MODULE 4

What can I do at home?

This module aims to provide Energy Educators with the knowledge and confidence to support households to understand, and potentially improve, their energy use.

To be read with Module 4 slides.

1. OUTLINE

- Why energy efficiency in homes matters? Recap from module 2
- The states of homes – recap from module 2
- Climates and surroundings – location, location, location!
- Building envelope
- Appliances (electrification)
    - Fixed
    - Movable
- Lights and Phantom loads

2. WHY ENERGY EFFICIENCY IN HOMES MATTERS?

Recap from Module 2.

3. HOMES

Recap from Module 2.

4. CLIMATES AND SURROUNDINGS – LOCATION, LOCATION, LOCATION!

The location of your home matters a great deal. Building for energy efficiency varies significantly both between and within Queensland's climate zones. If we consider a region's climate and a location's microclimate, the conditions in which we live, and the performances of our homes can vary tremendously.

Climates zones for National Construction Codes (NCC):

https://www.abcb.gov.au/resources/climate-zone-map

5. WHERE CAN HOME ENERGY EFFICIENCY BE FOUND?

There are three categories of home energy efficiency features:

- Building shell or envelope
- Fixed appliances
- Moveable appliances

The following chapters go into further detail on each category, describing what those categories are, what they can do for your comfort and energy bill, and the barriers to accessing these efficiencies.

Generally, the biggest wins to be had are with the building shell and fixed appliances, but don't discard moveable appliances as they might be the quickest gains.

Every home is different and doing a Home Energy Assessment or even a quick Tune Up will provide you with some information and options on how to improve energy efficiency specifically for your home.

5.1 Building envelope

All the features presented in this section can greatly affect the energy efficiency of your home. You will see that there are huge variations between homes.

5.1.1 Types

There are many types of homes. This is a fast-evolving space, with likely more to come, for example, modular homes deployed after disasters, tiny homes, liveable sheds (or houses), demountable homes, converted churches, commercial spaces and warehouses. (We will focus mostly on conventional homes here).

5.1.2 Materials

A home is made of many different materials. The industry is continually researching materials that are more sustainable, resilient, and affordable. Hemp and fungus, for example, are upcoming materials that could become common construction materials.

All about home construction materials: https://www.yourhome.gov.au/materials

Fungus and hemp in building materials: https://theconversation.com/scientists-create-new-building-material-out-of-fungus-rice-and-glass-98153

The building envelope's external colour greatly affects the energy efficiency and comfort levels of homes. "*Before aircon, the main way people had to keep cool was through how they designed their homes. In hot countries, buildings are often painted white…".*

https://theconversation.com/if-youve-got-a-dark-roof-youre-spending-almost-700-extra-a-year-to-keep-your-house-cool-225674

