Household carbon footprint reduction: a personal case study

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ATA meeting

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Overview

- Background
- Data collected
- Examples of initiatives
  - Power use
  - Solar panels
  - Refrigerator
  - Transport
  - Heating and cooling
  - Water
  - Communications
- Concluding observations

Background

- University career in electronics, academic teaching and research
  - Interest in innovation and adoption of technology within communities
  - Compulsive data collector
  - Retired 18 months ago
- 2 person ‘down-sized’ household
  - 10yo inner city town house
- Initial motivation
  - Belief in need for sustainable living, reaction to consumer culture, family
  - Putting off for years - time, other priorities, uncertainty of what to do
  - Cost not the major factor, but subsidies important
  - See as lifestyle investment - c/f plasma TV, sunroof for car, o/s holiday etc.
- Detailed case study has value and limitations
  - Perspective of innovator/early adopter
  - Application to other situations judged by others
  - Challenge is to change behaviours of wider community


Solar Panels
Louvres
Blinds, shades, sealing
Scooter, bike
Rethink use of appliances, car, etc

An endless series of tricky decisions…

e.g. How do you make a cup of tea with least carbon emissions?

A

Electric jug

B

Gas kettle

C

Microwave

D

Tefal ‘Instacup’

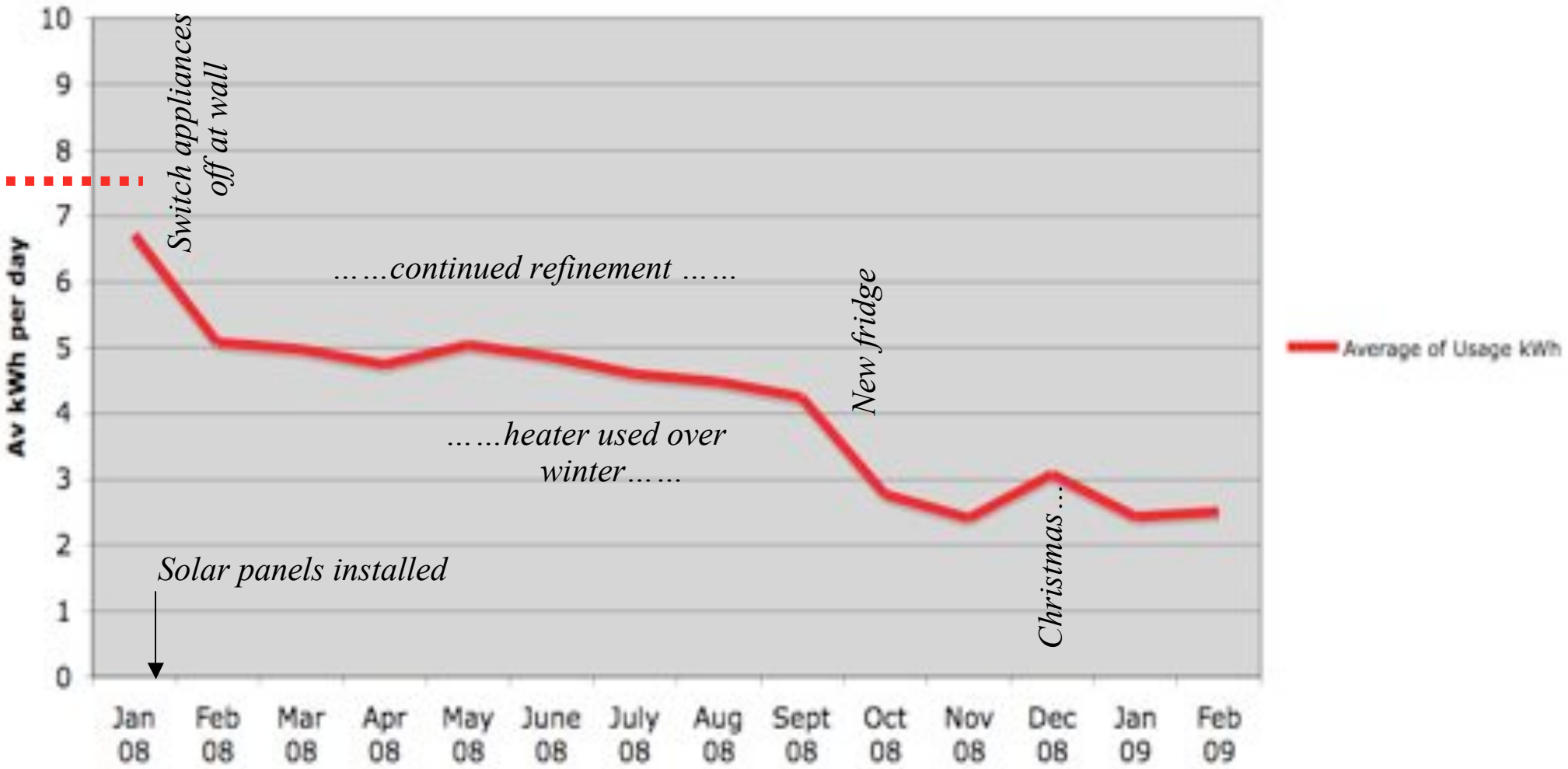
- We need to:
  - Research alternatives
  - Measure performance
  - Question habits
  - Challenge expectations
  - Make pragmatic decisions

Repeatedly…

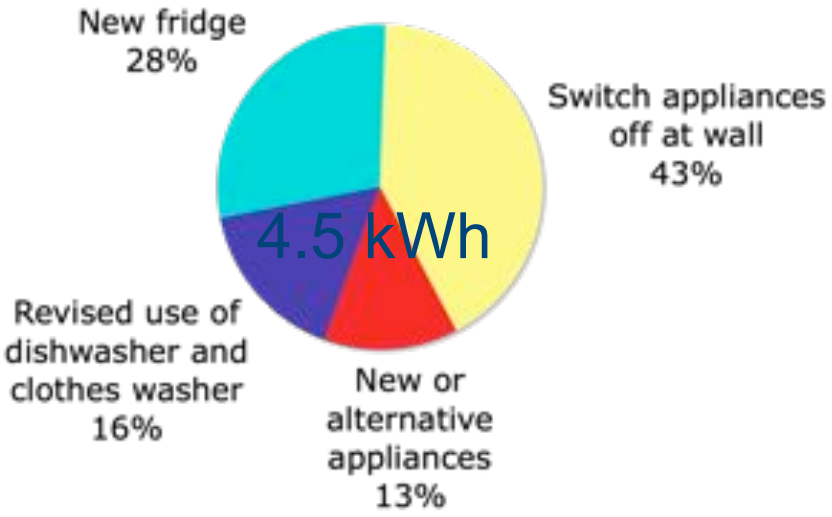
Data collected

- Initial household audit
  - several months
  - ~60 appliances
  - Different cycles, etc
- Daily data logging (12+ months)
  - Solar output (net & gross)
  - Electricity consumption
  - Gas, water use
  - Car, scooter, bike kms
  - Refrigerator
  - House temperatures
  - Met Bureau data
- Basis for decision making
  - build personal model of how things work

