



Electricity Futures for Australia: What Could They Look Like?

Luke Reedman | Presentation to AIE/EA, Newcastle
15 May 2012

ENERGY TRANSFORMED FLAGSHIP
www.csiro.au



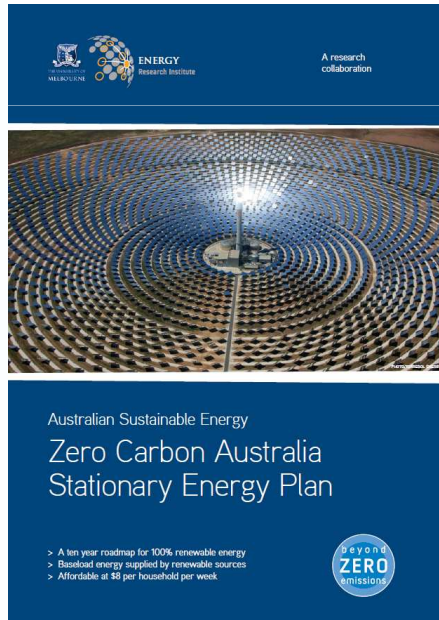
Outline

- Wide range of views
- Examples
 - External
 - CSIRO
- Differences
- Gaps
- Where our work is going

Wide range of views

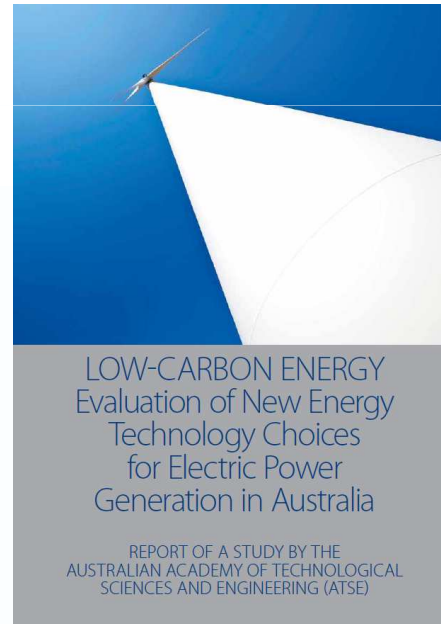
Examples of different views

THE GARNAUT REVIEW 2011

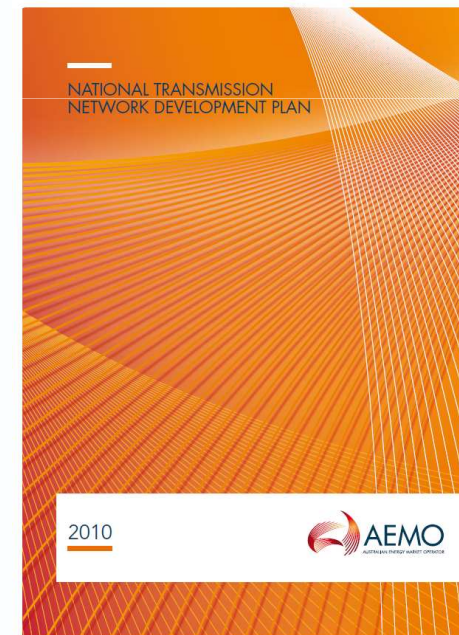


STRONG GROWTH, LOW POLLUTION

MODELLING A CARBON PRICE

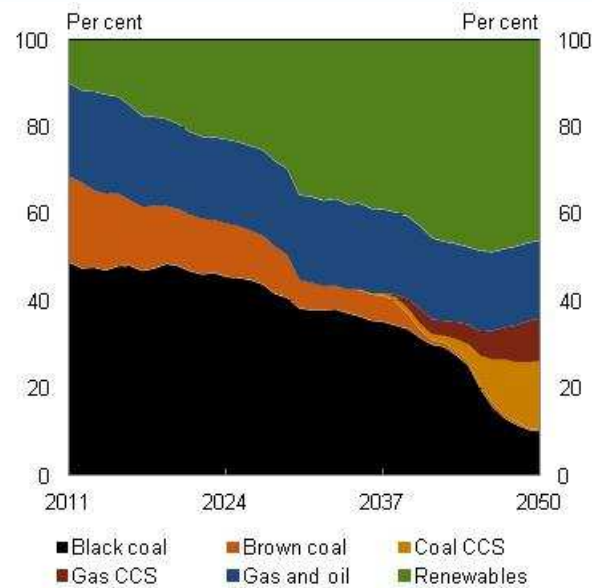


