Centre for Energy and Environmental Markets

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# UNSW Project for the CSIRO Future Grid Cluster: *Robust energy policy frameworks for investment into future grids*


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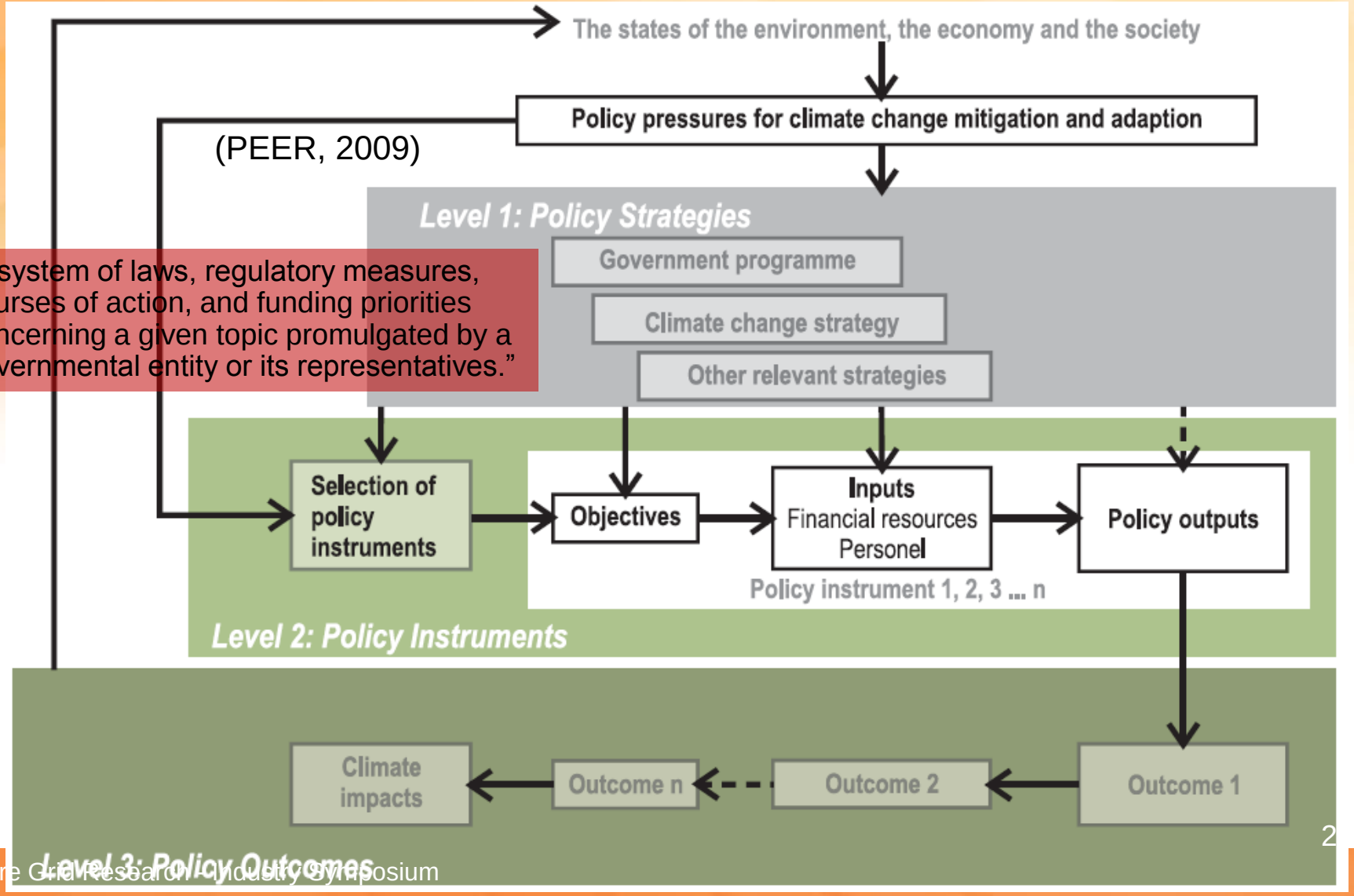
Future Grid Research – Industry Symposium

