GHG-ENERGY CALC HELP

Ben Rose and Steve Grabham

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CONTENTS

OVERVIEW

GHG-Energy Calc is a tool for doing rapid, comprehensive estimations of energy used and greenhouse gas (GHG) emissions produced by any Australian household or small business. It has the capacity to:

- Be used either as a GHG calculator or energy calculator.
- Rapidly show how changes in consumption/energy usage can affect emissions produced and fossil fuel energy consumed by everyday activities.
- Show the relative energy and GHG impacts as a percentage of the household or business total.
- Produce one-page printable audit summaries.

The user can switch between energy and GHG results instantly by clicking the '**Change to**' button at top right of the form. The black dot shows the current choice. Click the blank/white button to change.

For a detailed explanation of the emission factors used in GHG-Energy Calc, refer to Rose, Nov. 2009. *'GHG-Energy Calc Background Paper'*

Notes:

For tips and information on how to reduce your energy consumption and GHG emissions, refer to the relevant booklets and brochures on the website.

It is the Authors' intention to periodically update and improve this Calculator. We welcome feedback and suggestions for improvement. Email: biroses@westnet.com.au

GHG Calculator

The greenhouse gas emissions calculations relate to:

- Direct emissions, which are the emissions resulting from direct energy consumption.
- Embodied emissions from the production of goods, including extraction and production of raw materials, manufacture and transport but excluding emissions from services such as retail, wholesale, insurance and other.

Results are expressed in CO_2e (carbon dioxide equivalent). This unit takes into account all 'Kyoto listed' greenhouse gases. Although carbon dioxide (CO_2) is the major greenhouse gas accounting for 70 % of global warming, there are other more potent greenhouse gases that make a contribution to global warming, but are emitted in much smaller amounts, for example nitrous oxide (N_20) and methane.

Another significant cause of global warming is nitrogen oxides such as NO and NO_2 from the hot exhausts of jet aircraft at high altitudes and the exhausts of large diesel ship engines. Nitrogen oxides are not greenhouse gases in themselves but react with oxygen to form ozone, a potent greenhouse gas that is not included in the Kyoto list of GHG's presumably because of its short life. GHG-Energy Calc includes options to include the global warming potential (GWP) of nitrogen oxides and 'contrails' from aircraft.

The results show the average annual emissions by each person in the household, compared to the 'Estimated Sustainable World Average' (ESWA), which is about 2 tonnes *(estimate from IPCC, 2001).* The average (per person /per year) for Australia is 27.6 t, of which around 13 t − 6 times the ESWA − is from domestic sources *(estimate from ABS, 2000)*.

Energy Calculator

As for the emissions calculations, energy relates to fossil fuel energy used in the home, for transport and consumption items:

- *Direct energy* − in the form of fossil fuel generated electricity and fossil fuels used directly by the household for transport and in the home.
- *Embodied or indirect energy* – Fossil fuel energy that is used for the production of raw materials, manufacture and transport of goods, food, housing and waste materials (as for embodied emissions above).

The energy results are expressed in kilowatt hours. A kilowatt hour equals one unit of energy or gas consumption on our energy bills.

1 kilowatt hour (KWh) = 3.6 MJ.

One litre of petrol contains about 10 kWh of energy

A person would use 1 kWh of food energy to walk 40 km

A car would use about 1kWh of fuel energy to travel 1 km

The results show average annual energy use by each person in the household. Domestic energy usage is about half of total energy consumed in Australia and it is this portion that people have individual control over through practicing energy efficiency and changing their consumption choices.

** Notes:*

i. Greenhouse gases cause global warming. They are, in order of total global warming impact, carbon dioxide CO_2 which accounts for about 70% of global warming and is by far the most abundant GHG, methane CH4 (20 times more potent greenhouse gas than CO_2) and nitrous oxide N_20 (320 times more potent greenhouse gases than CO_2). There are many other man-made gases, mainly chlorofluorocarbons that contribute to global warming but their effect is relatively minor. Greenhouse gas emissions are expressed in carbon dioxide equivalents (CO_2e).

ii. The 'sustainable world average emissions' figure is estimated by dividing the figure 11.6 billion t of CO_2 that is added to the atmosphere annually by mankind's activities (IPCC, 2001) and dividing by a world population of 6 billion. As population and emissions continue to increase, the per capital sustainable emissions will decrease.

iii. Many nations, including the EEC block, Australia and the US have now legislated or are legislating for 'hard targets' for CO_2e emission reduction of at least 50% by 2050.

