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26 November 2021

To whom it may concern,

Thank you for the opportunity to provide a response to the Inquiry into Renewable Energy in Victoria.

Renew is a national, not-for-profit organisation that inspires, enables and advocates for people to live sustainably in their homes and communities. Established in 1980, Renew provides expert, independent advice on sustainable solutions for the home to households, government and industry.

The primary focus of this submission is the need for a just and inclusive strategy for residential gas substitution. Government planning and action is needed to ensure that no Victorians are left behind in a market transition away from gas.

There is no pathway to net zero emissions and a 100% renewable energy supply that does not include a transition away from residential gas appliances. Over 2 million homes are connected to the gas network, accounting for over 40% of Victoria's gas consumption;[1] substituting residential gas use is a significant opportunity for an urgent reduction in overall gas demand.[2]

Technologies are already in place that make all-electric homes both accessible and financially appealing for many households. In this submission we provide **independent modelling** of energy bills and upfront costs associated with the construction of all-electric homes and dual fuel homes connected to gas. We find that building efficient, all-electric homes leads to significant financial savings for households.

However, key legal, financial, and informational barriers risk preventing Victorians from accessing the benefits of the substitution of residential gas with all-electric homes.

Our recommendations:

1. Enact a moratorium on new gas connections
2. Remove existing regulatory barriers to all-electric homes
3. Lift energy efficiency standards in the National Construction Code
4. Introduce retrofit programs to address the upfront costs of fuel switching for low income and vulnerable Victorians
5. Address the specific barriers faced by renters
6. Develop a gas transition plan for social housing
7. Ensure accurate information and labelling for consumers

[1] DELWP 2021, "Victoria's Gas Substitution Roadmap." https://engage.vic.gov.au/help-us-build-victorias-gas-substitution-roadmap, accessed 26 Nov 2021

[2] Northmore Gordon 2020, "Victorian Gas Market – Demand side measures to avoid forecast supply shortfall." http://environmentvictoria.org.au/wp-content/uploads/2020/06/Vic-Gas-Market-Demand-Side-Study-Final-Report-1.pdf, accessed 26 Nov 2021

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61 (3) 9639 1500
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Households are already financially better off with all-electric homes

Renew has undertaken **independent, original modelling** of the costs and benefits to households of a range of household energy scenarios.

We modelled the energy bills and upfront costs for newly constructed dual fuel homes (with a gas connection) and all-electric homes (with no gas connection). We have used detailed energy use and tariff data to calculate bills and other costs for a medium-large 200m2 detached home in Melbourne across a range of energy scenarios. These calculations include the upfront cost of gas installation, regular gas account fees, and the cost of appliances. Information on our modelling methodology and assumptions is provided in Appendix 1.

Alongside the impact of choosing gas or all-electric, there are other factors that can influence household energy bills. These include better thermal efficiency (measured with NatHERS star ratings) and installing efficient appliances and solar panels. We have modelled comparable scenarios for dual fuel and all-electric homes across two levels of efficiency to consider these impacts.

We modelled the costs and benefits of four scenarios:

1) A basic 6-Star dual fuel home (connected to gas), with basic appliances and no solar
2) A basic 6-Star all-electric home (not connected to gas), with basic appliances and no solar
3) An efficient 7-Star dual fuel home (connected to gas), with efficient appliances and solar
4) An efficient 7-Star all-electric home (not connected to gas), with efficient appliances and solar

A full summary of the features of each home is as follows:

	6-STAR BASIC DUAL FUEL	6-STAR BASIC ALL-ELECTRIC	7-STAR EFFICIENT DUAL FUEL WITH SOLAR	7-STAR EFFICIENT ALL-ELECTRIC WITH SOLAR
NatHERS rating	6	6	7	7
Hot water	Gas instantaneous	Heat pump	Gas instantaneous	Heat pump
Heating	Gas	Heat pump (basic)	Gas	Heat pump (efficient)
Cooling	Evaporative	Heat pump (basic)	Heat pump (efficient)	Heat pump (efficient)
Cooking	Gas	Induction	Gas	Induction
Other appliances	Electric	Electric	Electric	Electric
Solar	None	None	6.6 kW	6.6 kW

