Challenges and opportunities for Distributed Energy

- How well do electricity industry arrangements establish and allow such distributed energy options to suitably receive
  - Energy and network values
  - Wider social and environmental values

- In restructured industries a question of wholesale & retail market design, network regulation & policy frameworks
  - Challenges of technology and participant neutrality for emerging DE options that have very different technical & economic characteristics, location near and ownership by end-users
  - *Retail markets where distributed energy resides are the 'unfinished' business of many electricity industry restructuring processes*
  - *Intersection of regulated network and competitive supply/demand options invariably complex and imperfect*
  - No serious efforts yet in most jurisdictions to fully address environmental, energy security and wider social externalities of energy markets

Some current developments

Power supply shake-up

Daniel Mercer, The West Australian, July 15, 2013

Hundreds of thousands of WA households could be hit with higher electricity prices under a proposed shake-up of bills aimed at recovering the massive cost to the system caused by the popularity of rooftop solar panels.

Hundreds of thousands of WA households could be hit with higher electricity prices under a proposed shake-up of bills aimed at recovering the massive cost to the system caused by the popularity of rooftop solar panels.

WA's energy chiefs are understood to be pushing for a change in the structure of bills to make customers pay more in fixed charges.

At present, most of a householder's electricity bill stems from the amount of electricity used. Fixed costs, such as the supply charge, make up about 15 per cent of the bill. However, solar panels have slashed consumption for those households, cutting revenue to State-owned power companies, including retailer Synergy and network operator Western Power.

The trend has been highlighted as one of the big issues facing the electricity system and Energy Minister Mike Nahan has been warned that if nothing is done the consequences could be catastrophic. Either households without solar panels would be left to pick up the tab, forcing their bills to unaffordable levels, or electricity providers would be financially crippled.

WA's take-up rate of photovoltaic cells - initially fuelled by generous State and Federal incentives - stands at more than 10 per cent of households and this figure is expected to double within years.

"To encourage energy efficiency governments must not only establish environmentally responsible construction and manufacturing standards, but can also set a regulatory framework for progressive energy tariffs to make consumers more aware of energy efficiency as a means to reduce overall national energy costs…." *(World Energy Council, 2012)*

Do we want our electricity market to reduce its price signals to end-users on the value of undertaking energy efficiency actions? *eg. by increasing standing charges relative to variable charges* (QCA, 2013 pricing determination)

"The ESAA estimated the current total of PV 'avoided' costs at $340 million, or around $30 per household. To put this into context, this sum is – according to the ESAA's own data – just one eleventh of the cross-subsidy paid by households with no air conditioning. The ESAA estimates these air con network costs at $330 per household, and it is certainly not "hidden", because it has been one of the key reasons why networks have been "supersizing" their grids over the last few years, at an aggregate cost of nearly$40 billion." *(RenewEconomy, 2013)*

Do we want our electricity market to continue current cross subsidies for air-conditioning, but instead target the smaller cross-subsidies for clean and green PV?

(Solar Citizens, 2013)

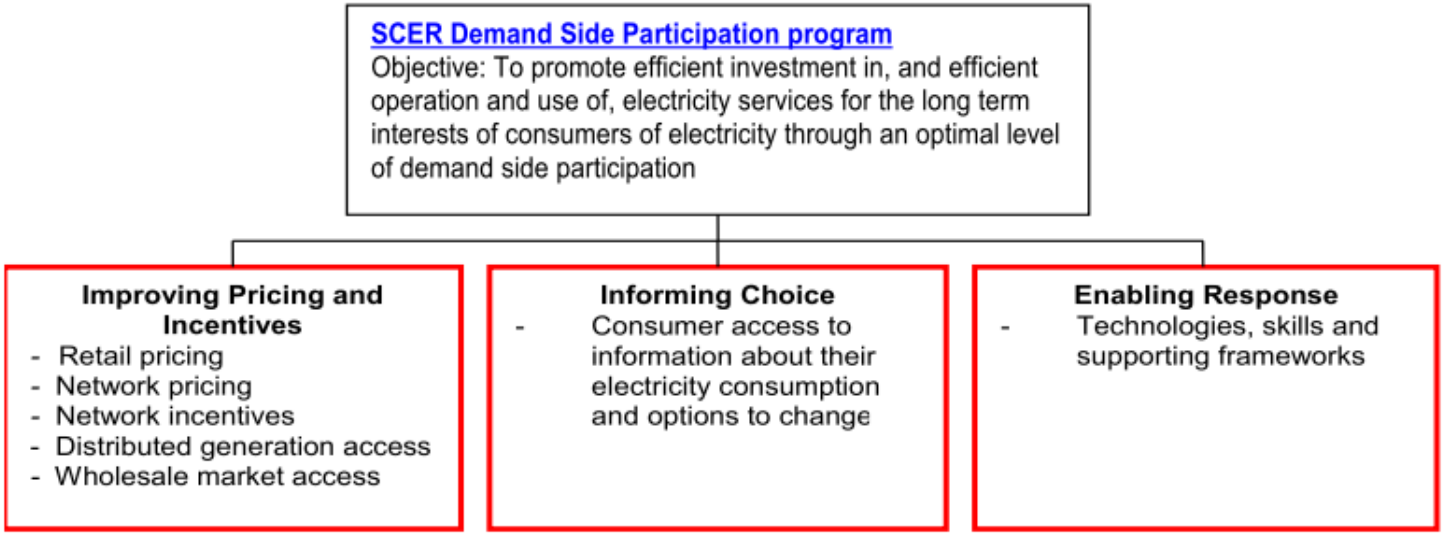
Table 1: Tariff 11 – Bill Impacts for the Typical (Median) Customer

Tariff Component	*Frozen 2012-13*	*Transitional 2013-14*	*Increase*
Fixed charge (cents/day)[1]	26.170	50.219	*91.9%*
Variable charge (cents/kWh)[1]	23.071	26.730	*15.9%*
Annual Bill[2] ($, GST inclusive)	***1,184***	***1,451***	***22.6%***

