



Ballarat's energy use and emissions

stats & facts

1. Key findings - Cutting emissions for Ballarat

- Total emissions for the Ballarat region are 1,442,000 tonnes; and consist broadly of 60% from electricity generation and use, 12% from gas use and 28% from transport.
- Average electrical energy use for BREAZE member households responding to the Climate of Change survey in 2008 was estimated to be 52% of the 2007 average for Ballarat and 39% of the national average (total average BREAZE member usage = 1097 kilowatt hours per person). BREAZE members have implemented a range of energy efficiency and micro renewable energy generation actions and have a lot of useful information to share about how they minimise their energy consumption.
- Approx. 50% Ballarat's electricity consumption is for industrial purposes, and from a relatively small customer base. Projects that engage with local industry to generate renewable energy and reduce energy consumption may result in substantial emissions reductions.
- A 10% input from wind power could cut emissions for Ballarat by close to 87,000 tonnes immediately, i.e. 10% of total electricity purchased from greenpower.
- BREAZE has directly facilitated the installation of 234 KW of solar panels in the Ballarat district (as of Aug 2009) which are generating 304 Megawatts of clean energy per year¹. This represents a reduction of 420 tonnes of CO₂ per annum if these systems replace standard coal fired powered electricity. Installation of 5,000 domestic 1 kw systems in the next year could reduce 9,000 tonnes of greenhouse gas emissions (approx. 10% of emissions from electricity).
- Approximately 5,000 Ballarat households use electric hot water systems (BREAZE survey – 16% of households have electric hot water). If all these households switched to solar hot water it would save a total of 26,000 tonnes of CO₂ per year (assuming similar climatic conditions to Melbourne).
- The majority of residents in Ballarat commute via private vehicle. Substantial emissions savings could be achieved through use of sustainable transport and alternatives such as car pooling.
- Encouraging water efficiency measures and eliminating the need for pumped water supply through the super pipe could save 22,000 tonnes of greenhouse gas
- BREAZE's activities have focused on reducing direct emissions from household activities. This represents a significant but minor proportion (35%) of total emissions per person. Indirect² emissions generated as a result of government, industry and agriculture to support households accounts for 65% of total emissions per person. Significant emissions reductions can be made by targeting these sectors and reducing emissions intensive consumption.
- Climate change, carbon emissions pricing and oil constraints will present new challenges to long food supply chains, and greater access to locally produced basic foods will help with increased economic resilience, food security, regional development, personal health and emissions reduction benefits

1. Based on a measured generating capacity of of 1300kw per year from systems installed in Ballarat

2. Indirect emissions largely occur off-site from the household and are not directly related to the household's behaviour. Indirect emissions are embodied in purchases made by individuals and households, and make up a surprisingly large proportion: two thirds of the total emissions for the average Australian.



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2. Overview - How much energy do we use in Ballarat?

Total energy use in 2008 was:

Electricity = 629,209 Megawatt hours (MWh)

Gas = 2,070,000 Gigajoules (Gj)

Transport = xxx

Total energy used per person in 2008 was:

Electricity = 2,100 kilowatt hours (Kwh)

Gas = 39 Gj

Fuel for transport = xx

Total "direct³ energy" used per person:

Electricity =

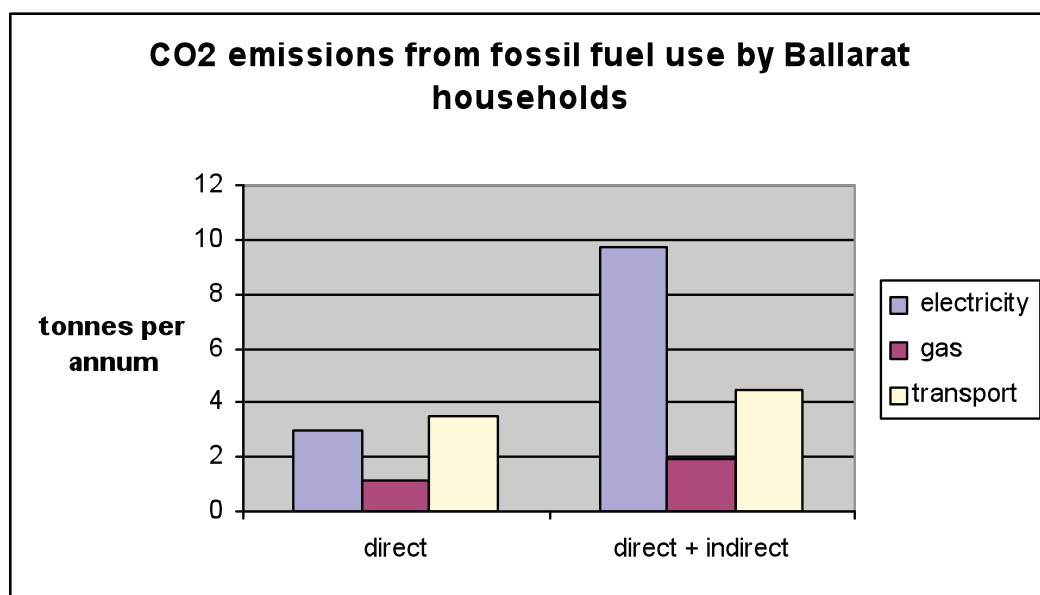
Gas = 23 Gj

Fuel for transport = xx

3. Overview - How many emissions do we produce?

From activity within the City of Ballarat we produce 1,442,000 tonnes of greenhouse gas per annum.

This equates to approx. 16.1 tonnes of emissions per person per annum. The main contribution is from non domestic electricity use.



3. Direct emissions are commonly associated with individual behaviour, and have some direct connection with the individual or household. Petrol used in a car, or natural gas burnt in a house are good examples. Some other direct emissions, such as air travel, are a little further removed from a household, but still can be directly related to householder behaviour, which is application of word direct used here.

In 2008, we produced:

Total emissions:

Electricity = 870,000 tonnes CO₂e

Gas = 171,000 tonnes CO₂e

Transport = 401,000 tonnes of CO₂e

Total per person emissions:

Electricity = 9.7 tonnes

Gas = 1.9 tonnes

Transport = 4.5 tonnes

Per person emissions for "direct energy" used:

Electricity = 3 tonnes

Gas = 1.1 tonnes

Transport = 3.5 tonnes

4. Ballarat's Energy Use and Emissions Profile

4.1 Total energy consumption⁴

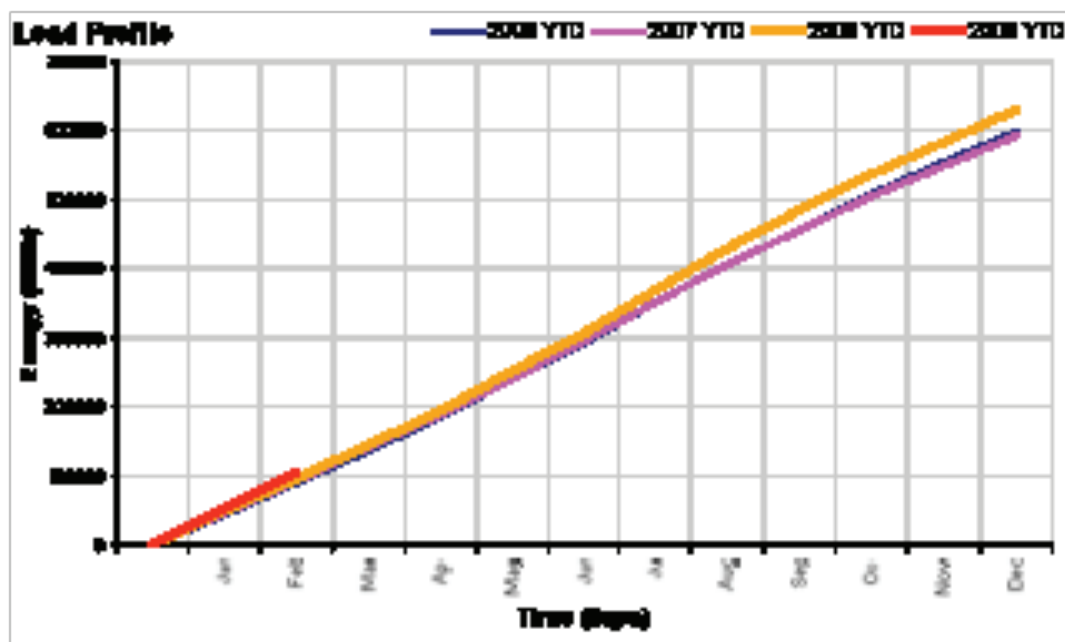
Electricity

Data from Powercor shows that total electricity consumption in the City of Ballarat in 2006 was 599,696 MWhr. Electricity consumption has grown by:

- 6.4 % from 2007 to 2008, and
- 9.3 % from 2008 to 2009 (trend at Feb 2009).

