Households Better Off:
Lowering energy bills with the 2022 National Construction Code

August 2021

renew.

Document information

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1. Summary

1.1. The project

The National Construction Code is set to be updated in 2022. Governments are considering whether to increase the minimum NatHERS energy efficiency rating of new homes from 6 to 7 Stars, and whether to introduce higher standards for appliances, solar, and overall home energy use.

Renew decided to find out what these changes could mean for households.

We modelled the energy use, energy bills and upfront costs of homes to test the impact of better energy performance. We compared business-as-usual homes with a range of scenarios that are under consideration for the 2022 NCC, as well as other efficient options such as all-electric homes.

Our analysis was undertaken for a typical medium-large sized detached home in four locations: Hobart, Melbourne, Sydney, and Perth.

Our findings demonstrate that households are better off with higher energy standards.

- In all scenarios, improvements to energy efficiency meant lower bills and lower carbon emissions.
- In nearly all scenarios, improving standards meant more money in residents' pockets on a monthly basis because energy savings were higher than increased mortgage repayment costs.
- Households choosing to use the savings of better home energy performance to pay off their mortgage faster can cut years off the life of their home loan.

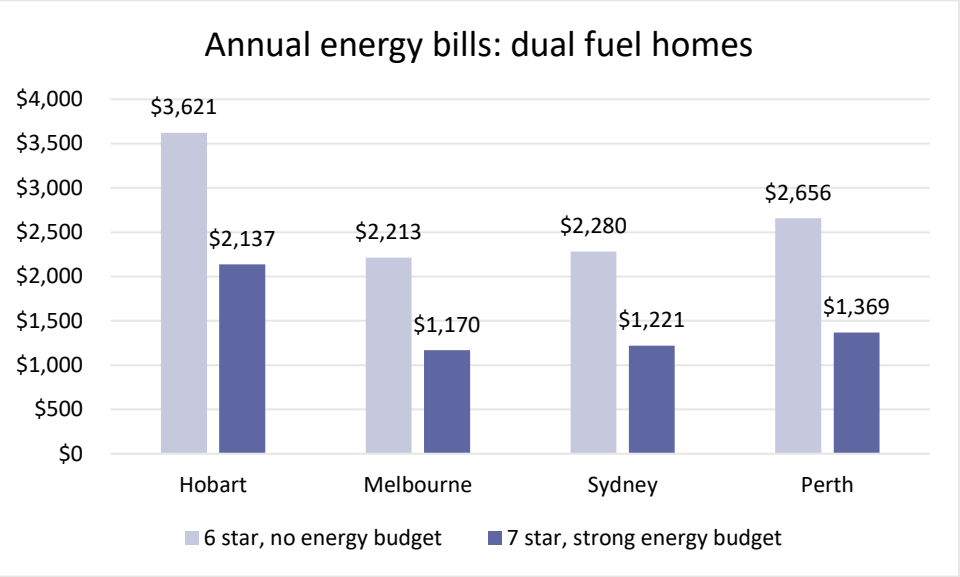
1.2. Findings: households are better off with efficient homes

Governments are considering requiring new homes to meet a 7-Star NatHERS rating and to include an "energy budget" that encourages efficient appliances and onsite solar PV. Under the energy budget rule, a limit for energy use of fixed appliances would be set that could be offset with onsite solar generation.

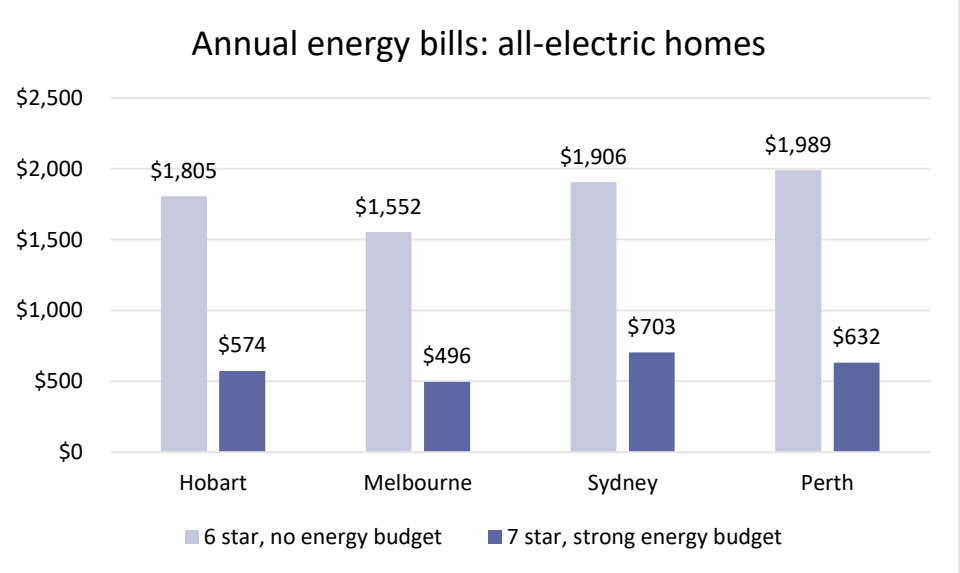
We compared a business-as-usual 6-Star home with no energy budget (basic appliances and no solar) to a 7-Star home with a strong energy budget (efficient appliances and large solar). A similar scenario is under consideration as a minimum requirement for new homes in the 2022 National Construction Code.

To demonstrate the impact of changes to the Code without including the financial impacts of choosing whether to connect a home to gas, we made this comparison for both dual fuel homes (with gas connection) and all-electric homes (without gas connection).

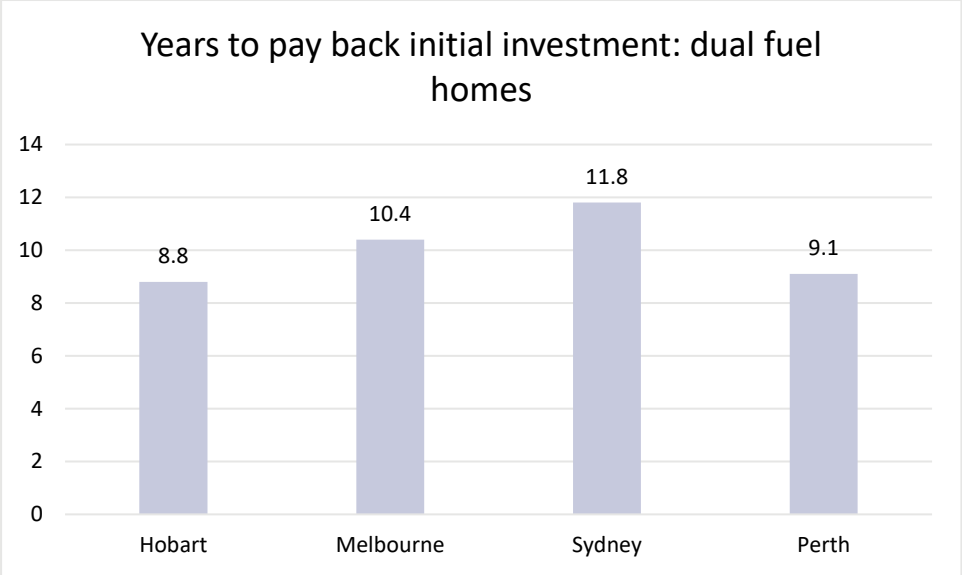
Bills were significantly less for the more efficient homes. In dual fuel homes, households saved $1,484 a year in Hobart, $1,043 in Melbourne, $1,059 in Sydney, and $1,287 in Perth.

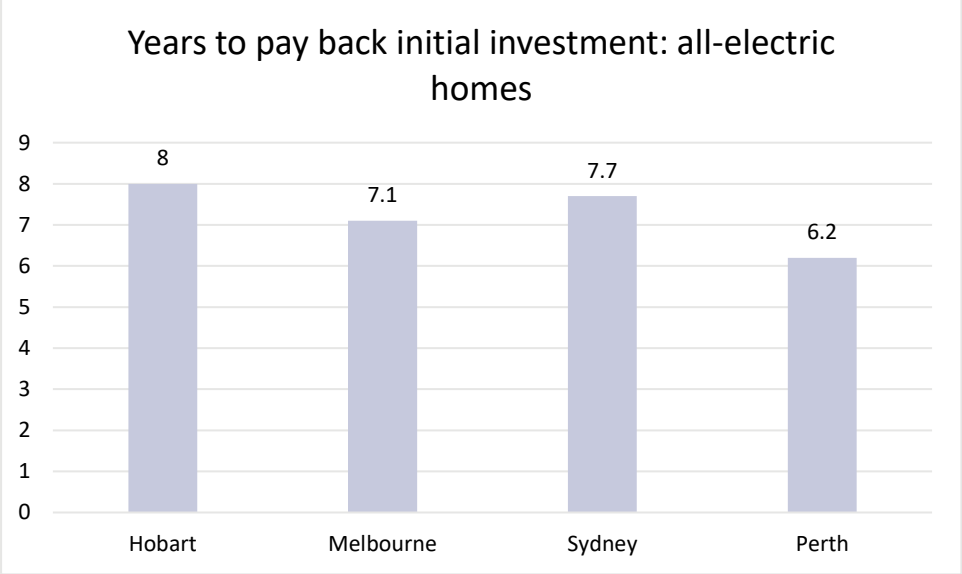


In all-electric homes, introducing a 7-Star rating, efficient appliances and large solar meant annual bill savings of $1,231 in Hobart, $1,056 in Melbourne, $1,203 in Sydney, and $1,357 in Perth.

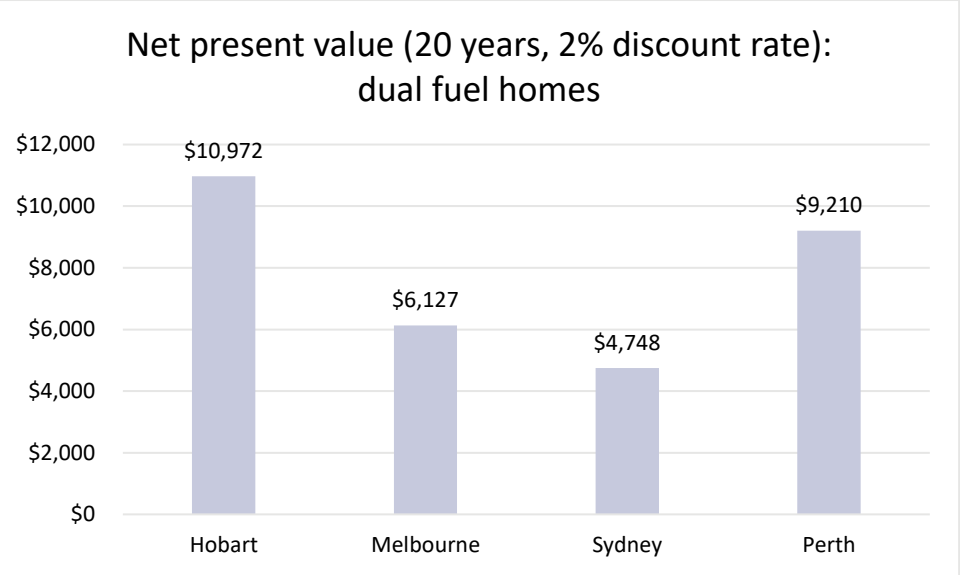


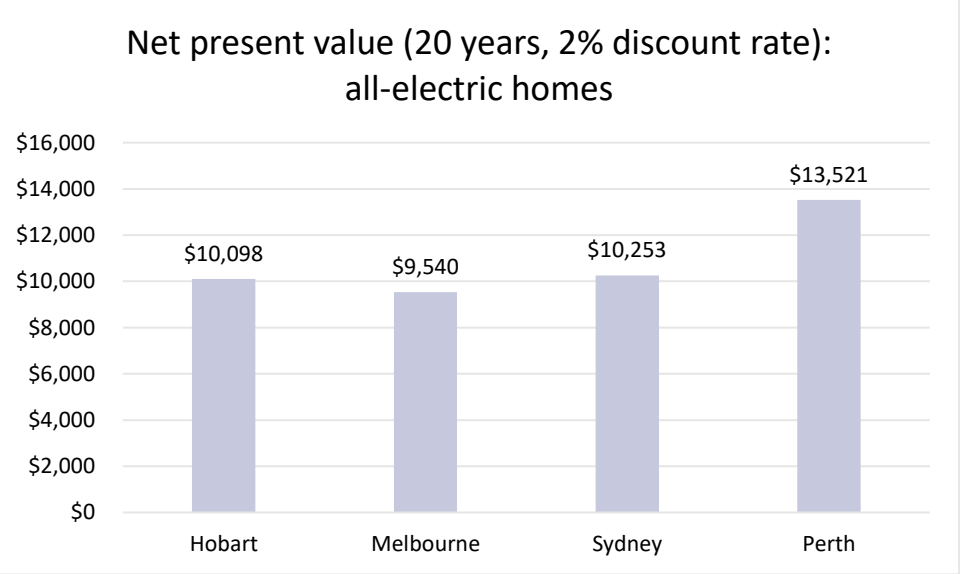
The savings on energy bills were found to pay back for the initial investment in higher energy performance over a number of years, with ongoing benefits into the long term:



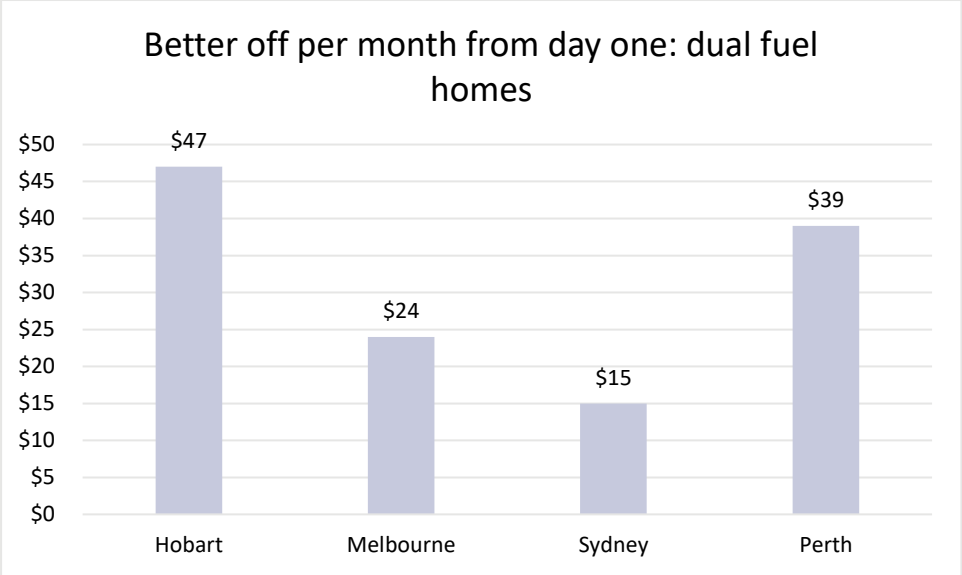


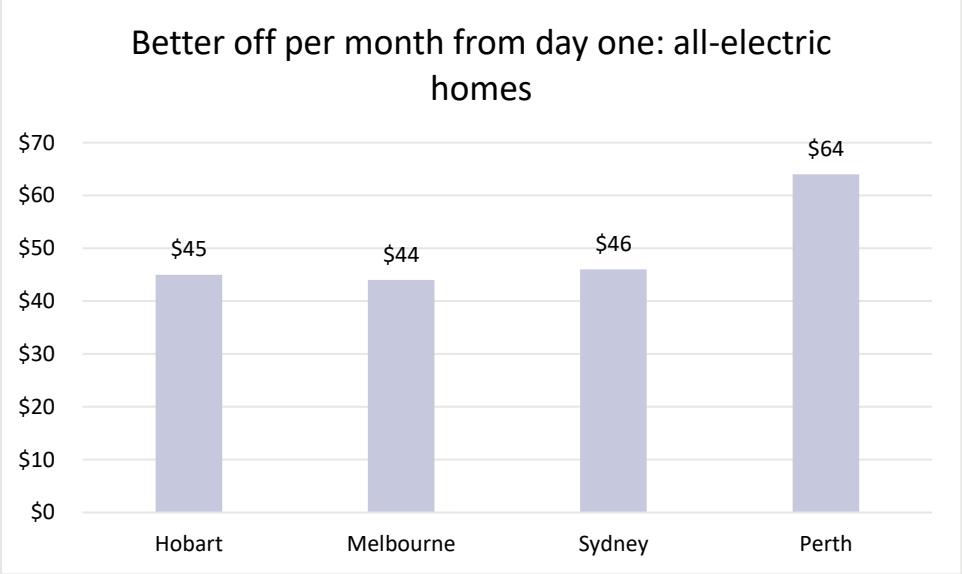
The economic value of the investment in better energy performance was found to stack up.



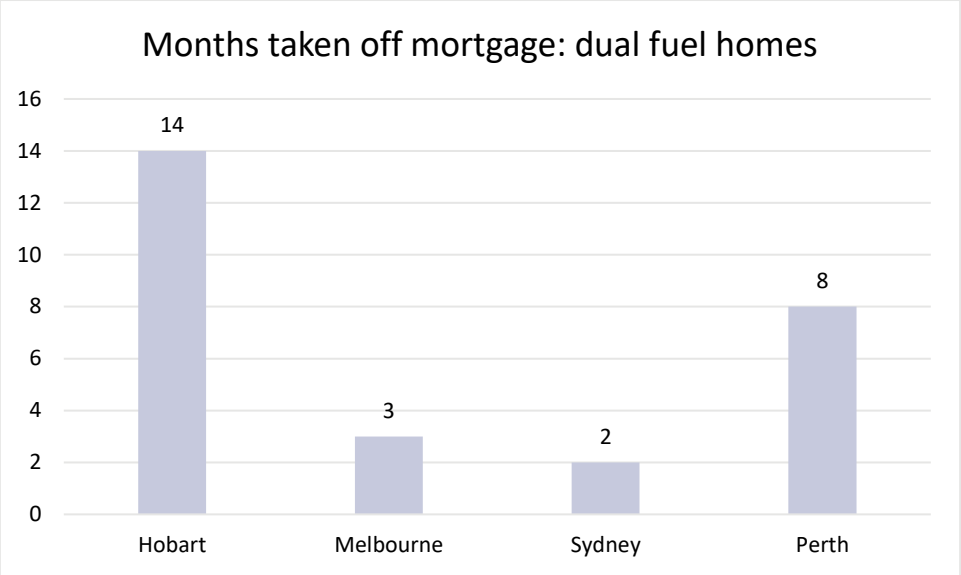


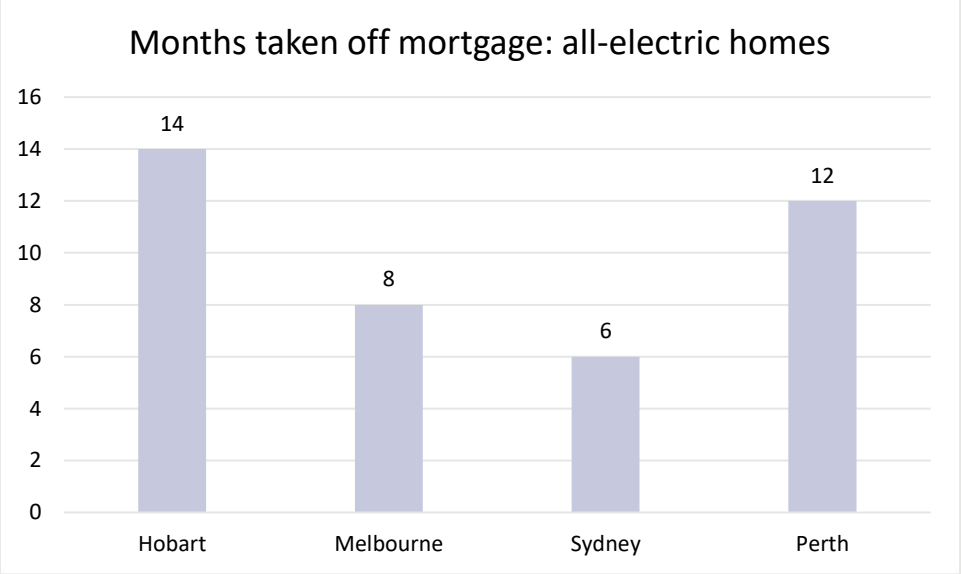
Even with the additional upfront costs of better energy performance added to the home loan, bill savings outweighed increases in monthly repayments – so households are better off from day one.



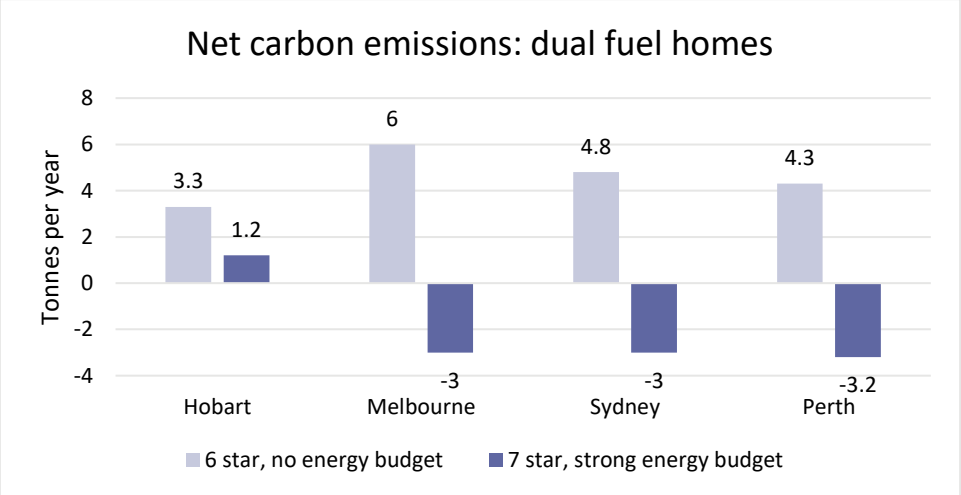


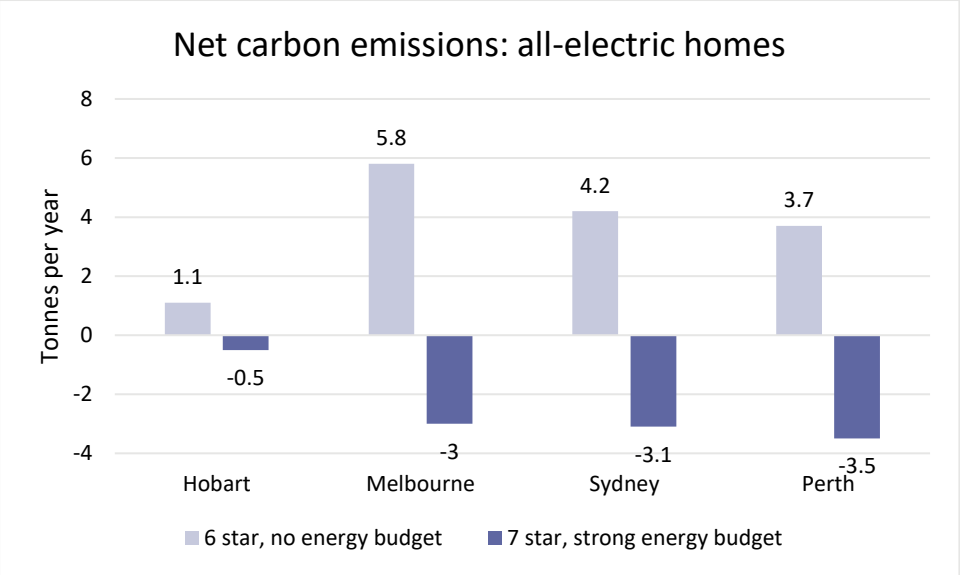
Households that choose to put the money they save into additional mortgage repayments can take months off their home loans with no impact on their cash flow when compared to business-as-usual.