HOW THE CALCULATOR WORKS

For a full explanation of the calculations and algorithms used, refer to the background paper on this website *(*Rose, 2009. *GHG-Energy Calc Background Paper).* A brief summary of how the Calculator works is as follows:

The Calculator multiplies figures entered by conversion factors to give energy and emissions. All of the conversion factors used in the Calculator are *full cycle**, i.e. they include the additional upstream energy and emissions from extracting and refining fuels and generating and transmitting electricity.

** Note: Other calculators may use point source factors (from the burning of the fuels only) and would give lower energy and emissions results.*

Fuels
Direct energy of fuel consumption is a straightforward calculation multiplying the figures entered by fuel energy content factors taken directly from Department of Climate Change, 208 *National Greenhouse Accounts (NGA) Factors Workbook.* Similarly, fuel emissions are estimated by multiplying weight or volume of fuel by emission factors. (DCC, 2008).

Electricity
Calculation of electrical energy is estimated by multiplying the number of units entered by the user by 3, based on the assumption that grid electricity generation is 33% efficient *(CSIRO, 2004).* The emissions from electricity are estimated by multiplying the units entered by an emission factor for the particular state *(DCC, 2008)*

Embodied energy and emissions
Embodied energy and emissions for food, vehicles, waste, housing and possessions are calculated using estimated emission factors for Australian manufacturing, food and building materials *(Rose, 2009).*

ACCURACY OF RESULTS

The Calculator is designed to give estimates of energy and emissions, not 'hard and fast results'. The accuracy of the results is affected by the accuracy of the figures entered and the uncertainty of the energy and emission conversion factors used in the Calculator:

- The results are only as accurate as the figures entered. It's up to you whether you do a 5 minute 'guesstimate' or a 'sit-down and think' audit.

- The conversion factors used by the calculator are only the best available estimates. In reality, energy and emissions vary depending on such factors as the quality of the crude oil or coal energy sources and the efficiency of refining processes and electricity generation.

Assuming that the input figures are reasonably accurate:

- Direct energy results can be expected to be accurate to within about 5%, as the calculation is straightforward, using AGO conversion factors.
- Direct emission results can also be expected to be accurate to within about 5%, as the calculation is also a straightforward use of AGO conversion factors. Total global warming potential of emissions from air travel and cruise ship results are less certain. For example the global warming potential of jet exhaust gases is '2 to 4 times that of CO_2 emissions' *(IPCC, 1999)* and the Calculator assumes a factor of 2.7 for jet aircraft and 1.5 for cruise ships.
- Indirect (embodied) energy for food, goods, vehicles and housing can only be expected to be accurate to within about 25%. This is because in reality there is great variation in process and manufacturing energy inputs between different brands and between different items under any classification of goods.
- Embodied emissions for food, goods, vehicles and housing can only be expected to be accurate to within about 35%. In addition to the uncertainty of energy inputs for any class of goods described above, there is additional uncertainty of emission factors due to the different mixes of fuels used by processors and manufacturers.

However, estimates for some items will be probably be high and others low, so the inaccuracies can be expected to balance out. The uncertainty of the result totals shown by the Calculator are likely to be about 10% for energy and about 15% for GHG emissions, assuming the figures entered by the user are accurate.

DATA ENTRY

1. The first step is to enter the total number of people (adults, children and infants) normally residing in the household or business in the box at the top of the screen.

2. The other sections are filled in according to the captions and hints. Placing the cursor / arrow on a box gives a hint or examples relating to the data that is required in that box. Clicking on a section heading gives further information in the box to the right of the Calculator screen.