The following graph shows the increase in electricity use based on Powercor energy use figures.

Figure 3 - Ballarat Electricity use – Total to Date: data provided by Powercor Feb 2009.



4. Obtaining accurate stationary energy use and greenhouse emission figures for households has been a challenge. This report represents the best information available to us at the time of production (Sept 2009). For example:

- The City of Ballarat (in My Ballarat, September 2006) states that community greenhouse emissions in 2006 reduced by 12.6% on 1999 figures – this appears to be based on a per capita interpolation from state-wide energy and fuel use figures produced by Australian Bureau of Agricultural and Resource Economics (ABARE). If so, it is not a specific representation of Ballarat's emission profile and so must be treated with some caution.
- There is no information available to know whether the state-wide trends in the reduction of the inefficient use of fuels like wood, coke, kerosene and fuel oil apply in the same proportion to the Ballarat population.
- The data interpolated from ABARE statistics for the Cities for Climate Protection Program estimates total electricity use for 2006 in Ballarat at 890,626 MWh compared to the total recorded by Powercor of 599,696MWh this is almost a 50% discrepancy.
- DSE has provided some aggregated energy use figures for Ballarat for gas and electricity, these are potentially more accurate than the ABARE data as they are based on metered energy delivery to households.
- BREAZE has been able to collect some information on energy use by households both through individual case studies and through surveys carried out by the University of Ballarat. Energy costs were reported in the surveys and some estimates of the associated energy use have been calculated using below average utility service and energy costs – this will have probably over estimated the amount of energy BREAZE households use as we expect a higher proportion of green power and gas purchasers and therefore higher energy costs.

Household electricity consumption accounted for 31% of Ballarat's total electricity use in 2007⁵. Table 1 shows the total electricity consumed in Ballarat in 2007 and 2008, and proportionally how many emissions were generated by household electricity use. The table also shows total and per person emissions associated with this electricity use.

Table 1 - Ballarat's total and domestic electricity consumption, and associated emissions, 2007 & 2008

Year	ELECTRICITY CONSUMPTION		TOTAL EMISSIONS*		PER PERSON EMISSIONS	
	Total electricity used in Ballarat (Megawatt hours)	Domestic electricity use (based on 31% of total (Megawatt hours)	Total emissions from electricity consumption in Ballarat (tonnes)	Total emissions from domestic electricity use (tonnes)	Per person emissions total electricity use (tonnes)	Per person emissions domestic energy use (tonnes)
2007	591,193	183,270	817,436	253,405	9.1	2.8
2008	629,209	195,055	870,000	269,700	9.7	3

* Note – based on emissions for Victorian coal fired electricity generation

Industrial use is estimated to account for around 50% of Ballarat's total electricity use (based on ABARE statewide percentage use per sector for 2005). In 2008 this totals approx. 315,000 megawatt hours of electricity, and is spread over a relatively small customer base. Encouraging industry energy efficiency on the demand side could save these businesses money as well as reducing greenhouse emissions. The Maine's Power Project implemented in Central Victoria by the Mount Alexander Sustainability Group and CSIRO is a great example of industrial energy efficiency with an aim to improve energy efficiency by 30% <http://www.csiro.au/resources/MainesPowerFactsheet.html>.

Another substantial energy consumer is the pumping of potable water to the city. Recent figures suggest it took 16,000 megawatt hours of electrical power to pump 12.1 gigalitres through the new pipeline connecting Ballarat to the Goulburn system. This is about 2.5% of the total electrical energy use for the City and will have generated about 22,000 tonnes of CO₂ if produced using standard coal fired power stations.

Natural Gas

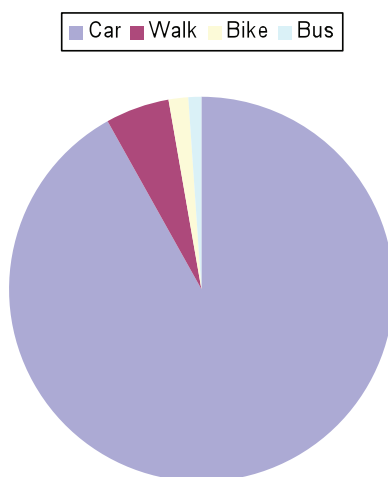
We use approximately 171,000 Gigajoules (Gj) of natural gas, of which approximately 58% is used for domestic purposes, and the balance is used for industrial and commercial purposes.

