PUSCH Australia

Solar Heating and Cooling in Australia – An industry roadmap for the built environment

Update

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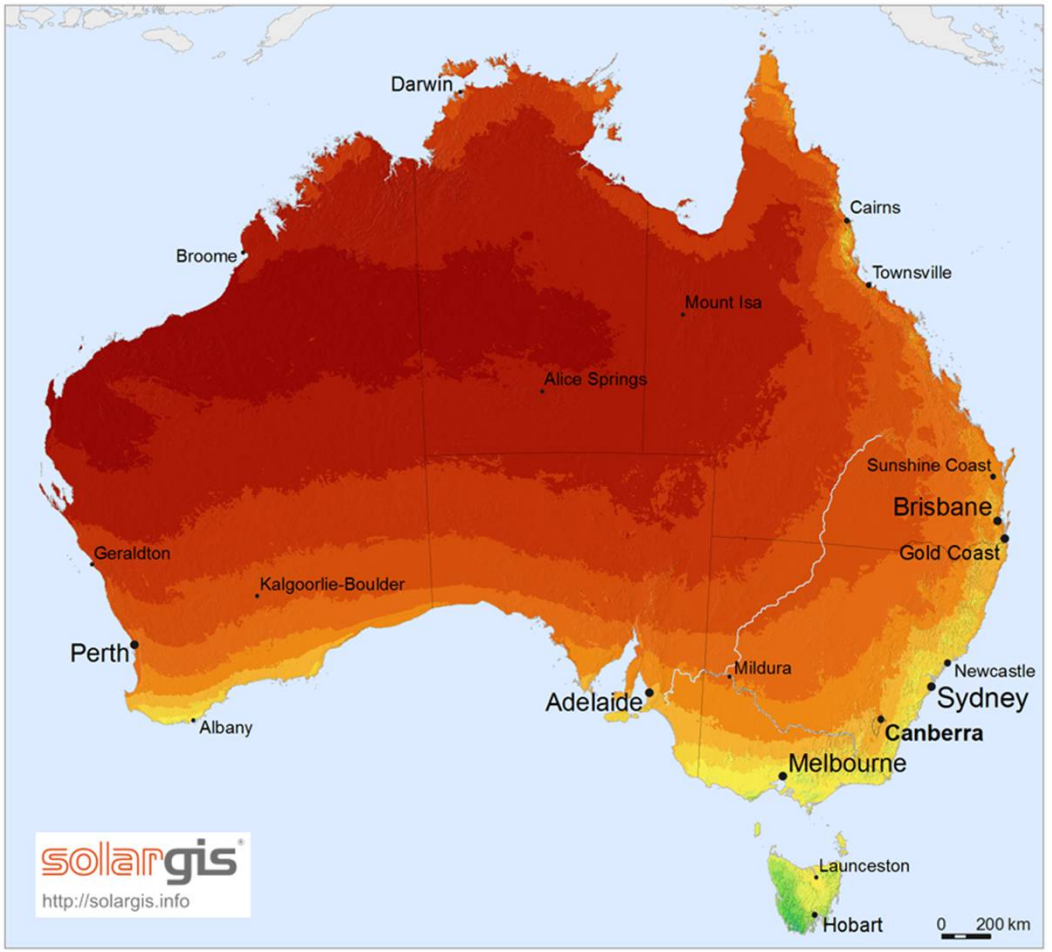
Global Horizontal Irradiation