*University of Sydney*

*10 July 2014*

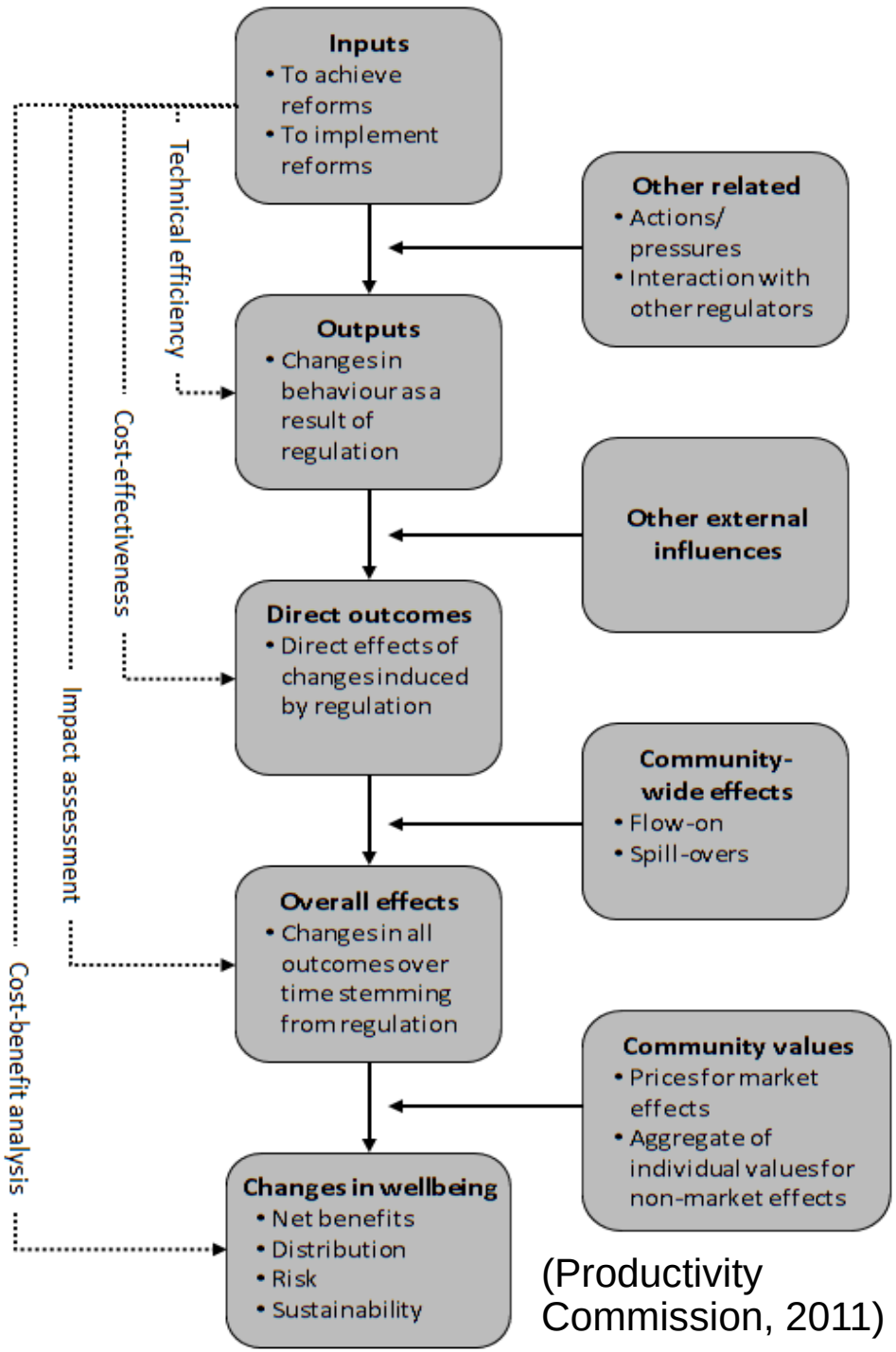
# Relevant policy processes … in theory




(PEER, 2009)

"a system of laws, regulatory measures, courses of action, and funding priorities concerning a given topic promulgated by a governmental entity or its representatives."

