



Complexity and Uncertainty in Public Policy: a Scientist's Perspective

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- Complexity
- Uncertainty
- Government policy uncertainty
- Opportunities for anti-science
- Communication
- Knowledge gaps
- Funding gaps
- National priorities

- Public policy challenges in the modern world require expertise across a large range of disciplines covering most research fields in the natural and human sciences – the “Science”
- The Anthropocene – the era in which human activity is affecting all life on the planet – is an example, which requires all of Science to meet the challenges of climate change, food, water, energy, population and health
- There is no World or Australian government agency, research organisation or NGO with which has the Scientific expertise or the mission to address the challenges of the Anthropocene



A wide spectrum of Energy research:

– Technologies

- ▶ Solar Energy
- ▶ Nuclear Science
- ▶ Fusion Energy
- ▶ Fossil Fuels / CCS
- ▶ Hydrogen Fuel Cells
- ▶ Artificial Photosynthesis
- ▶ Biosolar

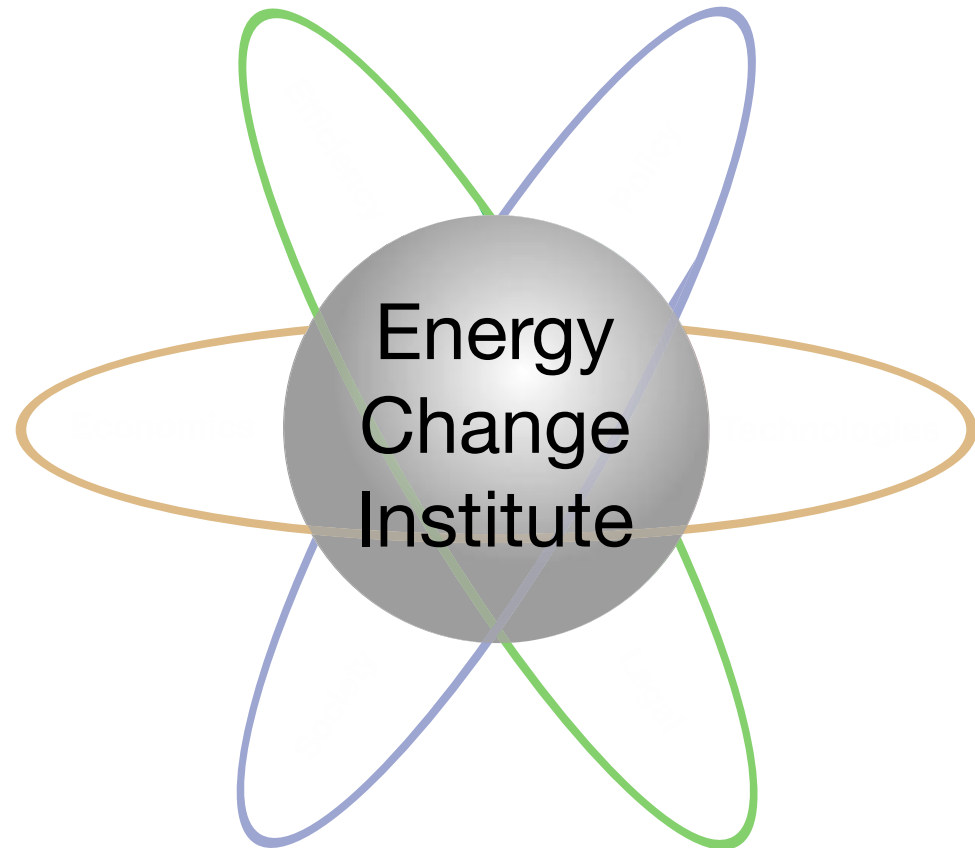
– Efficiency

– Economics

– Policy

– Regulation

– Sociology



Technology and policy neutral



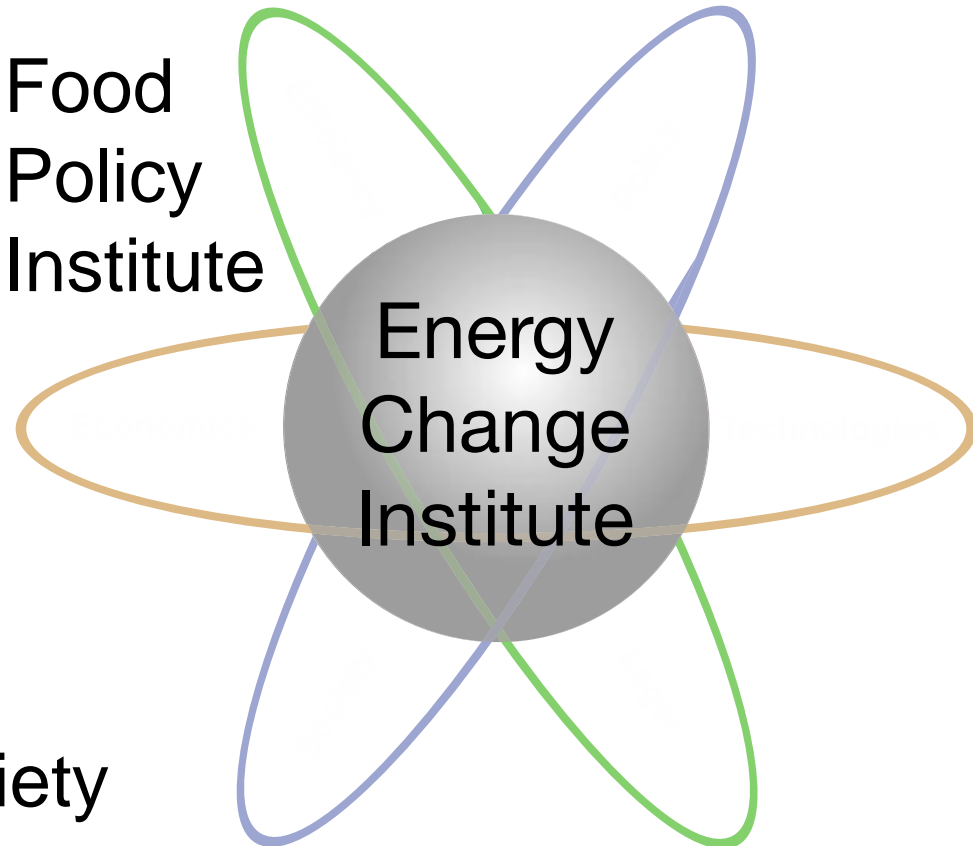
Climate Change Institute

Fenner School of
Environment and Society

National Centre for Epidemiology and Public Health

National Security College

Food
Policy
Institute



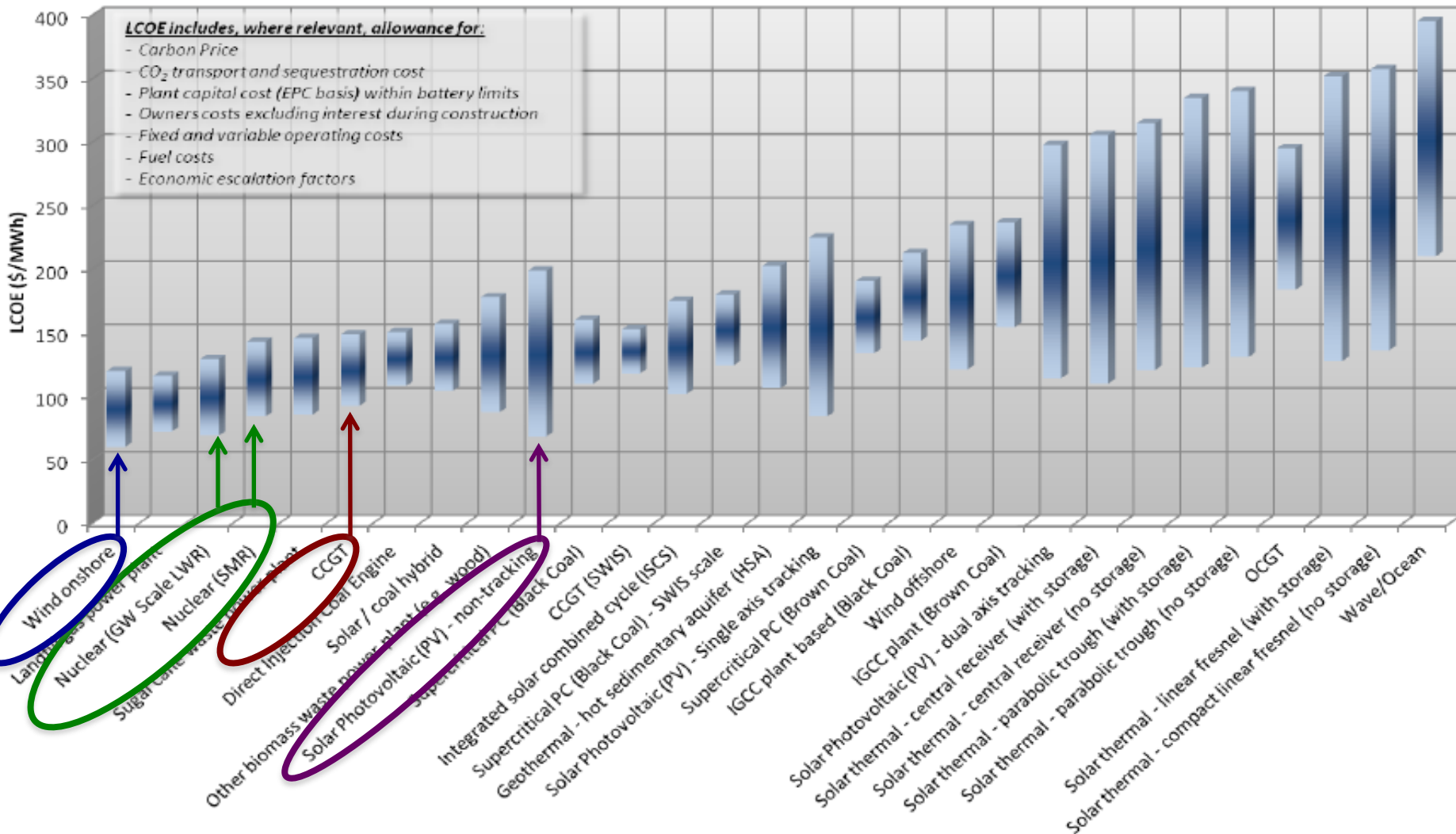
- Solving complex and often ill-defined problems creates large and difficult-to-quantify levels of uncertainty in the Science
- High levels of uncertainty can diminish buy-in by policy makers, funding agencies and the wider community
- Nevertheless, there is a responsibility on Science to articulate uncertainty even if the possible scenario outcomes for policy decisions are many and varied