Australia



Average annual sum, period 2007-2012

< 1100 1300 1500 1700 1900 2100 2300 > kWh/m^2

SolarGIS © 2013 GeoModel Solar

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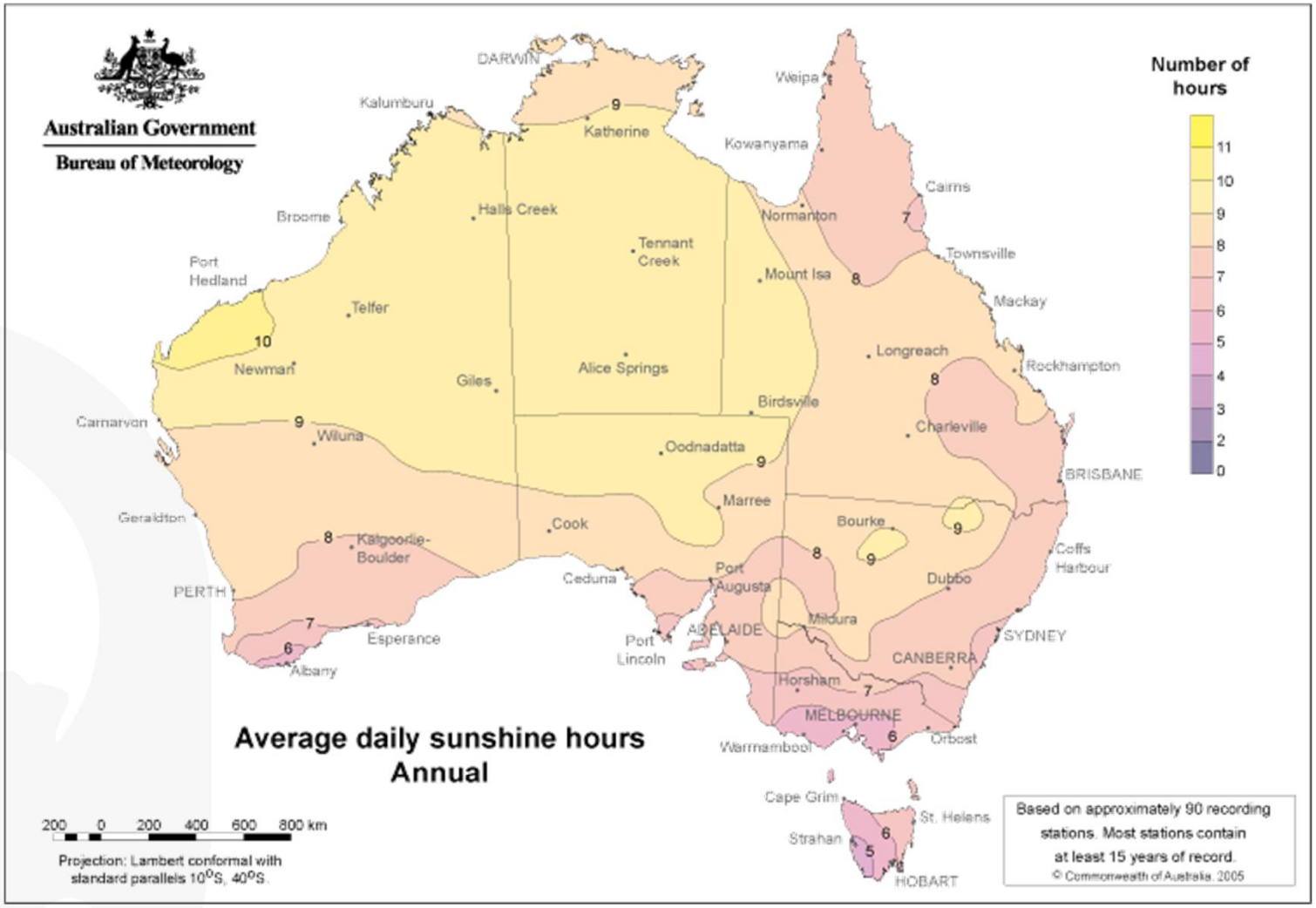
Australian Government
Bureau of Meteorology
Number of hours
11
10
9
8
7
6
5
4
3
2
0
DARWIN
Kalumburu
Katherine
Weipa
Kowanyama
Cairns
Broome
Halls Creek
Normanton
Tennant Creek
Townsville
Port Hedland
Mount Isa
Telfer
Mackay
Longreach
Newman
Alice Springs
Rockhampton
Giles
Birdsville
Carnarvon
Charleville
Wiluna
Oodnadatta
BRISBANE
Marree
Geraldton
Bourke
Cook
Coffs Harbour
Kalgoorlie-Boulder
Port Augusta
Dubbo
Ceduna
PERTH
Mildura
Esperance
ADELAIDE
SYDNEY
Port Lincoln
CANBERRA
Albany
Horsham
MELBOURNE
Orbost
Warrnambool
Cape Grim
St. Helens
Strahan
HOBART
Average daily sunshine hours
Annual
200 0 200 400 600 800 km
Projection: Lambert conformal with standard parallels 10°S, 40°S.
Based on approximately 90 recording stations. Most stations contain at least 15 years of record.
© Commonwealth of Australia 2005

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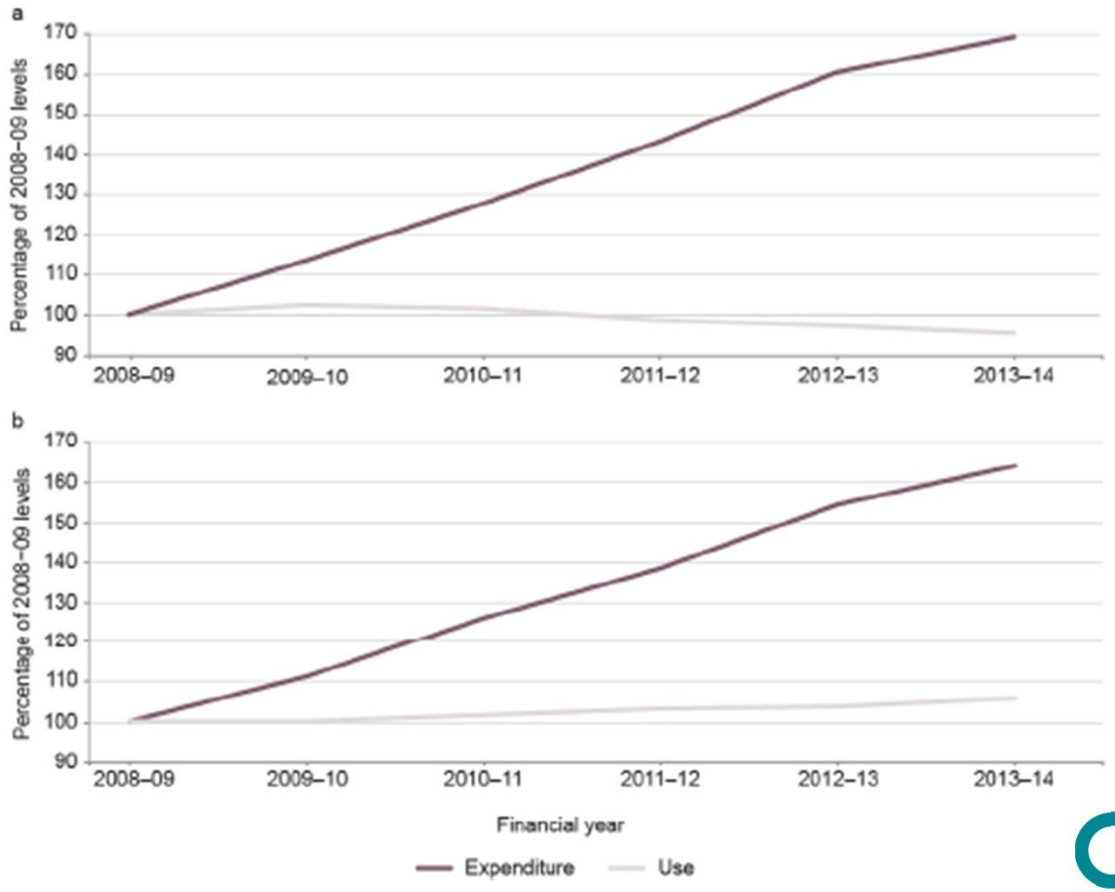
Net Household Expenditure and Use



a – Electricity
b – Gas

Source: ABS (2016)