DRAFT ENERGY WHITE PAPER
STRENGTHENING THE FOUNDATIONS FOR
AUSTRALIA'S ENERGY FUTURE

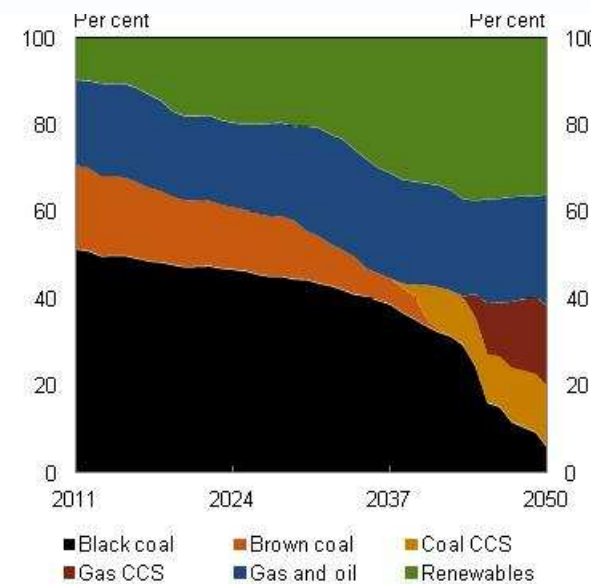


Strong growth, low pollution – Gov Policy

SKM-MMA

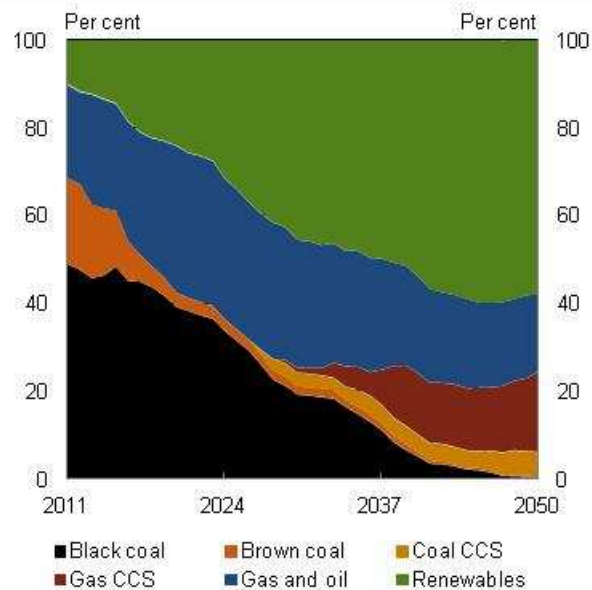


ROAM

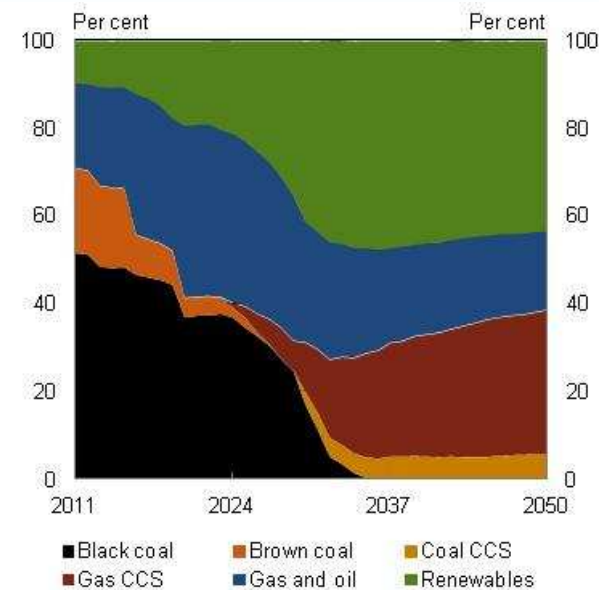


Strong growth, low pollution – High-price

SKM-MMA



ROAM



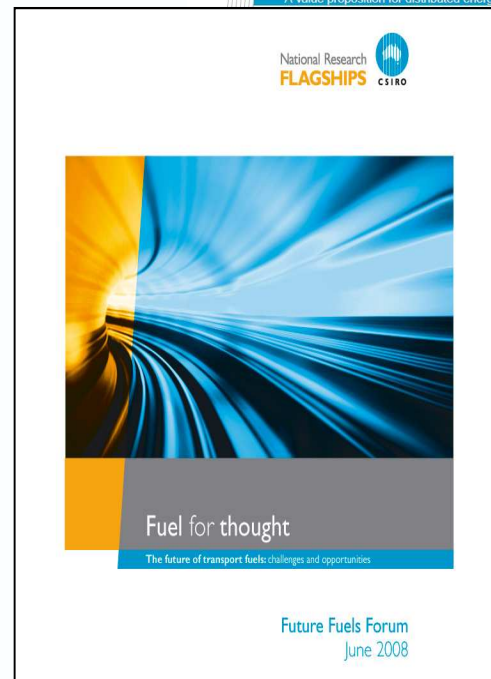
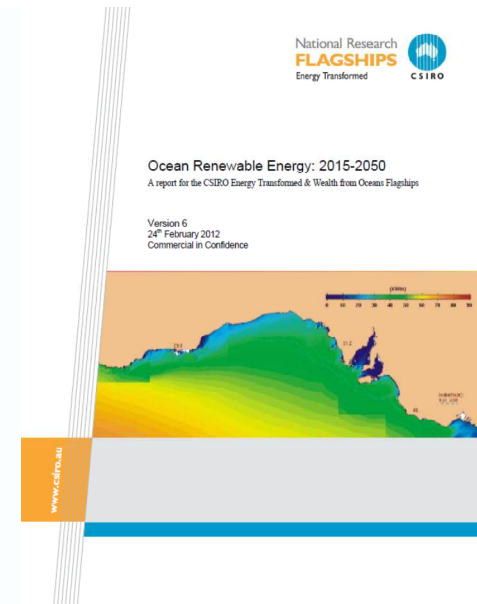
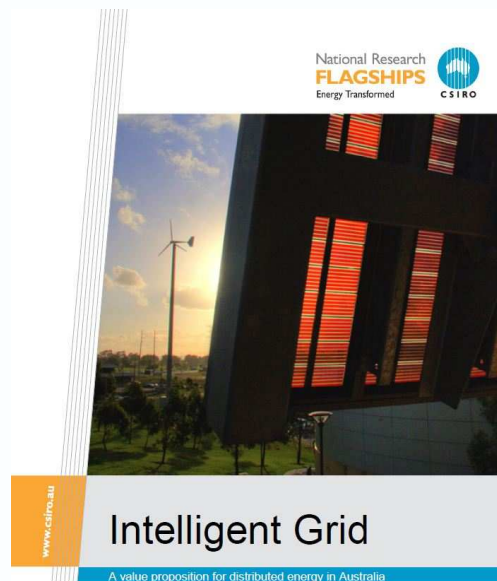
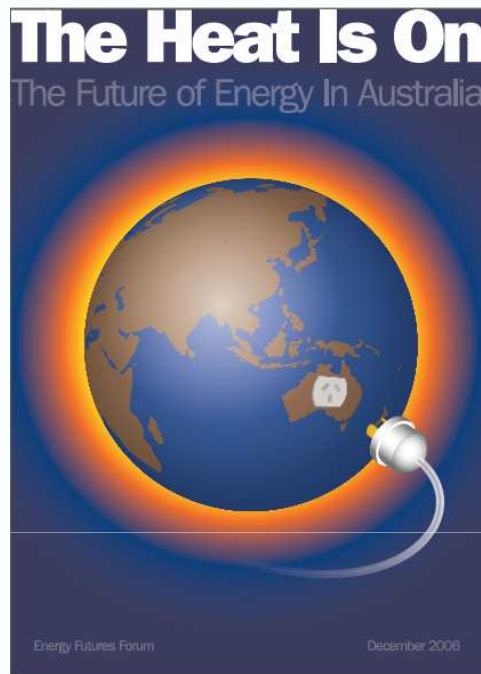
National Transmission Network Development Plan (NTNDP)