1. GST exclusive.
2. Based on a typical (median) customer on Tariff 11 consuming 4,250kWh per annum.

Other developments

SCER Demand Side Participation Program *(SCER, 2013)*

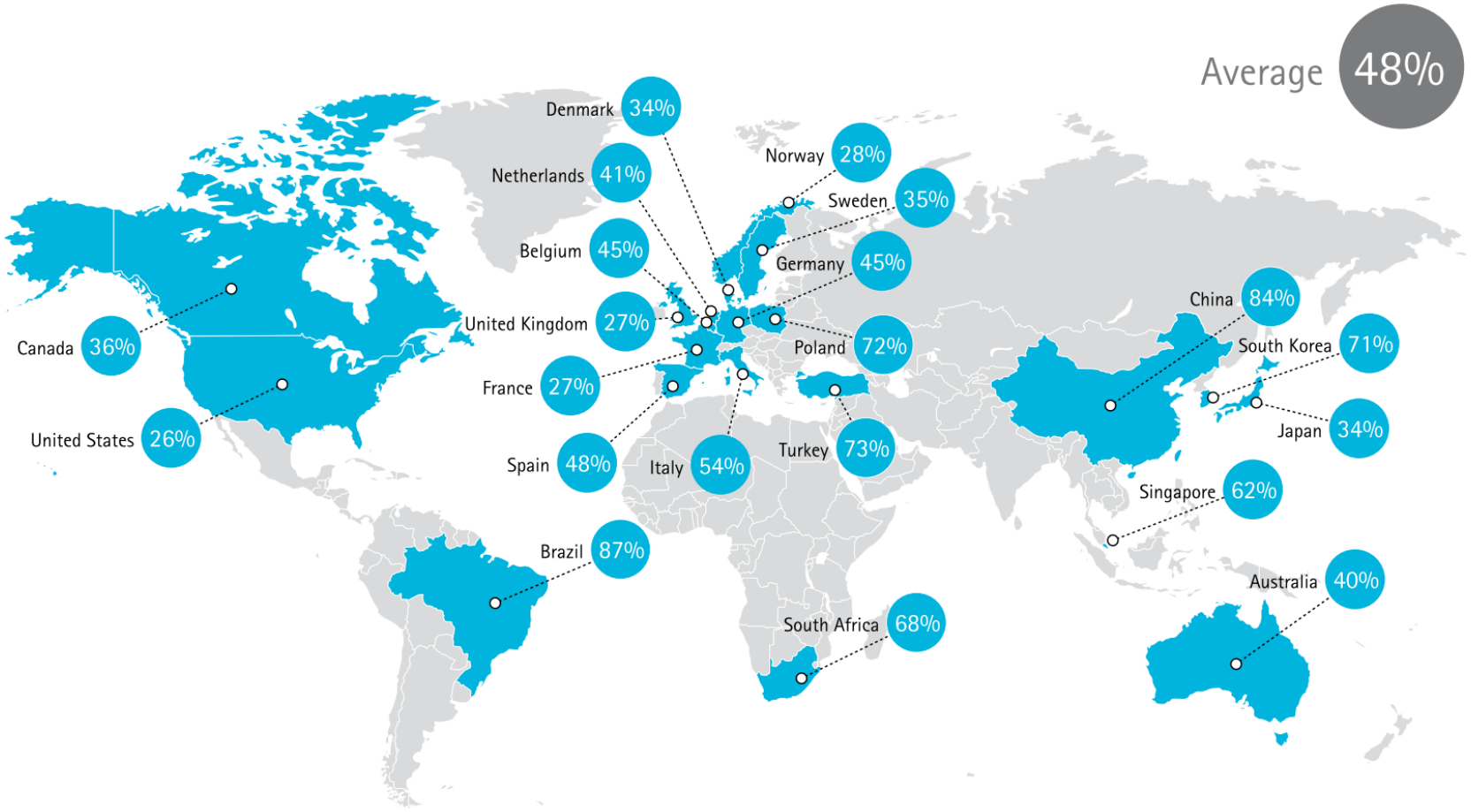


The Standing Council on Energy and Resources (SCER) has adopted this framework to guide its demand side participation (DSP) work. The framework provides an overview of SCER's policy objectives for DSP:

- **Improving pricing and incentives**: consumers need clear signals about the cost of their energy consumption in order to efficiently manage their demand, and supply chain businesses need appropriate incentives to implement and facilitate demand side participation options.
- **Informing choice**: consumers and demand side providers need a range of information so that they can identify and implement efficient demand options.
- **Enabling response**: a range of technologies, skills, and supporting frameworks are required to support pricing, information, and demand management options, and to enable timely responses to market signals.

New business opportunities - end-user interest

In the next 12 months, are you planning to spend money on energy-related products and/or services for your home (e.g., energy-efficient appliances, smart thermostats, etc.)?

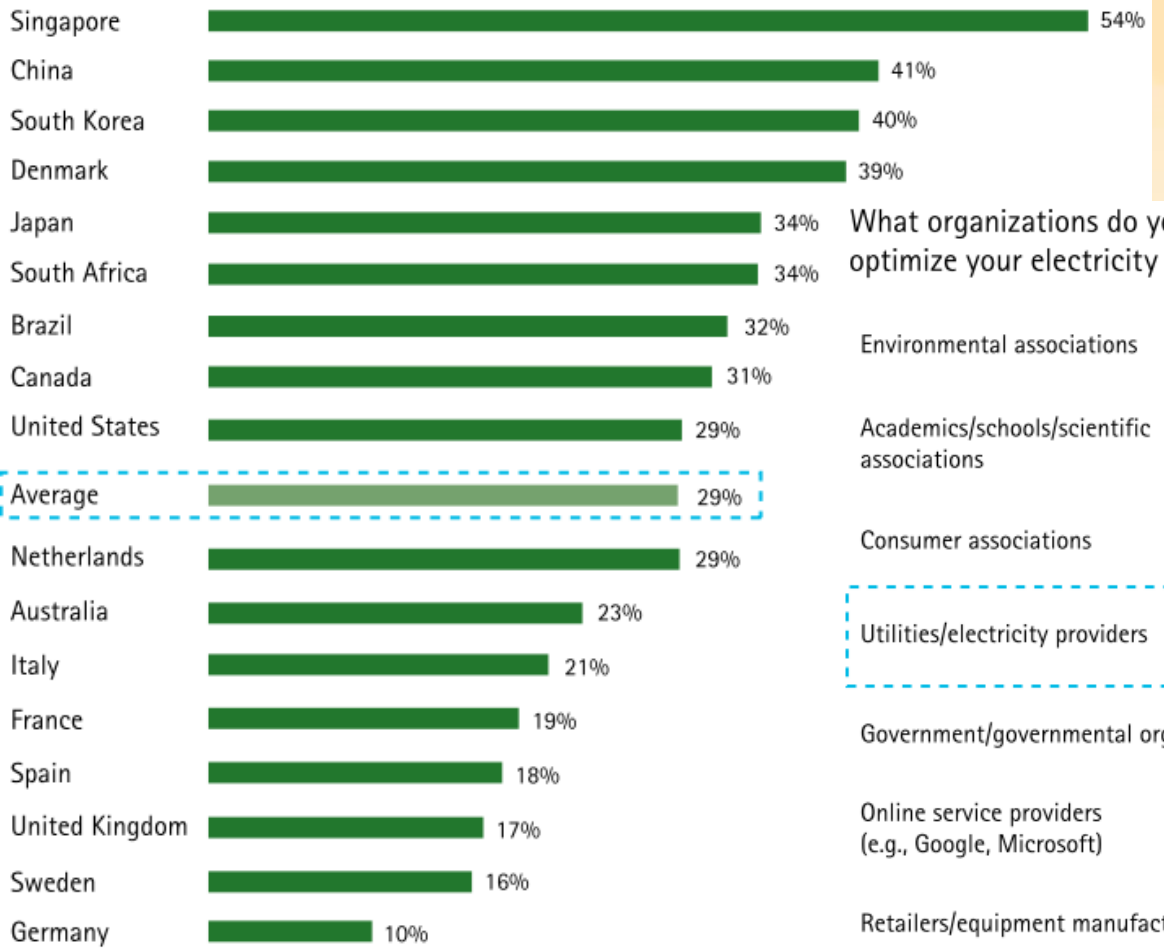


Base: All respondents
Source: Delivering the New Energy Consumer Experience, Accenture, 2013.