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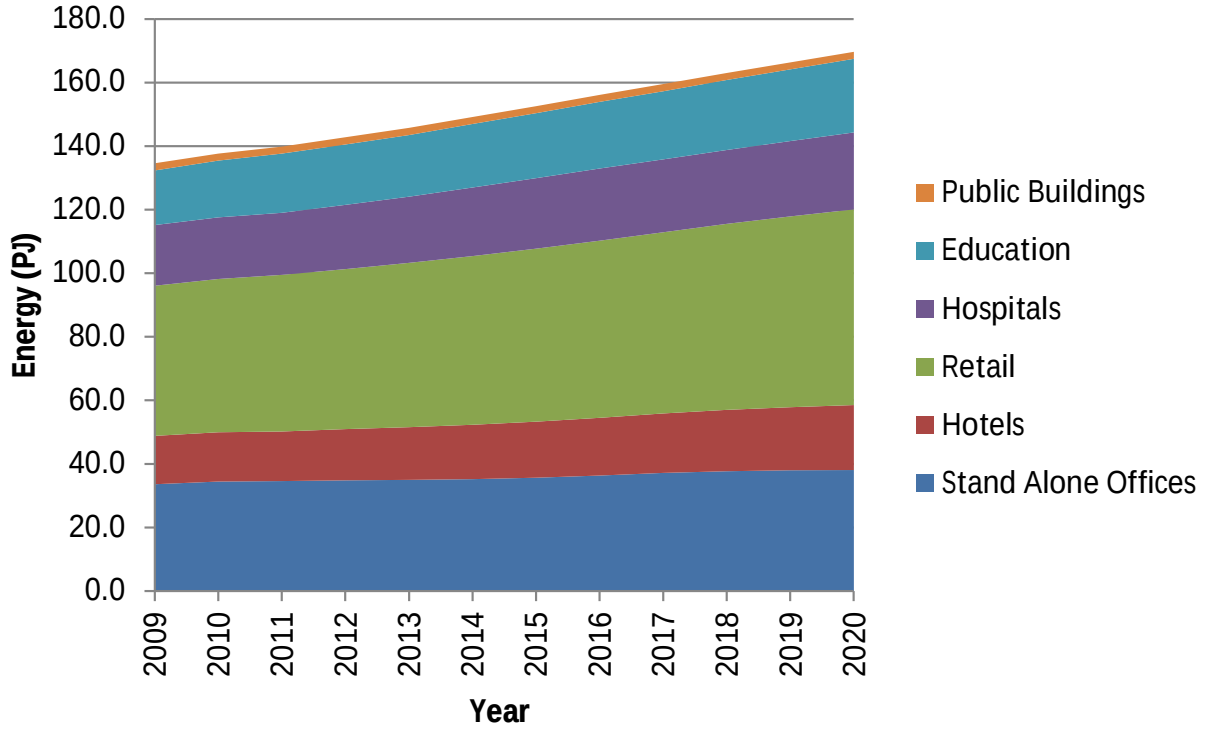
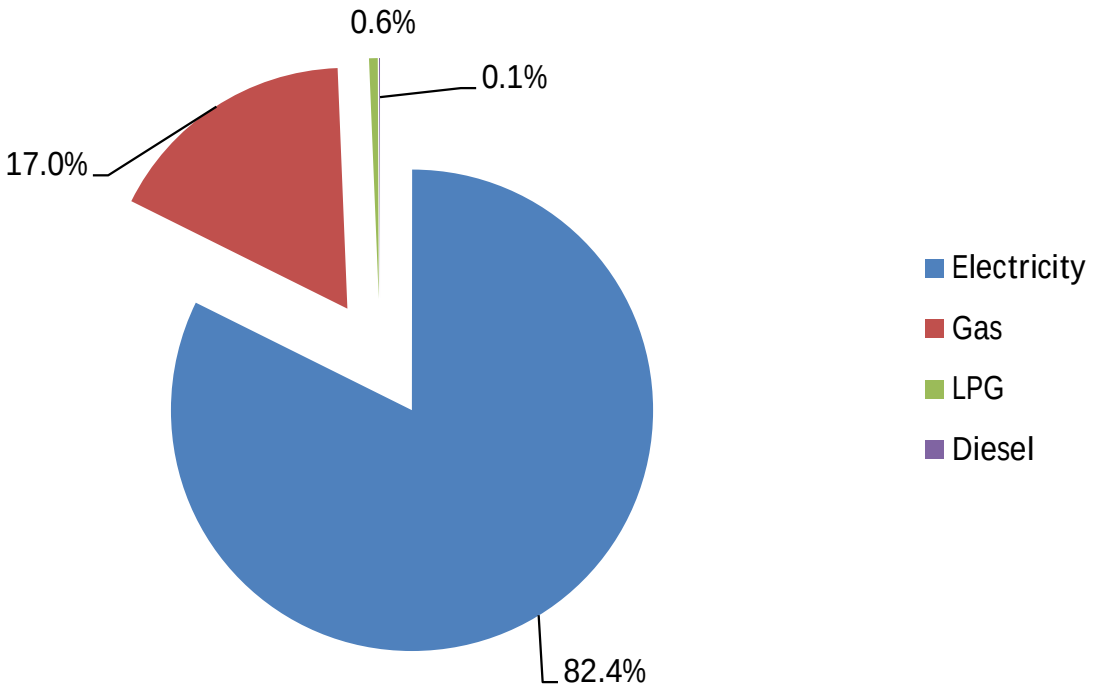
Total Energy Consumption Commercial Buildings



