



# Integrating high penetrations of renewables into the Myanmar electricity industry – possible lessons from Australia

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*Progress Towards Myanmar's  
Sustainable Development goals  
Australian Myanmar Institute  
Yangon University, 27-30/11/2017*

# Our 2030 destination



*(United Nations Sustainable  
Development Goals, 2015)*

- Ensure universal access to affordable, reliable and modern energy services
- Increase substantially the share of renewables in the global energy mix
- Double the global rate of improvement in energy efficiency
- Enhance international cooperation to facilitate access to clean energy research and technology, and promote investment in energy infrastructure and clean energy technology
- Expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries..



# Our challenge – the energy trilemma

Choose any two? .... *but you may get none*

## 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 supply across the population.

### Environmental Sustainability

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



ENERGY  
EQUITY



ENERGY  
SECURITY



ENVIRONMENTAL  
SUSTAINABILITY

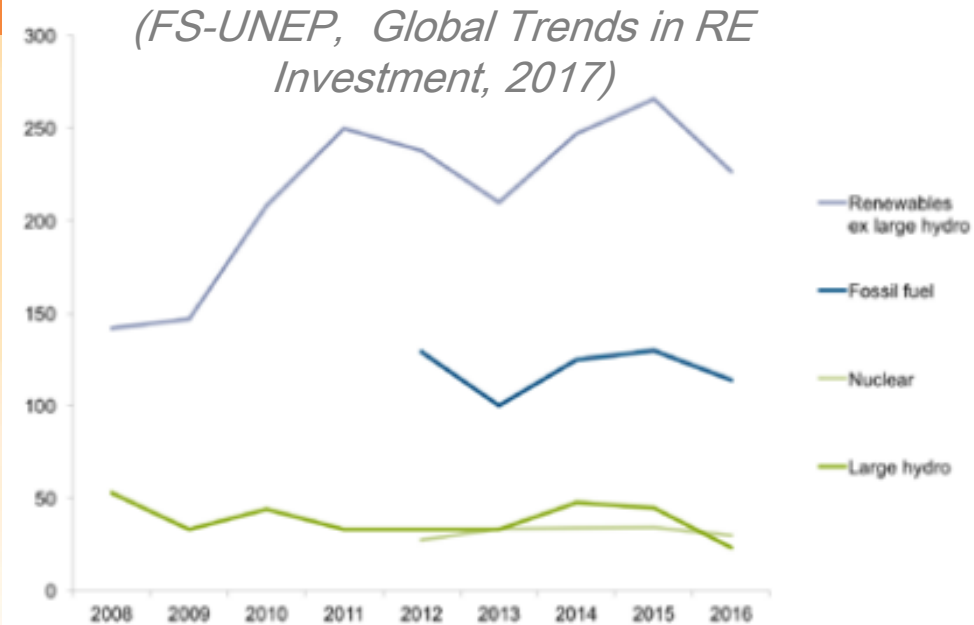
(World Energy Council, The  
Energy Trilemma, 2016)



# The opportunity of renewables

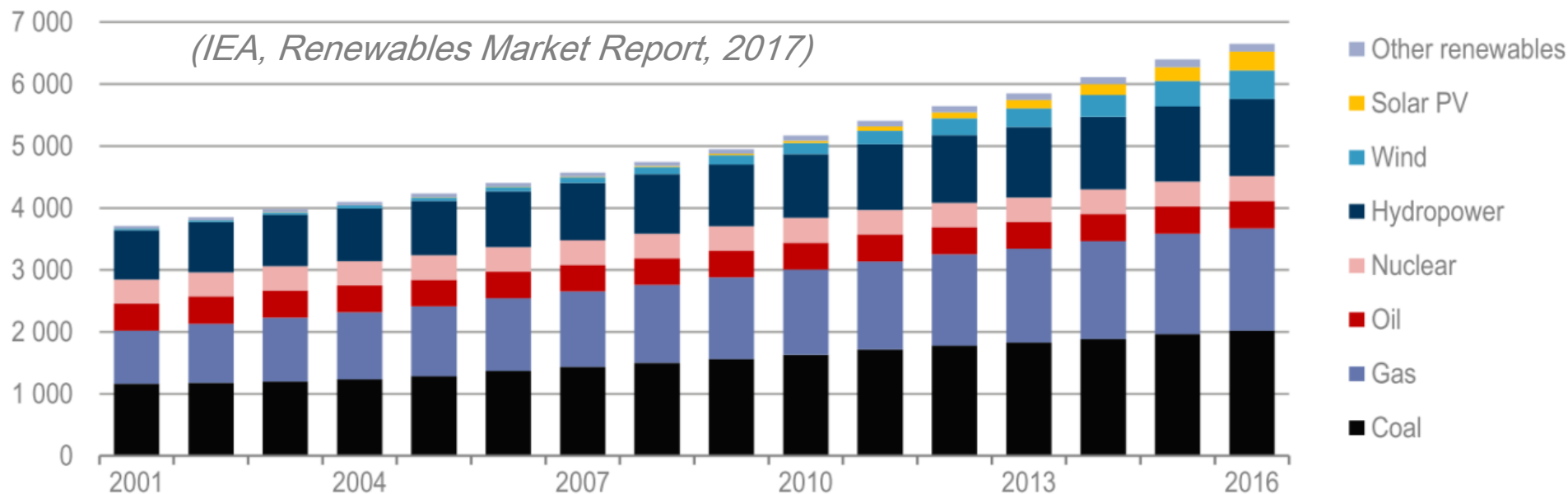
- Still modest contribution to global electricity capacity
- ..but growing rapidly, particularly 'ex large hydro'