Finally, introducing higher thermal efficiency standards and an energy budget would reduce household carbon emissions.




Net carbon emissions: all-electric homes
Tonnes per year
8
6
4
2
0
-2
-4
1.1
-0.5
5.8
-3
4.2
-3.1
3.7
-3.5
Hobart
Melbourne
Sydney
Perth
6 star, no energy budget
7 star, strong energy budget

2. Introduction

2.1. The National Construction Code

The National Construction Code (NCC) sets the minimum energy efficiency standards for new homes built in Australia.

The NCC is updated every 3 years, with the next update due to come into effect in 2022. The Code is developed by the Australian Building Codes Board; approved by state, territory and Commonwealth building ministers; and implemented and enforced by state and territory jurisdictions.

Since 2010, the minimum energy efficiency standard for new homes in most locations under the NCC is a 6-Star NatHERS rating (or equivalent).[1]

Minimum standards in the NCC have an important influence on how new homes are built. According to CSIRO figures, only 10% of houses and 32% of apartments are built to energy efficiency standards higher than those required by the Code.

In 2019, state, territory and commonwealth governments committed to improving energy efficiency standards for homes over the coming decade through the *Trajectory for Low Energy Buildings*. As a part of this commitment, work was commenced to lift the minimum thermal energy efficiency standard for new homes in 2022 to a 7-Star NatHERS rating.

Alongside the planned increase to 7-Star new homes, new rules are being considered that are set to introduce an 'energy budget' for new homes. This budget will consider overall energy use and factor in thermal efficiency, appliances, and onsite solar, allowing for the efficiency of different appliances and solar generation to be traded off against one another to fall within a mandatory limit.

From August 2021, public consultation will begin on the proposed new rules. By May 2022, Ministers will make a decision on whether to proceed with an increase in standards.

Two key questions are being considered. First, whether to increase the minimum NatHERS rating for new homes to 7 Stars. Second, whether to introduce an energy budget, and if so at what level. Two options for energy budgets are being prepared for public consultation: one is set at a basic level, and second is set at a stronger level that is 30% more stringent than the basic option.

2.2. Modelling household costs

Changes to energy efficiency standards have an impact on households. Requiring higher energy efficiency standards typically increases upfront costs due to construction costs and

[1] Homes in tropical humid areas (including Darwin and Cairns) are required to achieve only a 5-star NatHERS rating.

higher quality appliances, while reducing costs over the long term through reduced energy bills.

In this project, Renew has modelled the costs and benefits to households across a range of scenarios to examine the possible impacts of changes to the NCC.

We used Renew's simulation tool *Sunulator* to model household energy consumption and solar generation. *Sunulator* simulates the operation of heating and hot water appliances and energy production from solar PV systems on a daily basis, creating half-hourly consumption and generation data over a year to estimate how much solar generation will be consumed onsite versus exported. Updated climate data files are used to calculate heating and hot water requirements and soalr generation across the range of locations.

The tool allows for detailed configuration of appliances, thermal efficiency and solar generation. Energy consumption of heating and hot water appliances is calculated from the gas or electricity input required to generate the same heat energy output. The electricity required for fans and controllers of gas heaters is added to base electricity consumption for dual fuel scenarios.

Unlike FirstRate and AccuRate, Sunulator doesn't simulate heat flows to model a building's thermal performance. Instead it mimics such modelling by simulating the operation of air conditioners and reconciling total annual energy consumption to the results published by NatHERS.

In addition, there is a significant and growing number of real-world examples of higher efficiency, renewably-powered, all-electric homes and communities[2] that Renew can use to verify any modelling outputs. We are increasingly seeing real-world all-electric home examples perform better than predicted by Renew models, giving us greater confidence in these types of analyses.

We furthermore developed detailed cost profiles of home energy scenarios by calculating energy use alongside local energy tariffs, appliance costs and the upfront costs of thermal energy efficiency improvements during construction.

All modelling was conducted for a medium-large sized detached home (200 square metres).

Alongside our analysis of the impacts of energy budgets and fuel choice for households under various NCC scenarios, we also undertook modelling to examine the impact of raising NatHERS thermal shell efficiency ratings from 6 to 7. In order to do this, we compared the energy use and costs for pairs of homes that were identical other than NatHERS rating.

[2] Including: https://www.liveatthecape.com.au/ and https://www.thepaddockcastlemaine.com.au/

2.3. Outputs

By analysing the costs of upfront construction, appliance purchase, and energy usage, our modelling provides a number of key insights on how households fare under different energy efficiency scenarios.

Bills

We calculate annual energy bills (gas and electricity) across the different scenarios. Our results show the bill amount for gas and electricity separately, as well as a combined figure.

Payback period

The payback period on an upfront investment measures the period of time it takes for ongoing savings (in the form of reduced energy bills) it takes to equal the amount of additional money spent upfront. To find this figure, we simply divided the additional upfront costs of each scenario by the annual amount of savings on energy bills. Results are calculated with reference to the baseline scenario.

Net present value

Net present value (NPV) is a common metric used to compare ongoing financial benefits or inflows with total investment costs. A discount rate is applied over a given period of time to ascertain the benefits. We have selected a conservative 2% discount rate over a 20-year time period. A NPV greater than zero indicates that an investment is beneficial. Results are calculated with reference to the baseline scenario.

Better off per month

A key innovation of this report is that we directly compare the monthly cash flow of mortgage borrowers across our range of scenarios.

For each scenario, we calculate the expected monthly mortgage repayment, including increased costs of higher energy efficiency standards. (We have conservatively assumed a 25-year loan term at a 5% interest rate.)

We then calculated the expected monthly bill savings due to reduced energy consumption. If these savings are higher than the additional costs of monthly mortgage repayments, then households are better off overall.

For example, a borrower with mortgage repayments that are $20 per month higher than the baseline, but with energy bills that are $50 less than the baseline, is $30 per month better off from day one of their mortgage.

Results are calculated with reference to the baseline scenario.

Months saved off 25-year mortgage

This finding measures the impact on the life of a mortgage if a borrower uses their monthly savings to pay off their mortgage sooner.

To find this, we assume that the additional monthly cash flow (the 'better off per month' figure above) is used as an additional monthly mortgage repayment amount.

The effect of additional payments is that a mortgage is repaid sooner. We calculated the amount of time that would be taken off a 25-year home loan if this amount was repaid monthly as an additional payment.

Carbon emissions

To determine the carbon emissions of homes in each scenario, we calculated the total gas and electricity required to power each home and applied government emissions factors to calculate total annual carbon emissions associated with energy use.

To calculate the impact of solar PV, we assumed that energy generated onsite replaced energy purchased from the grid. We furthermore assumed that excess renewable energy generated onsite could be exported to the grid and reduced societal consumption.
The emissions impacts of the growth of distributed energy resources (DER) such as solar and the changing structure of the electricity grid have not been considered in this analysis but form an important policy context.

Embedded carbon emissions are not considered as a part of this analysis.

2.4. Locations

For the purposes of this report, we have selected four locations: Hobart, Melbourne, Sydney, and Perth. These locations were selected as major locations for housing construction that range across a number of climate zones.

The costs and benefits of energy efficiency improvements vary according to climate. For example, upfront construction costs may be higher in colder climates, but so too are bill savings on heating.

For each location we utilised local heating and cooling patterns, construction costs, energy tariffs, carbon intensity factors, and mortgage amounts. With minor exceptions based on availability, we assumed similar appliance selection in each location to allow for clear comparison. We note that the selection of certain appliances included in this report varies by location: for example, ducted gas heating is significantly more common in Victoria than in other states.

These locations represent a significant range of climate zones and housing markets. Nonetheless, we note that not all climate zones are represented in this modelling. Humid tropical climates including locations such as Darwin and Cairns (NatHERS climate zones 1 and 2) are not included in this report. At the time of writing, government consideration is being given to increasing minimum NatHERS ratings for new homes in these climates from 5 to 6 Stars. Further modelling of the costs and benefits of energy efficiency

improvements in these locations would be beneficial but is beyond the scope of the current report.

2.5. Scenarios

We selected six possible scenarios for energy efficiency and appliance selection to model a range of consumer outcomes.

The six scenarios were selected to correspond to potential NCC minimum standards and to demonstrate the costs and benefits of consumer choices within the parameters of the legal minimum standards.

Scenario 1: 6-Star baseline

Our baseline scenario represents business as usual. This scenario measures a home with a NatHERS rating of 6 Stars, along with a typical mix of electric and gas appliances and no solar PV.

Scenario 2: 7-Star dual fuel (no energy budget)

This scenario has an identical configuration of appliances as scenario one, but with the NatHERS thermal efficiency rating increased to 7 Stars. Comparing this scenario with scenario one shows the difference resulting from increased thermal shell ratings alone, without other efficiency improvements or solar.

Scenario 3: 7-Star dual fuel (basic energy budget)

This scenario represents what we believe to be a likely configuration of thermal shell and appliances for a 7-Star home with a basic energy budget, as being considered as a minimum for the 2022 NCC. Alongside the 7-Star rating, it differs from the first two scenarios with heat pump cooling in place of evaporative cooling, and a small solar PV system (3.5kW).

Scenario 4: 7-Star dual fuel (strong energy budget)

This scenario represents what we believe to be a likely configuration for the stronger energy budget option under consideration. Energy budget scores are improved over scenario 3 with more efficient heat pump cooling and a larger solar PV system (6.6kW).

Scenario 5: 7-Star efficient all-electric

This 7-Star rated scenario exchanges all gas appliances for electric, meaning that no gas connection is required. Heat pumps are used for heating and cooling, alongside induction cooking. A 6.6kW solar PV system is included. This scenario would be compliant with all NCC options under consideration, although the Code is ‘fuel-neutral’ and does not mandate all-electric appliances.

Scenario 6: 7.5-Star efficient all-electric

Scenario 6 goes beyond the requirements of the proposed NCC by including all-electric appliances and solar identical to scenario 5, but also increased NatHERS thermal efficiency ratings of 7.5.

	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5	SCENARIO 6
Description	6-Star dual fuel (baseline)	7-Star dual fuel	7-Star dual fuel (basic energy budget)	7-Star dual fuel (strong energy budget)	7-Star all-electric	7.5-Star all-electric
NatHERS rating	6	7	7	7	7	7.5
Hot water	Gas instantaneous	Gas instantaneous	Gas instantaneous	Gas instantaneous	Heat pump	Heat pump
Heating	Gas *	Gas *	Gas *	Gas *	Heat pump	Heat pump
Cooling	Evaporative	Evaporative	Heat pump (3 star)	Heat pump (5.5 star)	Heat pump (5.5 star)	Heat pump (5.5 star)
Cooking	Gas	Gas	Gas	Gas	Induction	Induction
Other appliances	Electric	Electric	Electric	Electric	Electric	Electric
Solar	None	None	3.5 kW	6.6 kW	6.6 kW	6.6 kW

* fixed gas furnace heating assumed in Hobart, Sydney and Perth. Ducted gas heating assumed in Melbourne.

