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Influences on residential uptake of distributed generation and energy efficiency

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Traditional approach to modelling EE & DG

In order to model deployment of a particular technology (eg. PV)

1. identify its sources of cost and value (installed cost vs value of elec)
2. determine its financial attractiveness (simple payback time, NPV)
3. used in models to determine impacts of different policies

– if purely a financial decision, no one would install PV

Rebate	Final capital cost	Approx annual revenue (15c/kWh)	Simple payback time	Disc. payback time (7% / 2.5%)
$0	$13,000	$220	59 yrs	never
$4,000	$9,000	$220	41 yrs	never
$8,000	$5,000	$220	23 yrs	142 yrs

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Our approach

- rather than focus on technology and cost, focus on end-user behaviour & decision-making (eg. will I install PV?)

Influences:

1. Broader Social Context (BSC)
   - human behaviour very complex, influenced by BSC from birth
   - variety of different behaviours, habits and practices (not all our actions are based on conscious decisions)
2. Infrastructures of Provision (IoP)
   - infrastructure that provides energy and energy services
   - important component of BSC

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Infrastructures of Provision

Draws on a broader definition of technology (www.iiasa.ac.at)

- ***hardware*** involved in delivery of energy services (from electricity generation through to end-use equipment and housing stock)
- ***software*** (the knowledge to appropriately design, manufacture and use the hardware)
- ***orgware*** (the associated commercial and governance systems and institutional frameworks and capacity to deploy and integrate the hardware)

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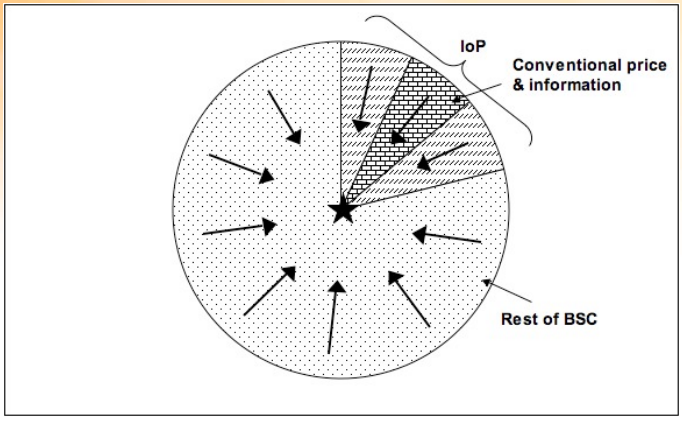
Influences on end-users



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Residential PV Case Study

Examples of IoP influences (in addition to government policies eg. PVRP)

1. Energy supply industry-related:
   - Those more derived from the energy supply industry
   - eg. the nature of the tariffs applied to electricity used on-site and exported eg. flat rate, ToU, types of FiT
   - eg. the costs of connection as well as the administrative difficulties in getting connected
2. Associated physical infrastructure:
   - Those related to the infrastructure more closely associated with the end-user
   - eg. whether the householder owns the premises
   - eg. solar access, both at the time of installation and in the future
   - eg. State & local government building regulations and requirements
3. Hardware-related:
   - Those that are more directly related to the technologies themselves
   - eg. high capital cost of PV systems
   - eg. availability of systems and personnel to install them

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Price sensitivity

No single price sensitivity, payback time influenced by:

- Prior to installation
  - whether the homeowner was on a particular type of tariff prior to system installation
  - demand profile prior to system installation
- After installation
  - the cost of the system including connection costs, new meter etc.
  - whether the homeowner is on a particular type of tariff after system installation
  - system output (influenced by solar access, placement of inverter)
  - demand profile after system installation
  - the availability of rebates etc.
- A bell-shaped distribution curve of payback times across the population.

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Broader Social Context influences

Despite poor payback, 82,490 kW installed in Oz by end 2007

- People like having the electricity meter spin backwards
- People like the feeling of 'independence'
- Because of altruism and simple ideological support
- Because ownership can be seen as a sign of wealth

Conversely, many people are unlikely to install a PV system, even when they are financially viable

- Because of ideological opposition
- Because of aesthetic values
- People tend to discount longer-term benefits more than is realistic
- Because they just don't 'get around to it'

