Submission

No 34

INQUIRY INTO THE ECONOMICS OF ENERGY GENERATION

University of Technology Sydney
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1/08/2012

NSW Parliament Public Accounts Committee Inquiry into the economics of energy generation

Presentation to Citizens Jury

Chris Dunstan

Research Director Institute for Sustainable Futures University of Technology Sydney 21 July 2012







Factors relevant to the economics of generation

- The need for generation
 - Trends in demand and price
 - Potential for Demand Management
 - Technology change (solar PV, Electric Cars, etc)
- The type of generation required
 - For peak demand or for (anytime) energy
 - Emissions constraints
- Fuel type (solar, wind, gas, coal, etc)
- The relationship between generation and networks
 - Differing generation technologies and costs will drive differing network structure and costs

NSW energy projections to 2020 – the disappearing shortfall



http://igrid.net.au/sites/igrid.net.au/files/images/Meeting%20NSW%20Electricity%20Needs%20in%20a%20Carbo n%20Constrained%20World%20%28June%202009-1%29.pdf Source: Meeting NSW Electricity Needs in a Carbon Constrained World: (ISF: 2009)

Energy Consumption is Falling



What is driving the decline in electricity demand? May 2012 Source: Oliver Nunn and Felix Jander IES

Institute for Sustainable Futures

The Australian Decentralised Energy Roadmap (Dec 2011):

Key report of the CSIRO Intelligent Grid Research Program 2008-2011

www.igrid.net.au



What is Decentralised Energy (DE)?



The DE Roadmap (in a nutshell):

- 1. Unprecedented electricity sector capital investment is happening now (mainly in networks)
- 2. Business as Usual is currently delivering: higher prices, higher bills & higher carbon emission
- 3. Decentralised Energy (DE) can deliver: lower electricity bills & lower carbon emission
- 4. Removing market barriers to DE requires partnership and coordinated Government leadership
- 5. Not acting now will lock in higher infrastructure and carbon costs for decades



D-CODE Cost Curves





Centralised Fossil

Grid intelligent grid an Australian research collaboration

(4/M/\$)

Cost

D-CODE Cost Curves

Open Cycle Gas Potential new electricity sector resources in Australia 900 by cost component Ocean (tidal) 800 700 Solar PV (grid connected) 600 Supercritical brown coal (dry cool) Solar Thermal (with storage) - coal Refuse Derived Fuel (RDF) to energy Sewage gas (Munisied water) **Residential Cogeneration** Supercritical black coal (dry cool 500 mproved Hydro Efficiency Improved power station efficiency Combined Cycle Gas Turbine Commercial Trigeneration **Residential Hot Water** Residential Energy Efficiency 400 Commercial Energy Efficiency Industrial Cogeneration Wind (offshore) Agricultural Biogas IGCC with CCS Biomass Plant Biomass Cogen Industrial Energy Efficiency Wind (onshore) 300 200 Landfill gas 100 0 0 20 40 80 100 120 140 160 180 200 220 **Energy generation potential (TWh)** Potential to 2020 (TWh/yr) Annualised Capital & Fixed O&M Cost (\$ Annualised Capital & Fixed O&M Cost (\$/MWh)

Annualised Network Capital (\$/MWh)

Variable O&M Cost (\$/MWh) \square Cost of CO2 (\$/MWb)

Q. If DE is so good, why is it not happening?A. Institutional Barriers (= "market failure")



Classifying Barriers to Decentralised Energy

	Barriers										
Technical Institutional											
Current C Technology		Current Costs	Regulatory Failure	Inefficient Pricing	Payback Gap	Split Incentives	Lack of Information	Cultural Barriers			
What it costs What it does What slows it down											