Power use: average daily energy kWh



Power use: areas of savings

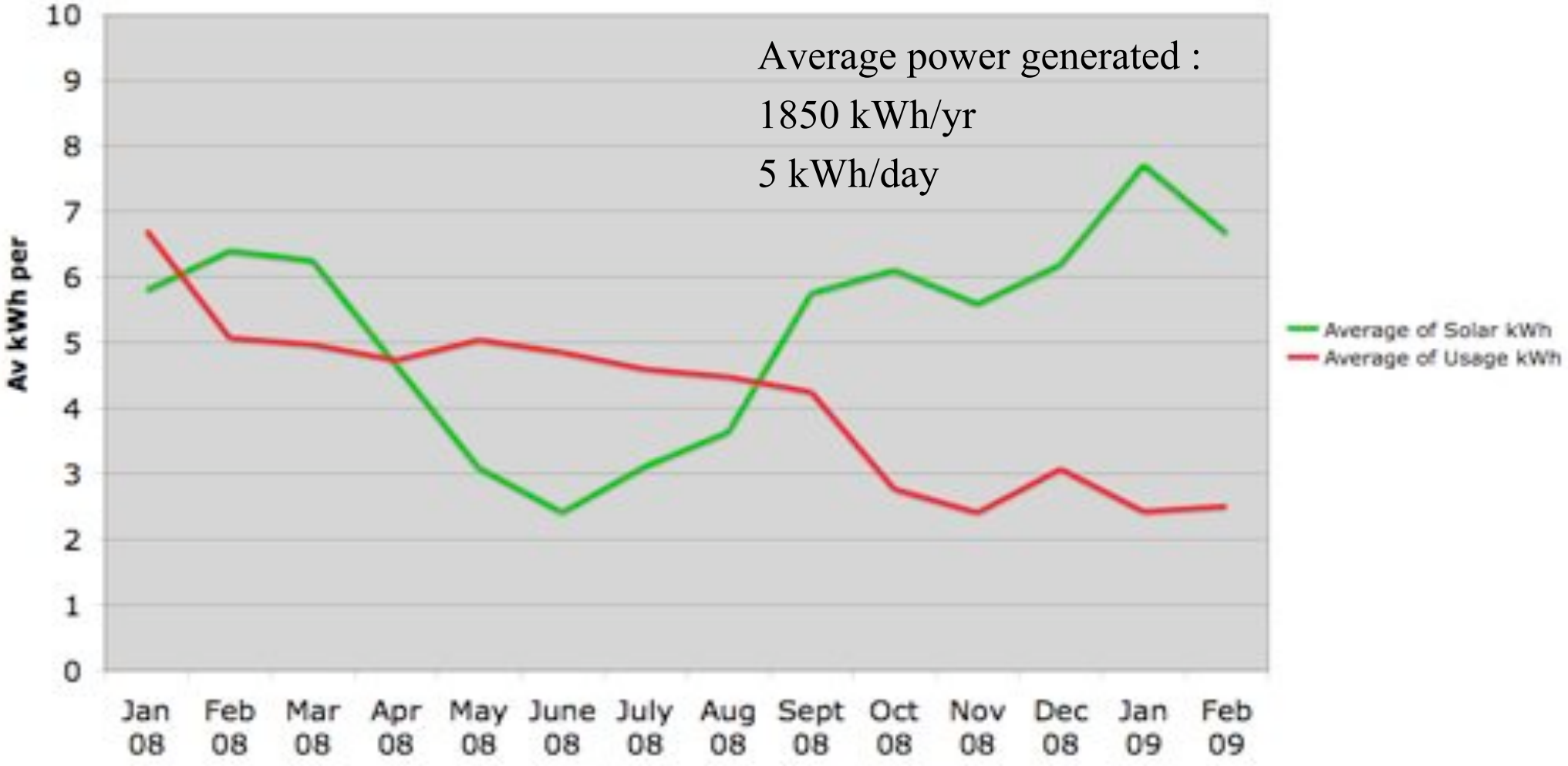


Standby power: switching off at wall

Appliance	Make	kWh
Central heating	Brivis	0.45
Tape player	Sanyo	0.29
Audio system	Altec Lansing	0.24
Printer	Lexmark Laser	0.17
Filter coffee machine	Sunbeam Aroma	0.17
Wireless N/W	Apple Airport	0.11
Cable modem		0.10
Gas Heater	Archer	0.09
Standard Lamp		0.08
Computer	iMac 20"	0.08
Desk Lamp	Modul	0.07
Radio/tape	Phillips	0.06
Phone charger	LG	0.04
Clotheswasher	Asko	0.02
Phone charger	Nokia	0.01
	Total saving	**2 kWh**

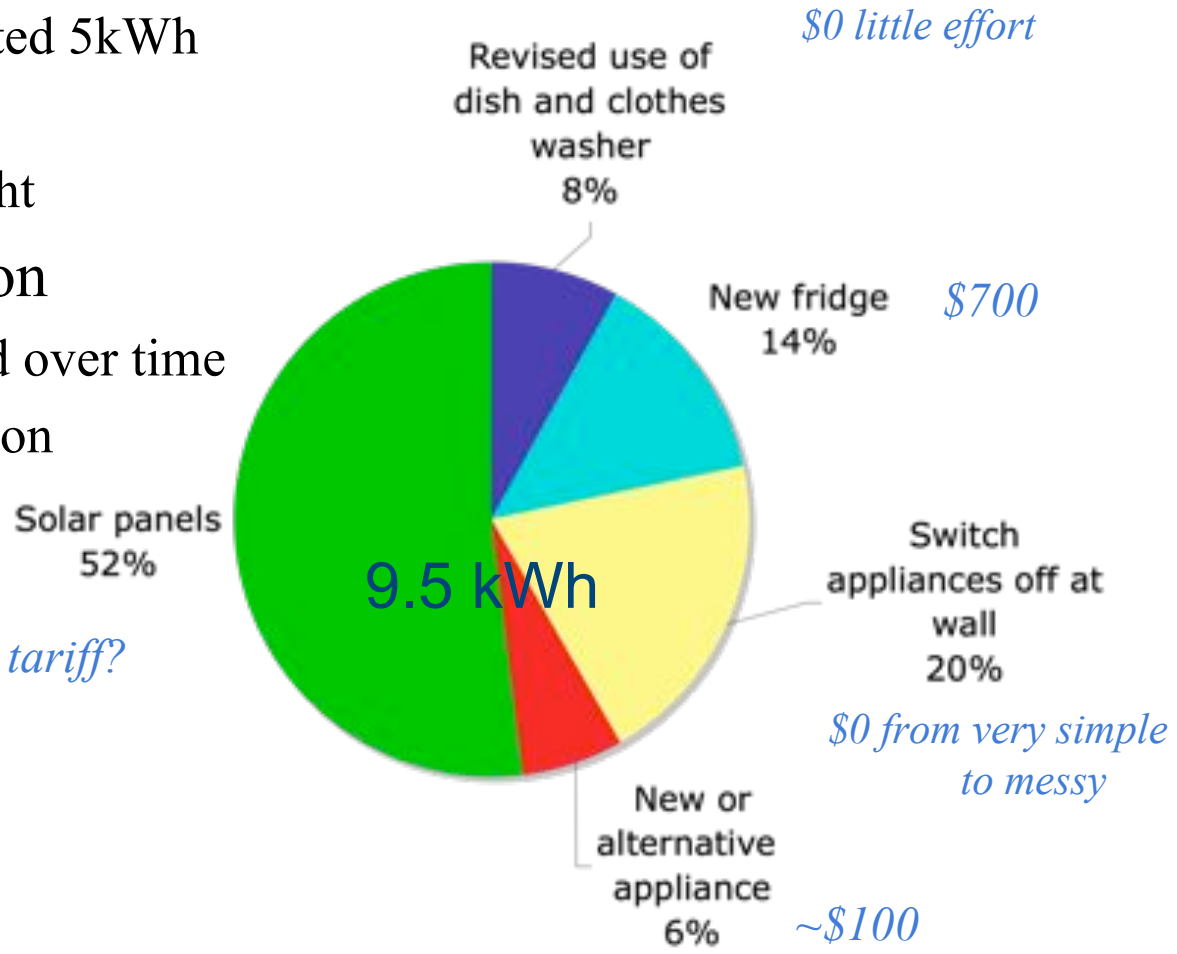

Solar panels
1.5kW system, 32° pitch
A long time to finally commit
Hard to take in all factors
Variable advice
Importance of convenient graphic display

