Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA



From Energy Consumers to Prosumers

Engagement of users in both self generation and energy management

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Joint Director (Engineering), CEEM

EUAA Conference

Brisbane, Australia

October 2013

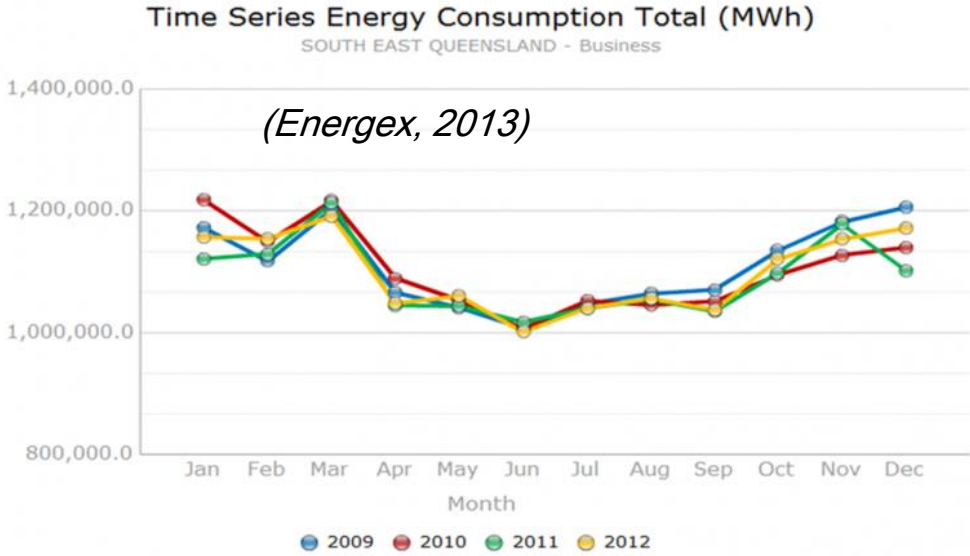
Prosumers

- **"Prosumer** a portmanteau formed by contracting either the word **pro**fessional or, less often, **pro**ducer with the word con**sumer**."
  - prosumer (professional–consumer) as market segment?,
  - prosumer (producer–consumer) as having greater independence from mainstream economy.
  - Differentiates traditional passive consumer from consumers taking more active role in service provision

(www.wikipedia.org)

Growing role – Falling demand

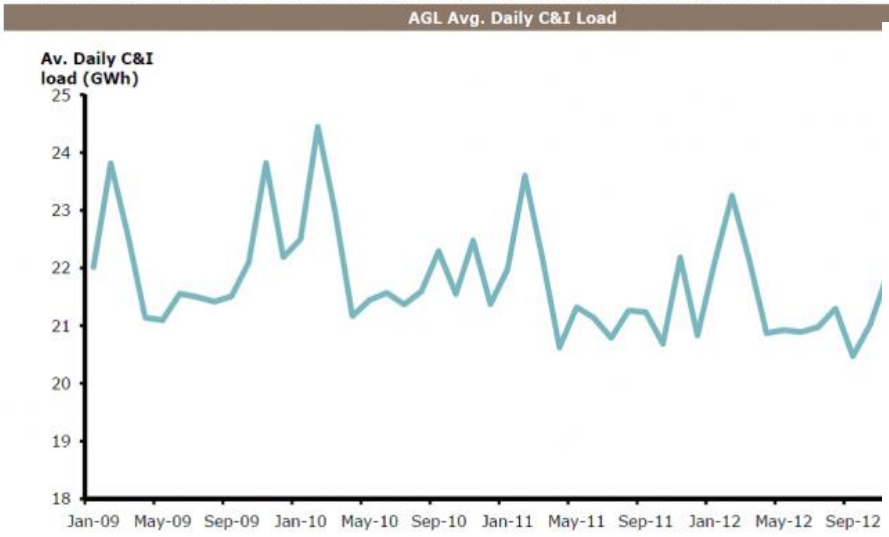
- Context specific drivers, outcomes

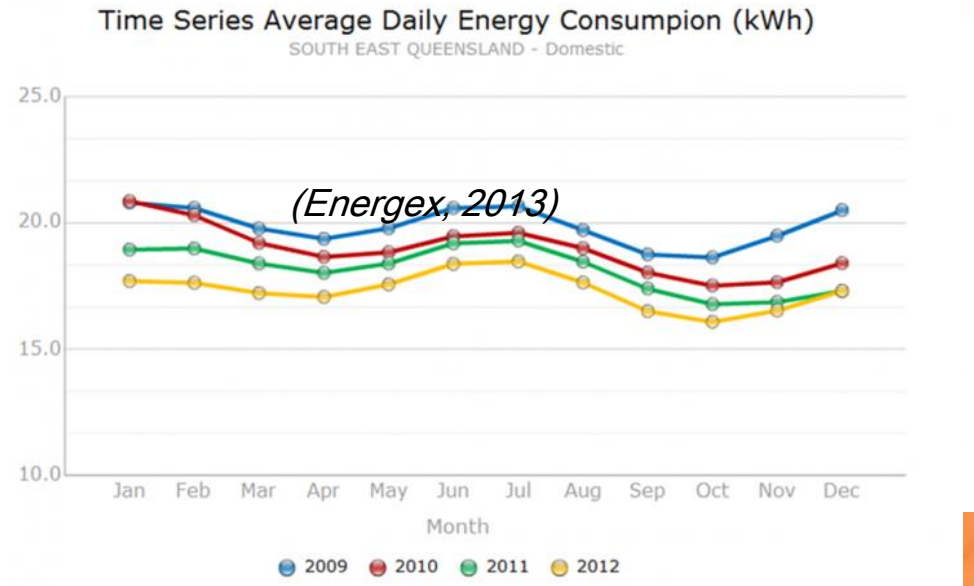


(Energex, 2013)

C&I loads declined post-GFC, but stabilised in 2012 at 1.1% growth (YoY).

- However, C&I demand remains susceptible with the most adverse trends occurring in the NSW region (-2.1% YoY) following a number of manufacturing site closures