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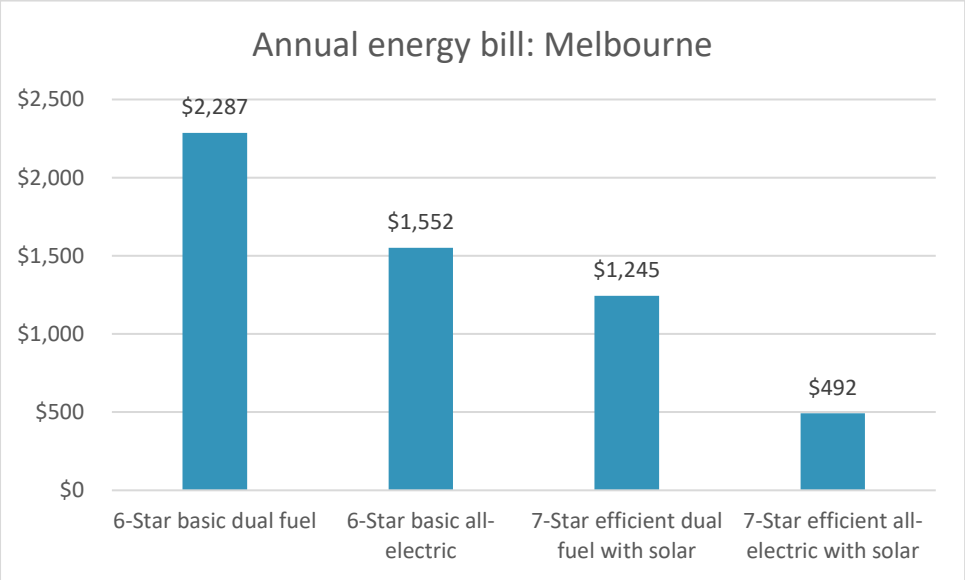
Findings

Energy bills

Our findings show that all-electric homes result in lower bills than comparable dual fuel homes. Choosing even a basic all-electric home was found to save $735 annually over a basic dual fuel home. Meanwhile, an efficient all-electric home with solar saved $1,795 a year, cutting bills by 78% from a basic dual fuel home. Even when compared to an efficient dual fuel home with solar, the all-electric home still saved $753, cutting bills by 60%.



Net present value

We calculated the net present value (NPV) of the various energy scenarios, using the basic dual fuel home as the baseline scenario against which others are compared. We applied a conservative 2% discount rate for a 20-year period. We found that the choice to go all-electric was a good value investment. A basic all-electric home had a NPV of $16,671, while an efficient all-electric home with solar had a NPV of $25,482. Because the all-electric homes combined lower ongoing bills with lower upfront costs, the overall economic value of all-electric homes was found to be significantly higher than a dual fuel home with comparable energy efficiency. Lower upfront costs mean that even a basic all-electric home was found to have a higher investment value than an efficient dual fuel home.

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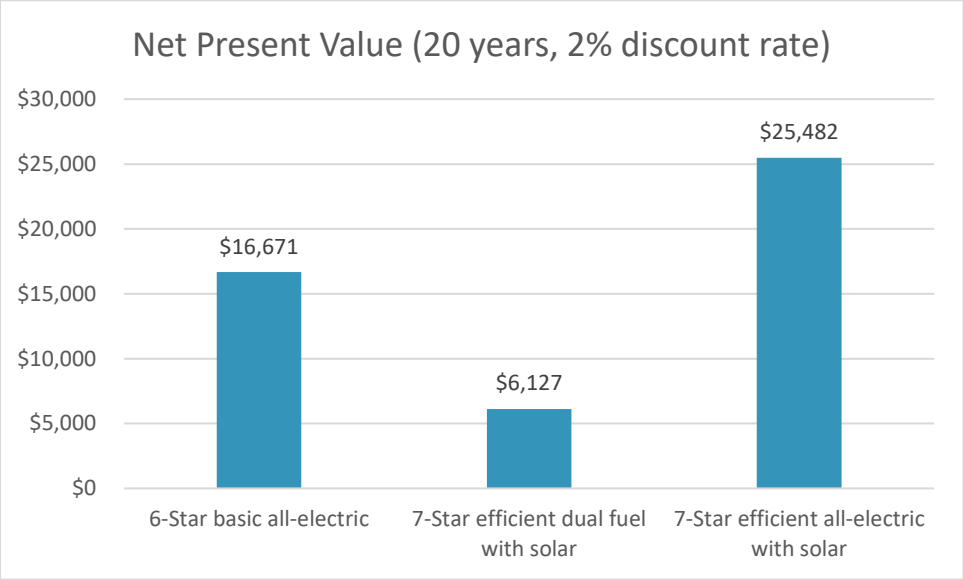