There are three methods used to enter data into the calculator:

   a. Click on a combo box (containing an arrow), and a drop-down menu will show the options available. Select the option that most closely fits your situation.

   b. Click on an edit box and enter numeric data. Limit numeric precision to one decimal place.

   c. Click a radio button to choose option (mutually exclusive).

ONLY NUMERIC DATA is accepted. Text and other data will result in an error message occurring. If this happens just click it, then re-enter numeric data.

There is no need to press the Enter button after entering values. When you input data, the result is calculated instantly and if your computer sound is switched on you may hear a tone.

Once data has been entered you can either jump to any other box by moving the cursor/arrow and left-clicking on it, or press the Tab key to advance to the next box (left to right of the section, top to bottom of the form). Shift + Tab moves to the previous box.

Notes:

- i. *In general, annual usage figures are entered but shorter period options are given for some sections, where these may be easier to recall. For example, the Food section looks at a weekly input, as it would be virtually impossible to recall the total for each food category for a whole year.*
- ii. *There is no need to enter 0 in boxes that do not apply, but a 0 may appear in boxes that have had data inserted, then deleted.*
- iii. *You will only be able to enter/alter data in boxes that allow you access.*
- iv. *Data can be altered or deleted at any time, and in any order.*
- v. *Some boxes will show a default value after some selections, but may be altered if you have a more accurate figure.*
- vi. *Numeric values for the whole form can be removed by clicking the **Clear** button. Options selected within sections remain.*

RESULTS

Totals for sections / categories show in a panel on the right-hand side, with your Household Total at the bottom. In addition, figures in red on the right show the approximate percentage of the Household Total that each section represents.

The Household Total is the total of all categories above it.

In the GHG calculator you will also see (bottom centre) the tonnes of greenhouse gas emissions (CO_2e) attributed to each person in your household, and how that compares to the Estimated Sustainable World Average (ESWA) GHG emissions of 2 tonnes /person /year.

In the Energy calculator you will also see (bottom centre) the amount of energy (kWh) attributed to each person in your household, and how that compares to a typical African household energy consumption of 2800 kWh / person /year.

Clicking the 'Show Energy Costs' button below the totals column will show the cost of your energy use. You can update the costs per unit by clicking 'update prices' on the energy cost pop-up window.

PRINTING RESULTS

1. Results can be printed by clicking **File** (top left), then **Print**.
2. A prompt will appear asking if you want a large printout.
3. If you select yes, you will need to select landscape in **Properties**.
4. If you do not select the large option, the printout will fit across an A4 (portrait) page.

Alternately you can use **Alt** + **PrintScreen** to save what is on screen to the clipboard, then:

- Open a word-processor program (e.g. Word).
- Open a New document and Paste (clipboard contents) into it. You may need to set page orientation to Landscape.

Print using the program's options.

PROGRAM COMMANDS

Standard window controls apply. There are two menu items − **File** and **Help**.

File contains two items − **Print** and **Exit**:

- Click **Print** to open a dialog box, allowing the on screen form to be printed (see Results page).
- Click **Exit** to display a message box confirming your request to exit.

Help contains two items − **Contents** and **About**:

- Click **Contents** to show the Contents page.
- Double clicking a topic will take you to the appropriate page.
- Click **Index** to access Help via key words.
- Click **'about'** to show information about the program.

SCREEN LAYOUT

The window commands are in the top right corner (**Minimize**, **Maximize**/**Restore**, and **Close**).

The screen layout generally reflects the level of impact that each section has on GHG emissions. Changes to transport modes and distance traveled generally have the greatest impacts on emissions, although changes to household energy and consumption may be easier to implement.

Information hints related to the location of the cursor are displayed alongside the cursor when paused. The hints are also displayed in the status bar at the bottom of the screen.

TRAVEL BY AIR AND CRUISE SHIP

Air and overseas travel accounts for a significant portion of the world's oil consumption and is a major source of emissions that is often overlooked in statistics. In general, per passenger GHG emissions from long haul aircraft flights and ocean cruises are equivalent to one person driving the same distance in a medium sized car. As long distances are often traveled in a short time and the passengers are not aware of the fuel used, the large amounts of energy used and emissions produced tend to be un-noticed.