Comparison of baseline with strong energy budgets

Alongside our analysis of various scenarios above, we furthermore conducted a separate comparison between homes representing the status quo with homes that represent the strongest proposed changes under the National Construction Code. To do this, we directly compared a 6-Star home with no energy budget (including basic appliances and no solar) with a 7-Star home with a strong energy budget (including efficient appliances and large solar PV systems).

To demonstrate the impacts of the code without including impacts of fuel choice, we undertook this comparison twice: once comparing dual fuel homes, and once comparing all-electric homes. The results of these comparisons are shown in the summary section of this report.

The appliance and solar configuration used in this modelling was selected prior to the release of full draft standards for the NCC. The exact efficiency levels and size of solar PV required to meet Code standards may vary from those selected.

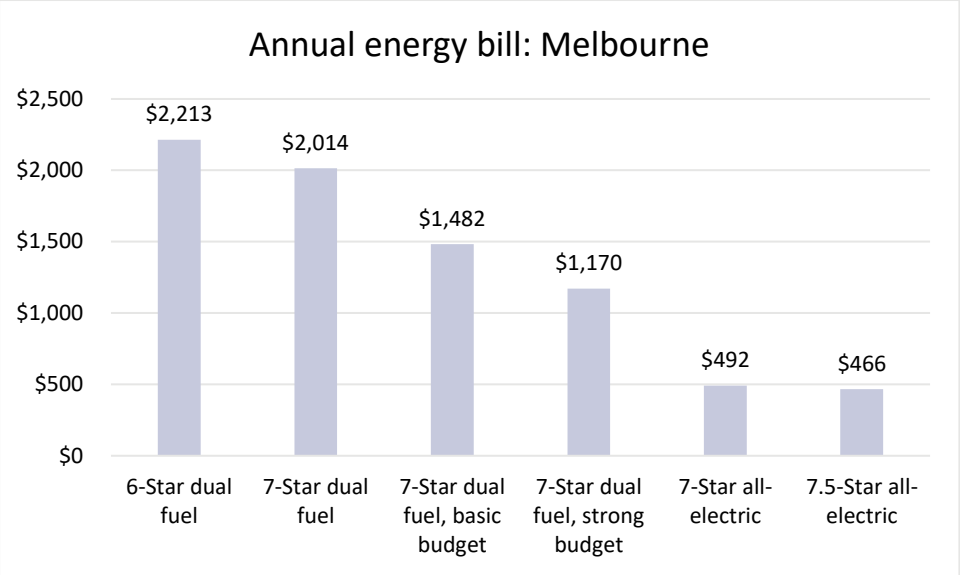
	SCENARIO A	SCENARIO B	SCENARIO C	SCENARIO D
Description	6-Star dual fuel (no energy budget)	7-Star dual fuel (strong energy budget)	6-Star all-electric (no energy budget)	7-Star all-electric (strong energy budget)
NatHERS rating	6	7	7	7
Hot water	Gas instantaneous	Gas instantaneous	Heat pump	Heat pump
Heating	Gas	Gas	Heat pump (basic)	Heat pump (efficient)
Cooling	Evaporative	Heat pump (efficient)	Heat pump (basic)	Heat pump (efficient)
Cooking	Gas	Gas	Induction	Induction
Other appliances	Electric	Electric	Electric	Electric
Solar	None	6.6 kW	None	6.6 kW

3. Results

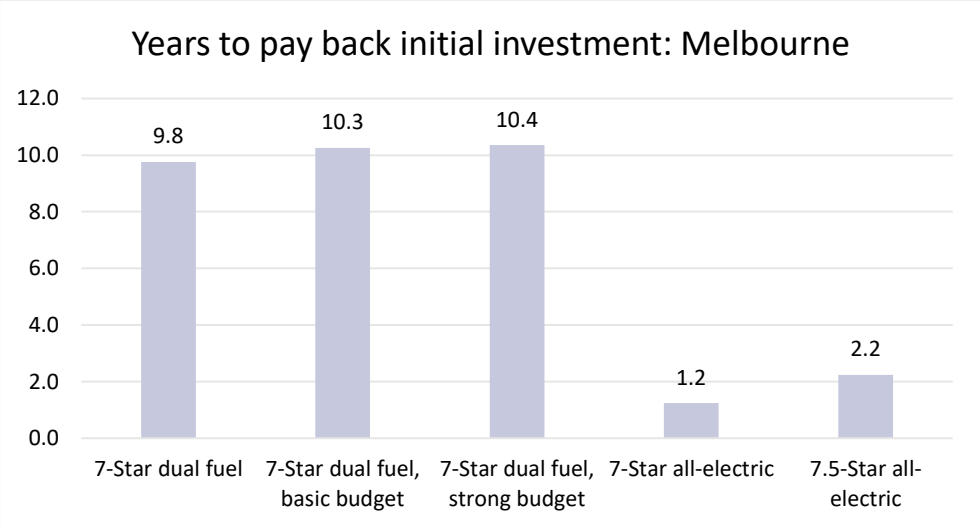
3.1. Melbourne

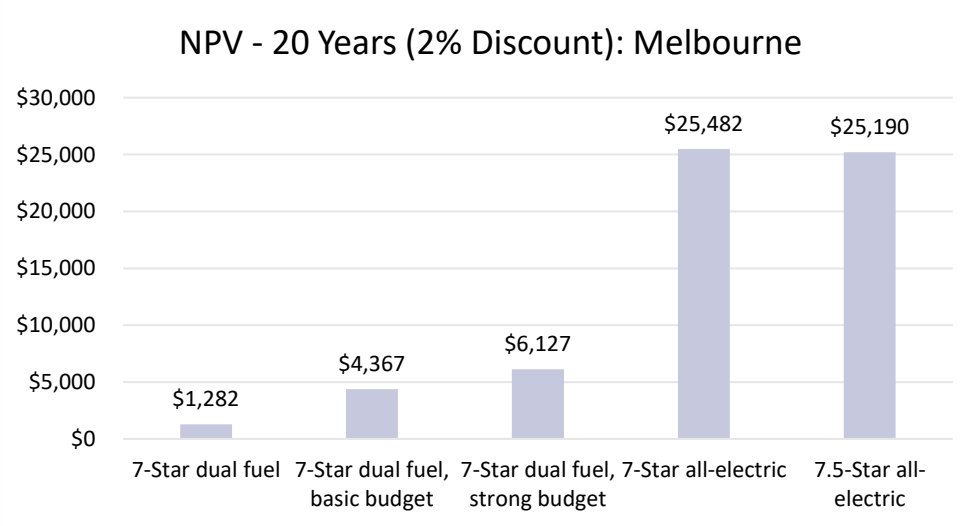
The total annual energy use and bills of each scenario in Melbourne are as follows:

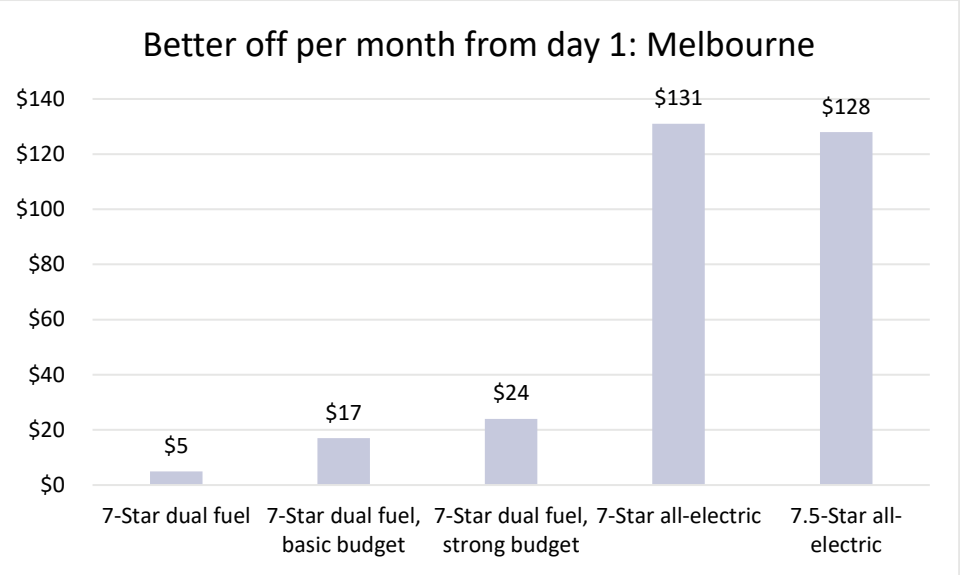
SCENARIO	6-STAR DUAL FUEL	7-STAR DUAL FUEL	7-STAR DUAL FUEL, BASIC ENERGY BUDGET	7-STAR DUAL FUEL, STRONG ENERGY BUDGET	7-STAR ALL-ELECTRIC	7.5-STAR ALL-ELECTRIC
Average daily gas use (MJ)	96.9	74.6	74.6	74.6	0	0
Annual gas bill ($)	$1032	$853	$853	$853	0	0
Average daily electricity import (kWh)	11.06	10.79	7.00	6.70	8.10	7.81
Average daily electricity export (kWh)	0	0	8.96	19.02	16.7	16.65
Annual electricity bill ($)	$1,255	$1,235	$703	$391	$492	$466
Total annual energy bill	**$2,287**	**$2,089**	**$1,556**	**$1,245**	**$492**	**$466**
Annual bill savings from business as usual	-	*$199*	*$731*	*$1,043*	*$1,795*	*$1,821*
% savings from business as usual	-	*9%*	*32%*	*46%*	*78%*	*80%*

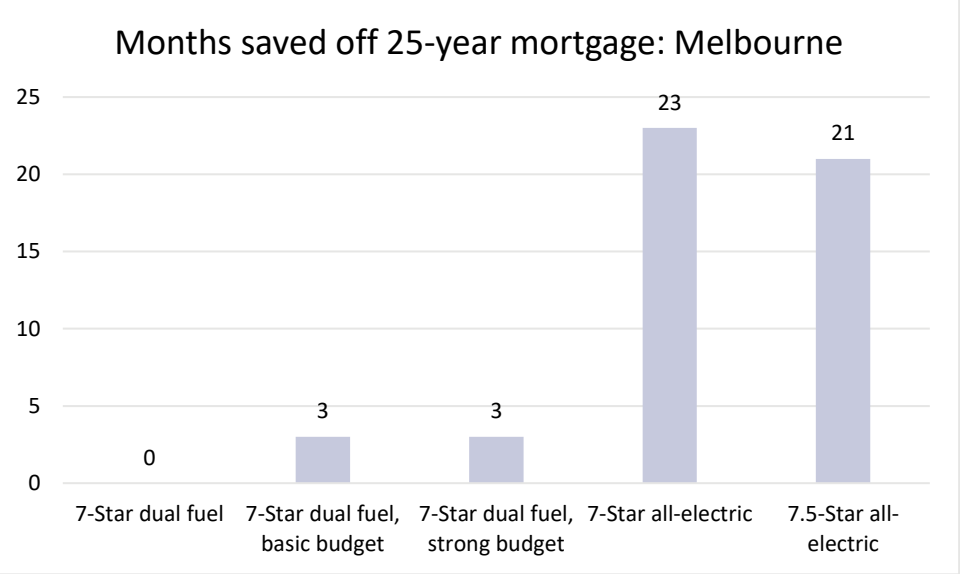


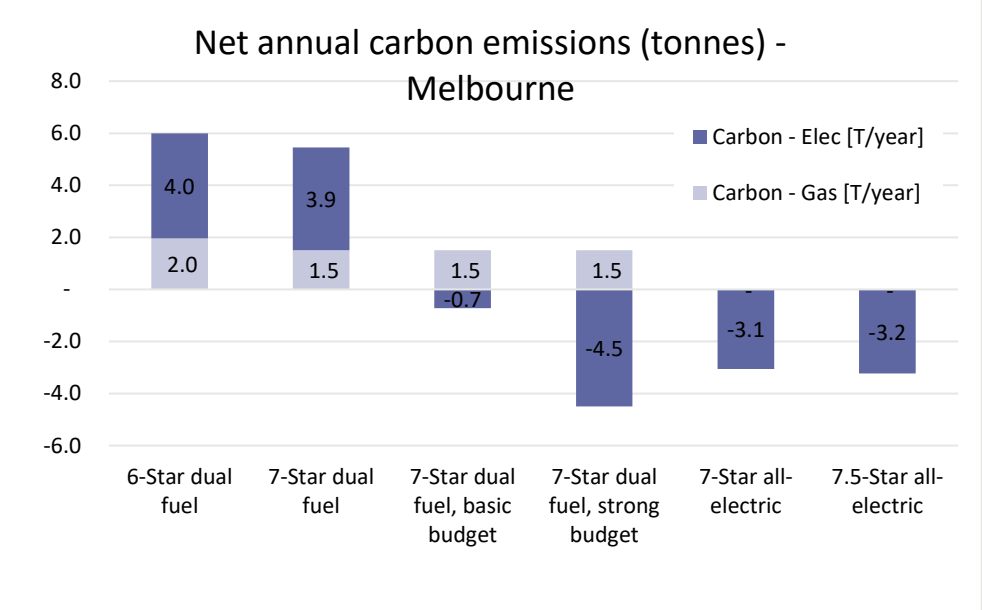
Further findings are presented as follows:






Better off per month from day 1: Melbourne
$140
$120
$100
$80
$60
$40
$20
$0
$5
$17
$24
$131
$128
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric

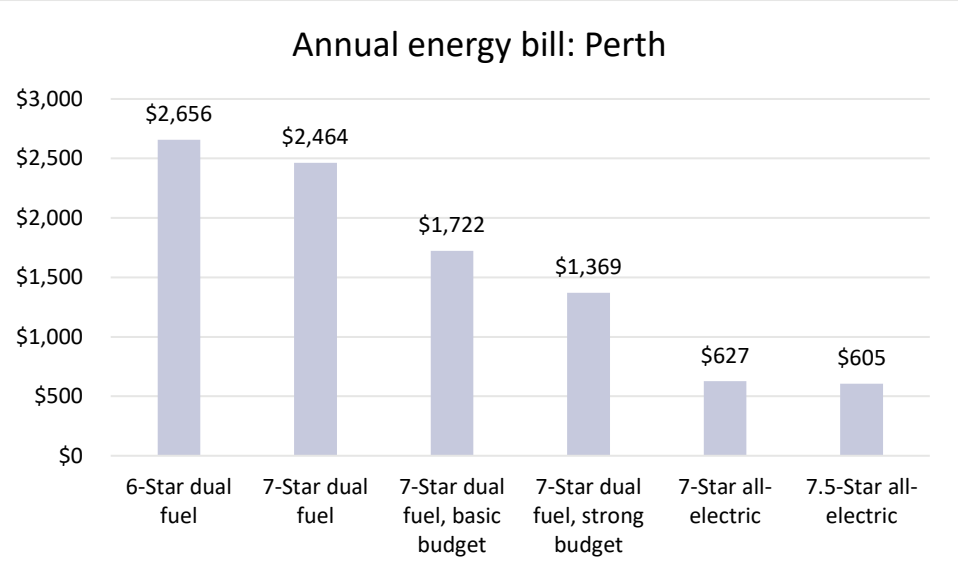

Months saved off 25-year mortgage: Melbourne
25
20
15
10
5
0
0
3
3
23
21
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric


Net annual carbon emissions (tonnes) - Melbourne
8.0
6.0
4.0
2.0
-
-2.0
-4.0
-6.0
Carbon - Elec [T/year]
Carbon - Gas [T/year]
4.0
2.0
3.9
1.5
1.5
-0.7
1.5
-4.5
-3.1
-3.2
6-Star dual fuel
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric

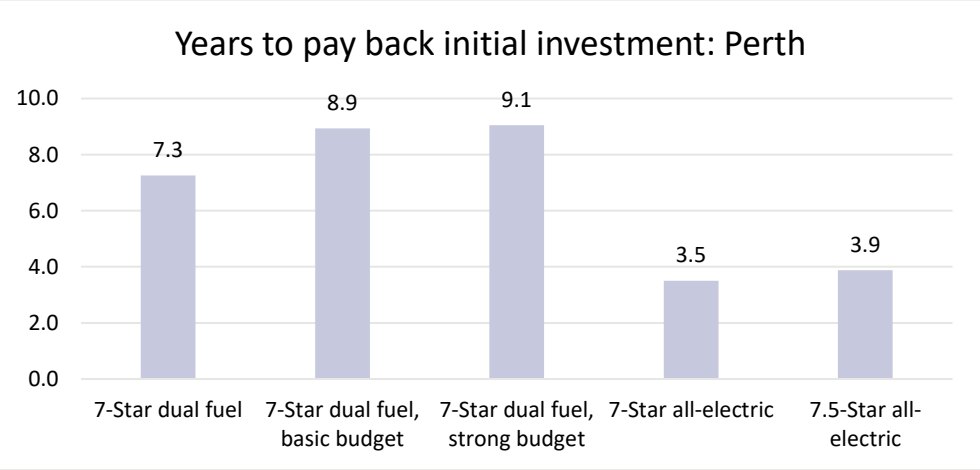
3.2. Perth

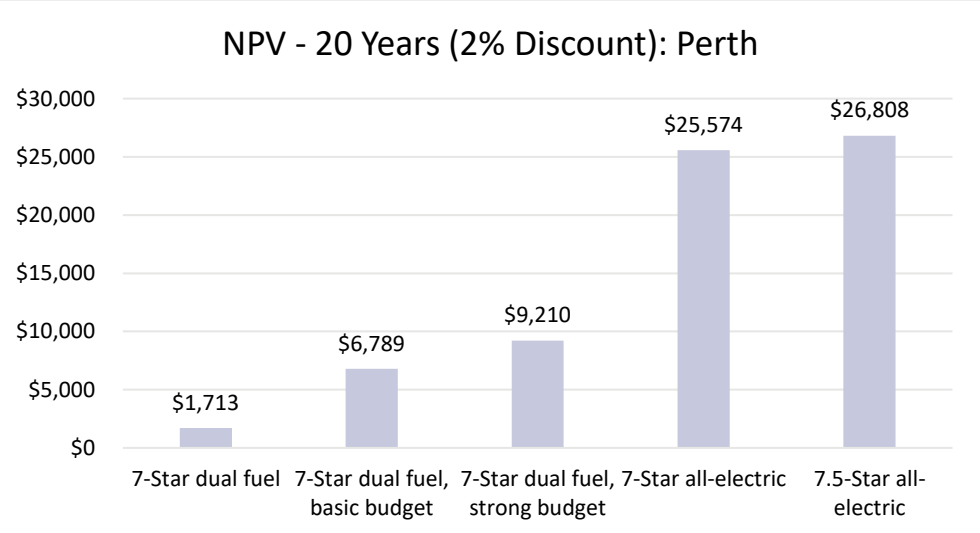
The total annual energy bills of each scenario in Perth are as follows:

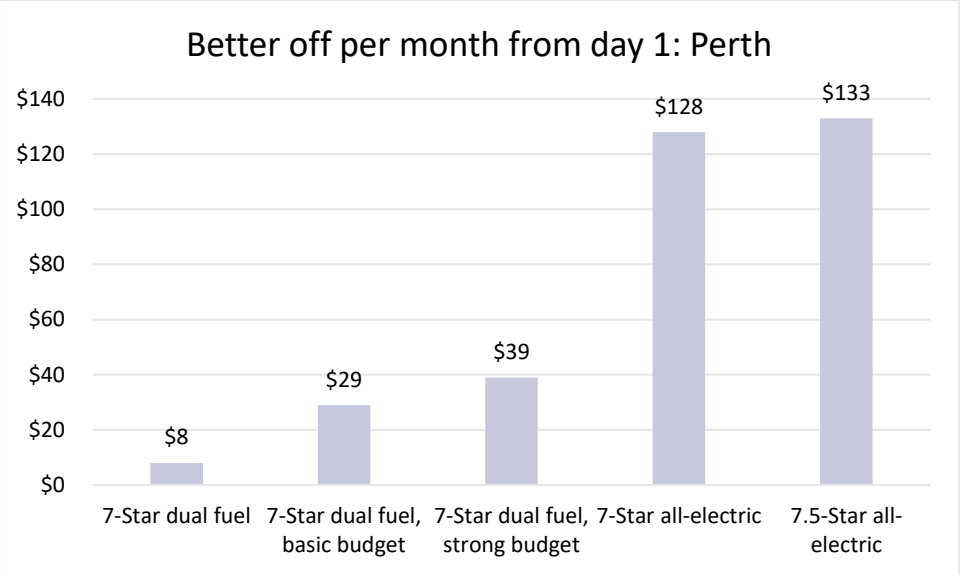
SCENARIO	6-STAR DUAL FUEL	7-STAR DUAL FUEL	7-STAR DUAL FUEL, BASIC ENERGY BUDGET	7-STAR DUAL FUEL, STRONG ENERGY BUDGET	7-STAR ALL-ELECTRIC	7.5-STAR ALL-ELECTRIC
Average daily gas use (MJ)	60.6	51.5	51.5	51.5	0	0
Annual gas bill ($)	$984	$847	$847	$847	0	0
Average daily electricity import (kWh)	12.04	11.52	7.34	7.04	7.55	7.38
Average daily electricity export (kWh)	0	0	11.37	23.75	21.82	21.96
Annual electricity bill ($)	$1,813	$1,758	$1,015	$662	$627	$605
Total annual energy bill	**$2,797**	**$2,605**	**$1,863**	**$1,510**	**$627**	**$605**
Annual bill savings from business as usual	-	*$192*	*$934*	*$1,287*	*$2,170*	*$2,192*
% savings from business as usual	-	*7%*	*33%*	*46%*	*78%*	*78%*

