

**Impact of Environment Canterbury's  
Clean Heat project  
on Christchurch electricity usage**

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## Introduction

In 2008/09 Environment Canterbury, Meridian Energy and Orion NZ Ltd worked together to establish the impact of Environment Canterbury's Clean Heat project on household electricity usage. Their combined study looked at the electricity usage of homes that had participated in Clean Heat prior to July 2007. Data was collected on a household's electricity usage prior to, and after, participation in Clean Heat. The results of that study are summarised in this paper.

## The Clean Air Plan and the Clean Heat project

The Clean Air Plan, or more formally Chapter 3 of Environment Canterbury's Natural Resources Regional Plan, seeks to improve air quality in Christchurch, with a particular focus on reduction of the pollutant PM<sub>10</sub>. The primary means to achieving this is through the replacement of open fires and polluting wood burners in the city with clean air approved heating appliances.

The Clean Heat project operated by Environment Canterbury assists Christchurch residents, who need to replace their open fires and polluting wood burners, by providing financial assistance to them. The Clean Heat project subsidises the installation of a clean air approved heating appliance, and also subsidises the installation of any necessary insulation in the home; thereby bringing floor and ceiling insulation up to a certain level.

The Clean Heat project has been operating since 2003 and has subsidised the installation of around 14,000 clean air approved appliances to date. Around 12,000 homes converted to approved appliances before July 2007. Of these 12,000 homes, Meridian were able to provide monthly electricity usage figures for approximately 3,453 homes for 12 months before, and between 12 and 24 months after, conversion.

The data on these 3,453 homes was used to calculate the impact of Clean Heat on Christchurch electricity usage. Given this large data pool the findings are considered likely to be representative of the impact of the Clean Heat project across all 14,000 participating homes.

For instance, the uptake of the various forms of appliances by the 3,453 homes was broadly representative of the uptake witnessed by all 14,000 homes that have participated in Clean Heat since inception in 2003.

	% uptake of appliances	
	% of homes in "sample"	% of homes since 2003
Heat pumps	57%	60%
Woodburners	20%	24%
Pellet fires	19%	16%
Gas	4%	0%

## Overall impact of Clean Heat project on electricity usage

Across the 3,453 homes that data was available for, electricity usage in the year after installation of an approved appliance was on average the same (0% movement) as that witnessed in the previous year. Electricity usage in the second year after installation was 2% lower than that witnessed in the year prior to installation.

Across the various forms of clean heat appliances installed the results were as follows<sup>1</sup>:

<b>Converted from open fire or wood burner to</b>	<b>No. of homes data available for</b>	<b>Increase in electricity usage from year before, to year after, conversion</b>	<b>Increase in electricity usage from year before, to two years after, conversion</b>
Heat Pump	1,973	2%	1%
Solid Fuel	689	-2%	-5%
Pellet Fire	662	-3%	-4%
Gas	122	-7%	-10%
Total	3,454 <sup>1</sup>	0%	-2%

These results indicate that the Clean Heat project<sup>2</sup> has had very limited impact on electricity usage overall, despite around 8,000 homes in total shifting from a wood/coal based form of heating to heat pumps. The reasons for this are thought to be:

- a large number of homes with inefficient open fires etc also operated electrical resistance heaters to stay warm. These “inefficient electrical heaters” have been removed during the conversion.
- to receive subsidies from ECan, homes were brought up to standard for ceiling and underfloor insulation. This may have reduced the use of other forms of electrical heating throughout the remainder of the house e.g the bedroom heater.

Installation of a heat pump only saw a very minor increase (around 2%) in electricity usage on average. However the change in electricity usage was very dependent on the form of heating that was replaced.

Those homes that converted to solid fuel appliances, pellet fires or gas all saw a decrease in electricity usage.

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<sup>1</sup> Conversions to diesel heating and electrical night store heating were very minor at only eight and one homes respectively. Consequently results are not shown for conversions to these devices as the number of households is not statistically sufficient to draw overall conclusions.

<sup>2</sup> The study only looked at homes that have been through the Clean Heat project. Because of the threat of regulation via ECan’s Clean Air Plan, many homes have over the last few years removed open fires/woodburner outside of ECan’s subsidised Clean Heat project. This is generally because these homes did not wish to incur the additional cost of installing insulation. While we have no data on these homes, we suspect that their change in electricity usage would not be dissimilar to the Clean Heat homes.

