My Next Step Could Be:

Want to help get to Zero Net Emissions.

What can I do at home?

My next step could be:

- What should my next car be
- What should my next hot water service
- What should my heating be
- What should my cooling be
- What should my next cooker be
- What should my next Clothes Washer, Dishwasher and other appliances be
- Solar PV and Battery

Can I get off Gas

- **Hot water** *link to "*What should my next hot water service "
- **Heating** *Link to* "What should my heating be"
- **Cooking** *Link to* **"**What should my next cooker be"

Note there are incentives to get off gas. These are delivered through Solar Victoria and also through the Victorian Energy Upgrades (VEU).

My Next Car:

Electric cars now offer the range and come at a cost that can be competitive with a car powered by fossil fuels. They can be charged at home and at fast charging stations that are being rolled out on an accelerating rate. In planning for your next car you should seriously consider these.

Advantages:

- Minimal to no fuel costs
- Minimal maintenance costs
- Minimal emissions

Disadvantages

- Battery life is currently limited but improving
- Range is currently limited by availability of fast charging stations
- Cost

Should I go for a hybrid.

- A hybrid that can be plugged in can be run as an electric car. Limited range as an electric vehicle
- A hybrid that cannot be plugged in is a more efficient fossil fuel vehicle
- They will have higher maintenance costs. An iternal combustion engine has about 2000 components. An electric only has about 20.
- They may be “stranded assets” when obsoleted by advances in electric vehicles

The Your Home web site has some useful tips:

https://www.yourhome.gov.au/energy/transport

My Next Hot Water Service

The typical life of a hot water service is 15 years. If yours is over 10 years old then you should be thinking about the next replacement, given when it goes, you will want to move quickly.

Lets make an assumption that you have already decided to have Solar PV installed. If not why not?

Thus you want to use that free electricity to heat your hot water.

You probably want to use the hot water often when the sun is not shining.

So do you store the energy generated in batteries or in a hot water tank.

If you relied on battery storage then you could use an electric instant hot water service. This is a major drain on the battery storage and not very efficient.

If you selected an air source Heat Pump with a storage tank, then the water can be heated while the sun shines, the energy being stored in the water for use when needed. Government rebates (Federal and State) consider Heat Pumps as solar.

If the right sized tank is chosen there should be little electricity consumed overnight in heating the water.

Advantages:

- Free hot water once installed
- Minimal emissions

Disadvantages:

- Cost of initial purchase

The Your Home web site has some useful tips:

https://www.yourhome.gov.au/energy/hot-water-service

Links to Rebate schemes:

Solar and heat pump hot water system rebate | energy.gov.au

Solar hot water rebate | Solar Victoria

Victorian Energy Upgrades scheme (formerly VEET).

Like all these schemes you need to have a supplier who is registered to claim the rebates.

Note the Solar Vic rebate of $1000 is enhanced by $400 if the tank is locally manufactured. This needs to be considered in the overall pricing and may or may not be worth chasing.

My Next Heating System

The most common space heating currently is gas ducted.

This is using fossil fuels that are becoming more emissions intensive as we search for more and more alternative sources of the gas.

The alternatives are wood and electric.

Wood is fine if the source is renewable, that is, it is being replaced by plantings, preferably on the same property on which it is burnt. It does however add to particle pollution but that is another issue.

Lets make an assumption that you have already decided to have Solar PV installed. If not why not?

You may also have batteries installed or plan to.

You have brought your insulation up to standard and the house is reasonably well sealed.

Electric heating now makes a lot of sense.

Note the benefits of thermal mass, that is heat retained by concrete slab or internal masonry walls, is not dependent on heating in the slab but any heat available in the room is absorbed by the slab or internal masonry walls.

There are typically five types of electric heating that can be used:

1. In slab resistive heating
2. In slab hydronic
3. Hydronic with radiators
4. Reverse cycle heat pumps – single units
5. Reverse cycle heat pumps – ducted system
6. Ground sourced heat pumps
7. Infrared heating

1. **In Slab electric heating**

   This would rely on the concrete slab trapping the energy captured by the solar PV array during the day and releasing it at night. The slab would have to be well insulated below and on the edges. It will be very slow to respond to changes in need such as when it has been off for a period. It will be difficult to zone and isolate the zones effectively. It is not something that can be retrofitted.

2. **In Slab hydronic heating** has the same limitations.

   However it can be switched to having heat provided by a heat pump. See 3 below.

3. **Hydronic heading with radiators**.