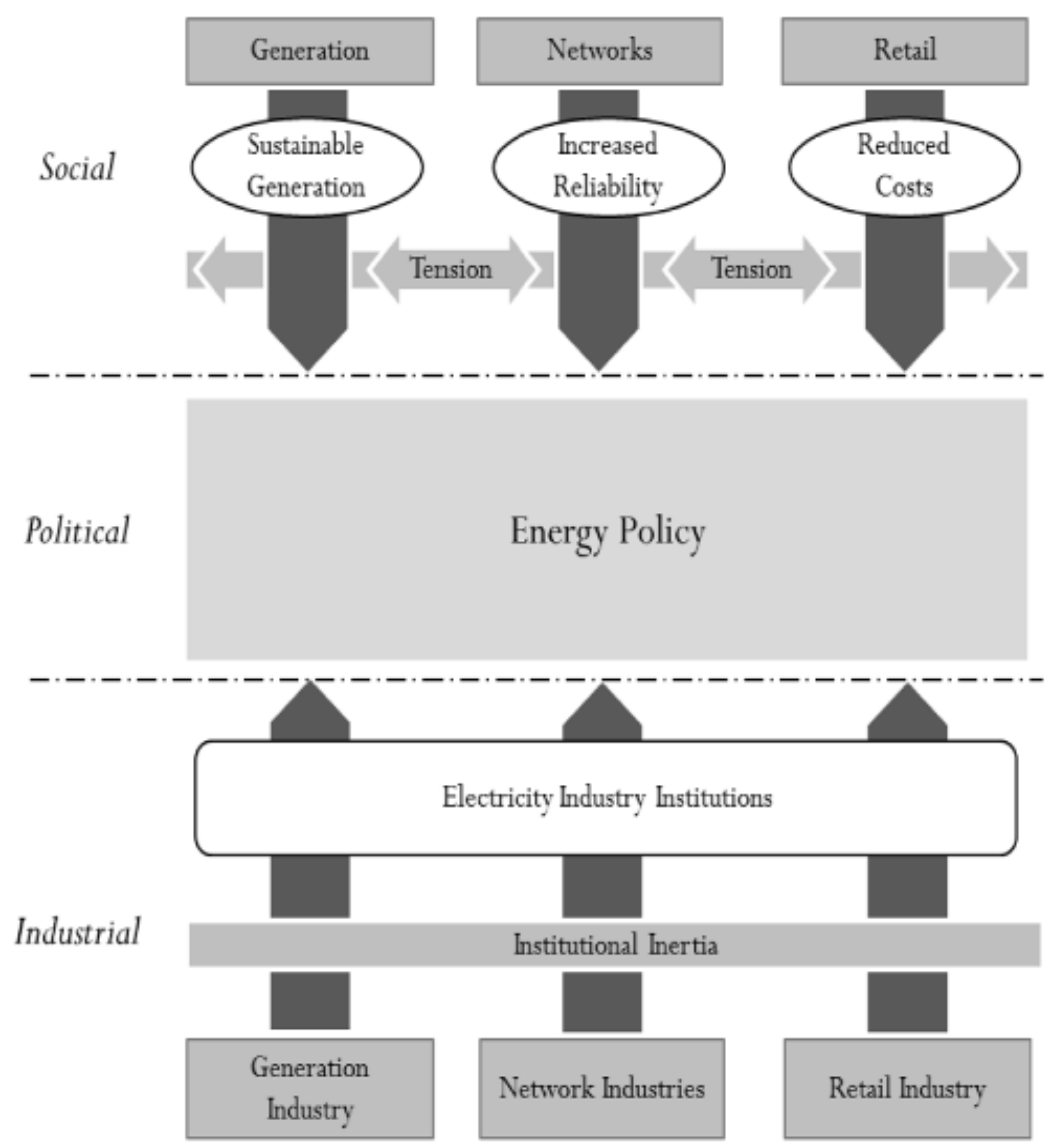
# Policy assessment a key part of this process




(Productivity Commission, 2011)