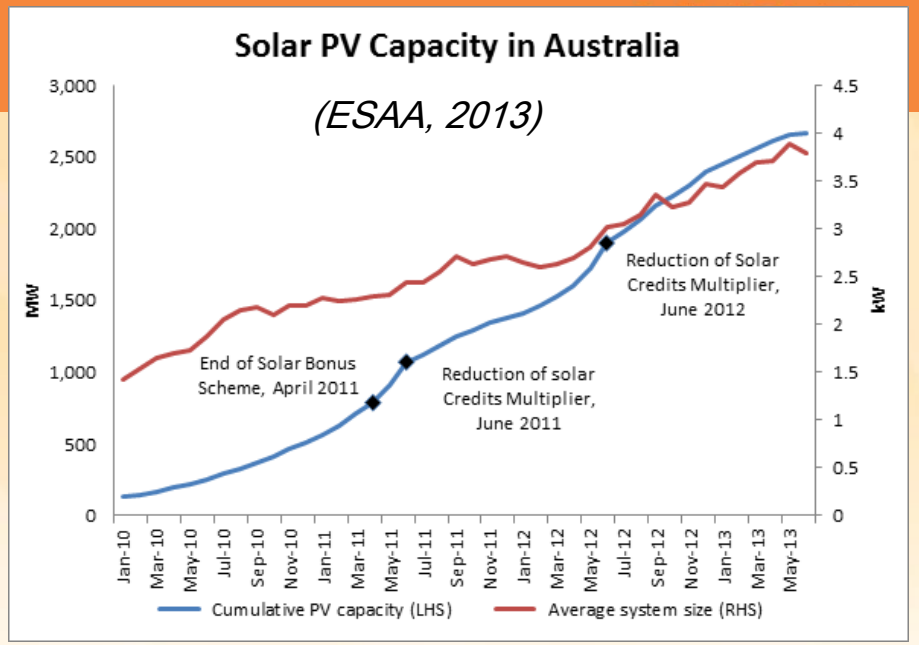


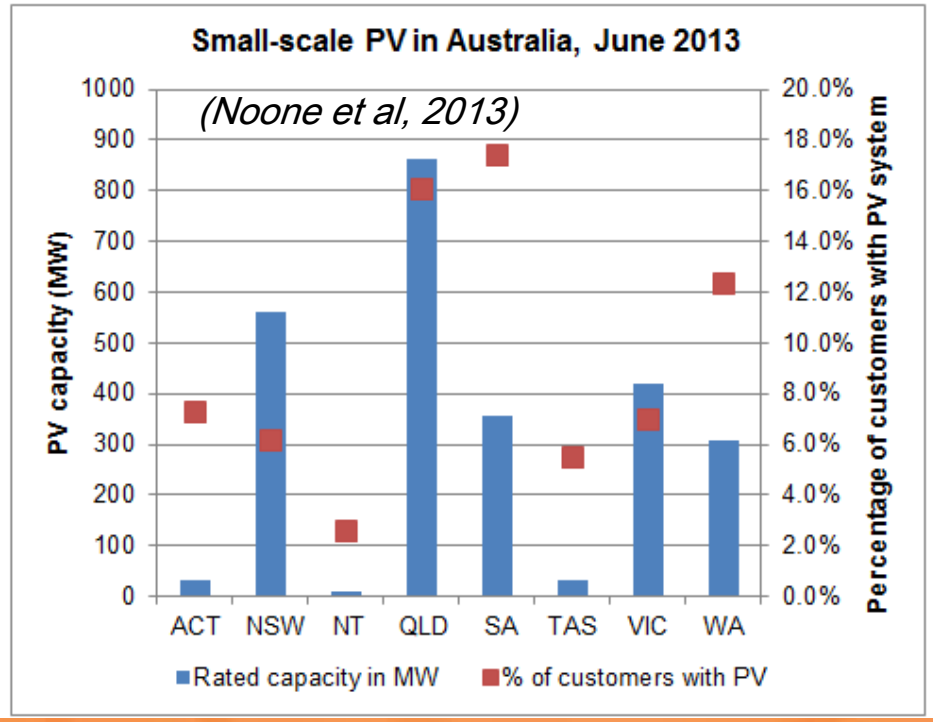


(Energex, 2013)

Distributed Generation

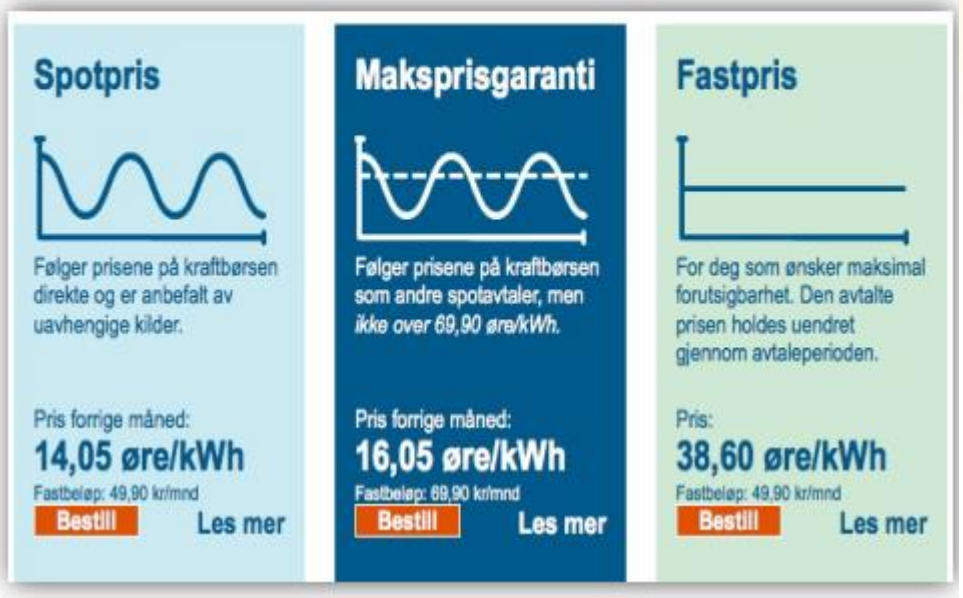
(City of Sydney, 2012)





New business models

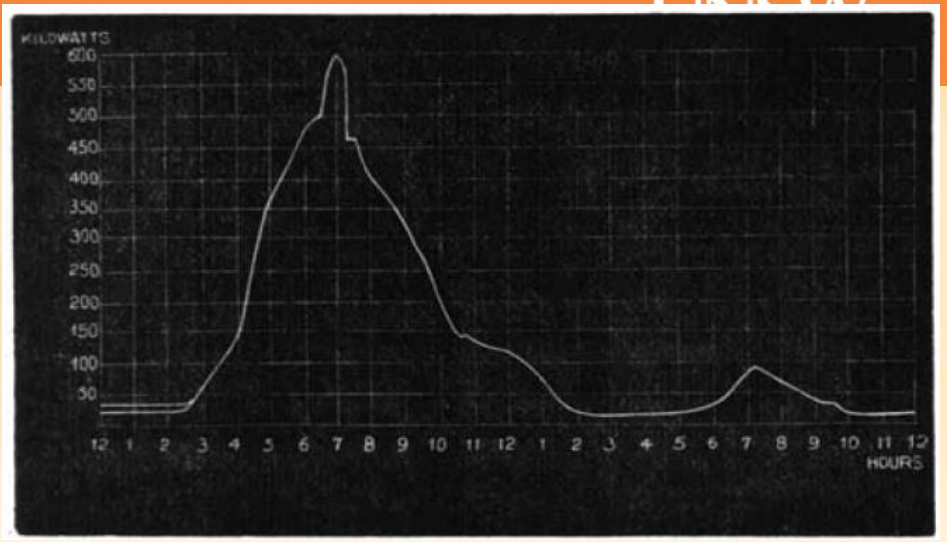
In Norway Spot-tied Contracts are 55.4% of all residential electricity contracts



Existing Models	New Models
Customer as Consumer	Customer as Collaborator
Energy is Commodity	Consumers also Commodities
Profit from Energy	Profit from Innovative Markets
	Profit from Integrated Services
Expertise in Energy	Expertise in IT, Finance, Energy
Incumbent Strength	Fresh Choice for Customers
Energy Security for Customers	Independence and Predictability for Customers
Shrinking Market	Growing Market

(vaasaETT, 2013)

Drivers
- new technologies?



JOURNAL
OF THE
SOCIETY OF
Telegraph-Engineers and Electricians.

Founded 1871. *Incorporated* 1883.

VOL. XVII. 1888. No. 73.

The One Hundred and Seventy-seventh Ordinary General Meeting of the Society was held at the Institution of Civil Engineers, 25, Great George Street, Westminster, on Thursday, April 12th, 1888—Mr. EDWARD GRAVES, President, in the Chair.

The minutes of the previous meeting were read and approved.

The names of new candidates were announced and ordered to be suspended.

Donations to the Library were announced as having been received since the last meeting from Messrs. J. B. Baillière et Fils; Messrs. De La Rue & Co.; C. H. W. Biggs, Member; and R. H. Krause, Member; to whom the thanks of the meeting were heartily accorded.

The following paper was then read:—

CENTRAL STATION LIGHTING: TRANSFORMERS *V.* ACCUMULATORS.

By R. E. CROMPTON, Member.

The present paper is the outcome of the discussion which took place on Messrs. Kapp's and Mackenzie's papers on transformers, recently read before this Society. I was asked to give facts and figures in support of the statement I then made, that I believed the distribution of electricity by transformers offered no special advantages over other methods, particularly over distribution by means of accumulators used as transformers.

COST OF 10,000 LIGHT, OR 600-KILOWATT, PLANT.

A.T.—ALTERNATING TRANSFORMER DISTRIBUTION.

	£
Generating Station, Buildings, Chimney Shaft, Water Tanks, and General Fittings	11,000
Dynamos and Exciters — 865 Kilowatts, including spare sets, divided as convenient ...	5,540
Motive Power, *i.e.*, Engines, Boilers, Steam and Feed Connections, Belts, &c., at £8 12s. per I.H.P.	12,470
500 Transformers, *i.e.*, one to every pair of houses, at £15 each	7,500
2,000 yards Primary or Charging Main, exterior to area of supply, at £308 per 100 yards	6,160
20,000 yards Distributing Main, 50 m/m. sectional area, at £91 7s. (*see* Table 1)	14,270
Regulating Gear	500
	£57,440

B.T.—ACCUMULATOR TRANSFORMER DISTRIBUTION.