1. Enter flights and cruises taken by all members of the household during the year.
2. Use the Trips pop-up calculator to enter all flights and cruises in either km or duration. It will convert the trips to km, add them and enter total km in the air and sea travel boxes
3. Note that 'Short haul' fights are less than 800km one way and 'Long haul' flights are longer than 800 km one way.

Table 1 Flight distances via shortest route (approximate km):

700	Sydney - Melbourne/Brisbane;	Melbourne – Adelaide;	Montreal - Washington
1200	Sydney - Adelaide		
1500	Brisbane – Cairns;	Perth - Karratha	
1500	London - Rome		
2100	Sydney - Auckland		
2800	Los Angeles - Chicago		
3000	Perth - Darwin		
3200	Sydney - Perth/Darwin		
3500	London - Cairo		
3700	Washington - Los Angeles		
4000	Perth - Malaysia/Singapore		
4200	New York - Los Angeles		
5400	Perth - Auckland		
5600	London - New York		
6000	Perth - Hong Kong		
6600	Sydney – Malaysia;	Perth - Calcutta	
6800	London - Nairobi		
7500	Sydney - Hong Kong;	Perth - Mumbai	
7800	Sydney - Tokyo;	Perth - Delhi	
8300	Perth - Johannesburg		
9100	London - Johannesburg		
14600	Perth - London		
16500	Sydney - New York		
17200	Sydney - London		

Notes:

i. *The hot exhausts of jet aircraft produce oxides of nitrogen that react to form ozone, a potent but short lived greenhouse gas. Jet exhausts also emit water vapor, which condenses to form contrails - high clouds of ice crystals that contribute to global warming. These emissions into the upper atmosphere cause aircraft exhausts to have 2-4 times more global warming effect than the $CO_{2\ from}$ the same amount of fuel used by a road vehicle. The calculator assumes a factor of 2.7(IPCC, 2000). The emissions box provides options to include the global warming effect of the fuel burn CO_2 only, added effects of other exhaust gases (nitrogen oxides and contrails) and also for embodied emissions of the aircraft and airport facilities.*

ii. *Long-haul jets emit about 0.27 kg CO_2e per passenger km including embodied emissions. The fuel consumption for long-haul flights was derived from the Boeing website, which cites the fuel consumption of a Boeing 747 at 12 L/km. This equates to about 4 L/100 passenger km when the aircraft is carrying 300 passengers (75% loaded).*

iii. *Short haul flights cause more emissions - about 0.4 kg CO_2e per passenger km- mainly because taking off, climbing and landing use much more fuel than cruising in level flight.*

Travel by ocean liner emits about 0.36 kg CO_2e per person km. Ship exhausts also emit high levels of nitrogen oxides. Although ships are the most efficient means of carrying freight, the same is not true for passengers. A large gross tonnage of ship per passenger is used - from 20 t per passenger for budget liners to 50 t per passenger for luxury liners. The QM2, which at 150,000 gross t, carries only 2800 passengers carries a 'people mass' of less than 280 t. A similar sized cargo ship would carry over 100,000 t of cargo.

PRIVATE VEHICLES

This section is for calculating energy and emissions from use of private vehicles owned by the household. You should include kilometres of private travel in business vehicles and taxis.

1. Select from the body size/type box (drop-down menu) the closest description of your vehicle(s). Also estimate kilometres of private travel in business vehicles and taxis.

2. Select fuel type.

3. If you know the fuel consumption, enter it in the Consumption box and this will give a more precise calculation. If not, the Calculator uses a default figure based on your vehicle body size/type.

4. Select the option of per year / month / week.

5. Enter the amount traveled in that period.

6. You can select whether you want the emissions figure given by the calculator to include:
   - Only emissions from the production and combustion of the fuel used by the vehicle during the year.
   - Additional embodied emissions from the manufacture and servicing of the vehicle.
   - Additional embodied emissions from the construction and maintenance of road infrastructure.

   The Calculator estimates per kilometre energy and emissions from all sources.

7. To estimate fuel emissions only:
   - Leave the 'body type/ size' boxes blank.
   - Fill in fuel consumption and kilometers traveled.