(Accenture, 2013)

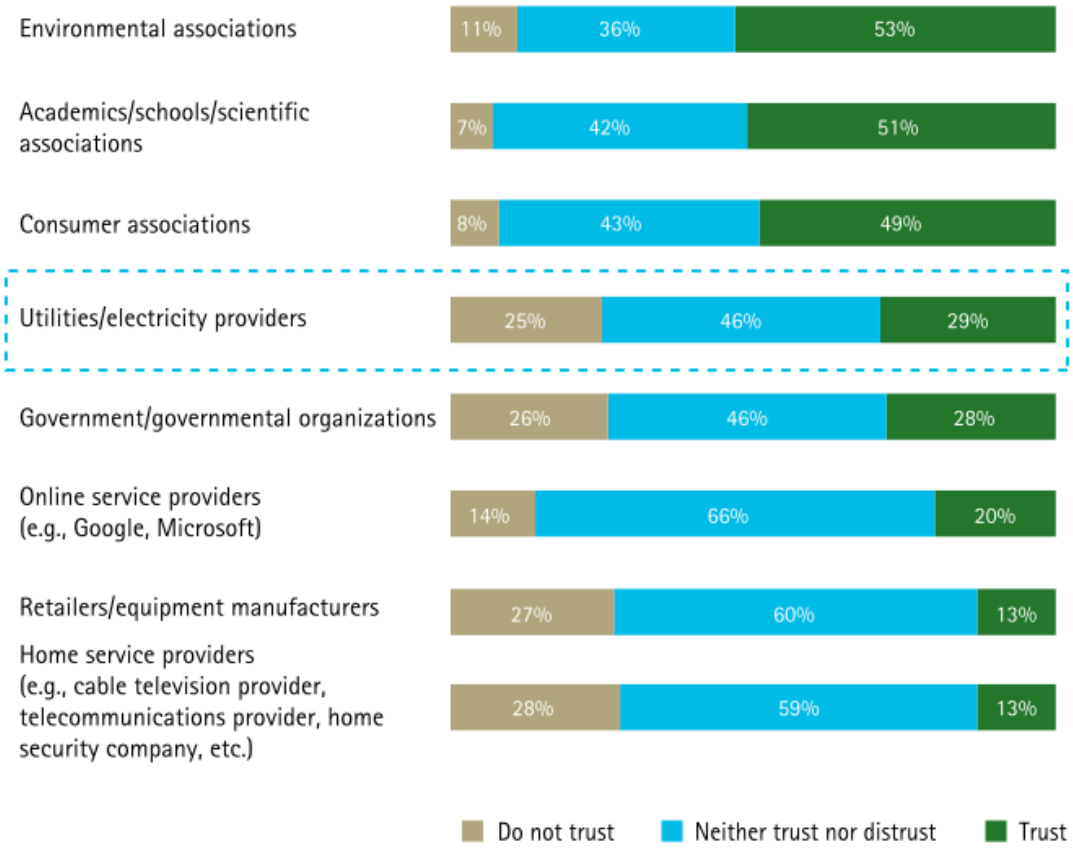
Currently some ‘trust’ issues for electricity providers

Do you trust your utilities/electricity providers to inform you about actions you can take to optimize your electricity consumption?



(Accenture, 2010)

What organizations do you trust to inform you about actions you can take to optimize your electricity consumption?

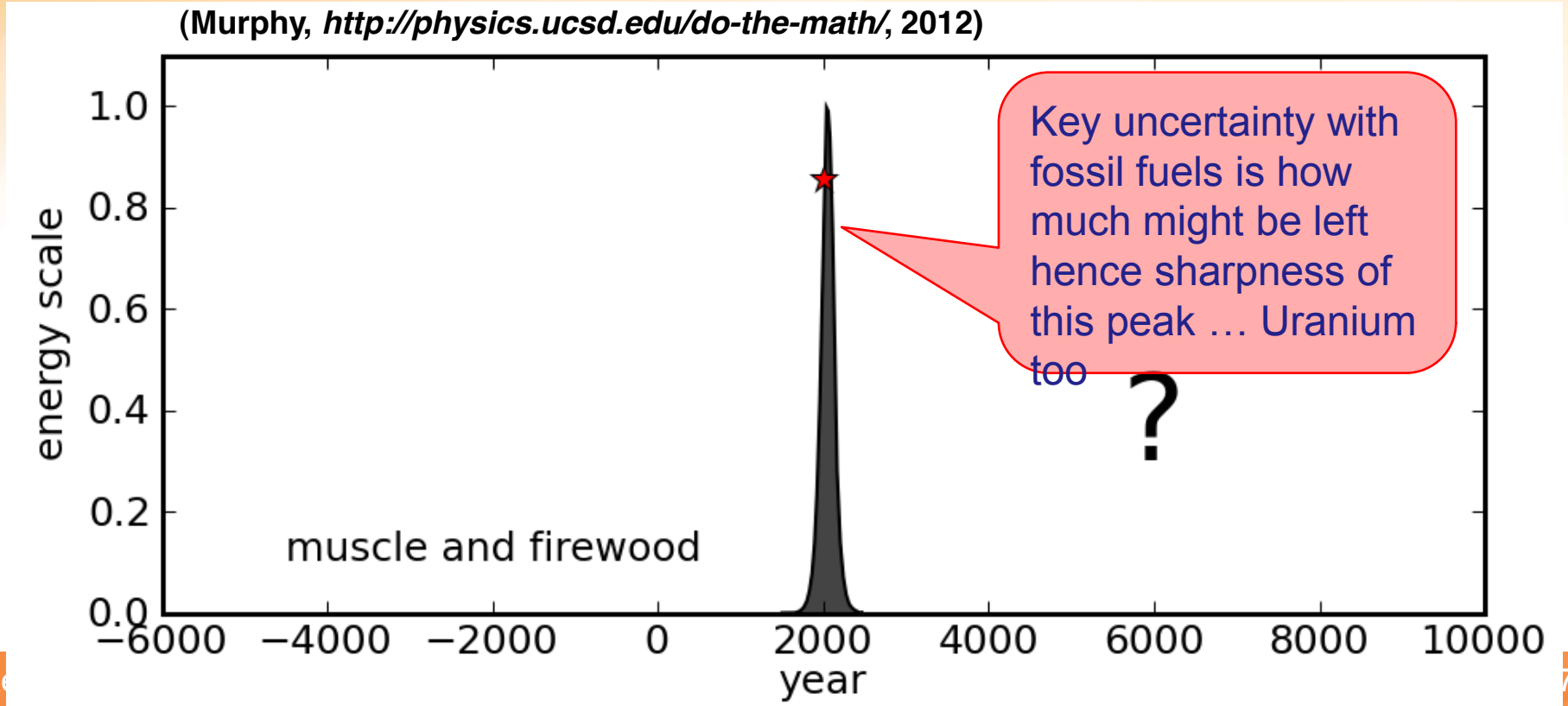


Conclusions- current 'retail' markets and prices

- Aren't providing and pricing what end-users actually need and hence want to buy
- Are clearly not economically efficient because
  - Current market arrangements don't facilitate appropriate levels of demand-side participation and energy efficiency which are both essential to achieve highest possible economic efficiency
  - NSPs faces perverse incentives to increase network expenditure, currently largely fail to implement non-network solutions
  - Still don't properly reflect broader societal objectives – social and environmental
- Some current developments
  - *may reduce potential role of pricing further – eg. increasing fixed charges which aid cost recovery, but don't send appropriate 'signals' to end users*
  - *may actively discriminate against new options – eg. solar tariffs*

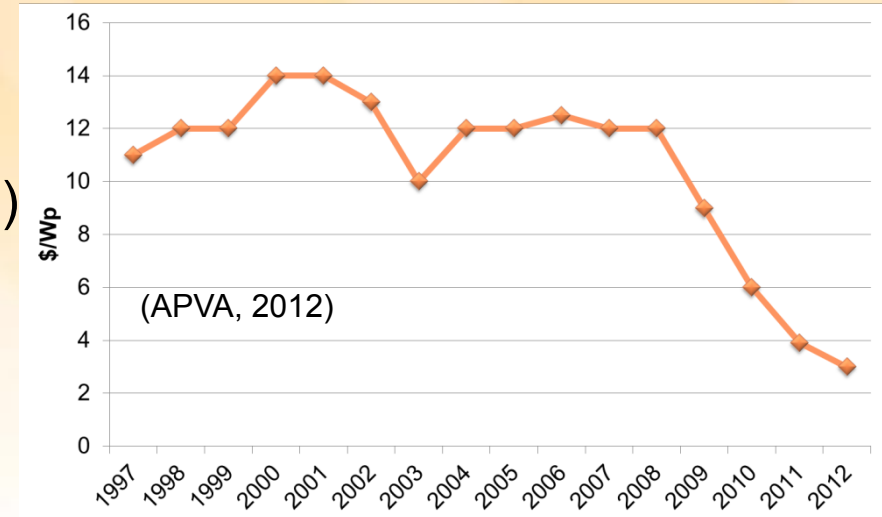
Taking a longer-term perspective, 100% renewables a question of when.. and how

