



*Tasmanian Royal Society  
Lecture  
28th July 2016*

*Associate Professor Heather Lovell*

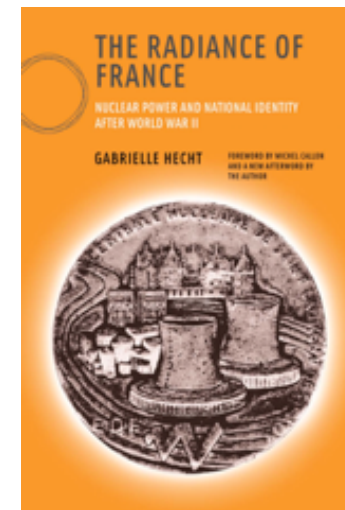
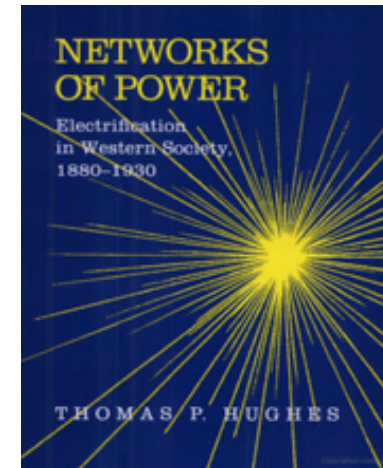


# **Smart grids, messy society**

# Infrastructure, society and politics

"Electric power systems embody the physical, intellectual, and symbolic resources of the society that constructs them...electric power systems, like so much other technology, are both causes and effects of social change." (Hughes, 1983, p2)

“Many fundamental technical choices – such as choices about system design and programmatic development – have significant and inseparable political dimensions” (Hecht, 2009, p338)



# Big data and decision making in the electricity sector

**“Data will play a dominant role in the future energy value chain”** (PWC, 2014, *Utility of the Future*, p2)

## Fixing the grid

**THE PROBLEMS:**

- Electric grid is outdated
- Small fluctuations become big outages
- Political and economical challenges

**THE SOLUTIONS:**

- Real-time monitoring
- Smart, self-healing technology
- Sensors and two-way communication
- Data analysis

<http://www.businessinsider.com.au/smart-electrical-grid-with-big-data-2015-10>, sourced 18<sup>th</sup> July 2016

# Changes underway in Australia's electricity sector

1. Demand from the grid
2. Pricing & tariffs
3. Household rooftop solar
4. Technological innovation



**Big data** viewed as helping to manage change



source: <http://onestepoffthegrid.com.au/wp-content/uploads/2015/08/solar-rooftops.jpg>

# **BUT....its not all big data: exploring a case of scarce data**



## **What I will cover**

1. the *Death Spiral*
2. Scarce Data
3. Off grid households in Tasmania
4. Implications for decision making



Australian Government  
Australian Research Council

Dr Phillipa Watson  
UTAS



RESEARCH EDUCATION DESIGN  
Sustainability Consultants



Australian Indices		Currencies		Global Indices		World	
S&P/ASX 200	5886.5 +50.25 +0.86%	AUD/USD	1.001679	DOW JONES	14266.40 -27 -0.1%	BHP	
S&P/ASX 100	4708.7 +41.50 +0.88%	AUD/EUR	1.001671	S&P 500	2126.86 -2 -0.1%	NAS	
S&P/ASX 50	3788.9 +46.30 +1.23%	AUD/GBP	1.001678	NASDAQ	3071.74 +1.7	WBC	
ALL ORD	5882.3 +46.30 +0.79%	AUD/JPY	1.001671	FTSE 100	7067.26 +12.2 0.2%	WOW	

## Australia stares down an electricity 'death spiral'

TONY WOOD | 11 DEC 2013, 7:14 AM | 27  
INDUSTRIES | RESOURCES AND ENERGY | CLIMATE | ENERGY MARKETS | SMART ENERGY

Australia's electricity transmission and distribution network businesses are facing some unprecedented challenges and the answers are neither obvious nor painless. A history of poor regulation is going to make life more difficult for what were supposed to be low-risk and low-return, regulated monopoly businesses.

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01/12/2014 at 5:40 AM | Updated 01/12/2014 at 5:11 AM

## Reforms needed to stave off electricity 'death spiral'

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Paying per kilowatt hour of electricity consumed sounds reasonable but it is not the right cost for networks as not total power consumed but how much is consumed.