   Note that this function is useful if you want to estimate emissions from particular trips.

Notes:

i. *Vehicle embodied emissions are estimated according to vehicle weight and are generally around 25% of fuel emissions; infrastructure embodied emissions are about 15% of fuel emissions.*

ii. *The embodied energy calculation is annualized over the life of the vehicle, assuming:*
   - *Average life of vehicle is 15 years or 225,000 km.*
   - *Embodied energy is proportional to the weight of the vehicle.*

iii. ***For most accurate results, fill in the actual fuel consumption in km/L of your vehicle from your driving experience, or the litres of fuel per week that your vehicle uses.*** *There are several reasons why actual fuel consumption varies:*
   - *There is considerable variation in fuel consumption within the classes, between models and makes, and manual/auto (can add up to 10% for auto). For example 6 cylinder Magnas and Commodores, which are in the large class, consume about 10 - 11 L /100 km on the city cycle whereas most Falcons consume about 12 L /100km.*
   - *The driver factor − speed and rate of acceleration − can increase fuel consumption by more than 20%.*
   - *The loaded weight of the vehicle generally affects fuel consumption more than engine size.*
   - *Other factors such as tyres under-inflated, engine requiring tuning or an old or worn engine will increase fuel consumption.*

iv. *The default fuel consumption figures used in the calculator are approximate average city cycle figures for each class of car from the AGO Australian Fuel Consumption Guide. City cycle figures more closely approximate what most drivers achieve (with a mix of city and country driving) than the highway cycle figures. Motorcycle figures are estimates from retailers, brochures and from personal experience.*

v. *Vehicle embodied emissions can be omitted if your vehicle years and has traveled more than 225,000 km (the assumed vehicle life).*

PUBLIC TRANSPORT

This section is for calculating energy and emissions from use of public transport − bus or train. The results are an estimate of the energy / emissions per passenger kilometer and include the embodied energy of the bus and train and the transport infrastructure. The bus is assumed to be carrying 20 passengers and the train 120 passengers.

1. Enter the total kilometres traveled by all members of the household, in the Bus box.
2. Select period of travel (year / day / week / month).
3. Repeat for train.

Notes:

i. 'Wk day' means daily travel on work-days only, and calculates annual amount at: 5 working days /week and 48 working weeks /year (240 days), whereas 'day' assumes 365 days /year.

ii. Though taxis are viewed as 'public transport', extensive travel by taxis (home and overseas) should be included in the Private Transport section.

ELECTRICITY

This section accounts for the emissions from and energy used at the power station for the generation of electricity used by the household.

1. Select the source of your electricity.

2. Enter your electricity consumption. An annual figure summing bills for a whole year is best as individual bills will contain seasonal variations. Daily consumption from your bill will probably be less accurate.

3. If you subscribe to a 'Green Power' scheme, choose your plan/amount. You will be shown the amount of greenhouse gases avoided by renewable power generation, compared to the normal generation method used in your state.

Notes:

i. *For wind and hydro energy (‘Green Power’, operational fossil fuel emissions are negligible. The figures used are essentially the annualized embodied energy and emissions from the construction of the generators and infrastructure.*

ii. *1000 KWh of electricity read from the meter = 3.6 GJ.*

iii. *Electricity generation from fossil fuel power stations is only about 33% efficient. About 2/3 of the energy supplied as fuel to the power station is lost, including mainly waste heat losses, power station processes and about 5-10% transmission losses. Hence the Calculator results show energy use as three times the energy read from the meter; for example 1000 kWh at meter = 3,000 kWh of energy used (Rose, 2009). For Green Power, fossil fuel energy is only the embodied energy used to make the generators and transmission lines; hence the energy figure shown in the results is low. The same applies to Tasmania which has mainly hydro-electricity.*

iv. *Coal has the highest GHG emissions of all fossils fuels. About 75% of electricity generated in Australia is from coal fired power stations, most of which are among the most inefficient and polluting electricity generation technologies. For this reason, emissions for Victoria and NSW, which have mainly coal fired power stations, are higher than for NT, which has gas fired power stations.*

v. *Although the operational greenhouse gas emissions from nuclear fission electricity generation are low compared to fossil fuels, nuclear power is not included in the Calculators because it is not used in Australia. Nuclear energy has not been accepted by the Australian community as a safe, sustainable electricity generation option.*

OTHER FUELS

These are other fuels that may be used in the home or buildings for space/room heating, water heating, cooking and recreation.

