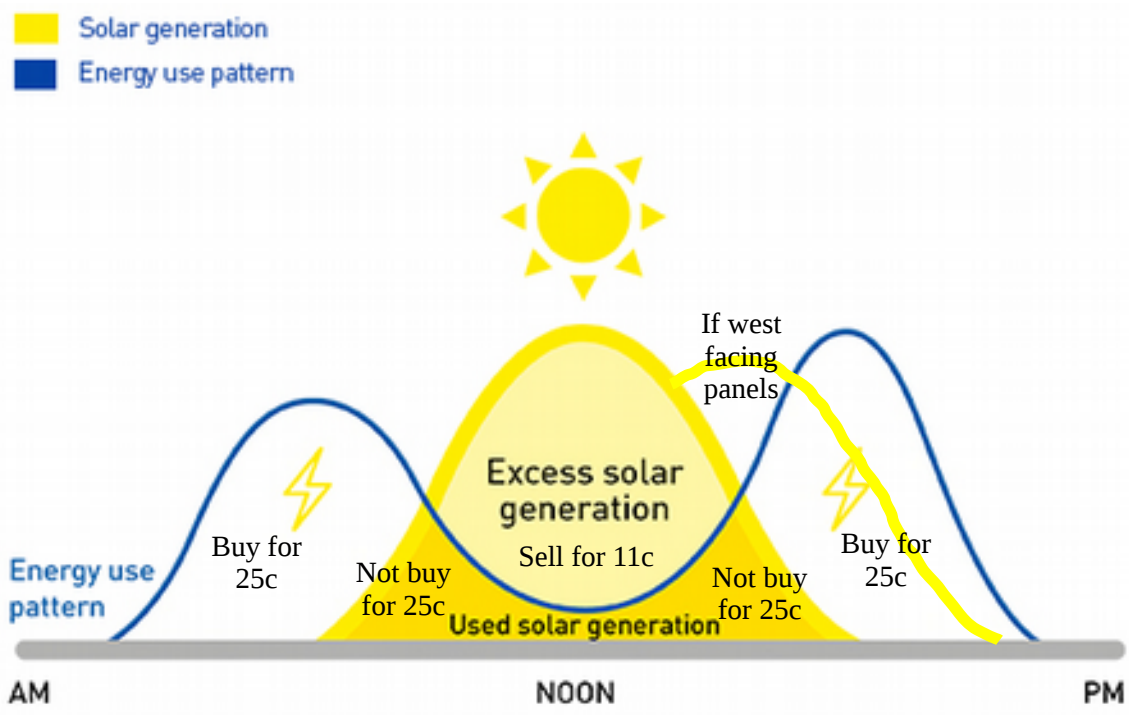
S03: Solar Design

Handout – Basic selection of a system

Selection of a system based on constraints and customer requirements

1) Fix energy issues first before sizing the solar system		
Notes: • The size of the solar system required could vary greatly before and after implementing energy efficiency issues. • The same principle applies to insulating a house before you size and air-conditioner. • Energy efficiency upgrades can have pay back periods equal to or better than solar	Do first: • Draught proofing • Ceiling insulation • Wall/floor insulation • Reverse Cycle Air conditioning • Heat Pump Hot water	Do second: • LEDs • 24 hour time clocks (equipment best to run 10 am - 2 pm) • Replace old fridge/freezer • Electric/hybrid vehicle • Induction cook-top (and turn off the gas connection) • Educate on energy use/wastage

2) Estimate or measure your customers load profile



Notes:
- The above graph presents a typical week day where the owners are not at home during the day.
- When at home on weekends and holidays more energy is used during the day increasing the savings. The same principle applies to home businesses or stay at home parents.
- West facing panels generate energy later in the day which is closer to peak demand which can increase savings.