Institutional barriers are crucial

Survey of Perceived Barriers



- Do stakeholders agree these barriers are real?
- Which barriers most important?
- Do different stakeholder groups see barriers differently?
 - 800 stakeholders;
 - 200 replies



and the	AUSTRALIAN ALLIANCE TO SAVE ENERGY Creating an Energy-Efficient Australi
10.90 mm	BARRIERS TO DEMAND MANAGEMENT:
	A SURVEY OF STAKEHOLDER PERCEPTIONS Chris Dunstan, Katie Ross, Nicole Ghiotto
	Report #2 of the Australian Alliance to Save Energy Research Project Scaling the Peaks: Demand Management and Electricity Networks
	June 2011
A.	energetics

Survey Respondents

Category	Respondents	# Respondents
Utilities 🔺	Energy Utility – Network	29
	Energy Utility – Retailer	5
	Energy Utility – Generator	1
Government	Government Agency – Federal	2
	Government Agency – State	20
	Government Agency – Local	8
End User	Energy Consumer – Commercial	12
	Energy Consumer – Industrial	2
DM Provider	Demand Management Provider	8
	Demand Management Consultancy	17
	Energy Supply Consultancy	14
Other	Environmental organisation	16
*	Consumer organisation	8
	Industry organisation	3
	Regulator	2
	Research Institution	26
	Other	28



Level of Agreement

Govt 🔺 End User

• DM Provider



VAverage

Stakeholder Type:

According to the National Electricity Law...

s. 7 - National electricity objective (NEO)

- The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services *for the long term interests of consumers of electricity* with respect to—
- (a) **price, quality, safety, reliability** and **security** of supply of electricity ...

The NEM Report Card 2011

	CRITERIA	GRADE	KEY PERFORMANCE INDICATOR
IEO	Reliability		
L L	Security		
len	Quality		
curi	Safety		
Ľ	Price		

The NEM Report Card 2011

	CRITERIA	GRADE	KEY PERFORMANCE INDICATOR		
	Deliebility		Average Supply Interruption Duration (mins/year)		
NEO	Reliability	В	Reliability Unserved Energy (USE)		
ے بر	Security	C	Estimated Security Unserved Energy (USE)		
.ue	Quality	Ungraded	Customer Severity Index (CSI)		
In cur	Safety	Ungraded	Lost time injury frequency		
	Prico	6	Residential retail electricity price (c/kWh)		
	FILE	C	Small business retail elec. price (c/kWh)		
	Customer bills	В	Residential electricity bill as % of h'hold spend		
			Carbon emissions from electricity (t CO ₂ e/yr)		
	Environmental	F	Carbon intensity of electricity (kg CO ₂ e/MWh)		
	performance		Share of renewable energy (%)		
NEO	Energy efficiency	D	Electricity savings as % of total electricity consumed		
urrent	Demand management	D	DM programs as a % of peak demand		
ן כר	Protection of		Proportion of disconnected residential		
i.	vulnerable	C	customers on payment plans and pensions(%)		
2 Z	customers		Number of 'energy poor' households		
	Customer	C	Number of complaints per year		
	satisfaction	.	Surveyed customer satisfaction		
	Level of	D	Generation market concentration		
	competition	D	Retail market concentration		

KEY: A= Very good; B= Good; C= Fair; D= Poor; F= Very Poor; Ungraded= insufficient data

Criterion: RELIABILITY KPI: System Average Interruption Duration Index (SAIDI)



Note: Good international benchmarks not available

Criterion: PRICE

KPI: Residential electricity price in NEM states (1955-2013)



Criterion: Environment KPI: Greenhouse Gas emissions in the NEM



Criterion: Environment Greenhouse Gas emissions in the NEM



Criterion: Demand Management Peak Demand Reduction





The Australian Decentralised Energy Roadmap

Distributed Generation – International Comparison



Capacity grew by 20% between 2006 and 2010

Wild Card 1: Solar PV

Australian solar industry:

- 1031MW installed capacity in 2011
- 9400 Employees in 2010
- Growth rate 210% 2010-2011

International industry growth rate: 44% annually



Cost of Solar PVs is falling fast



Wild Card 2: Electric Cars

The Mitsubishi i-MiEV

(Chevy) Holden Volt





(16kWh of batteries + 150 km range)

(16kWh of batteries + 54 kW electric generator)

Q. How many Volts = Australia's total peak electricity demand?A. ~800,000 (= 6% of the fleet)

What about wild cards interactions? e.g. EV + PVs

Cost of Solar PV: 2001-2011

(Chevy) Holden Volt



Solar is already at grid parity cost in parts of Australia



(16kWh of batteries + 54 kW electric generator)

What happens when you combine: cheap solar energy with...