FIGURE 25. INVESTMENT IN POWER CAPACITY – RENEWABLE, FOSSIL-FUEL AND NUCLEAR, 2008-2016, \$BN



GW

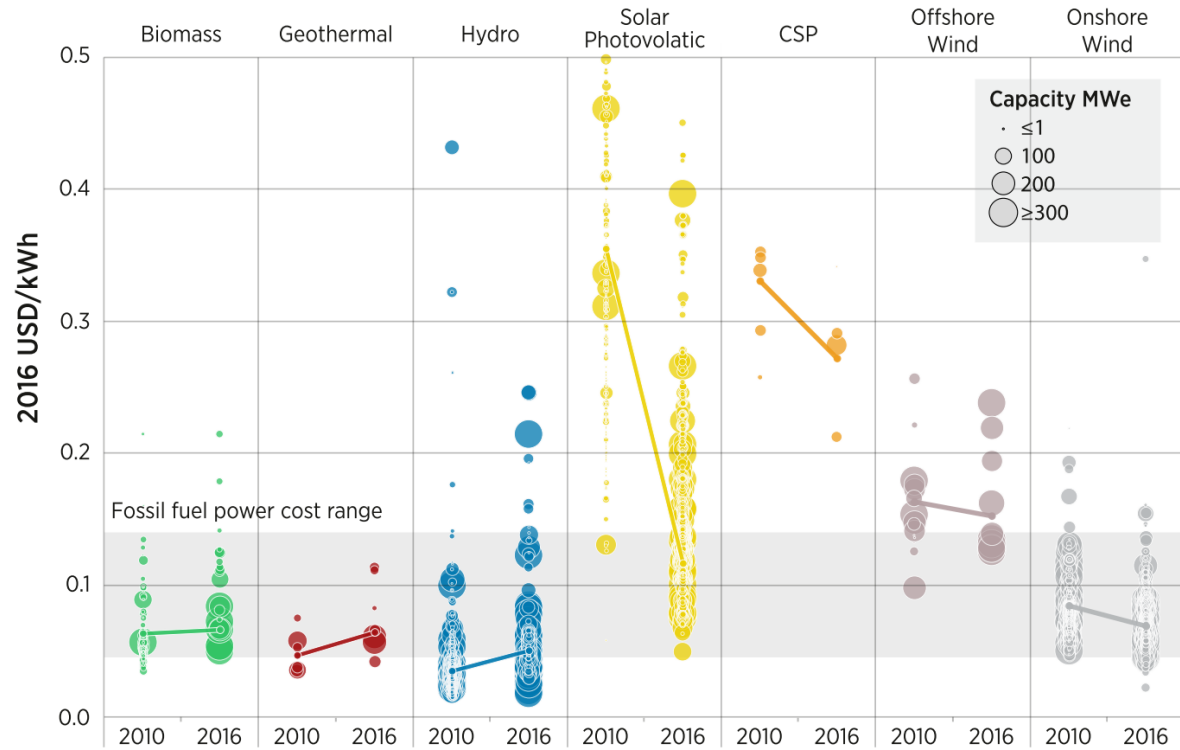
*(IEA, Renewables Market Report, 2017)*





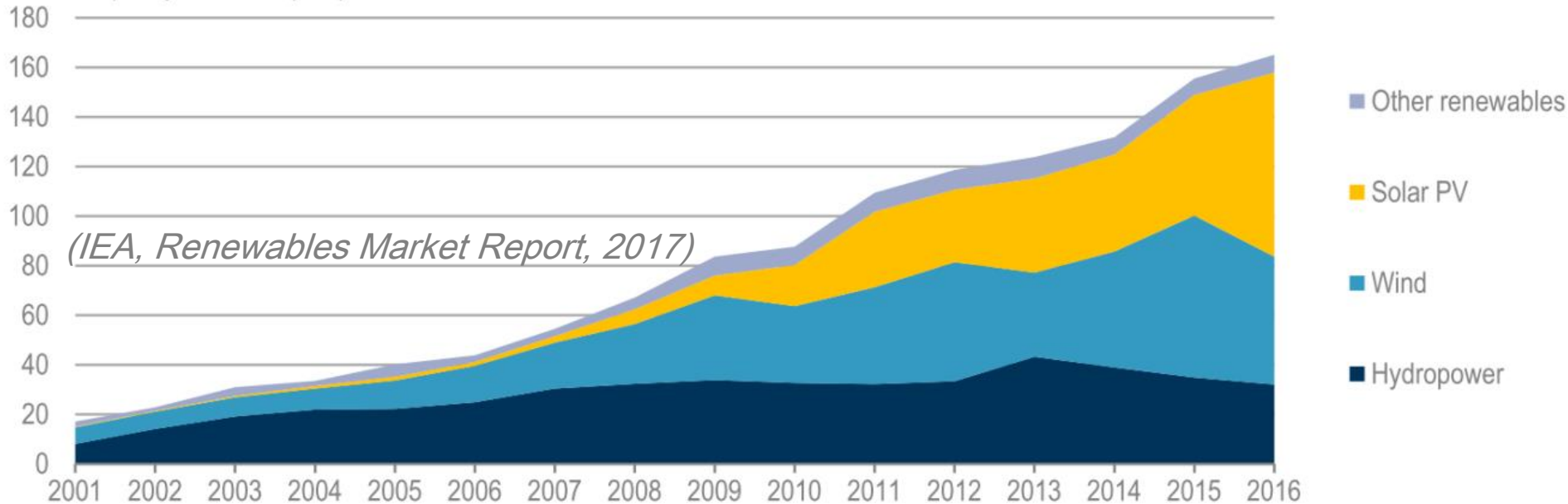
# ... particularly wind & solar PV

- Falling costs
- Wide suitability wrt resource, societal acceptance



(IRENA, Renewables Sharply falling generation costs, 2017)