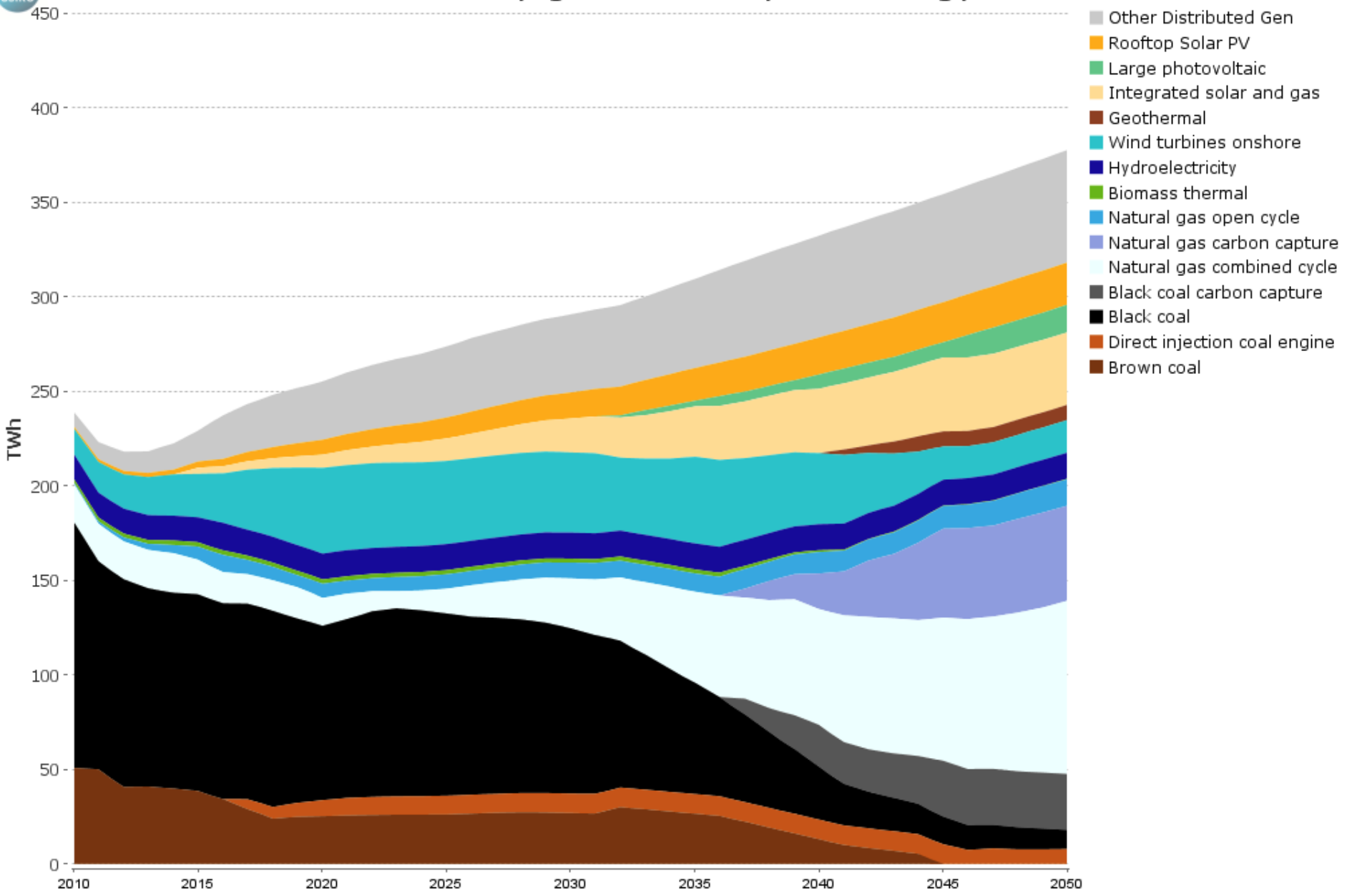
Scenario building - AETA

LCOE FOR 2020 TECHNOLOGIES (NSW*)

* Note: Default region is NSW except brown coal technologies (VIC) and SWIS scale (as specified)