Solar panels: output



Solar panels:

- Initial disappointment
  - Output lower than expected 5kWh
  - Installation not ideal?
  - Origin just can't get it right
- Daily interest in operation
  - Understanding developed over time
  - Trigger for audit and action

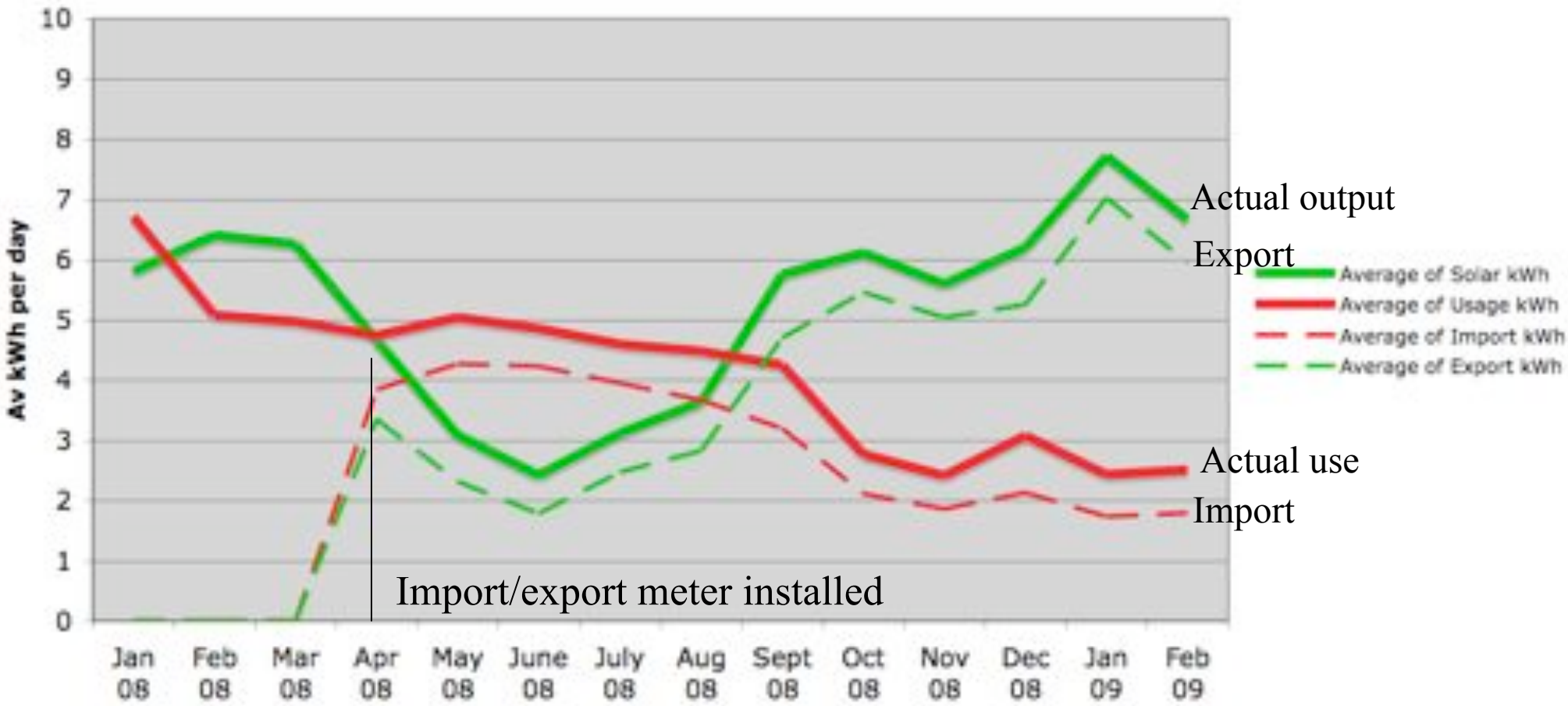


Solar panels: Net vs Gross feed-in tariff

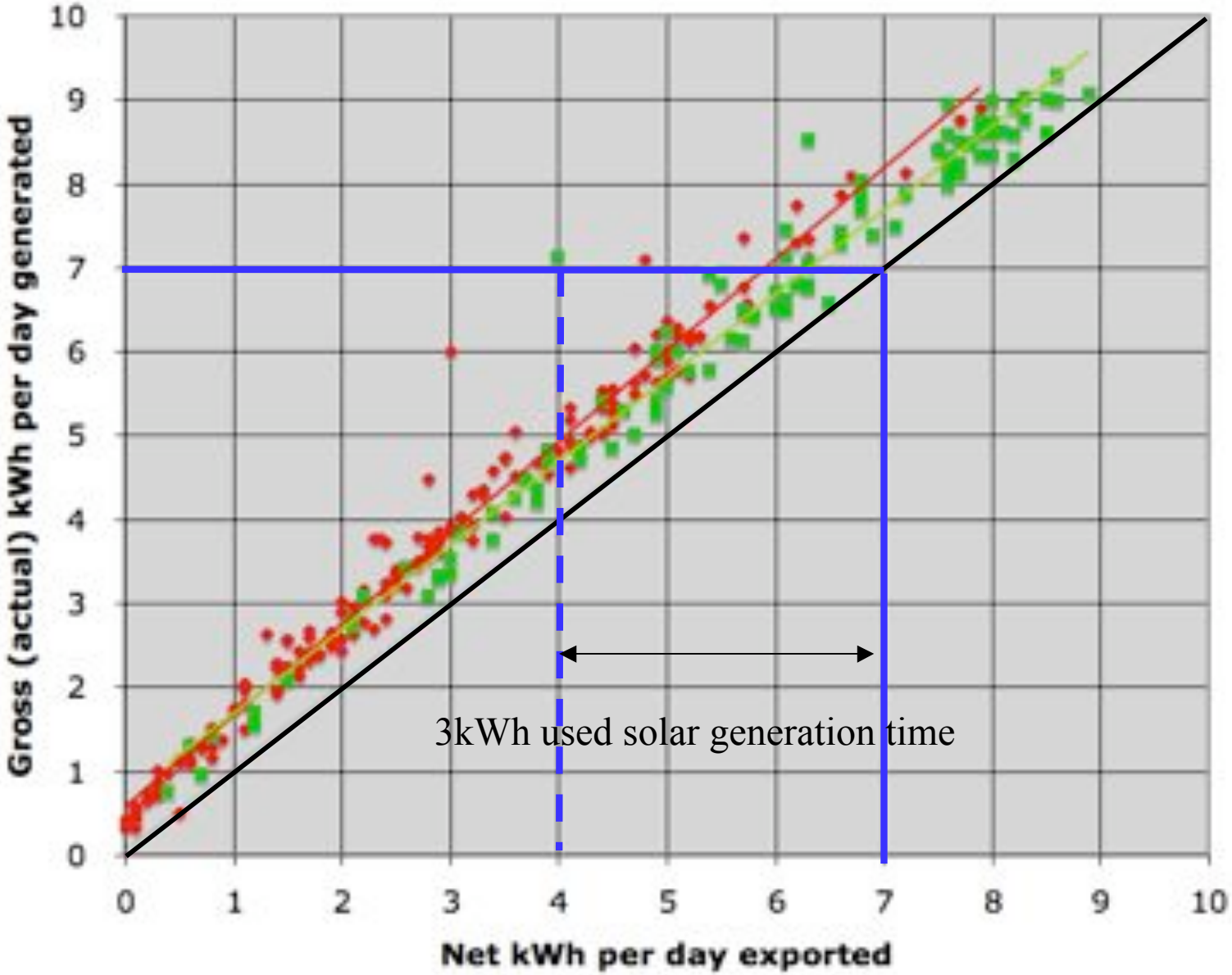
- Net Feed-in tariff
  - Difficult to understand
  - Difficult to quantify carbon contribution
  - Annoying, forces odd behaviours
  - However - a real incentive to reduce energy use