	£
Generating Station, Buildings, Chimney Stack, Water Tanks, and General Fittings	8,000
Dynamos — 600 Kilowatts, in 6 sets of 100 Kilowatts each...	4,800
Motive Power, *i.e.*, Engines, Boilers, Steam and Feed Connections, &c., at £8 12s. per I.H.P.	8,600
4 Groups of Accumulators, in all 240 cells, in series, at £40 per cell, including Stands ...	9,600
2,000 yards Charging Main, at £306 17s. 6d. per 100 yards (*see* Table 2)	6,137
20,000 yards Distributing Main, 161·25 m/m. sectional area, at £100 12s. 6d. (*see* Table 2) ...	20,125
Regulating Gear	2,500
	£59,762

Drivers – growing technology capabilities and falling costs?

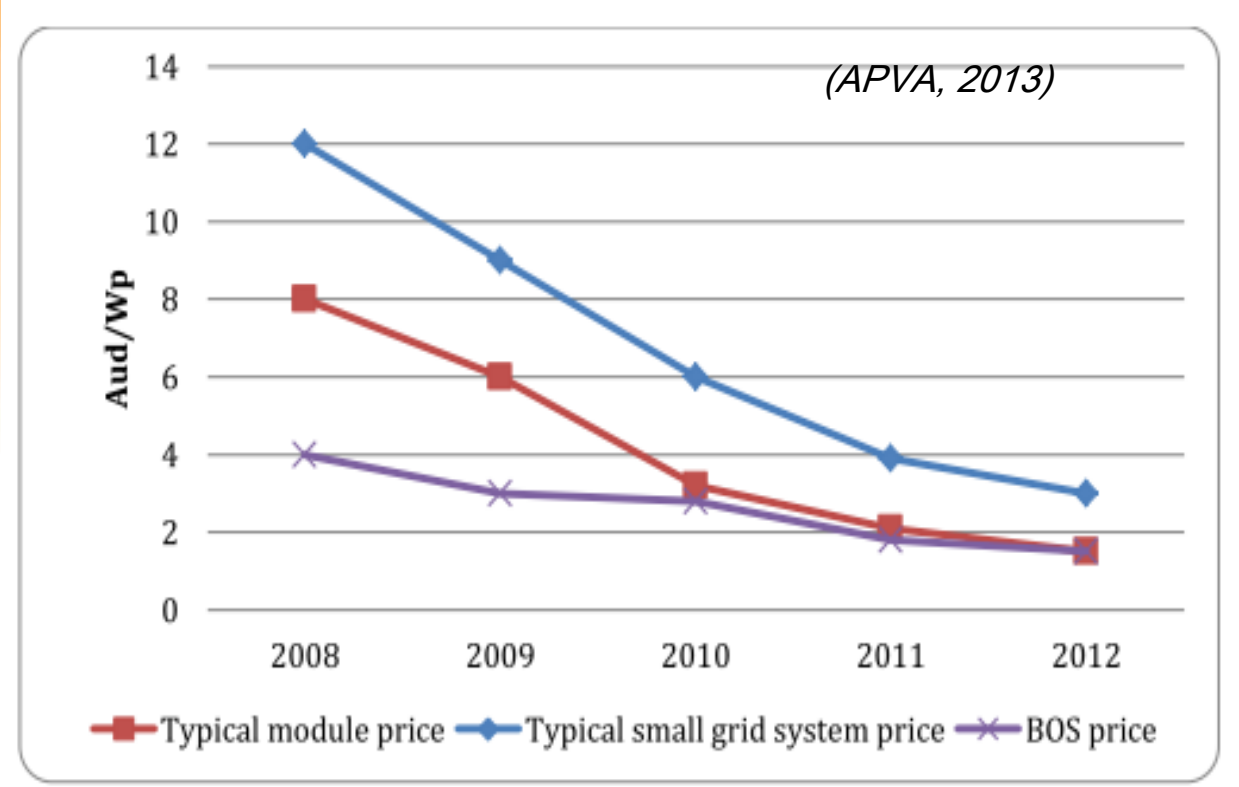
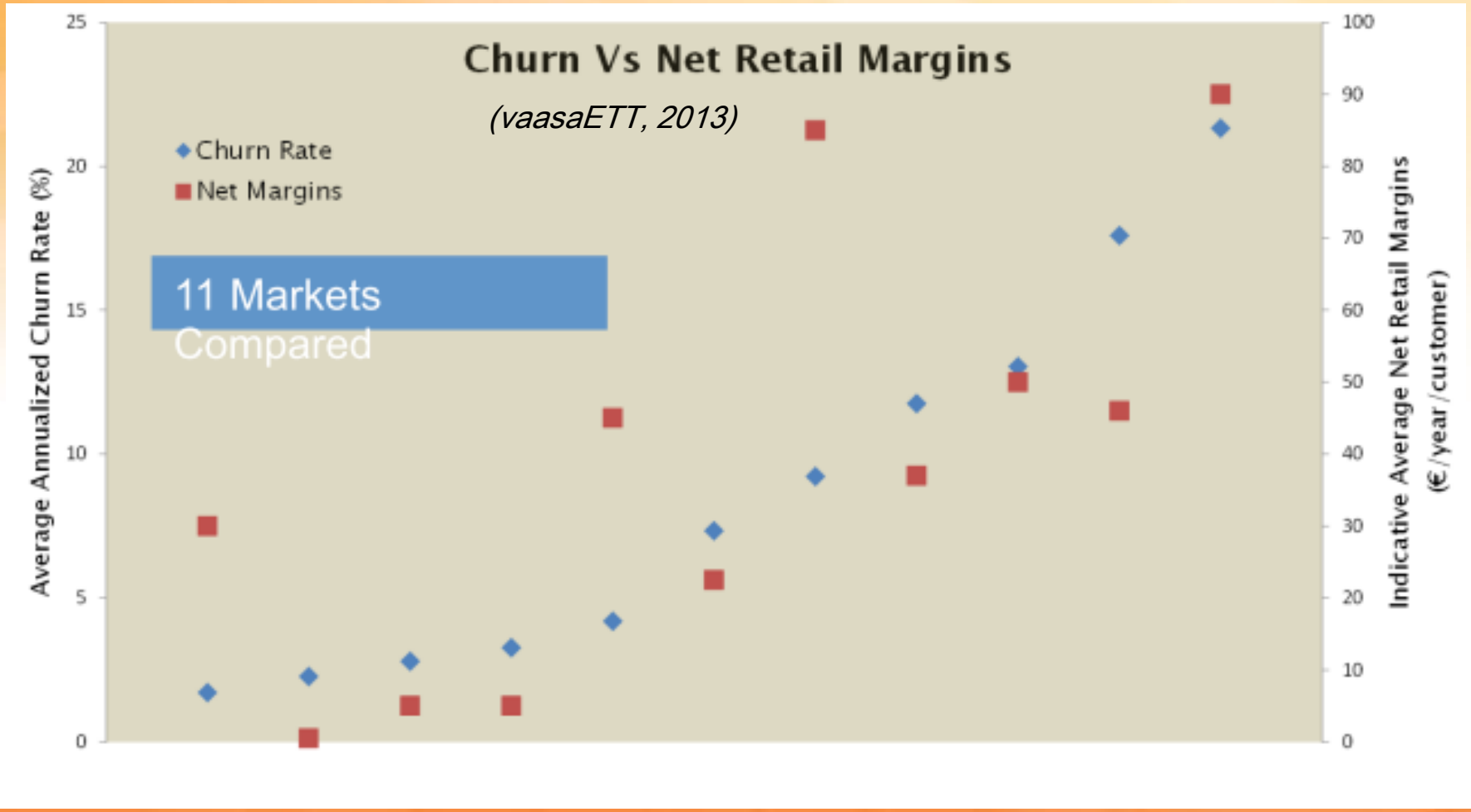


Figure 2: Typical module, system and balance of system costs Australia 2008-2012

More competition?