Source - ***pitt&sherry***

Fuel Mix
Commercial Buildings



Source - ***pitt&sherry***

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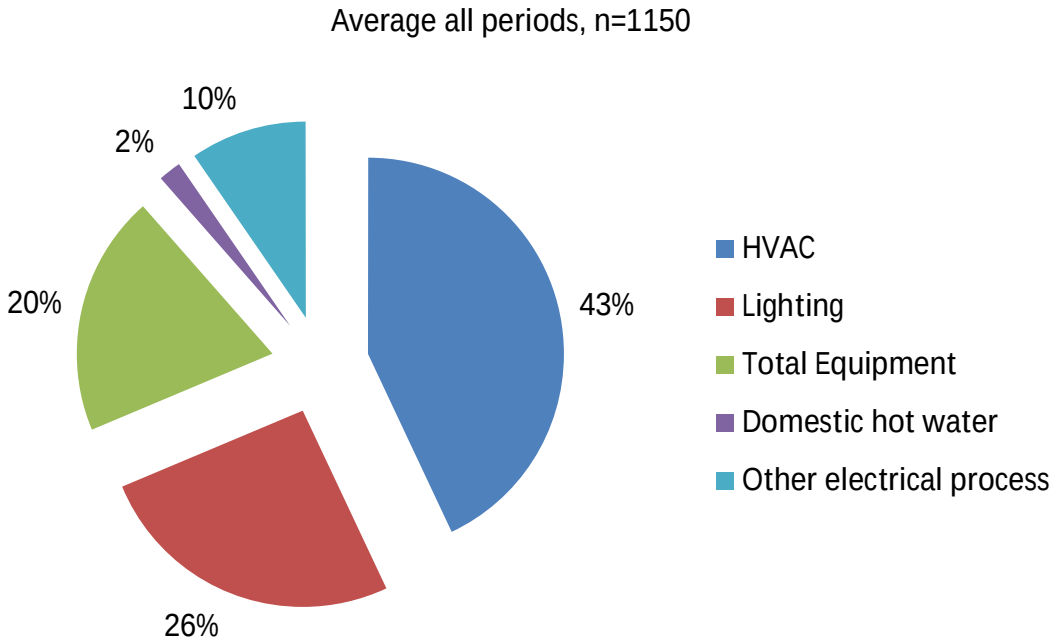
Electricity End Use Shares Commercial Buildings