- *Our only technically feasible option*
- *Wind and PV seem well placed to play major role*



Growing interest in future 100% renewable electricity

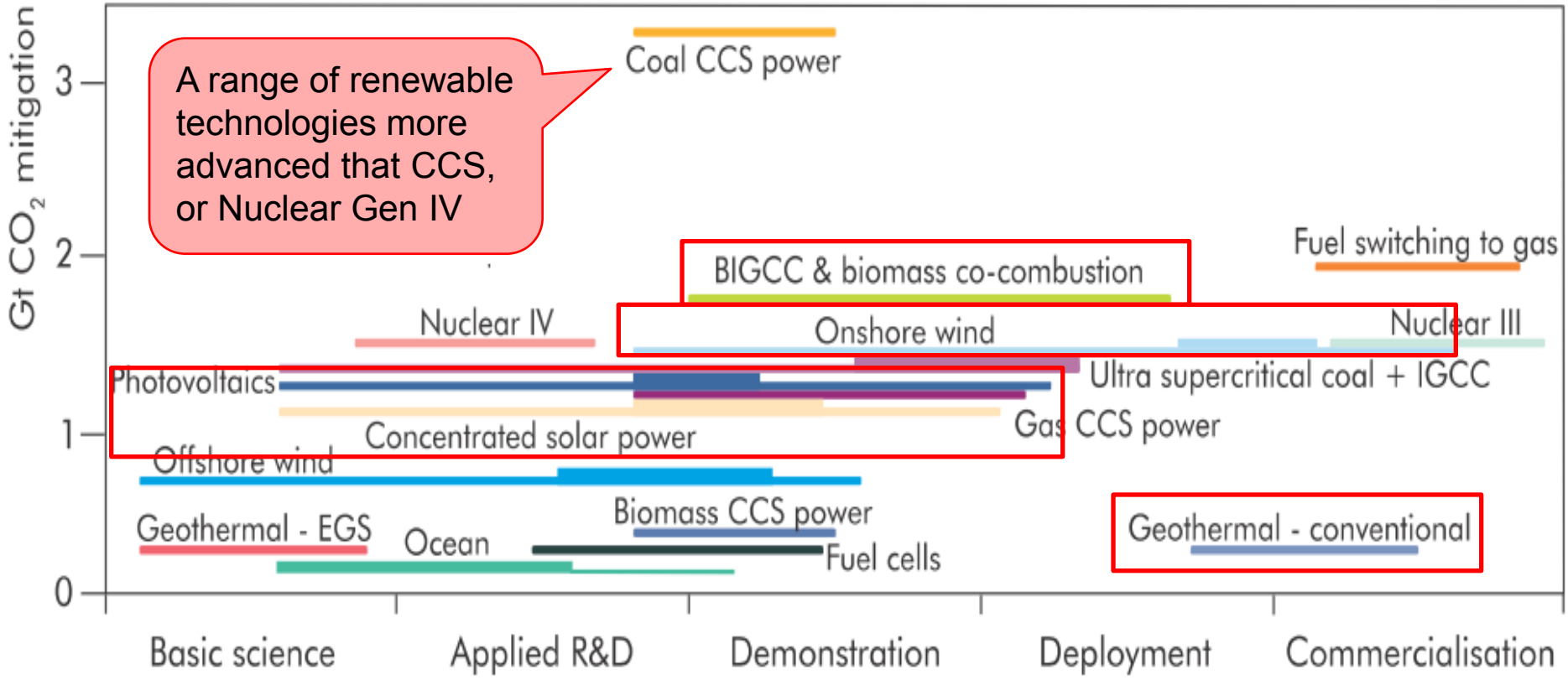
- Many drivers including
  - climate change (and given poor progress of other low carbon options)
  - energy security (most countries see fossil fuel $ as economic liabilities)
  - falling renewable technology costs



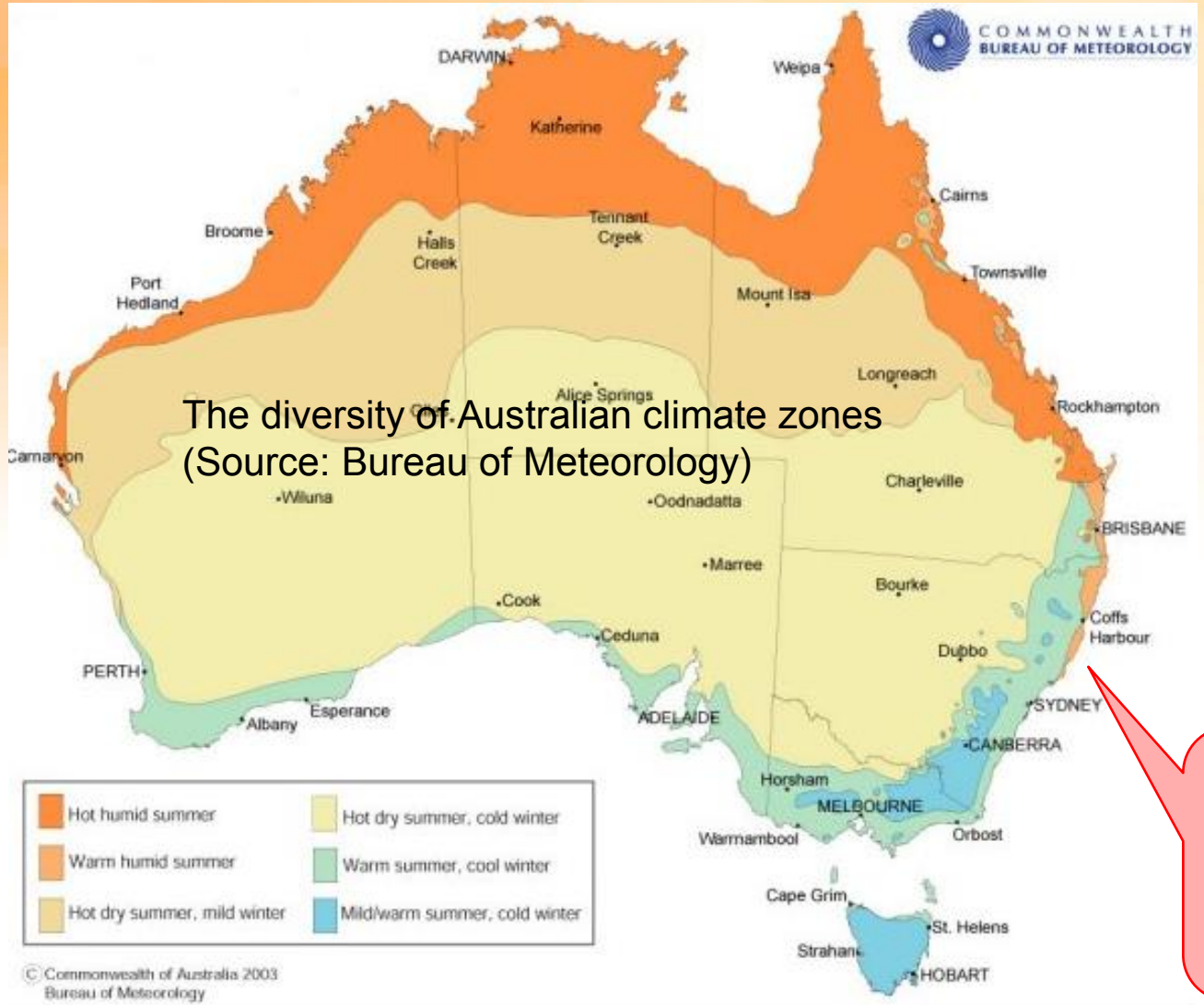
- Some key questions
  - *Technical feasibility?* – can 100% renewables mixes utilizing highly variable and somewhat unpredictable solar and wind reliably meet demand at all times and locations
  - **If yes,** *Economic feasibility?* – is 100% renewables economically worth doing given likely costs vs costs of inaction, other options
  - **If yes, how do we get there**