It was a few years ago that economists talking about a "death spiral" for the ro Australia has invested in its electricity

The idea was that as consumers genera solar panels and supplement this at nq they will opt out of the national power



# 1. The death spiral

Households leaving the electricity grid in Australia using rooftop solar and battery storage



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## Death spiral begins for Australian electricity companies

Download audio Show transcript

Saturday 10 May 2014 12:29PM

Australian electricity prices have doubled over recent years leaving consumers paying some of the highest prices in the developed world. As Jess Hill reports, the bulk of the increase can be attributed to consumers paying off large costs incurred by network companies which have invested in infrastructure, despite demand falling each year since 2009. This makes alternatives such as solar power increasingly attractive, leaving fewer consumers of grid electricity paying the price for a policy built on false projections.

105 2%

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Saturday 12 noon Repeated Thursday 1pm Presented by Robyn Williams

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Save the coast generation - Saturday 10 May 2014

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Hopes for Australian budget 2014 10:00 AM

Australia playing catch-up with Europe, US and China in deploying renewable energy 10:10 AM

Death spiral begins for Australian electricity companies 12:29 PM

Elizabeth Kubler - The Sixth Extinction 1:30 PM

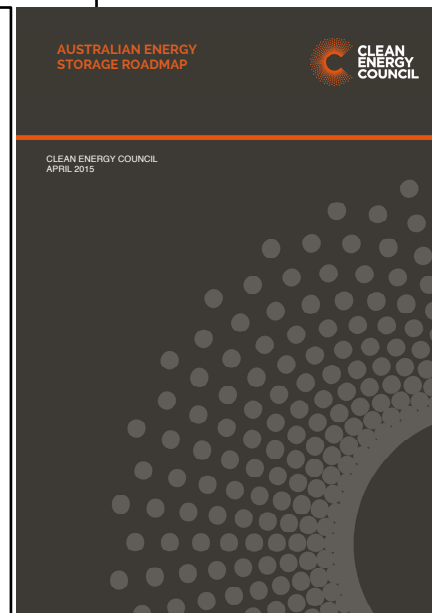
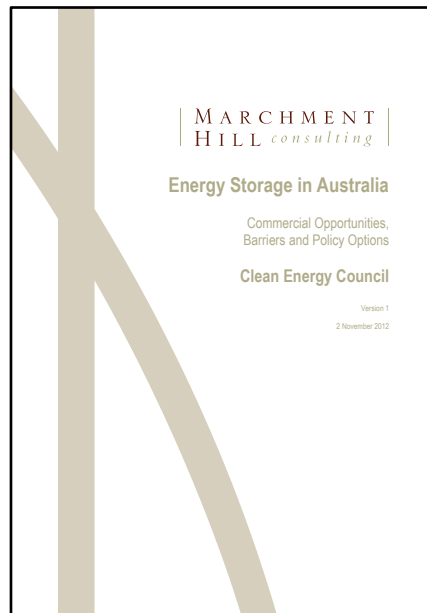
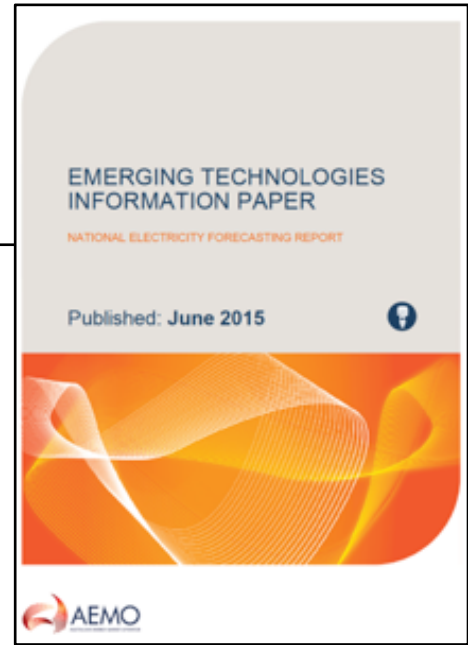
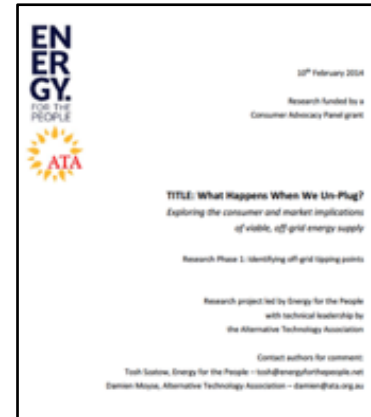