# In practice –contested, rapidly changing context *always challenging, occasionally shambolic*

# Policy guidance in practice… *Electricity Industry as a Socio-Technical System*



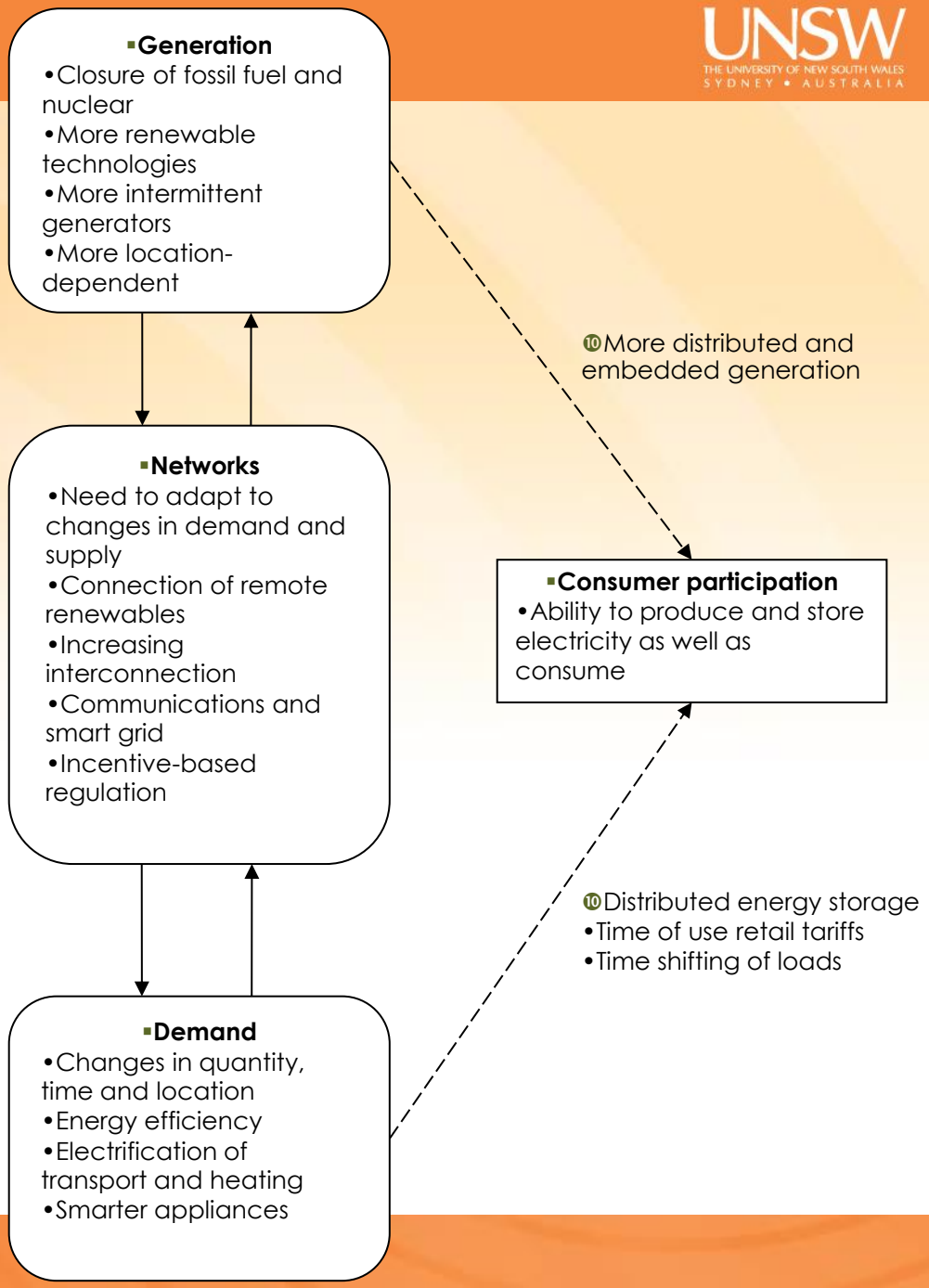

(Sue et al, 2014)

# Policy guidance in practice - *Robust policy frameworks*

- Optimal decision or policy
  - one that is expected to be optimal for a given predicted future … but how will it perform under other possible scenarios
- Robust/resilient decision or policy
  - one that has *the ability to perform reasonably well under a wide range of possible futures*
- Strategies for developing more robust policies
  - **Anticipatory**: scenario analysis, multiple policy instruments for comprehensive, coherent action driving multiple, diverse and ideally modular options
  - **Adaptive**: built-in policy adjustments, effective policy review and learning (governance) *(adapted from Twomey et al, forthcoming)*

# Robust energy policy frameworks for invest-ment into future grids

- What will be different for future grids?
  - High renewables
  - Distributed generation
  - Storage? EVs? DSP?
  - *Other surprises*
- Real challenge not getting single policies right, but framework
- Hence, explore robustness of energy policy frameworks in "challenge" scenarios incorporating these elements



# Specific project objectives

- Development and application of interdisciplinary policy assessment framework to better understand and assess existing, proposed policy options for driving appropriate investment in electricity industry given its unique technical, economic and wider social characteristics.
  *Key focus on coherence and comprehensiveness of policy framework*
- Development of high level (i.e. focused on broader policy relevant perspectives) quantitative analysis tool for exploring potential impacts, associated uncertainties of different policies on future electricity portfolios.
  *Key focus on modelling uncertainties*
- Application of policy assessment framework and analysis tool to develop high level insights on coherent and comprehensive climate and energy policy frameworks for driving appropriate investment in the future grid.
  *Key focus on maximising synergies, minimising possible conflicts between multiple policy instruments.*

