Centre for Energy and Environmental Markets

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Distributional Effects of the Australian Renewable Energy Target via Wholesale, Retail Price Impacts

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International Energy Workshop (IEW)
Beijing, 4-6 June 2014

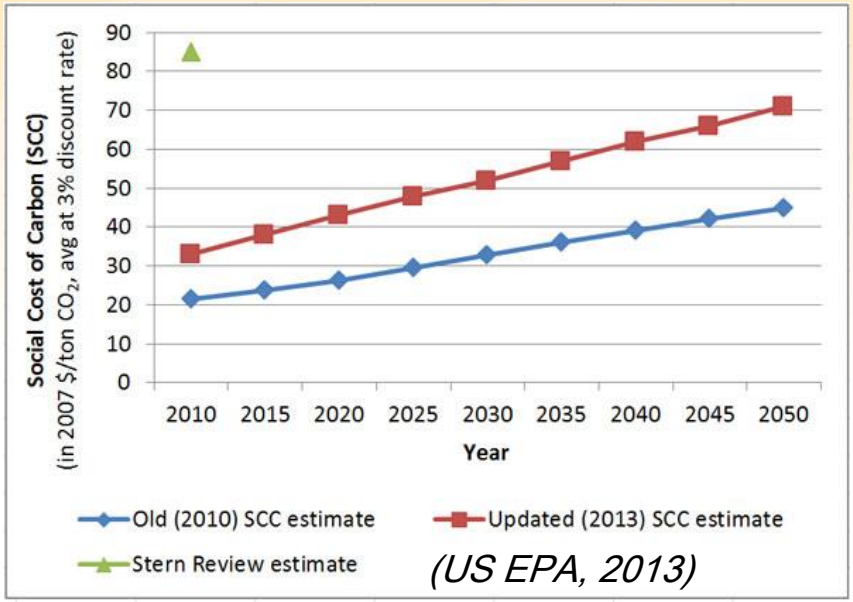
‘Interesting’ times for clean energy in Australia

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 adaptation, and impacts of failing to effectively manage climate change (SCC)

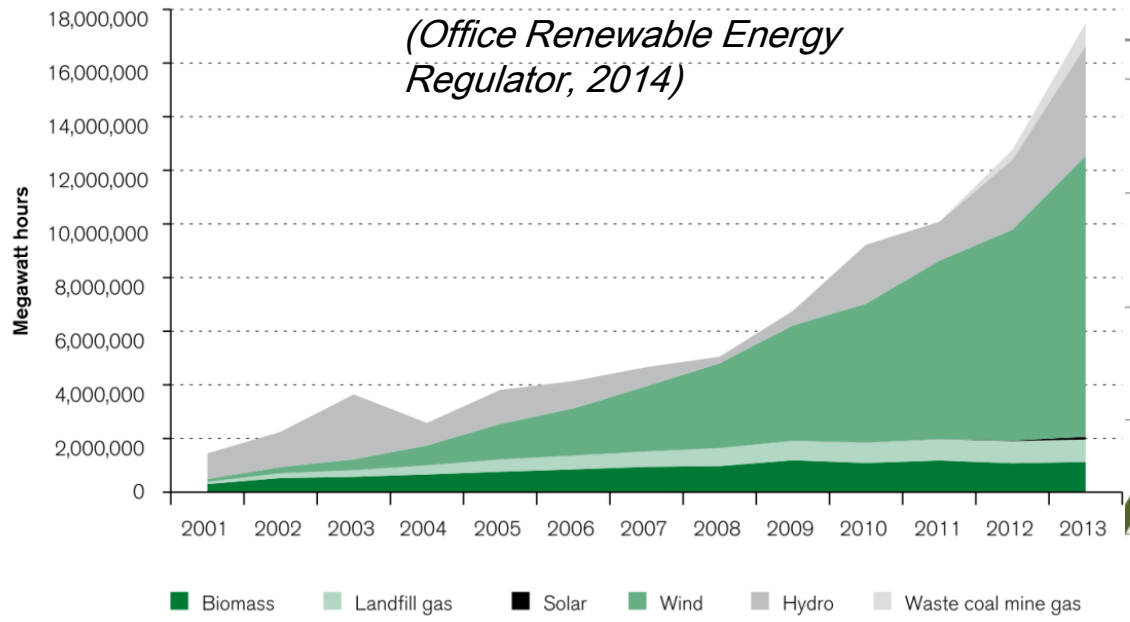


(US EPA, 2013)

- *Instead, real question is who, pays how much, to whom, for what, when? ie. a question of* ***distribution***

Renewable energy progress

Graph 2: Supply of large-scale renewable electricity generation, 2001 to 2013



(Office Renewable Energy Regulator, 2014)

(ROAM Consulting, 2014)