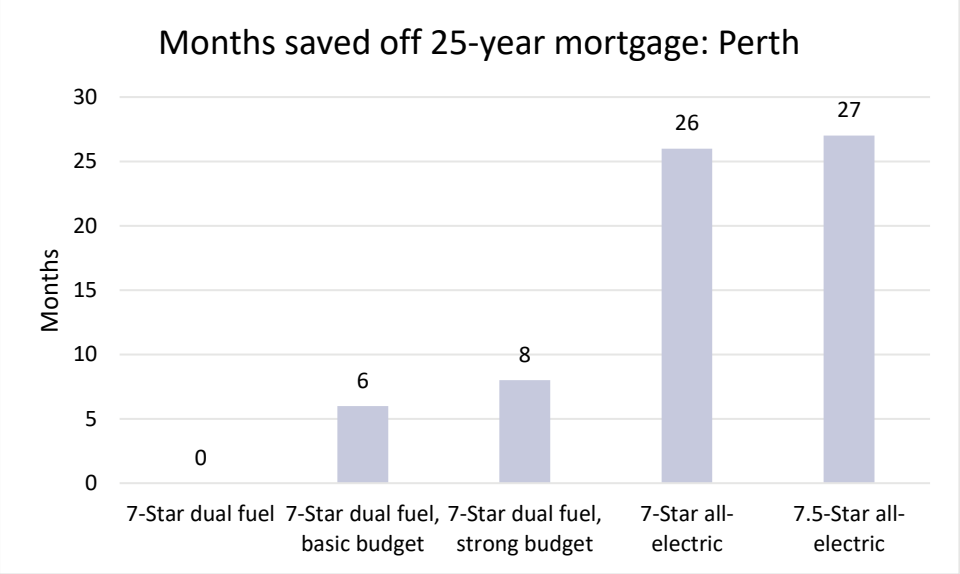


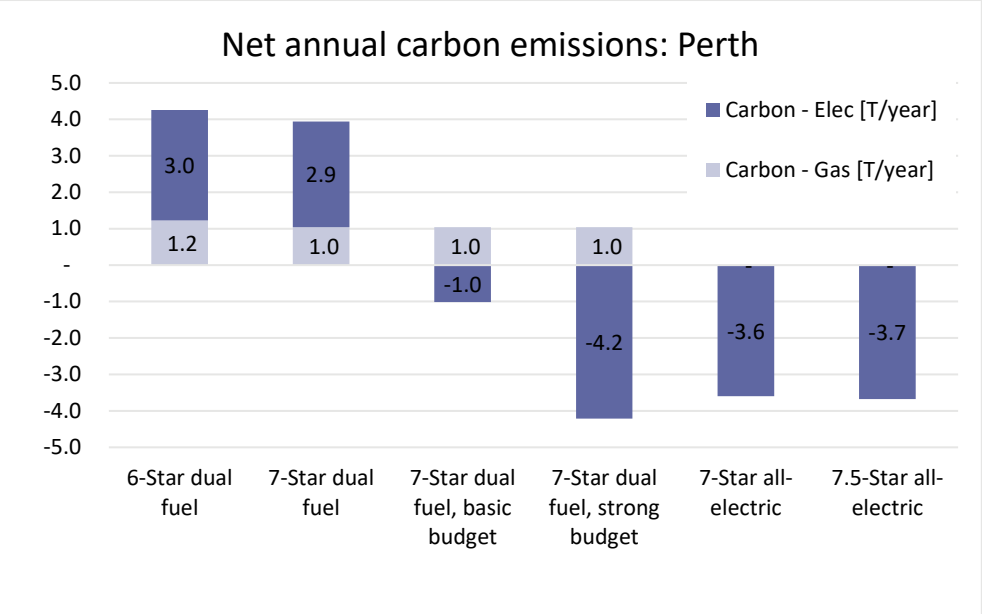
Further findings are presented as follows:






Better off per month from day 1: Perth
$140
$120
$100
$80
$60
$40
$20
$0
$8
$29
$39
$128
$133
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric

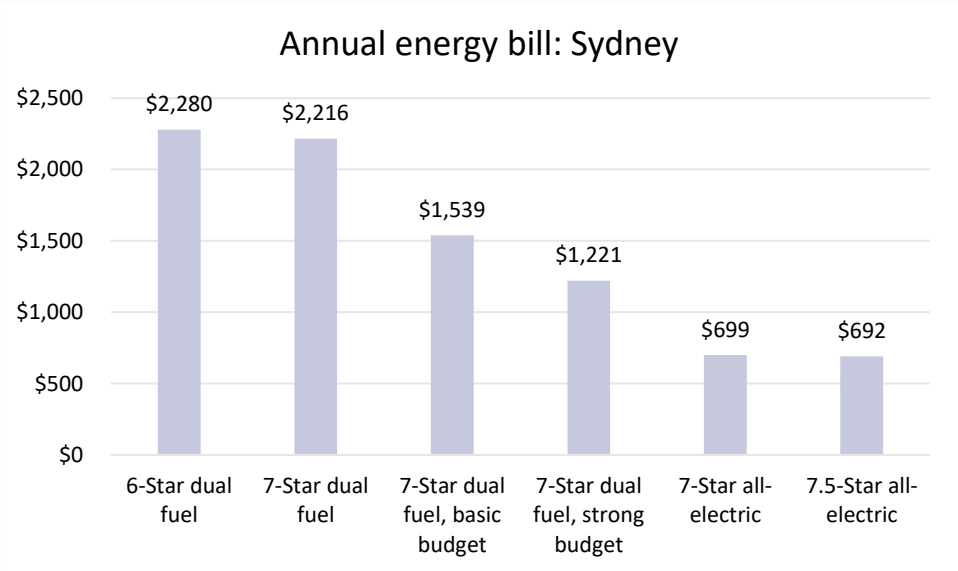

Months saved off 25-year mortgage: Perth
Months
30
25
20
15
10
5
0
0
6
8
26
27
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric


Net annual carbon emissions: Perth
5.0
4.0
3.0
2.0
1.0
-
-1.0
-2.0
-3.0
-4.0
-5.0
Carbon - Elec [T/year]
Carbon - Gas [T/year]
3.0
1.2
2.9
1.0
1.0
-1.0
1.0
-4.2
-3.6
-3.7
6-Star dual fuel
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric

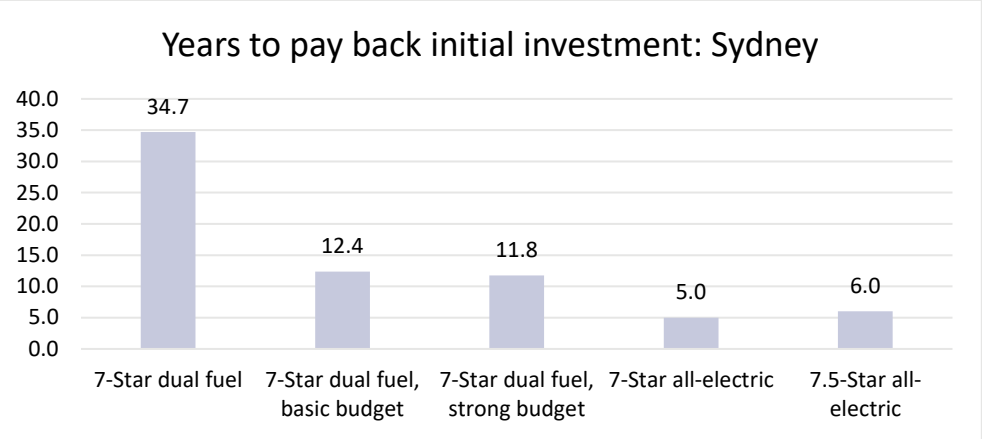
3.3. Sydney

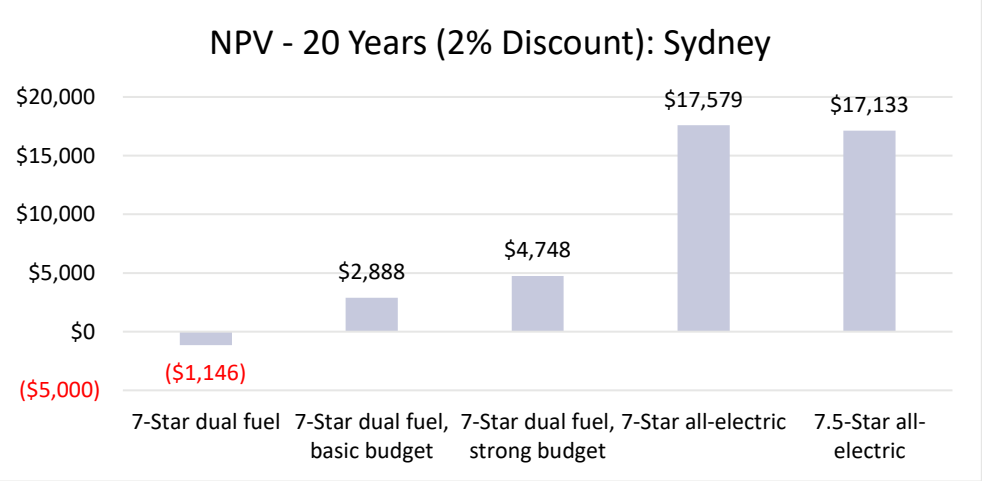
The total annual energy usage and bills of each scenario in Sydney are as follows:

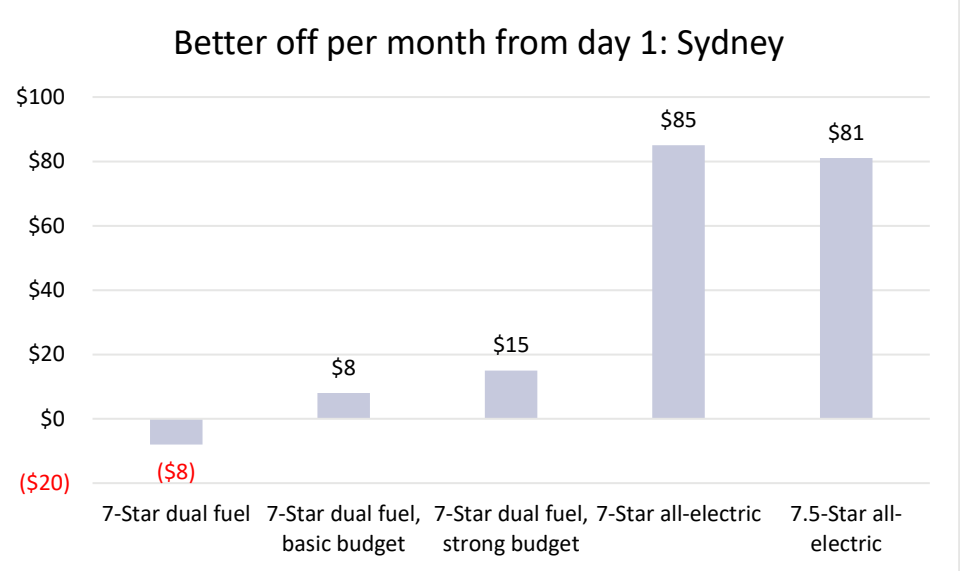
SCENARIO	6-STAR DUAL FUEL	7-STAR DUAL FUEL	7-STAR DUAL FUEL, BASIC ENERGY BUDGET	7-STAR DUAL FUEL, STRONG ENERGY BUDGET	7-STAR ALL-ELECTRIC	7.5-STAR ALL-ELECTRIC
Average daily gas use (MJ)	56.0	51.8	51.8	51.8	0	0
Annual gas bill ($)	$720	$683	$683	$683	0	0
Average daily electricity import (kWh)	11.08	10.84	7.00	6.64	7.65	7.60
Average daily electricity export (kWh)	0	0	9.55	20.13	18.25	18.32
Annual electricity bill ($)	$1,660	$1,633	$956	$638	$699	$692
Total annual energy bill	**$2,380**	**$2,317**	**$1,639**	**$1,321**	**$699**	**$692**
Annual bill savings from business as usual	-	*$64*	*$741*	*$1,059*	*$1,681*	*$1,688*
% savings from business as usual	-	*3%*	*31%*	*44%*	*71%*	*71%*