Zero Carbon Australia 2020

- The starting position of the plan is that CO₂ level must be reduced to between 300-350ppm
- “What if we were to try and build a 100% renewable energy system to power the Australian economy in just 10 years? How could we possibly do that, and what would be the cost?”
- Considers currently available technology:
 - 60% concentrating solar thermal (CST) with 17hr molten salt storage (gross 220MWe (net 217 MWe) modules air-cooled, capacity factor around 72%, effectively baseload, 12 sites each with installed capacity 3,500MWe per site)
 - 40% wind (48,000MWe capacity, average 30% capacity factor, 6,400 x 7.5 MW wind turbines in 23 geographically diverse locations)
 - backed up by 2% crop waste biomass (co-firing at CST plant sites, pelletised fuel source delivered to sites by rail) and hydro (existing plant discounted to account for future drought).
- Most of the deployment occurs in 2015-2020, with 15,000MW of wind and 5,000MW CST operational by 2015

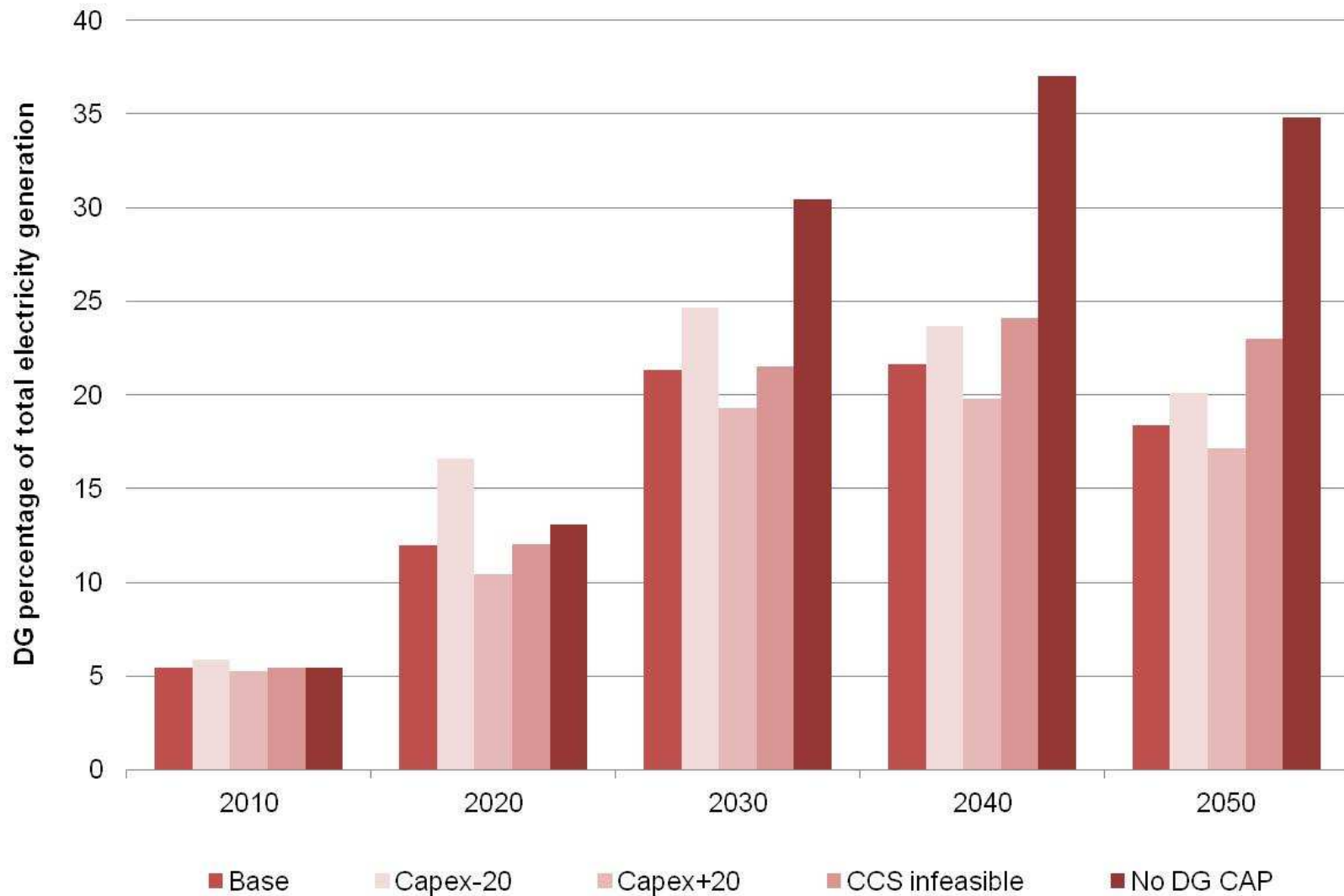
Ours...



