



Smart Future Energy Systems

Dr John K Ward

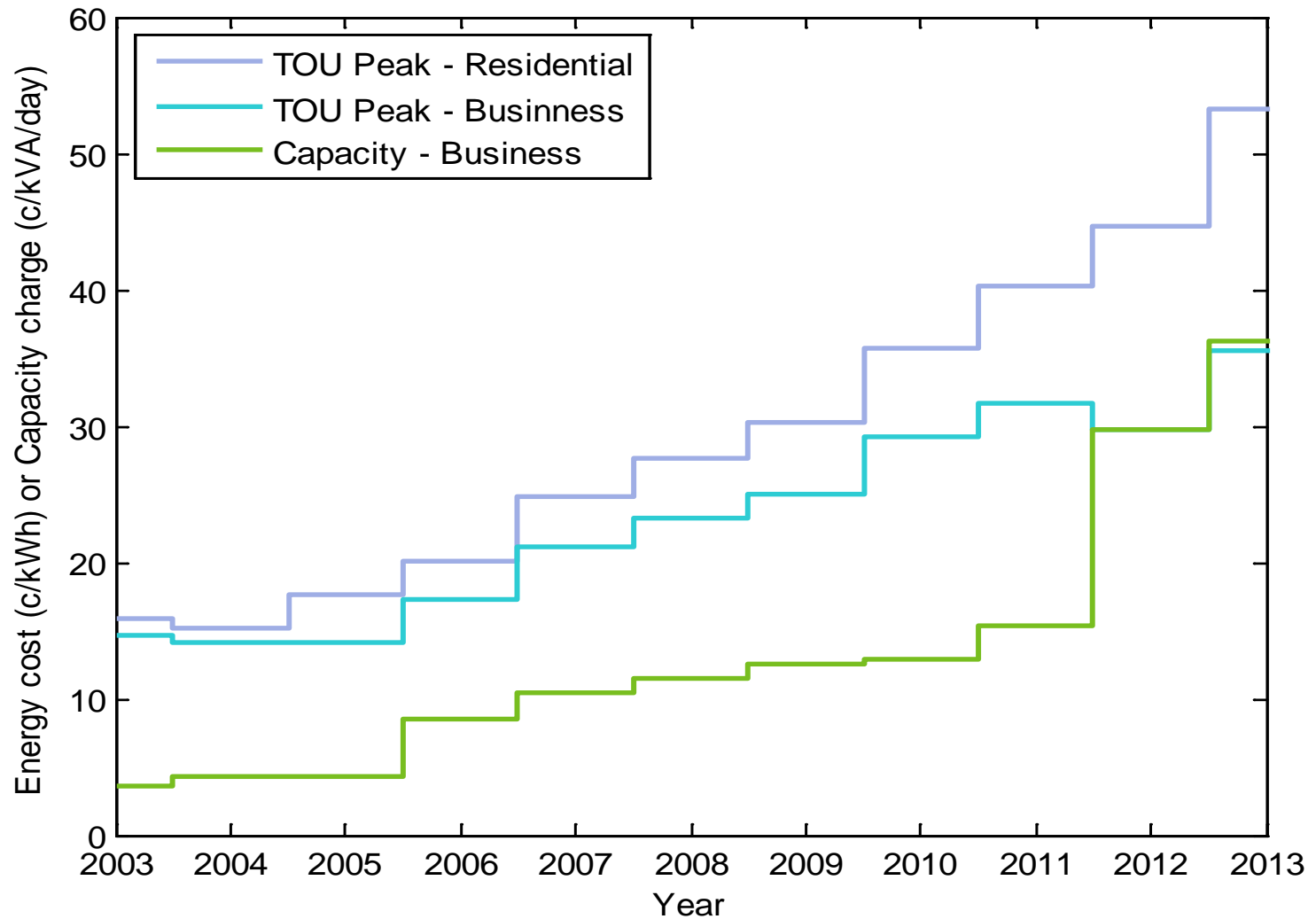
2 October 2015

ENERGY FLAGSHIP