...although still long way to go for low carbon

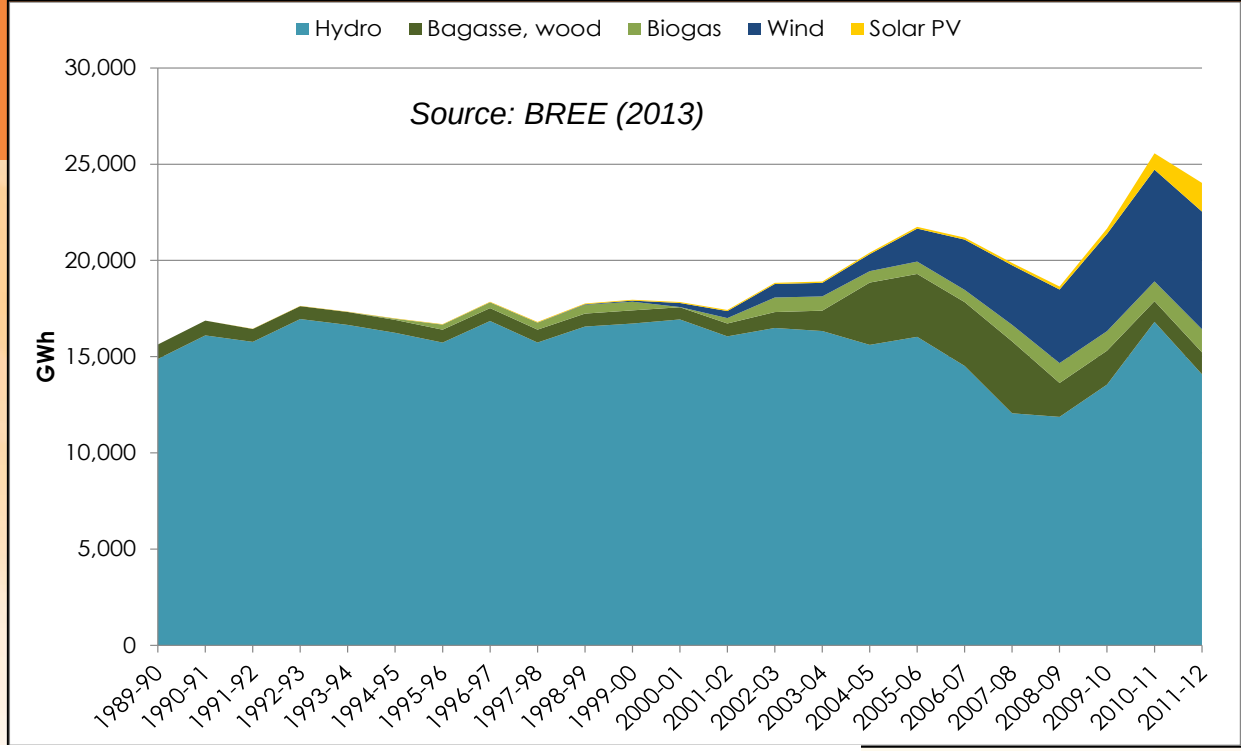
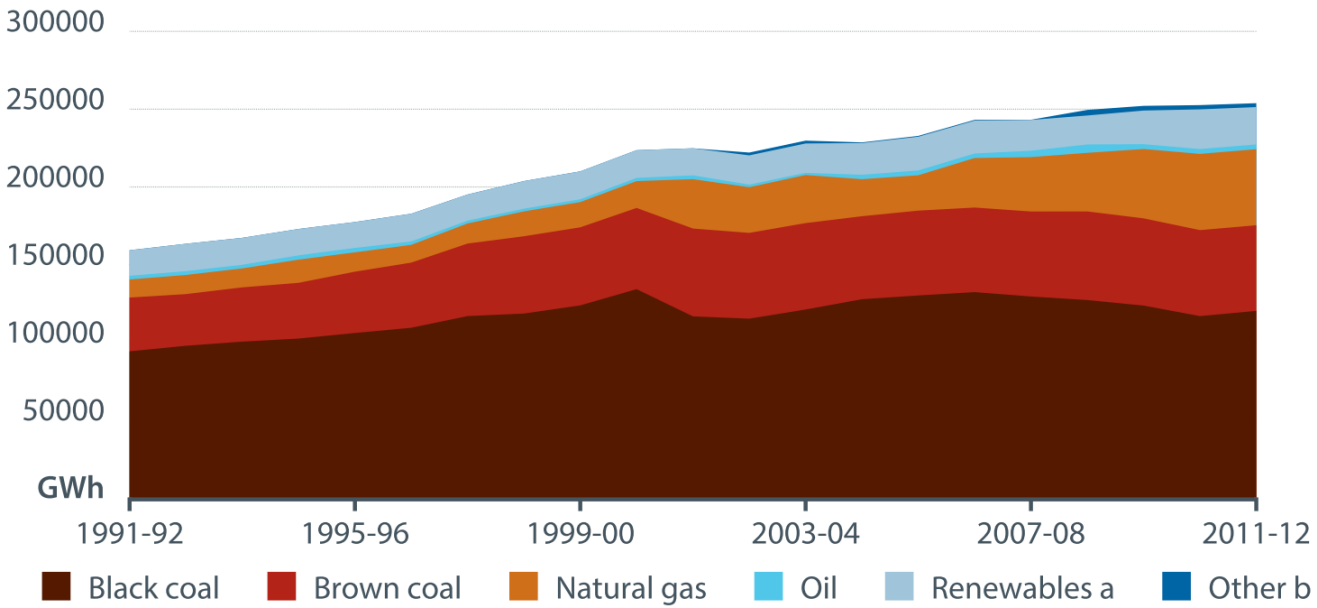


Figure 3: Australian electricity generation, by fuel type



Renewable energy almost entirely climate policy in Australia

Figure 2: Australian energy production, by fuel type

(BREE, 2013)

