Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA



Progress in energy transitions – some Australian and global perspectives

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Energy Transitions and Health – Where next?

Centre for Air Pollution, Energy and Health Research (CAR)

Melbourne Town Hall
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A destination – shaped by energy trilemma

Choose any two?

Balancing the 'Energy Trilemma'

Energy Security
The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand.

Energy Equity
Accessibility and affordability of energy supp across the population.

Environmental Sustainability
Encompasses the achievement of supply and demand-side energy efficiencies and the development of energy supply from renewabl and other low-carbon sources.

ENERGY SECURITY

"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 –

- *price, quality, safety, reliability, and security of supply of electricity; and*
- *the reliability, safety and security of the national electricity system."*

National Electricity Law (Schedule to the National Electricity (South Australia) Act 1996), s.7

ENERGY EQUITY

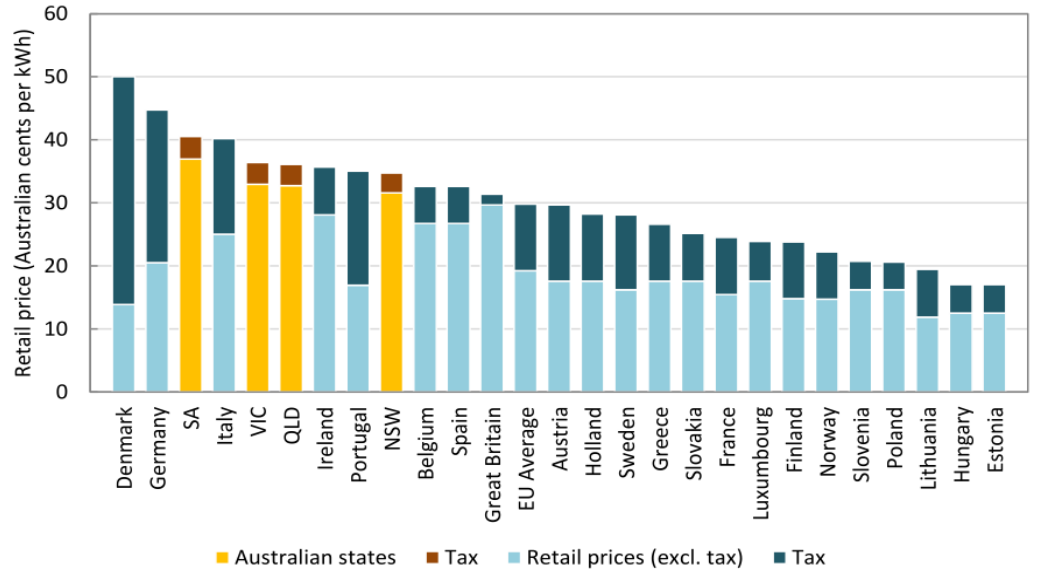
(World Energy Council, 2016)

ENVIRONMENTAL SUSTAINABILITY

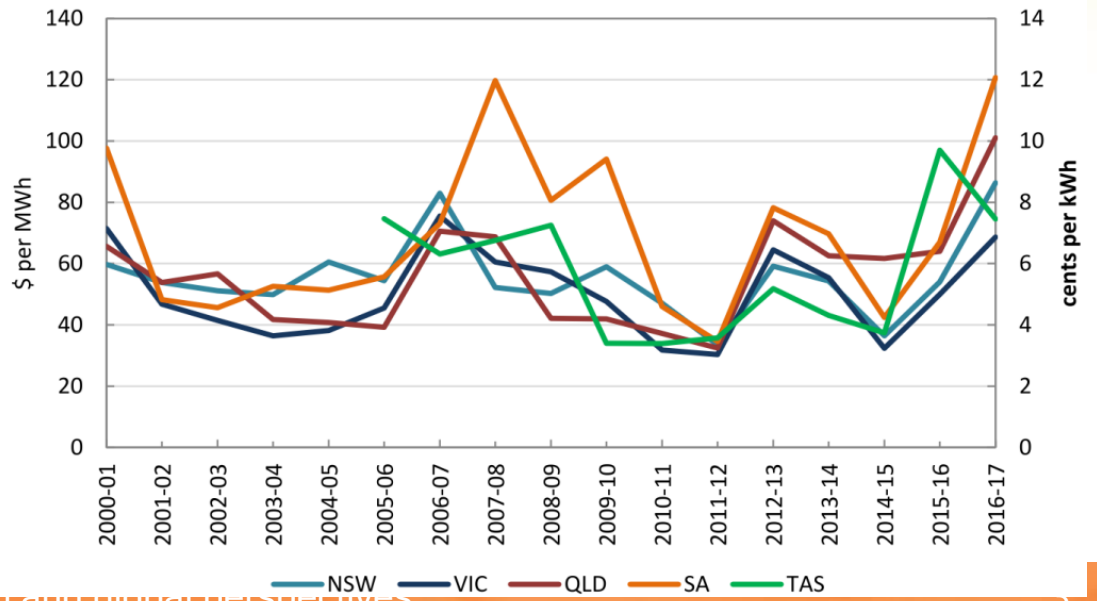
.. but you may get none

amongst world's most expensive, wholesale, retail electricity prices, reasonable reliability but growing concerns, amongst world's most emissions intensive electricity sector as well

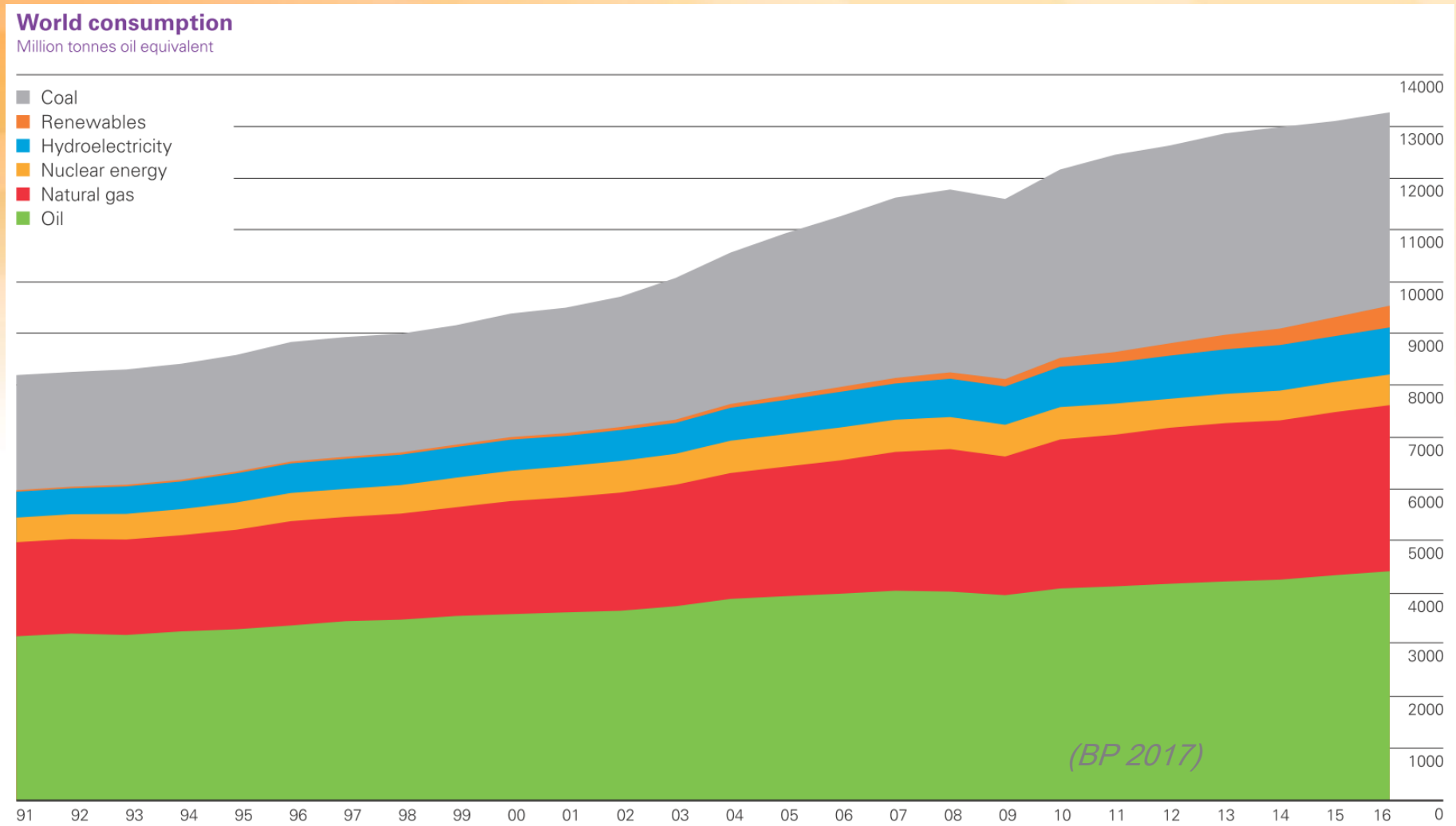
Figure 1.9: Comparison of residential electricity prices (before and after tax) (Australian cents per kWh) (May 2017 prices in Australia, 2015 prices in European countries)[62]