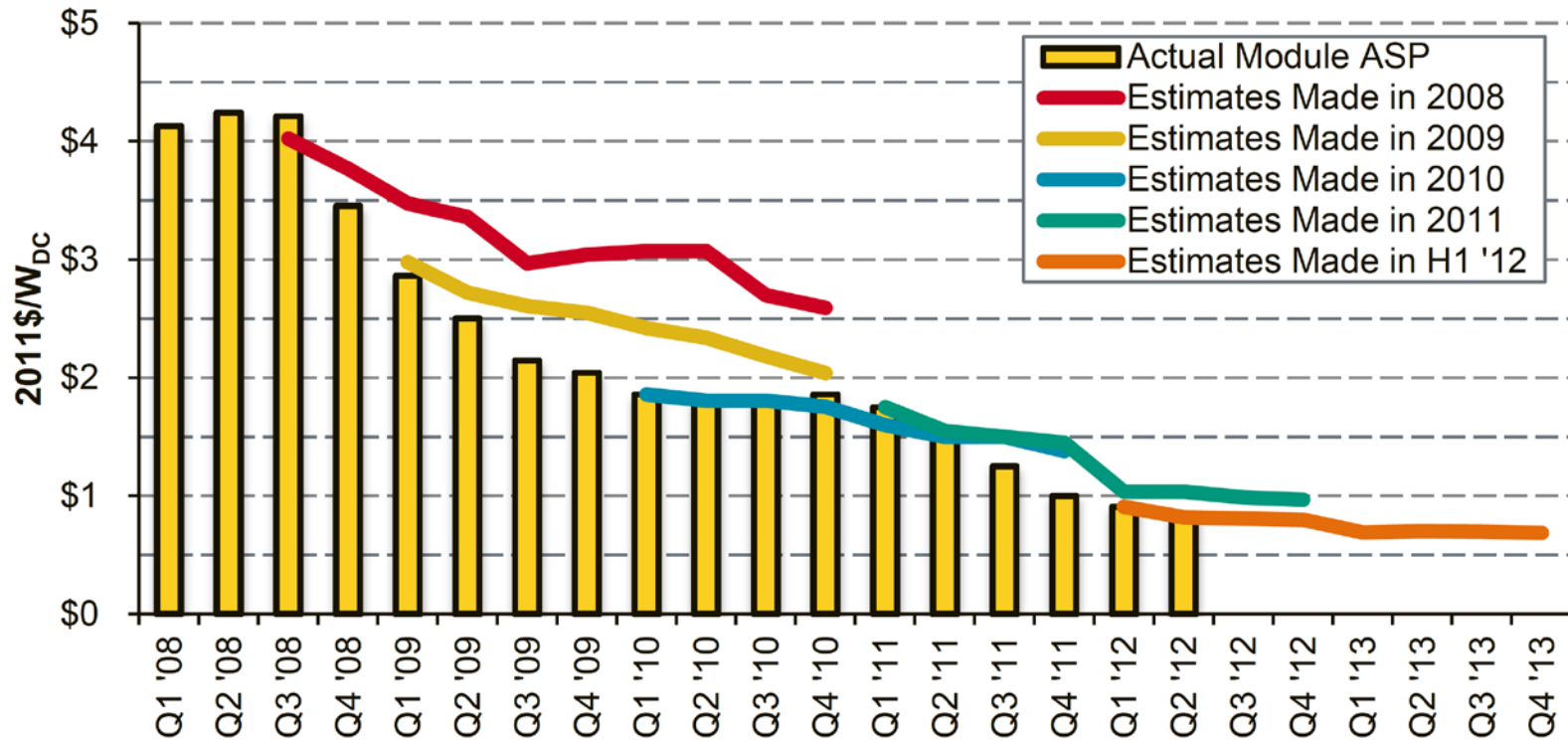
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We are in interesting times:



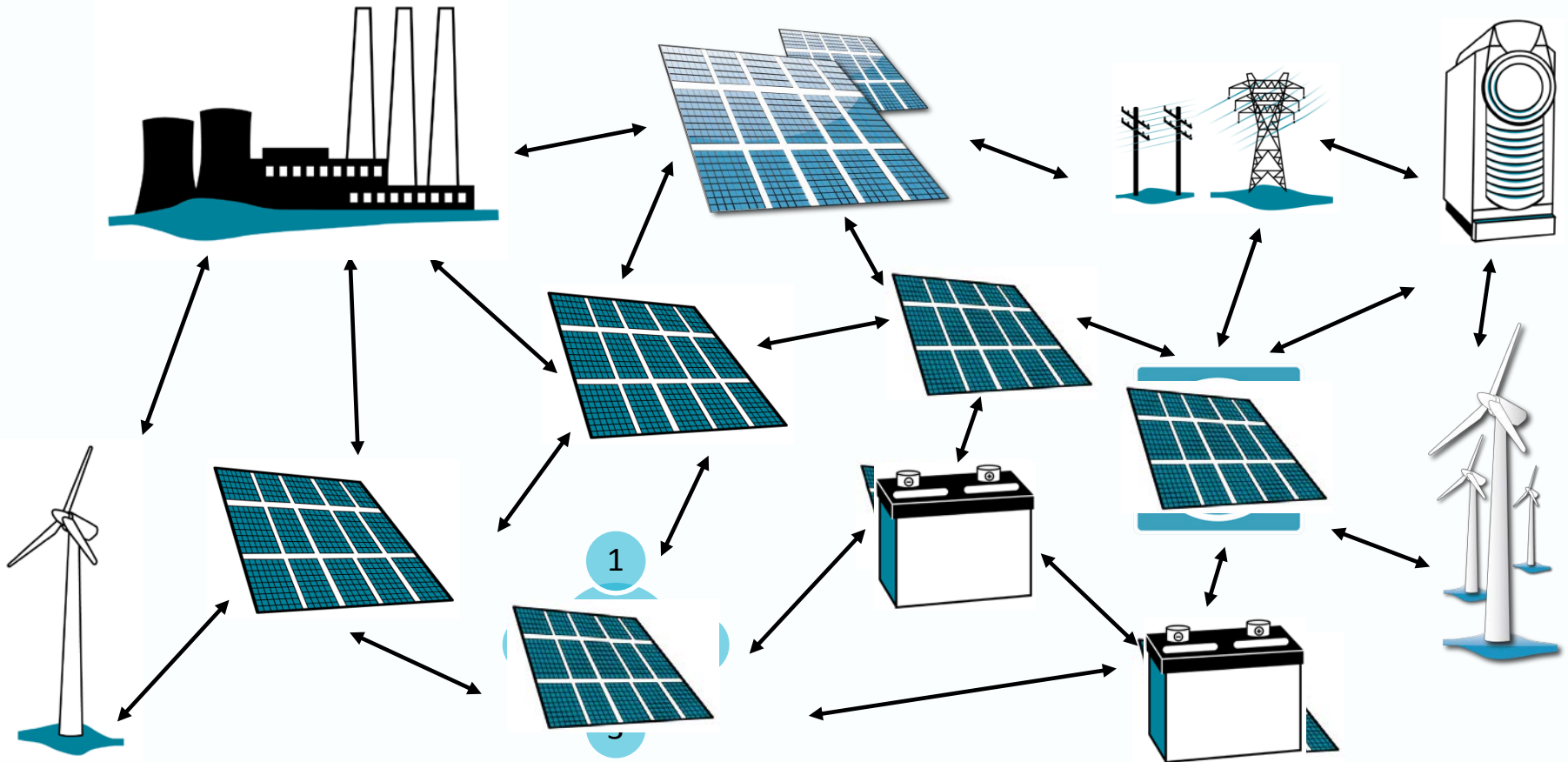
PV price trends



<http://www.nrel.gov/docs/fy13osti/56776.pdf>

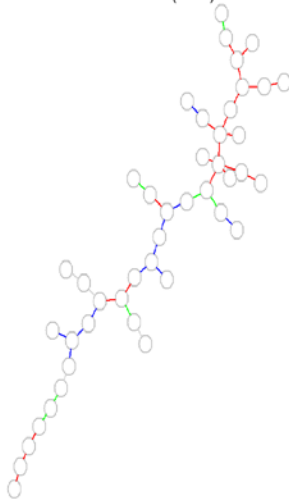
Context - A Changing Electrical Grid

Forecasting, managing storage and gathering information in an increasingly complex grid

