ECONOMIC IMPACTS OF INCREASED ENERGY RATINGS FOR NEW HOUSES IN VICTORIA

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Centre of Policy Studies

Centre of Policy Studies
PO Box 11E,
Monash University,
Victoria 3800
Australia

Contact person: Dr. Philip Adams

Telephone:	(61-3) 9905 5094
Facsimile:	(61-3) 9905 2426
Email:	philip.adams@buseco.monash.edu.au
Web address:	http://www.monash.edu.au/policy/

Introduction

Using MMRF-Green, we model the economic impacts of increased energy ratings, as determined by the Sustainable Energy Authority of Victoria (SEAV), for new houses built in Victoria. Results for two groups of scenarios are reported. Our preferred group is the first. For these scenarios, we assume that housing investors are forward looking. For scenarios in the second group, we assume that investors are myopic.

Each group comprises four individual scenarios:

4-StarA This shows the effects of increasing the energy rating to 4 stars, with the additional cost per new house assumed to remain constant through time.

5-StarA This shows the effects of increasing the rating to 5 stars, with the additional cost constant.

4-StarB In this scenario, we model the effects of increasing the rating to 4 stars, with the additional unit cost per new house smoothly falling to half its initial level by year 10 and remaining at that level thereafter.

5-StarB This shows the effects of increasing the rating to 5 stars, with unit costs declining as in Scenario 4-StarB.

Economic model

MMRF-Green is a multi-sector dynamic model of the Australian economy covering the six states and two territories. It models each region as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. Since MMRF-Green is dynamic, it is able to produce sequences of annual solutions connected by dynamic relationships. The model also includes enhanced capabilities for environmental analysis.

As each state and territory is modelled as a mini-economy, MMRF-Green is ideally suited to determining the impact of region-specific economic shocks. It has already been used to address a wide range of issues, including the economic impacts of large export-oriented projects, the effects of global trading in greenhouse emission permits, and the effects of changes in state and federal tax rates.

In this study, we make particular use of the model's regional disaggregation facility. This allows state-level results for output and employment to be disaggregated down to projections for 57 sub-state regions. The method is an adaptation of the regional disaggregation method first devised for the ORANI model, and later applied to sub-state regions for the MONASH model. The geographic boundaries of the sub-state regions are based on the Statistical divisions defined in the Australian Standard Geographical Classification (ABS catalogue number 1216.0). Our division structure differs slightly from that of the ABS. In particular, for Victoria we identify separately the energy intensive La Trobe Valley as a separate region, with *Gippsland* re-defined to include all areas in the ABS statistical division *Gippsland* other than the La Trobe Valley.

Enhancements

A number of enhancements have been made to the existing model to facilitate simulations for this study. These involved building into the model's theory and database, a new dwelling-services industry. This industry produces dwelling services, as does the existing

dwelling-services industry. However, the capital of the new industry is built with 4 and 5 star compliant technology, while the capital of the old industry is built with existing non-compliant technology. In the basecase, we assume that all housing investment is undertaken by the old housing services industry; there is no investment in the new industry. In the deviation simulations, we assume the reverse. Thus by the deviation simulations with the basecase simulation we can deduce the effects of enforcing 4 and 5 star ratings.

Modelling Assumptions

The imposition of new energy standards for housing has two direct effects:

(1) It increases the cost of new housing construction; and

(2) It reduces household expenditure on energy.

In Scenarios 4-StarA and 5-StarA, over time the energy savings just offset the additional cost of construction. In Scenarios 4-StarB and 5-StarB, the excess of accumulated energy savings over additional construction cost gradually increases until year 10. In that year, and thereafter, the excess is about twice that in year 1.

Forward-looking scenarios

In the forward-looking scenarios we assume that housing owners/investors correctly anticipate that the energy savings will eventually cover the additional construction cost. Thus, they fund the additional construction expense by borrowing with the borrowing cost over time fully paid by the savings in energy costs.