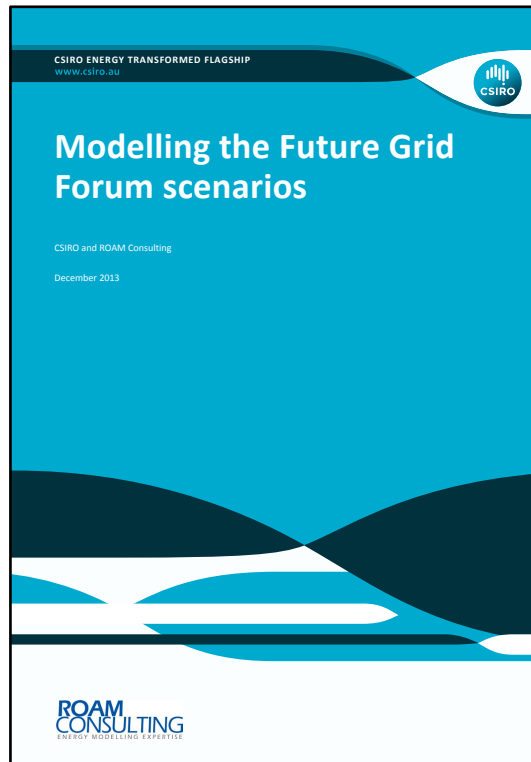
## 2. Scarce Data?

### Lack of data identified as an issue in off-grid policy & research reports

- shortage of data on who is *already* off grid
- future scenarios not based on actual data

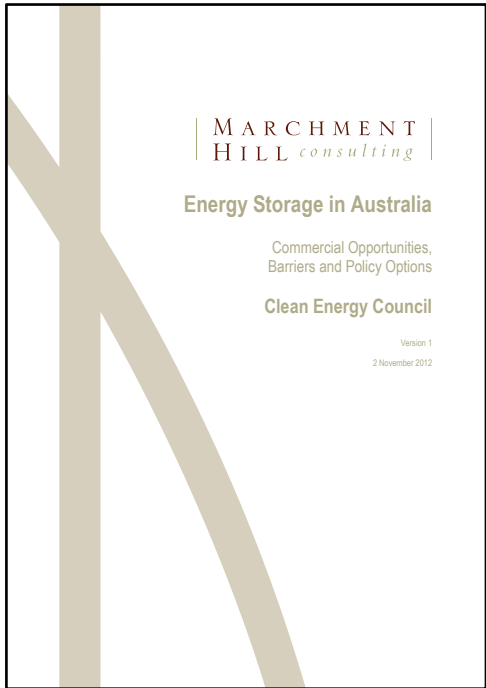
“Data on the number of installed battery storage systems is hard to find”  
(CEC, 2015: 6)





*"We assume that domestic scale battery systems are available in 0% of detached dwellings in 2015"* (CSIRO & Roam Consulting, 2013: 28)

*"Practically no households have yet taken up domestic storage technology independently."* (Marchment Hill, 2012: 38).





Scarce data is a barrier to effective decision making



“A common pattern is that outsiders and entrepreneurs nurture and develop radical innovations... ‘below the surface’ of incumbent regime[s].” (Geels, 2010: 498)

### 3. Off grid households in Tasmania

#### Several different research approaches used to source off grid data for Tasmania

##### Whole of market data

- *TasNetworks* data on cancelled new connection applications (2012+)
- Phone survey of specialist installers & architects in Tasmania [9]
- Clean Energy Regulator, Clean Energy Council, Department of State Growth, OTTER, Sustainable Living Tasmania, Living Off Grid Tasmania