Source - ***pitt&sherry***

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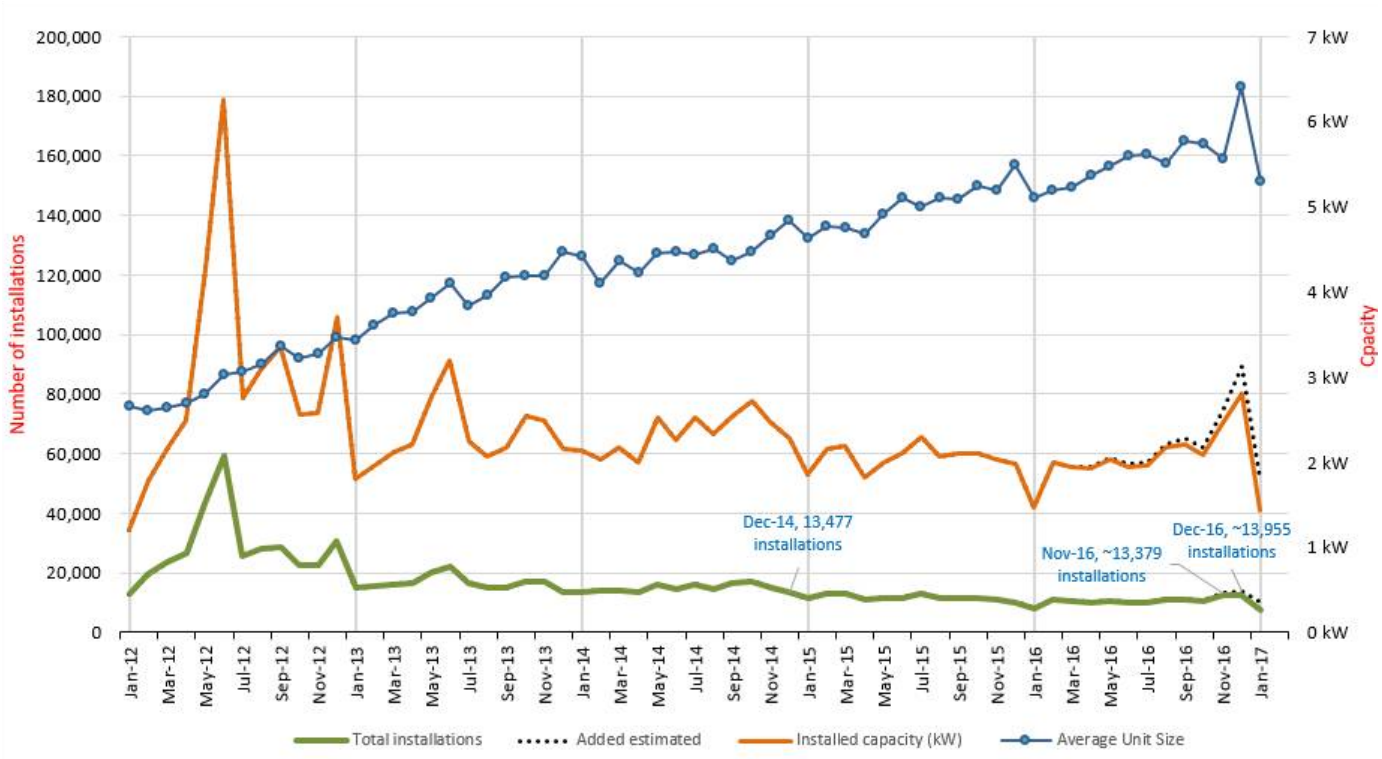
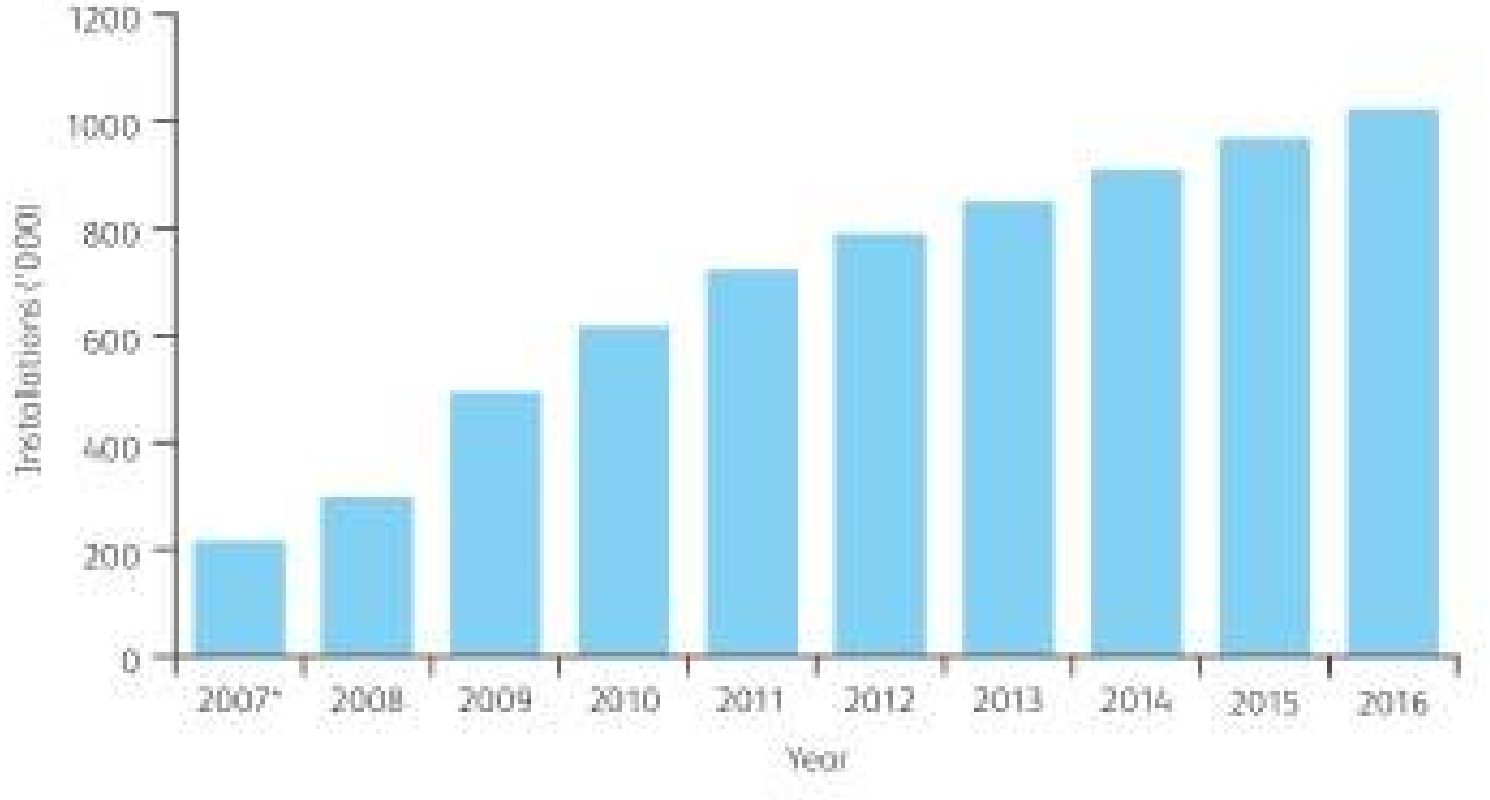
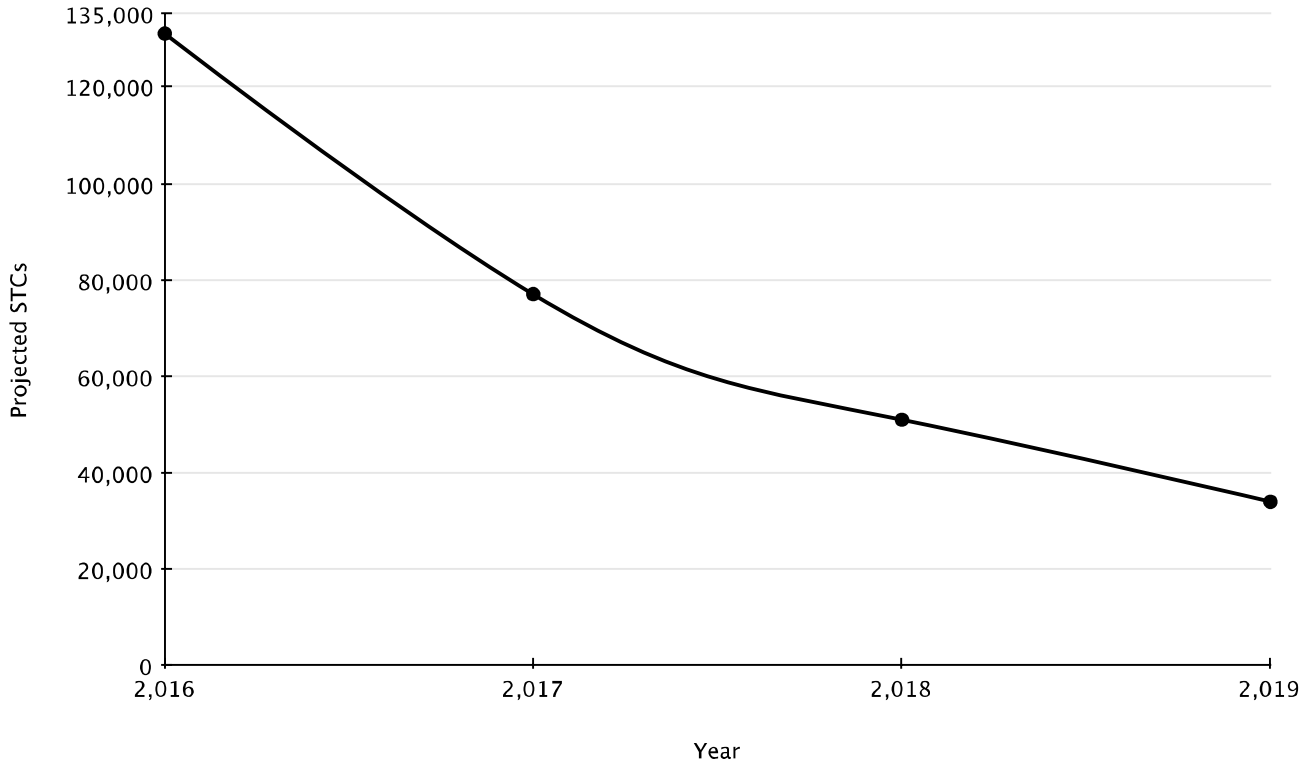
PV installations