Based on this assumption, in the deviation simulations for 4-StarA and 5-StarA we fix the number of new buildings constructed at its base case level. The base-case is consistent with the SEAV estimate of 30,000 houses per annum. In fixing investment, we also fix the stock and the price of dwelling services.[1]

In the deviation simulations for 4-StarB and 5-StarB, housing investors need to borrow less and repay less than in the "A" scenarios. This leaves room for additional housing construction. In the second year, we assume additional housing investment worth $2.6 million; the difference in that year between the total construction costs in the "A" and "B" scenarios. We assume that this is equivalent to 15 extra houses.[2] In the third year, we assume that a further $2.6 million is spent leading to a total of 30 additional houses, and so on. In the tenth year, the number of houses is 135 above its basecase level.

The increased construction expenditures (relative to basecase) imposed in our modelling of the four forward-looking scenarios are as follows.

[1] In the standard model, there is a single industry, called dwelling ownership, which produces the services of the housing stock. The only primary input to this industry is housing capital. Its only output is housing services sold directly to households. Increasing the cost of housing construction reduces the rate of return on investment in the dwelling ownership industry. This reduces housing investment, housing capital and the output of housing services, leading to a higher price for housing services.

[2] This assumes a construction cost for each house of around $175,000.

Additional Construction Expenditure – Forward Looking Scenarios*

	4-StarA			5-StarA			4-StarB			5-StarB		
	Houses	Extra cost/ house	Total ($m)	Houses	Extra cost/ house	Total ($m)	Houses	Extra cost/ house	Total ($m)	Houses	Extra cost/ house	Total ($m)
2002	30000	1722	51.7	30000	3323	99.7	30000	1722	51.7	30000	3323	99.7
2003	30000	1726	51.8	30000	3331	99.9	30015	1640	49.2	30015	3165	95.0
2004	30000	1730	51.9	30000	3339	100.2	30030	1558	46.8	30030	3007	90.3
2005	30000	1735	52.0	30000	3348	100.4	30045	1475	44.3	30045	2848	85.6
2006	30000	1739	52.2	30000	3356	100.7	30060	1393	41.9	30060	2689	80.8
2007	30000	1743	52.3	30000	3364	100.9	30075	1310	39.4	30075	2529	76.1
2008	30000	1747	52.4	30000	3372	101.2	30090	1227	36.9	30090	2369	71.3
2009	30000	1752	52.5	30000	3380	101.4	30105	1144	34.4	30105	2209	66.5
2010	30000	1756	52.7	30000	3389	101.7	30120	1061	32.0	30120	2048	61.7
2011	30000	1760	52.8	30000	3397	101.9	30135	977	29.5	30135	1887	56.9
2012	30000	1764	52.9	30000	3405	102.2	30150	894	26.9	30150	1725	52.0
2013	30000	1769	53.1	30000	3413	102.4	30165	896	27.0	30165	1730	52.2
2014	30000	1773	53.2	30000	3422	102.7	30180	898	27.1	30180	1734	52.3
2015	30000	1777	53.3	30000	3430	102.9	30195	900	27.2	30195	1738	52.5
2016	30000	1782	53.5	30000	3439	103.2	30210	902	27.3	30210	1742	52.6
2917	30000	1786	53.6	30000	3447	103.4	30225	905	27.3	30225	1746	52.8
2018	30000	1790	53.7	30000	3455	103.7	30240	907	27.4	30240	1751	52.9
2019	30000	1795	53.8	30000	3464	103.9	30255	909	27.5	30255	1755	53.1
2020	30000	1799	54.0	30000	3472	104.2	30270	911	27.6	30270	1759	53.3
2021	30000	1804	54.1	30000	3481	104.4	30285	913	27.7	30285	1764	53.4

* The numbers in the columns labeled "Total" are total changes, relative to base, in expenditures on wall insulation, double-glazed windows, etc.

In calculating the numbers shown in the columns labeled "Extra cost/house" we make allowance for additional cost associated with replacement of depreciated weather strips and external blinds. A depreciation rate of 4.0 per cent is assumed.