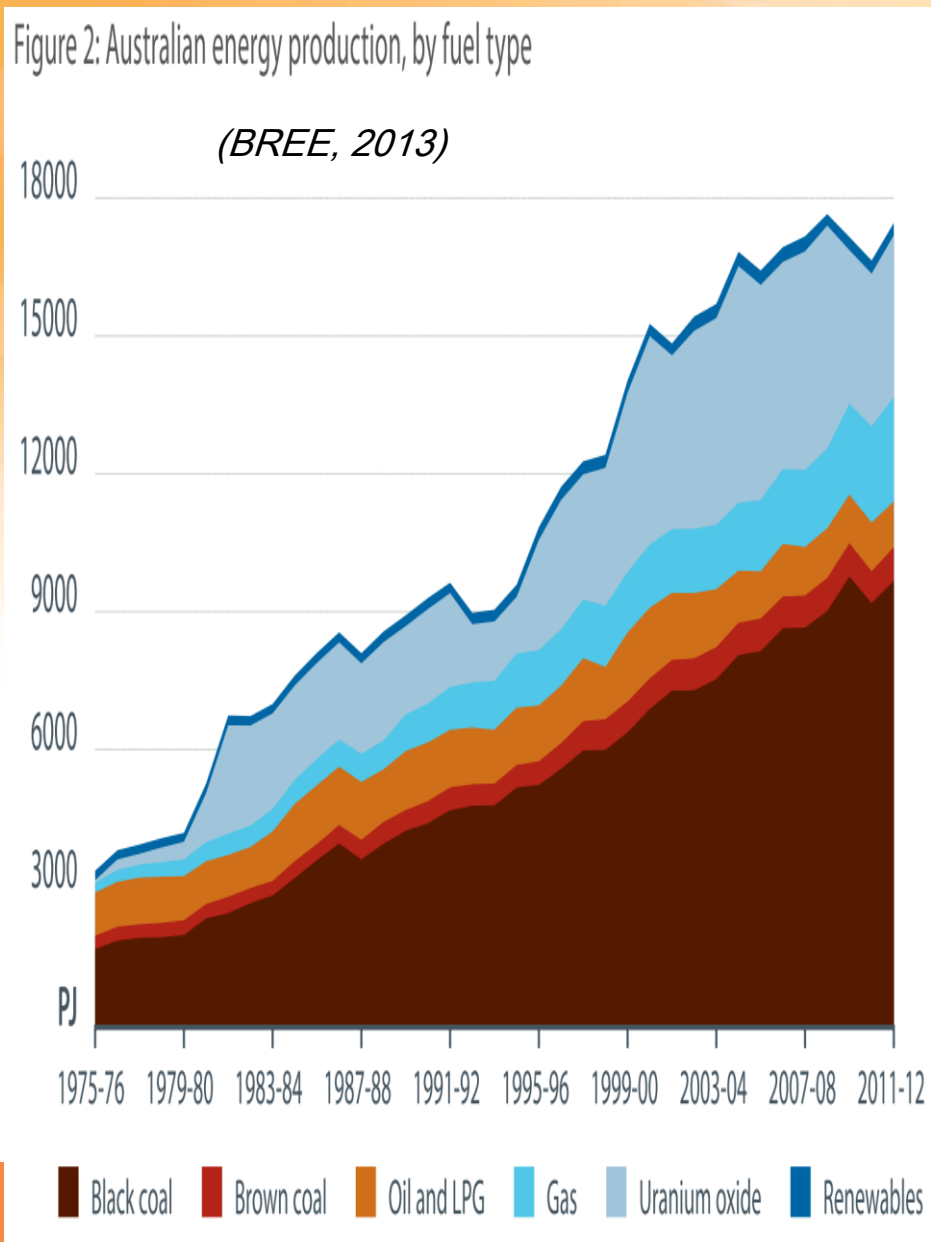
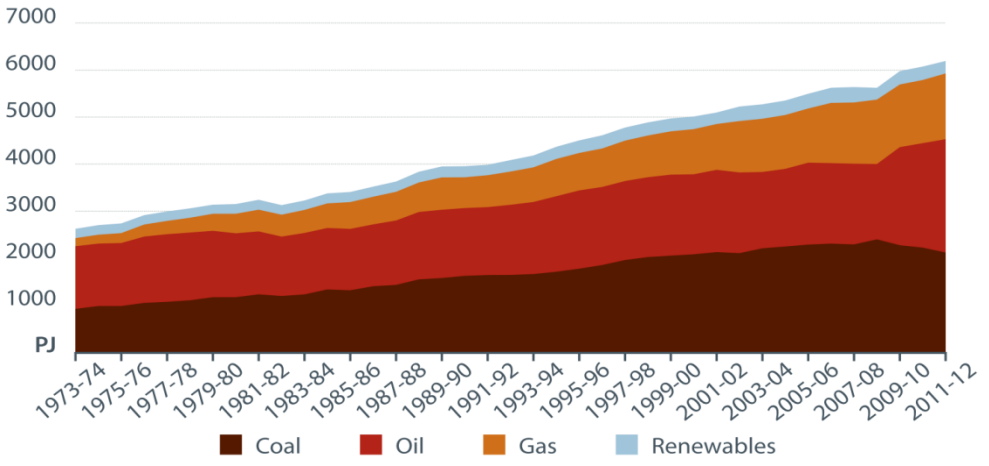
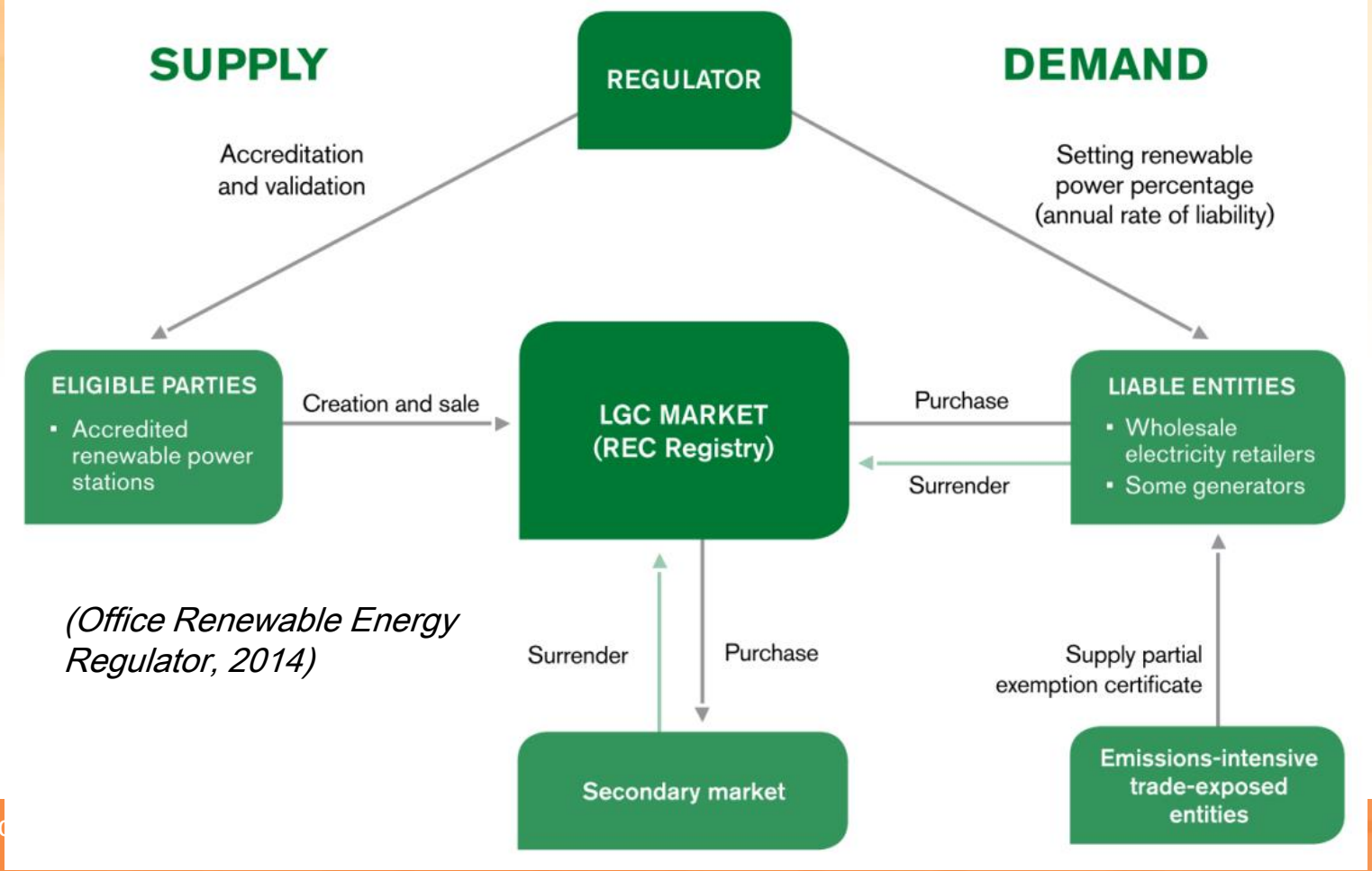