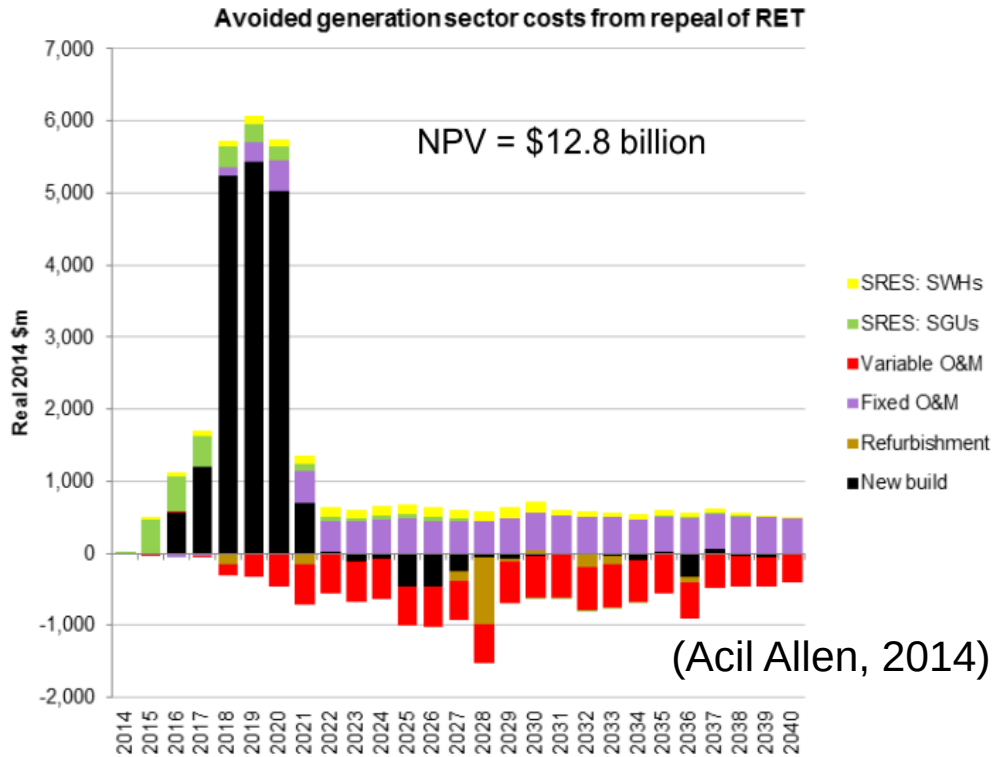
# Robust energy policy frameworks – *3 policy pillars*

| 1. Regulation | 2. Market Design | 3. External Policy Drivers |
|---|---|---|
| • Transmission network planning<br>• Distribution network planning<br>• Grid codes | • Fundamental market design<br>• Spot market rules<br>• Ancillary service market rules | • Carbon policies<br>• Renewable & energy efficiency policies<br>• Fuel policies<br>• Broader relevant policies |

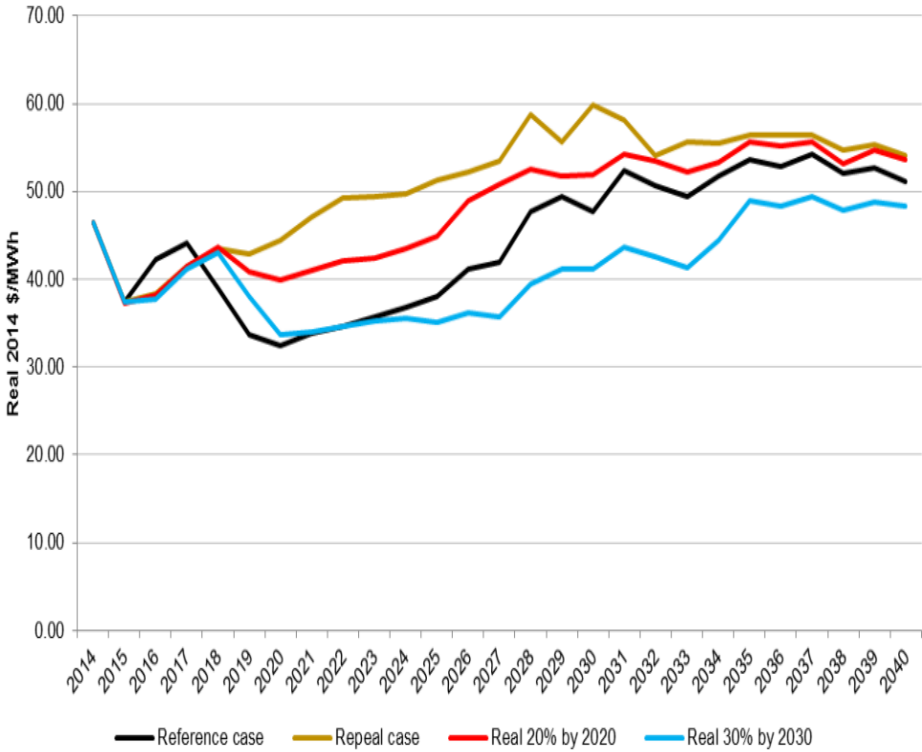
- Most policies will affect all three (complex and interrelated)
- Assessment of any policy must be **highly contextual**
  - Impact of a particular policy depends heavily upon surrounding policy settings
  - Subtle and seemingly distantly related factors can have a big influence

# Role of modelling - *eg. Acil Allen for RET Review*

- RET will raise overall industry costs but reduce prices
  - but modelling of industry costs more robust than modelling of wholesale market prices
  - and economic benefits don't usually include transfers between producers and end-users, focus should be on cost-reflective prices