(ACCC, 2017)



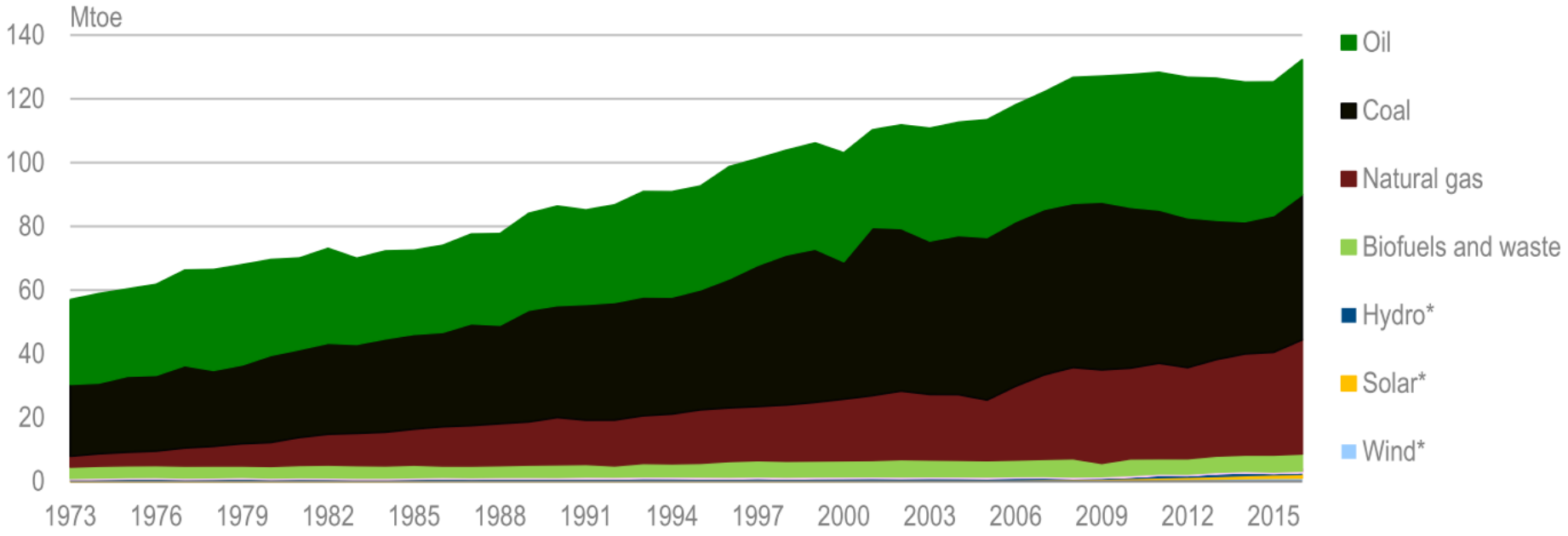
To date, globally



World primary energy consumption grew by 1.0% in 2016, well below the 10-year average of 1.8% and the third consecutive year at or below 1%. As was the case in 2015, growth was below average in all regions except Europe & Eurasia. All fuels except oil and nuclear power grew at below-average rates. Oil provided the largest increment to energy consumption at 77 million tonnes of oil equivalent (mtoe), followed by natural gas (57 mtoe) and renewable power (53 mtoe).

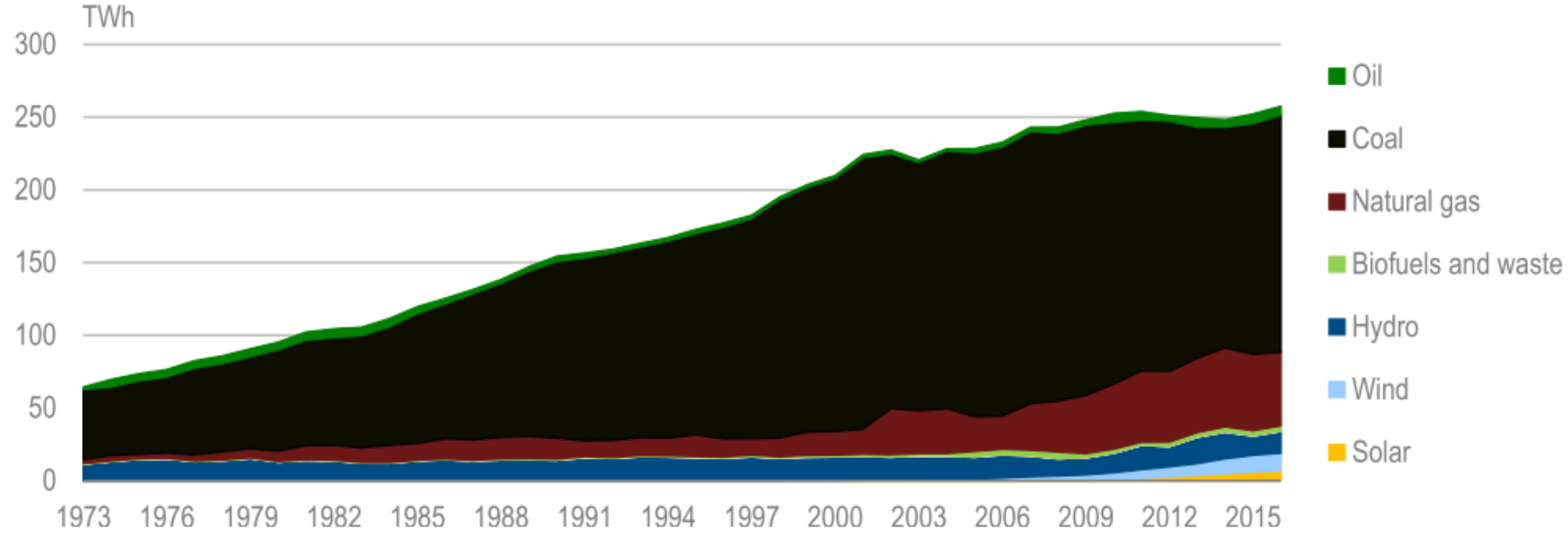
.. and in Australia

Figure 1.3 Total primary energy supply by source, 1973-2016

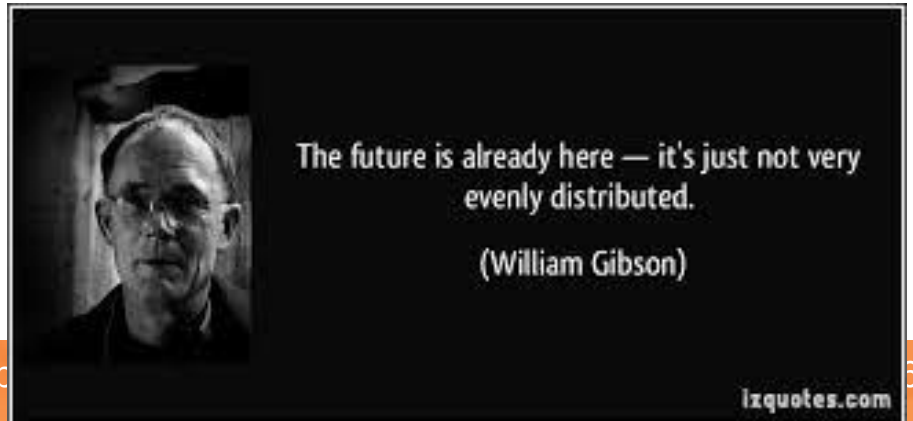


(IEA, Australian energy policy review, 2017)