Capacity additions (GW)



(IEA, Renewables Market Report, 2017)

# Myanmar & Australian electricity sectors - an 'order of magnitude' world apart

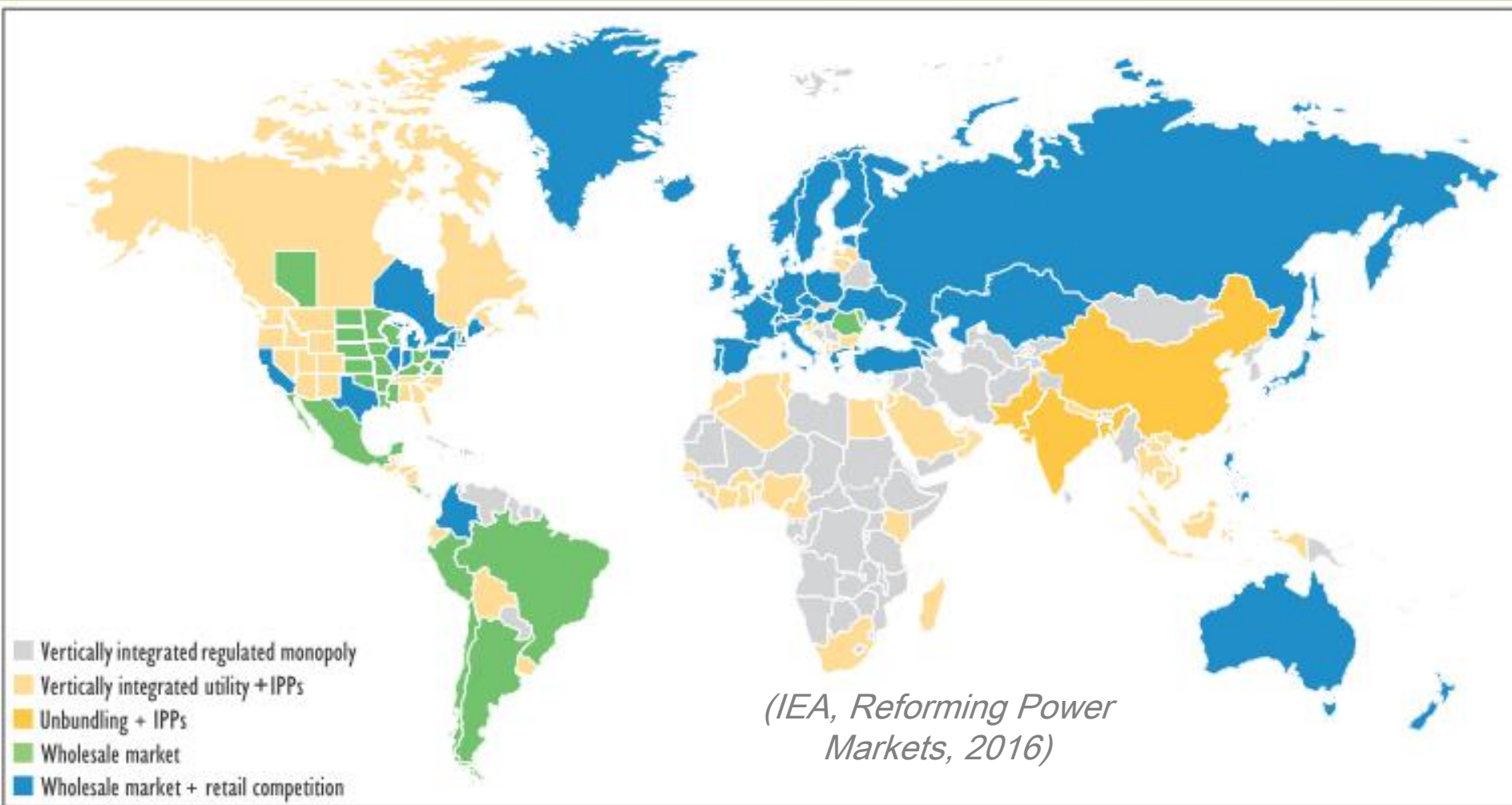
## COMPARE AUSTRALIA to MYANMAR

Myanmar

**If Myanmar were your home instead of Australia you would...**

- die **16.13 years** sooner
- be **10.1 times more** likely to die in infancy
- make **96.05% less** money
- spend **99.68% less** money on health care
- use **98.85% less** electricity