Household cash flow

By avoiding gas connection costs and replacing gas ducted heating with reverse cycle air conditioners (heat pump technology), the upfront cost of an all-electric home was found to be less than a dual fuel home by over $6000.

Using a basic 6-Star dual fuel home as our baseline comparison, we calculate how much of a financial impact each scenario will have on overall monthly household cash flow. For each scenario, we calculate the expected monthly mortgage repayment, including any increased costs of higher energy efficiency standards and appliances. (We have conservatively assumed a 25-year loan term at a 5% interest rate.) We then calculate the expected monthly bills for each scenario, which differ according to energy efficiency and fuel choice. If these savings are higher than any 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.

Once again, all-electric homes were found to leave households with more money in their pocket from day one. A household would be $91 a month better off choosing a basic all-electric home over a basic dual fuel home. Again, the biggest financial benefit was found for households choosing an efficient all-electric home with solar – enjoying savings of $137 a month. While making a dual fuel home more efficient was found to benefit households, the relatively high upfront costs of gas connections and appliance installation meant that even efficient dual fuel homes always led to worse overall cashflow than all-electric homes.

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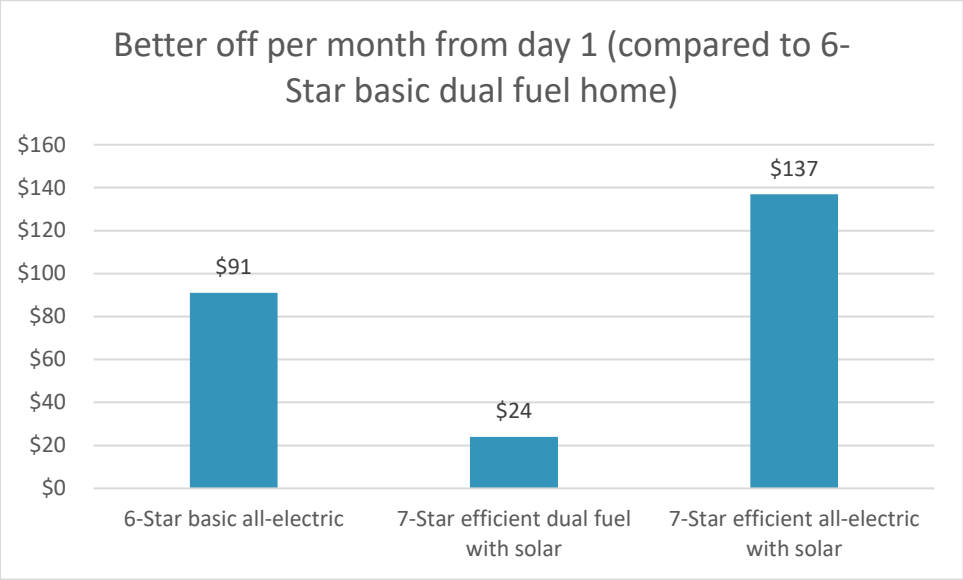
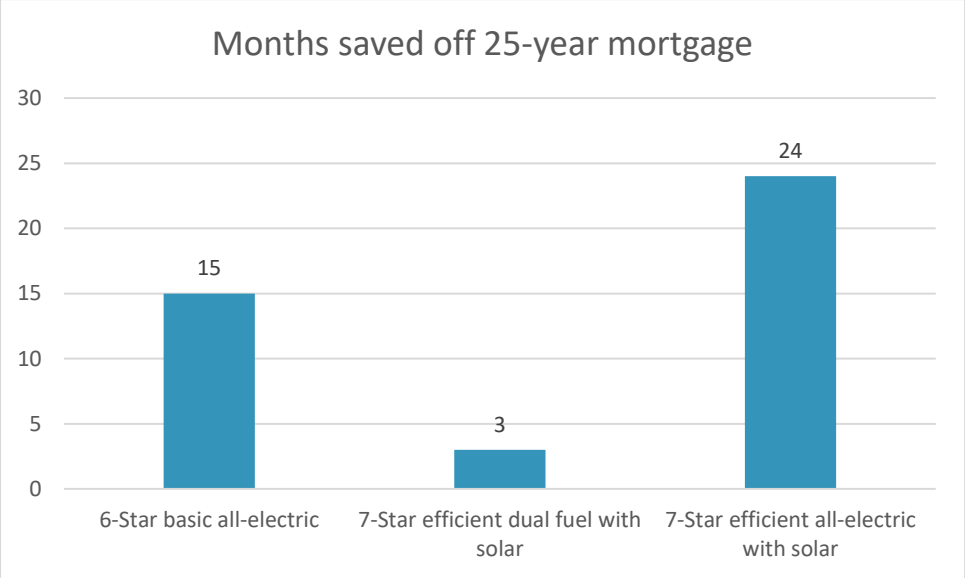