Figure 1: Australian energy consumption, by fuel type



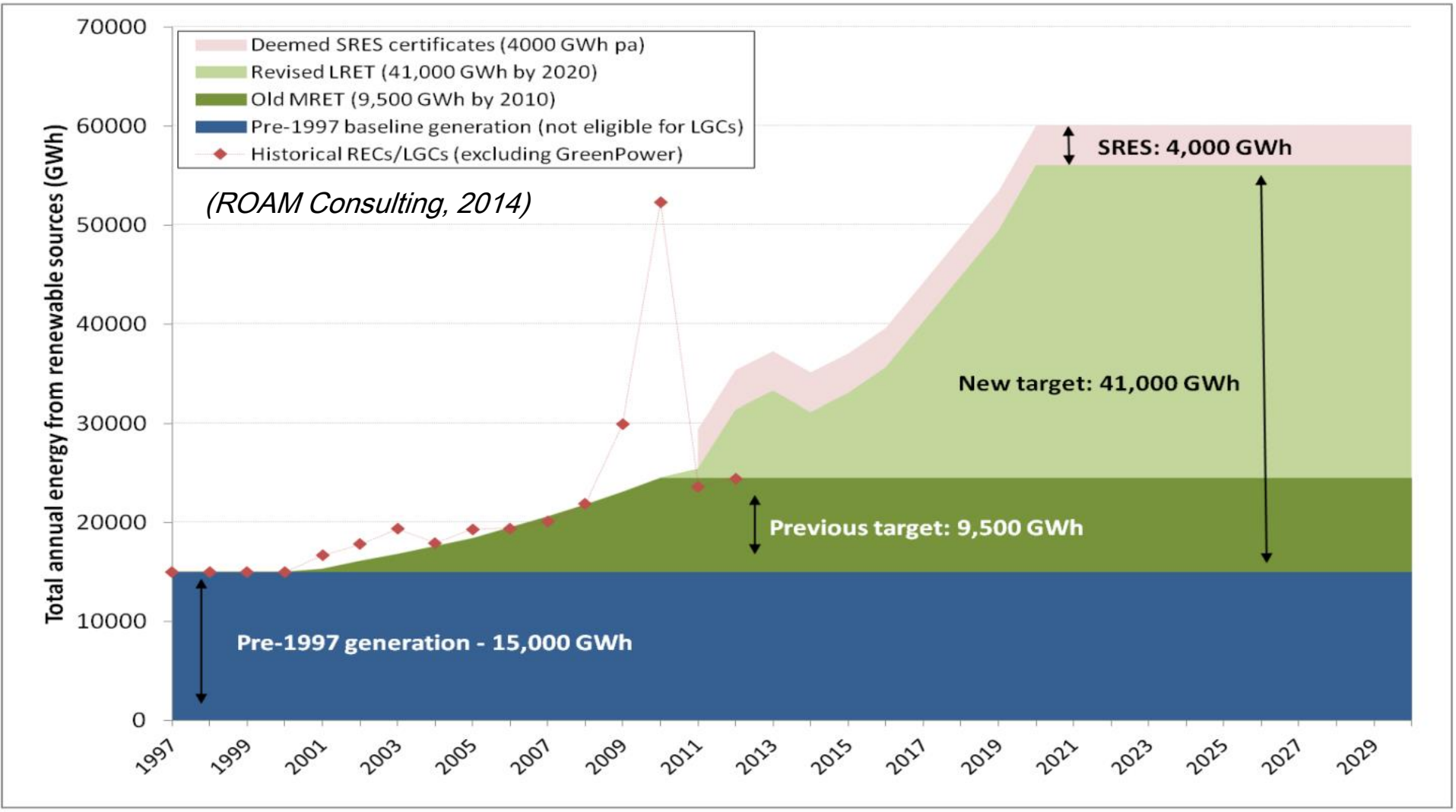
The Australian Renewable Energy Target

- A green certificate / RPS based approach



(Office Renewable Energy Regulator, 2014)

RET target …. *currently under review*



Considerable discussion on RET costs... *but what of distributional implications*

- Producers versus consumers
- Different consumer classes: Households, small business, commercial and industry (SME --- large)
- Within consumer classes

"Ensure that the cost but also the benefits of the German energy transition are allocated in a fair way across the different energy sectors and stakeholder groups." (IEA, 2013)

"To date, little analysis has been publicly provided on the impact of these [large industry RET] exemptions including the costs and benefits to other electricity customers." (IPART, 2012)

RET's competing effects on electricity prices

- **Wholesale prices** lower due to merit order effect ↓ **Benefit**
- **Retail prices** higher as cost of policies passed to consumers ↑ **Cost**

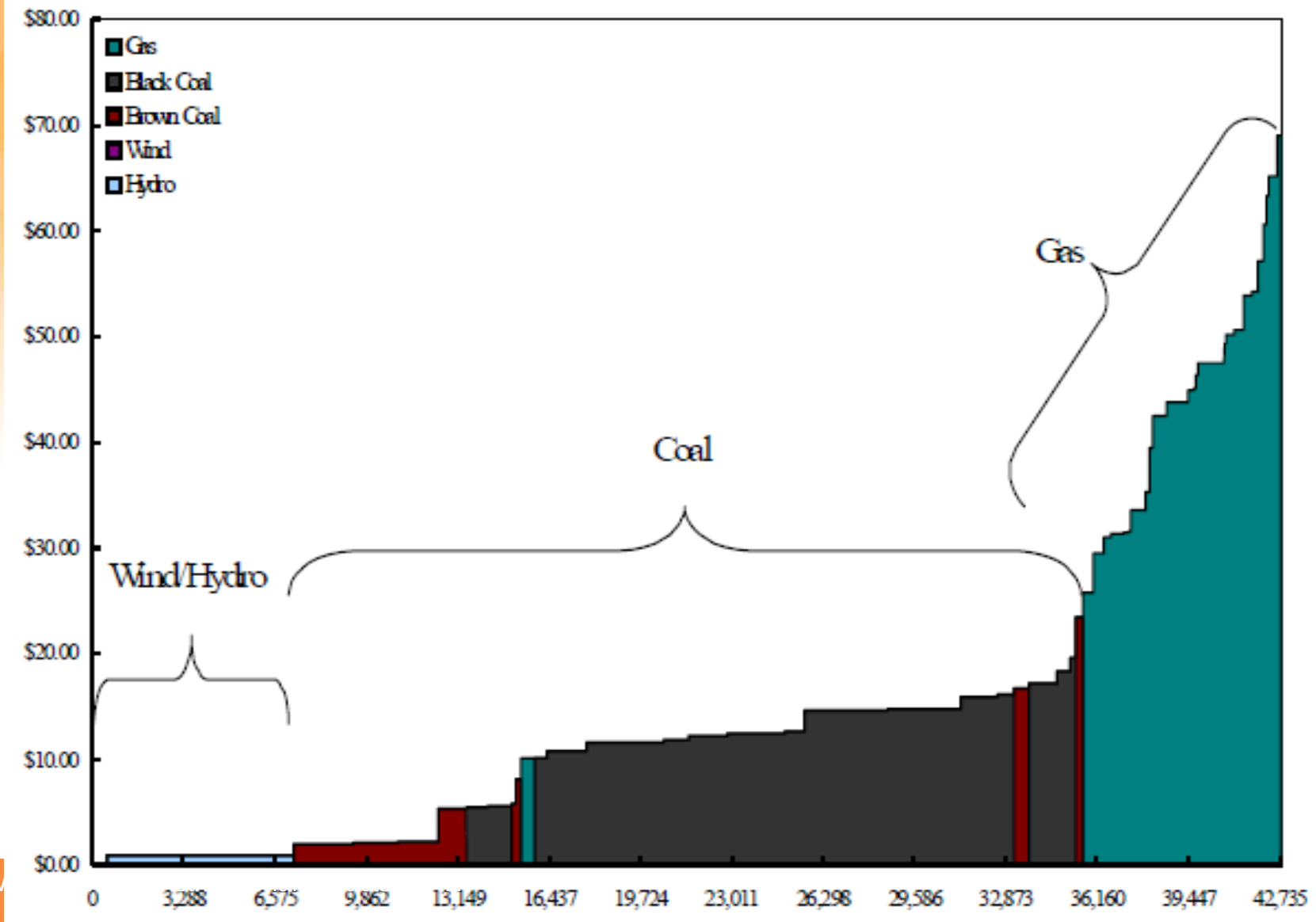
- **Net effect** depends… ↓ ↑

  … Design of policy
  - Exemptions for industry

  … Design and structure of electricity wholesale and retail markets
  - Pass-through of benefits and costs