The aggregate energy savings (relative to basecase) imposed in our modelling of the forward-looking scenarios is as follows.

Value of Fuel Savings – Forward Looking Scenarios*

	4-StarA			5-StarA			4-StarB			5-StarB		
	Houses	Extra saving/ house	Total ($m)	Houses	Extra saving/ house	Total ($m)	Houses	Extra saving/ house	Total ($m)	Houses	Extra saving/ house	Total ($m)
2002	30000	148	4.4	30000	205	6.2	30000	148	4.4	30000	205	6.2
2003	30000	148	8.9	30000	205	12.3	30015	148	8.9	30015	205	12.3
2004	30000	148	13.3	30000	205	18.5	30030	148	13.3	30030	205	18.5
2005	30000	148	17.8	30000	205	24.6	30045	148	17.8	30045	205	24.6
2006	30000	148	22.2	30000	205	30.8	30060	148	22.2	30060	205	30.8
2007	30000	148	26.7	30000	205	36.9	30075	148	26.7	30075	205	37.0
2008	30000	148	31.1	30000	205	43.1	30090	148	31.1	30090	205	43.2
2009	30000	148	35.5	30000	205	49.2	30105	148	35.6	30105	205	49.3
2010	30000	148	40.0	30000	205	55.4	30120	148	40.1	30120	205	55.5
2011	30000	148	44.4	30000	205	61.6	30135	148	44.5	30135	205	61.7
2012	30000	148	48.9	30000	205	67.7	30150	148	49.0	30150	205	67.9
2013	30000	148	53.3	30000	205	73.9	30165	148	53.4	30165	205	74.1
2014	30000	148	57.7	30000	205	80.0	30180	148	57.9	30180	205	80.3
2015	30000	148	62.2	30000	205	86.2	30195	148	62.4	30195	205	86.5
2016	30000	148	66.6	30000	205	92.3	30210	148	66.9	30210	205	92.7
2917	30000	148	71.1	30000	205	98.5	30225	148	71.3	30225	205	98.9
2018	30000	148	75.5	30000	205	104.6	30240	148	75.8	30240	205	105.1
2019	30000	148	80.0	30000	205	110.8	30255	148	80.3	30255	205	111.3
2020	30000	148	84.4	30000	205	117.0	30270	148	84.8	30270	205	117.5
2021	30000	148	88.8	30000	205	123.1	30285	148	89.3	30285	205	123.7

* The numbers in the columns labeled "Total" are total changes, relative to base, in savings on the usage of electricity, gas, LPG and firewood.

Myopic scenarios

In the myopic scenarios, we assume that housing investors do not take account of the energy savings when considering investment decisions. For them, increasing the cost of new houses simply lowers the rate of return on dwelling investment. This causes the construction of new houses to fall and the price of housing services to rise. Based on elasticities in MMRF-Green, the increased construction costs in the "A" scenarios will lower the number of new houses built each year (relative to the basecase) by 275 (4-Star) and by 550 (5-Star). These translate into reduced investment expenditures of $49.5 million (4-Star) and $99.0 million (5-Star). In the "B" scenarios, the losses diminish until the tenth year, where the number of new houses built is 138 (4-Star) and 275 (5-Star) less than in the basecase. These translate into reduced expenditures of $25.2 million (4-Star) and $49.5 million (5-Star).

The increased construction expenditures (relative to basecase) imposed in our modelling of the four myopic scenarios are as follows.