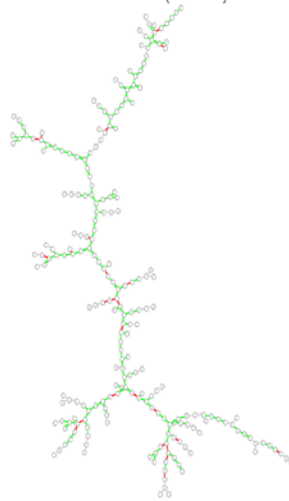


NFTS

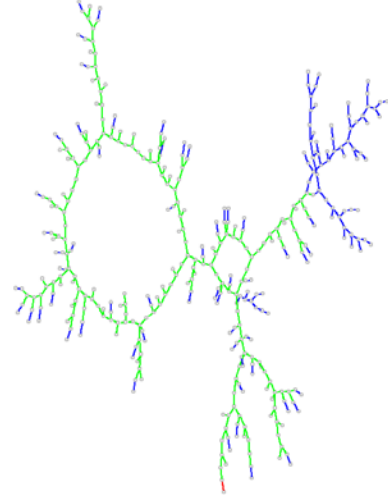
Prototype 1
11kV Urban (ACT)



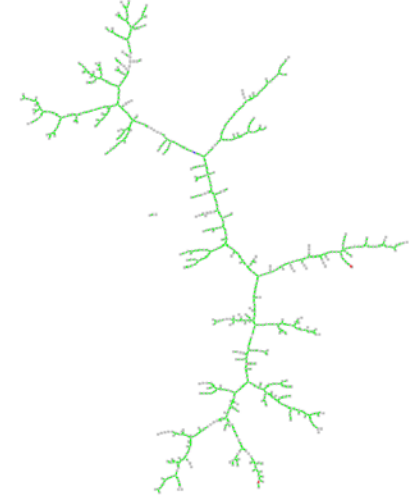
Prototype 2
22kV Urban (Victoria)



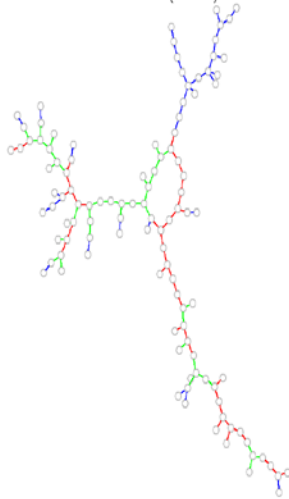
Prototype 5
11kV Short Rural (NSW)



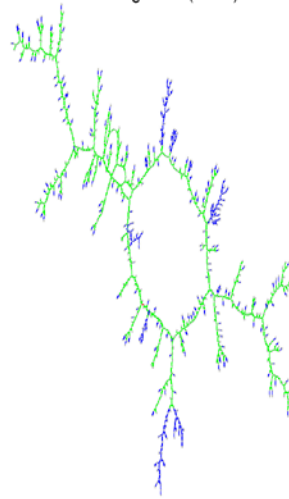
Prototype 6
22kV Long Rural (Victoria)



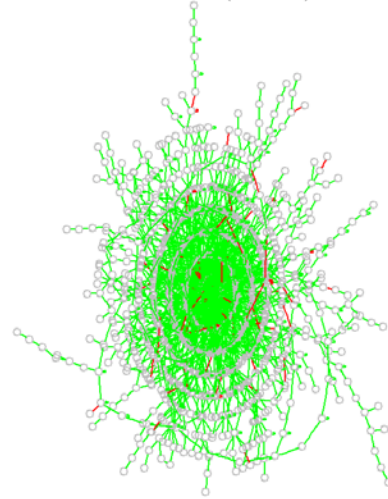
Prototype 3
11kV Urban (NSW)



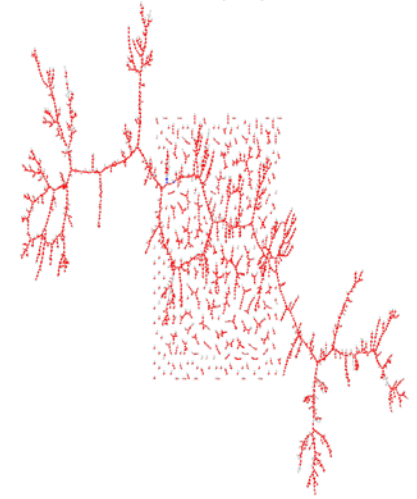
Prototype 4
22kV Long Rural (NSW)