Transport Energy Use

In 2006, Ballarat's total emission from petrol, LPG and diesel were estimated to be 401,000 tonnes of CO₂ using figures interpolated from ABARE statewide tally. This is equivalent to about half of the emissions from total electricity use, and works out to be 4.5 tonnes per person per annum – this figure includes commercial and heavy vehicles. Passenger vehicles account for about 78% of these emissions – producing approximately 3.5 tonnes per person.

Cars are the primary means of transport to work within the Ballarat community and the vast majority of trips are made by one person with no passengers (67.2%) – ABS 2006. Only 5.7% of trips were made as a passenger in a car. 3.7 % of people walked to work and 1.2% rode their bicycles. 0.9% of people used buses to travel to work in Ballarat, which is slightly lower than for Melbourne 1.0% but higher than Bendigo at 0.7%.

Transport we take to work in Ballarat



5. DSE energy consumption data 2009

6. DSE energy consumption data 2009

Recent figures from the Ballarat region on urban bus usage show the average number of trips per day (averaged across all routes for the entire year) in 2008 was 6,000 compared to 5,700 in 2007, this represents an increase of 4.35 % overall.

The average Australian emissions from car travel are 2.55 tonnes per annum, which means that people in Ballarat create approximately 1/3 more transport generated emissions than the national average. In a State context, according to Environment Victoria, substitution of 25% of private car travel with public transport, cycling or walking, Victoria's projected transport emissions could be reduced by 1.16 million tonnes or 8.3%, from 2006 to 2020.

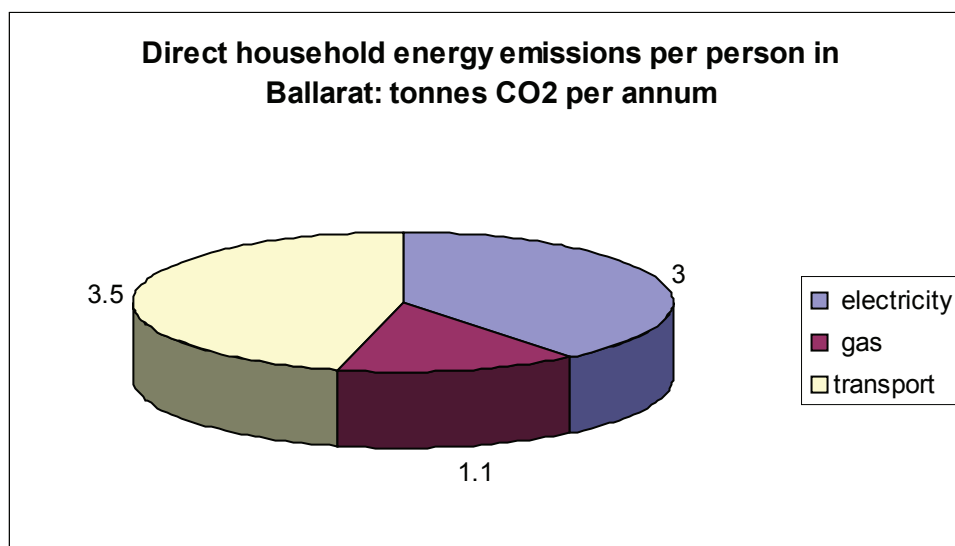
In Ballarat, a 50% reduction in total estimated private vehicle emissions for 2006 would represent a saving of 1.75 tonnes per person or 157,500 tonnes for the whole of Ballarat⁷.

It is important to note that these figures do not take into consideration emissions generated by transport outside of the City, and most notably travel by aeroplane. The average ... , which generates large amounts of greenhouse gas emissions, e.g.

4.2 Per person energy consumption

Ballarat's population at June 2008 was approximately 90,000 and each person uses 7.56 gigajoules (Gj) (2100 kilowatt hours) of electrical energy per year, compares with 10.18Gj (or 2800kwhs) for the national average. Additionally, we use about 23.0 Gj natural gas domestically per person per year, creating a total of 30.6 Gj of energy per person per year (DSE energy consumption figures 2009).

Gas use based on the figure of 23.0Gj per person will generate 1.1 tonnes per person per annum⁸. Adding this to household electricity consumption, these figures suggest direct emissions per person in Ballarat for household energy use are approximately 4.1 tonnes of greenhouse gas per annum. This compares to the national annual average stated by the University of Sydney above of 3.6 tonnes per annum⁹.