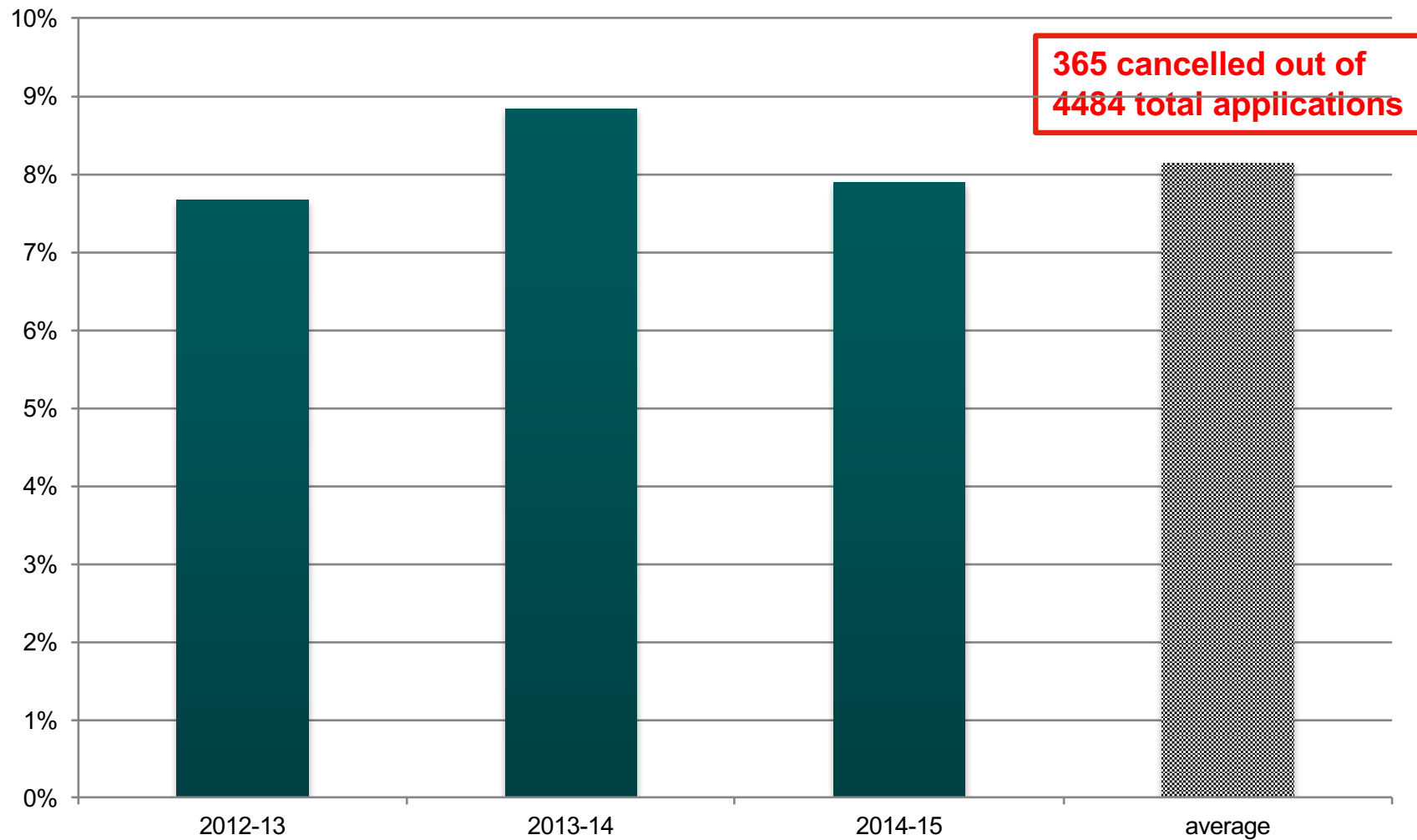
##### 'Bottom up' survey of householders

- online survey [c20], & follow up phone interviews and home energy tours [10]



# New electricity connection applications

## TasNetworks % of applications cancelled



# Evidence from specialist installer survey

- Some households making the choice for financial reasons
- Generous sizing of systems so provide reliable electricity supply without behavioural changes
- Not necessarily technical enthusiasts nor environmentally motivated
- But diversity of motivations remain

*“Mostly they want to reduce their bill, because it costs so much to connect the grid to the building site.”*  
[Installer #1]