(Acil Allen, 2014)



# But what of uncertainty in Acil Allen modelling?

## Sensitivities

- Sensitivities have been run for lower electricity demand and for a shadow carbon price
- Lower electricity demand utilises low economic growth scenarios from AEMO/IMO and holds off-grid/embedded generation flat
  - Reference case, Real 20% and Real 30%
- A Carbon shadow price is assumed to be linked to European permits and commencing in 2021: price is around A$9.50/tonne CO2-e, escalating at 3%

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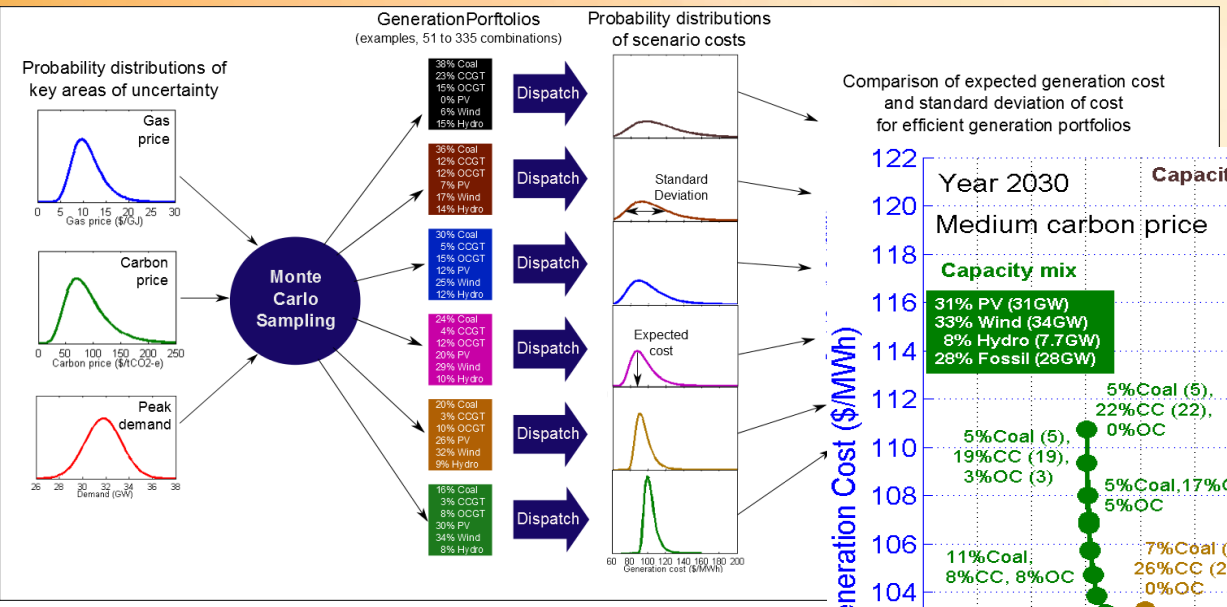
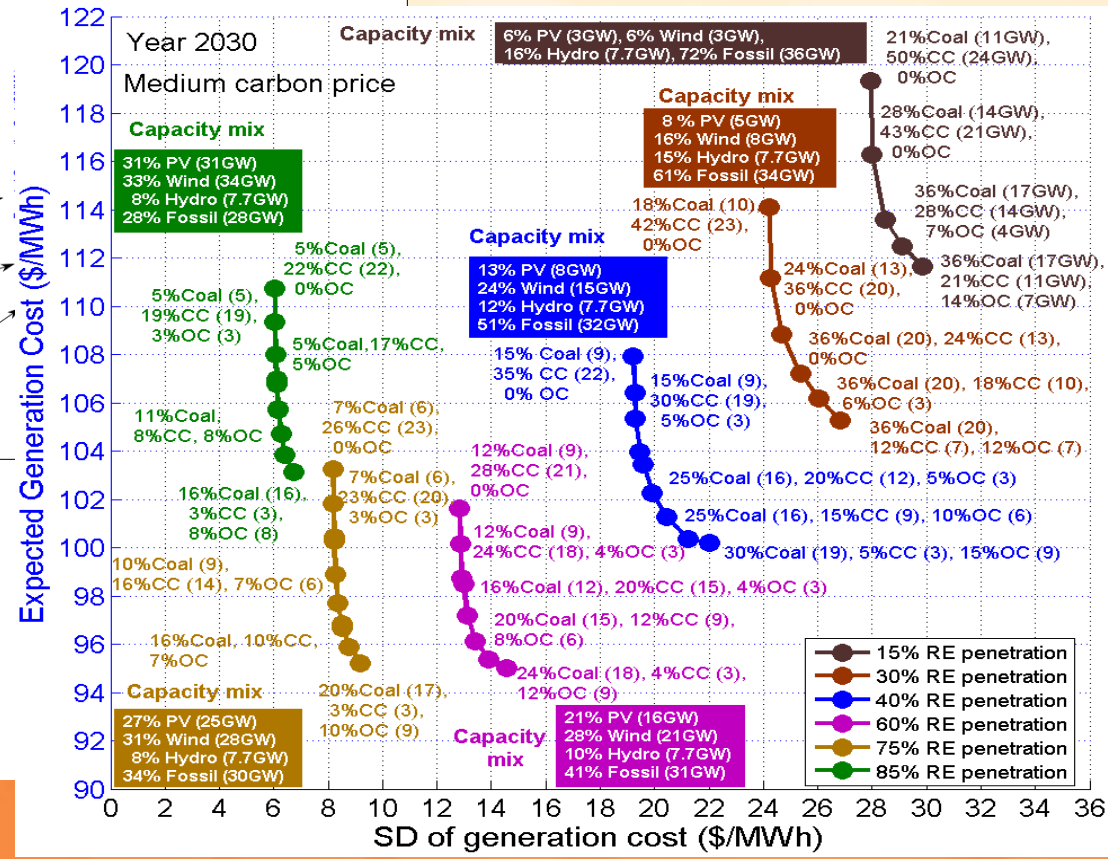
# Other possible approaches to uncertainty