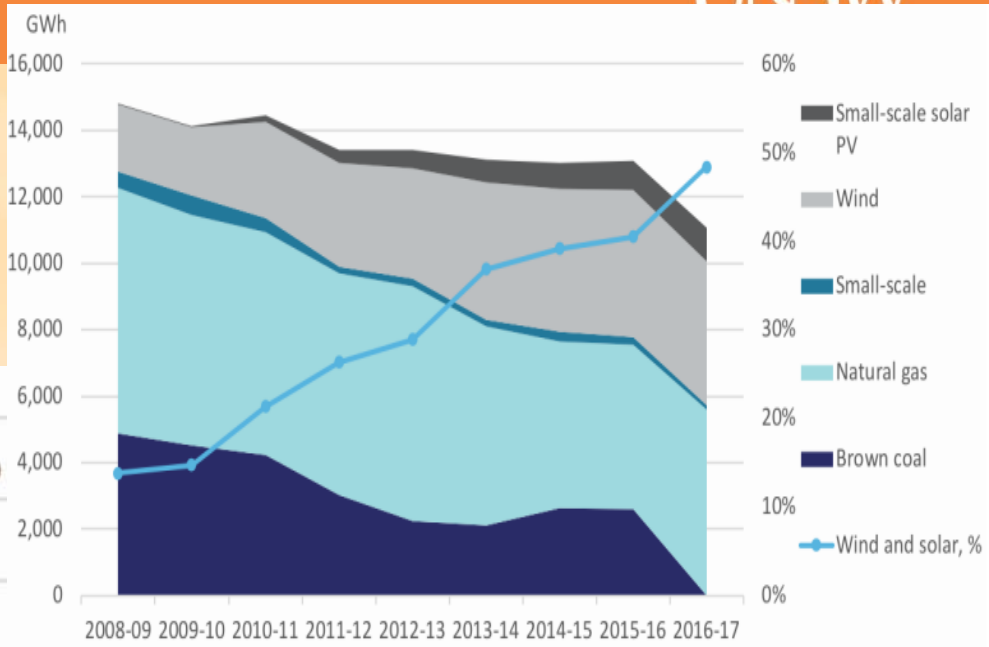
.. and for Australia's electricity sector

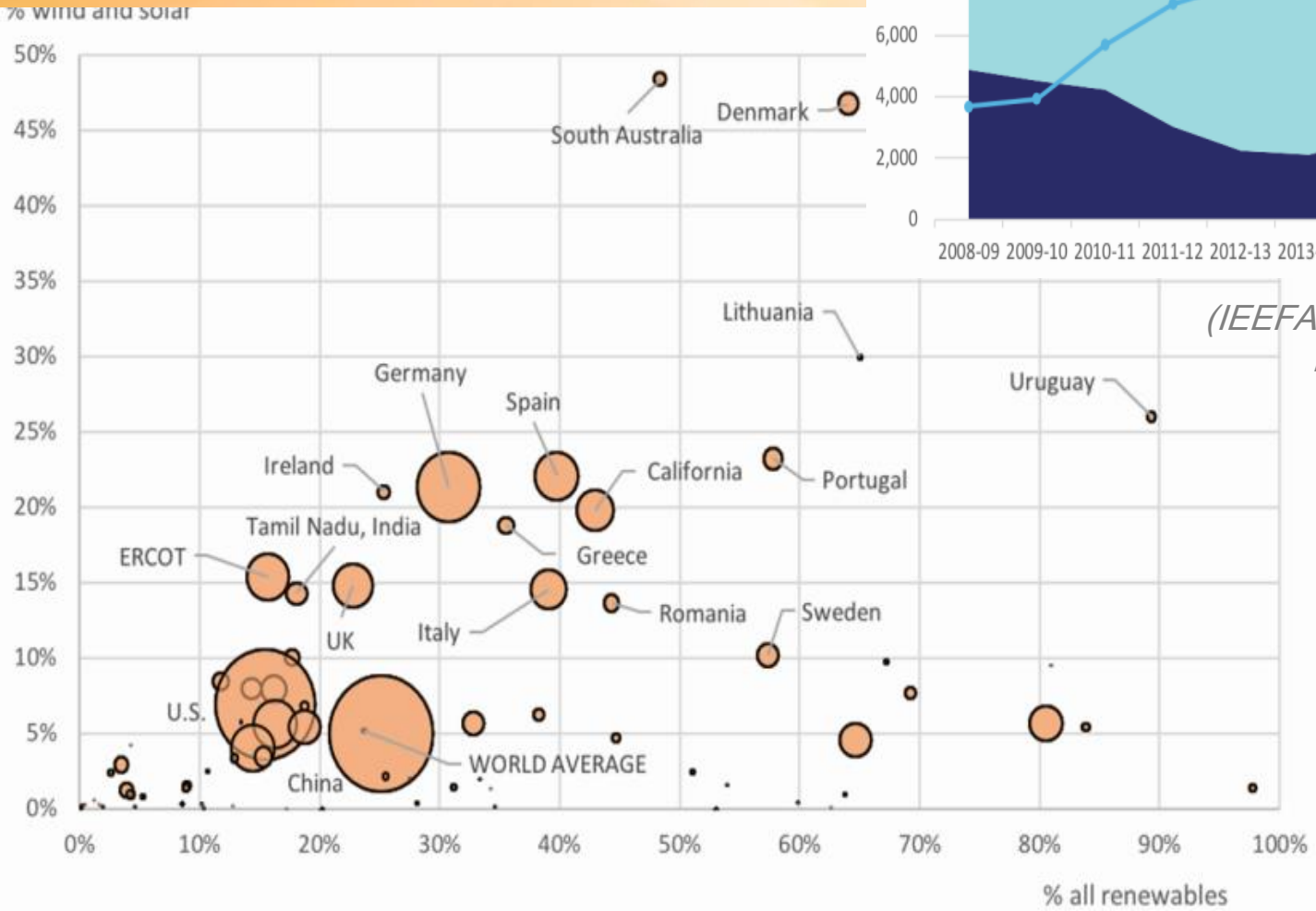


(Australian Energy Statistics, 2017)