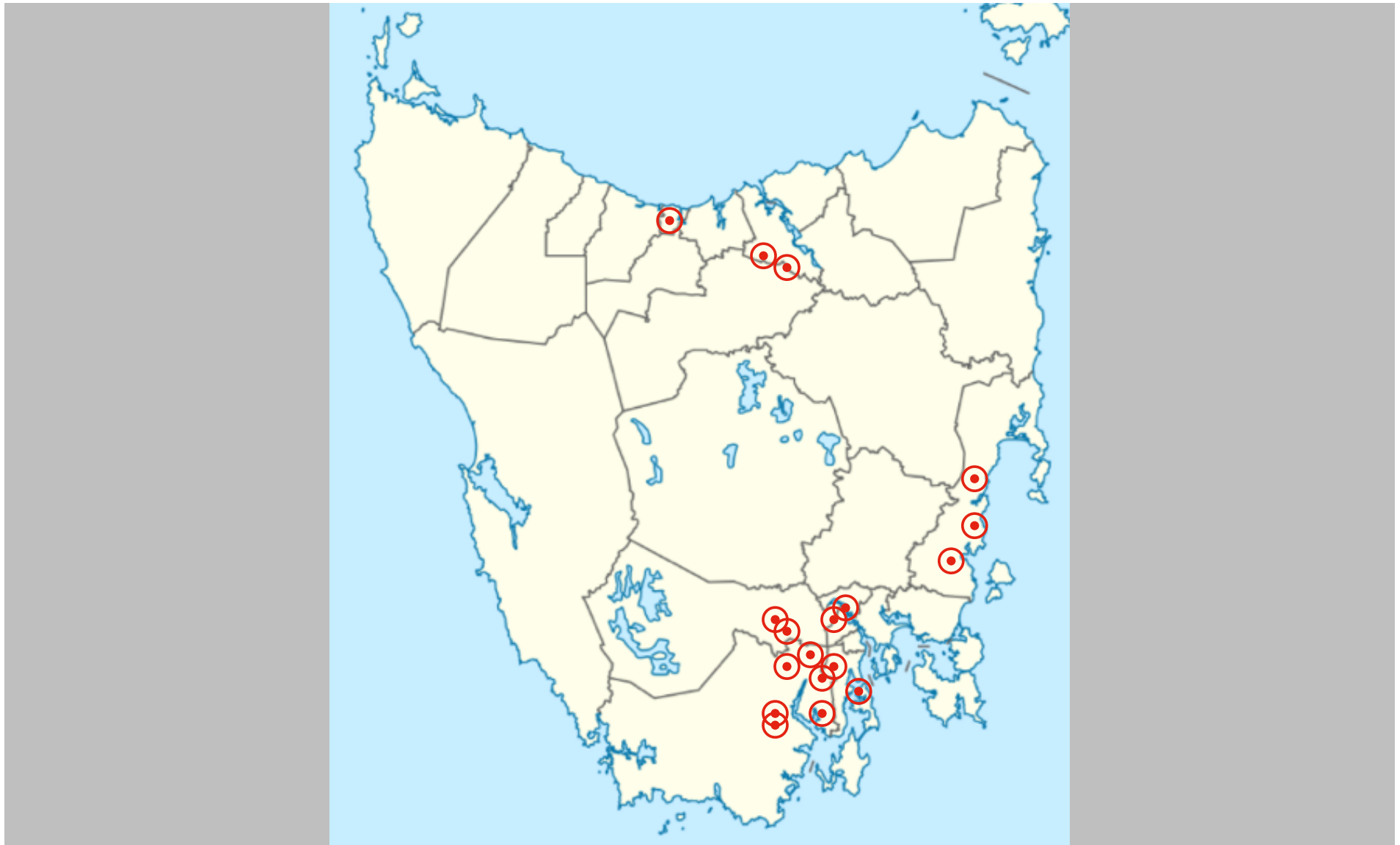
*“People are choosing to go off grid because it is financially better than connecting.”* [Installer #2]

*“People are off grid mainly because of the cost of connection to TasNetworks”* [Installer #3]

*“There is increasing interest in adding battery storage to grid connected systems”* [Installer #5]

# Online survey of Off Grid Households

<https://www.surveymonkey.com/r/28PONGLN>



# Home energy tours



“The cost of going off grid with my new build was the same as having the power connected. I am living exactly as I had been in my previous houses, except when the weather's a bit dull... I don't turn off any stand-by on my appliances, lights are on whenever I want, I watch TV whenever, I boil the jug for tea often and all appliances are standard. My system is state of the art and cost less than \$20,000.” [survey respondent #11]

“I have a very simple lifestyle (e.g. no fridge) - maybe it would not suit many people” [survey respondent #10]

“It simply wouldn't suit some peoples' lifestyle if they are used to lots of modern appliances of high wattage. However if someone was thinking about it I would be happy to recommend it if they were looking at simplifying their life.” [survey respondent #6]

“housework that requires power e.g. washing machine, dishwasher, vacuuming and ironing is done during the day not at night.” [survey respondent #4]

How many households are currently off grid in Tasmania?

