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Demand Response in Appliances – the A-HELP Project

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This presentation will cover:

- The air conditioner peak load problem in Australia
- Ways to approach the problem
- Aims of the A-HELP project
  - Australian Household Electricity Load Management Platform
- Potential economic value of A-HELP
- Need for an international approach to demand response

The air conditioner market in Australia

- Australia was not a high-AC country (until recently)
- Number of AC households growing fast
  - Up to 70% of new homes in Sydney have ducted
- Still plenty of room for growth
  - AC ownership still low by US standards
  - Potential shift from cooling single rooms to cooling whole house
  - Use of AC often reserved for very hot days only
- Peak demand on extreme days already a problem
  - MW impact could double by 2015

Air Conditioner Penetration, Australia and USA

Why has AC ownership grown?

- Economic and pricing factors
  - Real incomes have been rising strongly
  - Real AC prices have fallen (thanks to China)
  - Capital costs masked: bundling with new home finance
  - Operating costs masked: lack of price signals
- Long term promotion by some utilities
- Poorly designed and shaded houses
- Growing stresses from noise, crime, high-rise living
- Global warming
  - Last few years have been hottest on record in Australia

Why Household Sector AC is a problem

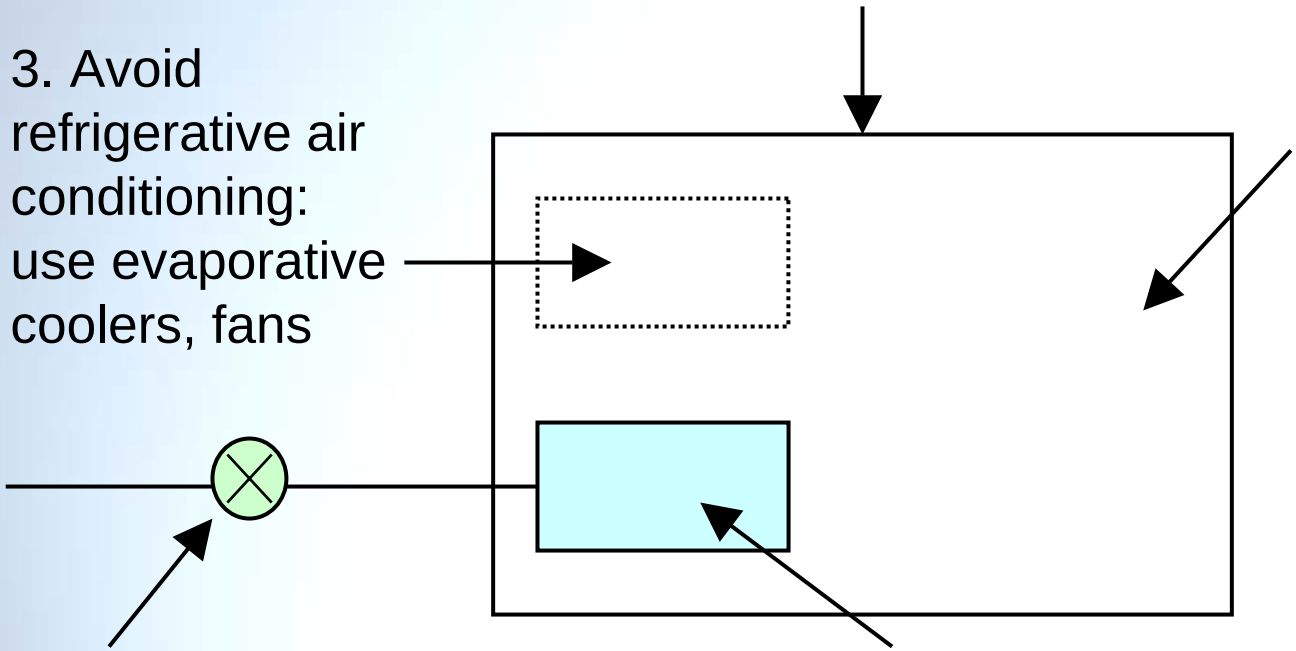
- Up to 50% of HH sector load on extreme hot day peaks
- Projected to drive system investment
- More difficult load than Commercial Sector AC
  - HH load factor very low, little contribution to energy revenue
  - Commercial sector AC load shape is much flatter
- Massive cross-subsidy from non-AC to AC households
  - About $100 per household per year (10% of average bill!)
- Economics of the AC load are inefficient and inequitable
- Electricity suppliers cannot RECOVER the costs or LIMIT them

What is Government doing about it?