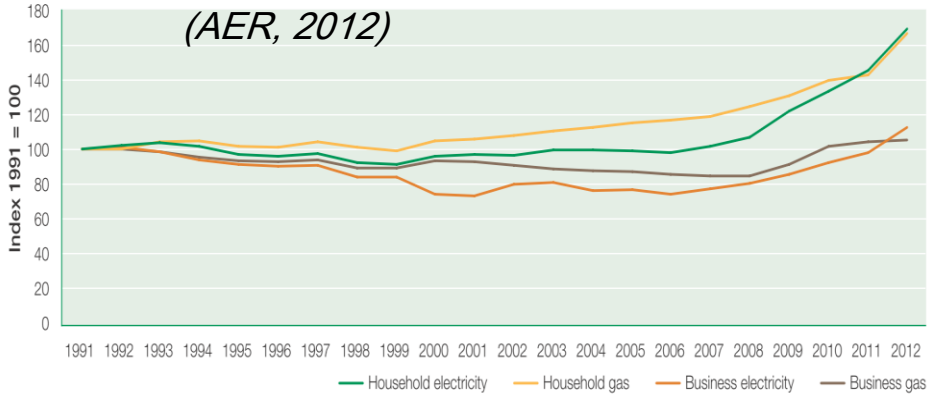
Driver – prices?

Accessibility: affordability is always key

Figure 2

Electricity and gas retail price index (real)—Australian capital cities

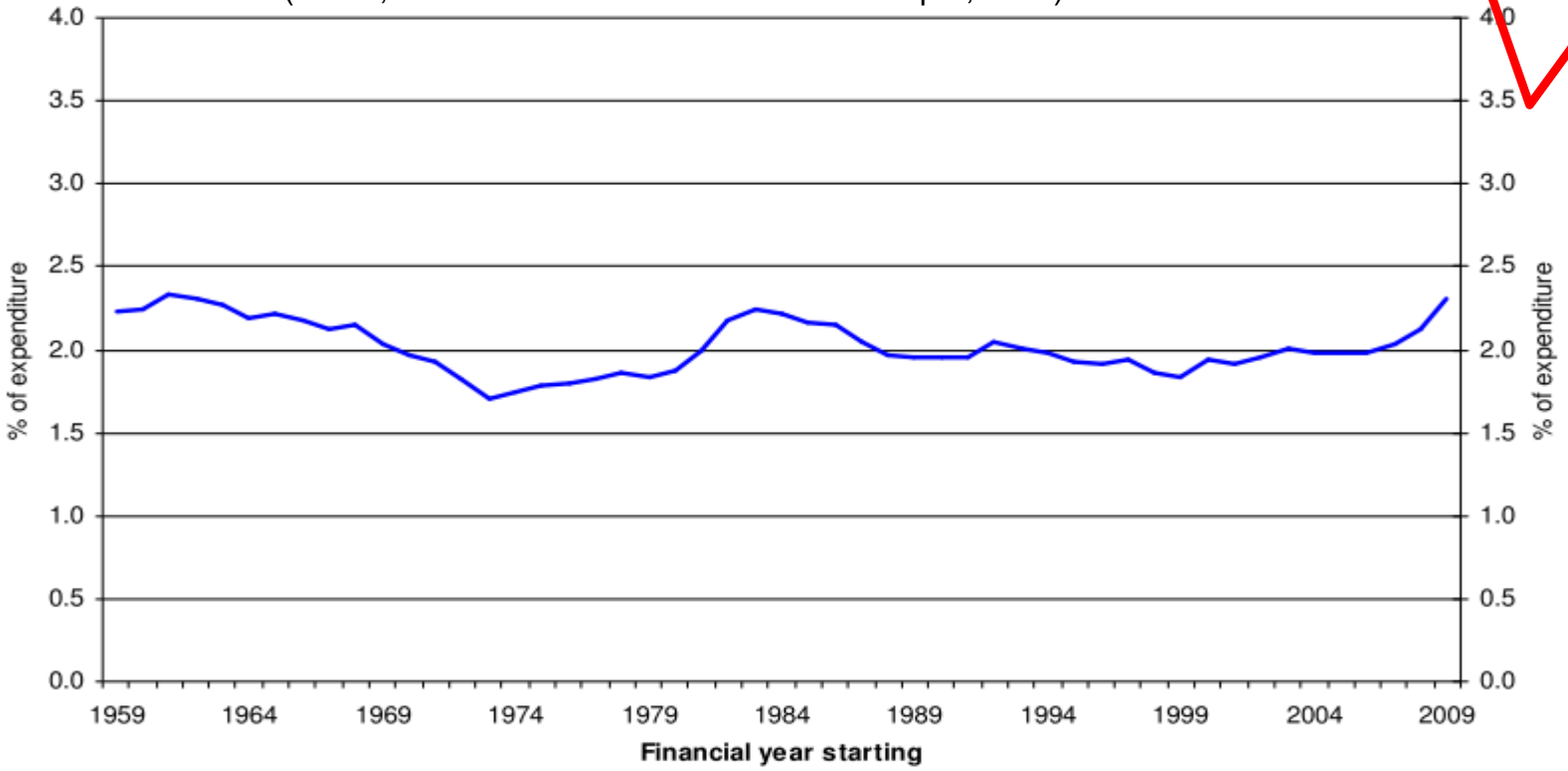
(AER, 2012)



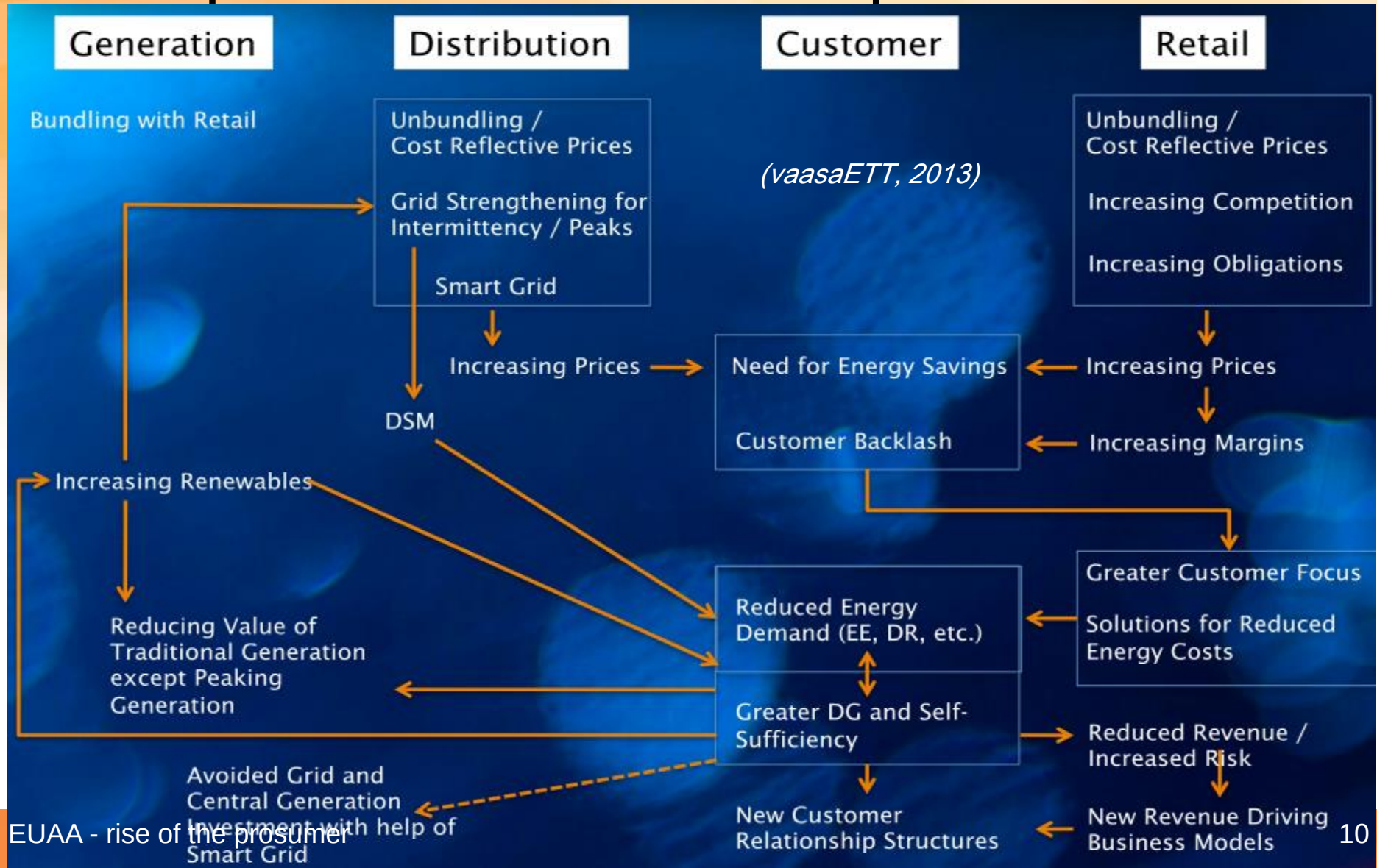
Note: Consumer price index electricity and gas series, deflated by the consumer price index for all groups.