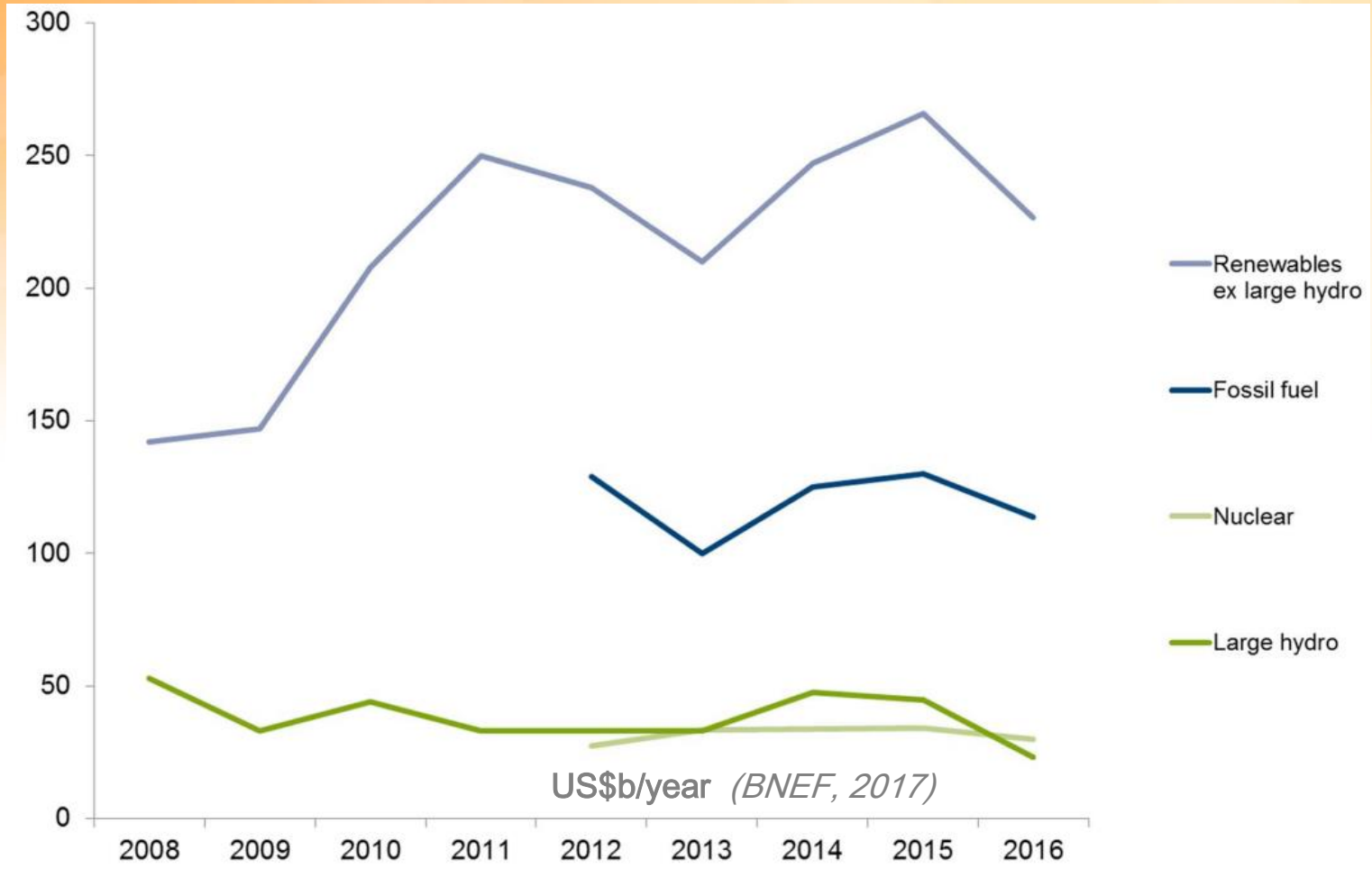
.. yet in South Australia



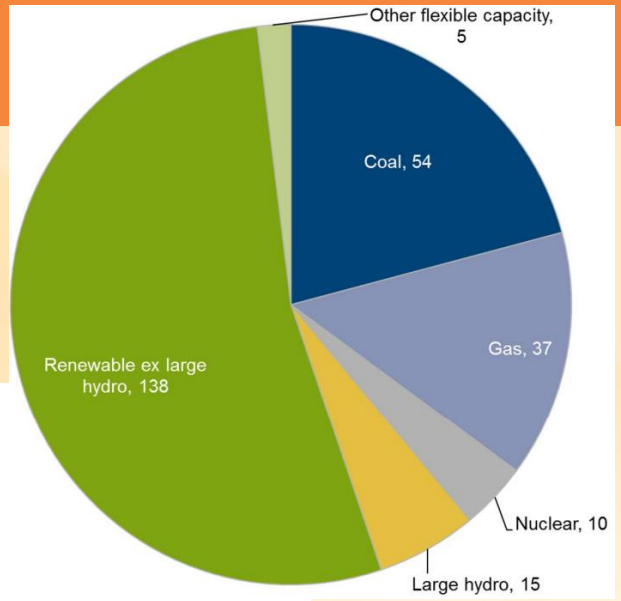


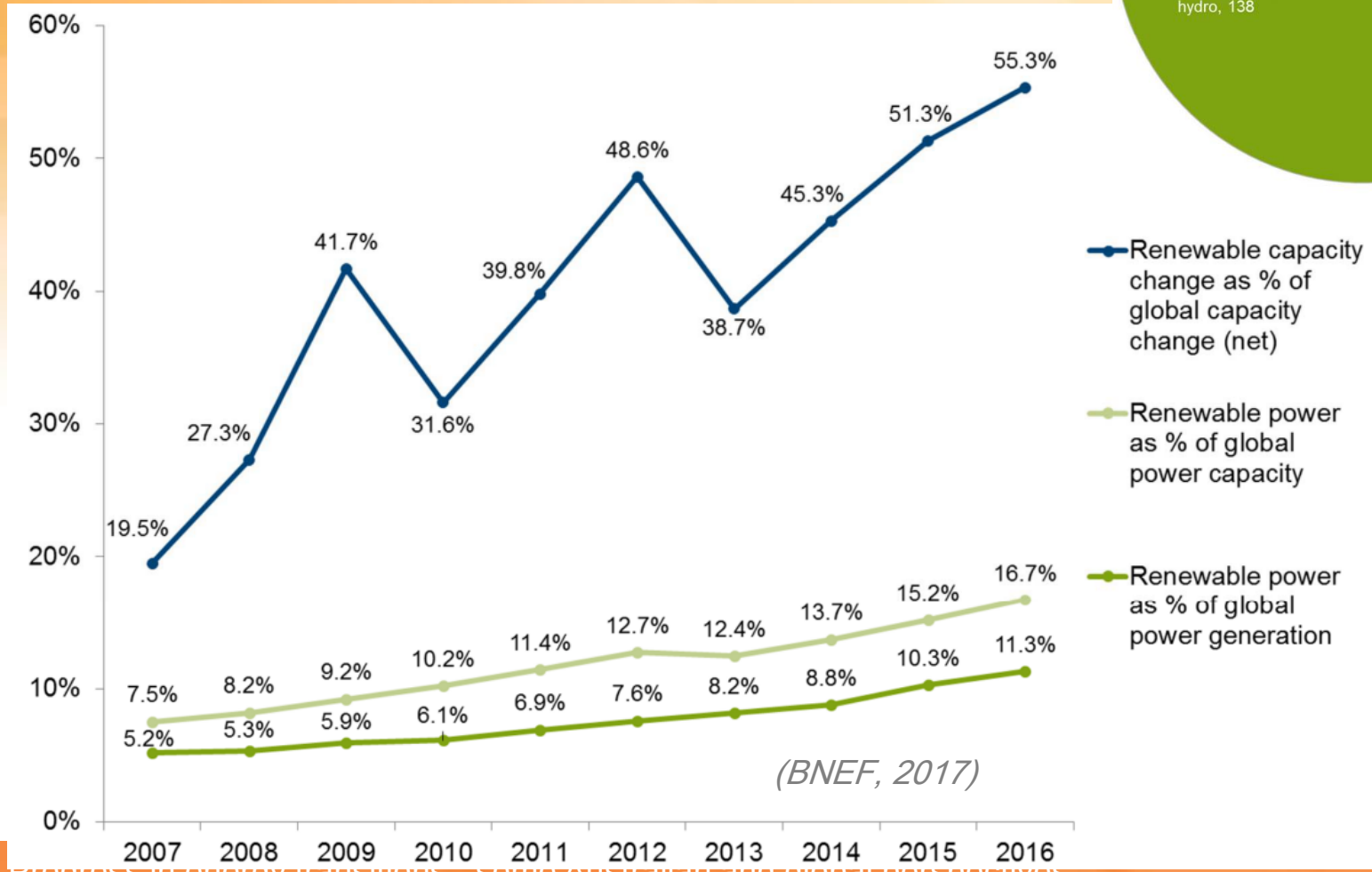
(IEEFA, Power Industry Transition, here and now, 2018)