# Electricity sector governance too



# ...but some shared opportunities and challenges, opportunities for learning

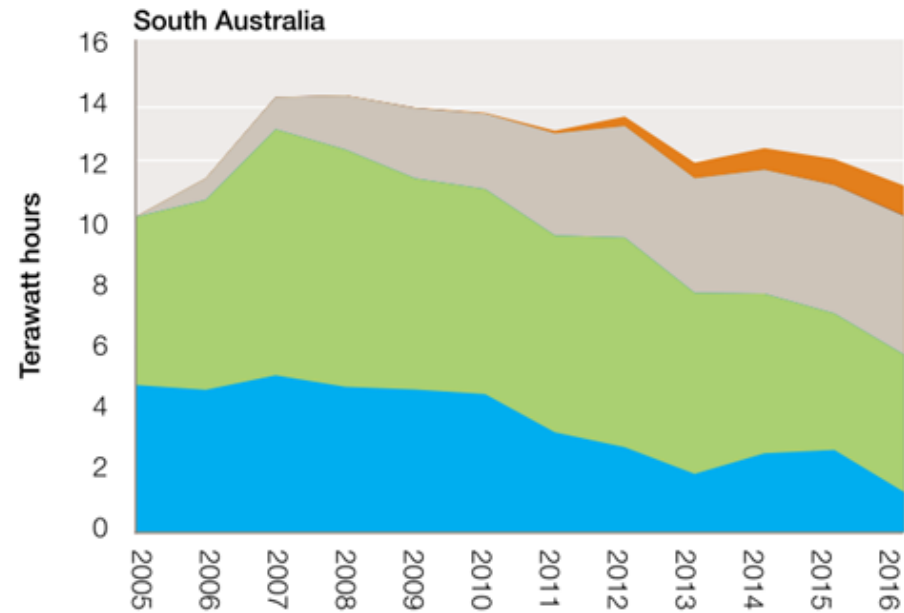
- Both old + new energy pathway options
  - Significant fossil fuel resources – coal, gas
  - Excellent renewable energy options, including solar
- Challenges of delivering energy services to remote communities
- *For Australia, variable RE penetrations still modest, but focussed*
  - South Australian Wind
  - Household PV
  - Off-grid systems



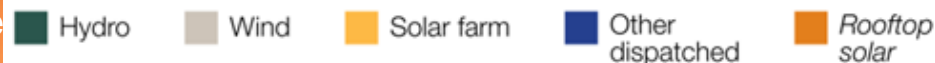
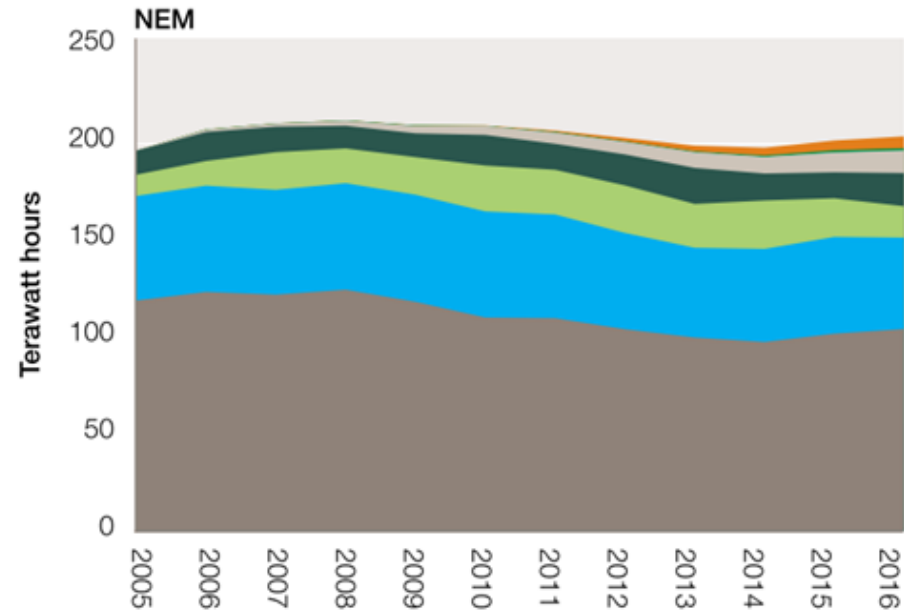