5.1.3 External shading

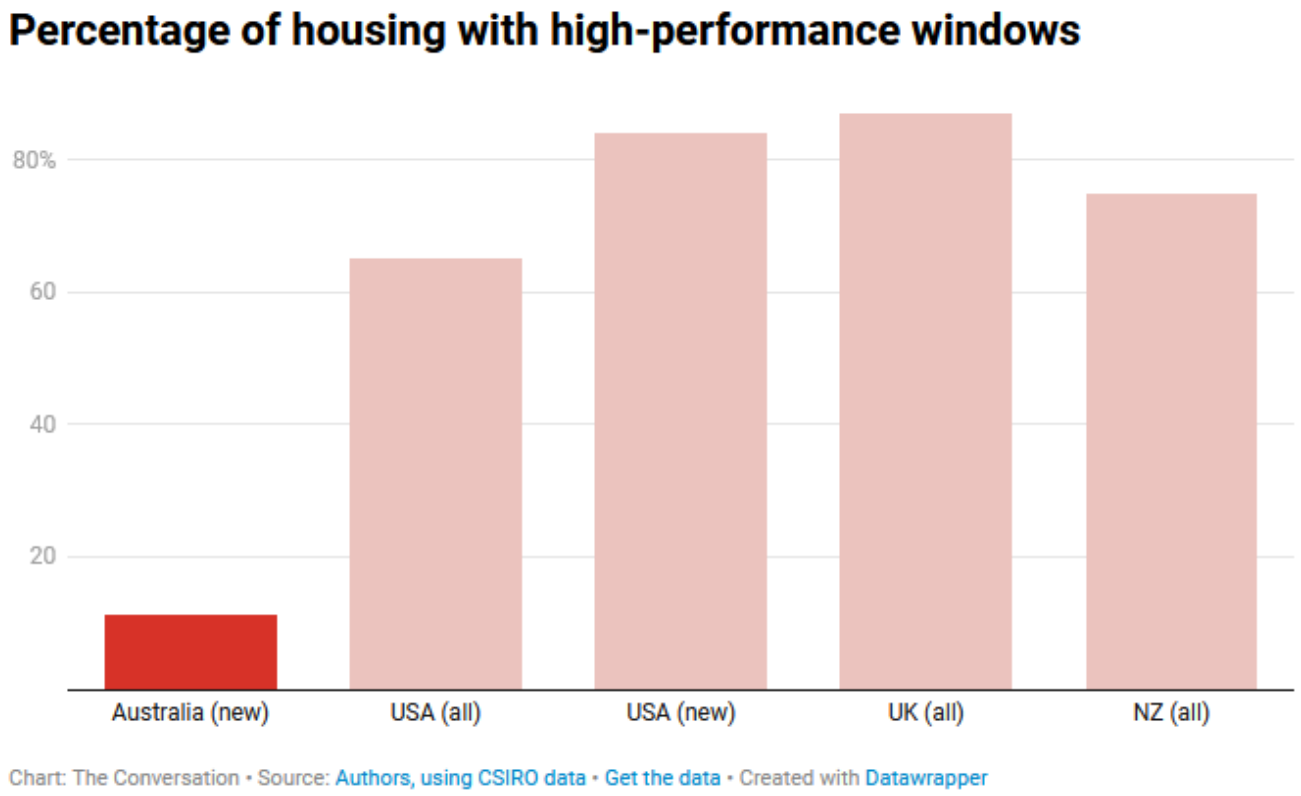
Shading can be achieved through various features including awnings, trees and verandas.

External shading is particularly important as it can block up to 90% of the heat coming into your home.
https://theconversation.com/top-10-tips-to-keep-cool-this-summer-while-protecting-your-health-and-your-budget-193723

All about shading: https://www.yourhome.gov.au/passive-design/shading

5.1.4 Windows

Windows come in a huge variety, from frame to size to glazing and treatments (such as coatings that block light for example). As demonstrated in the table below, Australia is well behind New Zealand, the United States and the United Kingdom in terms of windows performance for energy efficiency.



Original schematic:
https://theconversation.com/on-hot-days-up-to-87-of-heat-gain-in-our-homes-is-through-windows-on-cold-days-its-40-of-heat-loss-heres-how-we-can-fix-that-212117

Windows are also a part of the ventilation of your home. Make sure they open and close and have screens for security and pest exclusion. Poorly designed windows can provide unwanted draughts.

All about windows: https://www.yourhome.gov.au/passive-design/glazing

5.1.5 Internal shading

Internal shading such as blinds and curtains can improve heat gain and losses. Internal shading is not as effective as external shading; however, it is often the only available option for low income households (due to the low cost), renters (temporary fixture), and apartment dwellers (they might not require body corporate approval).

Look for internal shading options that block light out (black out vs sheer) and contain the air between the window and shade (sealing) as much as possible. For example, a pelmet: they block the heat and cold!

Pelmets are effective in keeping the house warm during winter, especially for the colder regions of the state, like Toowoomba or Stanthorpe. Pelmets work by stopping the movement of cold hair. When warm air hits a glass window, it cools, becomes dense and drops to the floor, pulling in more warm air the top the curtain, and the process starts again. Pelmets stop the movement of air, creating an insulation affect.

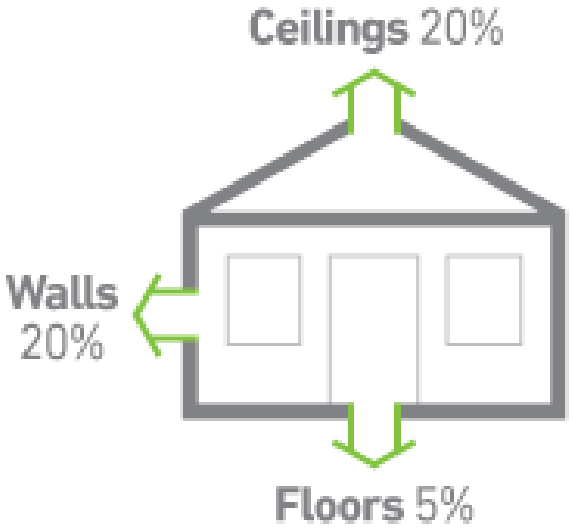
Pelmet:



5.1.6 Insulation

Insulation can seem quite complex, but really the goal is for your home to act as a thermos in winter and a cooler in summer. To achieve this, various materials can be used all around the building







envelope.