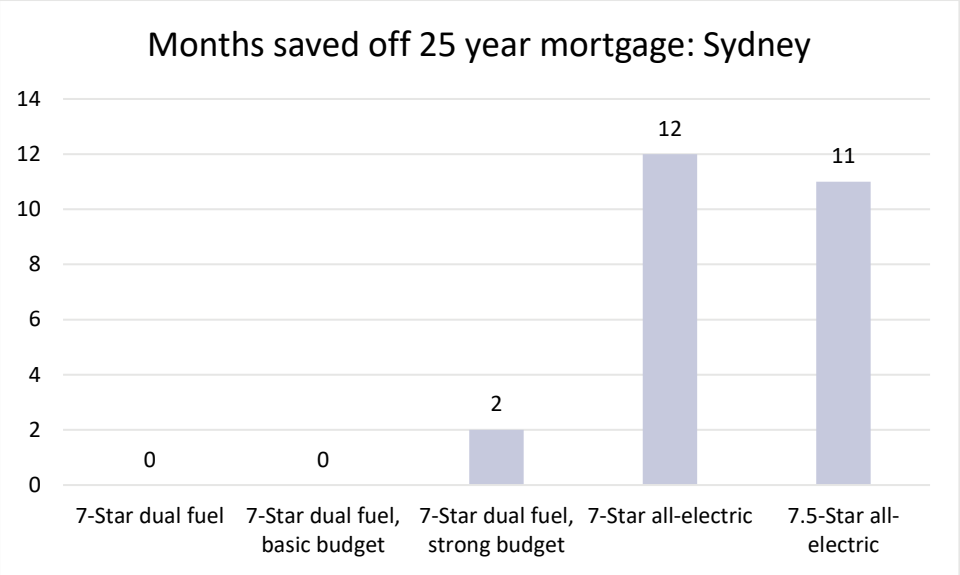


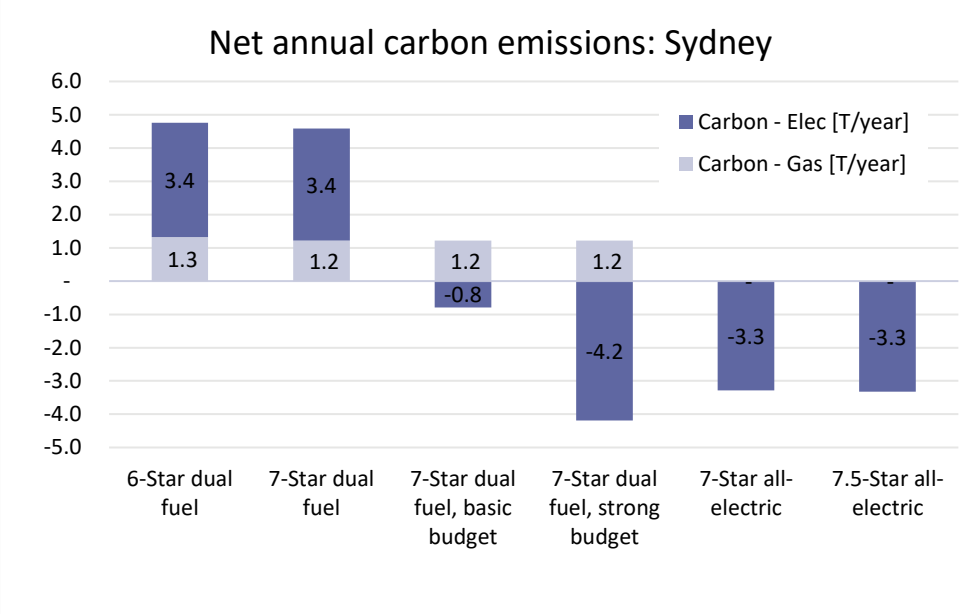
Further findings for Sydney scenarios are presented as follows:







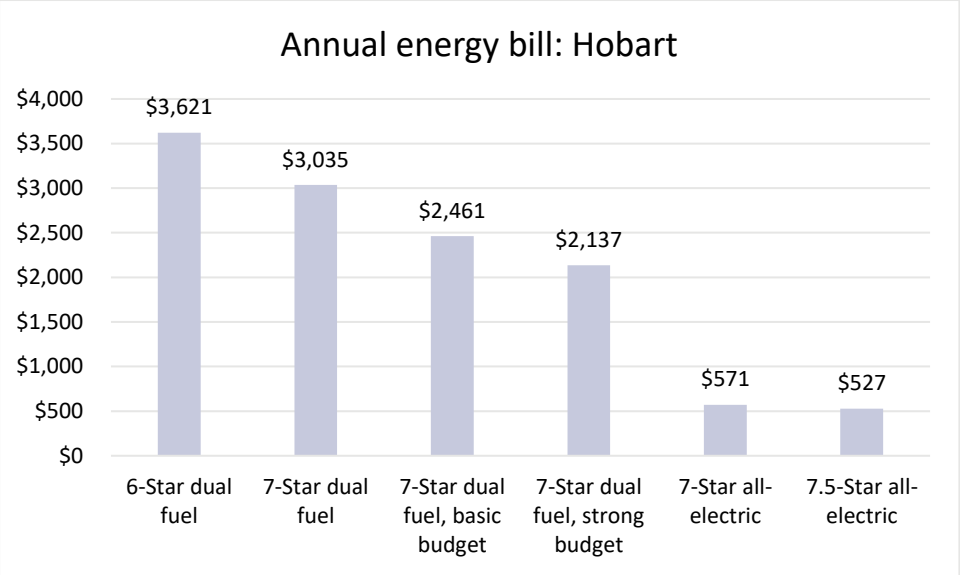

Months saved off 25 year mortgage: Sydney
14
12
10
8
6
4
2
0
0
0
2
12
11
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric


Net annual carbon emissions: Sydney
6.0
5.0
4.0
3.0
2.0
1.0
-
-1.0
-2.0
-3.0
-4.0
-5.0
Carbon - Elec [T/year]
Carbon - Gas [T/year]
3.4
1.3
3.4
1.2
1.2
-0.8
1.2
-4.2
-3.3
-3.3
6-Star dual fuel
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric

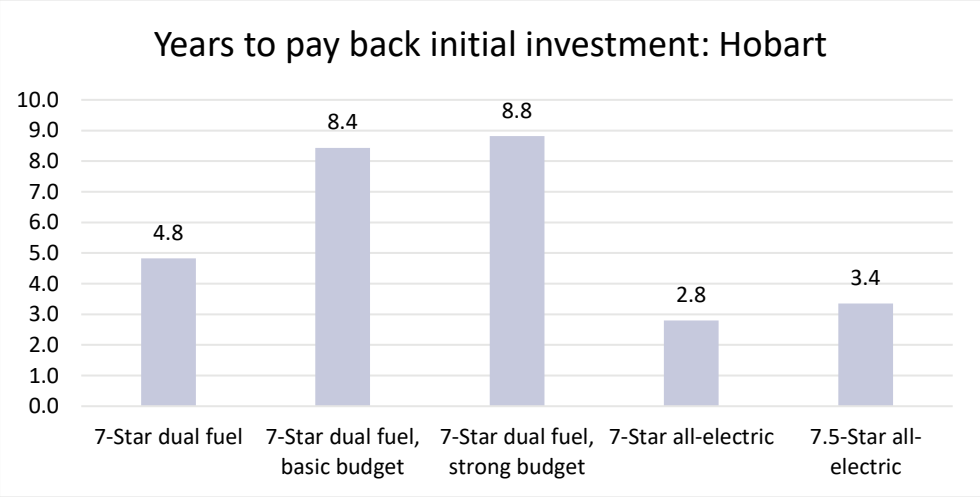
3.4. Hobart

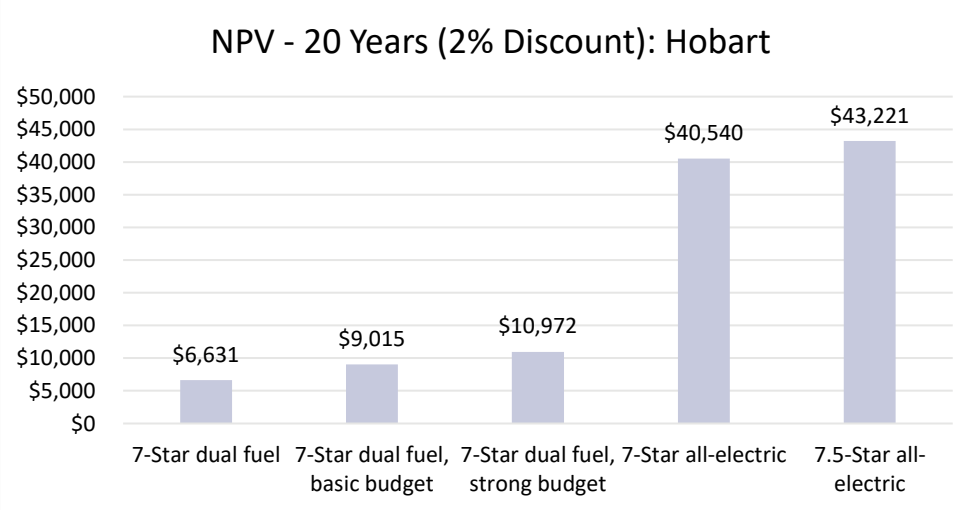
The total annual energy usage and bills of each scenario in Hobart are as follows:

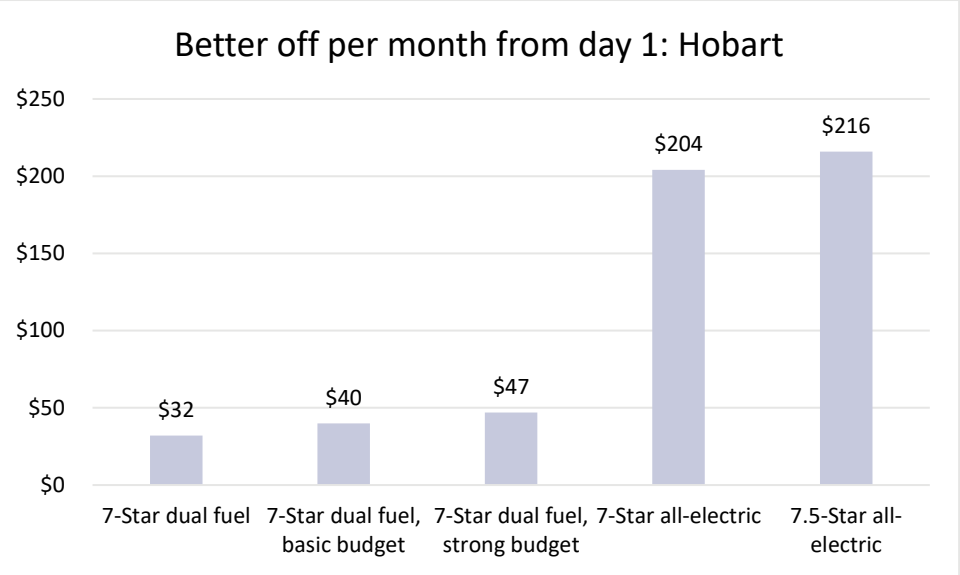
SCENARIO	6-STAR DUAL FUEL	7-STAR DUAL FUEL	7-STAR DUAL FUEL, BASIC ENERGY BUDGET	7-STAR DUAL FUEL, STRONG ENERGY BUDGET	7-STAR ALL-ELECTRIC	7.5-STAR ALL-ELECTRIC
Average daily gas use (MJ)	135.6	96.3	96.3	96.3	0	0
Annual gas bill ($)	$2,175	$1,602	$1,602	$1,602	0	0
Average daily electricity import (kWh)	13.44	13.27	9.51	9.26	8.59	8.12
Average daily electricity export (kWh)	0	0	9.21	19.49	16.44	16.64
Annual electricity bill ($)	$1,743	$1,729	$1,155	$831	$571	$527
Total annual energy bill	**$3,918**	**$3,332**	**$2,758**	**$2,434**	**$571**	**$527**
Annual bill savings from business as usual	-	*$587*	*$1,161*	*$1,485*	*$3,348*	*$3,391*
% savings from business as usual	-	*15%*	*30%*	*38%*	*85%*	*87%*