# Facilitating utility- scale variable RE

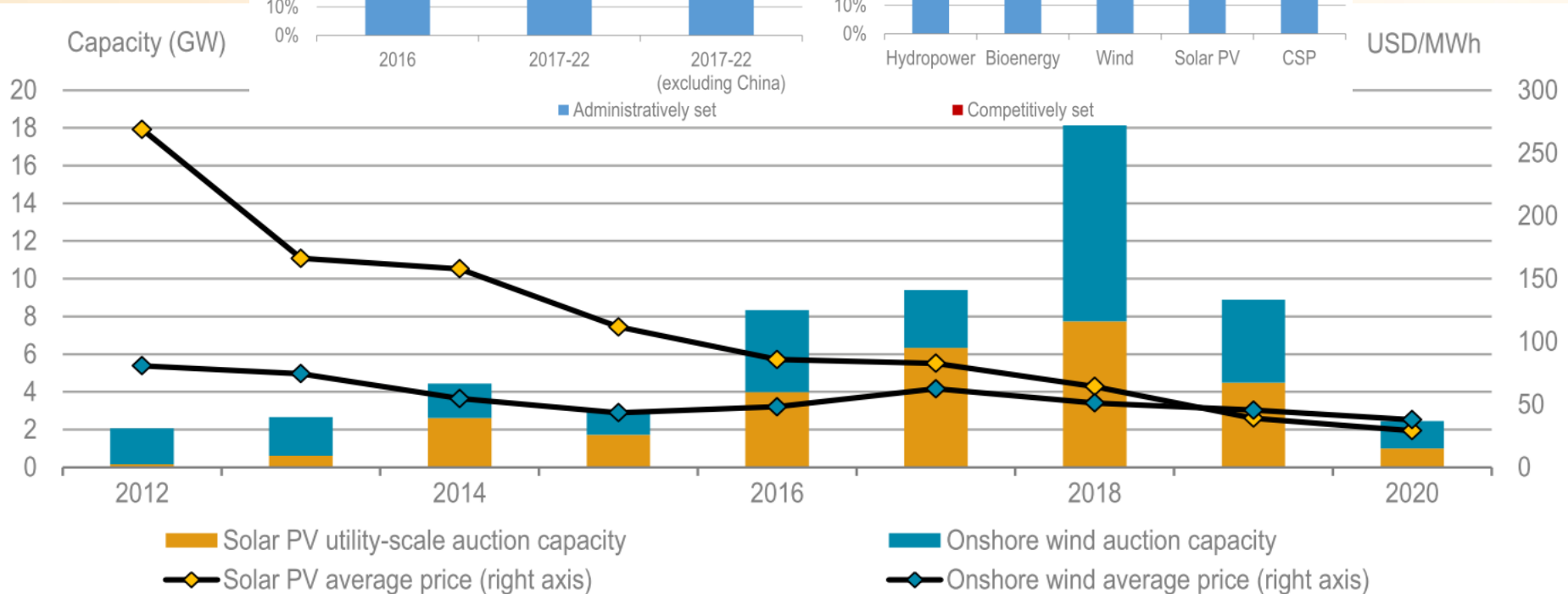
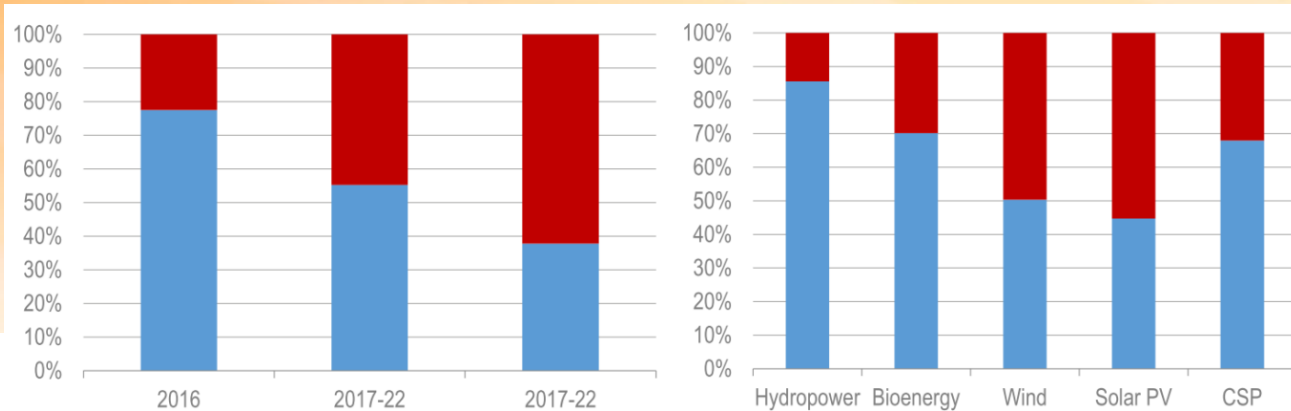
- Transmission interconnection
- Value of complementary resources – gas, hydro
- Integrated power system operation
- Integrated power system planning
- *Support for new players*



(AER, State of Energy Market 2017)



# RE support policy – from FiT and Green Certificate Markets to (State govt) auctions





# Residential PV

- Driven by falling PV costs, retail electricity price rises, social change, rejection of existing retail arrangements

- Facilitated by:

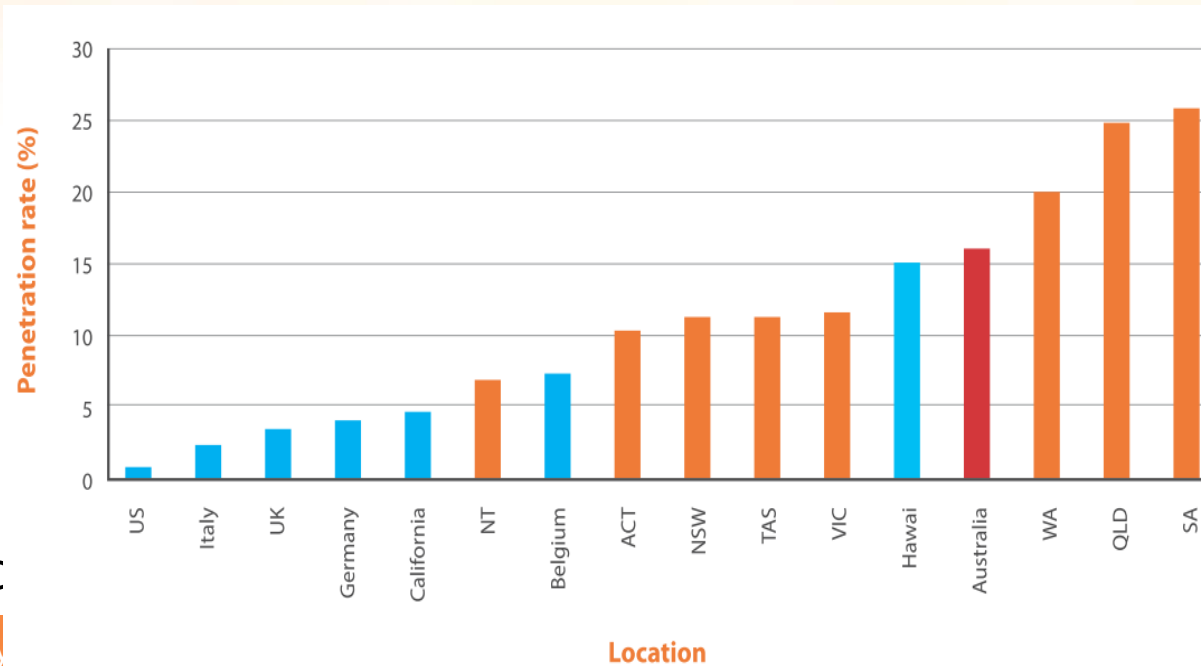
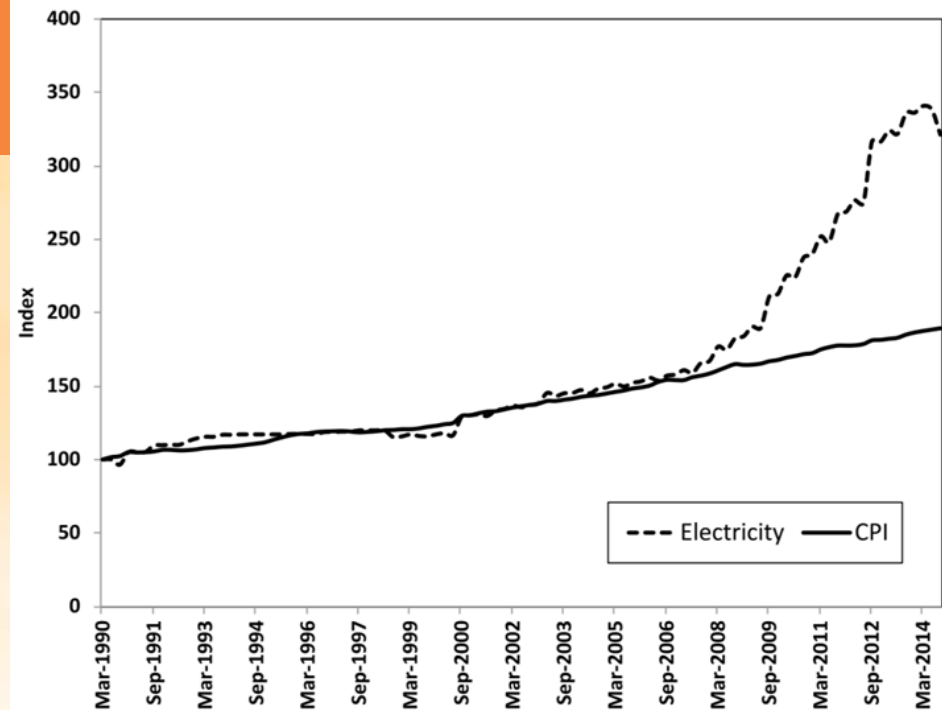
Early targeted policy FiT

Regulatory environment limiting power of incumbent network, retail businesses

Present volumetric tariffs that cross-subsidise PV

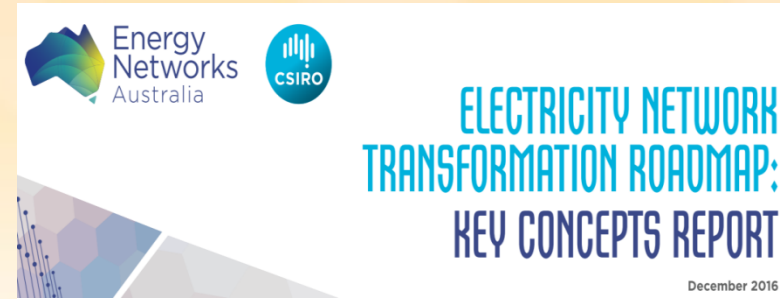
New business entry that reduced 'soft' costs of PV

'Best practice' technical stnc



# Our energy future – how centralised or distributed? democratised or privatised?

- Some trends towards greater community involvement
  - Embedded networks
  - Community funded projects
  - Solar Citizens political advocacy
- ...yet other trends towards greater private participation
  - Greatest PV deployment at individual household
  - Improving options for leaving the grid entirely



**Transformation on an unprecedented scale**

The electricity system supporting Australia's modern economy and lifestyle is experiencing change on an unprecedented scale. The transformation is driven by customers as they embrace new technologies, take control of their energy use and support action on climate change. By 2050, it is estimated that customers or their agents - not utilities - will determine how over \$200 billion in system expenditure is spent and millions of customer owned generators will supply 30-50% of Australia's electricity needs.