Original schematic:
https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/building-or-renovating/key-principles-of-energy-efficient-design/planning-and-design/insulation

All about insulation: https://www.yourhome.gov.au/passive-design/insulation

5.1.7 Ventilation, draughts and leaks

For any home to remain healthy, ventilation is paramount. Unwanted draughts and leaks are a key concern of energy efficiency as a lot of heat and cold will be lost. Ventilation (i.e. deliberate and/or controllable air movements) can be passive, such as simply opening doors and windows to allow outside air to move through your home, or it can be active, such as pedestal fans, rangehoods or and bathroom extraction fans.

Ventilation is used to maintain air freshness/quality in your home. All rooms require ventilation, some more than others. The kitchen, bathroom and laundry (especially if you use a clothes dryer), require extra ventilation as a lot of water vapour or moisture is produced in these rooms. Ventilation is very important to prevent mould.

Leaky vs ventilated

There is a difference between ventilation and leaks. Leaks are uncontrolled and can result in draughts in your homes making your home harder to keep cool in summer and warm in winter. Draughts can make the home uncomfortable or unhealthy.

An energy efficient home should be relatively airtight, meaning it has few leaks and draughts.

All about ventilation and airtightness:
https://www.yourhome.gov.au/passive-design/ventilation-airtightness

Draught proofing:
https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/building-or-renovating/key-principles-of-energy-efficient-design/planning-and-design/insulation/draught-proofing

5.1.8 What could go wrong?

Our homes' building envelope tends to be unshaded, uninsulated, draughty, poorly ventilated, with poor quality windows, many of which are oversized. This is why existing Australian homes have an average energy rating of 1.8 stars. This means that our homes lose heat in winter, and coolness in summer, and often come with mould issues.

To combat this, we install heating and cooling appliances that have to work really hard to barely make us comfortable and cost us a fortune in energy.

5.1.9 Financial Support

For low-income household the No-Interest Loan Scheme (NILS) is often a good place to start.

Nils can be used for a variety of essential goods and services up to $2000. You can borrow up to $3000 for housing such as bond or rent in advance or recovery from natural disaster.

Loan purpose includes, but is not limited to the below:

- Housing repairs
- Fridge, washing, machines, air con etc

The client must go through a budget and demonstrate that they can service the loan.

If a loan is approved the payment is made to the supplier which must be an Australian business with valid ABN. Clients can find more information on the website eligibility and how to apply and find their local NILS program through the website https://goodshep.org.au/services/nils/.

NILS isn't the only referral option. If clients are eligible, the below options may be able to assist with housing repairs.

- My Aged Care: https://www.myagedcare.gov.au/find-a-provider/
- NDIS: https://www.ndis.gov.au/participants/working-providers/find-registered-provider/provider-finder

NILS is a great option for a wide range of people on low incomes even if they are eligible for funding from My Aged Care and NDIS.

Local emergency relief, with local funding/brokerage may be able to be used for a variety of options for clients.

The State and Federal Governments do often provide financial support to improve a households energy performance. This is often targeted at vulnerable households, and sometimes (but rarely) designed to include renters. Financial support can come in the form of grants, rebates, discounts or programs:

- The Queensland Government recently (in 2023-2024) offered the Climate Smart Energy Savers rebate. It is likely that similar programs will be offered again in future.
- The Queensland Government is currently developing the Social Housing Energy Performance Initiative (SHEPI), co-funded in equal parts with the Federal Government to a total $116M. SHEPI will provide energy upgrades to 32,000 public (28,000) and community (4,000) houses. The

Federal government is co-funding the SHEPI as part of its Home Energy Upgrades Fund for social housing (HEUF), and is making similar contributions to other states. The Federal Government matches state funding, and the HEUF is significantly under-spent.