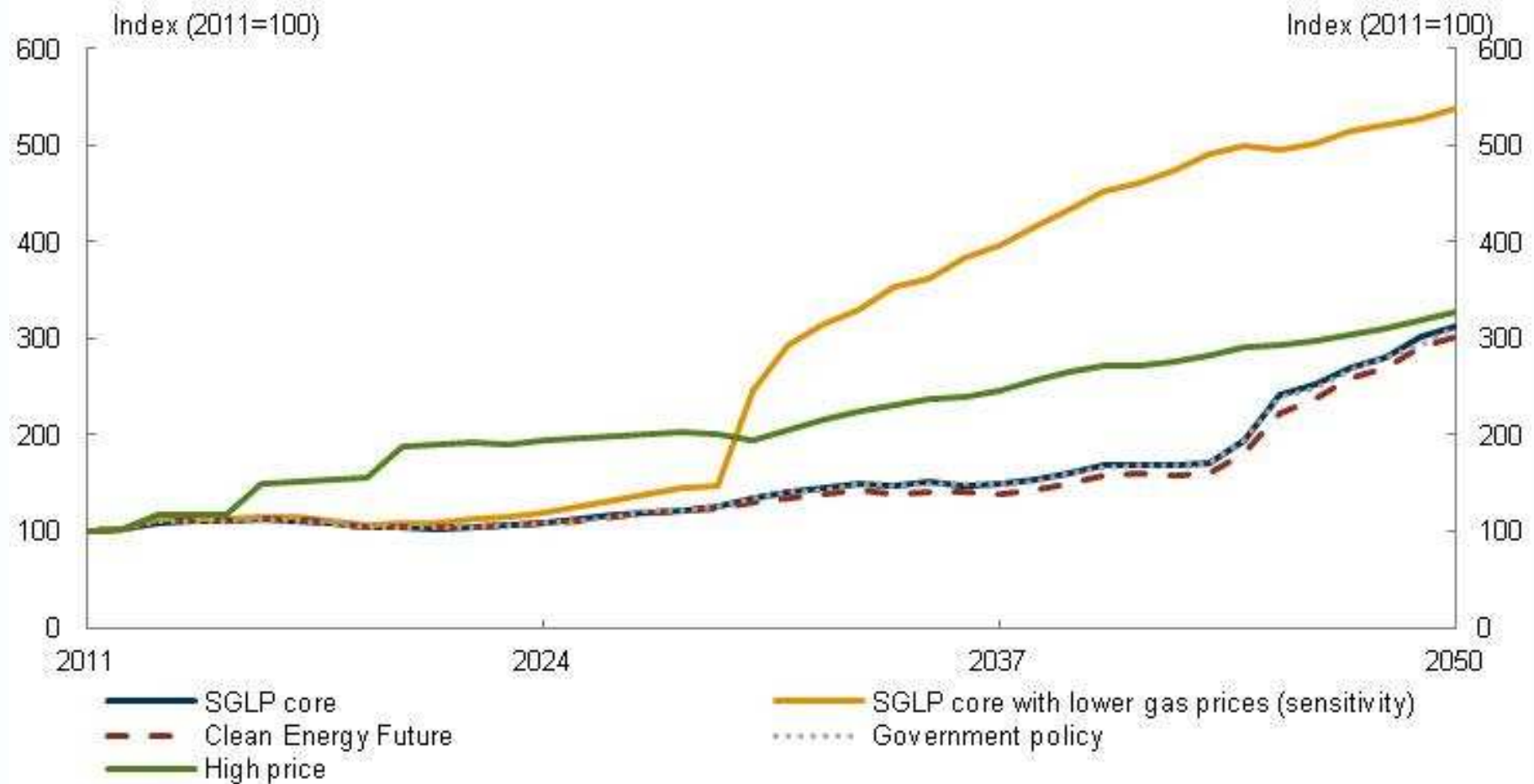
Why the difference?