Technical feasibility: range of proven renewables

Figure 4.6 ▶ **Near-term technology development priorities and CO_2 mitigation for power generation technologies** (IEA, *Energy Technology Perspectives*, 2010)



Some new NEM regions to consider

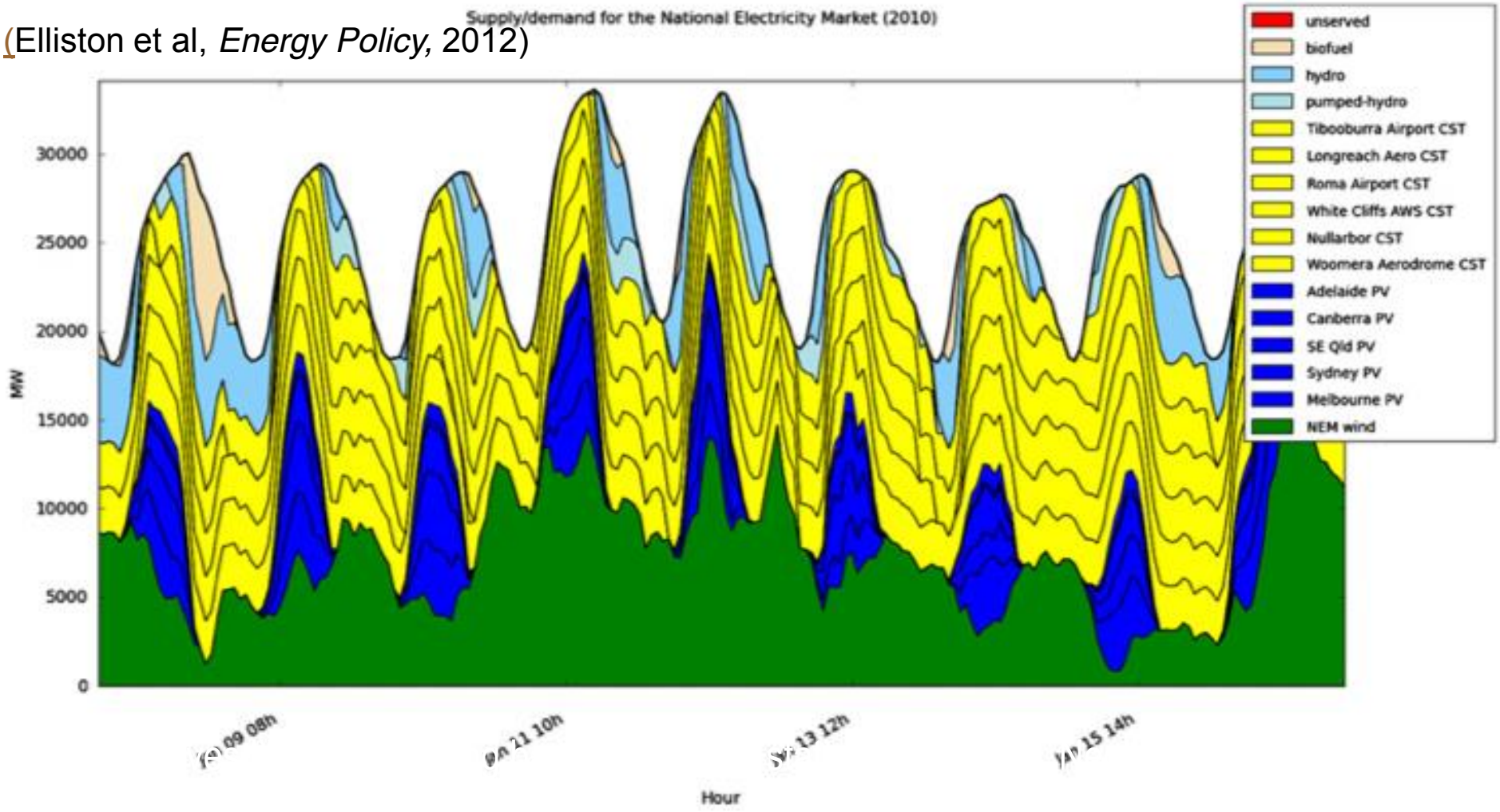


The diversity of Australian climate zones
(Source: Bureau of Meteorology)

Considerable 'integration' value in having diverse climate regions across the NEM

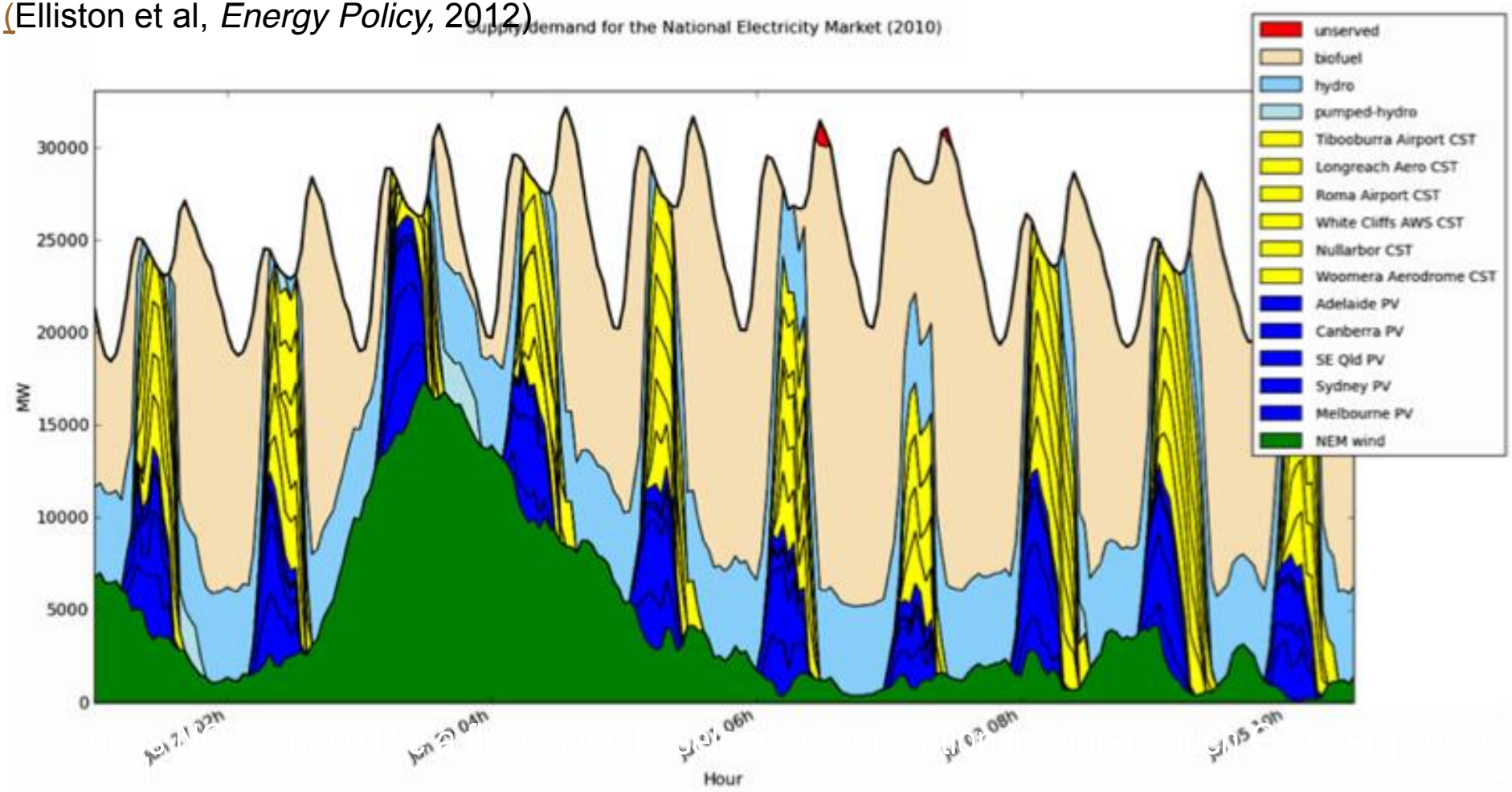
Technical feasibility? Supply and Demand for a Typical Week in Summer 2010 – Baseline Simulation