Additional Construction Expenditure – Myopic Scenarios*

	4-StarA			5-StarA			4-StarB			5-StarB		
	Houses	Extra cost/ house	Total ($m)	Houses	Extra cost/ house	Total ($m)	Houses	Extra cost/ house	Total ($m)	Houses	Extra cost/ house	Total ($m)
2002	29725	1722	51.2	29450	3323	97.9	29725	1722	51.2	29450	3323	97.9
2003	29725	1726	51.3	29450	3331	98.1	29740	1640	48.8	29485	3165	93.3
2004	29725	1730	51.4	29450	3339	98.3	29755	1558	46.3	29520	3007	88.8
2005	29725	1735	51.6	29450	3348	98.6	29770	1475	43.9	29555	2848	84.2
2006	29725	1739	51.7	29450	3356	98.8	29785	1393	41.5	29590	2689	79.6
2007	29725	1743	51.8	29450	3364	99.1	29800	1310	39.0	29625	2529	74.9
2008	29725	1747	51.9	29450	3372	99.3	29815	1227	36.6	29660	2369	70.3
2009	29725	1752	52.1	29450	3380	99.6	29830	1144	34.1	29695	2209	65.6
2010	29725	1756	52.2	29450	3389	99.8	29845	1061	31.7	29730	2048	60.9
2011	29725	1760	52.3	29450	3397	100.0	29860	977	29.2	29765	1887	56.2
2012	29725	1764	52.4	29450	3405	100.3	29860	894	26.7	29765	1725	51.4
2013	29725	1769	52.6	29450	3413	100.5	29860	896	26.7	29765	1730	51.5
2014	29725	1773	52.7	29450	3422	100.8	29860	898	26.8	29765	1734	51.6
2015	29725	1777	52.8	29450	3430	101.0	29860	900	26.9	29765	1738	51.7
2016	29725	1782	53.0	29450	3439	101.3	29860	902	26.9	29765	1742	51.9
2917	29725	1786	53.1	29450	3447	101.5	29860	905	27.0	29765	1746	52.0
2018	29725	1790	53.2	29450	3455	101.8	29860	907	27.1	29765	1751	52.1
2019	29725	1795	53.4	29450	3464	102.0	29860	909	27.1	29765	1755	52.2
2020	29725	1799	53.5	29450	3472	102.3	29860	911	27.2	29765	1759	52.4
2021	29725	1804	53.6	29450	3481	102.5	29860	913	27.3	29765	1764	52.5

* The numbers in the columns labeled "Total" are total changes, relative to base, in expenditures on wall insulation, double-glazed windows, etc.

In calculating the numbers shown in the columns labeled "Extra cost/house" we make allowance for additional cost associated with replacement of depreciated weather strips and external blinds. A depreciation rate of 4.0 per cent is assumed.

The aggregate energy savings (relative to basecase) imposed in our modelling of the myopic scenarios is as follows.

*Value of Fuel Savings – Myopic Scenarios**

	4-StarA			5-StarA			4-StarB			5-StarB		
	Houses	Extra saving/ house	Total ($m)	Houses	Extra saving/ house	Total ($m)	Houses	Extra saving/ house	Total ($m)	Houses	Extra saving/ house	Total ($m)
2002	29725	148	4.4	29450	205	6.0	29725	148	4.4	29450	205	6.0
2003	29725	148	8.8	29450	205	12.1	29740	148	8.8	29485	205	12.1
2004	29725	148	13.2	29450	205	18.1	29755	148	13.2	29520	205	18.1
2005	29725	148	17.6	29450	205	24.2	29770	148	17.6	29555	205	24.2
2006	29725	148	22.0	29450	205	30.2	29785	148	22.0	29590	205	30.3
2007	29725	148	26.4	29450	205	36.3	29800	148	26.4	29625	205	36.4
2008	29725	148	30.8	29450	205	42.3	29815	148	30.9	29660	205	42.4
2009	29725	148	35.2	29450	205	48.3	29830	148	35.3	29695	205	48.5
2010	29725	148	39.6	29450	205	54.4	29845	148	39.7	29730	205	54.6
2011	29725	148	44.0	29450	205	60.4	29860	148	44.1	29765	205	60.7
2012	29725	148	48.4	29450	205	66.5	29860	148	48.5	29765	205	66.9
2013	29725	148	52.8	29450	205	72.5	29860	148	53.0	29765	205	73.0
2014	29725	148	57.2	29450	205	78.6	29860	148	57.4	29765	205	79.1
2015	29725	148	61.6	29450	205	84.6	29860	148	61.8	29765	205	85.2
2016	29725	148	66.0	29450	205	90.6	29860	148	66.2	29765	205	91.3
2917	29725	148	70.4	29450	205	96.7	29860	148	70.6	29765	205	97.4
2018	29725	148	74.8	29450	205	102.7	29860	148	75.1	29765	205	103.5
2019	29725	148	79.2	29450	205	108.8	29860	148	79.5	29765	205	109.6
2020	29725	148	83.6	29450	205	114.8	29860	148	83.9	29765	205	115.7
2021	29725	148	88.0	29450	205	120.8	29860	148	88.3	29765	205	121.8

