 million per annum to $21 million per annum for the 5.4 Mt target (see Table 2). In net present value terms (using a 7% discount rate), the additional benefits represent around $23 million for 2.0 Mt target, $31 million for the 2.7 Mt target and $66 million for the 5.4 Mt target.

The above is just one example of an alternative persistence scenario. The main point here is that, given that this issue has been contested in recent projects, sensitivity analysis around this assumption could have been undertaken.

Note that persistence levels maybe higher than those assumed in our analysis. Adoption of some efficient appliances changes to surrounding fittings which can last beyond 20 to 25 years. Furthermore under some activities –for example the commercial lighting activity (more than 50% of business activities) – certificates created are limited to specified number of operating hours when many of the business premises operate for much longer.

[8] See Queensland Council of Social Services (2009), *QCOSS Response to Queensland Parliamentary Inquiry into Energy Efficiency*, August for some evidence on the lack of financial resources to invest in economic energy efficiency amongst low income households.
[9] See A, Muirdeen (2012), "The Energy Saver Incentive: learnings from a white certificate scheme" presentation to the Energy Efficiency Summer Studies Program, Canberra
[10] Other studies have also not included this benefit

Table 2: Additional benefits from alternative persistence assumptions

Year	2.0 Target		2.7 Target		5.4 Target	
	Energy Savings, MWh	Benefit, $M	Energy Savings, MWh	Benefit, $M	Energy Savings, $/MWh	Benefit, $M
2015	176175	0	218983	0	341997	0
2016	403876	0	519631	0	873763	0
2017	635390	0	823903	0	1444947	0
2018	663938	0	872319	0	1555417	0
2019	663869	0	872215	0	1554417	0
2020	659511	0	864208	0	1531804	0
2021	651301	0	849370	0	1486086	0
2022	625834	0	815784	0	1416775	0
2023	592664	0	775420	0	1349730	0
2024	563590	0	742345	0	1307809	0
2025	537872	0	707151	0	1251604	0
2026	511205	0	666525	0	1180562	0
2027	466629	0	601504	0	1180562	2
2028	437535	1	574858	1	1180562	5
2029	437535	3	574858	4	1180562	9
2030	437535	4	574858	6	1180562	13
2031	437535	8	574858	10	1180562	21
2032	437535	8	574858	10	1180562	21
2033	437535	8	574858	10	1180562	21
2034	437535	8	574858	10	1180562	21
2035	437535	8	574858	10	1180562	21
2036	437535	8	574858	10	1180562	21
2037	437535	8	574858	10	1180562	21
2038	437535	8	574858	10	1180562	21
2039	437535	8	574858	10	1180562	21
2040	437535	8	574858	10	1180562	21
NPV at 7%		23		31		66
NPV at 3.5%		46		60		129

Source: Jacobs analysis based on data provided in Oakey Greenwood (2013)

3.2.3 Treatment of carbon emissions

Carbon benefits were not explicitly considered in the benefit cost analysis as reducing carbon emissions was not seen as a goal for the Victorian Government and that the National Government were implementing a policy to reduce emissions. Oakey Greenwood in its supporting report do mention reducing carbon emissions as a possible benefit, valuing the benefits using carbon price forecasts from Point Carbon, which were lower than the Federal Treasury forecast of carbon prices.

Even though reducing carbon emissions is not the principle goal of the State Government, it is still major co-benefit of the scheme and may even be considered a principle goal of the scheme since the target is denominated in carbon abatement. The Direct Action approach being promulgated by the Federal Government is trying to achieve a 5% reduction (on 2000 levels) in emissions by 2020. Thus the VEET would not crowd out emission reductions from other sources. It would merely mean that the Federal Government needs to do less under its policy.

There is considerable uncertainty over future carbon values and sensitivity analysis could have been undertaken. The lower forecasts for current carbon prices reflect the oversupply of permits in the EU and the uncertainty over future carbon price trajectories. But there is a high likelihood that the carbon price would increase and would be higher than current forecasts once long term targets are set and assuming that global goals to substantially reduce emissions are adhered to.

To not include the benefit of reducing carbon emissions is tantamount to saying there is no externality. This is a major point of difference with previous studies were the carbon mitigation benefits were significant.

Indicative estimates of the potential value of carbon mitigation are provided in Table 3. The carbon emission reductions found by Oakey Greenwood are used and it is assumed that the emission reduction in 2030 persists until 2040. A carbon price starting at \$10/t CO_2e in 2015 increasing to \$23/t CO_2e in 2020 is assumed. Thereafter, carbon prices are assumed to increase by 5.5% per annum reflective of carbon price trajectories to achieve global concentrations less than 550 ppm. The prices assumed are still significantly lower than in the Federal Treasury forecast in 2013.