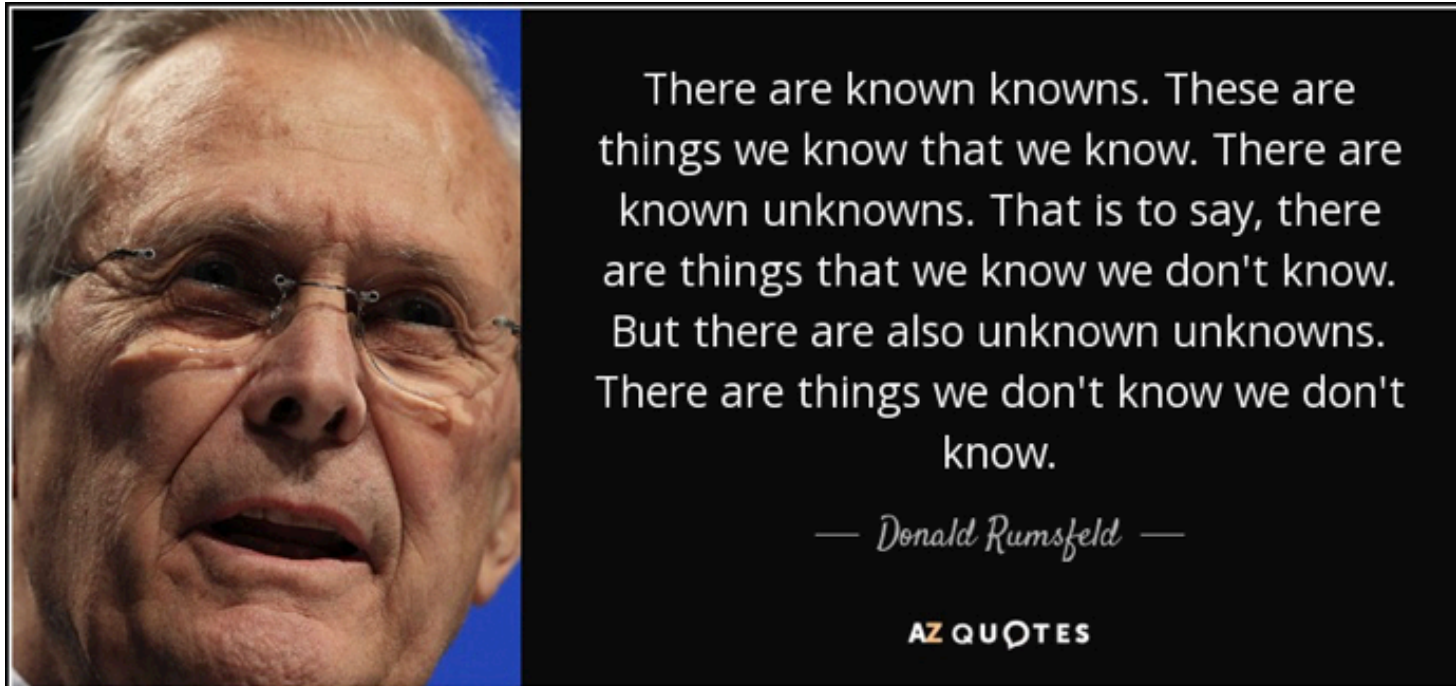
**200 to**  
**10,000**  
**households**





## 4. Implications for decision making

- Focus on big data can blind us to situations of *scarce data*
- Scarce data increases uncertainty and risk
- Exploratory data gathering a worthwhile activity
  - helps avoid policy crises
  - qualitative and quantitative data equally important



# Thank you

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Thank you to all those organisations and individuals who assisted with this research including TasNetworks, Living Off Grid Tasmania, Department of State Growth, specialist installers, and all the households who undertook the survey and interviews/home visits.

**Tasmania off-grid household survey:**

**<https://www.surveymonkey.com/r/28PNGLN>**

**<https://secure.utas.edu.au/smart-grids-messy-society>**