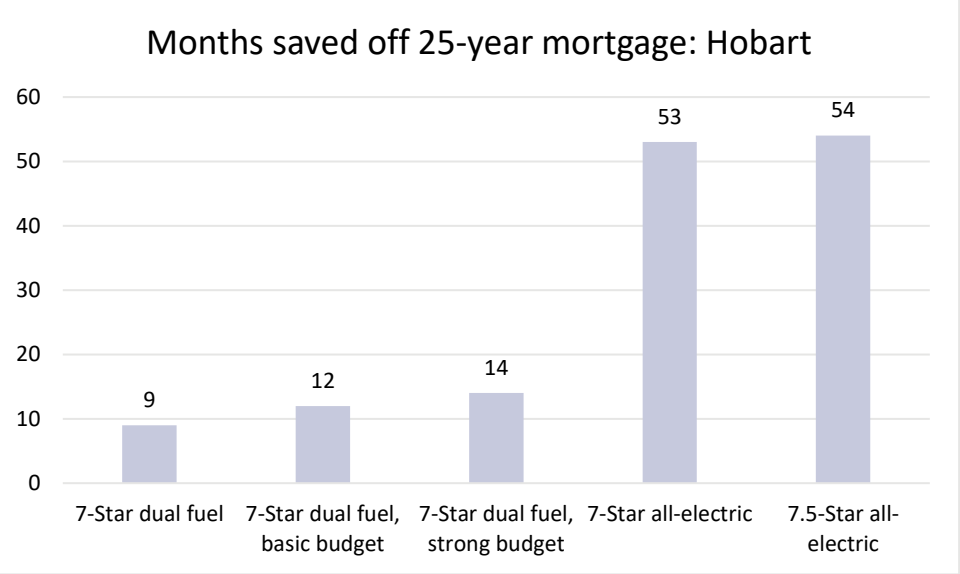


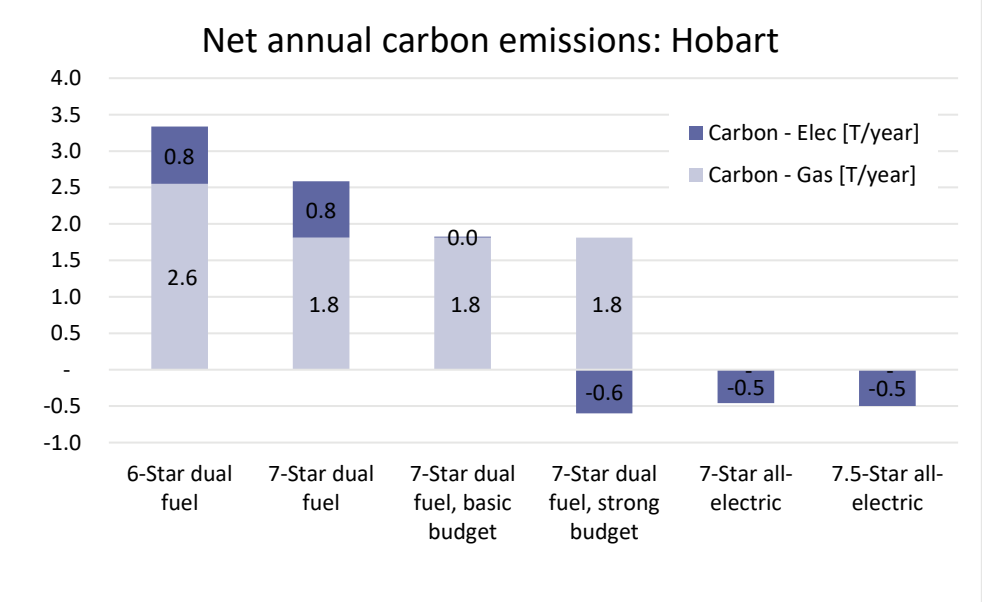
Further findings are presented as follows:






Better off per month from day 1: Hobart
$250
$200
$150
$100
$50
$0
$32
$40
$47
$204
$216
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric


Months saved off 25-year mortgage: Hobart
60
50
40
30
20
10
0
9
12
14
53
54
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric


Net annual carbon emissions: Hobart
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-
-0.5
-1.0
Carbon - Elec [T/year]
Carbon - Gas [T/year]
0.8
2.6
0.8
1.8
0.0
1.8
1.8
-0.6
-0.5
-0.5
6-Star dual fuel
7-Star dual fuel
7-Star dual fuel, basic budget
7-Star dual fuel, strong budget
7-Star all-electric
7.5-Star all-electric

4. Data and assumptions

In this section we provide further details on the input data used for modelling.

4.1. Thermal build-cost premium

The additional cost of construction for homes performing above the baseline 6-Star NatHERS rating has been calculated using cost figures provided by the ABCB. The ABCB has provided a per-metre estimate of additional costs to achieve a 7-Star rating compared to a 6-Star rating in each location. These figures are expected to be used in formal government modelling for the NCC and broadly conform to our expectations based on industry examples. Under a performance rating framework, increases in thermal rating can be achieved through a range of features and as such consumer and builder choices can affect the cost premium of achieving a given rating.

For the purposes of assessing the additional premium cost associated with the 7.5-Star scenario 6, we assumed a premium double that of the 7-Star scenarios.

LOCATION	COST PER M^2 – 7 STARS	COST FOR 200M^2 HOME	COST PER M^2 – 7.5 STARS	COST FOR 200M^2 HOME
Hobart	$14.14	$2,828	$28.28	$5,656
Melbourne	$9.69	$1,938	$19.38	$3,876
Sydney	$11.05	$2,210	$22.10	$4,420
Perth	$6.98	$1,396	$13.96	$2,792

4.2. Tariffs

Gas and electricity tariffs were sought from major retail providers in each location. Flat tariffs were assumed. The following electricity and gas tariffs were applied:

LOCATION	ELECTRICITY PRICE ($/KWH)	ELECTRICITY DAILY SUPPLY CHARGE	GAS PRICE ($/MJ)	GAS DAILY SUPPLY CHARGE	ELECTRICITY FEED-IN TARIFF ($/KWH)
Hobart	$0.2200	$1.01	$0.0399	$0.55	$0.08
Melbourne	$0.1980	$1.05	$0.0220	$0.70	$0.08
Sydney	$0.3040	$0.90	$0.0240	$0.63	$0.07
Perth	$0.2933	$1.05	$0.0408	$0.22	$0.07

4.3. Appliance costs

To calculate the additional capital expenditure required for each scenario, we included the purchase and installation costs of a range of fixed appliances, including heating, cooling,

hot water, cooking and solar. The costs of these appliances were sourced from online searches, direct information from suppliers, and existing Renew research. For the majority of scenarios the appliance selection was kept identical across the four locations. The major exception was that ducted gas heating was assumed for Melbourne, while wall furnace gas heating was assumed in other states.

The capital expenditure figures do not include unfixed appliances.

Solar

Solar PV systems including installation were assumed to cost $4,500 for 3.5kW systems and $7,000 for 6.6kW systems in all locations. In Melbourne we included a Victorian solar rebate of $1,400; no rebates were applied in other states.

Gas heating

In Melbourne, ducted gas heating was assumed. Based on industry interviews, we modelled the Brivis CC320I 7 OTL, with a purchase price of $3,000 and an installation price of $6,000, for a total capital expenditure of $9,000.

In Hobart, Perth and Sydney, wall furnace gas heating was assumed. We assumed four heating units required in total, including main living area and bedrooms. Based on industry interviews and previous Renew research, we have assumed a total capital expenditure for purchase and installation of $4,900.

Cooling

We modelled evaporative and heat pump cooling options (with heat pump units being used for heating as well as cooling in the all-electric scenarios). We assumed non-ducted heat pump systems, requiring one large unit in the living area and three smaller units in bedrooms. Based on online research and previous Renew research, we selected the following models:

TYPE	MODEL	HEAT KW	COOL KW	PRICE	INSTALL COST	TOTAL PRICE
Heat pump (large)	Mitsubishi Heavy Industries SRK63ZRA-W	7.1	6.3	$1,569	$800	$2,369
Heat pump (small)	Mitsubishi Heavy Industries SRK20ZSXA-W	2.7	2	$1,190	$650	$1,840
Evaporative	Promina P46			$2,630	$2,000	$4,630

One installation cost was included for full-house installation of evaporative cooling, while we included an installation cost for each heat pump unit (a total of four units). As such, the total cost for cooling capital expenditure in scenarios with evaporative cooling was $4,630, while for homes with heat pump cooling total capital expenditure was $7,889.

Gas connection

We assumed a cost to connect the newly constructed home to the gas network, including pipes and meter, at $1,500. This cost was included for all dual-fuel scenarios but not included for all-electric scenarios.

Hot water

The following options were included:

TYPE	MODEL	PRICE	INSTALLATION	TOTAL
Instantaneous gas	Infinity 26	$1,395	$600	$1,995
Heat pump	Stiebel Eltron 302L	$3,700	$1,000	$4,700 ($3,512) *

* An STC discount of $1,188 was applied to the heat pump hot water option, resulting in a total cost of $3,512.

Cooking

Based on online research of common models, we assumed a gas cooktop to have a purchase cost of $500 and an installation cost of $170, for a total expenditure of $670. We assumed an induction cooktop to have a purchase cost of $750 and an installation cost of $250, for a total expenditure of $1,000.

4.4. Heating and cooling use

The number of hours of heating and cooling use varies according to location and climate, as well as individual preference. This report assumes heating and cooling use in line with assumptions made for government appliance cost calculators at www.energyrating.gov.au/calculator.

LOCATION	DAYS HEATING PER YEAR	HOURS HEATING PER DAY	DAYS COOLING PER YEAR	HOURS COOLING PER DAY
Hobart	270	10	30	4
Melbourne	150	10	90	6
Sydney	60	11	60	11
Perth	120	8	120	9

4.5. Mortgages

We assumed that the loan amount was for 80% of the purchase cost of the home. Median mortgage amounts for newly constructed homes for each city were used. Figures were from May 2021.[3]

LOCATION	LOAN AMOUNT (BASELINE)
Hobart	$305,714
Melbourne	$518,397
Sydney	$669,796
Perth	$442,291

This median figure was assumed as the mortgage price for scenario 1 in this report (a 6-star dual fuel home representing business as usual). For other scenarios, additional capital expenditure was added on to the implied purchase price of scenario 1 to calculate the mortgage amount and monthly repayments for each scenario.

We assumed a 25-year mortgage at 5% interest p.a. This is a higher interest rate than is currently widely available and so is a conservative estimate resulting in relatively high assumed mortgage repayments. Longer mortgages at lower rates would increase the impact of energy bill savings and additional repayments.[4]

The monthly required repayments calculated for each scenario are presented in the below table.

LOCATION	HOBART	MELBOURNE	SYDNEY	PERTH
6-Star dual fuel	$1,787	$3,030	$3,916	$2,586
7-Star dual fuel	$1,804	$3,042	$3,928	$2,594
7-Star dual fuel (basic budget)	$1,844	$3,074	$3,969	$2,634
7-Star dual fuel (strong budget)	$1,864	$3,094	$3,988	$2,654
7-Star all-electric	$1,837	$3,043	$3,962	$2,627
7.5 Star all-electric	$1,854	$3,053	$3,975	$2,635

[3] Sourced from: https://www.canstar.com.au/home-loans/average-home-loan-australia/

[4] Mortgage scenarios can be tested using an online mortgage calculator. We have verified our mortgage calculations using: https://www.commbank.com.au/digital/home-buying/calculator/home-loan-repayments

4.6. Carbon emissions

Emissions intensity metrics from the National Greenhouse Accounts Factors[5] were used to calculate the carbon emissions in each scenario. The emissions intensity applied was an addition of Scope 2 and Scope 3 emissions, as follows:

LOCATION	ELECTRICITY EMISSIONS FACTOR (KG CO2-E / KWH)	GAS EMISSIONS FACTOR (KG CO2-E / GJ)
Hobart	0.16	51.5
Melbourne	1.00	55.5
Sydney	0.85	64.6
Perth	0.69	55.6

It should be noted that the emissions associated with gas are likely to be understated in these carbon accounting factors.[6]

[5] https://www.industry.gov.au/sites/default/files/August%202021/document/national-greenhouse-accounts-factors-2021.pdf

[6] https://renew.org.au/our-news/the-gas-industry-is-lying-about-their-emissions/

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