- **Long-run effects?**

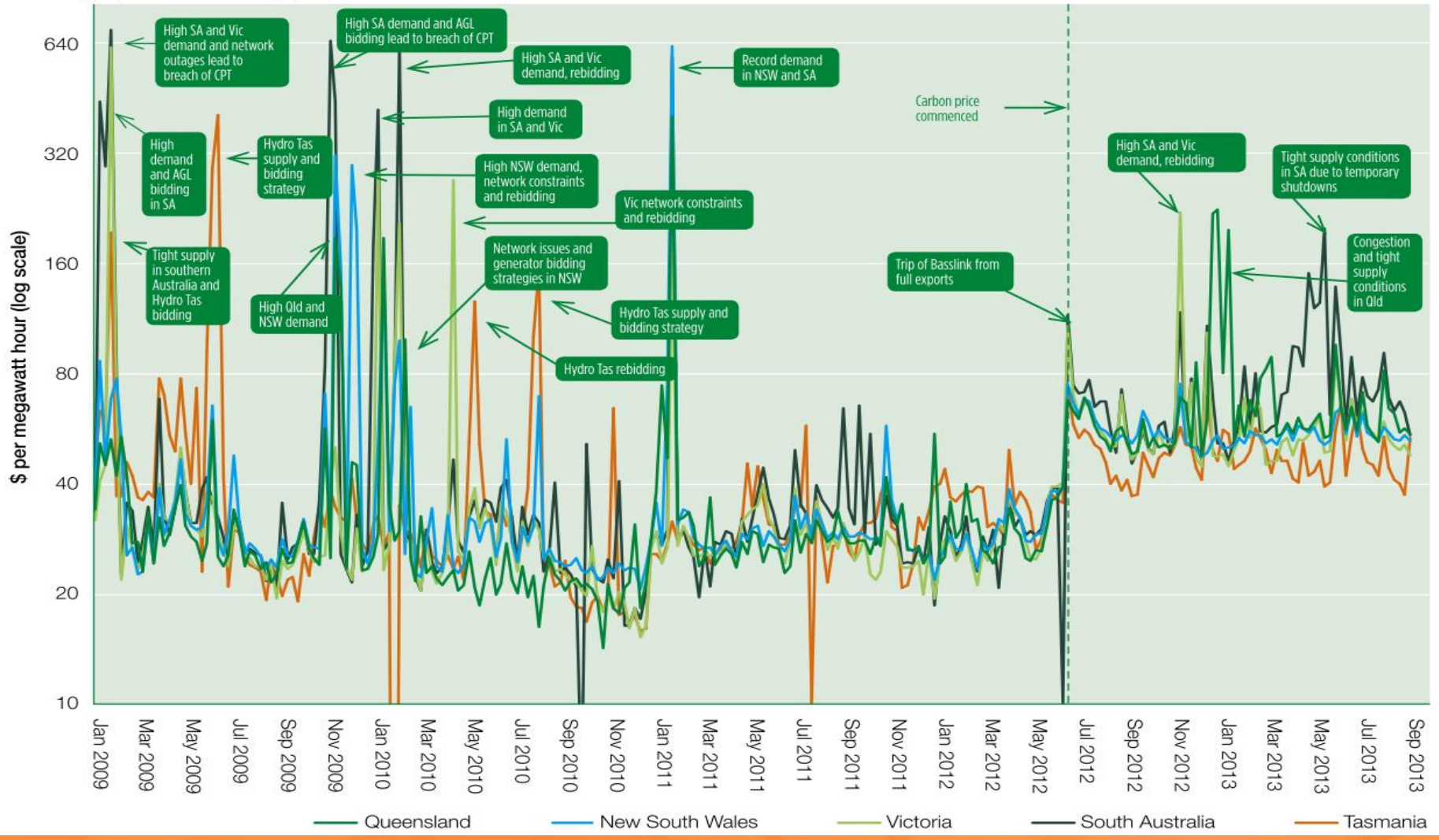
Current *stylised* NEM Merit Order w/o $C



NEM wholesale prices

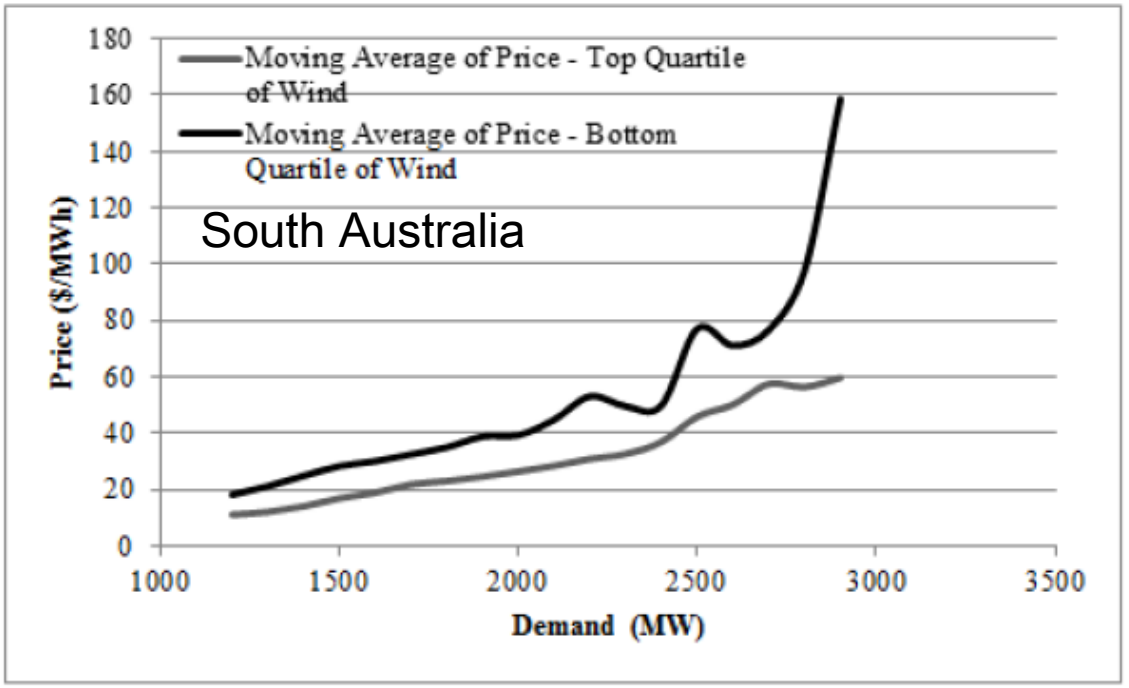
Figure 1.15
Weekly spot electricity prices

(Australian Energy Regulator, 2013)

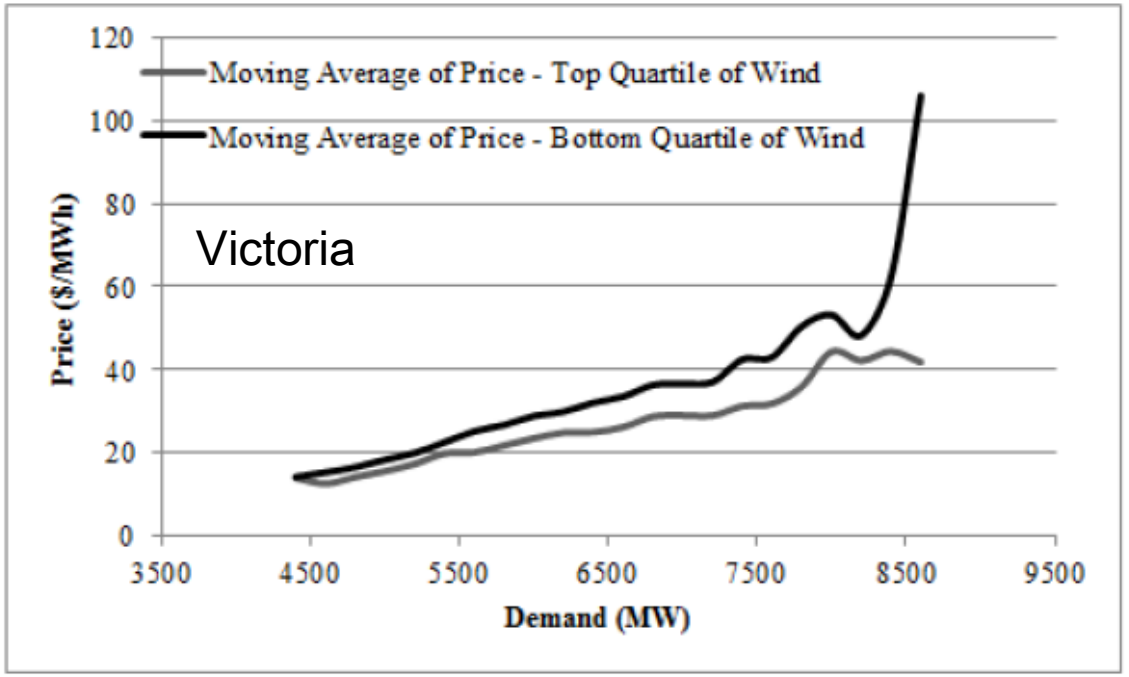


Evident wind impact on wholesale electricity prices in NEM States with high penetrations

although note complexities of such analysis



(Forrest, Energy Policy, 2013)