1. If you use a solar water heater, select the unit size. The calculator shows annualized embodied emissions, assuming a 20-year life.

2. If you use gas, enter the annual number of units of gas used per year and select the appropriate unit, for example units of mains gas (from gas bills) or 45kg cylinders of LPG.

3. Enter the amount of any other fuels used per year. This includes tonnes of wood or coal and litres of oil and kerosene. Enter litres of boat and lawnmower fuel under ‘Kero / oil’.

FOOD/ GROCERIES

This section estimates the annual embodied energy and emissions from food consumed by the household. The information used in GHG-Energy-Calc is shown in Table 2 below.

1. Estimate the number of litres or kilograms of each category of foods normally purchased in a week. Estimate to 1 decimal place, for example 6.5 (kg).

2. Click in an input box to show examples of typical foods in that category. There are boxes for low EE (fresh), medium EE, high EE and very high EE foodstuffs.

Note:
The energy used in (and embodied emissions from) primary production, manufacturing, packaging and processing varies greatly between different types of food. For example: More than 6 times the energy is used to produce meat, dairy products and many processed foods than is actually contained in the foods.

Table 2 Global Warming Potential (GWP) for 8 categories of foods, used in *GHG-Energy Calc*. *(Rose, 2009; Eckard, R., 2006.University of Melbourne, Vic DPI)*

Food class	Energy inputs - lower (MJ/kg)	Energy inputs - higher (MJ/kg)	Average EI energy input MJ/kg (a)	Methane, NOx emissions (kg CO_2e / kg product *	Emissions from energy, lower, kg CO_2/kg food = (B)*.095	Emissions from energy higher, kg CO_2/kg food = (C)*.095	Average total emissions kg CO_2e/kg
L1- Fresh/minimally processed. Fresh fruit / veg, grains, flour, rolled oats	3	10	6.5	0	0.285	0.95	0.6
L2 - Pasta, biscuits, rice, muesli, pulses, soy products, canned/bottled cool/juice drinks, cakes, breads	11	20	15.5	0	1.045	1.9	1.5
M1 - Milks (dairy and soy)	6	10	8	0.7	0.57	0.95	1.5
M2 - Canned or bottled fruit/veg based foods, frozen fruit/veg, dried fruits/nuts, sugar, beer, honey, soaps, papers, eggs, pastries	21	30	25.5	0	1.995	2.85	2.4
MH1 - Chicken meat, chocolates, wine, jam, potato chips, cooking oil, margarine, tea/herbs, ground coffee, processed breakfast cereals Dairy – yoghurts, ice creams custards	30	44	37	0	2.85	4.18	3.9
MH2 - Soup powders, instant coffee, spirits; pork, fish, soaps and detergent, shampoo, disposable nappies	45	120	82.5	0	4.275	11.4	7.8
H1 - Red meats (lamb and other ruminants), Dairy - cheese/butter/cream/milk powders	44	90	67	6.4	4.18	8.55	12.8
H2 - Beef	44	90	67	9	4.18	8.55	20

WASTE

The Waste section is for estimating the energy and emissions embodied in municipal solid waste (MSW) – the rubbish that is thrown in your kerb-side collection bin(s).

1. Enter/alter the size of the rubbish bin(s) used for verge pick-up.
2. A large size 'wheelie bin' holds 240 L and the small size, 140 L.
3. Enter the approx. % volume (do not include the % character) that your bins normally contain at pick-up, assuming that the waste is pressed down by hand. If you have separate bins for waste and recyclables, enter percentage that each bin contains at pick-up (assumed to be weekly for the landfill bin and fortnightly for the recyclables bin).
4. If you normally compost your food waste select the appropriate radio button (Yes/No) for that item.
5. Emissions from the consumption of newspapers, magazines and packaging are accounted for in this section and are not included in the 'Food and groceries' section.