- Focus
- Assumptions
- Models
- Technology coverage
- Spatial/temporal scale

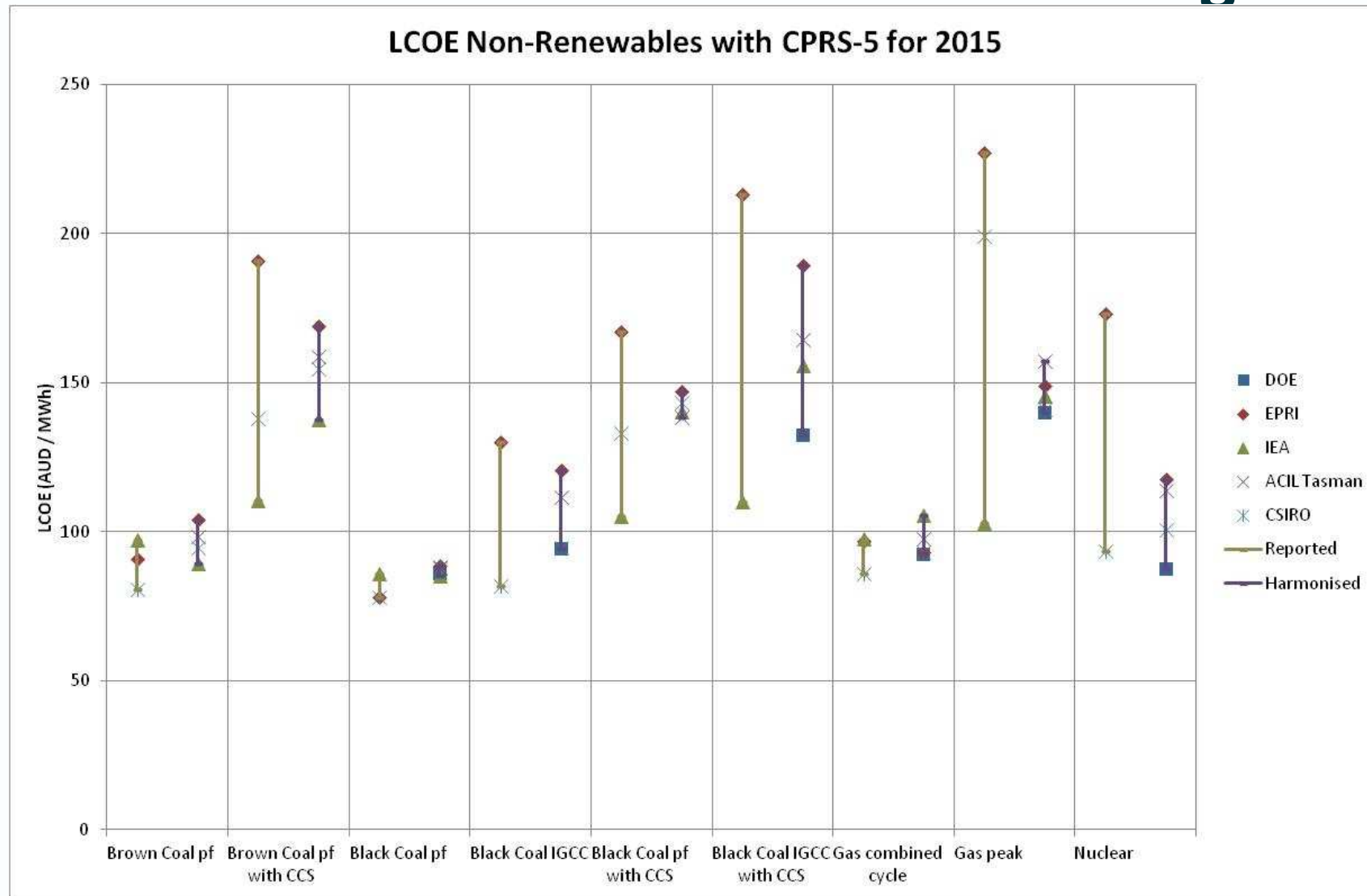
Example of sensitivity cases



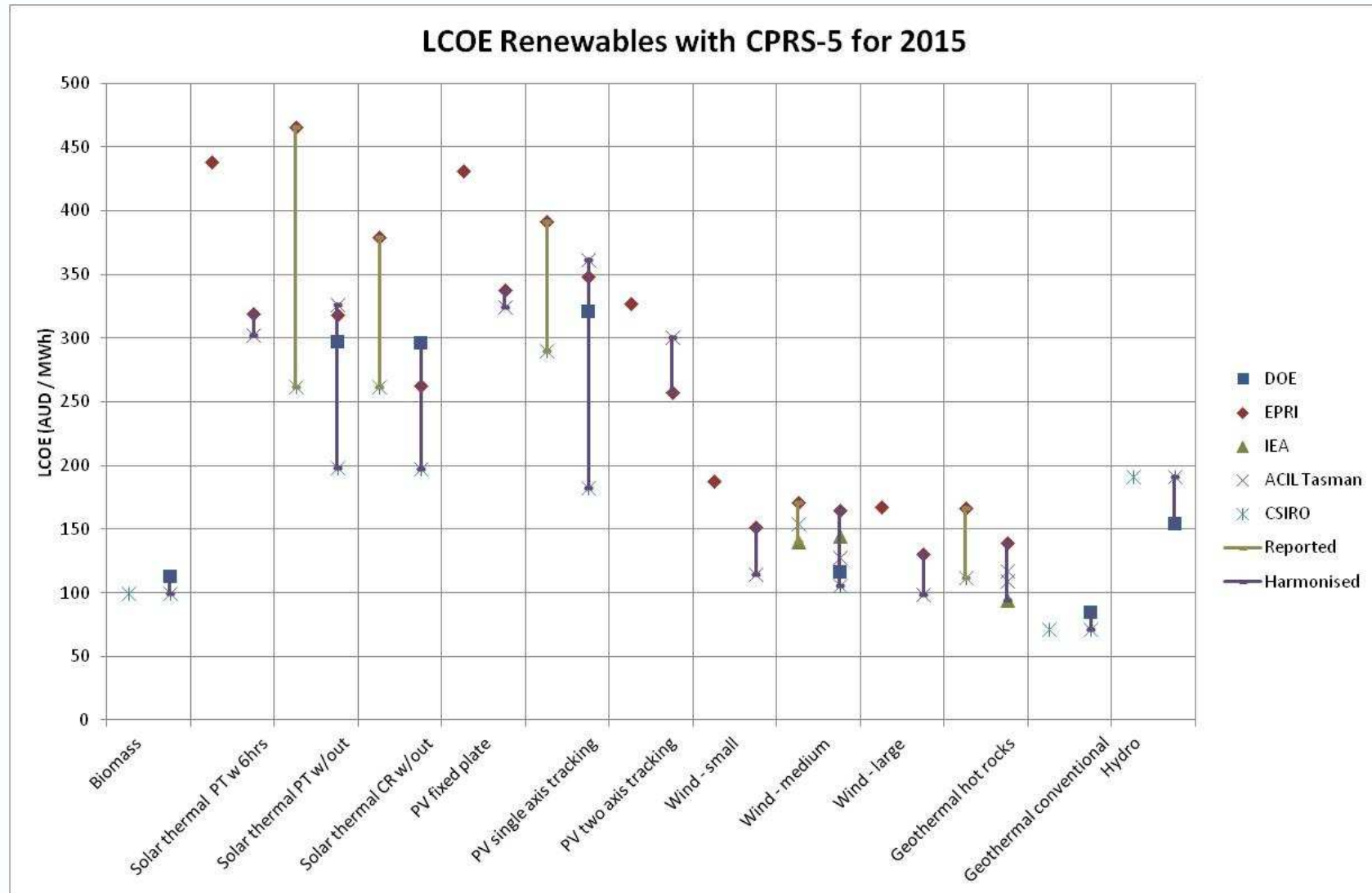