* The numbers in the columns labeled “Total” are total changes, relative to base, in savings on the usage of electricity, gas, LPG and firewood.

Summary: What is modelled and what is not

Essentially, we model the economic effects of an expenditure shift towards investment expenditure on energy saving products such as roof and wall insulation, and away from consumer expenditure on energy.

Forward-looking

In Scenarios 4-StarA and 5-StarA, we assume that consumer borrowing finances the extra investment expenditure. The borrowing undertaken in each year has a life of 20 years (the length of the simulation) and is financed entirely by consumers’ reduced spending on energy. In Scenarios 4-StarB and 5-StarB the extra investment expenditure is less, while the energy savings are the same. This means less borrowing, and allows additional houses to be built.

Myopic

In these scenarios, we assume that housing investors ignore the future energy savings when making their investment decisions in each year. The additional unit cost of construction associated with compliance, therefore, reduces the number of new houses built. This reduces the total savings and the total construction costs relative to the Forward-looking scenarios.

In our modelling of the economic costs and benefits we do not account for any benefits that arise directly from lower greenhouse emissions and from lower energy usage.

Effects on Victorian macroeconomic variables

Detailed results are shown in supporting Tables 1 and 2 for each scenario.

Forward-Looking Scenarios 4-StarA and 5-StarA

The effects of the expenditure shift are clearly shown in the results for Victorian macroeconomic variables. Private consumption falls relative to base, with the gap gradually widening over time. This reflects the accumulation of reductions in spending on energy. On the other hand, real investment jumps relative to base in the first year, and remains elevated at about the same level thereafter. Interestingly, the gradual fall in consumption and the increase in investment spending are both less than suggested by the direct effects of the shocks. This reflects a mild stimulation of real Gross State Product (GSP). Increased real GSP means more income for consumption, which leads to more investment.

Note on employment

In our model, employment is measured in terms of hours worked, not persons employed. Therefore, the percentage change in employment, as simulated by the model represents a percentage increase in hours worked. To derive an estimate of the effect on numbers of persons employed (supporting Table 2), we assume that the shocks do not affect industry ratios of employed persons to employed hours. Under this assumption, a percentage increase in hours worked translates into the same percentage increase in persons employed. Based on this calculation, in 2021 around 500 additional full and part-time jobs are created in VIC by the 4-Star policy (see Table 2 for Scenario 4-StarA). Most of these new jobs are located in service industries, notably trade, finance and public services (see Table 6 for Scenario 4-StarA).

Where did the additional real GSP come from? The answer lies mainly in the timing of the expenditure shocks. Initially housing expenditure jumps, while reductions in energy expenditure occur gradually over time. For nearly all of the simulation period, the increased housing expenditure more than offsets the contraction in energy spending, thus stimulating real GSP. As the net size of the spending shock becomes smaller, so does the stimulus to real GSP. Nevertheless, even at the end of the period, real GSP is above its value in the basecase.

There are two other positive influences on real GSP in this simulation. In general, the switch in expenditure favours industries that are labour intensive at the expense of industries that are capital intensive. This provides scope for an increase in aggregate employment relative to capital, especially in the short-run where the construction shock dominates. Furthermore, the switch leads to slightly lower energy prices relative to prices for construction goods. Energy is used more intensively than construction in traded-goods industries. Thus the competitiveness of the Victorian export and import-competing industries is stimulated, leading over time to an increase in inter-state and international exports relative to inter-state and international imports.