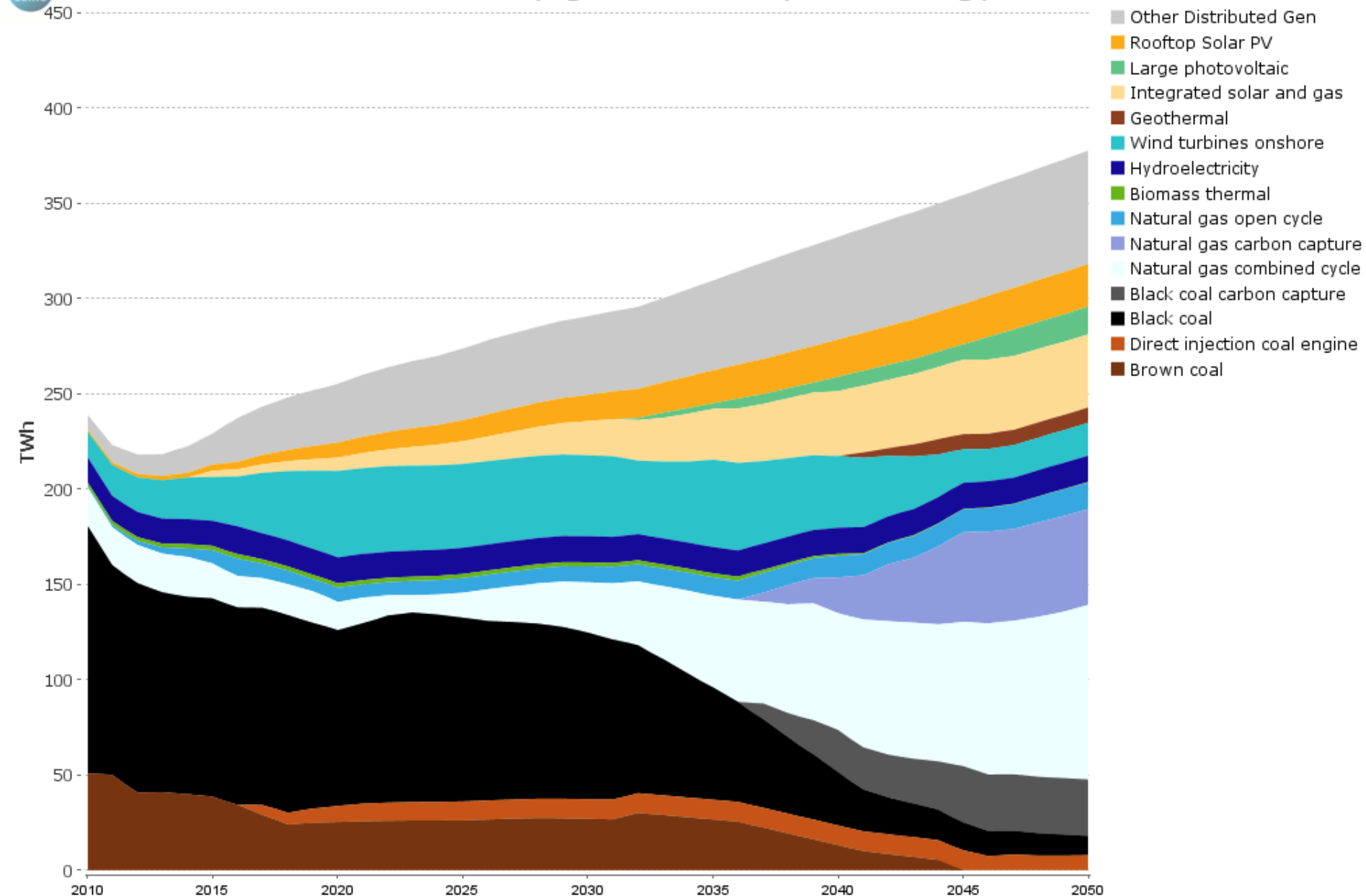
Electricity generation by technology



Source: Copyright Commonwealth Scientific and Industrial Research Organisation 2012-.
Chart based on user selected assumptions and generated by CSIRO's eFuture tool,
Electricity Simulation Model #1953. Conditions of use, see www.efuture.csiro.au (Background).

- The challenges of the Anthropocene face a policy vacuum for global societal/environmental responses
- Scientific uncertainty can act as a pretext for government policy uncertainty/paralysis – when the opposite is needed to provide a firm direction whose consequences can be tracked over time