1. Improve thermal shell performance

3. Avoid refrigerative air conditioning: use evaporative coolers, fans

2. Minimise solar gain in summer, maximise in winter



5. Build in automated demand response capability

6. Create incentives to *activate* the DM capability

4. If AC is installed, ensure that unit (and ducting) are energy-efficient

Strategy limitations

- Increase building shell thermal efficiency
  - Increasing insulation standards had no perceptible impact on AC takeup
  - Impact of more sophisticated house rating systems unknown
  - Slow - only acts at the rate of new building and renovation
- Promote evaporative cooling where possible
  - Only suitable in some climate zones (not eastern Australia)
  - Evaporative coolers losing capital cost advantage
  - Water consumption also becoming a resource problem

Strategy limitations

- Programs to increase energy efficiency of new ACs sold
  - Minimum Energy Performance Standards (supported by energy labelling) can impact on market more rapidly
  - BUT will tend to increase kWc rather than reduce kWe
  - Still little effect on ducting and systems design

- CONCLUSION: Strategies 1,2,3 and 4 not enough:
  - We need demand response as well

Demand Response

- Need a way to signal AND a way to respond
- Demand management/response programs are not new
  - Large off peak water heater load since 1930s in Australia
  - Many US utilities have large AC load control programs
  - Industrial and commercial electricity users already participate
- New pricing, metering/control and response technologies offer lower cost, more flexible possibilities
- Much of the cost is in the last link to the appliance
  - Can be ‘retrofitted’ to existing AC stock, but costly
- Much cheaper to build the capability in at the factory
  - This is the focus of the A-HELP project

Objectives of A-HELP

- To develop standards for demand response capability that focus on the appliance and its modes of response
  - Define the factors that determine acceptability for end users and costs/benefits for energy suppliers
  - NOT to define technical communications protocols and standards (plenty of those already) but cross-refer to them
- To get those standards broadly accepted internationally
- To get demand response capability built in to *every product sold*
  - obvious ones are ACs, swimming pool pump controllers

What makes demand response acceptable to users?

- Will restart if remotely cycled off (not give fault message)
- Will not start on its own if it was off before the signal
- Will intelligently respond to signal by reducing output
- Will intelligently respond to early warning of impending high price period (eg by over-cooling)
- Will graduate its response according to the signal (according to rules which the user can preset or agree beforehand)
- Will do all this automatically, without drawing attention to itself
- BUT users can check what the appliance is doing if they want, and why it is doing it (eg by ‘seeing’ the price signal it is seeing)
- Users can over-ride if they really want to

What do energy utilities want?

- More interested in recovering costs (with TOU tariffs) than limiting them, but if they MUST develop DR, then:
- Compatibility with their communications, control, metering and billing systems (for both retailers and distributors)
- Not to be tied to single providers and proprietary systems
- To easily identify households with DR-capable appliances
- To easily identify DR-capable products on the market
- Low cost to access and activate (no need for service call)
- An ‘easy sell’ to enroll customers for DM tariffs & programs
- Predictable, measurable outcomes and low over-ride rates