Gas price uncertainty



Future cost of low-emission technologies

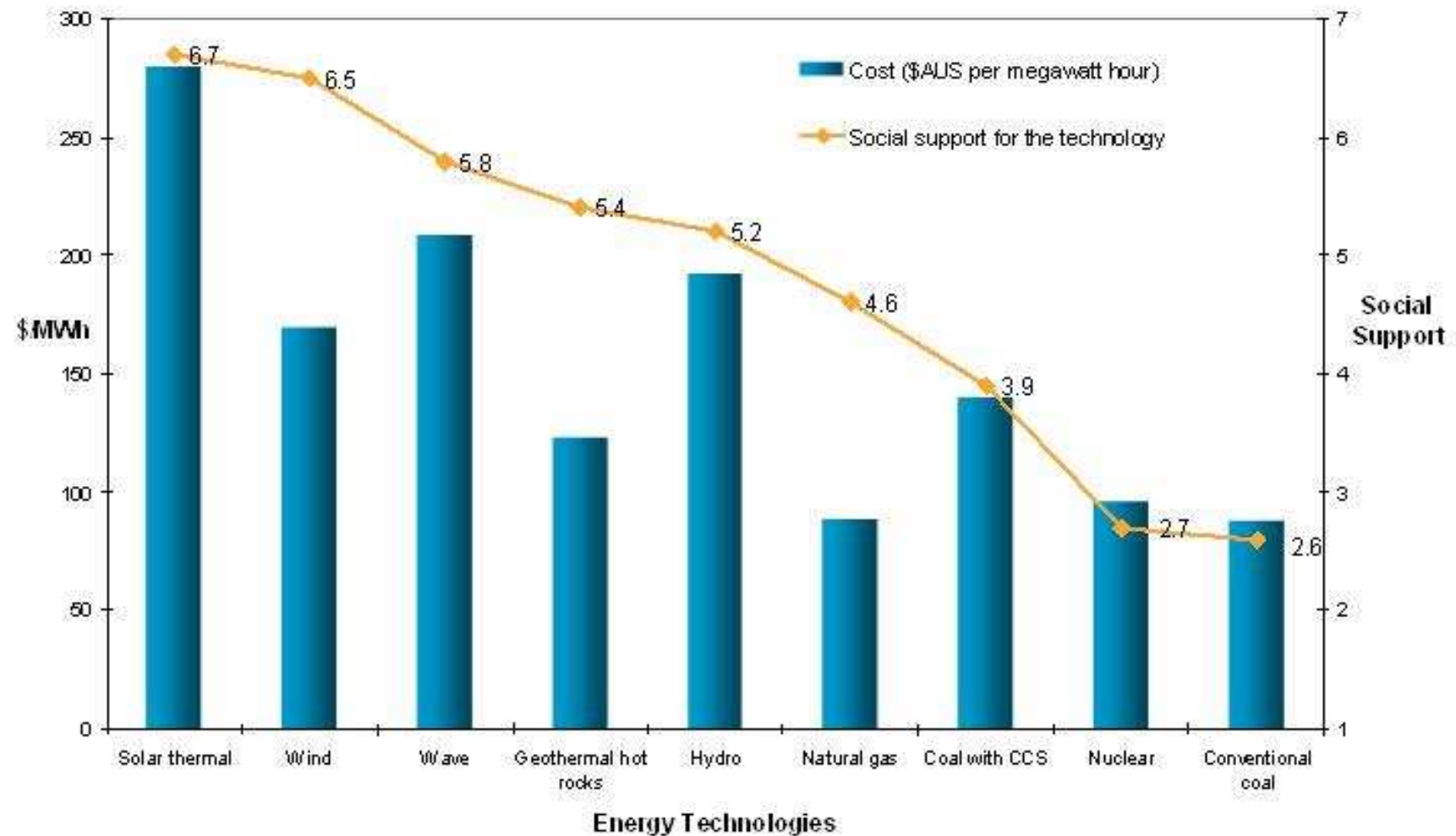


Future cost of low-emission technologies



What about real people?