### Impact of heat pump installation

Those homes that removed an open fire actually saw a decrease in their electricity usage when they installed a heat pump. Although this is counterintuitive, this result reflects the inefficiency of open fires and that open fires are often “backed up” by electrical resistance heating. Removal of this resistance heating with efficient heat pumps saw a drop in electricity used.

However if a home removed a freestanding woodburner, and replaced it with a heat pump, electricity usage increased by 8% to 11%. This reflects the greater efficiency of a freestanding woodburner compared to an open fire, and consequent less need for electric resistance “back up” heating.

<b>Converted to heat pump from:</b>	<b>Increase in electricity usage from year before, to year after, conversion</b>	<b>Increase in electricity usage from year before, to two years after, conversion</b>
Open fire	-2%	-3%
Insert woodburner	4%	1%
Freestanding woodburner	8%	11%
Overall	2%	1%

### Inefficiency of open fires compared to woodburners

The study confirmed that open fires were more inefficient than polluting woodburners, and that inset woodburners were more inefficient than free standing woodburners.

	<b>Increase in electricity usage from year before, to year after, conversion</b>	<b>Increase in electricity usage from year before, to two years after, conversion</b>
<b>Converted from open fire to:</b>		
Heat Pump	-2%	-3%
Solid Fuel	-5%	-9%
Pellet Fire	-11%	-13%
Gas	-4%	-7%
<b>Converted from inset woodburner to:</b>		
Heat Pump	4%	1%
Solid Fuel	-2%	-3%
Pellet Fire	-3%	-2%
Gas	-15%	-18%
<b>Converted from freestanding woodburner to:</b>		
Heat Pump	8%	11%
Solid Fuel	0%	-2%
Pellet Fire	-1%	-2%

## Other results

The study also showed that homeowners reduce their electricity usage most if they convert to gas or pellet fires. Of course, their lower electricity bills may be outweighed by additional gas and pellet bills.

The results also showed that usage of electricity falls slightly in the second year after installation of a heat pump, compared to the first year. This is thought due to the homeowner getting used to operating the heat pump more efficiently.

## Methodology

Environment Canterbury, Meridian Energy and Orion NZ Ltd worked together to make this project possible. Data was exchanged between the three parties so as to allow Orion to finally collate information on electricity usage of homes that had participated in Environment Canterbury's Clean Heat project prior to July 2007.

The flow of information between the parties was such that private information on individual households was not exchanged between the parties.

Of the 11,815 homes that participated in Clean Heat up to July 2007, Meridian were able to identify 3,703 of these as Meridian customers. Some Meridian customers could not be identified as Environment Canterbury could only pass onto Meridian street addresses rather than electricity ICP identifiers.

Of the 3,703 Meridian customers identified, electricity meter reading information on 249 of these customers was incomplete. Less than one year of billing information prior to, or after, the households heating source being converted was available. Consequently complete information was available to be analysed on 3,454 homes.

Of the 3,454 homes with complete data 1,973 (57%) installed a heat pump, 689 (20%) a solid fuel burner, 662 (19%) a pellet fire, 122 (4%) gas heating, 8 diesel heating and one home installed a night store heater.

In the study no account has been taken for weather differences between years and the impact this may have on electricity usage. This was due to no data being available to determine the average electricity usage of a Christchurch household that did not change heating appliances. None of the participants in the study had access to information on the heating appliance used in a home, other than those that participated in the Clean Heat project. Consequently there was no "control data" to compare the results with to effectively eliminate the impact of changing weather.

However, as the analysis looked at homes electricity usage one year before, and up to two years after, conversion, and as homes converted over the period 2003 to 2007, there is some "staggering" in years. In other words, in 2005 some homes electricity usage would be considered "per conversion" and some homes "post conversion". This means that if 2005 was a particularly cold year, the impact of the cold weather on the results should be less than if all homes were either pre, or post, conversion in 2005. The staggering effect effectively reduces the impact of weather on the results.

Also, the study did not take into account the impact in changes in non-heating electrical usage over time. In other words it did not take account of perhaps greater television usage in 2008 compared to 2003. However as per household electricity

usage tends to increase over time, the failure to take into account changing situations in a home generally leads to the results being over-stated. In other words the impact of the Clean Heat plan on electricity usage is likely to be slightly lower (probably less than 1%) than the reported figures due to changing non-heating electricity use.