Table 3: Benefit of carbon abatement

Year	Abatement, t CO_2e			Price, \$/t CO_2e	Benefit, \$M		
	2 Mt target	2.7 Mt target	5.4 Mt target		2 Mt target	2.7 Mt target	5.4 Mt target
2015	299981	388875	609455	10	3.0	3.9	6.1
2016	433996	576182	1043349	13	5.4	7.2	13.0
2017	732400	934345	1541274	15	11.0	14.0	23.1
2018	758567	951162	1676493	18	13.3	16.6	29.3
2019	612981	803305	1479643	20	12.3	16.1	29.6
2020	629645	813199	1460542	23	14.2	18.3	32.9
2021	665633	864926	1491935	25	16.6	21.6	37.3
2022	609151	804941	1408990	26	16.1	21.2	37.2
2023	568522	763980	1357887	28	15.8	21.3	37.8
2024	535947	718403	1276348	29	15.7	21.1	37.5
2025	495894	665114	1205252	31	15.4	20.6	37.3
2026	481815	636761	1151799	33	15.7	20.8	37.6
2027	428996	552736	996719	34	14.8	19.1	34.4
2028	338806	427364	784883	36	12.3	15.5	28.5
2029	279700	342716	576054	38	10.7	13.1	22.1
2030	236089	249451	465710	40	9.6	10.1	18.9
2031	236089	249451	465710	43	10.1	10.7	19.9
2032	236089	249451	465710	45	10.6	11.2	21.0
2033	236089	249451	465710	48	11.2	11.9	22.1
2034	236089	249451	465710	50	11.8	12.5	23.4
2035	236089	249451	465710	53	12.5	13.2	24.6
2036	236089	249451	465710	56	13.2	13.9	26.0
2037	236089	249451	465710	59	13.9	14.7	27.4
2038	236089	249451	465710	62	14.7	15.5	28.9
2039	236089	249451	465710	66	15.5	16.3	30.5
2040	236089	249451	465710	69	16.3	17.2	32.2
NPV (7%)					143	179	319
NPV (3.5%)					211	258	463

Source: Jacobs analysis

The analysis indicates significant benefits to carbon abatement, with the net present value of the benefit for a 7% discount rate ranging from $143 million for a 2.0 Mt target to $319 million for a 5.4 Mt target. When using a 3.5% discount rate, the net present value of the benefits ranges from $211 million for a 2.0 Mt target to $463 million for a 5.4 Mt target.

Higher levels of persistence than assumed would lead to higher abatement increasing the benefit of the Scheme.

3.2.4 Fixed costs

The studies found there was no reduction in fixed costs as there was no new plant that was being deferred. However, as demand is reducing across the three VEET scenarios, it is possible that the reduction reduces the loading on some existing plant to the point where market revenues no longer cover fixed operating costs. Further details need to be provided on the operating profiles of the generating units to see if there are generators that are no longer recovering fixed annual operating costs. This is particularly the case when there is so much over-capacity in the market.

As an indication, we undertook an analysis of the potential benefits from reduced fixed operating costs from shutting uneconomic plant. In Table 3, we highlight the implications of assumed generation reductions from energy efficiency and how that would reduce the capacity factor for a 500 MW coal-fired unit. We then calculate the benefits assuming that a reduction in capacity factor of greater than 15% would lead to further cycling or mothballing of the unit thus reducing fixed operating costs. The results are shown in Table 4, and indicate potential benefits ranging from around $50 million to $100 million in net present value terms.

Table 4: Benefits from potential fixed operating cost reductions

Year	2.0 MT target			2.7 Mt target			5.4 Mt target		
	Energy saving	Capacity factor reduction	Savings in fixed O&M, $M	Energy saving	Capacity factor reduction	Savings in fixed O&M, $M	Energy saving	Capacity factor reduction	Savings in fixed O&M, $M
2015	176175	4.3%	0	218983	5.4%	0	341997	8.4%	0
2016	403876	10.0%	0	519631	12.8%	0	873763	21.5%	12.5
2017	635390	15.7%	12.5	823903	20.3%	12.5	1444947	35.6%	12.5
2018	663938	16.4%	12.5	872319	21.5%	12.5	1555417	38.4%	12.5
2019	663869	16.4%	12.5	872215	21.5%	12.5	1554417	38.3%	12.5
2020	659511	16.3%	12.5	864208	21.3%	12.5	1531804	37.8%	12.5
2021	651301	16.1%	12.5	849370	20.9%	12.5	1486086	36.6%	12.5
2022	625834	15.4%	12.5	815784	20.1%	12.5	1416775	34.9%	12.5
2023	592664	14.6%	0	775420	19.1%	12.5	1349730	33.3%	12.5
2024	563590	13.9%	0	742345	18.3%	12.5	1307809	32.2%	12.5
2025	537872	13.3%	0	707151	17.4%	12.5	1251604	30.9%	12.5
2026	511205	12.6%	0	666525	16.4%	12.5	1175999	29.0%	12.5
2027	466629	11.5%	0	601504	14.8%	0	1048897	25.9%	12.5
2028	404709	10.0%	0	509818	12.6%	0	876734	21.6%	12.5
2029	290355	7.2%	0	371656	9.2%	0	670632	16.5%	12.5
2030	193599	4.8%	0	239601	5.9%	0	452916	11.2%	0
NPV (7%)			$52.04			$76.68			$102.17
NPV (3.5%)			$62.18			$97.05			$131.89