5.2 Appliances

Appliances are divided into fixed and moveable appliances. Think of the moveable ones as the ones that a renter brings with them. Fixed appliances are hot water systems, air conditioning and the cooking stove and oven.

Before we dive into the specifics of appliances, more detail about appliances' star ratings and the new 'rising star' of energy efficiency - the heat pump – would be helpful.

5.2.1 Calculating consumption and cost

How do you calculate how much electricity your appliances use and how much do they cost to run?

Calculating how much electricity an appliance uses, and the costs associated is quite complicated and not for everyone.

Guide - How to calculate how much electricity appliances (for those with high energy literacy): resource coming soon

For those with lower levels of energy literacy, Ergon has booklet which has a ranking of appliances by consumption and cost.

Thankfully for us, appliances with an energy star rating mean that the calculations have been done. See energy star ratings below.

Note that if we don't calculate from scratch, then a lot of assumptions have been made for us. That means we might lose accuracy.

5.2.2 Energy star ratings

The Australian Government's Energy Rating website explains how appliance star ratings work and provides energy calculators for appliances: https://www.energyrating.gov.au/industry-information/understand-requirements/minimum-energy-performance-standards

The energy star rating and energy calculator are most useful to compare similar appliances. For example, comparing a 400L fridge with another 400L fridge.

Energy calculator link: https://calculator.energyrating.gov.au/

When using the energy star rating to find out how much an appliance costs to run in a year, we need to be mindful of the assumptions used to make the calculations. The energy star rating makes several assumptions that might be of interest if our actual patterns of use differ widely from those assumptions, such as:

Televisions and computer monitors = 10 hours use plus 14 hours in standby per day.

Fridges and freezers = in use 24 hours per day.

Clothes dryers = 1 full load per week.

Dishwashers = 7 uses per week at the ‘normal’ setting.

Clothes washers = 7 uses per week using a warm wash.

Swimming pool pumps = pumping 50,000 litres of water per day.

The tool also assumes an electricity tariff that might be very different from yours.

Climate zoned labels

Heating and cooling appliances are now climate zoned. Explainers here: https://www.energyrating.gov.au/consumer-information/products/heating-and-cooling

https://www.energyrating.gov.au/sites/default/files/2022-12/The%20New%20Zoned%20Energy%20Rating%20Label%20for%20Air%20Conditioners.pdf

Climate zoned labels are important. We cannot compare the star ratings between old (not climate zoned) and new (climate zoned). The climate zoned star rating better reflects actual use and variation through seasons in your specific climate zone.

Buying an appliance: household resource coming soon

Gas appliances are on a different star rating system altogether. Their star rating is lead by the gas industry and often thought to not be a reliable way to compare with other electrical appliances.

https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/save-energy-in-the-home/water-heating/choose-the-right-hot-water-system/gas-hot-water-systems

5.2.3 Heat pumps

The energy efficiency of heat pumps is very good and continuously improving with broader and broader use. They can be used to heat or cool spaces, water, and clothes. Your fridge is a heat pump. Your air conditioning, hot water system, clothes dryer, or pool heating could be a heat pump. They are becoming more affordable and are an essential component to the electrification of everything.

How heat pumps work: https://youtu.be/KH47xAXEEe0

Alan Pears on heat pumps: https://theconversation.com/heat-pumps-can-cut-your-energy-costs-by-up-to-90-its-not-magic-just-a-smart-use-of-the-laws-of-physics-185711

Heat pumps have no star ratings, although this is being accelerated. This means that there are many bad products out there, that end up being inefficient, noisy, lack good warranty and do not last https://www.solarchoice.net.au/heat-pumps/

Tim Forcey's comprehensive guide to buying a heat pump: https://switchedon.reneweconomy.com.au/content/so-you-want-to-buy-a-heat-pump-heres-how

5.2.4 Fixed appliances

Hot water systems and space cooling/heating (air conditioning and heaters) are the most costly appliances to run. Using them efficiently and choosing the most energy efficient one that you can afford will have significant impacts on your energy bills and comfort levels.

Which appliance costs you the most depends on your household and the appliances you have. In Queensland, hot water requires more energy in winter and would be the biggest component of your energy bill. In summer, air conditioning could be the biggest component, depending on use.