This can be powered by a Heat Pump which heats the water which is circulated by pipes to radiators positioned in all rooms where heating is required. It can be easily zoned by turning the off of room radiators.
Heat is captured during the day from solar PV generated electricity and stored in the water.
It can have an electric booster fitted which can boost from the batteries or from the grid.
Pipes can be run under the floor in a suspended timber floor house. In a house with a concrete slab floor, pipes can be run around the wall skirting boards or in the ceiling cavity and down the walls.
Heat pumps used for hot water will not provide sufficient heat.
For example:

- Altherma Hydronic Heating | Daikin

Advantages:

- Low emissions production
- Zoned
- Can be retrofitted
- Low running cost

Disadvantages:

- Cost of heat pump and installation
- There may be piping upgrades required.

4. Reverse cycle heat pumps – single units

These air source heat pumps are the most common form of air conditioning in houses currently.

The technology has improved greatly and the star rating can be taken as a reliable guide. Once considered of questionable benefit at extreme temperatures they now perform quite well year round.

Typically one large unit can be installed that provides heat to all of the living areas that can reasonable be opened up. Smaller ones can be installed in rooms such as studies or bedrooms where heating may be required.

Advantage:

- Cheap
- Efficient to run
- Low maintenance

Disadvantage:

- Down draft of air
- Cost may add up if many isolated rooms requiring heat

Note there are floor mounted units now available which work more from convection than from air flows. These look more like equivalent floor mounted gas units or panel heaters. May be appropriate for isolated rooms such as a study or bedroom. For Example; FLOOR STANDING | Daikin

5. **Reverse cycle heat pumps – multi-head systems**

   A multi head system enables you to have an internal air conditioner unit in a each of a number of rooms. These will be linked to a larger compressor outside the building. This is independently operated in each room. It does not have the losses in the ducting that a ducted system has. As the Victorian rebates are based on the outside unit and can only apply to one, this optimizes the benefit of these.

6. **Reverse cycle heat pumps – ducted system**

   A ducted heat pump systems a large compressor services multiple outlets. Some do not like the down draft effect of wall mounted systems and may elect for a ducted system with a centralised heat pump unit and floor vents. It can be zoned with the same restrictions on minimum number of zones opened that apply to ducted gas systems.

   There is some loss of efficiency in the ducting.

7. **Ground Source Heat Pumps**

   A variation on heat pumps is to install a ground sourced heat pump. These are much more efficient as they draw heat from a level of the ground that has a constant temperature, winter and summer. However the cost is high and not normally considered as justified in a retrofit.

The Your Home web site has some useful tips:
https://www.yourhome.gov.au/energy/heating-and-cooling

8. **Infrared Heating**

   Infrared panels can be installed on the ceiling or walls and appear as flat panels.
   They work by heating objects before it rather than heating the air. This can be a very efficient form of heating, particularly if there are objects with significant thermal mass such as tiled concrete floors.

My Next Cooling System

There are two commonly used cooling systems:

- Evaporative Coolers
- Reverse Cycle Heat Pumps (air source)

Lets make an assumption that you have already decided to have Solar PV installed. If not why not?

You may also have batteries installed or plan to.

You have brought your insulation up to standard and the house is reasonably well sealed.

Summer sun is denied access to the house with external shading.

If cooling is still required then electric cooling now makes sense.

Note the benefits of thermal mass for heating may in fact be a penalty for cooling. Heat retained by concrete slab or internal masonry walls, will be slowly released. Best not to allow it to be heated in the first place.

1. Evaporative Coolers

a. Typical installations

Typically, residential and industrial evaporative coolers use direct evaporation, and can be described as an enclosed metal or plastic box with vented sides. Air is moved by a centrifugal fan or blower (usually driven by an electric motor with pulleys known as "sheaves" in HVAC terminology, or a direct-driven axial fan), and a water pump is used to wet the evaporative cooling pads. The cooling units can be mounted on the roof (down draft, or downflow). To cool, the fan draws ambient air through vents on the unit's sides and through the damp pads. Heat in the air evaporates water from the pads which are constantly re-dampened to continue the cooling process. Then cooled, moist air is delivered into the building via a vent in the roof or wall.

Because the cooling air originates outside the building, one or more large vents must exist to allow air to move from inside to outside. Air should only be allowed to pass once through the system, or the cooling effect will decrease. This is due to the air reaching the saturation point. Often 15 or so air changes per hour (ACHs) occur in spaces served by evaporative coolers, a relatively high rate of air exchange.

b. Is it useful

For those extreme heat days it will have the effect of lowering temperatures and does it using less energy than a Reverse Cycle heat pump air conditioner.