Chart 3: Share of Household Final Consumption Expenditure on Electricity, Gas and Other Fuels, 1959-2009 (per cent)

(ESAA, Submission to AEMC DSP Issues Paper, 2011)



Complex drivers in developed markets



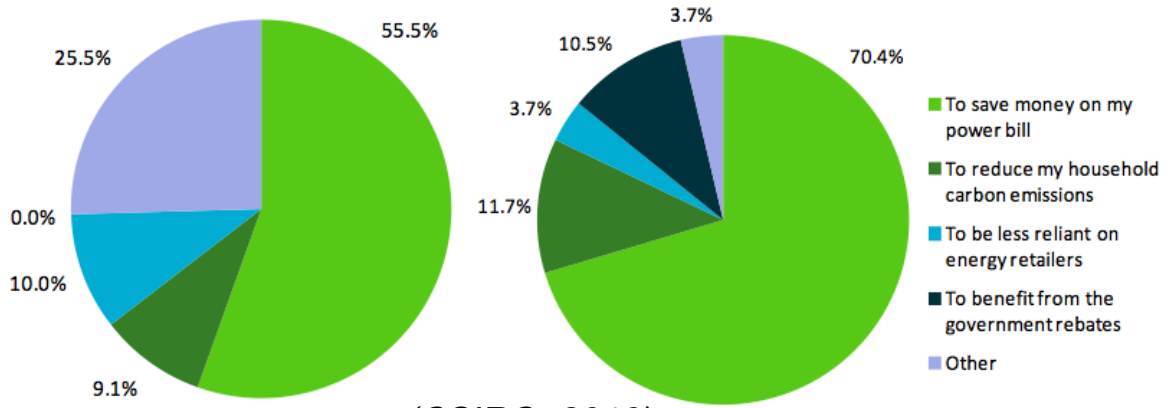
Potential implications – some real competition

"A market is any place where the sellers of a particular good or service can meet with the buyers of that good and service where there is a potential for a transaction to take place"

- Do consumers 'meet' with sellers?
  - *Electricity industry has traditionally had poor end-user engagement*
- Does the market sell the good or service desired?
  - *Buyers seeking energy 'services', not kWh 'goods'*
- Prices where supply meets demand?
  - Or are many buyers paying imposed 'prices' – ie. Charges

- *Prosumers can change their, and this, broader context*

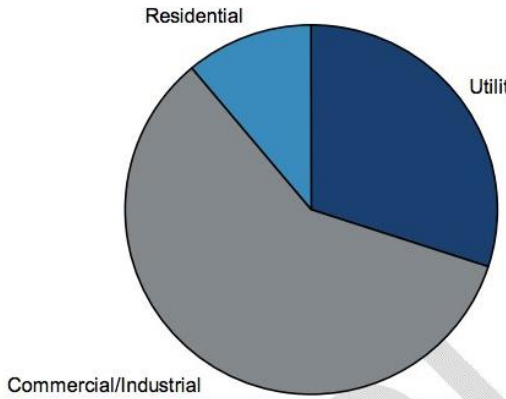
Renewable options are a 'market' response



(CSIRO, 2013)

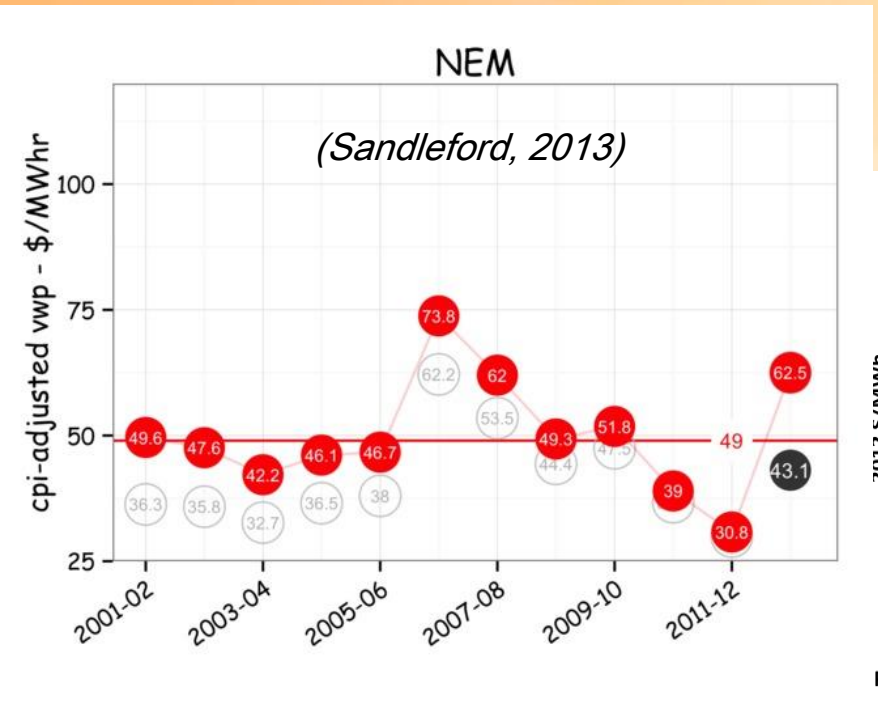
Figure 10 Motivation for distributed energy systems by households already using SHW (left) and SPV (right)

Figure 13: Solar PV Power Market, Germany, Market Segment by End-user Application, %, 2011

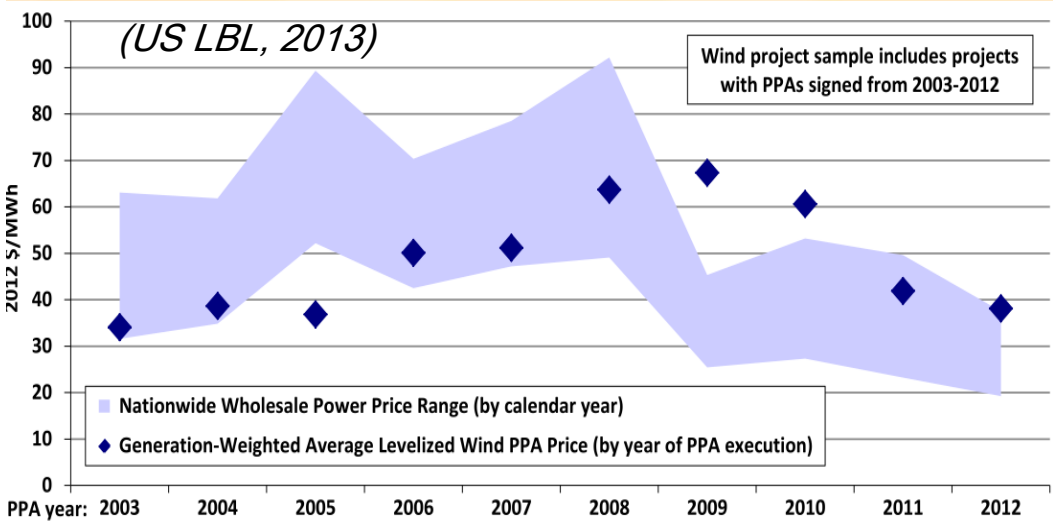


Source: GBI Research's Alternative Energy Proprietary Database (Accessed: July 18, 2012)

Falling prices, generation pressures



(Sandleford, 2013)



(US LBL, 2013)

Eon warns of more plant closures as first-h profits fall 42%

By Chris Bryant in Frankfurt

(vaasaETT, 2013)

Eon blamed a decline in European wholesale power prices and the boom in renewable energy for a fall in first-half earnings as capacity utilisation in its fossil power generation business declined.

The German utility reiterated that it would consider shutting or mothballing fossil power plants in Europe in response to what it describes as "interventionist" energy policies and regulations that subsidise and prioritise renewable energy.

In response…

"Hundreds of thousands of WA households could be hit with higher electricity prices under a proposed shake-up of bills aimed at recovering the massive cost to the system caused by the popularity of rooftop solar panels.