(Elliston et al, *Energy Policy,* 2012)



Technical feasibility: Supply and Demand for a Challenging Week in Winter 2010 – Baseline Simulation

(Elliston et al, *Energy Policy,* 2012)



Economic feasibility? Simulation extensions, *Search*

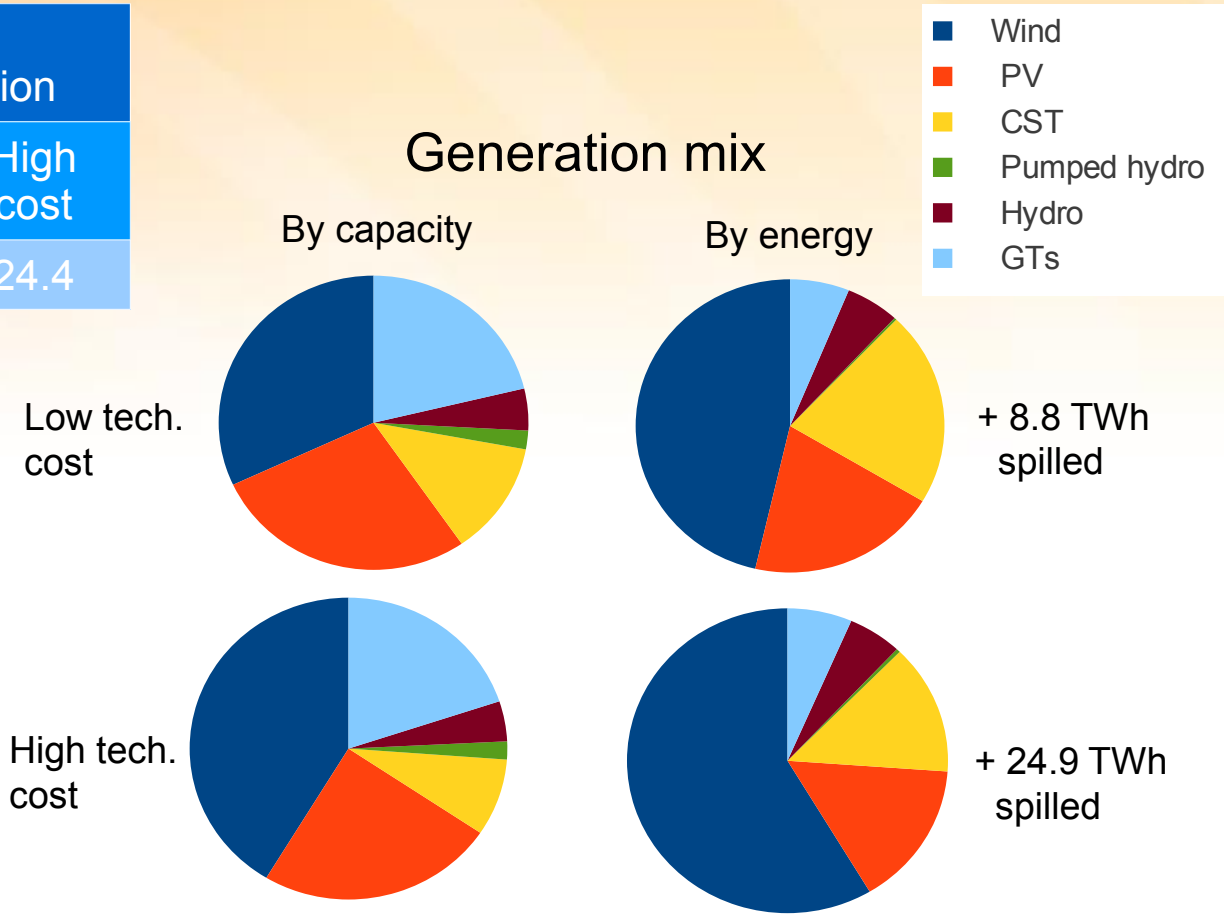
- Cost model – using AETA (BREE, 2012)
  - 2030 projected annualised capital cost ($/kW/yr)
  - Fixed O&M ($/kW/yr) and Variable O&M ($/Mwh)
  - Optionally including 'high level' indicative transmission costs
- Regional model
  - Each "generator" assigned to a region
  - Dispatch algorithm is now region-aware
  - Tracks hourly energy exchanges between regions
- *Search* algorithm
  - genetic algorithm seeks mix of technologies and locations to minimise overall industry annualised (capital and operating) cost *(including cost of USE)*

Preliminary findings

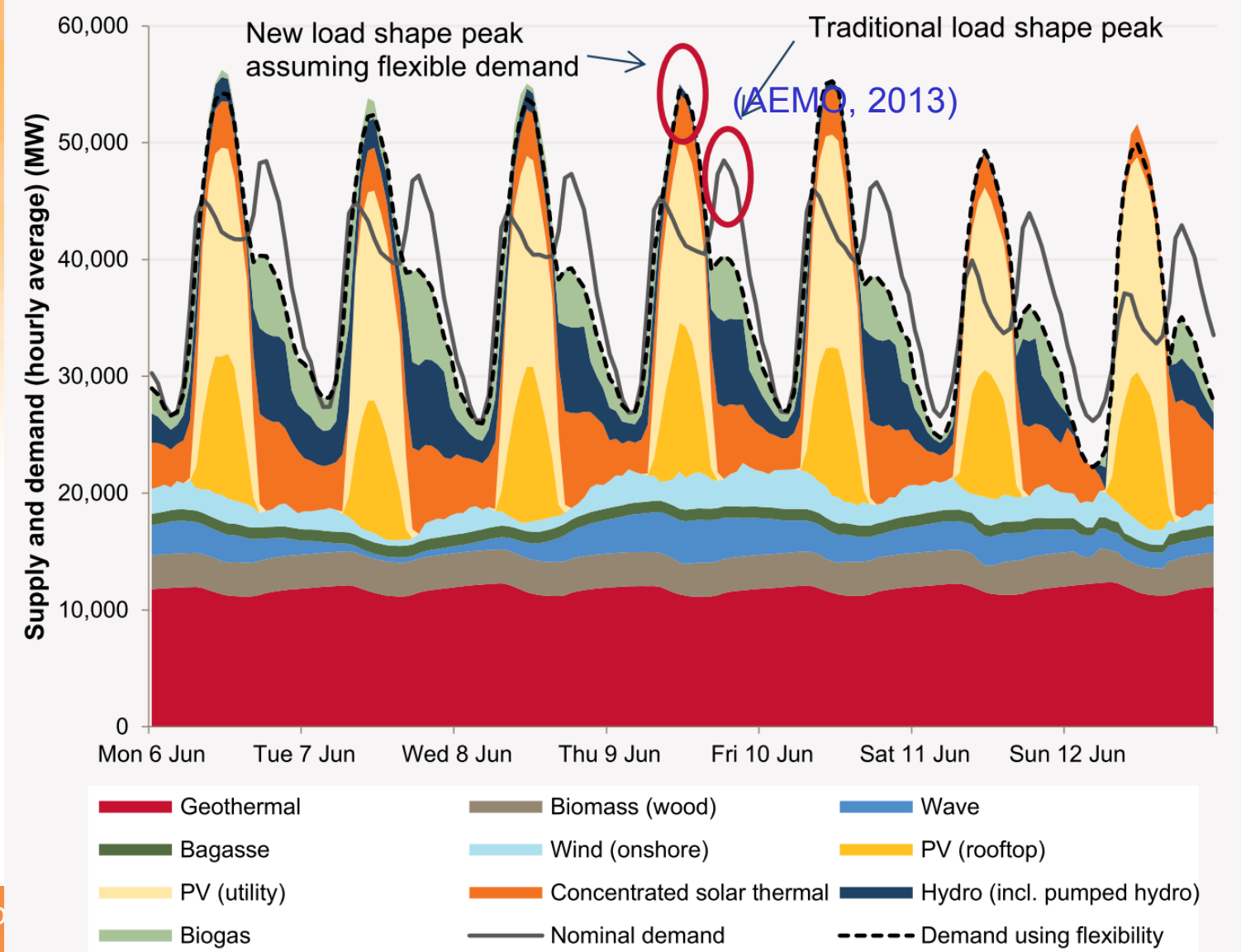
A$b/yr for AETA *high* and *low* technology cost scenarios