"free" battery storage and abundant local generation?

Electric Vehicle Market Share in Victoria



Source: Building the Electric Vehicle Market in Victoria: Policy & Technology Scenarios (ISF: 2012)

Wild Card 3:

Empowering consumers (& 3rd parties) with data



providing affordable, timely access to energy usage data

The common-sense idea that electricity customers should be able to securely download their own detailed household or building energy usage information from their utility website. Join the effort to give all Americans the access to their own energy usage information.

Learn More »





Tim El Eternario de 202 de construir	dgar April 2012 Incorport Where it is trees f area ne US Averaget 20 427 Tao Charle Averaget 10 412	comes from M M-of electricity Se serves of Natural Gao	fact i can do w ug to 30 treas by doing unity with cold water
Energy usage May 2012			My post charge 202 trees
Where my energy comes	story from Go Get to the the the the the the the the	ing Green poor energy from remewsible from polycoson varianted dealth and by from their sector year from to remewsible -mould be an to ver et can breather more the	nources. Approximanely one person - the every 5000 households e like planting 18 trees to help purify e easily
© Trick Shot Studios 2012			

Conclusions

- > Network investment is driving rapid rising power prices
- > Decentralised Energy is the best real prospect to rein in increasing bills
- > The is significant Decentralised Energy activity, but small compared to the potential
- > Decentralised Energy faces major barriers
- > Electricity network business have a key role to play in Decentralised Energy
- > Regulatory reform of electricity market is essential,
 - but slow, and not sufficient
- > Other policies, outside of the formal electricity market, will be required if a faster pace of change is desired



For more information:

- Australian Decentralised Energy Roadmap
- The NEM Report Card
- Intelligent Grid Research Program <u>www.igrid.net.au</u>

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Extra slides for reference



Overcoming Barriers - The Policy Palette



Primary Instruments

Overcoming Barriers - The Policy Palette





20 Policy Tools for DE



- 1: DE Coordination Agency
- 2: Decouple electricity sales from network profits
- 3: Reform National Electricity Rules
- 4: Streamline DG Licensing
- 5: Extend retailer EE targets
- 6: DE targets & reporting
- 7: Resource assessments & case studies
- 8: DE handbook & advisory service
- 9: Network planning info
- 10: Annual DE Review
- 11: Energy audits & technical support
- 12: Training & skills development
- 13: Streamline network negotiation process
- 14: DE Ombudsman
- 15: Public recognition & awards
- 16: Decentralised Energy Fund
- 17: Reform feed-in tariffs
- 18: Carbon Price
- 19: Cost reflective pricing
- 20: Network support payments