Forward-Looking Scenarios 4-StarB and 5-StarB

Relative to the results for the "A" scenarios, in the "B" scenarios, real consumption, real investment and real GSP are affected less in each year of the simulation. This is because the additional housing expenditure is less, as is the repayment burden on the borrowing required to finance that expenditure. Intuitively, we would expect to see these two factors

cancelling out in the long-run, so that the changes in real GSP in the final few years would be similar in the "A" and "B" scenarios. The extent to which there are differences in the long-run reflects, in the main, the additional stimulus to the housing stock in the "B" scenarios.

Myopic Scenarios

The effects in the myopic scenarios are much smaller compared to the effects in the corresponding forward-looking scenarios. This is because in the myopic scenarios: (a) the reduction in investment expenditure due to the fall in number of new houses built offsets the increase in expenditure arising from rating compliance; and (b) household consumption does not have to fall to finance additional borrowing repayments. Effectively, in the myopic scenarios we are only modelling the effects (relative to basecase values) of a switch in household expenditure away from energy products, and of a fall in the stock of housing.

Relative to the forward-looking results, the increase in investment expenditure is much smaller than in the myopic simulations (see point (a)), as is the reduction in consumption expenditure (see point (b)). Accordingly, we see relatively little impact on real GDP, employment and capital.

Effects on Victorian industries

Detailed results are shown in supporting Tables 3 to 6 for each scenario.

Forward-Looking Scenarios 4-StarA and 5-StarA

The expenditure switch has the obvious effects on the construction and energy industries. Production of the construction services industry expands, as does the production of primary suppliers, especially those producing goods and services that are favoured in the technology for producing compliant houses. The industries that suffer declines in output are those for which consumer demand declines – urban gas distribution, electricity supply, agriculture (which produces firewood) and petroleum refining (which produces LPG). Brown-coal generated electricity declines by slightly more than electricity demand because of substitution towards gas generated electricity. The competitiveness of gas generated electricity improves due to a fall in gas price.

The most trade-exposed sectors in the VIC economy, and the ones that rely least on VIC demand for absorption of their product, are Textiles, paper and wood products, and Chemicals other than petrol. These industries gain in terms of output and employment, reflecting the improvement in competitiveness of Victorian traded goods industries.

Forward-Looking Scenarios 4-StarB and 5-StarB

As in the "A" scenarios, energy-related industries suffer declines in output and employment, while construction related and trade-exposed industries are projected to experience increased output and employment. The main difference is that in the "B" Scenarios, the declines in output are generally less severe than in the "A" Scenarios, as is the expansions. Note too, that in the "B" Scenarios the output of dwelling services increases, reflecting the stimulus to the housing stock.

Myopic Scenarios

The industry effects in the myopic scenarios are similar in sign to the industry effects in the forward-looking scenarios, but in most cases are much smaller. This is because the change in consumption and investment expenditures are much smaller in the myopic scenarios. The exceptions are the energy industries that suffer similar output declines in both groups of simulations.

Effects on Victorian sub-state regions

Detailed results are shown in supporting Tables 8 and 9 for each scenario.

Forward-Looking Scenarios 4-StarA and 5-StarA

Two things stand out in our results for sub-state regions. The first is that all regions gain except for the energy-supply regions – East Gippsland (Gas) and La Trobe Valley (Brown coal electricity). The second thing is that of the other regions all gain by roughly equal percentage amounts. This is because the shocks are spread fairly evenly across all regions in relation to their size, and because the regions all have fairly even mixtures of industries that ultimately gain and lose. For example, the energy and construction industries are represented in the Barwon region in roughly equal proportions to their representations in the Melbourne region.

Forward-Looking Scenarios 4-StarB and 5-StarB

The regional pattern of the effects in the "B": scenarios is similar to the regional pattern in the "A" scenarios, although the energy-supply regions are less severely affected.