Without transmission		With transmission	
Low cost	High cost	Low cost	High cost
19.6	22.1	21.2	24.4

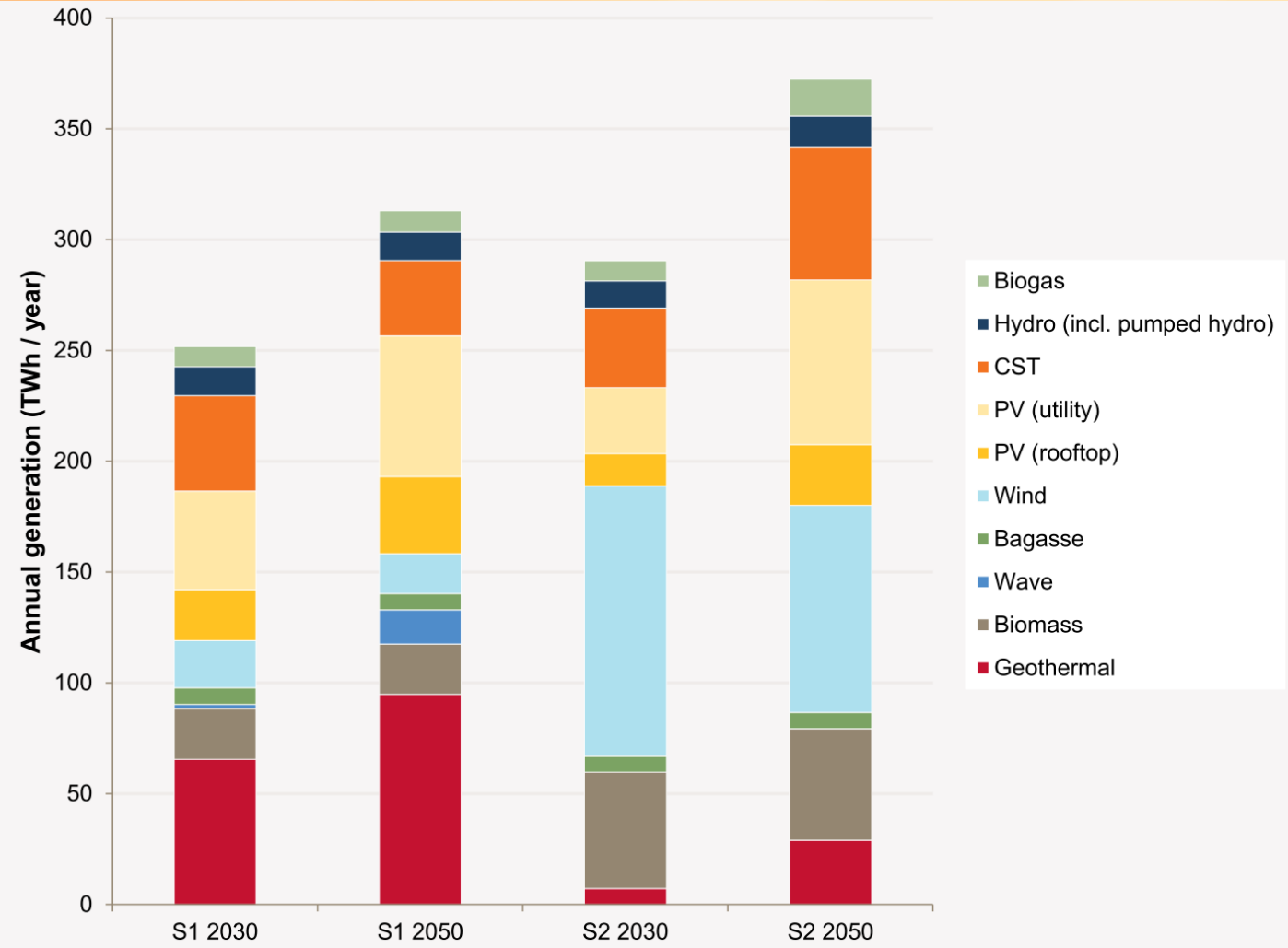
Current NEM costs approx. $10b/year. At carbon prices of $50-100/tCO2 100% renewables costs can be lower cost than ‘replacement’ scenario