Work Package	Policy Tool(s)	2012	2013	2014	2015	2016	2017	2018, 2019, 2020
Effective coordination of DE	#1: Establish central DE coordination agency	Nominate lead DE agency & role	Develop DE Strategy & Objectives	Annual Report on DE status		3 yearly review		3 yearly review
	#2: "Decouple" network revenue from sales volume	AER Consult & decide by June 2012 (NSW)	AER Consult & decide by 2013 (VIC & SA)	Implement NSW June 2014	Implement VIC & SA Dec 2015	Revenue cap operation	Review effectiveness and adjust	Next regulatory round starts 2019
Adapt	#3: Revise National Electricity Law to include environmental objective	Consult & consensus building	>	Legislative amendment	\rangle	\rangle	Review effectiveness and report	\sum
framework	#4,#13: Streamline Dist Genlicensing, connection &negotiation processes	Consult	Draft legislative change	Enact legislative Change	>	\rangle	Review effectiveness and report	\sum
	#2,4: Evaluate/expand AEMC/AEMO reviews	AEMO review of DemandSide Participation	Consider matters outside current scope	Implement matters outside scope	Review effectiveness (See#10)	\succ	\geq	Review effectiveness
Targets and reporting	#5: Establish economy- wide target for Energy Efficiency	Consult & develop annual targets	Announce targets and strategy	Review progress and report	Review progress and report	Review targets and strategy	\geq	
	#5: Extend and harmonise retailer energy efficiency targets	Advisory Committee	Draft legislation	Enact legislation		Review progress and report	$\boldsymbol{\succ}$	
	#6: Establish collaborative DE targets with networks	Consult on targets	Settargets and link to DE Fund	Review progress and report	Review progress and report	Review Targets	Review progress and report	Continue subject to outcomes
Address information gaps	#7 Produce DE Case Studies	Nominate agency & collect data	Publish pilot case studies	Evaluation and expand	Review effectiveness and scope	Operate and report		Continue subject to Review
	#8: Provide DE advisory service	Consult & nominate agency	Implement stand-alone service	Operate and report	Operate and report	Review	\sum	Continue subject to Review

Work Package	Policy Tool(s)	2012	2013	2014	2015	2016	2017	2018, 2019, 2020
Address information gaps	#15: Improve network planning information	Enact AEMC rule change re Network Planning & DM	Improve info (mapping and outreach)	Disseminate complementary information	Review & Compare effectiveness		Review & compare effectiveness	
	#10 Annual DE Review	Consult	Nominate agency to coordinate & collect data	Publish DE Review			Review effectiveness	
Facilitate understanding and action	#11: Audits and technical support	Review extension of EEOA/ Green Start etc	Implement	Operate and report	Operate and report	\rangle	Review effectiveness	\rangle
	#12: Training & skills development	Gap analysis & nominate delivery agencies	Pilot programs	Operate and report	Implement	Review curriculum relevance	\rangle	\rangle
	#14 DE Ombudsman	Consult on role & structure of Ombudsman	Legislate new ombudsman functions	Capacity building of ombudsman office/s	Operate and report	\rangle	\rangle	Review and continue subject to outcomes
	#15: Pubic recognition and awards	Establish framework	Operate and award	Review effectiveness	\rangle	Continue subject to outcomes	\rangle	
Streamline and rationalise incentives	#16: DE Fund	Consult on fund evel, source & reporting	Establish DE Fund and select projects	Fund projects based on performance	Operate and Report	Shift to funding via network regulation	Review: wind back and refocus Fund	Continue Fund subject to review
	#17: Reform Feed-in- Tariffs	MCE review nat 1 streamlining of FiT for small DG	Enact legislation and/or rules	Implement	Operate	Review Effectiveness	Continue subject to net benefits	
Pricing Reforms	#18: Pursue carbon price	Implement	Operate and Report	Set 2020 Emissions target	Transition to Emissions Trading	Operate and Report	\rangle	Set post 2020 Emissions targets
	#19: Incentivise cost- reflective pricing for networks and customers	Encourage voluntary ToU tariffs	Evaluate and educate re costs & benefits	Monitor and report, recognise best practice	Consider broad rollout with safety net	Review market and consumer impacts	\geq	Expand subject to benefit cost analysis
	#20: Establish default network support payments & negotiation framework	Review current practice	Consult on level and structure	Consider rule change if necessary	Operate and Report	Review	\rangle	Continue subject to review

Towards an effective DE policy

Australia's power bill: Network Capital Expenditure: DE Savings:

- ~ \$24 billion p.a.
- ~ \$9 billion p.a. (\$34m/day)
- ~ \$2.9 billion (2020)

An *Energy Savings Partnership:*

- > Focus on reducing peak demand *and* consumption
- Set ambitious collaborative targets with electricity networks
 E.g. \$1billion p.a. in avoided capex and consumers savings
- > Regular *performance reporting* by each network
- > Savings *Partnership Fund* to drive actions (say, \$300m p.a.)
 - c.f. UK £500 Low Carbon Networks Fund
- > Any unallocated funds offered to other DM service providers
- > Build into "business as usual" via economic regulation (AER)