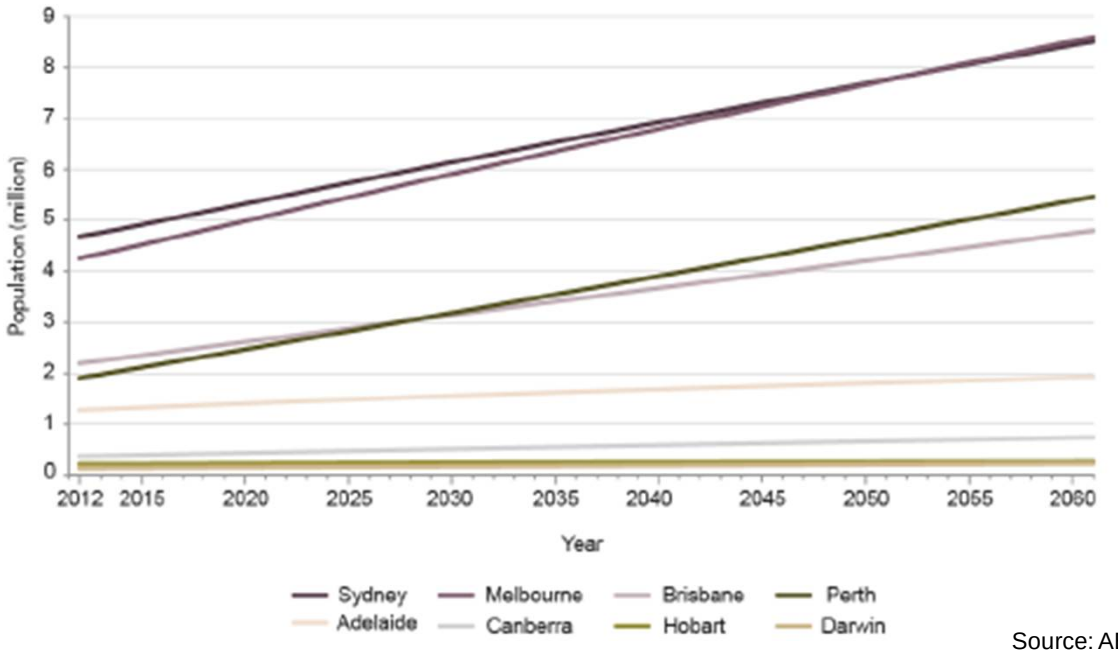
Cumulative Residential Solar Water Heater Installations



Commercial Solar Hot Water STC projection



What drives heating/cooling demand growth?



Projected Population
Australian Capital Cities
2012 - 2061

Source: ABS (2013)

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What drives heating/cooling demand growth?

- Economy continues growth path
- Residential Building Energy consumption growth from 441.1 PJ (2017) to 467 PJ (2020)
- Commercial Building consumption growth from 159.4 PJ (2017) to 169.6 PJ (2020)
- But: Electricity and Gas prices will continue to rise

Federal Regulatory and Support measures

- Renewable Energy Target (RET) with small-scale technology certificates (STC) for sale to electricity retailers
- Clean Energy Finance Corporation (CEFC)
- National Construction Code (NCC) Volume 1, Section J
- National Australian Built Environment Rating System (NABERS)
- Building Energy Efficiency Disclosure (BEED) Act with Commercial Building Disclosure (CBD), requiring Building Energy Efficiency Certificate (BEEC)
- Energy Efficiency in Government Operations (EEGO) with Green Leases

Other national programs

- AS5389 – estimate energy consumption of solar heating and cooling systems for receiving government support such as STCs
- Green Building Council (GBCA) – Green Star Rating

State Regulatory and Support Measures

- Environmental Upgrade Agreements (EUAs) – Victoria, NSW
- Energy Savings Scheme – NSW
- Victorian Energy Upgrade
- ACTSmart Business Energy and Water Program
- Energy Savers
- South Australian Energy Productivity Program
- Energy utility peak demand reduction projects, demand management projects and renewable energy buyback schemes

Market Barriers

- Very high initial cost
  - No local production of
  - Limited experience – high quotes to mitigate perceived risk
  - Bureaucratic hurdles for support programs
- Lack of awareness of benefits / unrealistic expectations
  - Strong interest but little knowledge
  - Quick payback expected
  - 100% solution expected
- Split Incentives