AEMO 100% Renewables Study

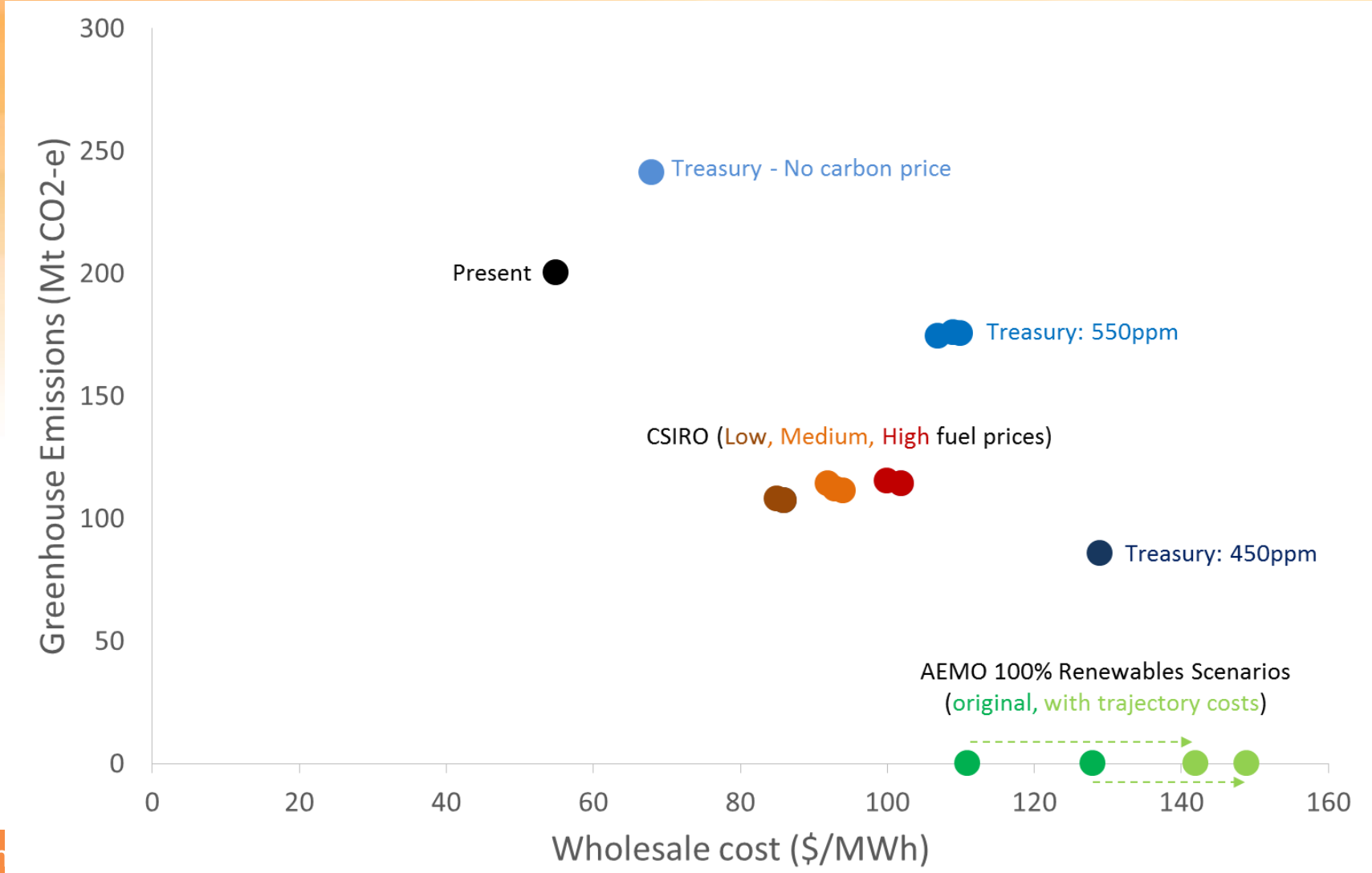


AEMO 100% RE – least cost generation mix



(AEMO, 2013)

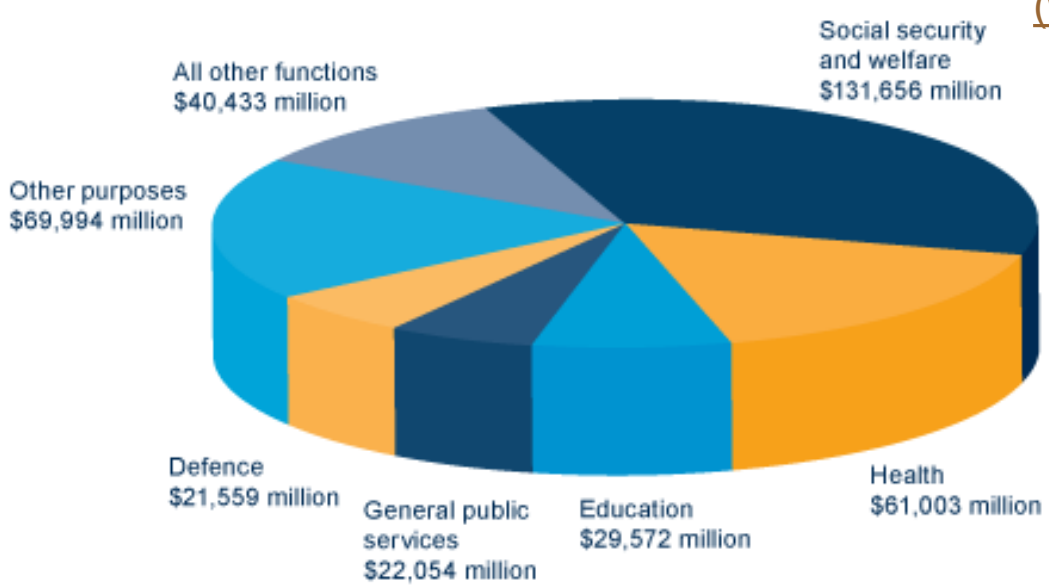
How do estimated costs compare?



An extra $10b/year compares to ….

- In 2012 Australian Households will spend **$642 billion** on living costs including:
  - $11.7 billion a year on meat *versus* $2.4 billion a year on seafood
  - $14.1 billion a year on alcohol *versus* $1.1 billion a year on tea and coffee
  - $78.4 billion a year on cars *versus* $2.2 billion a year on public transport
  - $8.0 billion a year on beauty *versus* $2.0 billion a year on brains
  - $19.0 billion a year on recreational *versus* $8.3 billion a year on medical
  - $9.5 billion a year on gadgets *versus* $5.1 billion a year on fashion
  - $10.5 billion a year on personal care *versus* $0.78 billion a year on pet pampering

(www.moneysmart.gov.au)



(www.treasury.gov.au)

Critiques of 100% RE Studies

- A range concerns – eg. Trainer (2013)
  - "AEMO concludes that 100% of Australian electricity demand could be met by RE. The claim is far from established and highly challengeable because some of the assumptions etc. are implausible and not likely to be borne out, and some crucial factors haven't been taken into account. Intermittency has not been dealt with at all satisfactorily, embodied energy costs seem not to have been considered, and it is admitted that some major costs have not been included. It is clear that a thorough study would have arrived at an annual capital cost in the early years of construction that was several times the sum claimed. *The main issue with renewables is not whether it is technically possible for them to meet total demand – it is whether the large amount of redundant plant needed to deal with intermittency could be afforded*"
- Current models certainly have major limitations
- Debate amongst key stakeholders including government and incumbents moving on from technical feasibility to 'economic affordability' and commercial 'realities' - **a useful outcome**

Table 2.2 Summary of clean energy technology progress towards the 2DS

IEA perspective on global clean energy progress, and policy needs towards protecting the climate (max 2 deg.C warming), (Energy Technology Perspectives, 2012)

CO_2 reduction share by 2020*	On track?	Technology	Status against 2DS objectives	Key policy priorities
			= Not on track; = Improvements but more effort needed; = On track but sustained support and deployment required to maintain progress.	
36%		HELE coal power	Efficient coal technologies are being deployed, but almost 50% of new plants in 2010 used inefficient technology.	CO_2 emissions, pollution and coal efficiency policies required so that all new plants use best technology and coal demand slows.
		Nuclear power	Most countries have not changed their nuclear ambitions. However, 2025 capacity projections are 15% below pre-Fukushima expectations.	Transparent safety protocols and plans; address increasing public opposition to nuclear power.
		Renewable power	More mature renewables are nearing competitiveness in a broader set of circumstances. Progress in hydropower, onshore wind, bioenergy and solar PV are broadly on track with 2DS objectives.	Continued policy support needed to bring down costs to competitive levels and to prompt deployment to more countries with high natural resource potential is required.
			Less mature renewables (advanced geothermal, concentrated solar power [CSP], offshore wind) not making necessary progress.	Large-scale RD&D efforts to advance less mature technologies with high potential.
		CCS in power	No large-scale integrated projects in place against the 38 required by 2020 to achieve the 2DS.	Announced CCS demonstration funds must be allocated. CO_2 emissions reduction policy, and long-term government frameworks that provide investment certainty will be necessary to promote investment in CCS technology.
		CCS in industry	Four large-scale integrated projects in place, against 82 required by 2020 to achieve the 2DS; 52 of which are needed in the chemicals, cement and iron and steel sectors.	

Where next?

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

-- Abraham Lincoln

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Thank you… and *questions*

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