5.2.4.1 Space heating and cooling

There are various ways to heat and cool the rooms in our homes. Reverse Cycle Air Conditioning (RCAC) is the most efficient way to do both as they are heat pumps, meaning they can both heat and cool.

Regardless of technology, the following is best practice for RCAC efficiency outcomes:

- Fixed appliances, as opposed to portable units, which are inefficient in various ways.
- Split systems as opposed to integrated units. Window units are integrated and inefficient in various ways, particularly the leaks all around them because of poor installation.
- Single appliances as opposed to a ducted system as there are significant energy losses in the ceiling's duct cut outs. Note that one outside fan with compressor – the noisiest bit - can be connected to several inside split systems that are in proximity.

For cooling, in Queensland, some dry areas may use evaporative cooling.

It is also important to make sure the outside fan with compressor of the RCAC is shaded. If they are in full sun, they will have to work very hard to cool that extra heat. Give them a little roof and plenty of air flow to keep them at maximum energy efficiency.

Lastly, clean the filters. It is better for your health and better for your bill.

How we operate space heating and cooling really matters. Here are some tips:

- To cool or dry, use the fan first and keep it on.
- Often in the heat, it is the humidity that makes it uncomfortable. Use the air conditioning on dry mode, as it dehumidifies the air and uses less energy than the cooling function.
- In summer, set the air conditioning to between 25-27 ^{o}C, and keep the fan on always to keep the air flow going.
- In winter, set the air conditioning to 20 ^{o}C, and keep the fan on low to bring that hot air down.

Energy Queensland has a great program for RCAC called PeakSmart. They offer a rebate for new units. In exchange, when the grid is threatening to black out, they will make your RCAC use a bit less energy. This means that we avoid blackouts, which is good for everyone. They survey PeakSmart subscribers regularly and most users report never noticing anything.

PeakSmart explainer:
https://www.energex.com.au/manage-your-energy/cashback-rewards-program/peaksmart-air-conditioning

Rebate for PeakSmart RCAC:
https://www.energy.gov.au/rebates/energy-efficient-air-conditioning-incentive-energex

How to keep cool without breaking the bank: household resource coming soon

Buying an appliance: household resource coming soon

5.2.4.2 Hot water

Again, there are many ways to heat water.

The most energy efficient ways are heat pumps. Heat pumps:

- Are relatively new and the offering is growing.
- Always come with a storage tank.
- Can be integrated (one big unit) or split (storage tank and compressor are separated).
- Solar hot water can also be very energy efficient, depending on location, and the type of technology. Solar hot water requires roof space in the sun which may not be available.

Electric resistive hot water systems (the old electric water heater), which most often look like a simple storage tank, are not efficient. Their efficiency decreases if they are:

- Too small or way too big
- The tank is not full
- They are not part of the electrification journey. If replacing gas, go straight to heat pumps.

Gas water heaters have a wide range of energy efficiency.

- Instantaneous ones are more efficient than storage one
- Their energy efficiency is much lower that heat pumps

Further information on all hot water systems:
https://www.choice.com.au/home-improvement/water/hot-water-systems/articles/gas-vs-electric-hot-water-systems

Heat pumps are the way of the future and below you will find more information to better understand how they work and what to watch for.

Hot water heat pumps are highly efficient and **use around 60 to 75% less energy than a resistive electric hot water system**. Heat pump systems use a refrigeration cycle to extract heat from the air to heat the water, like a reverse fridge.

Further information:

- Australian Government - hot water systems
- Sustainability Victoria – heat-pump hot water systems

Because hot water heat pumps do not have an energy star rating yet, there are bad products on the market. We recommend reviewing these sites before making any decisions:

- Heat Pump Hot Water Systems – A Complete Buyers Guide
- CHOICE Heat pump hot water systems comparison

5.2.4.3 Stoves and cooktops

For cooking, electrification is the way forward. Both stoves and cooktops used to be an integral part of the kitchen, however there are more and more portable options which can be easily bought and installed. Renters can bring with them their own air fryer and portable induction. More details can be found in the moveable appliance section.

More information on moving away from gas: https://cooksafecoalition.org/

5.2.5 Moveable appliances

5.2.5.1 Fridge

Reach for the stars! The more stars, the more energy efficient.