Unlike a ducted air conditioning system, these vents are ducted to the external air. So while it is operating, it is achieving 15 or so air changes through the drawing in of air cooled relative to the outside. This will improve your comfort.

If however your house has well suited and installed ceiling insulation, you may be as well off without having created these massive holes in this to provide for the ducts. You may also aspire to 5 or less air exchanges per hour. Keeping the heat out may be a better starting point than drawing in the cooled air.

The real concern comes in winter when you are seeking to retain heat generated in the building. The ducts and vents represent an enormous degradation of your building insulation. While there are covers that can be applied to close of the vents, in practise these are seldom used.

Even in summer, on days when it would not normally be necessary, you will find it necessary to run the cooler to make up for the heat penetration made worse due to the lack of building sealing and compromised of insulation.

c. Conclusion

Do not penetrate the insulation unnecessarily.

Seal the dwelling as best you can.

Install a high star rating reverse cycle heat pump air conditioner if necessary. This can efficiently provide both heating and cooling.

2. Reverse Cycle Heat Pumps

a. Reverse cycle heat pumps – single units

These air source heat pumps are the most common form of air conditioning in houses currently.

The technology has improved greatly and the star rating can be taken as a reliable guide. Once considered of questionable benefit at extreme temperatures they now perform quite well year round.

Typically one large can be installed that provides cooling to all of the living areas that can reasonable be opened up. Smaller ones can be installed in rooms such as studies or bedrooms where cooling may be required.

Often night time occupied rooms such as bedrooms do not require this as they can be opened up to get cooler night time air flow enhanced by ceiling fans.

There are floor mounted units now available which work more from convection than from air flows. These look more like equivalent floor mounted gas units or panel heaters.

Advantage:

- Cheap
- Efficient to run
- Low maintenance

- More efficient than ducted systems

Disadvantage:

- Down draft of air. Can get floor mounted ones that rely more on convection.
- Cost may add up if many isolated rooms requiring heat.

9. Reverse cycle heat pumps – multi-head systems

A multi head system enables you to have an internal air conditioner unit in a each of a number of rooms. These will be linked to a larger compressor outside the building. This is independently operated in each room. It does not have the losses in the ducting that a ducted system has.

10. Reverse cycle heat pumps – ducted system

Some do not like the downdraft effect of wall mounted systems and may elect for a ducted system with a centralised heat pump unit. It can be zoned with the same restrictions on minimum number of zones opened that apply to ducted gas heating systems. A ducted system is not as efficient as multiple single units.

There are efficiency losses in the ducting.

11. Ground Source Heat Pumps

A variation on heat pumps is to install a ground sourced heat pump. These are much more efficient as they draw heat, or the absence of heat in the case of cooling, from a level of the ground that has a constant temperature, winter and summer. However the cost is high and not normally considered as justified in a retrofit.

The Your Home web site has some useful tips:

https://www.yourhome.gov.au/energy/heating-and-cooling

What should my next Cooker/Stove be

Gas has been the popular type of stove tops over many years. The old electric hot plates were inefficient and difficult to control.

Induction cookers now offer an electric alternative. In this process it is the saucepan that is heated not the stove surface. Cooking vessels must be ferrous, that is iron or steel.

It is possible to get an induction cook top that can just sit over your gas cook top.

Induction cooking has good electrical coupling between the pan and the coil and is thus quite efficient, which means it puts less waste heat into the kitchen, can be quickly turned on and off, and has safety advantages compared to gas stoves. Cooktops are also usually easy to clean, because the cooktop itself does not get very hot.

When a stand alone stove is being replaced it will generally mean replacing the stove. You cannot safely fit a cooktop on top of such a stove.

What should my next Clothes Washer, Dishwasher and other appliances be

The Your Home web site has some useful tips:

https://www.yourhome.gov.au/energy/appliances

Solar PV and Battery

Having retrofitted to achieve a fully or substantially electric, home, then how will I get that energy. Solar PV can generally be installed on North facing roof space but can also face east and west for a substantial benefit where North is limited. West facing can have an impact on evening peak use. A typical installation these days would be a nominal 6 kW or more. Roughly speaking 4kWh per nominal kW is generated.

With the reduction to almost zero of the feed in tariff, this is no longer a consideration. This along with the generous Federal rebate scheme, make it a good time to install a battery. Sizing the battery can depend on your lifestyle and the time at which most electricity is used. The benefits of the rebate probably suggest that this would be a greater than 15kWh system. When installed it will want to be not in direct sun and not too far from the power box, so positioning could be a critical consideration.