- The short-term election cycle and multiple layers of government lead to disjointed and disconnected decision-making – where long-term, coordinated solutions are required

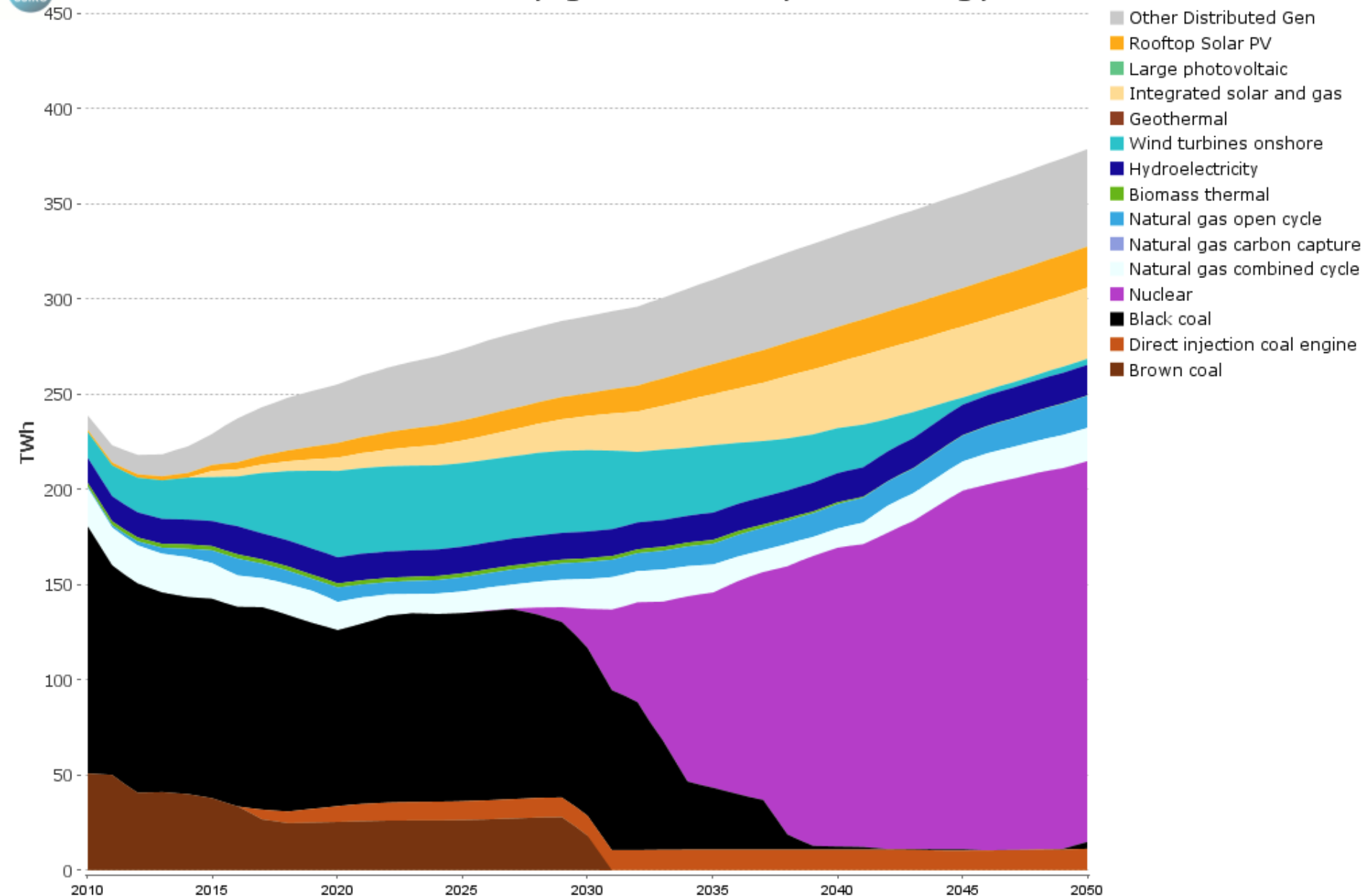
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- Uncertainty opens a window of opportunity for anti-science – scientists “don’t know what they’re doing”
- Information availability is increasing *via* the internet, with no vetting for scientific validity
- People can more easily cherry-pick information on the net that most closely matches their world view
- This presents greater opportunities for viewpoints to polarise sympathetically (rather than rationally) around anti-science perspectives