Payback time ≠ interest in PV

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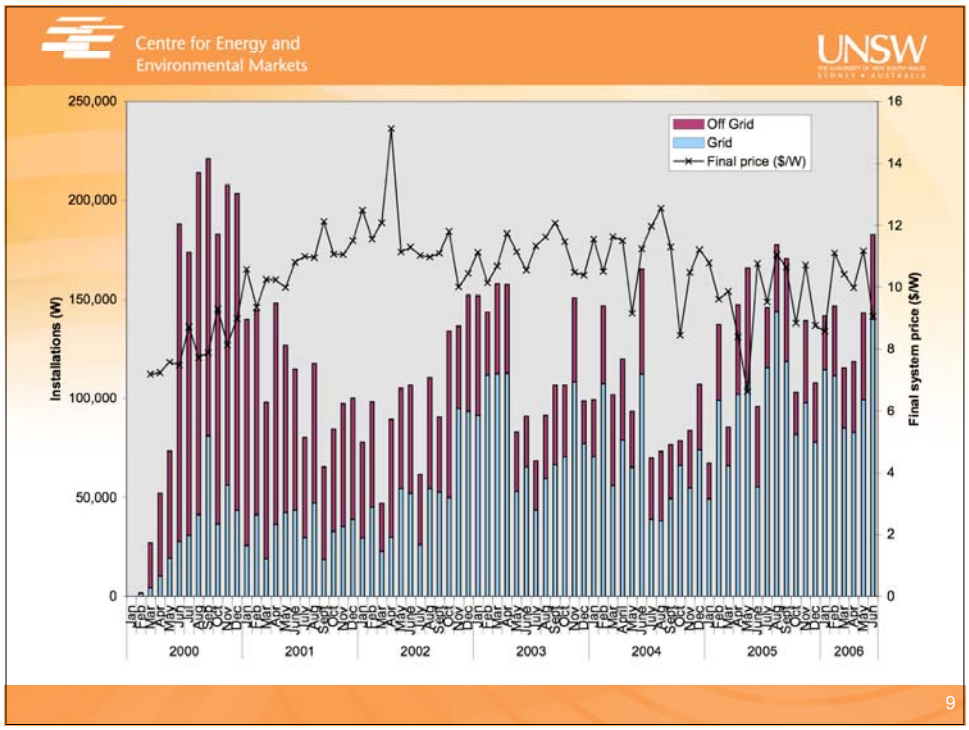
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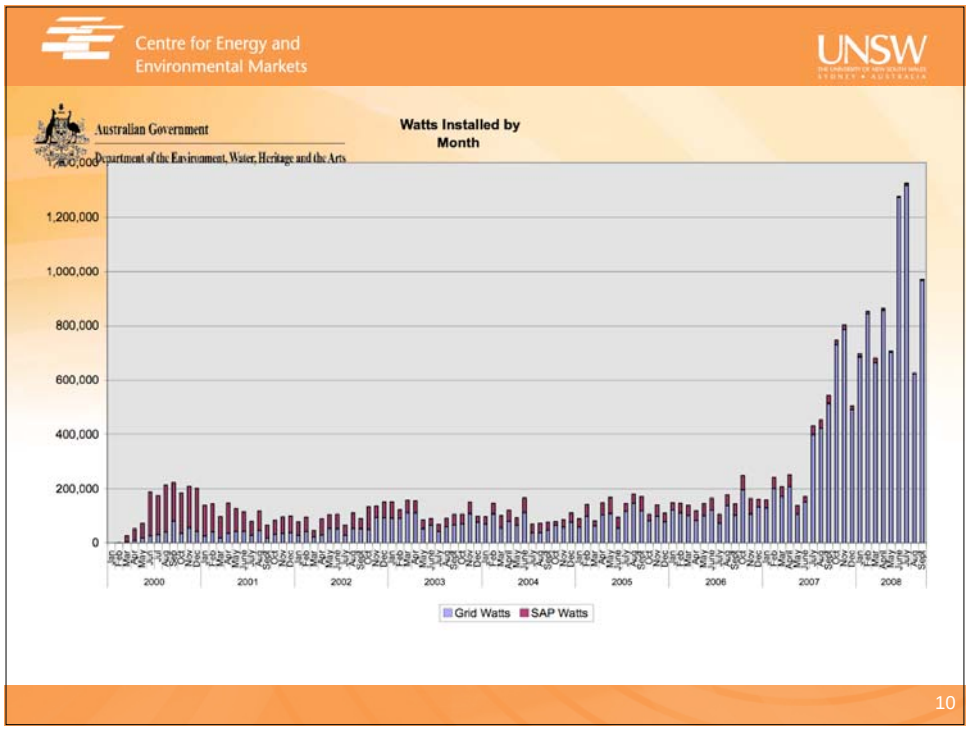
Off Grid
Grid
Final price ($/W)
Installations (W)
Final system price ($/W)
250,000
200,000
150,000
100,000
50,000
0
16
14
12
10
8
6
4
2
0
2000
2001
2002
2003
2004
2005
2006
9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Australian Government
Department of the Environment, Water, Heritage and the Arts
Watts Installed by Month
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
Grid Watts
SAP Watts
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Other case studies more complex

1. Residential hot water
2. Residential space heating and cooling

- both are energy services
- multiple different hardware options
- interactions between different types of hardware
- rapid purchase decisions
- behaviour change

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Main conclusions for DE

1. Generic financial costs and values are of limited value in modeling uptake of residential DE
2. Because of people's different circumstances & behaviour, modelling the GH impact of residential DE is not straightforward.
3. Policy used to drive uptake of DE needs to be developed with the IoP and BSC influences in mind, not only rely on selected information and price signals to promote rational responses in what is assumed to be a perfectly functioning energy market.
4. Because of the complexity of the IoP and BSC contexts in which decision-makers operate, and the resulting variety of influences on them, a number of coherent policies within an integrated energy policy framework are likely to be required to drive effective and efficient deployment of DE.

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Types of policies required

1. Command and control regulatory measures
   - Take the decision-making out of hands of end-users
2. Financially-based measures
   - Overcome up-front cost, split incentives etc
3. Enabling regulations and procedures & Training and accreditation
   - Solar access, installers etc
4. Energy Service Companies
   - provide energy service not just energy
   - need to create appropriate regulatory environment

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Thank you… and *questions*

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