Impact on 25-year mortgage

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. All-electric homes cut years off a home loan. A basic all-electric home left households paying off their loan 15 months faster, while an efficient all-electric home cut the loan by a full two years.



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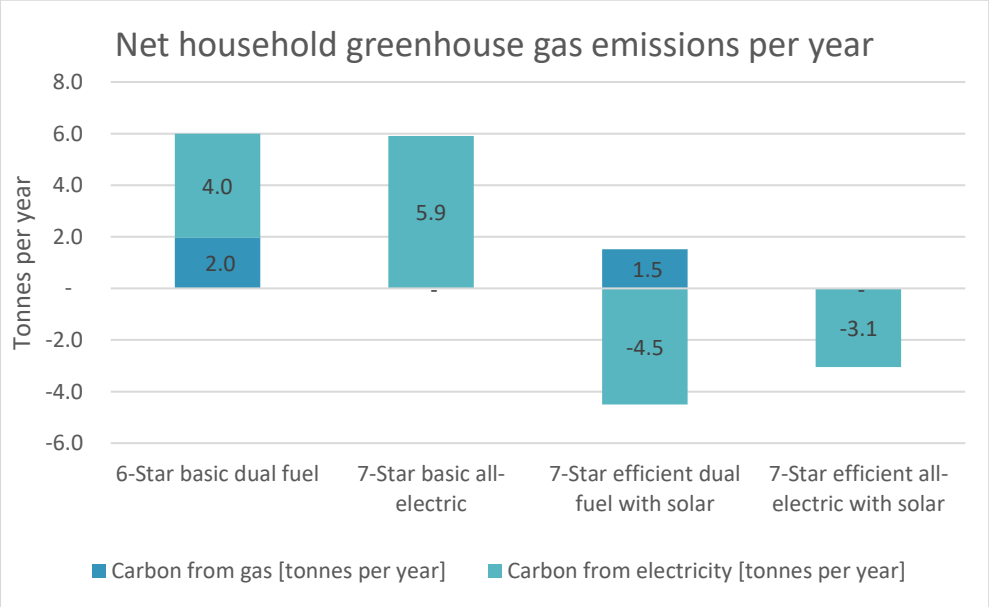
Household carbon emissions

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 having a home solar system, 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.

We found that the optimal choice to reduce household carbon emissions was an efficient all-electric home with solar, which by exporting energy to the grid had net negative emissions of 3.1 tonnes a year. The basic all-electric home with no solar only slightly reduced overall emissions from a basic dual fuel home as it imported electricity entirely from the grid. This finding demonstrates that household solar and other decarbonisation of Victoria's electricity remains an important aspect of the energy transition.