- Estimated yearly return from panel installation
  - Current Origin FIT ($0.20): ~$330/yr
  - With proposed $0.60 FIT: ~$1000/yr

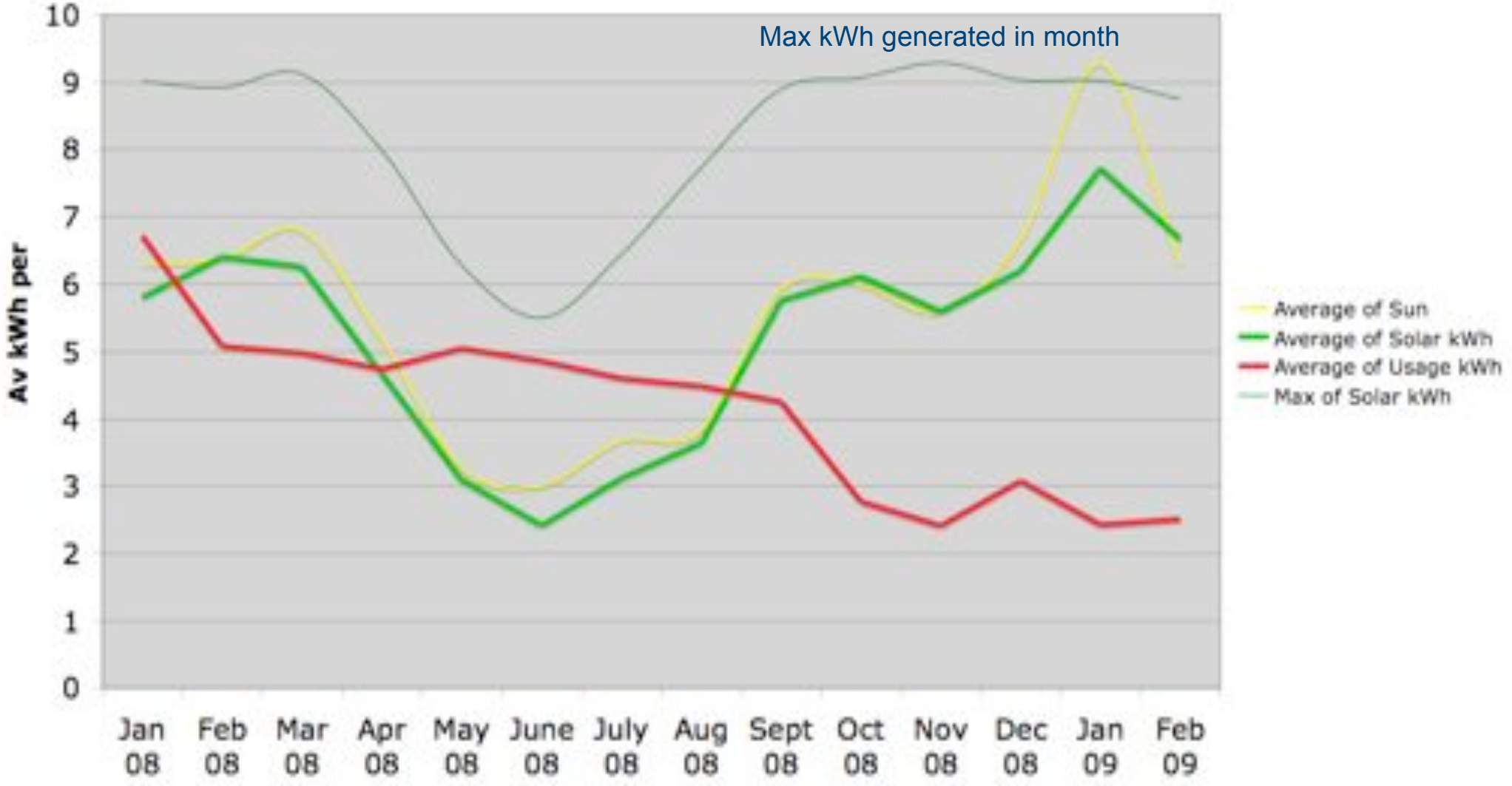
Solar panels: net import/export vs actual use/generation