MOE - Simulation vs. time-series regression

(see Würzburg et al. 2013 for an overview)

- **Electricity market modelling** (de Miera et al. 2008, McConnell et al. 2013, Sensfuß 2011, Sensfuß et al. 2008, Weigt 2009)
  - Careful calibration, definition of a reasonable counterfactual scenario
  - Long-run effects, including investment in generation and transmission capacity
- **Regression analysis of historical time-series data** 
  (Forrest and MacGill 2013, Gelabert et al. 2011, Jónsson et al. 2010, Neubarth et al. 2006, Roon and Huck 2010)
  - Short-term effects based on current market and generation structure
  - Neglects issues such as costs for new power plants and network development

Estimation method

$$\ln(price_t) = c + \gamma \ln(price_{t-1}) + \alpha_1 wind_t + \beta_1 demand_t + \sum_j \mu_j S_{jt} + \eta_1 W_t + \varepsilon_t$$

- Wholesale spot price dependent on wind, demand and seasonal dummies
- AR(1) term included, regression in logs
- Assumption: Inelastic demand in the short run
- Assumption: Omitted variables (fuel prices, etc.) uncorrelated with explanatory variables

Regression results

Pre-carbon (2011-12)

R-squared	0.6594
Root MSE	0.1908
Observations	8,760

	Coefficient	S.E.	t-stat
Price (t-1)	0.587338	0.006109	96.140
Wind	-0.000060	0.000005	-12.530
Demand	0.000030	0.000001	23.600
Constant	0.791780	0.033021	23.980
Add. Controls: Dummies for seasonal trends and weekends			
Total MO Effect	**-2.30**	**$/MWh**	

Post-carbon (2012-13)

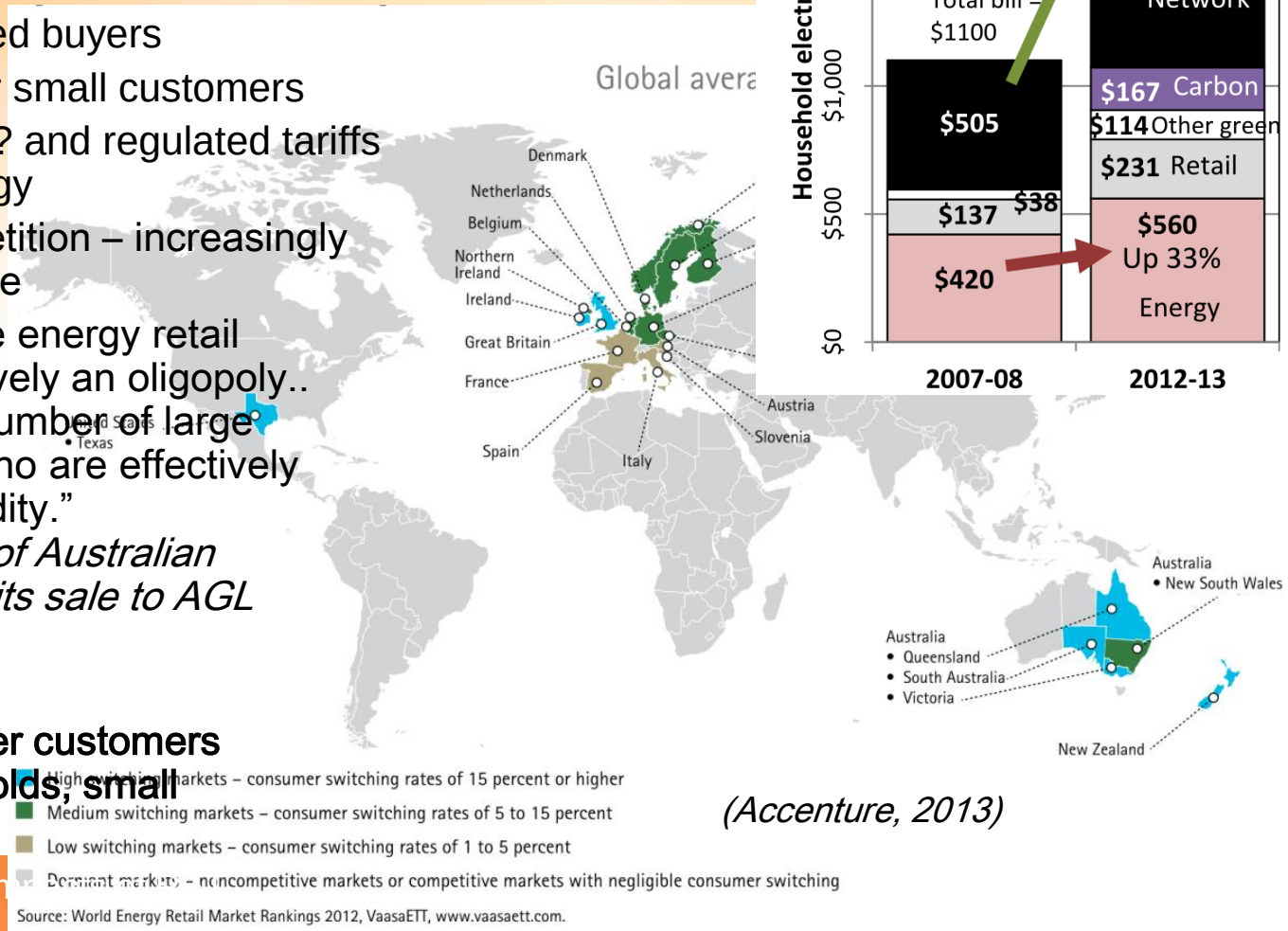
R-squared	0.5301
Root MSE	0.2078
Observations	8,760

	Coefficient	S.E.	t-stat
Price (t-1)	0.577430	0.007144	80.83
Wind	-0.000039	0.000005	-7.48
Demand	0.000032	0.000001	22.31
Constant	1.062013	0.039886	26.63
Add. Controls: Dummies for seasonal trends and weekends			
Total MO Effect	**-3.29**	**$/MWh**	