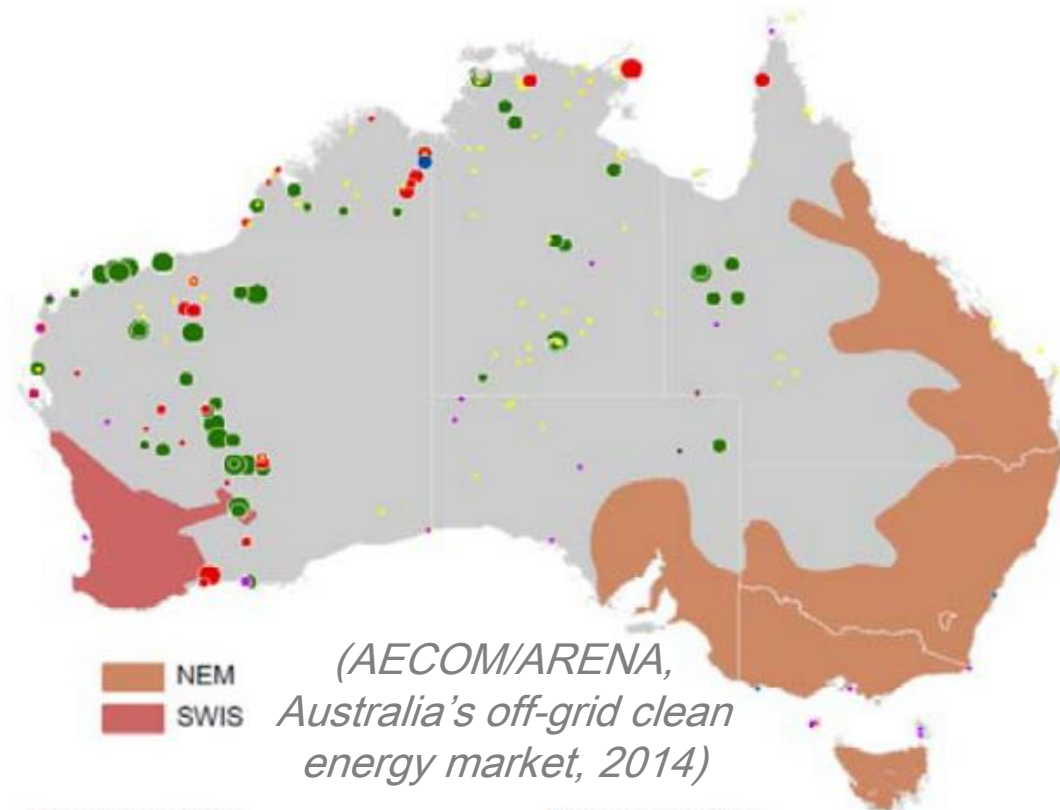


# Off-grid supply

- Generally highly subsidised
- PV's now increasingly competitive as 'fuel saver' on diesel grids
- Opportunities for 100% renewables (+storage) on remote grids
- Mini-grids implemented, operated by utilities
  - Growing interest, capability in RE and RE integration although still much to learn

| Electricity Markets       | Capacity |       | Consumption |       |
|---------------------------|----------|-------|-------------|-------|
|                           | GW       | Share | TWh         | Share |
| NEM                       | 49.0     | 83%   | 199         | 86%   |
| SWIS (WA)                 | 5.5      | 9%    | 17.7        | 8%    |
| Off-grid Mining Market    | 3.9      | 6%    | 12.4*       | 5%    |
| Off-grid Community Market | 1.0      | 2%    | 3.4*        | 1%    |

Existing off-grid generation



### Primary Fuel Type

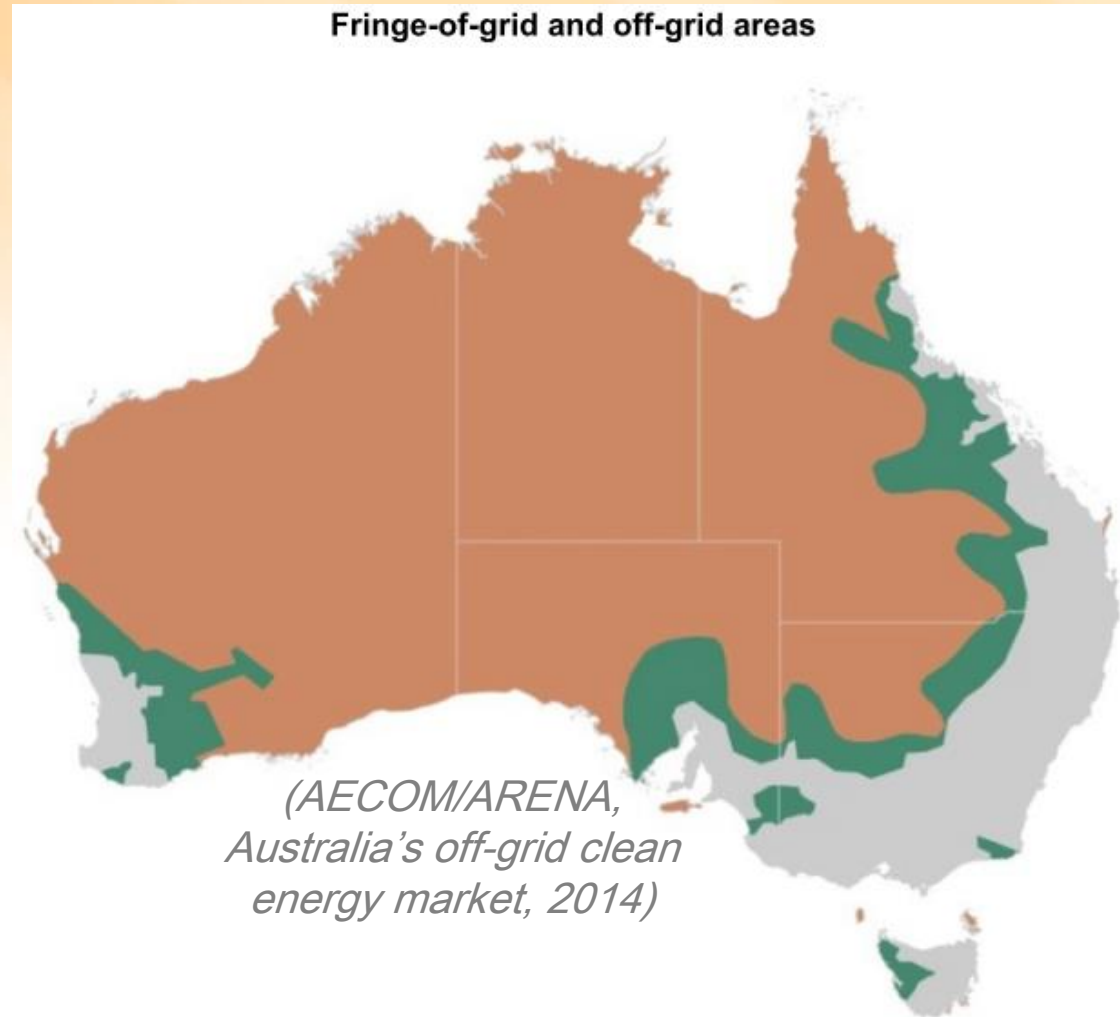
- Biogas
- Distillate
- Geothermal
- Hydro
- Natural Gas
- Ocean (wave)
- Solar
- Wind