Average electrical energy use for BREAZE member households responding to the Climate of Change survey in 2008 was estimated to be 3.95 Gj (1097 kilowatt hours) per person, or 52 % of the 2007 average for Ballarat and 39% of the national average.

General household electricity and gas use trends

A report titled Energy Use in the Australian Residential Sector 1986-2020 produced by the Department of the Environment, Water, Heritage and the Arts, 2008 provides detail on energy use trends for typical Australian households. It highlights the expected growth in energy use for electrical appliances. Energy use for cooling is projected to rise by a factor of five for the period 1990-2020 and the report states this growth is expected to be accelerated by climate change effects.

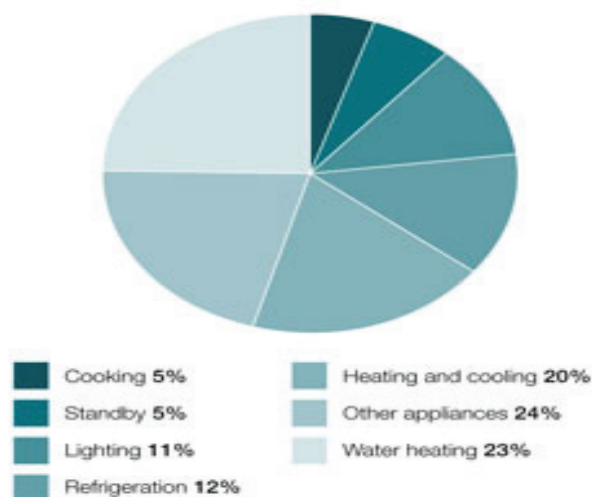
The study identified a lack of end-use data for residential energy use in Australia, particularly in regional areas. Data presented on the "Your home" site <http://www.yourhome.gov.au/technical/fs65.html> details the average emissions breakdown for home energy use. See below.

7. It must be noted that the 2006 estimates are based on interpolation of statewide figures and are estimates only.

8. Based on 0.051 tonnes CO2 per gigajoule of natural gas

9. We are comparing data covering a time period from 2005 to 2009 – the per sector percentage estimates are based on 2005 data and we are assuming the percentage use per sector has not altered significantly in 2008 -2009

Greenhouse gas emissions from home energy use (Baseline Energy Estimates, 2008)



Heating water is the single biggest energy consumer next to transport when considering direct energy use by householders. It represents 25% of energy used in the average home and 23% of greenhouse gas emissions.

4.2.1 Food and Fibre

28% of household greenhouse emissions are embodied in food compared to 10% directly from power and transport, and 50% of household water-use is embodied in food compared to 11% used directly on the garden¹⁰.

Victorian food production accounts for more than 60% of land used and almost 80% of harvested water.

Livestock

Livestock has been identified as a major contributor to greenhouse gas emissions. According to the report, in Victoria about 75% of agricultural emissions are due to methane from ruminant animals, cattle and sheep, arising from ruminant digestion where about 20% of the ingested carbon is lost as methane. According to a report by the Nous Group for Environment Victoria (Turning it around: climate solutions for Victoria November 2008), a 40% reduction in per unit emissions from enteric fermentation could deliver a 4.1 million tonne reduction by 2020 State wide.

5 Reducing our Emissions

Emissions savings through infrastructure

There are varying projections about how much renewable energy can be supplied from nearby wind farms. Powercor suggest up to 10% of Ballarats total energy use for 2008 (or nearly half all domestic requirements) could be met using renewable energy sourced from the nearest wind farm. According to Acciona, the Waubra wind farm is projected to generate enough electricity per annum to power 140,000 households. This is equivalent to a city 3-4 times the size of Ballarat. The generating capacity of the nearest wind farm will not always meet the demand profile of Ballarat and this may be the explanation for Powercors low 10% estimate. Even so a 10% input from wind power could cut emissions for Ballarat by 87,000 tonnes.

BREAZE has directly facilitated the installation of 234 KW of solar panels in the Ballarat district which are generating 304 Megawatts of clean energy per year¹¹. This represents a saving of 420 tonnes of CO₂ per annum (or 0.16% of Ballarat's domestic emissions from electricity) if these systems replace standard coal fired power.

The solar cities initiative expects to create similarly greenhouse savings through the installation of a solar park (approx 300kW), domestic PV systems (approx 250kW) and energy efficiency measures in homes.