Social acceptance versus cost



Web simulator under development

Public Web Energy Simulator

ws-esm-cbr.csiro.au:8080/pwes/

Getting Started Imported From Firef... hi whitepages.com.au ... (1) dmg file - Web S...

Public Web Energy Simulator

Places

- CSIRO Home
- PWES Home

Actions

- Learn about PWES
- Configure a Scenario
- View Results

Instructions

Help

Glossary

About the Public Web Energy Simulator Scenario Configuration Results

Simple Configuration Advanced Configuration **Display more information by scrolling the mouse cursor over the label of interest.**

Decision Levers

Treatment of Greenhouse Gas Emissions

Greenhouse Emissions Regulation Carbon Price

Greenhouse Emissions Starting Price 0 \$22.5 50

Greenhouse Emissions Price Rate of Growth 0.0 5.0% 6.0

Technology Policy

Renewable Generation Target 0.0 20.0% 40

Technology Readiness: Carbon Capture and Storage 2030

Maximum Allowable Share of Intermittent Generation Medium

Nuclear Permitted? ☐ Yes ☒ No

Explore Assumptions

Fuel Prices

Gas Starting Price (\$) 6

Gas Price Growth Rate (%) 1.0

Energy Demand

Demand Growth 1.0 1.7% 2.5

Cost Assumptions

Capital Cost Estimates CSIRO 2011

Financial Data

Discount Rate (%) 7

I want to see

Energy

Electricity Retail Prices ☐ Electricity Wholesale Prices ☐

Electricity Generation by Technology ☐

Environment and Resources

Greenhouse Gas Emissions ☐ Pollution production ☐

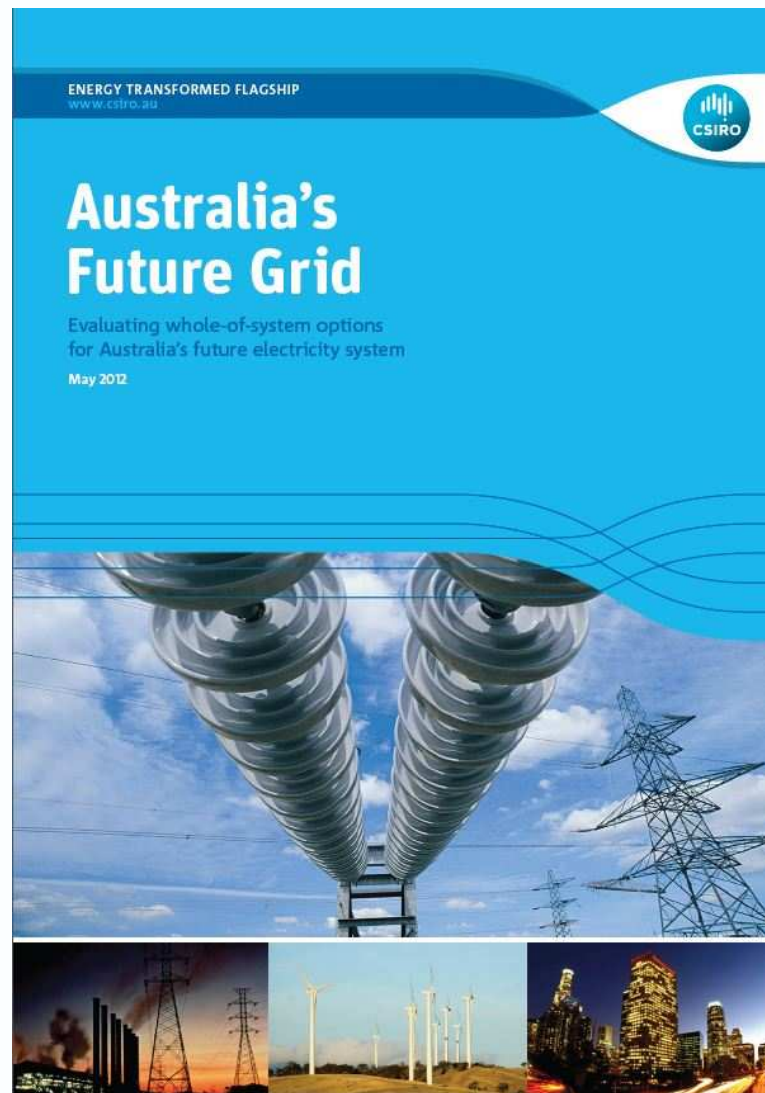
Fuel Consumption ☐ Water Consumption by Technology ☐

Controls

Run scenario At least one check box must be ticked under 'I want to see' to enable the Run button.