3) Estimate the savings based on the load profile

Example: A system that exports 8000 kW.h per year: **30% consumed, 70% exported:** • Sell = 8000kW.h x 0.7 x $0.11/kW.h = $616 • Not buy = 8000kW.h x 0.3 x $0.25/kW.h = $600 • Total savings = $616 + $600 = **$1216 per year** **70% consumed, 30% exported:** • Sell = 8000kW.h x 0.3 x $0.11/kW.h = $264 • Not buy = 8000kW.h x 0.7 x $0.25/kW.h = $1400 • Total savings = $616 + $600 = **$1664 per year**	2018/2019 energy prices: **Domestic ACT:** • 25.036c/kW.h (22.76 ex GST) **Commercial ACT:** • 30.558c/kW.h (27.78 ex GST) **Domestic NSW (capital region):** • 31.317c/kW.h (28.47 ex GST) **Solar feed in tariff:** • 11c/kW.h

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4) Size the solar system on constraints and customer requirements

"For optimum economic benefit (pay back period)"

Size the system to the buildings demand and time of use.

The fastest pay back periods are when solar energy is consumed during the day avoiding the need to buy it from a retailer.

A suitable pay back period can also be achieved by installing a bigger system than needed and selling the energy for 11c/kW.h.

"To never pay an electricity bill again"

Option 1:

- Put in a bigger system and use the grid as a battery

Issues:

- Sell for 11c/kW.h and buy for 25.036c/kW.h (uses the grid as a 'battery' for 14.036c/kW.h)
- Maximum 5kW export per phase

Option 2:

- Put in batteries

Issues:

- Around the same price as option 1 with the ACT Government rebate – however battery prices will rapidly come down.

Option 3:

- Go off-grid

Issues:

- While the cheapest economic option for remote areas, off-grid in suburbia is an unnecessary expense.
- From an environmental perspective, losses associated with the storage of renewable energy can be avoided by exporting the energy a neighbour.

"To never pay for petrol again"

- Buy an Electric Vehicle and charge it from the sun.

"Limited by retailer"

ACT - ActewAGL and Origin Energy will not offer a 11c/kW.h feed-in tariff if the installed capacity (DC Power of the solar panels) is greater that 10kW.
Existing systems on old feed-in tariffs are excluded from the 10kW limit.

"Limited by distributor"

ACT - Evoenergy will not connect the installation if the export power (AC Power from the inverter) is greater than 5kW per phase.

"On grid with some off grid"

In order to avoid retailer or distributor limitations, portions of the installation can be off-grid and connected to specific loads such as electric hot water systems.

"Net Zero Energy"

Energy generated must equal energy consumed, time of use could be ignored.
The client may consider not claiming/selling STCs to ensure 'additionality' of the environmental initiative. This is known as voluntary surrender.

"A specific size system"

The client may want the same size system as a friend or a specific package deal.

"Cost"

The client may only have a certain budget available

"Fill the roof"

The client may want to use all available roof space for energy generation. To best utilise the available space, high efficiency modules could be considered.

"Keep old system going"

The client may require maintenance or the replacement of an inverter on 40-50c/kW.h feed in tariff premises.
Note: You cannot install additional panels.

"Upgrade System"

The client may require a bigger system.

In any case

- Electricity prices are higher in NSW compared to Canberra making the pay back period more attractive.
- Each year the retail price of electricity from fossil fuel sources rises (resource based economy) and the cost from renewable sources decreases (manufacturing based economy).
- Producing energy with solar is cheaper than buying it from a retailer (even at off-peak), this gap will continue to widen each year.
- It may not be long until storing energy with batteries is cheaper than selling it to the grid and buying it back later.

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Tilt angles and orientation

Period		Feed in Tariff	Metering type	Considerations	System design	Orientation (Geographic)	Tilt angle
Past	March 2009 to June 2013	40-50c/ kW.h for 20 years	Gross	Feed in tariff was considerably higher than retail price	Maximum annual yield	North	Equal to latitude
Present	July 2013 to present	11c/ kW.h (was 7.5c until 2017)	Net	Size system to the buildings maximum demand and time of use Can store energy in electric vehicles	Maximum evening power	West to North West	Equal to latitude
					Maximum morning power	East to North East	Equal to latitude
					Maximum all day power	West to North West and East to North East	Equal to latitude
					Maximum annual power	North	Equal to latitude
Future		?c/ kW.h	Net Time of use metering	Decreasing price of batteries will make storage cheaper Store for peak times reducing the need to purchase power from a retailer Sell battery energy to grid at peak times	Maximum annual yield	North	Equal to latitude
					Maximum winter power for battery storage	North	Equal to latitude +22.5 degrees for the middle of winter