Importantly, through solar and other renewables, the emissions of the all-electric homes are expected to fall, while the emissions associated with gas consumed in the dual fuel scenarios are locked in. These findings show that, even with the high amount of coal-fired power generation in the current electricity grid, an all-electric home is slightly better for emissions than a home with gas. Over the lifetime of the house and appliances, as more renewable energy enters the grid, the emissions from all-electric homes will drop further.

It should be noted that emissions factors used for this analysis likely significantly understate the impacts of methane and fugitive emissions from gas.



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Barriers

As shown above, transitioning off the gas network to full electrification has financial benefits for Victorian households. But there are significant barriers excluding many Victorians from benefiting from the transition to all-electric homes – leaving vulnerable Victorians paying an unfair share of the cost and slowing down the Victoria's progress towards meeting its climate commitments.

While the savings enjoyed by households in all-electric homes is creating market incentives to transition away from residential gas, there is a significant risk of unjust social outcomes if this transition is left to the market alone.

Government action is needed to ensure that nobody is left behind in the energy transition.

Recommendations

1. Enact a moratorium on new residential gas connections

There is simply no reason why new homes in Victoria should be connected to gas. The Victorian Government should enact a moratorium on new residential gas connections.

As our analysis above shows, homes that are all-electric are already viable and cost-effective. Greenfield and brownfield developments connecting new homes to the gas network comes at a significant additional cost to residents, while locking in outcomes that are inconsistent with Victoria's climate commitments. Small-scale infill construction and development where reticulated gas exists can connect at minimal cost but maintain dependency on gas networks that is also inconsistent with climate commitments and the economic realities of managing a graceful exit from gas.

Retrofitting homes to remove established gas connections will come at a cost to governments and households.[3] While this cost is unavoidable for existing homes with a current gas connection, a moratorium on new connections avoids adding to the problem.

The ACT is currently exploring a moratorium on gas connections for new housing estates. This can provide a clear model to Victoria for implementation.

Some Local Government Authorities (LGAs) in Victoria have sought to apply planning policies that would ban gas connections to new developments. The Victorian government should, at a minimum, allow these planning measures to be applied by LGAs.

[3] Renew 2018, "Household Fuel Choice in the National Energy Market". https://renew.org.au/wp-content/uploads/2018/08/Household_fuel_choice_in_the_NEM_Revised_June_2018.pdf

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It should be noted that households in new gas-free developments with a specific preference for gas for particular loads may still use non-reticulated gas for those purposes. This is already common in areas of the state where reticulated gas is not available.

2. Remove existing regulatory barriers to all-electric homes

Not only are new gas connections still being permitted, current regulations are actively preventing the construction of new all-electric homes. As a matter of urgency, all regulations preventing Victorians from choosing all-electric homes or requiring unwanted connections to the gas network should be removed.

Key regulations blocking all-electric homes that should be modified urgently are:

- The Victorian Planning Provisions (VPP). The VPP is a set of standard, statewide planning provisions which ensure that planning schemes across Victoria are consistent. The VPP state that 'where available' residential developments must be connected to 'the satisfaction of the relevant gas supply agency'. (Clause 56.09-2) Not abiding by these provisions could impact on the ability of a developer to procure a planning permit.
- Victorian Plumbing Regulations. These regulations state that if a gas supply is available for connection in a new building, new solar hot water heaters must be boosted by gas. (Schedule 2, Clause 11 (4)) Heat pump water heaters are only allowed to be installed if they are not connected to the main electric supply. These regulations should be changed as a matter of urgency to allow all-electric homes in new developments, and start saving households money.

The plumbing regulations were introduced as a Victorian variation to the National Construction Code; this variation was made with the intention of increasing overall energy efficiency but is no longer fit for purpose in light of the broader energy transition. With the ongoing delays in finalising the 2022 NCC, it is critical that the Victorian government remove this variation and allow homeowners to set themselves up for a lower cost and zero emission future by foregoing a gas connection.

Additional work should be done to ensure other relevant regulations that favour gas over efficient electric technology – such as incentives in programs connected with the Victorian Energy Efficiency Target, to ensure alignment with the goal of residential gas substitution and to ensure no barriers exist to ongoing residential electrification.