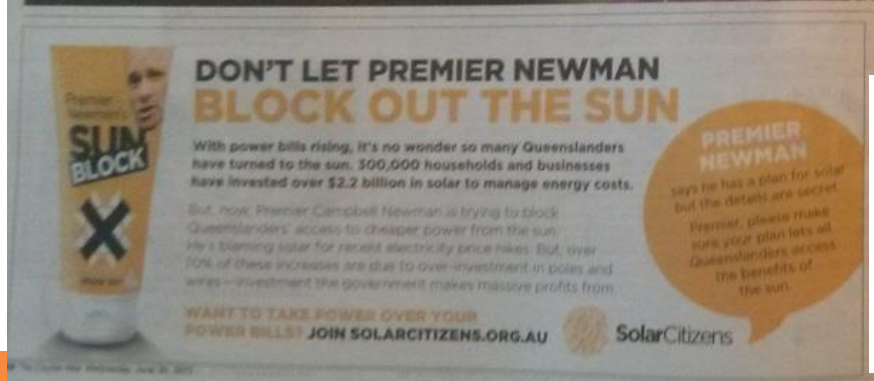
WA's energy chiefs are understood to be pushing for a change in the structure of bills to make customers pay more in fixed charges.

At present, most of a householder's electricity bill stems from the amount of electricity used. Fixed costs, such as the supply charge, make up about 15 per cent of the bill. However, solar panels have slashed consumption for those households, cutting revenue to State-owned power companies, including retailer Synergy and network operator Western Power.

The trend has been highlighted as one of the big issues facing the electricity system and Energy Minister Mike Nahan has been warned that if nothing is done the consequences could be catastrophic.

Either households without solar panels would be left to pick up the tab, forcing their bills to unaffordable levels, or electricity providers would be financially crippled.

WA's take-up rate of photovoltaic cells - initially fuelled by generous State and Federal incentives - stands at more than 10 per cent of households and this figure is expected to double within years." *(West Australian, 2013)*



(Solar Citizens, 2013)

Table 1: Tariff 11 – Bill Impacts for the Typical (Median) Customer

Tariff Component	*Frozen 2012-13*	*Transitional 2013-14*	*Increase*
Fixed charge (cents/day)[1]	26.170	50.219	*91.9%*
Variable charge (cents/kWh)[1]	23.071	26.730	*15.9%*
Annual Bill[2] ***($, GST inclusive)***	***1,184***	***1,451***	***22.6%***

1. GST exclusive.
2. Based on a typical (median) customer on Tariff 11 consuming 4,250kWh per annum.

(QCA, 2013)

Where next? Many forecasts to choose from

NATIONAL ELECTRICITY FORECASTING REPORT

For the National Electricity Market

2013

EXECUTIVE SUMMARY

Annual energy

Electricity demand across the National Electricity Market (NEM) in 2013–14 is forecast to be 2.4% lower than estimated under the medium economic growth scenario in the 2012 NEFR.

Continued increases in rooftop photovoltaic (PV) systems and energy efficiency savings from new building regulations have offset growth in residential, commercial and light industrial annual energy.

Lower-than-expected growth in most industrial sectors reflects the closure of the Kurri Kurri aluminium smelter in New South Wales, changes in operating levels of Victoria's Wonthaggi desalination plant, and the Olympic Dam mine expansion deferral in South Australia. A high Australian dollar in recent years also contributed to the dampening in annual energy growth.

Under the same medium economic growth scenario, the 10-year outlook (2013–14 to 2022–23) sees annual energy forecast to grow by 1.3%.

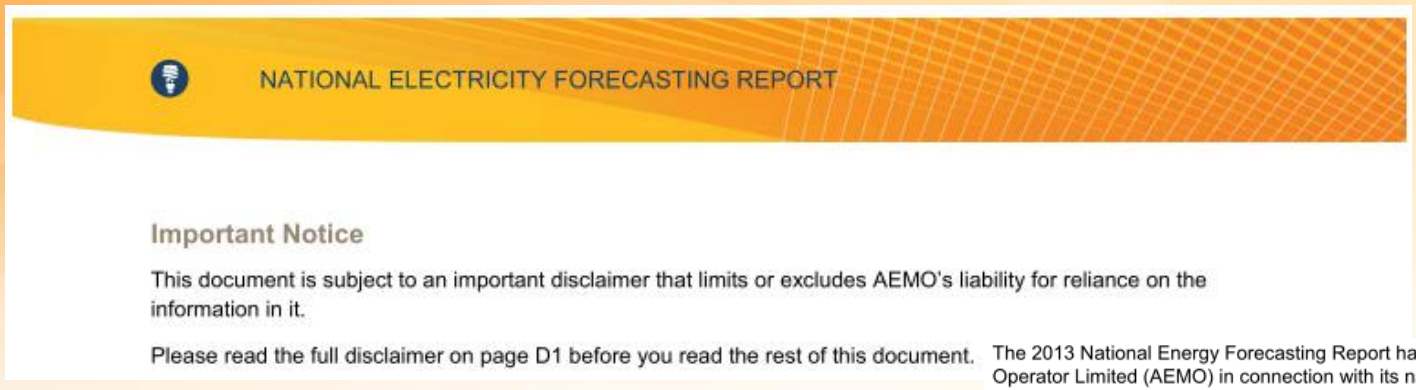
The main growth drivers over this period are the three large industrial liquefied natural gas (LNG) projects in Queensland, population growth in most NEM regions, and an easing in electricity price growth over the 10-year outlook period.

Maximum demand

Maximum demand (MD) forecasts see a combined 728 MW reduction across the NEM for 2013–14 under the medium economic growth scenario in the 2012 NEFR.

This is due to a rise in solar PV installations; increased energy efficiency projections as a result of building standards; and changes in industrial operations, including a revised timing of LNG and new mining projects, reduced operation at Wonthaggi desalination plant and the indefinite deferral of the Olympic Dam mine expansion.

The real executive summary of every technology forecast is the same



NATIONAL ELECTRICITY FORECASTING REPORT

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Please read the full disclaimer on page D1 before you read the rest of this document.

The 2013 National Energy Forecasting Report has been prepared by the Australian Energy Market Operator Limited (AEMO) in connection with its national transmission planning and operational functions for the National Electricity Market. The report is based on information available as at 3 April, 2013, unless otherwise specified.

Disclaimer

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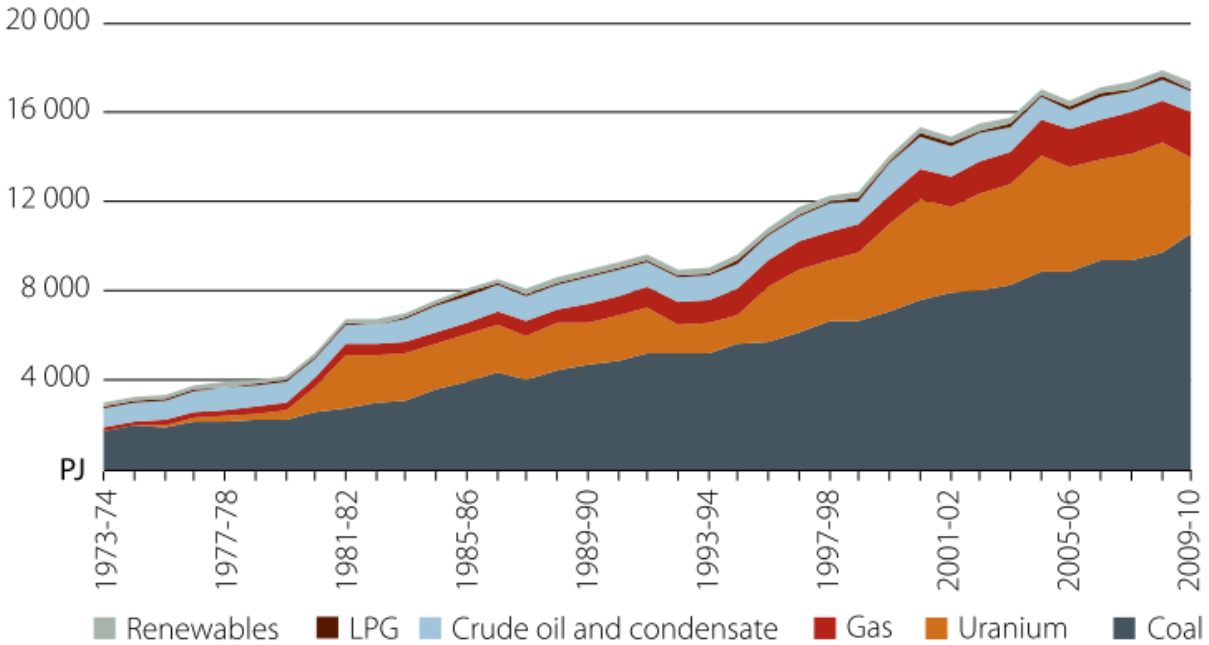
If history is your guide…