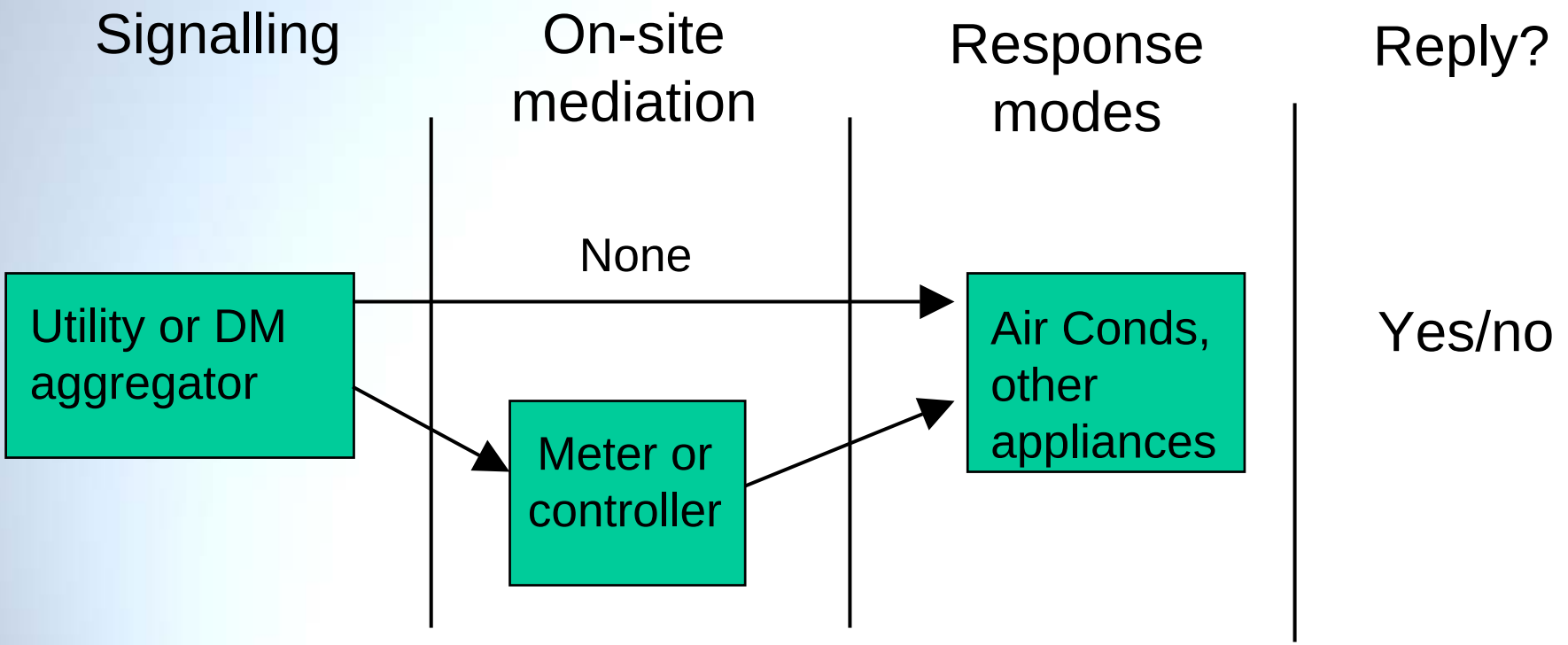
Other stakeholders

- Appliance manufacturers want certainty, international standards, market advantage
- Government policy agencies want standards for DR capability that can be called up in regulations, so
  - DRC can be indicated on energy labels (this also helps utilities who want to give cash incentives for those models)
  - Eventually, mandated as part of MEPS (if cost-effective)
- Electricity price regulators
  - Want low-cost DRC as competitive alternative to approving massive price increases for regulated networks

How to help all parties get what they want

- Need a standard classification of DR capability in clear, non-technical language that all stakeholders understand
  - Standards Australia has started work on this
- For Australia, need to get it adopted internationally
  - Most of our market is supplied from Japan, Korea, China, Thailand and Malaysia
  - Many of these countries (and others) have,or will have peak demand problems, so common interest
- PROBLEM IS STANDARDS, NOT TECHNOLOGY

Proposed standard DRC classification



A-HELP Stakeholders

- Australian Greenhouse Office
  - Understand that it may be greenhouse-neutral at best
  - Using role as co-ordinator of national appliance standards
  - It took AGO nearly a year to engage all the stakeholders
- AC industry association (AREMA) and individual AC firms
- Electricity suppliers industry association (ENA) and firms
- Home automation interests
- National research organisation (CSIRO) – software
- Demand response aggregators
- Metering and relay equipment suppliers

Why A-HELP is different

- Existing AC demand programs rely on retrofitting technology to products in the field (many of them unsuitable), A-HELP aims to get the capability built in to every unit
  - And so cheap it does not matter if it is used or not!
- Some initiatives with similar objectives (eg ECHONET in Japan, Title 24 in California), but A-HELP seeks open global DR standards for all appliances
- Approaches to DR have mainly focused on the technology, economics or utility needs, but A-HELP is starting from the appliance end

International links

- via Australian participation in IEA DSM/EE Program:
  - Task XV - Network Driven DSM
  - Task XIII - Demand Response Resources
- Australian Greenhouse Office MOUs with California Energy Commission, Korean government agencies
- AGO proposes to co-sponsor (with IEA?) 2 workshops on DR capability standards for appliances, over the next year
  - Probably one in Asia, one in Europe
- ACs are widely manufactured and traded, so the industry is global

What is at stake

- Global warming is leading to extreme heat events
  - Everyone who can afford it will want an air conditioner
  - AC markets will grow very fast, move northward
  - Electricity supply systems are unprepared (even in Australia!)
- AC demand will become a system stability issue
  - As well as an even bigger pricing and economic issue
- Much cheaper to build in effective DR capability than to retrofit it, or deal with system cost of uncontrollable load.

Costs and Benefits

- Benefits easier to quantify than costs
  - See following example for estimated $$
  - Platform for demand response in other appliances
- Costs will include:
  - AC controller costs (very low if built in)
  - Control interface costs (depends on device)
  - Loss of utility by AC users (can be minimised)
  - Customer recruitment and retention costs
  - Electricity distributor system control costs

Potential value

- If demand response capability had been in place in 2004
  - value to NEM customers up to $M 1,345 per year
  - Most of this is avoided payments to generators
- Need 950 MW of load, or 380,000 ACs
  - Assume 2.5 kW/AC diversified during TVoL event
  - 14-16% of installed AC stock controlled, 0.5 hrs off in 4.5
  - Value of $2,130 per participating AC per year
- Allowing for changes in generator bidding, etc. potential economic value about $1,000 per year per AC!
  - This a pretty good ‘value proposition’
  - Additional system value of emergency response

How to become involved

- A-HELP project about 18 months into a 10 year strategy
- It will not be quick or easy
- If you are interested:
  - Talk to me here at EEDAL, or
  - Email me at geosanna@ozemail.com.au
- If you are doing something similar, please let me know
  - It took a year to identify all the stakeholders just within Australia!

THANK YOU