3. Lift energy efficiency standards in the National Construction Code

The substitution of residential gas should take place alongside improvements in the energy efficiency and thermal comfort of homes. By reducing the amount of energy needed to heat and cool homes, potential pressure on the electricity grid is reduced while residents enjoy better health, comfort and lower energy bills.

Victoria should support and implement increases in the energy efficiency standards of new homes under the National Construction Code 2022, while continuing to work towards further stringency increases in future NCC iterations in line with the Trajectory for Low Energy Buildings.

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Consideration is currently being given to increasing the minimum NatHERS energy efficiency rating of new homes from 6 to 7 Stars. In Melbourne, this improvement in standards would result in a 27% decrease in the amount of energy required to heat and cool new homes. Meanwhile, 7 star rated homes require 78% less energy to heat and cool than a typical 2-star rated older home in Melbourne. This reduction in energy requirements through better thermal efficiency has an important effect of minimising the additional pressure on the electricity grid caused by the electrification of appliances and changed peak consumption patterns associated with distributed energy resources, and should be undertaken alongside gas substitution.

4. Introduce retrofit programs to address the upfront costs of fuel switching for low income and vulnerable Victorians

Government retrofit programs are required to address the structural problem of upfront costs to households of home gas substitution.

In the long term, residents stand to benefit from retrofits to replace gas with all-electric heating, cooling, cooking, and hot water. However, the upfront costs of retrofits mean that many Victorians are unable to access these benefits and long-term savings. Perversely, households on lower incomes are less likely to be able to meet upfront costs and are locked into higher bills on an ongoing basis due to poor thermal efficiency, inefficient appliances, and the duplicate connection fees incurred by dual fuel homes.

Large scale retrofit programs should be pursued to install energy productivity measures that would include (but not be limited to) reverse cycle air conditioners for heating and cooling, more efficient hot water (heat pumps), draught sealing, ceiling fans, efficient thermal building envelope, lighting and solar PV. The National Low Income Energy Productivity Plan (NLEPP)[2] estimates a cost of $3,800 per dwelling to invest in a combination of more efficient heat pump hot water, heating/cooling, lights, gap sealing and insulation (noting some houses will require slightly greater investment and some will require slightly less).

The Victorian government has already taken significant action through its commitment to rebates for heat pump heating and cooling for 250,000 low-income households, and energy efficiency retrofits of social housing homes. Appropriate evaluation of these programs should be undertaken and further programs considered to address remaining barriers to gas substitution faced by households.

5. Address the specific barriers experienced by renters

According to the 2016 Census, 28.7% of Victorian households rented their home. This proportion is increasing, particularly among younger Victorians and those with young families.

Rental homes are, on average, less energy efficient than owner-occupied homes. A significant driver of poor rental energy performance is the 'split incentive' problem, in which energy bills are paid by renters while energy efficiency upgrades are paid for by landlords. In practice, many landlords do not choose to pay the upfront costs of energy efficiency upgrades, the replacement of fixed appliances or the installation of solar.

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The structural problem of split incentives for renters and landlords means that retrofits are unlikely to happen without future government intervention at increased cost is a key reason why new homes should be built to be energy efficient and all-electric.

Specific strategies are required to ensure that renters are not left behind in the energy system transition. These include the continued strengthening of minimum rental standards to include energy measures such as insulation, efficient hot water, and increased efficiency levels of heat pump heating and cooling; these regulations should ensure that the replacement of fixed appliances is consistent with the goal of residential gas substitution. Further measures including rebates for efficient appliances and solar should be maintained and extended.

6. Develop a gas substitution plan for social housing

A specific gas substitution plan for public and community housing residents must be developed by the Victorian government.[4]

If residential gas substitution is left to market mechanisms based on the individual choices of households, public and community housing tenants risk being excluded from the transition. Like renters in the private market, social housing residents are in practice dependent on decisions of a landlord to spend money upfront on energy efficiency upgrades or the replacement of fixed appliances. Public housing tenants in some locations pay no gas connection fee and have constrained energy choices.