Encouraging water efficiency measures and eliminating the need for pumped water supply through the super pipe could save 22,000 tonnes of greenhouse gas

Replacing an electric storage hot water service meeting the needs of an average 3-4 person household with a gas boosted solar system will save 5.3 tonnes per annum of CO₂ in Melbournes climate¹². Approximately 5,000 Ballarat households use electric hot water systems (BREAZE survey – 16% of households have electric hot water). If all these households switched to solar hot water it would save a total of 26,000 tonnes of CO₂ per year (assuming similar climatic conditions to Melbourne).

10. Sustainable Food Systems for Victoria: What do we know? What do we need to know? www.ecoinnovationlab.com/pages/library.php

11. Based on a measured generating capacity of 1300kw per year from systems installed in Ballarat

12. <http://www.yourhome.gov.au/technical/fs65.html>

A one kilowatt photovoltaic grid connected solar system could be expected to generate about 1300 kilowatt hours per year in Ballarats climate¹³. This is approximately 80% of the average Ballarat person's annual electrical energy use. An energy efficient household can meet all of its electricity demand using a grid connected one kilowatt system.

Average electrical energy use for BREAZE member households responding to the Climate of Change survey in 2008 was estimated to be 3.95 GJ (1097 kilowatt hours) per person, or 52 % of the 2007 average for Ballarat and 39% of the national average. Clearly BREAZE members have great knowledge and experience in reducing energy consumption that would be valuable to share with the wider community.

Behaviour change to reduce emissions

Results from the A Climate of Change project research undertaken by BREAZE show that households with people strongly committed to being more sustainable use less energy. Attitude counts and many surveys have indicated that behaviour change alone can bring create up to a 30% reduction energy usage.

There is an immediate opportunity for Ballarat households to improve their energy efficiency, cut energy costs and reduce greenhouse emissions. The ACF green home program is one positive step towards making this a reality that has been implemented by in partnership by the City of Ballarat, BREAZE and the ACF http://www.acfonline.org.au/articles/news.asp?news_id=1436 . Environment Victoria is also delivering the green families program in the region, further strengthening efforts to extend behaviour change options to the Ballarat community.

BREAZE results indicate households with a high level of awareness and commitment are likely to use 48% less electrical energy than Ballarat households responding to a random survey¹⁴. This suggests a relatively even split between behavioural effects and structural and technological effects like installing solar hot water or improving insulation.

Recent research by the group Coolnrg has shown that energy efficiency measures implemented at home represent one of the greatest cost effective opportunities to cut greenhouse emissions worldwide. See the book 'blindspot' at <http://www.coolnrg.com/index.html>. Many municipalities are adopting home energy efficiency and sustainability programs as a vehicle to achieve big reductions in direct emissions from households. Mark Deisendorf identifies large scale energy efficiency and adoption of renewable energy technology as two of the most significant approaches to achieve rapid reductions in emissions.

Agricultural practices

Building food security

Recent research by the Victorian Eco-Innovation Lab at Melbourne University (April 2008) provides clear information on how we need to change our food production and handling systems to be sustainable in the face of climate change¹⁵.

This report makes the following recommendations / comments regarding building food security and resilience to climate change across Victoria

- Climate change, emissions pricing and oil constraints will present new challenges to long food supply chains, and ensuring access to locally produced basic foods could help increase resilience and food security under these conditions. Local production of food is also likely to have health and regional development benefits.
- Diverse small / medium sized farms could increase the resilience of the food system
- The knowledge of local bio-regions and ecosystems that is held by small / medium farmers could be important in adaptation to climate change
- Diversification in systems, products and technologies enables more widespread innovation and increases resilience
- Low-input farming (including organics) has significant potential to affect emissions profiles through soil carbon sequestration, and is likely to increase resilience in the context of climate change
- In Victoria, the innovation potential of low input agricultural methods and innovations are being largely overlooked in institutional or research investment
- Recognising and developing innovations that reduce input reliance may be resisted by some commercial interests

University of Melbourne and DPI research from 2003 demonstrated that emission reductions for livestock production are possible through the simultaneous implementation of three strategies:

13. <http://www.yourhome.gov.au/technical/fs65.html>

- genomics and animal breeding/ selection to increase feed conversion efficiency
- improved farm management strategies to extend lactation and improve pasture and grazing management to maintain production with fewer animals
- new dietary strategies including oil, enzyme and tannin supplements and improvements to diet quality to reduce methane emissions.

It is also important to consider eating less meat and changing the profile of meats available to include a higher proportion of non ruminants such as pigs, chickens, kangaroo and emu.



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