Notes:

i. *MSW amounts to about 480 kg per person per year and is composed of:*
   - *About 80% organic wastes of which about half is food scraps and half is paper and cardboard.*
   - *About 20% glass, plastics and metals plus some inert waste.*

ii. *This section **does not include**:*
   - *Garden wastes, as these are usually collected separately and mulched, composted or burned. They do not contain significant embodied energy and do not result in significant methane or embodied GHG emissions.*
   - *Old appliances and furniture that are discarded. Annual embodied energy of appliances is estimated in the 'House' Section.*

iii. *8 L of waste pushed down into the bins by hand equals 1 kg (RMIT, 2001).*

iv. *Recycling includes remanufacturing, composting and incineration.*

v. *Recycling of waste provides many benefits in terms of reduced solid waste to landfill and less pollution from nutrient and chemical leaching. It also reduces CO_2e emissions because recycled material use much less embodied energy and therefore have lower embodied emissions from their manufacture.*

vi. *Energy and emissions are incurred in collecting and sorting the wastes for recycling, so the energy and emissions savings from recycling are less than may be expected. GHG-Energy-Calc deducts a small percentage for each of the waste streams recycled − a total of about 20% if all collectable materials in the domestic waste stream are recycled and food wastes are composted (from Grant et al. (RMIT), 2001.* 'Life Cycle Assessment of Paper and Packaging waste management scenarios in Victoria'*).*

vii. *Organic waste in landfill also produces methane, a potent greenhouse gas. About 60% of this is collected and used as bio-gas to generate electricity but the remainder is lost to the atmosphere, contributing to global warming.*

viii. *Composting is assumed to produce no GHG emissions.*

ix. *It is best to first **reduc**e waste by minimizing purchase of papers, magazines and containerized, packaged products, **re-use** rather than throw things away and last of all **recycle** what is left.*

WATER

Enter annual water consumption. If not known, enter the average Australian domestic (household) usage: 160 (kL).

Notes:

i. *Although water is processed to the quality of a foodstuff it is more commonly treated as a waste stream (washing, cleaning, toilet, garden use). Though a relatively small contributor to emissions, it has been listed separately rather than including it with food or waste.*

ii. *The energy used to supply water for an average household is about 2/3 operational energy used to pump the water and 1/3 embodied energy of the water supply infrastructure and pipes.*

HOUSING

The housing section estimates the annual embodied energy and emissions of the buildings occupied by the family or business, based on the floor area and type of construction. Version 5 has a more comprehensive calculation method, enabling specific components construction types and 'add-ons' to be included. It also 'depreciates' the annualized figures according to the age of the dwelling (Table3)

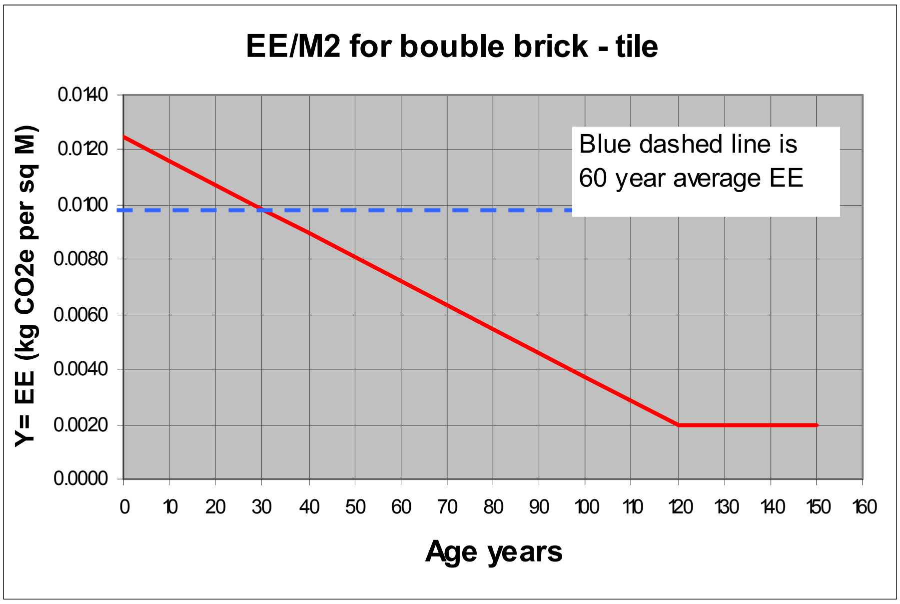
1. Select the construction type for the floor, walls and roof of the house - (e.g. walls - double-brick).
2. Select the configuration that best suits your house (e.g. 4 bedroom).
3. If known, enter the area of the house (including garage/carport). If not known, the calculator will default to an approximate figure for the selected configuration.
4. Click the 'including' button and enter the dimensions of 'add-ons' such as garage, patios, fences, swimming pool. The pop up calculator will estimate the annualized embodied energy and emissions of these and add them to the 'house' total.