### Power Generation

- Under 1 MW
- 1-10 MW
- 10-50 MW
- Over 50 MW

# Where next for the fringe of grid?

- Large cross subsidies between urban and rural areas
- Growing interest in opportunities to actually reduce the fringe of grid given improving RE options – both stand-alone and mini-grid
- Potential risks for investment in low density rural dx networks



# Solar home systems

- A key role on mini-grids and off-grid, particularly for 'access for all' where additional 'access' mostly solar driven

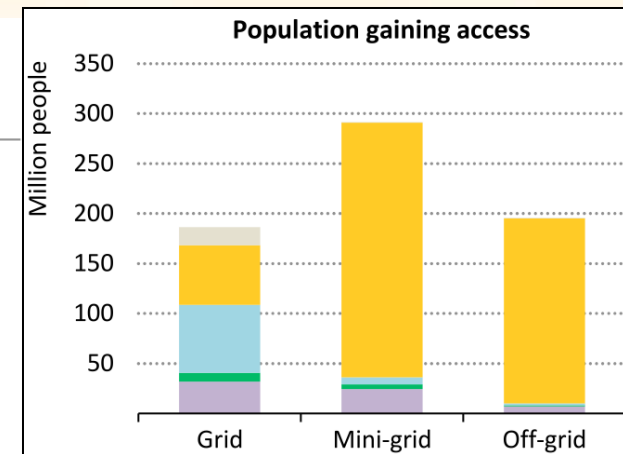
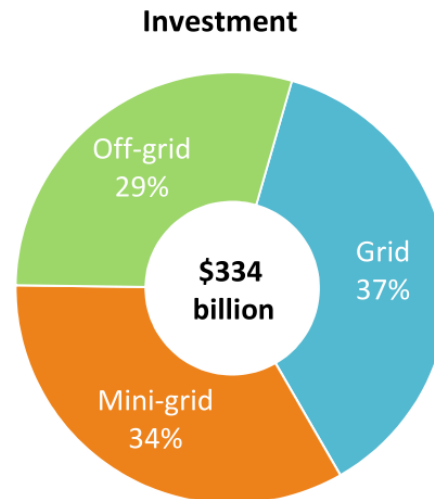
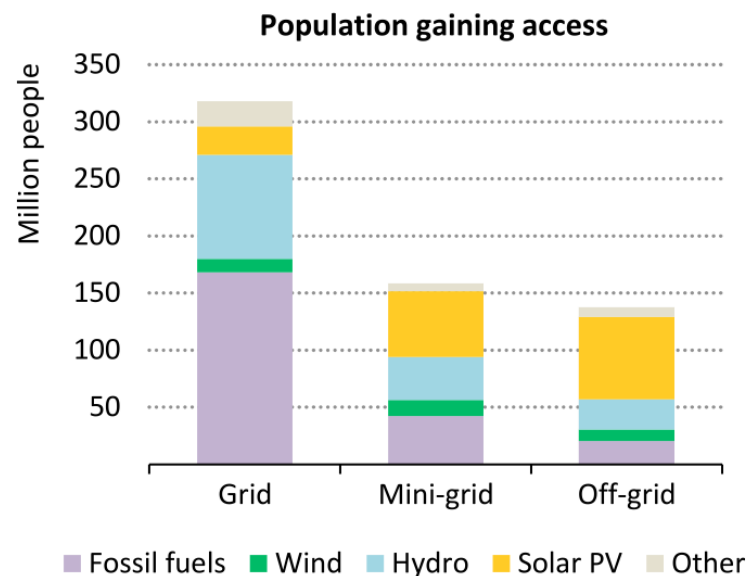


2012 to 2015 saw a 15-fold increase in investment in the off-grid solar sector\*

\*Off-Grid Solar Market Trends Report 2016, Bloomberg New Energy Finance and Lighting Global

*(BNEF, off-grid solar market trends, 2016)*

**Figure 2.5** ▶ Cumulative population gaining access to electricity and cumulative investment in the New Policies Scenario, 2017-2030



*(IEA, Energy Access Outlook 2017)*

# Possible lessons for renewables integration

*RE a growing opportunity to address all of our energy objectives*

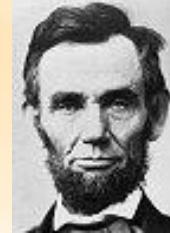
- **Utility-scale opportunities - *facilitating new entry likely key***
  - Resource mapping, relevant electricity industry information, high but transparent and independently assessable connection requirements
  - Value of large geographical tx network and complementary resources
  - Effective integration into power system operation and planning
- **Small-scale opportunities –*new entry inevitable***
  - Regulatory frameworks that restrict controlling power of incumbents
  - Options to increase community participation and leadership
- **Off-grid systems – *more or less coordinated pathway possible***
  - Cross-subsidies represent financial flow that can be redirected to reducing societal costs of delivering energy services to the vulnerable
  - Risk management frameworks have key role



# Where next?

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

Abraham Lincoln



"It depends..."