Ontario Electricity Conservation and Demand Management Program

- "Ontario **invested** about **\$1.7 billion** in conservation programs from 2006 to 2010.
- This will **save** ratepayers **\$3.8 billion** in avoided costs."
- "new conservation programs ... will require an **investment** of about **\$3 billion** over the next five years.
- The results will be ... an avoided lifetime supply cost of **\$10 billion**"



DE targets & incentives in Ontario

Energy Saving Targets for Local Distribution Companies (LDCs) in Ontario

Total Targets 2010-14: 1,330 MW peak 6,000 GWh

LDCs received incentive payments for achieving over 80% of their targets.

License Name 2011-2014 Net 2014 Net Annual Peak Cumulative Demand Energy Savings Target Savings Target (MW) (GWh) Algoma Power Inc. 1.280 7.370 1 2 Atikokan Hydro Inc. 0 200 1 160 Attawapiskat Power Corporation 3 0.070 0.290 Bluewater Power Distribution Corporation 10.650 53,730 4 Brant County Power Inc. 3 300 9.850 5 6 Brantford Power Inc. 11 380 48 920 Burlington Hydro Inc. 21.950 82.370 7 COLLUS Power Corporation 8 3.140 14.970 9 Cambridge and North Dumfries Hydro Inc. 17.680 73.660 Canadian Niagara Power Inc. 10 4 070 15 810 Centre Wellington Hydro Ltd. 1.640 7.810 11 Chapleau Public Utilities Corporation 12 0.170 1.210 Chatham-Kent Hydro Inc. 9.670 37.280 13 Clinton Power Corporation 0.320 1.380 14 Cooperative Hydro Embrun Inc. 0.340 1.120 15 I E.L.K. Energy Inc. 2.69016 8.250 17 ENWIN Utilities Ltd. 26.810 117.890 Enersource Hydro Mississauga Inc. 18 I 92.980 417.220 Erie Thames Powerlines Corporation 4.280 18.600 19 Espanola Regional Hydro Distribution Corporation 0.520 20 2.7607.190 Essex Powerlines Corporation 21 21.540 22 Festival Hydro Inc. 6.230 29.250 23 Fort Albany Power Corporation 0.050 0.240 24 Fort Frances Power Corporation 0.6103.640 25 Greater Sudbury Hydro Inc. 8.220 43.710 26 Grimsby Power Inc. 2.060 7.760 Guelph Hydro Electric Systems Inc. 27 · 16,710 79.530 2,850 Haldimand County Hydro Inc. 28 13.300 Halton Hills Hydro Inc. 29 6.150 22,480 Hearst Power Distribution Company Limited 30 0.680 3,910 Horizon Utilities Corporation 60.360 281.420 31 Hydro 2000 Inc. 32 0.190 1.040 33 Hydro Hawkesbury Inc. 9,280 1.820 Hydro One Brampton Networks Inc. 34 45.610 189.540 Hydro One Networks Inc. 35 213.660 1.130.210 36 Hvdro Ottawa Limited 85,260 374,730

http://www.oeb.gov.on.ca/OEB/_Documents/EB-2010-0215/Conservation%20and%20Demand%20Management%20%28CDM%29_Code.pdf

LDC CDM Targets

Queensland Energy Conservation and Demand Management Program

- > In 2009/10, Qld Govt allocated \$47 million for demonstration projects
- > In 2010, Energex and Ergon sought and were allocated ~\$220 million for Demand Management programs from the Australian Energy Regulator
- > Energex and Ergon now have extensive plans, teams, budgets and targets in place to reduce demand growth and support DE.



MW targets for 2010-2015

positive energy



http://www.energex.com.au/network/network_prices/pdf/Energy%20Conservation%20&%20Demand%20Management.pdf