- The complexity and uncertainty surrounding the Science required to address wicked problems make communication *difficult*
- This provides a boost to simple, knee-jerk responses that may appeal to non-experts
- Opportunities to disseminate mis-information also abound, especially on the unregulated internet
- Thus public “debates” on complex science can be confusing - and can’t convey scientific consensus

FASTS — Federation of Australian Scientific and Technological Societies

When is Science Valid?

A Short Guide on How Science Works and When to Believe It

Is it useful to test ideas further by public debate in the media?

Ideas should always be tested, but an idea is only widely accepted when the majority of scientists vote with their feet on its usefulness.

Does a media debate between two scientists contribute to this process? **Not really.**

The reason is twofold. **First, a debate does not allow the full scrutiny required of evidence-based expert examination.** **Second, the majority view of expert scientists cannot be reflected by a debate.** In a debate, one adversary is pitted against another. This does not tell us if the majority of the scientific community are sitting on one side or the other.

It's like having a debate between one person who believes that the earth is flat, and another person representing the rest of the population who believes the earth is round.

- It is the policy of the ANU Energy Change Institute and of the ANU Climate Change Institute to:
 - present the scientific consensus (and answer questions)
 - but **NOT** to debate the science
- Perhaps this policy should be universal
- Reasons:
 - Complexity and uncertainty need to be articulated clearly, and not used to confuse
 - The correct forum for debate is in the scientific arena where all evidence is open to rigorous scrutiny
 - The adversarial one-on-one debating system does not reflect the true scientific consensus
 - Debates give oxygen to misinformation and anti-science

- Complexity and uncertainty can hide the real knowledge that is needed to address wicked problems
- Attempts to systematically identify perceived knowledge gaps may be more distracting than a random, inquiry-led knowledge evolution
- It is unlikely that setting prescriptive national Science priorities will address knowledge gaps in the solution of interdisciplinary wicked problems

Funding Gaps

- The complexity of the Anthropocene challenges leads to gaps in the funding for solutions
- The ARC and other National Competitive Grants Programmes are divided into discipline groups:
 - Biological Sciences and Biotechnology Engineering
 - Mathematics and Informatics
 - Humanities and Creative Arts
 - Physics, Chemistry and Earth Science
 - Social, Behavioural and Economic Sciences
 - **Trans-disciplinary Science ??**
- Trans-disciplinary and whole-of-science research funding should be recognized – Chief “Scientist”

- Immediate, close-to-home priorities often conflict with long-term, global priorities that address the challenges of the Anthropocene
- Responding to the challenges of the Anthropocene needs to become a national priority in a way that will assist - not conflict with - other economic, strategic and social priorities
- Imposing Science discipline priorities to address wicked problems can distract/misdirect the search for concealed knowledge needed to address them

We need:

- A whole-of-Science approach
- A whole-of-planet approach
- A whole-of-government approach
- To better communicate scientific uncertainty – trajectories and scenario building
- To minimise government policy uncertainty – to provide industry and community certainty