Energy supply infrastructure slow to build, long economic asset life therefore physical change takes time

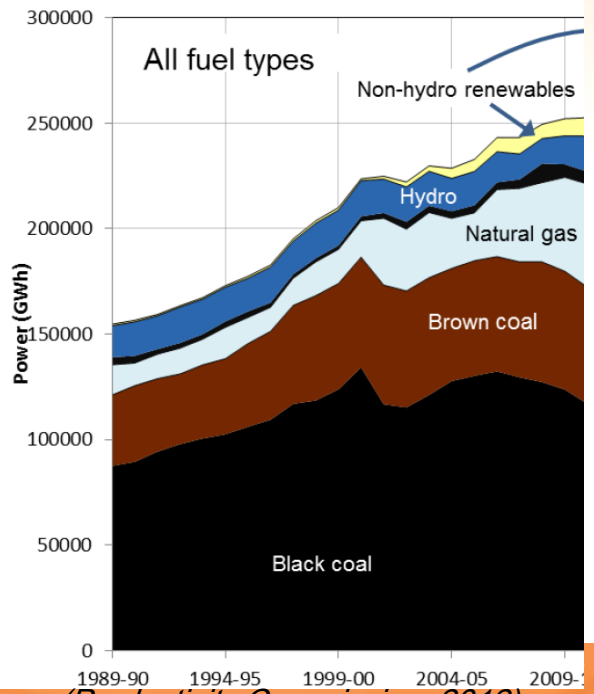
Figure 1: Australia's primary energy production



(BREE, 2012)

Source: ABARES 2011, Australian Energy Statistics.

Figure 2.2 **Growth in generation**
1989-90 to 2010-11

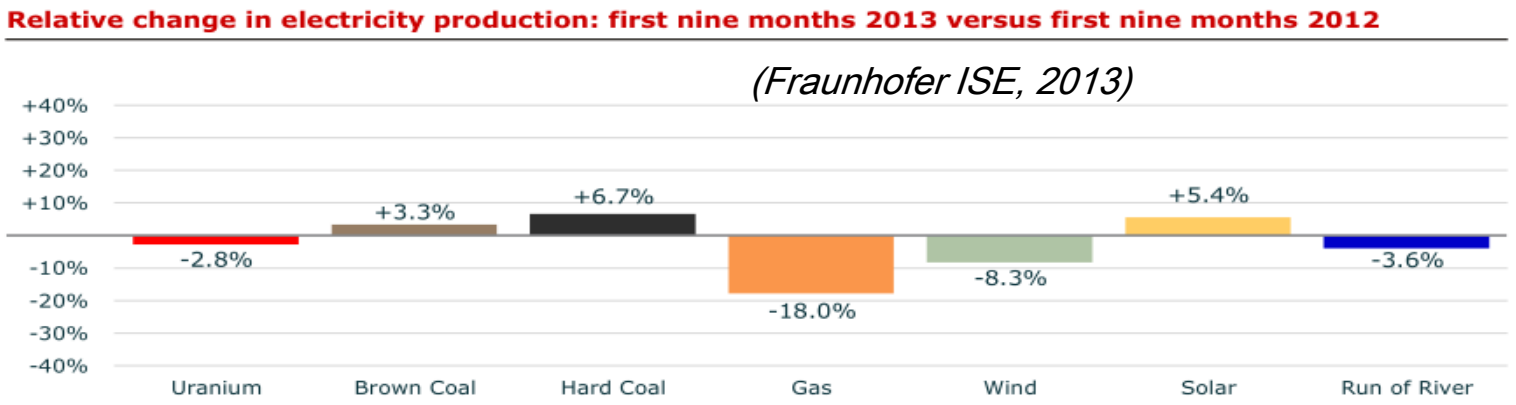


(Productivity Commission, 2012)

History repeats?

- Trends away from underlying developments may be short-lived and will see reversion to mean given time
- Recent shift to gas & RE in NEM may slow, stop, reverse
  - Increasing gas prices with LNG exports
  - Repeal of carbon pricing
  - Reduction in Renewable Energy Target
  - Moves to restrict deployment of residential PV
  - Falling prices might revive demand

Not just NEM issue – eg German gas gen down with low C, rising gas price

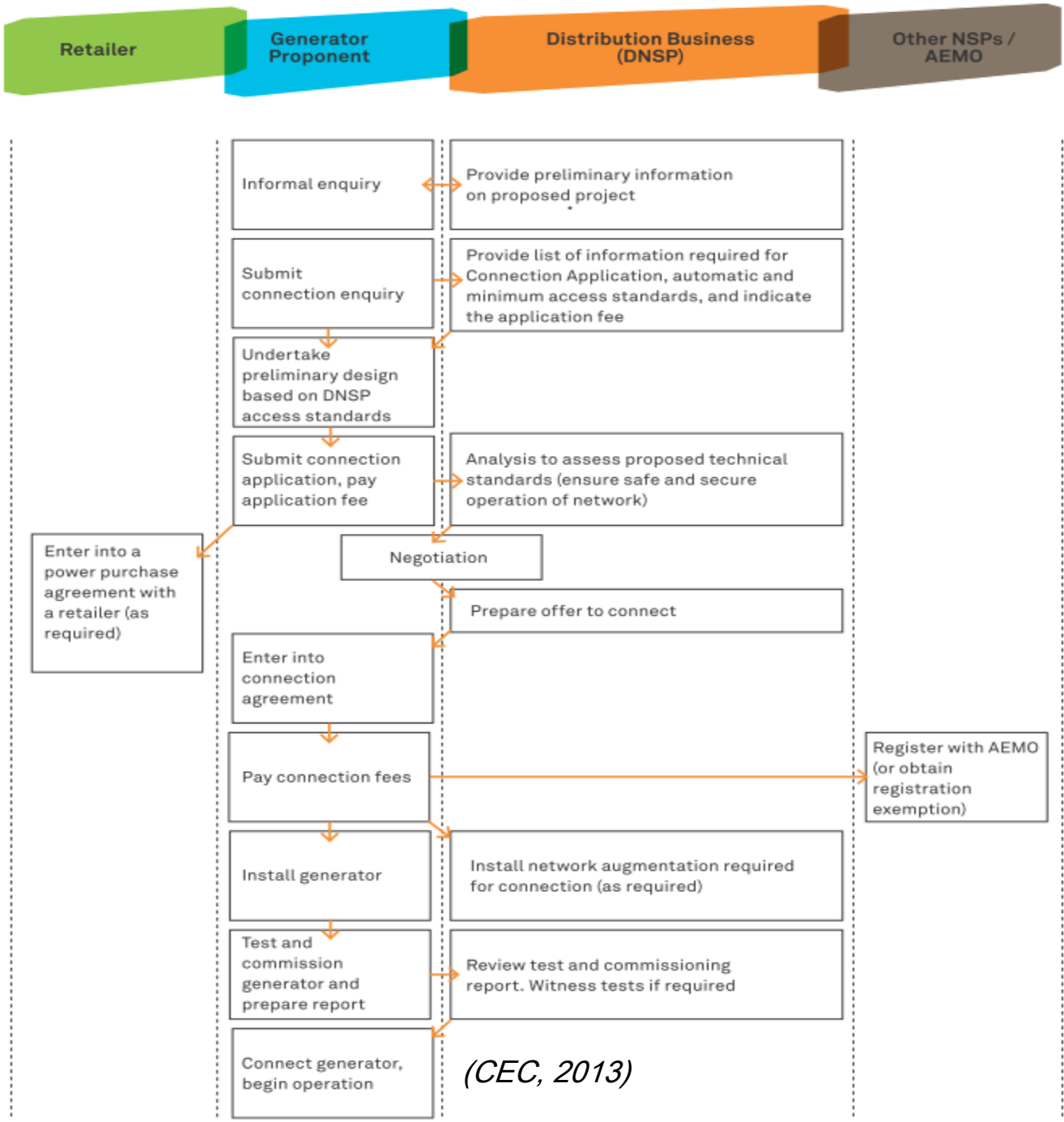


Choosing greater engagement

… but note challenges

- Larger commercial / industrial PV systems and cogen/trigen face significant challenges in obtaining network connection.