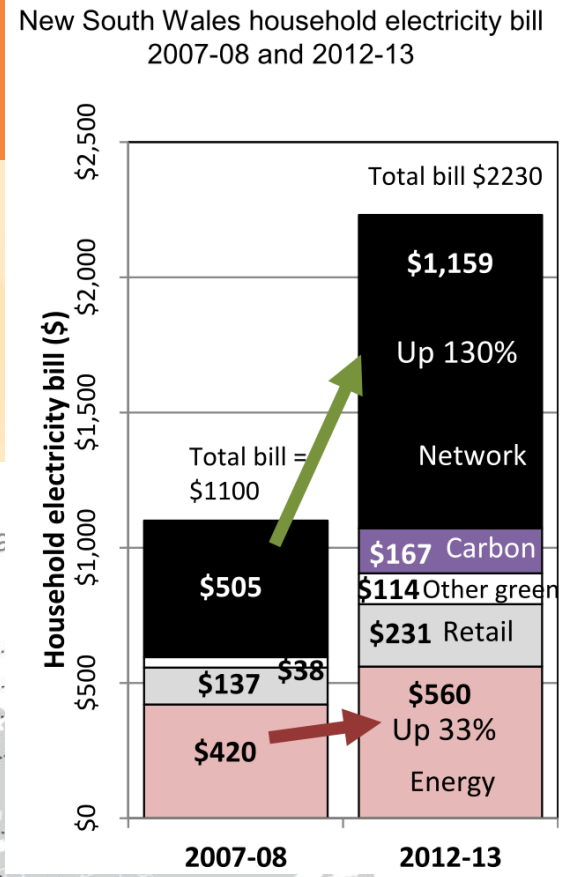
- Tobit regression because of censored data
- Differences before vs. after start of carbon pricing (higher operating costs of the marginal generation that wind displaces + more wind)
- Total effect by load-weighting effect of wind in each hour

NEM retail markets

- Supposedly an international success story…
  - By switching rates, price spreads – standard measures
- But is it really even a market?
  - Generally unengaged buyers
  - Limited metering for small customers
  - Mix of ?competitive? and regulated tariffs – network and energy
  - Limited price competition – increasingly oligopolistic structure
  - "The thing about the energy retail market is it's effectively an oligopoly.. There are a small number of large players—three—who are effectively providing a commodity."
    Jim Myatt, founder of Australian Power and Gas on its sale to AGL (crikey.com.au, 2013)
  - **Perhaps ok for larger customers but what of households, small business**



(Accenture, 2013)



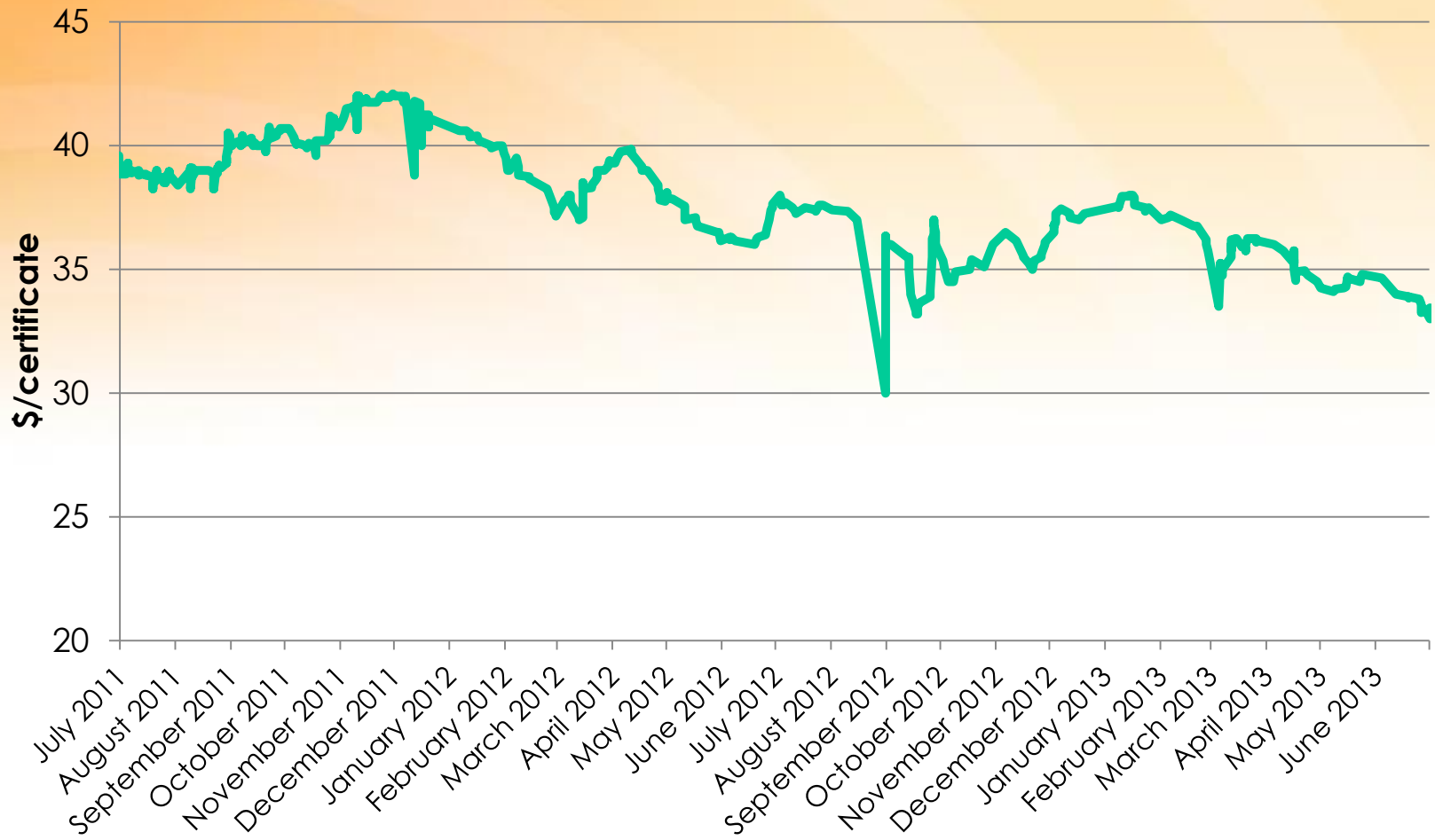
Methods to estimate wholesale allowance in regulated retail tariffs in Australia

$/MWh	NSW: Energy Australia	NSW: Country Energy / Origin Essential	NSW: Integral Energy / Origin Endeavour	QLD	Mean market price in the NEM
2011-2012					
Standalone LRMC	67.66	63.60	70.98	64.44	
Market-based	48.82	46.52	50.76	46.50	29.24
2012-13					
Standalone LRMC	87.76	84.35	91.51		
Market-based	68.24	66.86	72.64	41.59	39.4[b]
all exclusive carbon costs; [b]Assuming a mean carbon intensity of 0.92 t CO_2/MWh in the NEM					

Source: IPART 2013; IPART 2012b; IPART 2011; QCA 2012; QCA 2011

- LRMC approaches as largely employed to date (standalone) unlikely to incorporate merit order effects, other market changes
- Market-based (or more sophisticated LRMC) methods more likely to do so
- *Finally, a move towards using transparent forward prices, which are influenced by current spot prices and therefore the RET, other factors*

Pricing in the large-scale green certificates?