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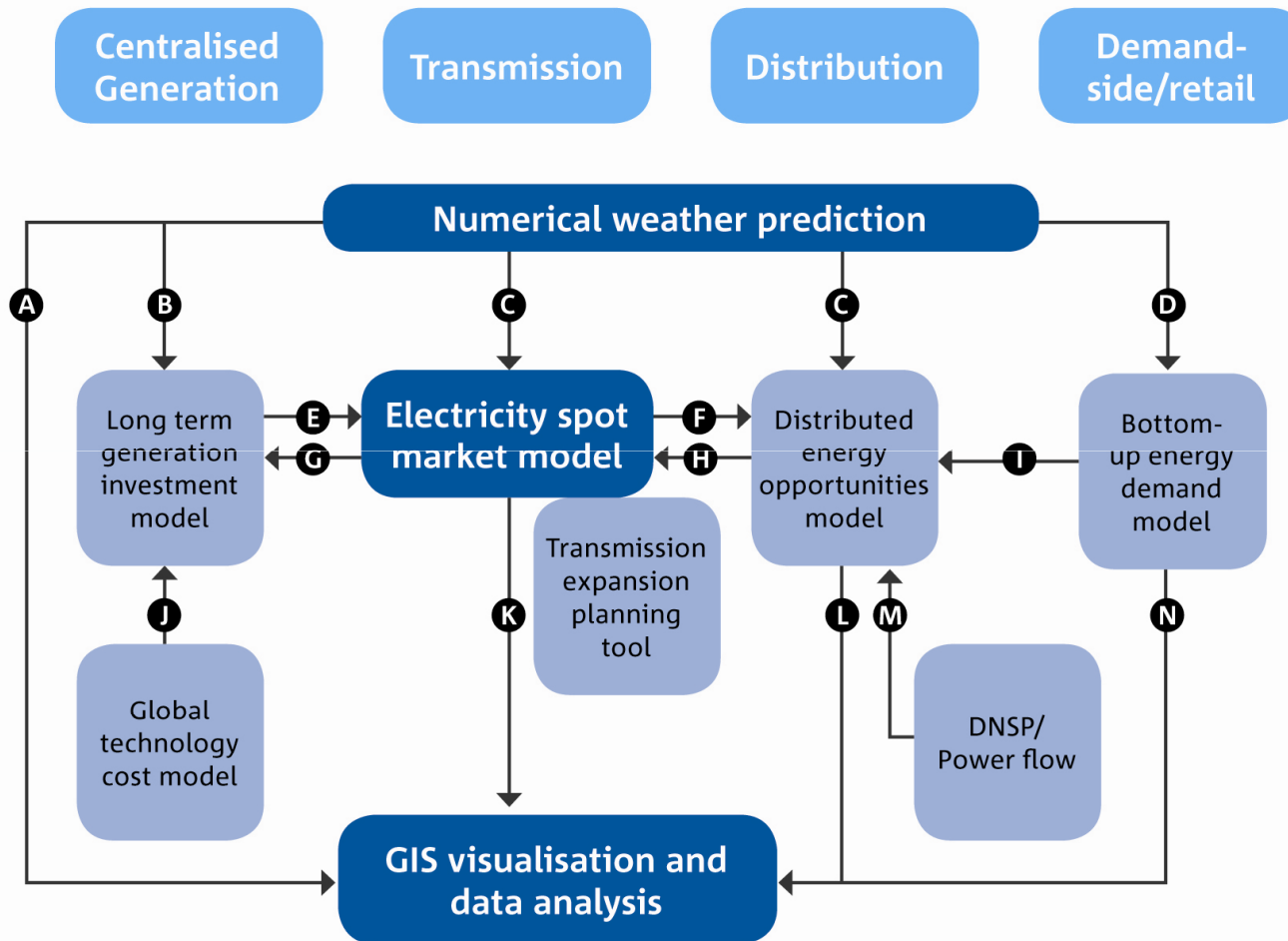
Our next adventure...



Possible scenarios

POTENTIAL OPTION TO BE EXPLORED	ANALYSIS REQUIRED TO CREDIBLY EVALUATE
Status quo / counterfactual	Project the most efficient, cost-effective electricity system pathway and technology mix for continuation of the current system that includes existing policy settings
High penetration of renewables	<p>Comparison of portfolio of renewables intermittent output with demand load profiles</p> <p>Analysis of output potential of 'baseload renewables' - geothermal, solar thermal with storage, and biomass</p> <p>Analysis of potential of large scale electrical and thermal storage options</p>
Australia as a clean energy importer (or exporter)	<p>Impact of natural gas export parity pricing in Australia</p> <p>Demand for and relative cost of current and future low emission electricity supply from (and to) SE Asia</p> <p>Cost, efficiency and feasibility of high voltage transmission lines</p>
High demand-side participation, including distributed generation	<p>Characterisation of the cost and performance of energy efficiency, fuel substitution and distributed generation options inclusive of distribution system requirements</p> <p>Alternative demand growth and load profiles under different levels and types of demand side participation</p> <p>Likely and managed EV recharging profiles and levels</p>
Socially constrained / unconstrained technology adoption	<p>Potential social limits to technology adoption – wind setback rules, CSG contribution to gas supply, nuclear power, CCS</p> <p>Impact of social limits on quantity and/or costs of electricity from affected technologies</p>
Evolution under high uncertainty	<p>Estimated impact of uncertainty on investment in transmission, distribution and generation infrastructure</p> <p>Characterisation of options for reducing uncertainty (e.g. renewable precincts), scale efficient network extensions</p>

How could it be done?



More information...

<http://www.csiro.au/Future-Grid-Forum>

What does it all mean?

Questions?

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w <http://www.csiro.au/Organisation-Structure/Flagships/Energy-Transformed-Flagship.aspx>

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