- More scenarios and sensitivities, computational multi-scenario simulation
- More formal modelling of uncertainties and tradeoffs…




(Vithayasrichareon et al, 2014)



# Ongoing work on policy development insights - *Designing electricity mkts for high RE penetrations*

- J. Riesz, M. Milligan, Invited overview article for Wiley Interdisciplinary Reviews – Energy and Environment (WIRES). Accepted (in press)

| Renewable technologies can be: | | Therefore markets should ensure: |
|---|---|---|
| Variable & Uncertain | → | Flexibility |
| Low SRMC | → | Effective investment signals |
| Non-synchronous | → | Suitable grid codes |

# Ongoing work on policy development insights – *eg. Optional Firm Access Model*

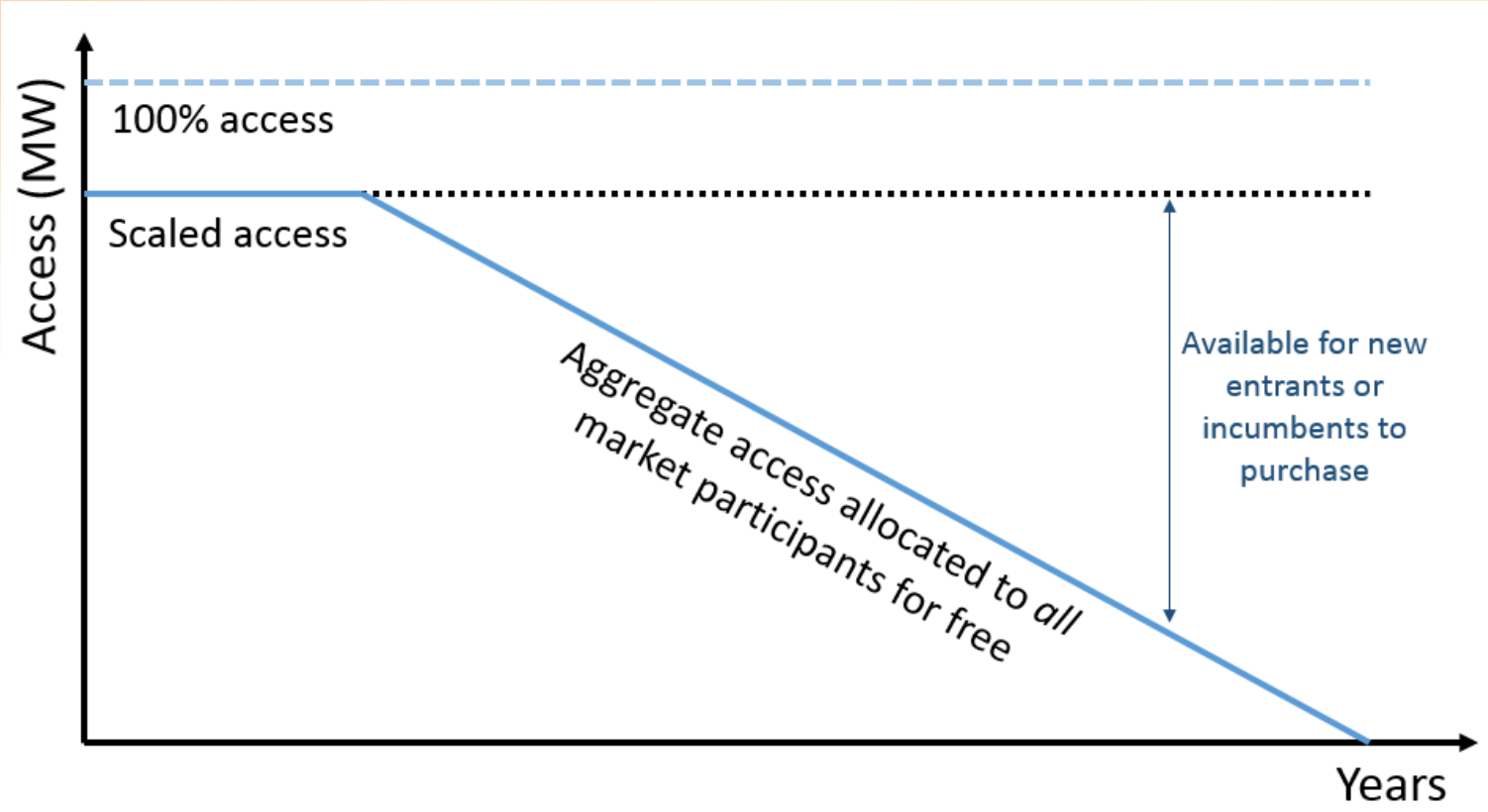
**CEEM Working Paper (May 2014)**

Grandfathering creates barriers to entry and exit, and exacerbates competitive disadvantage for new entrants.

Propose instead that existing network access is auctioned.

OR

New entrants provided with scaled access on equal footing with incumbents.



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# Much more to be done

**Table I.1** Summary of progress *(IEA Technology Perspectives, 2013)*

| On track? | Status against 2DS objectives | Policy Recommendations |
|---|---|---|
| Renewable power | On track to meet 2DS objectives in terms of absolute generation and investment levels.<br>Concentrating solar power, offshore wind, enhanced geothermal not advancing quickly enough. | ▪ For more mature markets and technologies, policies to enable greater market and system integration of higher penetrations of variable renewables are vital.<br>▪ For less developed markets and technologies, strategies should focus on market expansion or stimulating early-stage deployment.<br>▪ Policies must be predictable and transparent.<br>▪ Markets must be designed to allow recuperation of capital cost of investments. This is particularly important for technologies with very low marginal costs. |
| Nuclear power | Projected 2025 capacity 15%-32% below 2DS objectives.<br>Both new-build activity and long-term operation of existing reactors required to meet 2DS goals. | ▪ More favourable electricity market mechanisms and investment conditions required to de risk investments and allow investors to recuperate high upfront capital cost.<br>▪ Post-Fukushima safety upgrades should be quickly implemented to foster public confidence. |