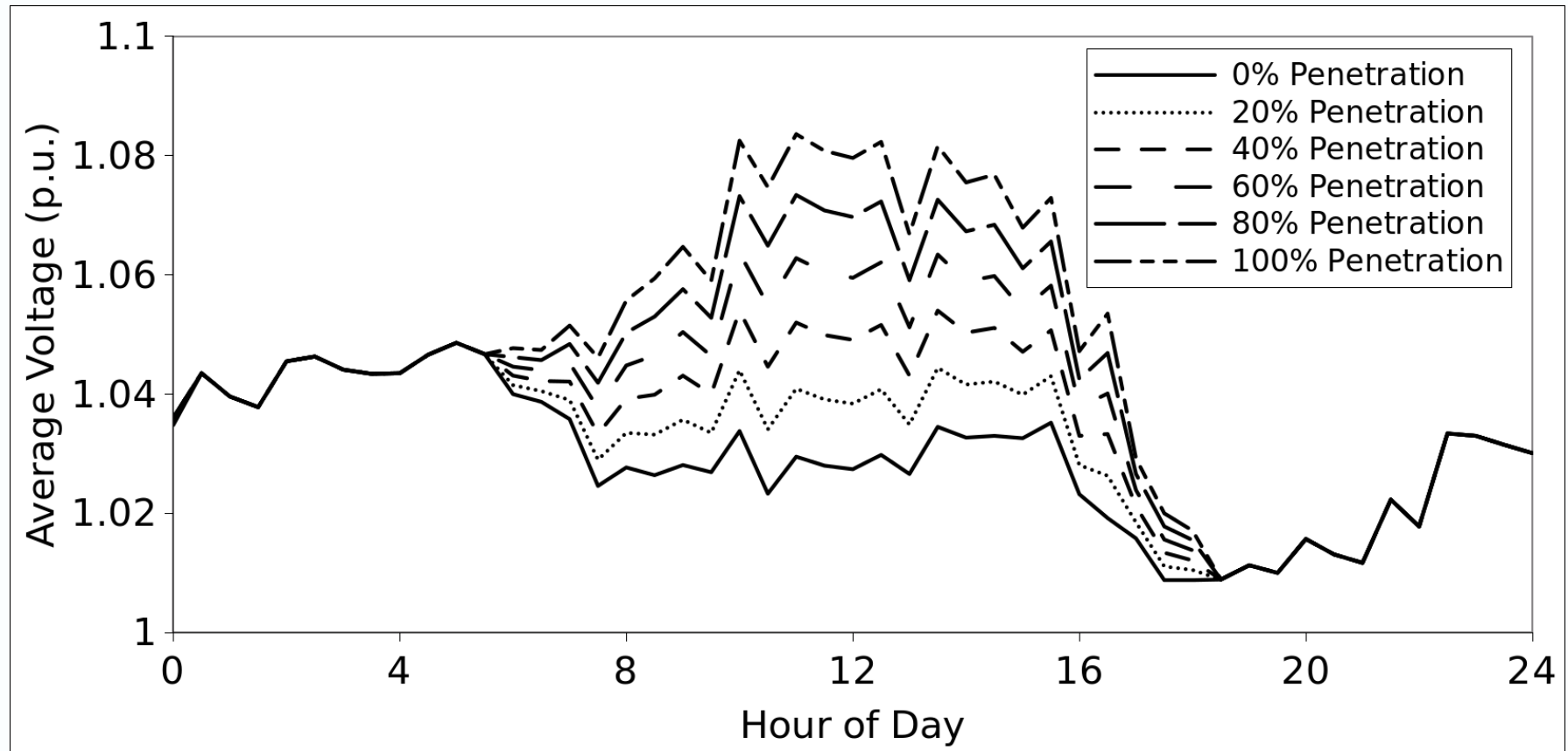
Prototype 7
22kV Urban (Victoria)