Certainly in global electricity sector, investment has moved



And renewables contribution now moving

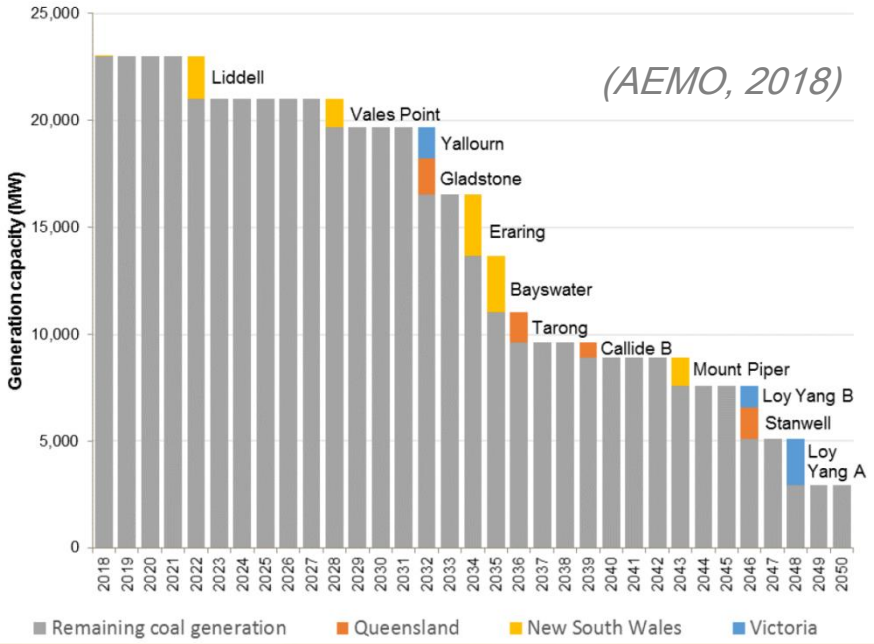


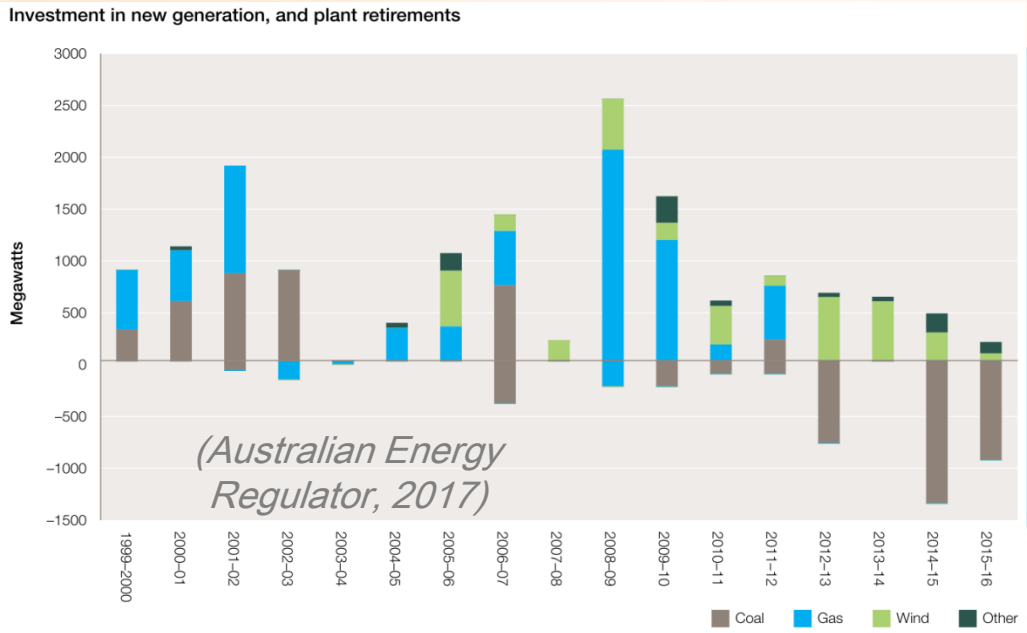


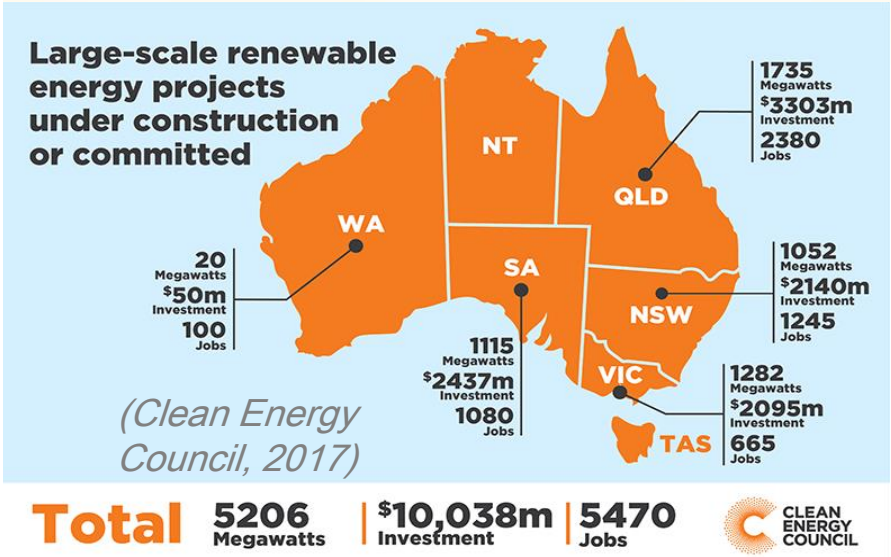
(BNEF, 2017)

..and in Australia

Figure 4 NEM coal generation fleet operating life to 2050, by 50th year from full operation or announced retirement







Where next?

"The best way to predict your future is to create it!"

Abraham Lincoln

"Keep calm..

& carry on"

Thoughtful, careful, efforts

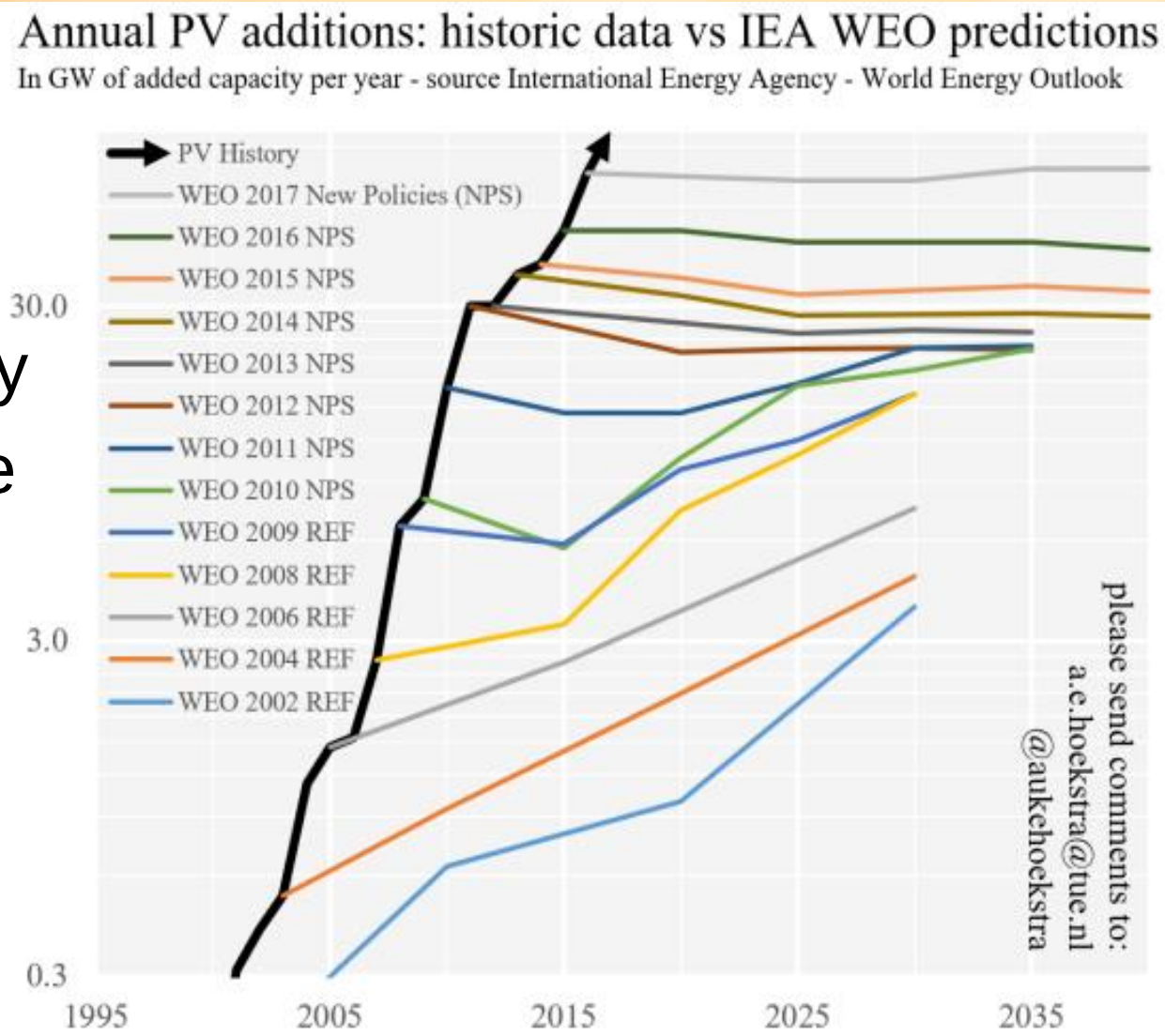
Tools for exploring the future

- Projections
  - Project from current data and historical trends into the future
- Forecasts / predictions
  - Add judgements – eg related trends
- Scenarios
  - Hypothetical alternative futures to help explore decision making