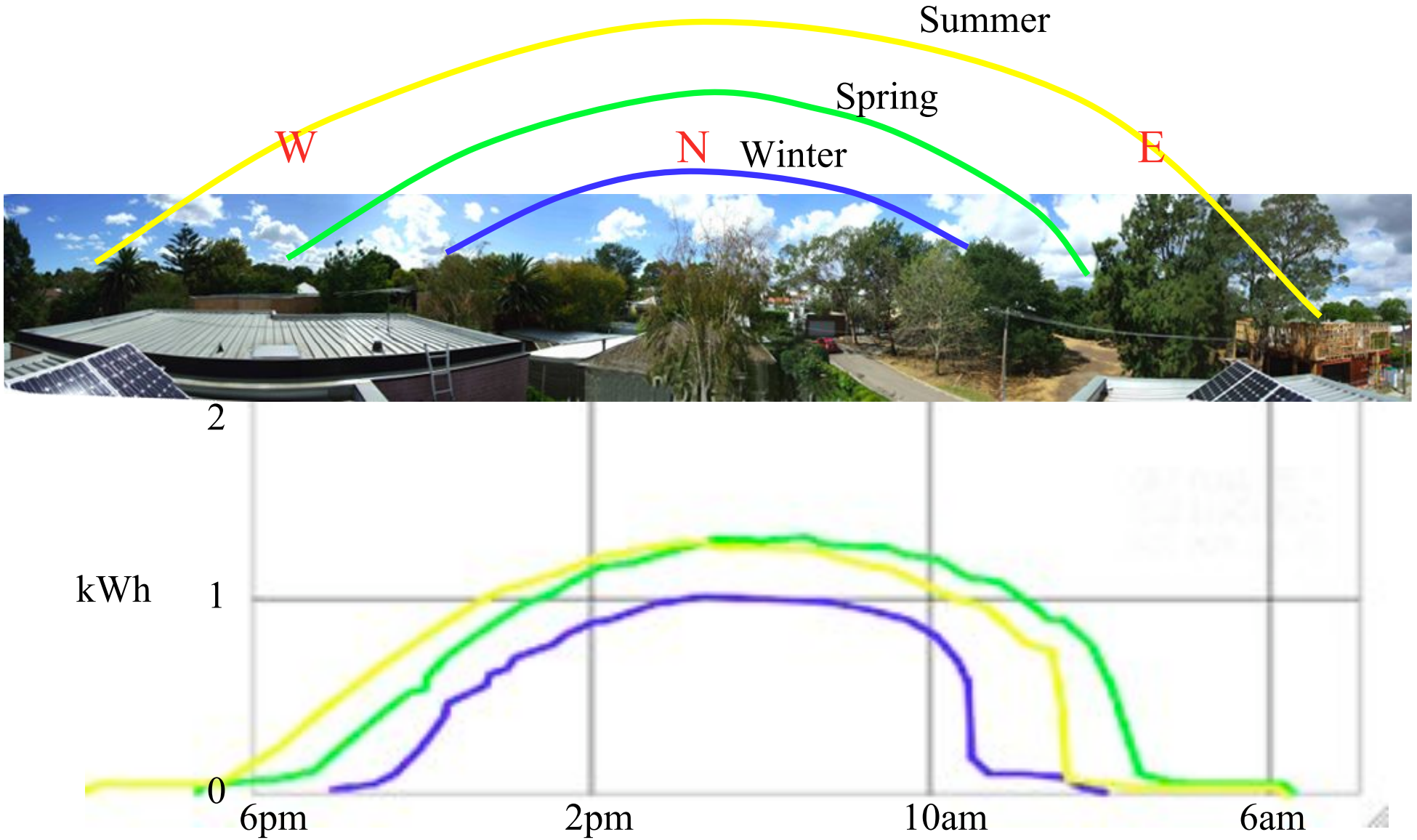
Solar panels: Net vs Gross feed-in tariff