A statewide strategy must be developed for the substitution of gas in Victoria's social housing. This strategy should include energy efficiency retrofits, replacement of gas appliances with efficient, all-electric appliances, and access to renewable energy through measures such as community renewables, storage and PPEs. Newly constructed social housing should be all-electric, which will benefit residents while also using government procurement processes to build industry capacity.

7. Ensure accurate information and labelling for consumers

Clear and accessible information must be provided to Victorian households about their consumer options for home energy use.

While growing, there is still limited community understanding of the financial, health and environmental benefits of shifting to all-electric homes. Furthermore, many people buying or renting a home are unable to access information about the home's energy efficiency.

As part of a gas substitution plan for the residential sector, Victoria should ensure clear, evidence-based consumer information is available on energy choices. Victoria should furthermore continue to roll out the Residential Energy Efficiency Scorecard and work with other state, territory and

[4] See Renew's submission to the 10 Year Strategy for Social Housing: https://renew.org.au/advocacy/climate-resilient-homes/social-housing-energy-strategy/

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Commonwealth governments to develop a nationally consistent scheme for the mandatory disclosure of home energy ratings.

Clear consumer information is needed about the benefits and costs of different fuels. Private advertising for gas appliances typically presents gas as a cheaper fuel than alternatives, however we are concerned that inappropriate comparisons are used in this advertising that lead to misleading conclusions. Independent and accurate information should be provided to Victorian consumers.

Other matters

We have focused on certain aspects of the issues. Lack of comment on other matters does not indicate our position on those matters.

Thanks for the opportunity to respond. If you have any questions or additional matters you'd like our view on, please contact me at rob.mcleod@renew.org.au.

Sincerely yours,

Rob McLeod
Sustainable Housing Advocate

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Appendix 1: modelling methodology and assumptions

Methodology

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 solar 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[5] 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.

The total annual energy use and bills found for each scenario are as follows:

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

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SCENARIO	6-STAR BASIC DUAL FUEL	6-STAR BASIC ALL-ELECTRIC	7-STAR EFFICIENT DUAL FUEL WITH SOLAR	7-STAR EFFICIENT ALL-ELECTRIC WITH SOLAR
Average daily gas use (MJ)	96.9	0	74.6	0
Annual gas bill ($)	$1032	$0	$853	$0
Average daily electricity import (kWh)	11.06	16.19	6.70	8.10
Average daily electricity export (kWh)	0	0	19.02	16.47
Annual electricity bill ($)	$1,255	$1.552	$391	$492
Total annual energy bill	**$2,287**	**$1,552**	**$1,245**	**$492**
Annual bill savings from business as usual	-	*$735*	*$1,043*	*$1,795*
% bill savings from business as usual	-	*32%*	*46%*	*78%*

1. Data and assumptions:

A full range of assumptions and input data is available in Renew's report, "Households Better Off: lowering energy bills with the 2022 National Construction Code".[6]

1.1. Tariffs

Gas and electricity tariffs were sought from major retail providers. 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)
Melbourne	$0.1980	$1.05	$0.0220	$0.70	$0.08

[6] https://renew.org.au/advocacy/climate-resilient-homes/households-better-off-lowering-energy-bills-with-the-2022-national-construction-code/

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We assumed heating and cooling use in line with assumptions made for government appliance cost calculators at www.energyrating.gov.au/calculator. In Melbourne this assumes 150 days of heating at 10 hours heating per day, and 90 days cooling at 6 hours cooling per day.

1.2. Appliance and upfront costs

We assumed 7-Star homes to have an additional build cost of $1,938 over equivalent 6-Star homes, based on ABCB figures.

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.

Heating

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. All-electric homes use heat pump RCAC units for both heating and cooling.

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:

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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.

The baseline cost of a mortgage was based on the average loan amount for a newly built home in Melbourne in May 2021 of $518,397.

1.3. Carbon emissions

Emissions intensity metrics from the National Greenhouse Accounts Factors[7] were used to calculate the carbon emissions in each scenario. It should be noted that these figures likely to significantly understate fugitive emission from gas. 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)
Melbourne	1.00	55.5

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

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