| Gas-fired power | Share in thermal generation has increased at the expense of coal in some regions, but not all. | ▪ Higher carbon prices and other regulatory mandates are required to drive coal-to-gas switching outside the United States.<br>▪ Development of unconventional gas resources would help bring down gas prices and potentially trigger coal-to-gas switching in regions that currently rely heavily on coal. Scaling up unconventional gas extraction requires careful regulation and monitoring, in order to avoid adverse effects on the environment. |
| Coal-fired power | Growth is outpacing increases in generation from non-fossil energy sources.<br>Projected global coal demand exceeds 2DS levels by 17% in 2017, higher than 6DS pathway. | ▪ Governments must explicitly recognise the impact of increasing coal-fired power generation.<br>▪ To reduce the impact of increasing coal use, ultra-supercritical units should be installed unless there is strong reason not to do so.<br>▪ Pricing and regulation that reduce $CO_2$ emissions, control pollution and reduce generation from inefficient units are vital. |
| CCS | Capture capacity of projects currently operational or in pipeline is only 25% of 2DS 2020 target.<br>Still no large-scale integrated projects in power sector; and few in industry. | ▪ Governments must show real financial and policy commitment to CCS demonstration and deployment.<br>▪ Near term policies should be supported by credible long-term climate change mitigation commitments.<br>▪ Recognise the large investments and long-lead time required to discover and develop viable storage capacity.<br>▪ Address $CO_2$ emissions from industrial applications and introduce CCS as a solution. |
| Industry | Reasonable progress in improving energy efficiency, but there remains significant potential to deploy best available technology and optimise processes. | ▪ Implement policies to ensure that new capacity is developed with best available technology and that industrial plant refurbishment projects are promoted to meet energy efficiency targets.<br>▪ Measures to facilitate access to financing are vital.<br>▪ Particular efforts are needed to improve energy efficiency in light industry and SMEs.<br>▪ To avoid technological lock-in of inefficient technology in developing countries, technology transfer efforts must be enhanced. |

Not on track | Improvement, but more effort needed | On track, but sustained deployment and policies required

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# Thank you… and *questions*

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