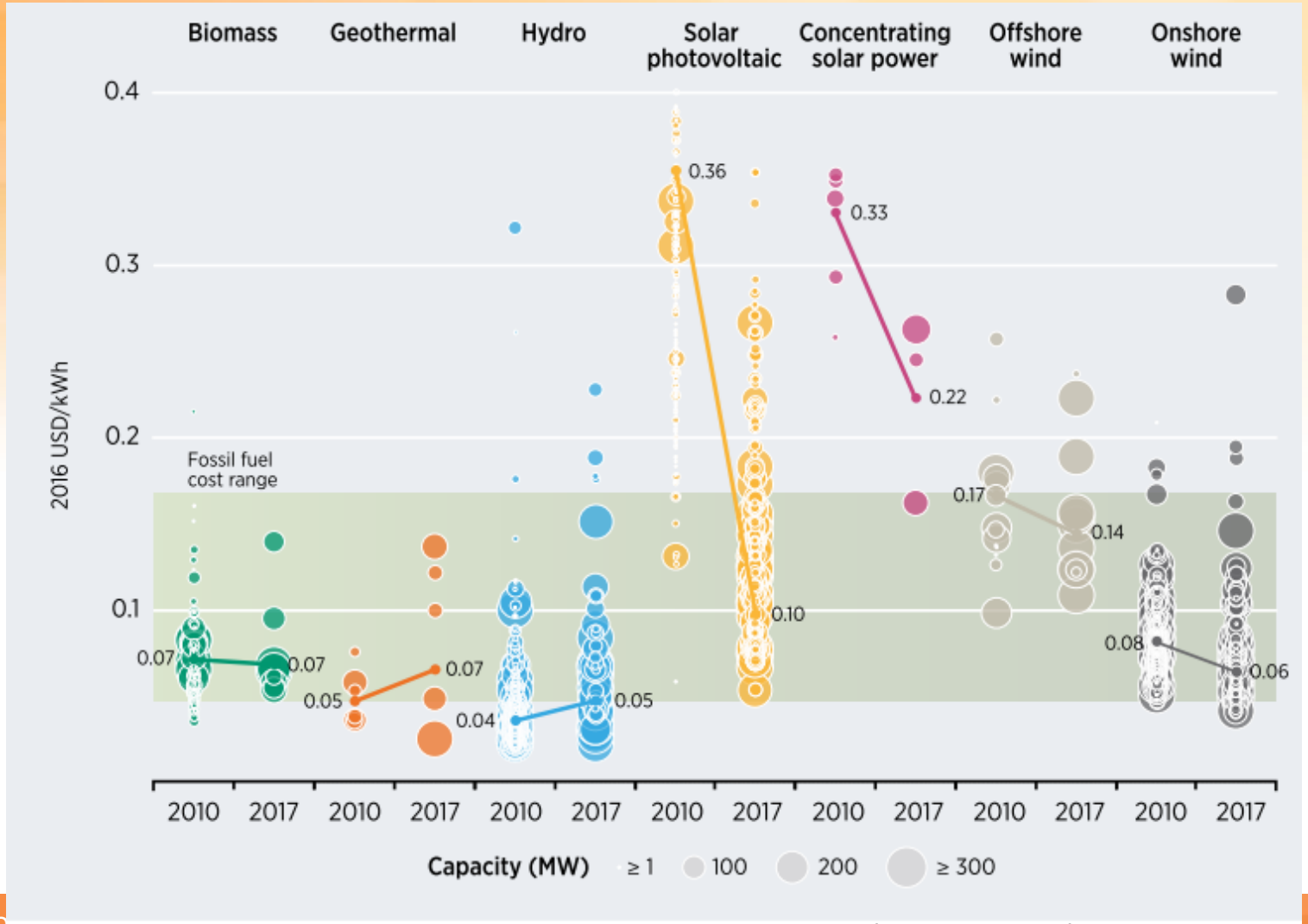
Take care with projections + forecasts

Trend is not destiny

Neither is expertise



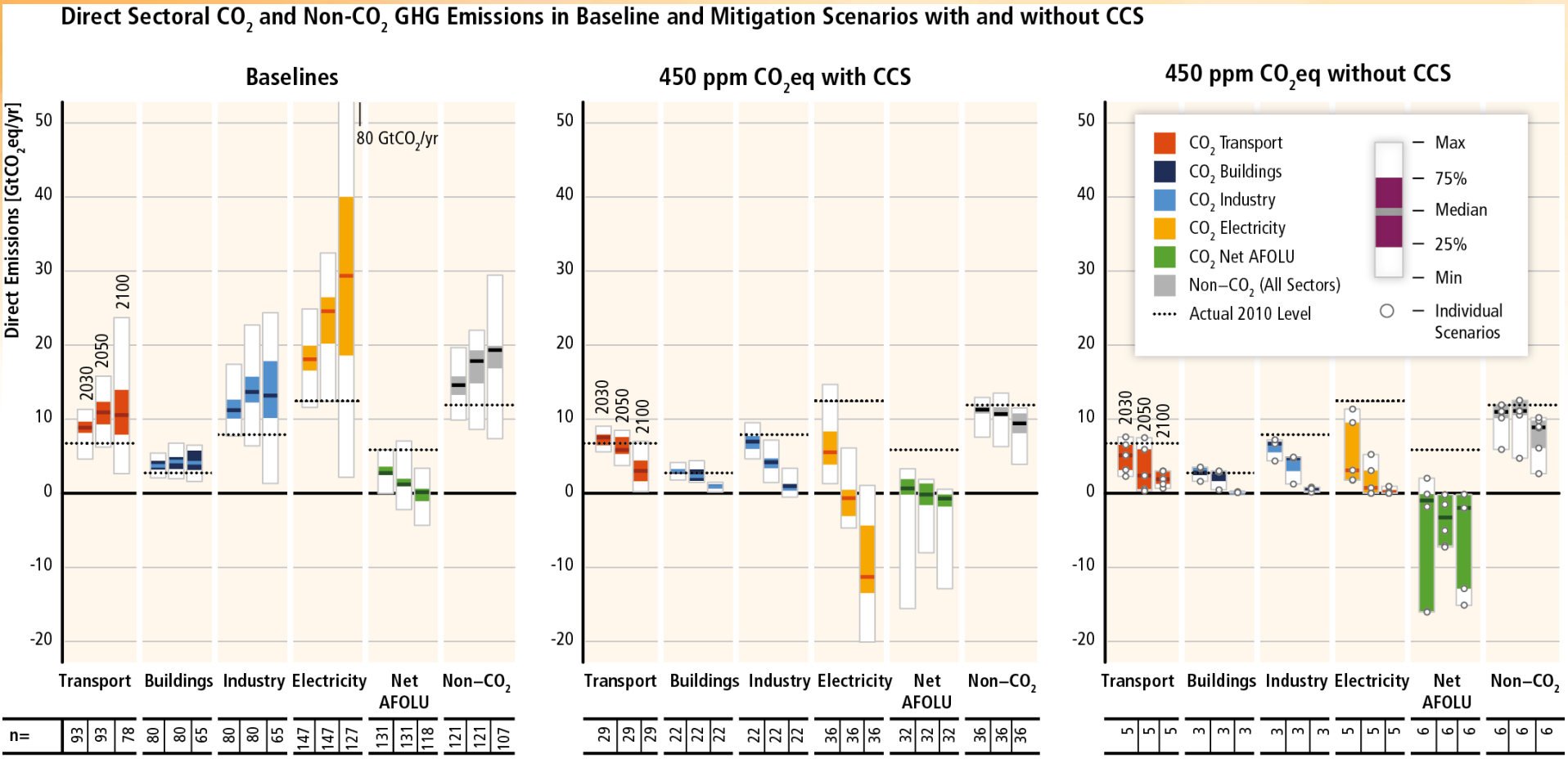
What we know keeps changing…



Source: IRENA Renewable Cost Database.