Solar panels: seasonal variation



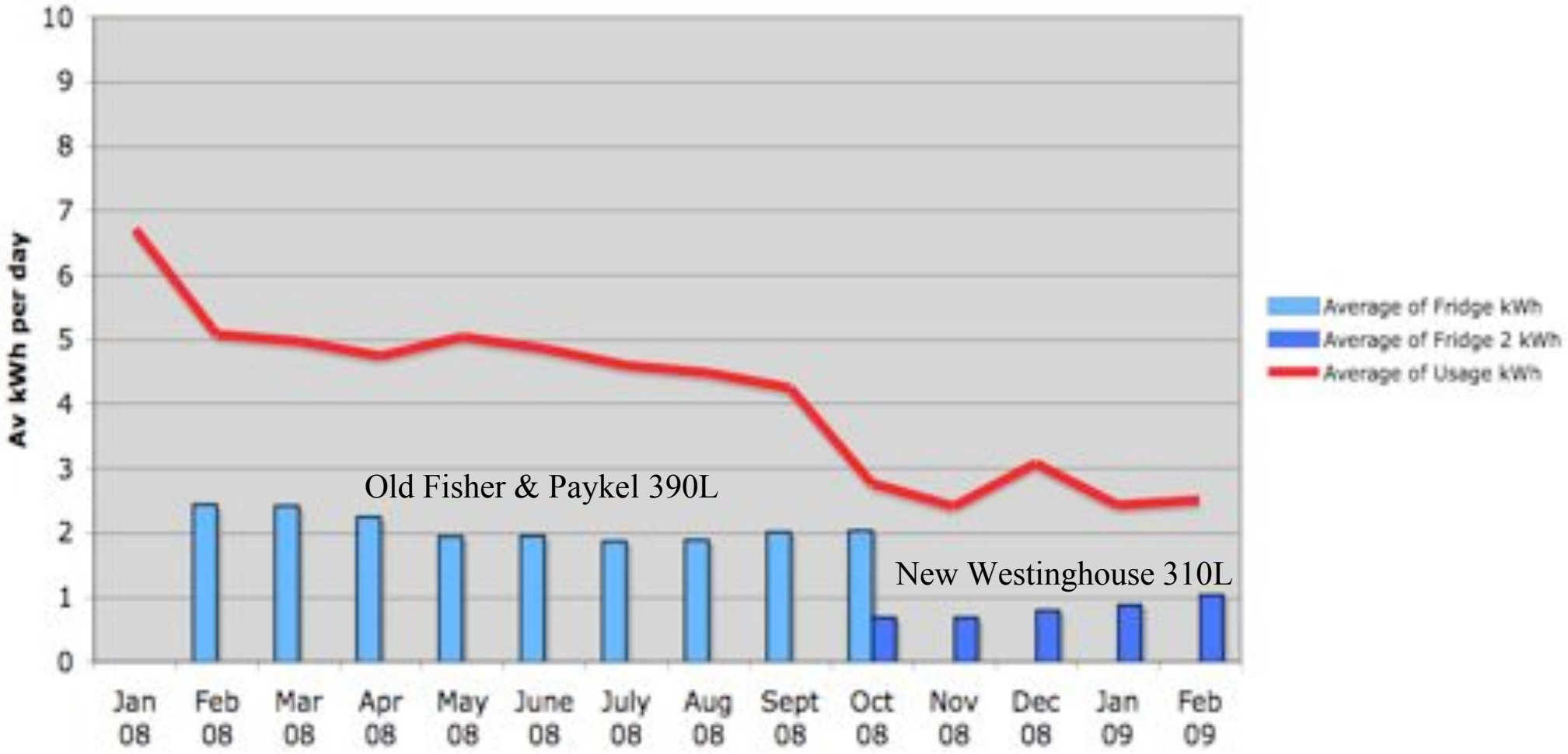
Solar panels: diurnal variation



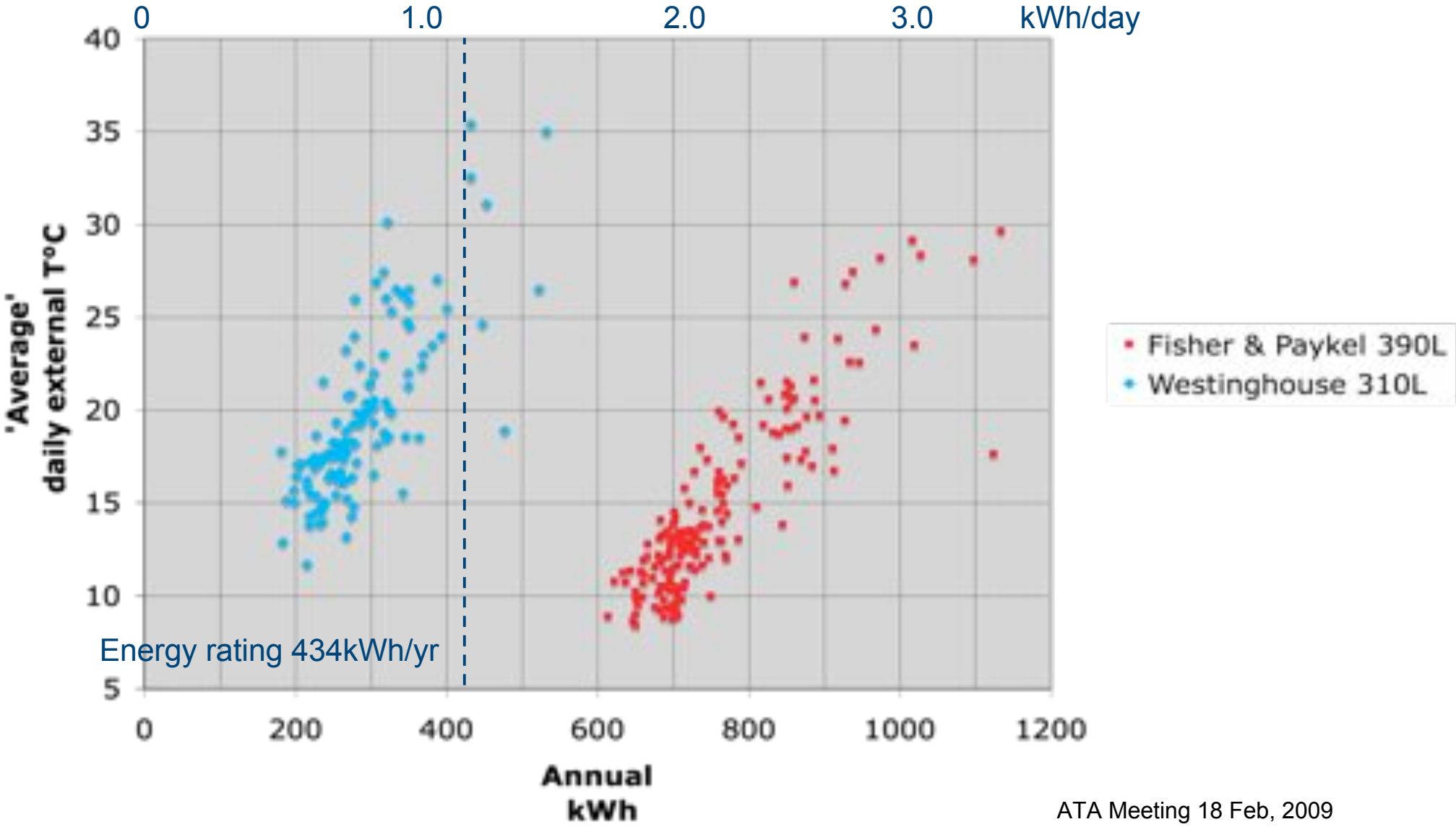
Refrigerator:

- Fridge is key to maximising Net export
- Waiting in vain for leading edge option
  - A long term investment so get it right
  - More efficient ones often odd configurations
- Pragmatic choice of smaller Westinghouse
  - Standard fridge size has grown
  - A challenge to ‘downsize’ requirements
  - Lower star rating but uses less power than larger size

Refrigerator: energy consumption



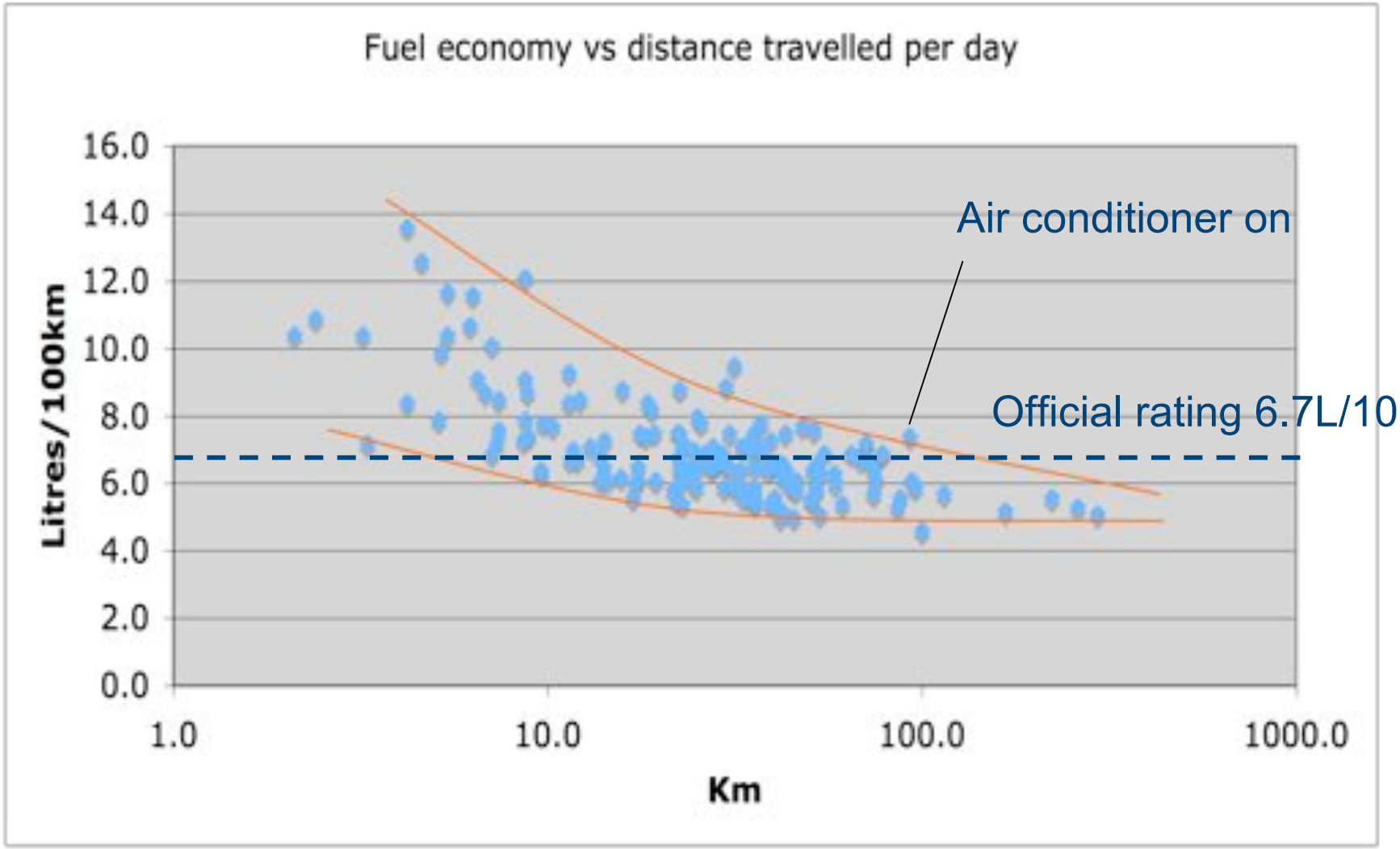
Refrigerator: energy vs average external temp