Myopic Scenarios

In line with the comparative effects on industries, the regional effects in the myopic scenarios are similar in sign to the industry effects in the forward-looking scenarios, but in most cases are much smaller. The exceptions are the energy-related regions (East Gippsland and La Trobe Valley) which suffer similar output declines in both groups of simulations.

Effects on welfare of Victorians

We measure the effects on welfare of Victorians in each of the eight scenarios by the changes from base in the sum of real consumption and investment expenditures in Victoria. These are given below.

Welfare changes for Victorians ($million, 2001 prices)

Scenario	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
4-StarA (Forward looking)	49.6	45.9	42.1	38.3	34.5	30.8	27.1	23.3	19.6	15.8
5-StarA (Forward looking)	97.4	92.1	86.8	81.5	76.4	71.4	66.4	61.4	56.4	51.4
4-StarB (Forward looking)	49.6	44.0	38.5	33.1	28.0	23.1	18.4	13.9	9.5	5.4
5-StarB (Forward looking)	97.4	88.4	79.5	71.1	63.1	55.4	48.0	40.9	34.0	27.5
4-StarA (Myopic)	-4.4	-3.8	-3.3	-3.1	-3.0	-2.9	-2.9	-2.8	-2.8	-2.9
5-StarA (Myopic)	-9.5	-8.4	-7.7	-7.3	-7.1	-7.0	-7.0	-7.0	-7.0	-7.0
4-StarB (Myopic)	-4.4	-3.5	-2.8	-2.3	-1.9	-1.6	-1.3	-1.1	-0.8	-0.6
5-StarB (Myopic)	-9.5	-7.9	-6.7	-5.8	-5.0	-4.4	-3.9	-3.4	-2.9	-2.5
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
4-StarA (Forward looking)	12.1	8.3	4.5	0.6	-3.3	-7.1	-11.0	-14.9	-18.9	-22.8
5-StarA (Forward looking)	46.3	41.3	36.1	31.0	25.8	20.6	15.3	10.0	4.7	-0.6
4-StarB (Forward looking)	1.3	-0.1	-1.5	-3.0	-4.5	-6.0	-7.5	-9.0	-10.6	-12.1
5-StarB (Forward looking)	21.1	19.8	18.4	16.9	15.4	13.9	12.3	10.7	9.1	7.5
4-StarA (Myopic)	-2.9	-2.9	-3.0	-3.0	-3.0	-3.1	-3.2	-3.2	-3.3	-3.3
5-StarA (Myopic)	-7.1	-7.2	-7.3	-7.3	-7.4	-7.5	-7.6	-7.8	-7.9	-8.0
4-StarB (Myopic)	-0.4	-0.4	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7	-0.8	-0.8
5-StarB (Myopic)	-2.0	-2.2	-2.3	-2.4	-2.5	-2.6	-2.7	-2.8	-2.0	-2.1

Changes in Greenhouse Emissions in Victorians (percentage deviations from base)