Source : Jacobs analysis based on DSDBI data on energy savings. Note capacity reductions was calculated by multiplying energy savings by 1.08 to arrive at a sent out basis and then assuming a 500 MW unit is affected.

However, these results should be interpreted with care as they need to be confirmed with simulation modelling of the dispatch with the lower targets or at least an appreciation of how the operating regimes of the generating plant are affected by the energy savings.

Another issue is that the finding of no reductions on fixed costs was also contingent on the assumed load growth rates and the impact of the current LRET target. With a number of energy efficiency schemes being axed and the potential for the LRET target to be reduced significantly, there is the prospect that the overhang in the market is not as acute as assumed in the analysis.

Furthermore, on the basis that energy savings may persist at reasonable levels to 2030 and beyond, then it may be reasonable to assume some future benefit in deferred network augmentation (even if NPV benefit is small). Previous studies also point to network infrastructure deferral benefits in the long term.

3.2.5 Customer operating cost benefits

Under the VEET, certificates can be earned for replacing halogen light globes with LED light globes. One benefit that may have been excluded is the benefit of not replacing inefficient halogen light globes on a regular basis. Halogen light globes have a shorter life than the more efficient LED lights.

This potential benefit was estimated using the following assumptions:

- Certificates created from replacement of halogens with LEDs: 299,000 for the 2,0 Mt CO2e target, 542,000 for the 2.7 Mt target, and 2,147,000 for the 5.4 Mt target.
- Average life of halogen lamps: 2 years
- Average life of LED lamp: 10 years
- VEECs earnt per LED installed: 0.85
- Cost of replacement halogen lamps: $3/lamp

Based on these assumptions, an estimate of the net present value of avoiding the cost of replacing halogen lamps is shown in the following table.

Table 5: Net present value of the benefits of avoiding halogen lamp replacements, $M

VEET target	2.0 Mt target	2.7 Mt target	5.4 Mt target
NPV at 3.5% discount rate	13	23	92
NPV at 7.0% discount rate	17	32	126

3.3 Cost assumptions

Costs of the scheme include certificate purchase costs, participant costs (comprising the capital costs of purchasing energy efficient equipment not recovered from sales of certificates) and administration costs. On a levelised basis, the average costs of the schemes are shown in Table 6.

Table 6: Average costs of scheme

Target	2.0 Mt CO2e	2.7 Mt CO2e	5.4 Mt CO2e
Cost, $m	297	416	973
Energy saved, MWh	4,838,016	6,292,276	11,015,475
Cost per unit, $/MWh	61	66	88

Note: Both costs and energy saved are discounted by 7% so as to calculate the cost per unit.

The costs range from $61/MWh on average for the 2.0 Mt target to $88/MWh on average for the 5.4 Mt Target. These costs are compared with costs for some other recent studies, using a similar target range. Costs are

higher for the current study, although not much higher for the lower target range. Costs are higher for the higher target range in this study probably due to the fact that large industrial customers were ineligible to partake in the VEET, removing potentially lower cost sources of energy efficiency. But it would be useful to confirm this by the underlying cost data used in the VEET analysis to be published.

Table 7: Comparison of costs across studies, $/MWh levelised cost

Target range	DSDBI study	SKM MMA Study NESI	ICRC determination of ACT EEIS Costs
3% of demand	66	64	72
4% of demand	88	78	-

3.4 Net benefit comparison

Table 6 shows a comparison of benefits and costs across similar target for another study undertaken by SKM MMA and compares with the VEET study findings for a similar target (although not at the national level). The comparison shows that costs are roughly comparable but that benefits are lower in the VEET study. This appears to be due to lower demand growth rates in the VEET study reducing infrastructure benefits but also due to the exclusion of some benefits and even more conservative persistence assumptions.

Table 8: Comparison of benefits and costs

Item	NESI Study		VEET Study
Target	State Schemes	4.5% Target	5.4 MT target
Cost, $M	2,062	1,551	973
Benefit, $M	2,019	2,218	258
Net benefit, $M	-43	667	-715