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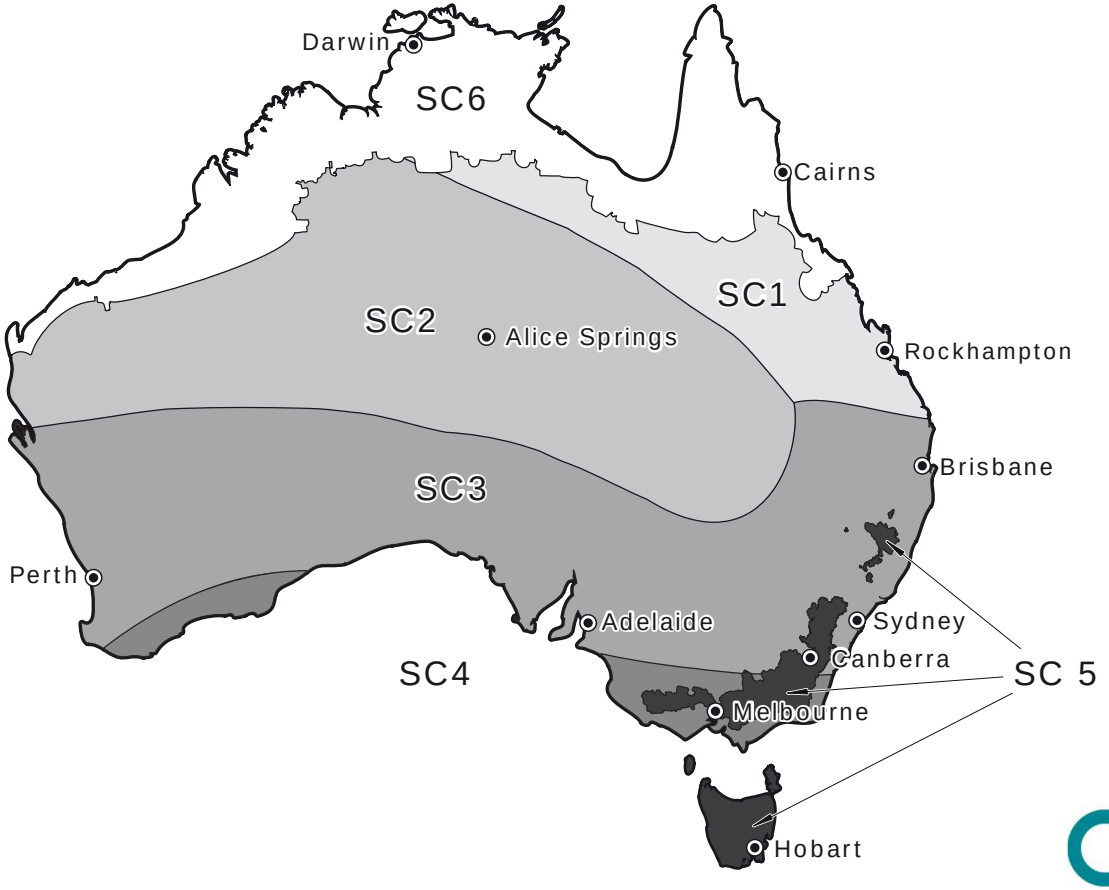
Market Barriers

- Inexperienced / untrained consultants and trade
  - SHC systems not covered in standard training and university curriculum
  - Consultant fee models only support standard systems design
  - Consultants inflate fees to cover risks
- Technical and financial risks
  - Project owners perceive risks
  - Negative perception from underperforming demonstration systems
  - Australian market interesting for international players but often targeted with limited focus/funds
- Alternative Technologies
  - PV and high efficiency heat pumps

Opportunities

Application	Residential	School	Universities & VET	Office	Public buildings	Hotel	Restaurant	Retail			Hospital
								Super-market	Retail strip	Shopping centres, excl. super-market	
Typical operating hours	3pm-12pm	9am-3pm	8am-9pm	8am-5pm	9am – 5pm	24 hours	8am-10pm 24 hours (chain)	7am-10pm	8:30am-6pm	8:30am-6pm	24 hours
Operating days	50 - 100	200	240	240	240	365	310-360	360	310	360	365
Comfort tolerance	Low	High	Medium	Low	Low	Low	Medium	Medium	Medium	Medium	Low
Indicative capacity range	2 to 15kW	5 to 50kW	50 to 500kW	5 to 500kW	30 to 500kW	100kW to 1MW	10 to 50kW	50 to 200kW	10 to 30kW	100kW to 1MW	100kW to 1MW
Relative hot water use	High	Low	Low	Low	Low	High	High	Medium	Low	Low	High
Fresh air requirement	Low	High	High	Low	Medium	Low	High	Low	Low	Low	High
Latent load	Average	Above average	Average	Average	Average	Average	Above average	Average	Average	Average	Above average
National HVAC energy use (PJ/a)	192	0.8	5.5	27.6	1.1	8.3	NA	NA	NA	NA	9.9
HVAC energy intensity ($MJ/m^2/a$)	115	<18	180, 440	380	300-550	690	NA	NA	NA	NA	680
Current stock size (number / '000 m2)	8,452,743 / 1,564,000	9,414 / 44,023	4,585 / 18,571	NA / 43,403	3010	4,445 / 11,787	13,987 / NA	1,891 / NA	346,704 / 22,599		1,322 / 13,984
Incumbent technology	AC, Split	AC, Split	AC, Ducted / Package, Central plant	AC, Ducted / Package, Central plant	AC, Ducted / Package, Central plant	AC, Ducted / Package, Central plant	AC, Split, Ducted / Package	AC, Ducted / Package	AC, Split, Ducted / Package		AC, Ducted / Central plant
Complexity of incumbent technology	Low	Low	Medium	Medium	Medium	Medium	Low to Medium	Medium	Low	Medium to High	High

Australian climate zones (AS5389)