Notes:

i. The figure calculated is the embodied emissions from the production of the materials used and the construction and maintenance (including painting) of the house annualized at a decreasing rate to a constant low level at 120 years.

ii. Embodied emissions for wood and light frame housing are about 50-70% of those from brick and concrete construction, which uses many times greater mass of materials (Lawson, 1996; Glover, 1991).

Table 3 'Depreciation curve' of housing embodied emissions for GHG-Energy Calc 5



CONTENTS

This section estimates the embodied emissions of possessions and house contents such as appliances, clothes, furniture, floor coverings, boats and trailers owned by households.

i. Select the appropriate quality/quantity option for the furnishings, appliances and chattels in the home from the 'contents' pull down menu.

ii. Enter kilograms weight of 'external items' - possessions such as caravans, boats, trailers, and tools. Version 5 has a pop up menu which sums nominal weights of common items

iii. Items that are older than the assumed life can be omitted - external items > 30 yrs, appliances > 20 yrs and computers > 6 years can be omitted.

It is not possible in a simple calculator to give detailed estimates based on individual items owned by the household, so a choice of minimal, basic, moderate, high and very high estimates is provided. The energy content per kg of goods in each of these categories was estimated (Rose, 2009; Carlsson-Kanyama, 2005). Embodied emissions were estimated by using an emission conversion factor of 0.12 kg CO_2e / kg goods *(Rose, 2009).* The user also enters the weight of large items such as caravans, trailers and boats and recreational off-road vehicles. Each category of goods has been allocated a lifespan of from 5 to 30 years and the emissions annualized.

Notes:

i. Annual embodied energy and emissions varies greatly for different types of goods and is dependent on the expected life of the item, materials and manufacturing processes used (see Table 3. below).

ii. If external items such as boats, trailers, caravans are older than 30 years (their assumed life), they can be omitted.

Table 9.2 Annual embodied energy and emissions attributable to contents and possessions (other than cars and external items) for 3 bedroom house

Household contents / possessions	Embodied energy kWh / year	Embodied emissions tonnes CO_2e/ year
LOW - Minimal furnishings all old or used; only small sized basic appliances, basic clothing and bedding, mostly more than 5 years old.	583	1.3*0.2 = **.26**
BASIC - Basic furnishings, and only small sized appliances, basic clothing and bedding.	1750	1.3*0.6 = **.78**
AVERAGE - Standard furnishings and appliances, one of each common appliance, including computer, sound system; average quality wardrobes and bedding.	2917	**1.3**
HIGH - High quality furnishings and all modern appliances generally less than 3 years old for executive quality house. Possessions exceed any three of the following: more than one of a particular large appliance, e.g. fridge/freezers, TV's, dishwashers, computers, pianos, audio equipment; more than one lounge or dining suite, more than 70 kg of books, large wardrobes of clothes and bedding mostly less than 3 years old.	4083	1.3*1.4 = **1.82**
EXTREME - Top quality near new furnishings and appliances for luxury house. More than one of more than 5 appliances or suites as above; large wardrobes of near new expensive clothes and bedding.	5251	1.3*1.8 = **2.34**

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