Extra tips:

- Clean the seals
- Replace the seals. If you can slide a piece of paper in or out, they need replacing today
- A full fridge uses less energy

5.2.5.2 Air Fryer

A rule of thumb in the kitchen is the smaller the appliance the more efficient it is! The air fryer wins over the oven.

Air fryers have no energy star ratings yet. They are likely better than ovens, but there are also some bad products on the market.

More information on air fryers:

- Bubble wrap and air fryers: unusual hacks to survive the cost of living surge
- Air fryer hack that saves money on electricity has been revealed

5.2.5.3 Induction

No energy star ratings yet. Some are portable and do not require specific rewiring. Ideal to try it out and they are suitable for renters.

No energy star ratings yet.

Induction should be better than coil/ceramic/gas appliances but like the air fryer, there are some bad products out there.

Induction vs ceramic cooktops:
https://www.choice.com.au/home-and-living/kitchen/cooktops/articles/induction-vs-ceramic-cooktops

5.2.5.4 Entertainment

Ergon Power Savvy compares TVs: 5-20-0009-Power-Savvy-Booklet-June-2023-www-V03.pdf

5.3 Lights and phantom loads

For lights, energy efficiency is all about LED.

Here is an infographic from the USA. The numbers would be different in Australia but it's still a good explainer:
https://cdn.shopify.com/s/files/1/0621/0895/8889/files/Phantom_loads_genergy_leaks_EpicGenerators.com.png?v=1674437088

6. ELECTRIFICATION

We speak about electrification throughout this module.

Here are Alan Pears tips on electrification, including planning your journey: https://theconversation.com/5-tips-for-getting-off-gas-at-home-for-a-cleaner-cheaper-healthier-all-electric-future-211261

This is a messaging guide for electrification. We thought it might be useful for your future conversations. Source: https://zerocarbonmerri-bek.org.au/moreland-launches-new-electrify-everything-messaging-guide/

Key recommendations

- *Support the transition. Share resources that help people install solar, buy electric appliances, access available rebates and learn more about the benefits of electrification.*
- *Be careful with savings-based messaging. People may dismiss cost-based messages, based on the difficulty of making comparisons.*
- *Don't focus on environmental benefit. It's not a broad lever for behaviour change with the general public.*
- *Do focus on the inevitability of electrification. Highlight the inevitability and exciting opportunity of going all-electric.*
- *Do talk about health and safety*
- *Do celebrate renewable energy which is widely supported.*

7. REFLECTION ON LEARNINGS

1. Rank appliances in order of how much they cost to run
    - Hot water
    - Aircon
    - Oven
    - LED lights

    Hint: Hot water and Aircon do compete

2. Order the following by energy efficiency gains to be had. Highest is 1 lowest is 5.
    - Upgrade envelope or shell of your home (insulation, draughtproofing, better windows)
    - Install of hot water heat pump
    - Change light bulbs to LED
    - Use fan and set aircon to 27oC
    - Replace oven with air fryer

    Hint: answers will vary as much as circumstances.

3. Action planning:
    - What will be your first action?
    - What will be your second action?

- What is your long-term goal?

Hint: There are no right or wrong answers. This is just to make you think about what steps you can take to improve the energy efficiency of your home.

4. What can you use the energy star rating for? Check all that apply.
    - Compare similar appliances running cost
    - Compare gas appliances with electric appliances
    - Find out how much an appliance cost to run in a year
    - Find out if paying more for the appliance mean paying less in electricity

5. When buying a new appliance what should you consider? Check all that apply.
    - The purchase cost of the appliance
    - The running cost of the appliance
    - The energy star rating
    - Similar appliances' energy star ratings
    - Water usage star ratings
    - How often you use this appliance
    - The highest star rating you can afford

6. Consider your home energy plan (refer to Tariff section in Module 3). When is the best time to use 'hungry' appliances?

7.1 To go further

Home energy efficiency in Australia, resources and people to follow:

- Your Home form the federal government: https://www.yourhome.gov.au/, can be a technical but very useful repository of information for everything related to homes from building to renovating.
- Alan Pears RMIT researcher, the father of energy efficiency in general in Australia
- Tim Forcey, home energy efficiency expert, has a handbook and a very famous Facebook My Energy Efficient Home MEEH
- Jenny Edwards, building scientist and architect, Instagram account and many talks and articles



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