Niche Fit

Climate Zone		Residential	School	Universities & VET	Office	Public buildings	Hotel	Restaurant	Retail	Hospital
SC1	Heat	◆◆ / ■■/ ▲▲	◆ / ■/ ▲				▲▲▲ / ◆◆◆	(▲ / ◆)[i]		◆◆◆ / ▲▲▲
	Cool	△△	△ / (◇)[ii]	◇◇◇ / (△△)[iii]	□□ / (△△)[iii]	□□ / ◇◇ / (△△)[iii]	□ / ◇ / (△△)[ii]	(△)[i]	□□ / (△△)[iii]	◇◇◇
SC2	Heat	◆◆ / ■■/ ▲▲	◆ / ■/ ▲				▲▲▲ / ◆◆◆	(▲ / ◆)[i]		◆◆◆ / ▲▲▲
	Cool	∧∧	∧	(∧∧)[iii]	□□ / (△△)[iii]	□□ / ◇◇ / (△△)[iii]	□ / ◇ / (△△)[ii]	(∧)[i]		
SC3	Heat	◆◆ / ■■/ ▲▲	◆ / ■/ ▲	(■■)	(■■)	(■■)	▲▲▲ / ◆◆◆ / (■■)[iv]	(▲ / ◆ / ■)[i]	(■■)[iv]	◆◆◆ / ▲▲▲ / (■■■)[iv]
	Cool	△△	△ / (◇)[ii]	(◇◇◇)[iv] / (△△)[iii]	□□ / (△△)[iii]	□□ / ◇◇ / (△△)[iii]	□ / ◇ / (△△)[ii]	(△)[i]	(□□) / (△△)[iii]	(◇◇◇)[iv]
SC4	Heat	◆◆ / ■■/ ▲▲	◆ / ■/ ▲	■■■	(■■■)	■■■	▲▲▲ / ◆◆◆ / ■■■	(▲ / ◆ / ■)[i]	■■	◆◆◆ / ▲▲▲ / ■■■
	Cool	△△	△	(△△)[iii]	(△△)[iii]	(△△)[iii]	(△△)[ii]	(△)[i, iii]		
SC5	Heat	◆◆ / ■■	◆ / ■■	■■	(■■)	■■	◆◆ / ■■	(◆ / ■)[i]	■■	◆◆ / ■■
	Cool									
SC6	Heat	◆◆ / ■■/ ▲▲	◆ / ■/ ▲				▲▲▲ / ◆◆◆	(▲ / ◆)[i]		◆◆◆ / ▲▲▲
	Cool	△△	△ / (◇)[ii]	◇◇◇ / (△△)[iii]	(△△)[iii]	(△△)[iii]	(△△)[ii]	(△)[i,iii]	□□ / (△△)[iii]	◇◇

▲: Solar Domestic Hot Water - solar PV, high efficiency heat pump, tank
◆: Solar Domestic Hot Water - solar thermal collectors, tank
■: Solar Heating and Domestic Hot Water - solar thermal collectors, tank
□: Solar Thermal Cooling AB - solar thermal collectors, tank, absorption chiller
◇: Solar Thermal Cooling DES - solar thermal collectors, tank, desiccant chiller
△: Solar PV Cooling - solar PV, high efficiency vapour absorption chiller

[i] Not a good diurnal load match; for worthwhile deployments, requires daytime usage.
[ii] Dependent on fresh air requirements and latent load
[iii] For smaller deployments
[iv] For parts of climate zone as per requirements

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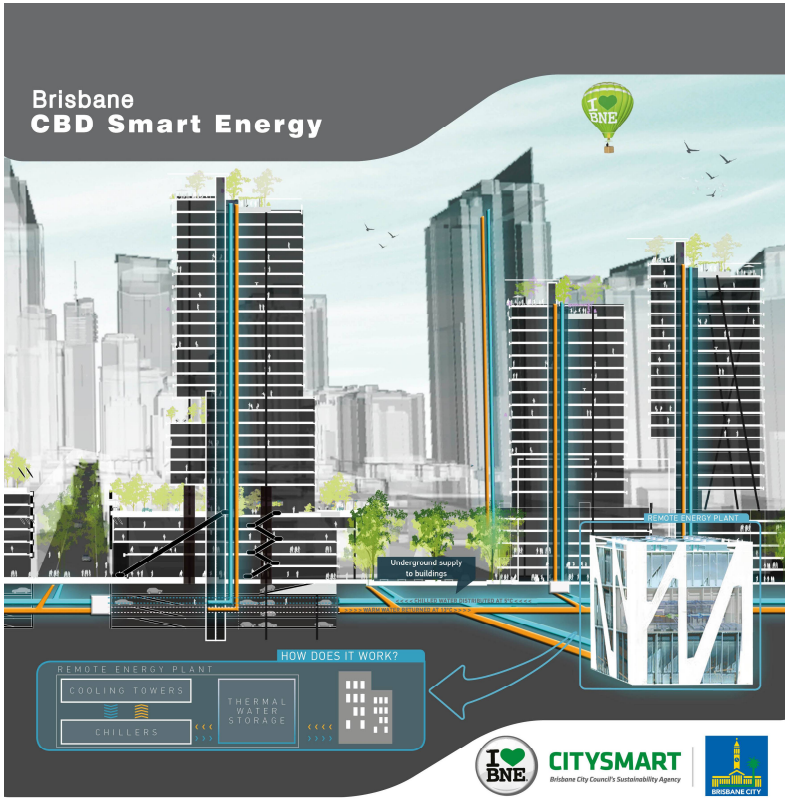
Recommendations

Regulate	Support	Inform
Standardisation / Best Practice design – extend AS5389	Environment Upgrade Agreements (EUA)	Training/Knowledge dissemination
	On-Bill Finance	
	Energy Performance Contracts (EPCs) / Energy Services Companies (ESCOs)	Pilot projects

Dark horse?



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Thank you!