Scenario	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
4-StarA (Forward looking)	-0.010	-0.026	-0.043	-0.060	-0.078	-0.096	-0.114	-0.132	-0.150	-0.168
5-StarA (Forward looking)	-0.013	-0.034	-0.058	-0.082	-0.106	-0.131	-0.155	-0.180	-0.206	-0.231
4-StarB (Forward looking)	-0.010	-0.026	-0.043	-0.061	-0.078	-0.096	-0.114	-0.132	-0.151	-0.169
5-StarB (Forward looking)	-0.013	-0.035	-0.058	-0.082	-0.107	-0.132	-0.157	-0.182	-0.207	-0.232
4-StarA (Myopic)	-0.014	-0.029	-0.046	-0.063	-0.081	-0.098	-0.116	-0.134	-0.151	-0.169
5-StarA (Myopic)	-0.019	-0.041	-0.064	-0.088	-0.112	-0.137	-0.161	-0.186	-0.210	-0.235
4-StarB (Myopic)	-0.014	-0.029	-0.046	-0.063	-0.081	-0.098	-0.116	-0.134	-0.151	-0.169
5-StarB (Myopic)	-0.019	-0.041	-0.064	-0.088	-0.112	-0.136	-0.161	-0.185	-0.210	-0.235
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
4-StarA (Forward looking)	-0.187	-0.205	-0.223	-0.242	-0.260	-0.279	-0.297	-0.316	-0.334	-0.353
5-StarA (Forward looking)	-0.256	-0.281	-0.307	-0.332	-0.358	-0.384	-0.409	-0.435	-0.461	-0.487
4-StarB (Forward looking)	-0.187	-0.205	-0.224	-0.242	-0.260	-0.278	-0.296	-0.315	-0.333	-0.351
5-StarB (Forward looking)	-0.258	-0.283	-0.308	-0.333	-0.358	-0.384	-0.409	-0.434	-0.459	-0.485
4-StarA (Myopic)	-0.187	-0.205	-0.223	-0.241	-0.259	-0.277	-0.295	-0.313	-0.331	-0.349
5-StarA (Myopic)	-0.260	-0.285	-0.310	-0.335	-0.360	-0.385	-0.410	-0.435	-0.460	-0.485
4-StarB (Myopic)	-0.187	-0.205	-0.223	-0.241	-0.259	-0.277	-0.295	-0.313	-0.330	-0.348
5-StarB (Myopic)	-0.260	-0.284	-0.309	-0.334	-0.359	-0.384	-0.409	-0.434	-0.459	-0.484

Changes in Greenhouse Emissions in Victorians (Kt deviations from base)

Scenario	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
4-StarA (Forward looking)	-15	-37	-61	-86	-112	-137	-163	-189	-215	-241
5-StarA (Forward looking)	-18	-49	-82	-117	-152	-187	-222	-258	-294	-330
4-StarB (Forward looking)	-15	-37	-62	-87	-112	-138	-164	-189	-215	-242
5-StarB (Forward looking)	-18	-49	-83	-118	-153	-188	-224	-260	-296	-332
4-StarA (Myopic)	-19	-42	-66	-91	-115	-141	-166	-191	-217	-242
5-StarA (Myopic)	-27	-59	-92	-126	-160	-195	-230	-266	-301	-336
4-StarB (Myopic)	-19	-42	-66	-90	-115	-140	-166	-191	-216	-242
5-StarB (Myopic)	-27	-59	-92	-126	-160	-195	-230	-265	-300	-336
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
4-StarA (Forward looking)	-267	-293	-319	-346	-372	-399	-425	-452	-478	-505
5-StarA (Forward looking)	-366	-402	-439	-475	-512	-549	-585	-622	-659	-696
4-StarB (Forward looking)	-268	-294	-320	-346	-372	-398	-424	-450	-476	-502
5-StarB (Forward looking)	-368	-404	-440	-476	-512	-548	-585	-621	-657	-693
4-StarA (Myopic)	-268	-293	-319	-345	-370	-396	-422	-447	-473	-499
5-StarA (Myopic)	-372	-407	-443	-479	-514	-550	-586	-622	-657	-693
4-StarB (Myopic)	-267	-293	-319	-344	-370	-396	-421	-447	-473	-498
5-StarB (Myopic)	-371	-407	-442	-478	-514	-549	-585	-621	-656	-692

Supporting Tables

For each scenario, we report seven tables of detailed results:

Table 1: Macroeconomic Variables (percentage deviations from base)

Table 2: Macroeconomic Variables (absolute deviations from base)

Table 3: Industry Real Value Added – VIC (percentage deviations from base)

Table 4: Industry Real Value Added – Australia (percentage deviations from base)

Table 5: Industry Real Value Added – Victoria (deviations ($million, 2001 prices) from base)

Table 6: Industry Employment – Victoria (deviations (thousand persons) from base)

Table 7: Government Revenue (deviations ($million, 2001 prices) from base)

Table 8: Output and Employment for Sub-state Regions in Victoria (percentage deviations from base)

Table 9: Output and Employment for Sub-state Regions in Victoria (absolute deviations from base)