Transportation: change of lifestyle

- Car (Honda Jazz)
  - Shared between family, but aim to get rid of eventually
  - Fuel efficiency display triggered changed driving habits
  - Down to 5000km annually
- Public transport
  - Extensive use locally and interstate
  - Inner location critical
  - Need to adapt to idiosyncrasies
- Bike 1500km
- Scooter 1000km

Transportation: Car fuel efficiency (Honda Jazz VTi)



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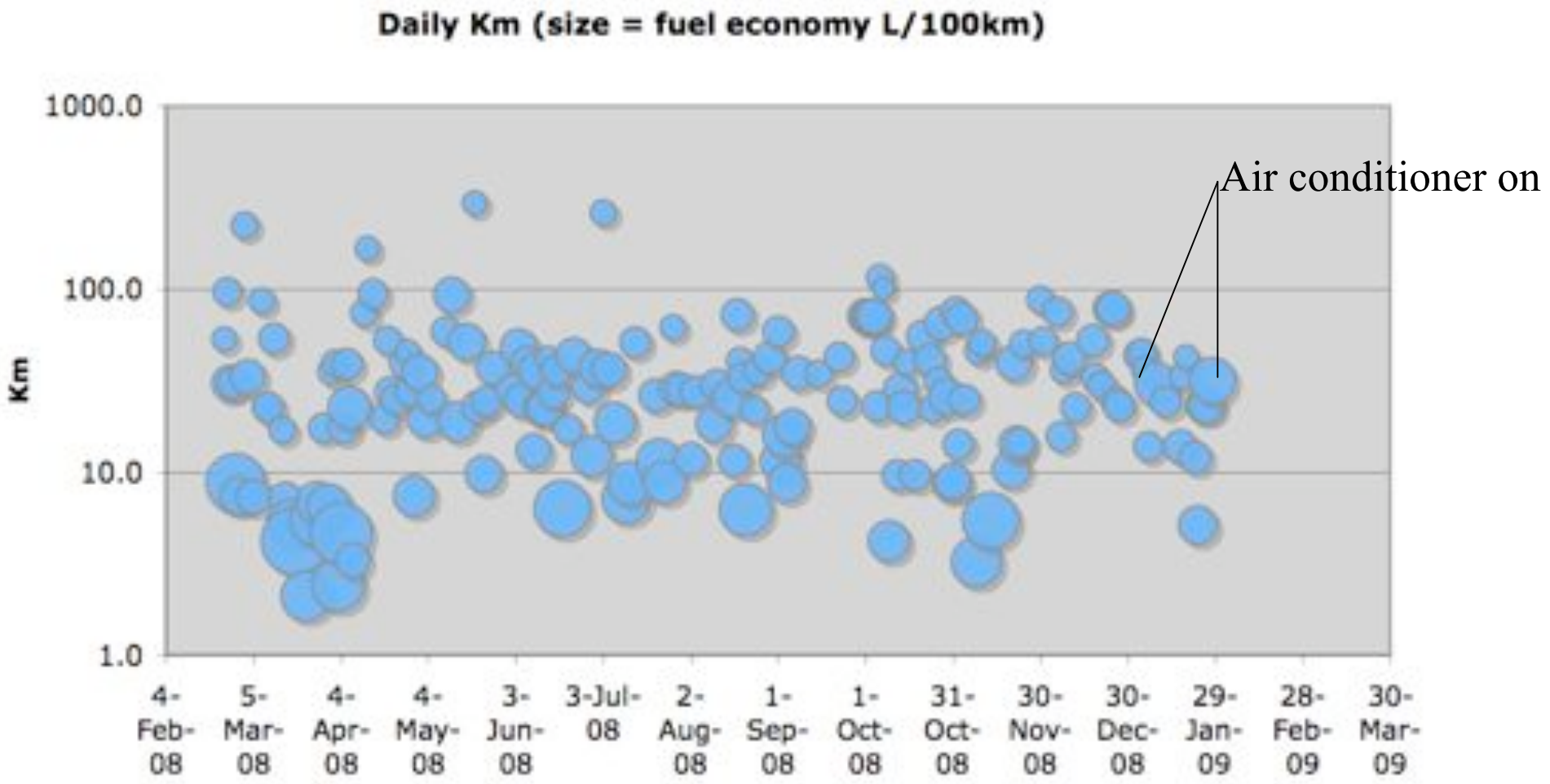
Transportation: Car fuel efficiency over time



Heating and cooling

- Cooling
  - Louvres create cross flow
  - Adversity of heat wave trigger for understanding/action
  - Sealing cracks and window shading, insulating crucial
- Heating
  - Replaced central heating with Archer 5.5 star gas space heater
  - Lessons learned in summer apply to winter
- Living with passive heating/cooling
  - Comparison between sailing and power boat - not for everyone
  - Compromise to style of house
- Gas and electricity emissions equivalent
  - Down to annually 1 tonne each

Water

- Tanks
  - 1000 litre tank for small vegetable garden
  - Plans to remove central heating unit to fit 2500 litre tank
- Hot water
  - Will replace gas hot water storage tank with instantaneous system, rather than solar
- Grey water
  - Solution not readily apparent so it's buckets+
- Water use behaviours are critical
  - Save 1000s of litres, showers, warm up water
  - A lot easier to understand than energy consumption

Communications, computers and entertainment

- Living room iMac computer
  - Replaces TV, VTR, CD player, DVD player and photo viewer
  - One simple remote!
  - Reasonable energy usage
  - Supplemented by notebook computer, iPhone
  - Altec Lansing speaker system disappointing standby power
- iPhone
  - Now 80% of computer usage
  - Invaluable for effective public transport use
- Wireless network/modem
  - Switch off with remote power switch

Lighting

- No ideal solution to halogen down light problem
  - Trialing compact fluros, etc
  - Disabled individual globes, use improved halogen globes in key areas
  - Use high efficiency standard and desk lamps
  - Beware standby contribution of power pack and non mains-switched lamps
- Must question the apparent need for uniform bright light
  - Houses still being built with ridiculous lighting systems

Concluding observations: personal reflection

- An individual approach
  - Family considerations
  - Trying to look at whole but become absorbed specific aspects
  - Progressively changing lifestyle - ‘sailing the house’
- Key triggers initiate leaps in understanding/progress
  - Investment decisions, downsizing
  - Installation of solar panels
  - Water restrictions, heat wave
  - Talking to others, Web research, ATA involvement, preparing this presentation
- Information
  - General information available but scattered, overwhelming
  - Personal model of how things work emerging from data collection