Figure 1 – Overview of the connection process



(CEC, 2013)

Table 2 - Connection application documents

Document Title		Description
Connection Application cover letter		One page document that brief description of the pr the appropriate contact d
Connection Application form		Some DNSPs will provide forms to be completed, w others will simply specify information to be provide
Generally not required for projects <5MW, but the requirements of the connection application will vary between DNSPs	Generator Performance Standards	This document outlines h generator meets the requ of the system, ensuring that it can safely interact with the DNSP's network. It identifies the limits that the system will work within, and is typically based upon Schedule 5.2.5 of the NER and supported by detailed modelling studies.
	Technical Data Sheets [5]	A series of spreadsheets that illicit technical information about the equipment being used in the installation and grid connection. Example speadsheets which are often used as a basis for DNSP data request formats are available on AEMO's website. It requests four categories of data (S, D R1 and R2), as outlined in Table 3. Only S data is required with the connection application, but if D data is available it is beneficial to include it. R1 and R2 data relate to information that is required to be provided during registration and proven during commissioning tests. These are not generally required for generators <5MW.

Table 4 - Typical components of a connection agreement

Component	Description
Terms and Conditions	
Network Services	Outline of the services to be provided by the DNSP Requirements of the generator to facilitate the provision of such services
Insurance	Insurance requirements of the proponent
Liabilities	Limit of liabilities of both pa
Variation to the charges	Outline of the conditions unc there might be a variation in
Taxes	Clarification of the ownershi government tax imposed on
Dispute resolution	Process for resolution of dis
Contract termination and extension	Provision for termination or of the contract
Notices	Process for issuing of notice
Technical Schedules	
Scope of works	Definition of each element of works to facilitate connection and identification of the responsible party for each element.
Term	Agreed connection date and duration of the agreement
Technical standards	A description of the technical standards that the generator will meet, including each of the aspects listed in section 3.5.2
Operating asset management	Definition of the generator's property boundary and equipment management (maintenance schedules, etc)
Access, inspection	Arrangements for access onto the generator's property (for metering, maintenance, etc)
Metering	The agreed provisions around metering, equipment rule, procedures for testing and inspection and metering data
Network protection	Outlines the network protection requirements
Testing and commissioning	Testing and commissioning procedures that will be applied
Fees and payments	Outlines the application fee, connection fees and the process for managing any other project fees levied by a third party Also outlines any ongoing payments to be made by the DNSP to the embedded generator for services provided
Technical reports	Reports pertaining to technical studies or detailed design carried out by the proponent

(CEC, 2013)

‘death spiral’?

Argued that rising prices encourage end-users to reduce consumption or even leave, meaning fixed costs have to be recovered from less and less consumption and/or customers

History repeats?

Savings from demand reduction depend critically on energy/network tariffs

End-user departure depends critically on DG technology progress, particularly storage

More of an issue for electricity or gas?

(via google news archive)

Thursday, August 4, 1983 — THE NEWS — Page 7A

Utilities grapple new enemy: a rate increase ‘death spiral’

By Jack Danforth
Orlando Sentinel

TACOMA, Wash. — There is a new buzz word surfacing in Pacific Northwest electric utilities these days. It is the "death spiral." The concept is simple, and consumers of electric power from Florida to Alaska have recognized it for years.

A death spiral occurs during periods of rising electric rates. The theory is that as electricity demand increases, electric utilities are forced to build expensive new power plants.

This causes electric rates to rise and consumers to use less power. Electric utilities have large fixed costs, so as demand — thus revenue — is reduced, rates must be increased again, causing further reductions in consumption, and the cycle is repeated: a death spiral.

The recent collapse of the Washington Public Power Supply System, also known as Whoops, has focused attention on the death spiral. In this region, electric rates for some utilities have tripled during the past three years.

The increases and the Whoops collapse have forced utilities, for the first time in the industry's history, to come to grips with the possibility that they have reached the limits of their customers' pocketbooks.

It long has been known that there is a finite amount of money available in the family budget for the electric bill. Consumers have different limits, but when taken as a whole there clearly is an economic wall that electric utilities cannot go past.

For the past 30 years, energy prices have been so low and relative incomes so high that the "wall" was far

alternative sources: gas-fired fuel cells, photovoltaic cells and a more efficient end-use of conventional resources, all of which are distinct possibilities within the next decade.

The old days of building more power plants regardless of the cost are gone. Utilities that continue that philosophy ultimately will be priced out of the market.

Conservation still is a vital cog in our energy policy of the 1980s. It is a dangerous oversimplification to say that conservation at a time of surplus energy only further reduces utility revenues, thus causing higher rates.

Programs as simple as the rebate program in Kissimmee, Fla., are one of the most cost-effective methods of stimulating energy efficiency in the country.

The rebate program concept originated there in 1981 and now is being used successfully by such major utilities as Pacific Gas & Electric in California. In these programs, utilities help customers pay the cost of conservation improvements, which is cheaper than building another expensive plant.

But consumers must understand that it is not a contradiction to promote more use of electricity, more industry and conservation at the same time. In many areas, thousands of kilowatts of electricity are available during off-peak times without building another plant. That results in a lower average cost of energy production.

There are times, of course, in a growing economy, when a new generating plant must be built. But that should not be done until the utility has explored all the cheaper alternatives — conservation and helping industries generate their own power from wasted

Another elephant in the room – Climate Change

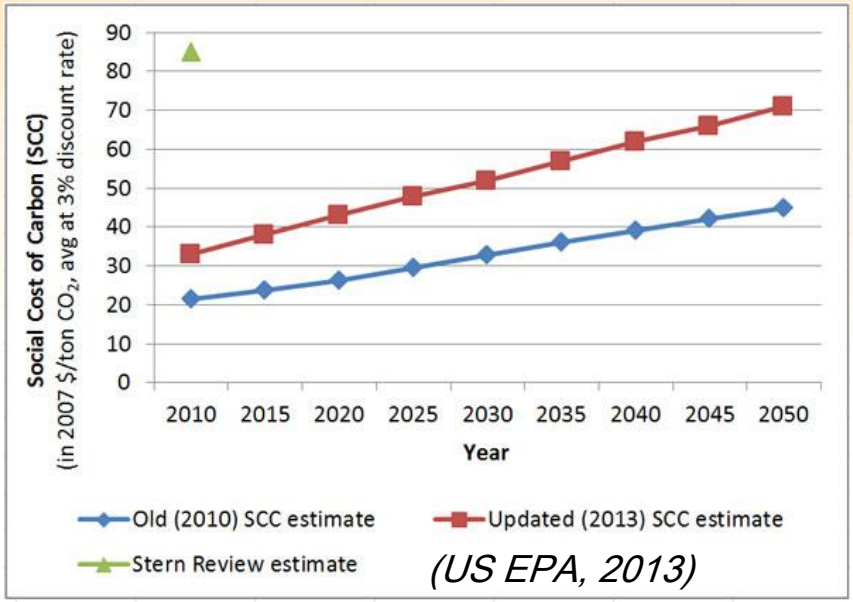
- Currently a lack of domestic and international progress, apparent loss of public and political interest and will
- … but even a dead elephant in the room is a problem

The question is not whether to have a price on carbon?

- Costs associated with reducing emissions regardless of particular means chosen (tax, emissions trading regulation, direct action)

And / or

- Social costs associated with impacts of failing to effectively manage climate change (SCC)



(US EPA, 2013)

- *Instead, real question is who, pays how much, to whom, for what, when?*

With regard to greater end-user engagement, different possible perspectives

- More people at the table means everyone wins? *(greater end-user engagement creates real competition)*
- If you're not at the table, you're probably on the menu? *(markets take advantage of un-engaged 'participants)*
- If you don't know there's a table you're almost certainly on the menu? *(market players take advantage of policy and regulatory indifference to un-engaged participants)*
- If you are at the table, some who have been on the menu may now coming to the table? *(residential, small business are increasingly seeing opportunities to engage better)*
- Tables may turn at some point *(future surprises possible)*

Where next?

"The best way to predict your future is to create it!"

Abraham Lincoln

"That depends…."

ANNUAL EUAA CONFERENCE 2013

Empowerment through participation

Centre for Energy and Environmental Markets

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Thank you… and *questions*

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