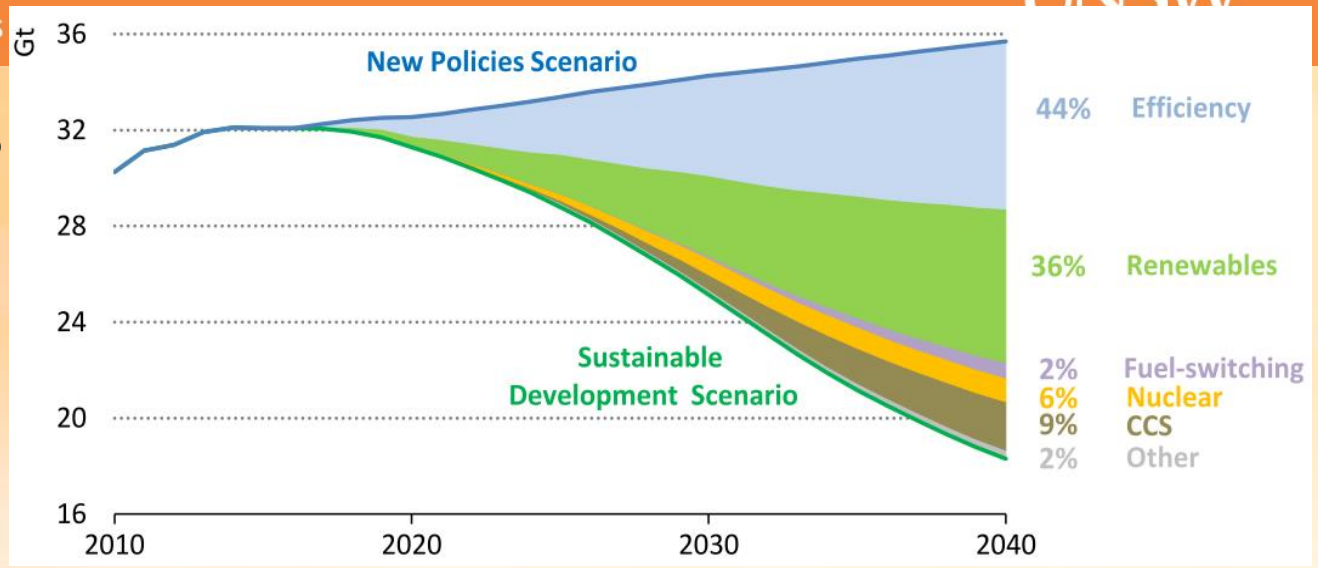
(IRENA, 2017)

IPCC scenarios for clean energy transition

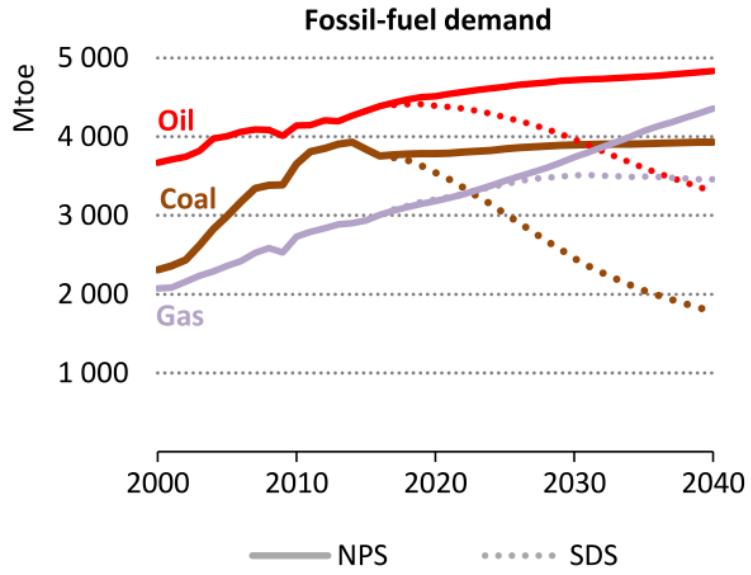


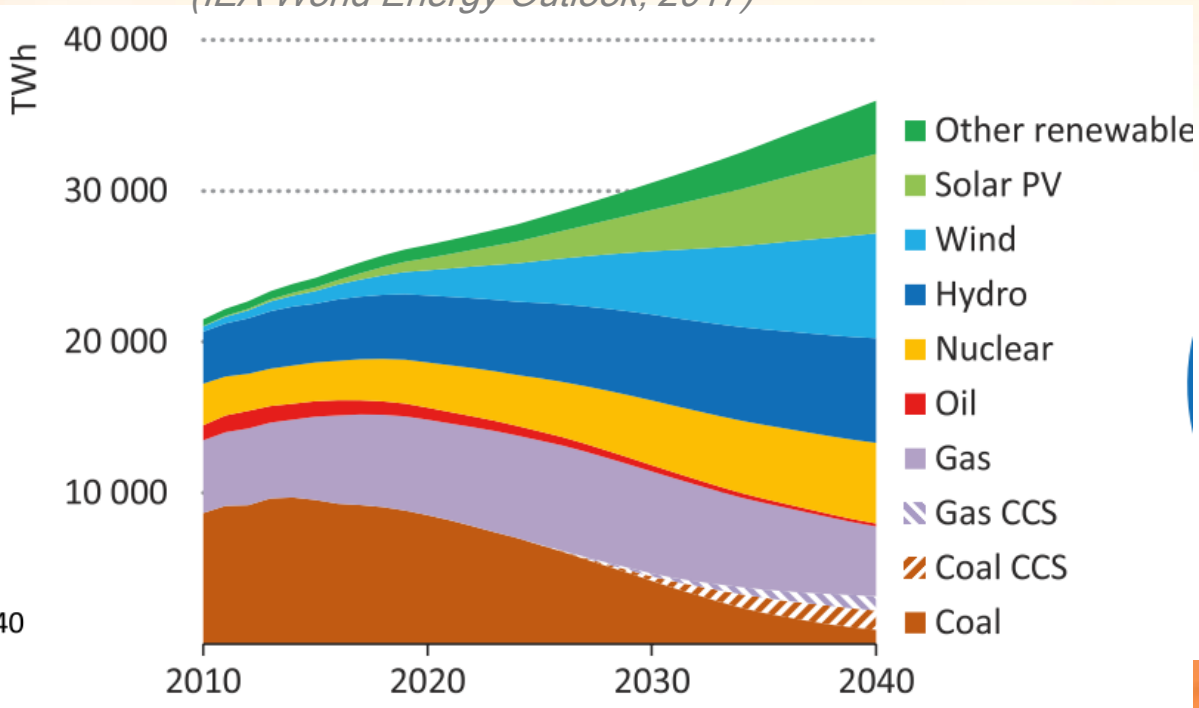
(IPCC, Fifth Assessment Report, 2015)

IEA pathways



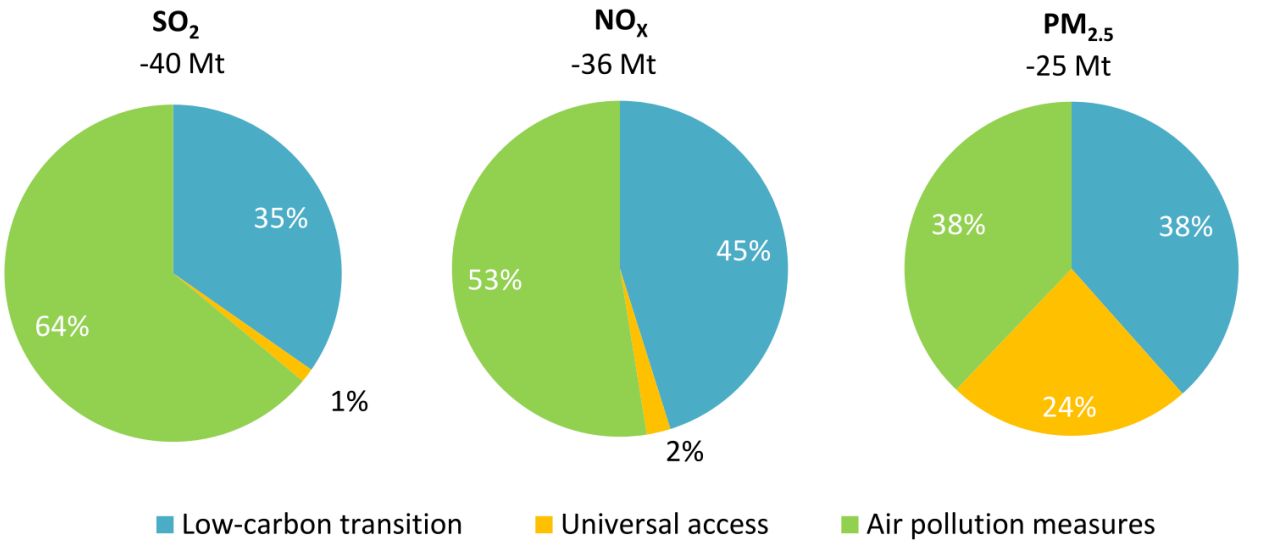
(IEA World Energy Outlook, 2017)