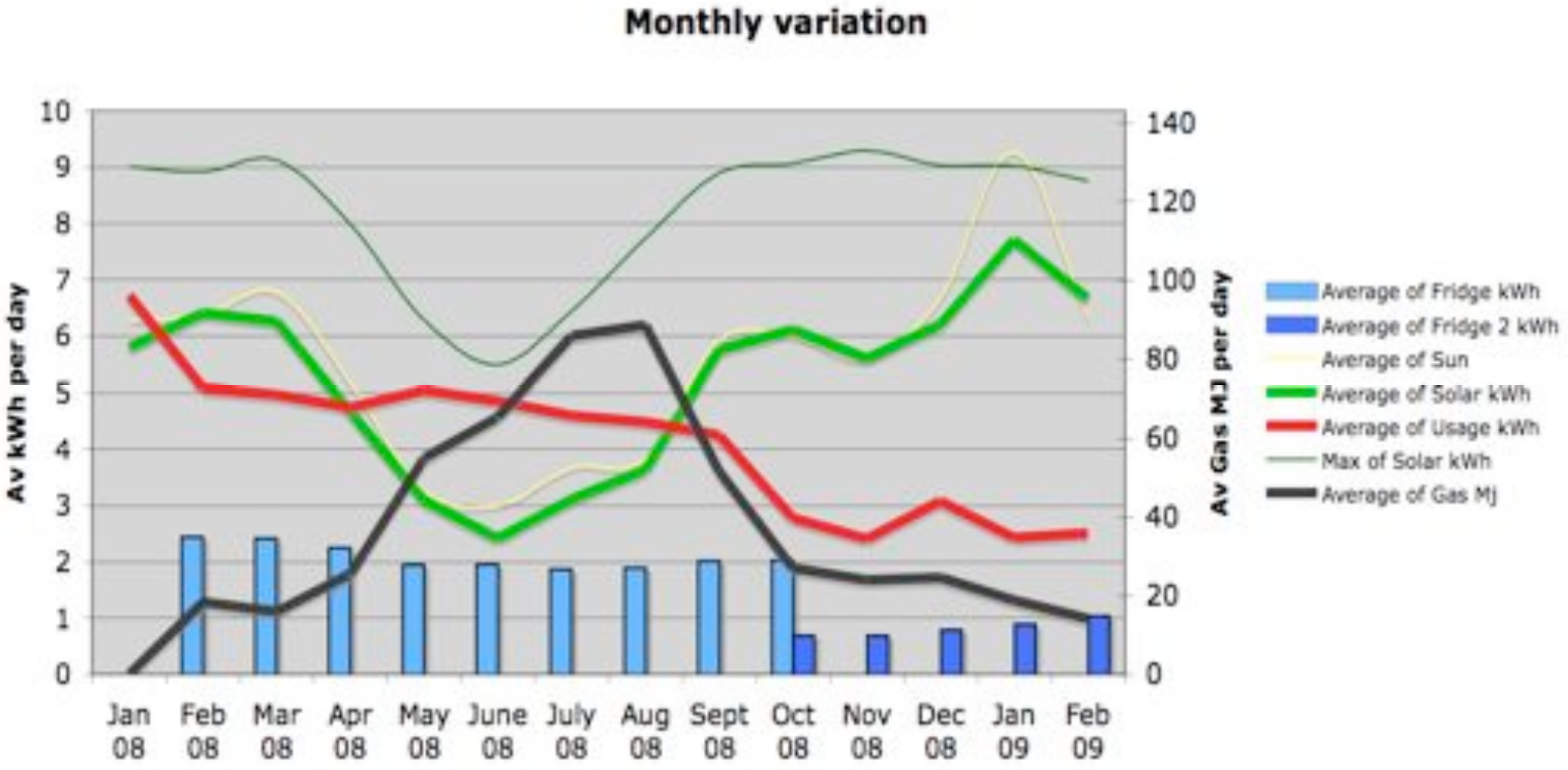
Concluding observations: need to recognise varied audience

People have different motivations, skills, knowledge, lifestyles, financial & housing situations and will respond accordingly

- The innovators
  - Researching and trialing solutions
  - Not risk adverse, intrinsic rewards
  - Write for Renew
  - Low fruit not necessarily interesting
- The early adopters
  - Actively adopting measures
  - Read Renew
  - Looking for low fruit
- The potential adopters
  - Like to do the right thing but not sure how to start
  - Waiting for others to lead
- The wider community
  - Probably not that interested

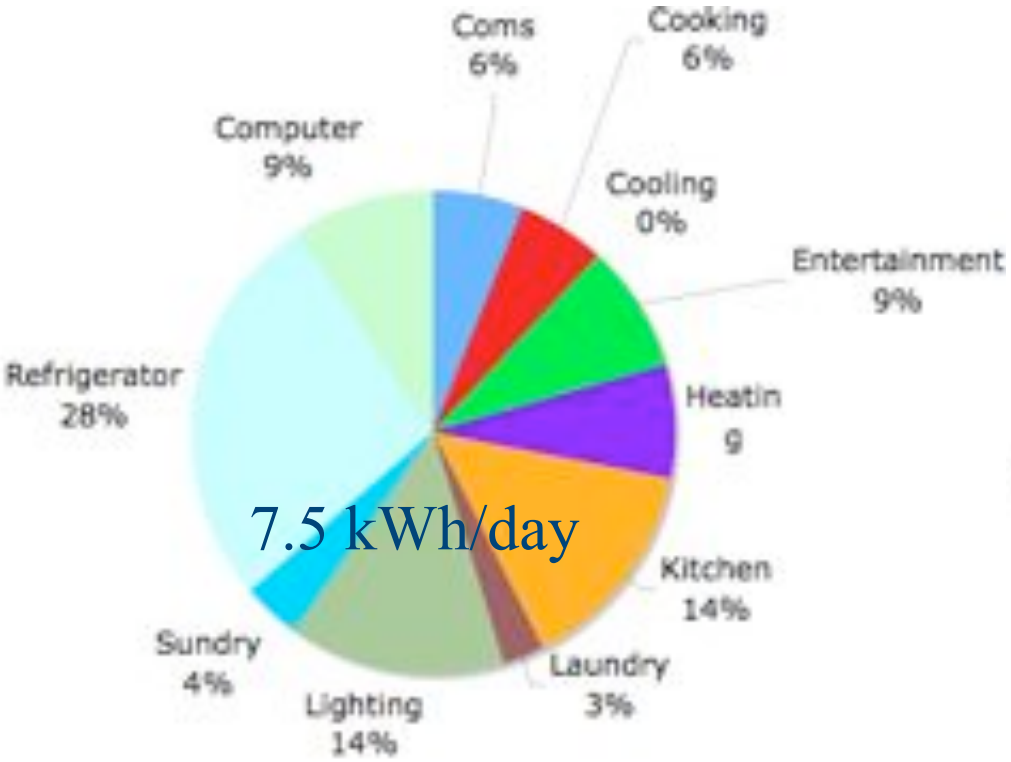
Concluding observations: Roles

- ATA
  - Seminars, Speakers, Expos, committees
  - Exploit targeted research and experiences of members
  - Provide expert advice, e.g. role for case managers
  - Foster community for innovators and adopters
  - Inform government
- Governments
  - Targeted incentive schemes
  - Mandating appliance, transport and building standards
  - Mandating visibility of effects, fuel efficiency displays, household power use
  - Advertising, school, trade and professional education
- Media, Consumer Association
  - e.g. Carbon Cops
- Individuals
  - Building local communities of interest


Monthly variation
Av kWh per day
Av Gas MJ per day
0
1
2
3
4
5
6
7
8
9
10
0
20
40
60
80
100
120
140
Jan 08
Feb 08
Mar 08
Apr 08
May 08
June 08
July 08
Aug 08
Sept 08
Oct 08
Nov 08
Dec 08
Jan 09
Feb 09
Average of Fridge kWh
Average of Fridge 2 kWh
Average of Sun
Average of Solar kWh
Average of Usage kWh
Max of Solar kWh
Average of Gas Mj

Appliance audit: power use breakdown

Initial estimation Jan 2008



Current use Feb 2009