Source: Nextgen

LRET allowance in NEM jurisdictions

LRET allowance ($/MWh)	NSW	VIC	QLD	SA	TAS	ACT
2011-12	2.67	4[a]	2.96	4[a]	8[a]	5[a]
2012-13	4.55	7[a]	4.10	4[a]	12[a]	4.24
[a]as modelled in AEMC (2013); NSW numbers are given for Energy Australia						

Source: IPART 2013; IPART 2012b; IPART 2011; QCA 2012; QCA 2011; ICRC 2012; ICRC 2011; AEMC 2013

- Depends on
  - (Forecast) price for LGCs
  - Renewable power percentage (RPP), depending on 20% goal for renewables + level of exemptions

Assumed pass-through rates

Pass-through merit order effect	Pass-through RET costs: 100%	40%	10%
0%	Electricity price not aligned to wholesale price movements; not exempt from RET costs	Electricity price not aligned to wholesale price movements; 60% exempt from RET costs	Electricity price not aligned to wholesale price movements; 90% exempt from RET costs
50%	Electricity price partially aligned to wholesale price movements; not exempt from RET costs	Electricity price partially aligned to wholesale price movements; 60% exempt from RET costs	Electricity price partially aligned to wholesale price movements; 90% exempt from RET costs
100%	Electricity price fully aligned to wholesale price movements; not exempt from RET costs	Electricity price fully aligned to wholesale price movements; 60% exempt from RET costs	Electricity price fully aligned to wholesale price movements; 90% exempt from RET costs

Households
industry

- Pass-through of RET costs mainly dependent on level of exemptions, but also method for calculating regulated retail tariffs
- Pass-through of merit order effects dependent on type of electricity consumer & method for calculating regulated retail tariffs

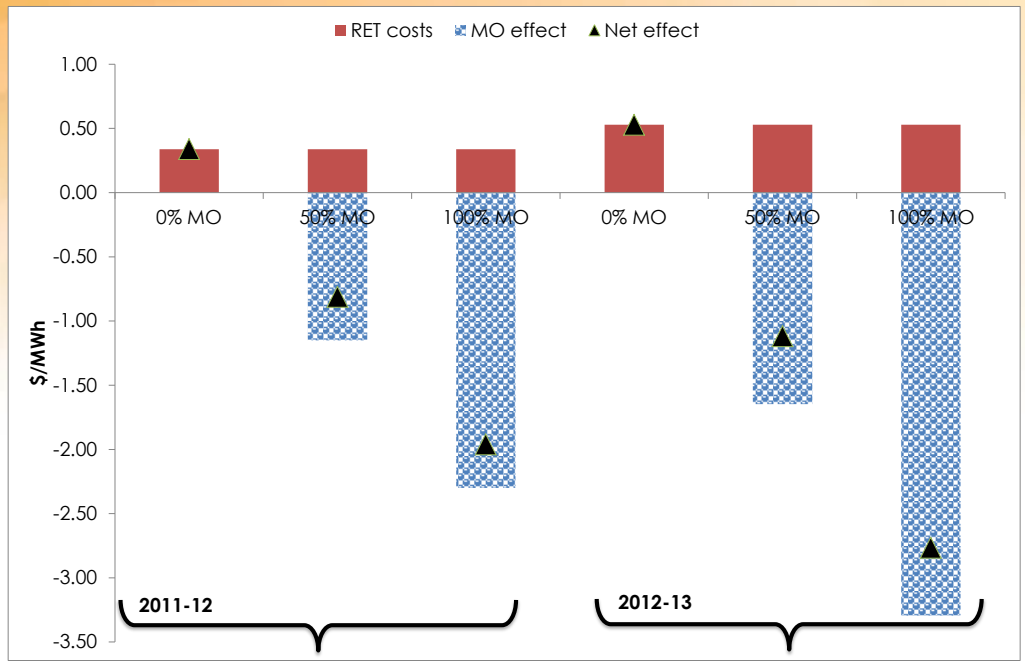
Indicative net impacts ($/MWh)

2011-2012		Pass-through RET costs 100%	40%	10%
Pass-through merit order effect	0%	3.38	1.35	0.34
	50%	2.23	0.20	-0.81
	100%	1.08	-0.95	-1.96
2012-2013		Pass-through RET costs 100%	40%	10%
Pass-through merit order effect	0%	5.29	2.11	0.53
	50%	3.64	0.47	-1.12
	100%	1.99	-1.18	-2.77

Impact highly dependent on assumed pass through of costs and benefits

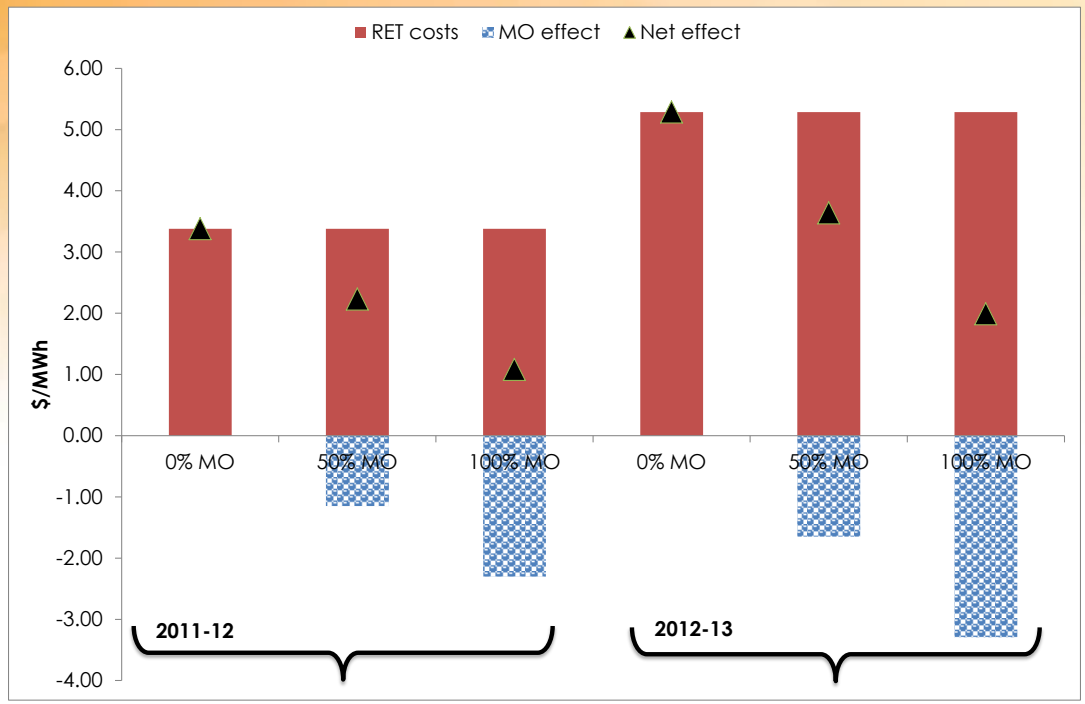
- Household price likely to rise
- Exempt industry price likely to fall

Large Industry Exemptions



- Merit order effect likely overcompensates energy-intensive industry for contribution to cost of Renewable Energy Target in the short-run
- Costs for households could be reduced if exemptions less generous
- *"[…] exemptions result in increased costs for other RET liable entities, because they must share the RET liability for the electricity exempted."* (Climate Change Authority, 2012)

Retail market design... *misdesign?*



- Costs to households could be reduced if merit order effects more appropriately passed through
- In Australia: Large percentage of consumers on regulated retail tariffs *(or 'competitive' tariffs based on these regulated tariffs0*
- Methods for calculating wholesale component in regulated retail tariffs determine pass through of merit order effects

Conclusions

- Benefits, costs of Australian renewable energy support policy could be distributed more equally, *in short-run at least*
  - Merit order effect likely overcompensates energy-intensive industry for contribution to cost of those policies
  - Surcharge for households would be reduced if surcharge for industry closer to merit order effect
  - Ensure merit order effects more appropriately passed through to consumers
- More generally, importance of considering distributional effects ex-ante and including review mechanisms when designing renewable energy policies
- **As always, limitations to our analysis and hence findings particularly with respect to longer-term impacts, e.g. environmental and energy security benefits, investment in generation / network capacity**

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