..with additional benefits

Figure 3.16 ▷ Air pollutant emissions savings by policy area in the Sustainable Development Scenario relative to the New Policies Scenario, 2040



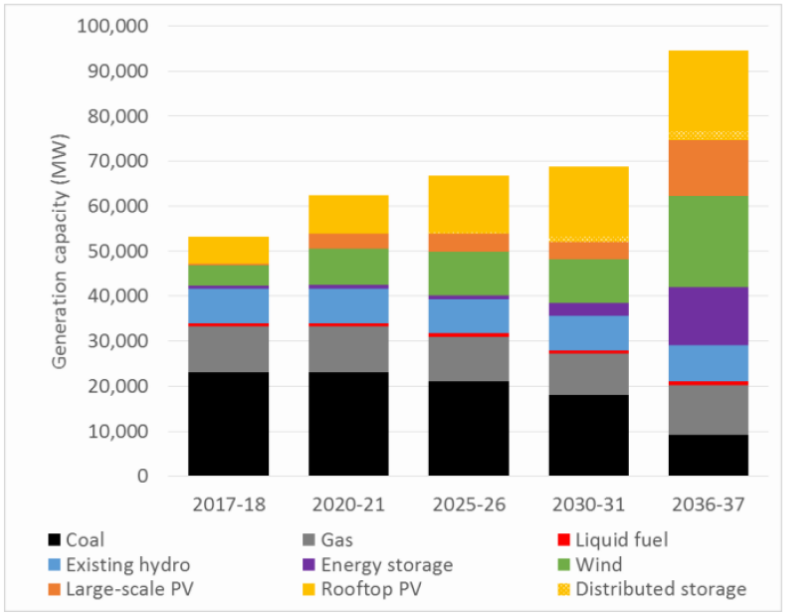
Air pollution control is the main contributor to reducing outdoor air pollution; achieving universal access to modern energy is particularly important for reducing $PM_{2.5}$ emissions

(IEA World Energy Outlook, 2017)

..and for Australia

- A wide range to choose from

Figure 9 **Preliminary projections of NEM generation capacity (left) and generation output (right), Neutral scenario**



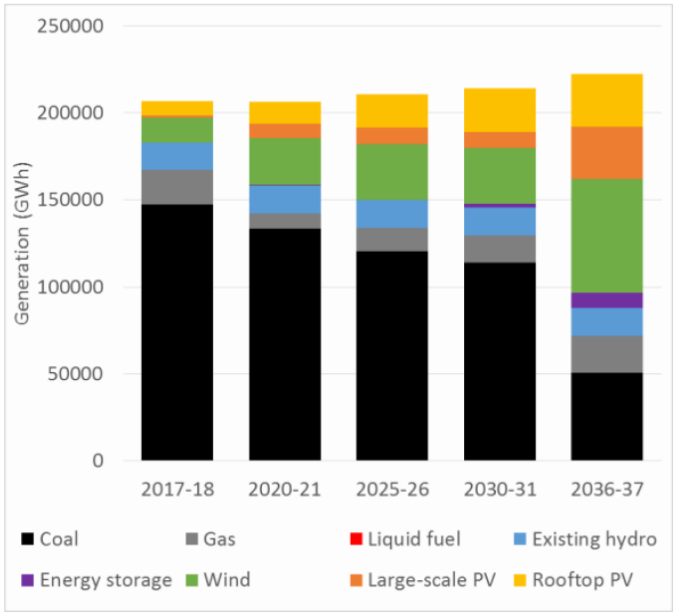
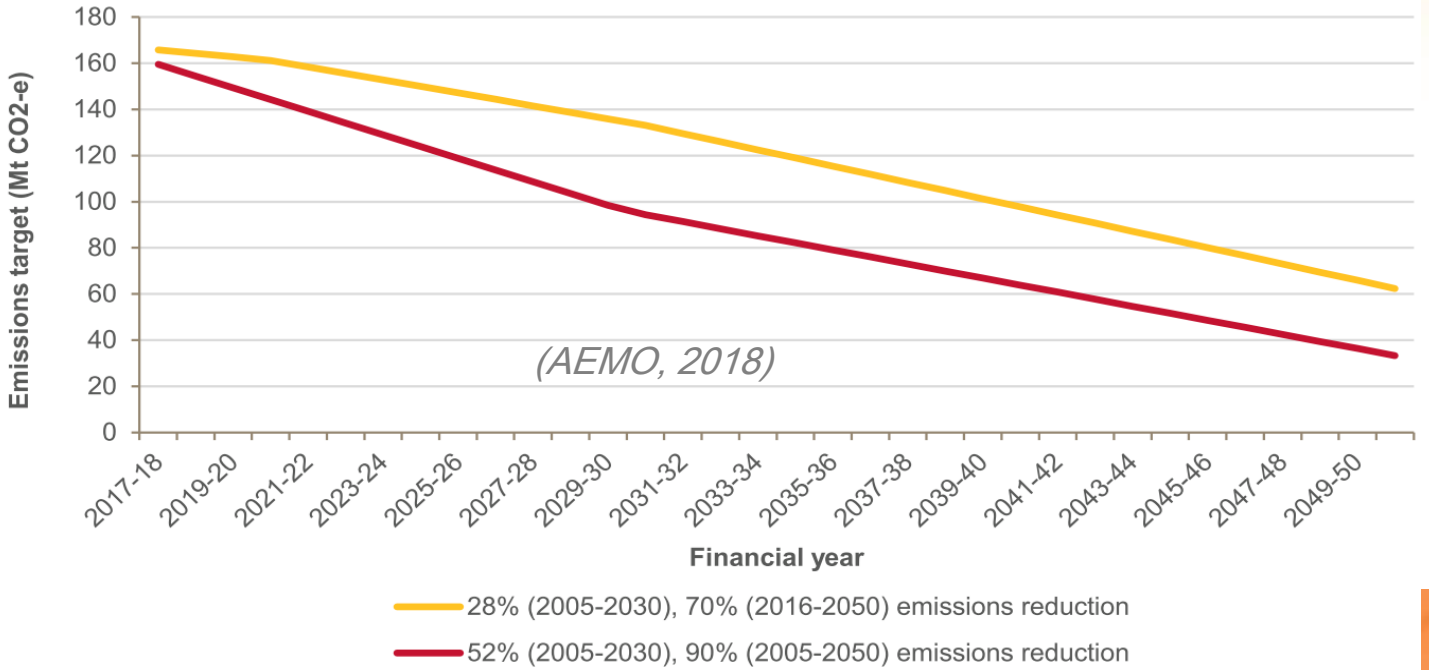


Figure 5 **Proposed NEM emissions reduction trajectories to be examined in ISP scenarios**



Areas of broad agreement

(UNSW Energy Transitions Blueprint, 2017)

- A carbon price, so emissions are factored into investment and asset decisions
- Significantly reduced reliance on coal and oil
- A range of clean energy technologies, with renewables key
- A significant role for energy efficiency
- Market mechanisms and technologies to manage high penetration variable renewables
- More engaged and informed energy users
- Integrated planning across:
    - energy, water and other services
    - liveable, affordable and healthy living environments
    - urban planning and transport to prevent lock-in to inefficient systems

Areas of ongoing debate, disagreement

(UNSW Energy Transitions Blueprint, 2017)

- The future role for carbon capture and storage and nuclear
  - both have struggled with cost and deployment
- The role of gas
- The role of hydrogen as another energy vector
- The extent of the challenges posed by integration of variable renewables
- The extent of changes needed in energy market design
- Future cost reductions for different renewable energy technologies

Sustainable Energy Futures

(UNSW Energy Transitions Blueprint, 2017)

- More renewable
- More electric
- More distributed and consumer driven
- More digital
- More flexible
- More global and more local

A possible way forward for Australia

(UNSW Energy Transitions Blueprint, 2017)

- A challenge yet also opportunity for more affordable, secure, environmentally sustainable energy services in Australia
- Need to reduce emissions fast – we are well placed to do this
  - Aging coal fleet, reducing oil stocks, loss of manufacturing, congested cities, sparse rural populations, vast renewable energy options
- Robust resilient policy frameworks are the key
  - Need comprehensive coherent regulatory, market design and policy
- Good governance crucial in getting these frameworks
  - Markets are a means not an end – *not always appropriate approach*
  - Political processes not well suited to our challenges *but profound societal change does require sufficient community consensus*
  - Transition must facilitate shared prosperity and equity *including the vulnerable, yet also our regional neighbours, global partners*

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Thank you… and *questions*

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