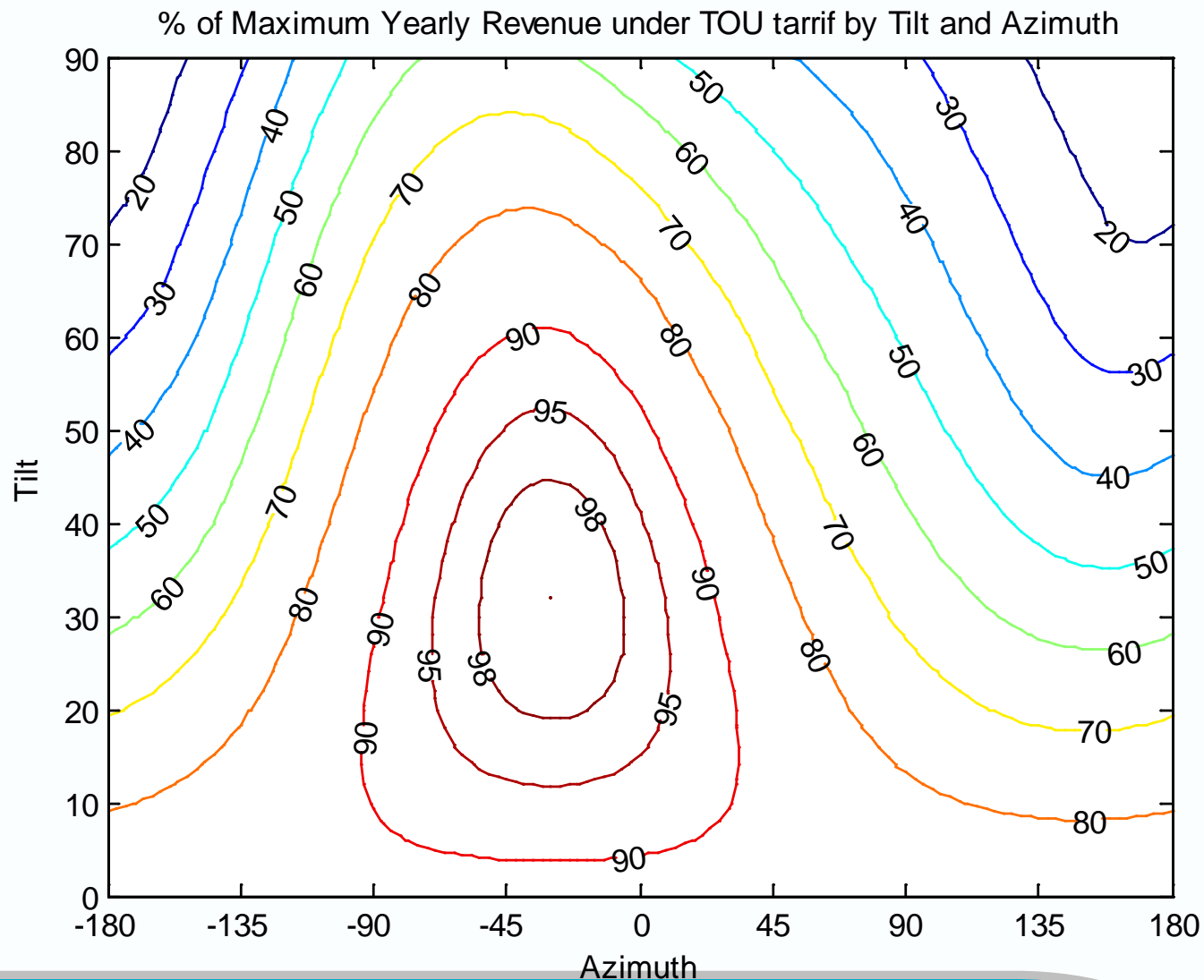
Prototype 8
22kV (WA)



PV Penetration & Voltages

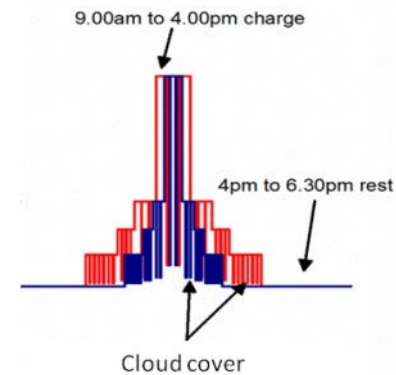
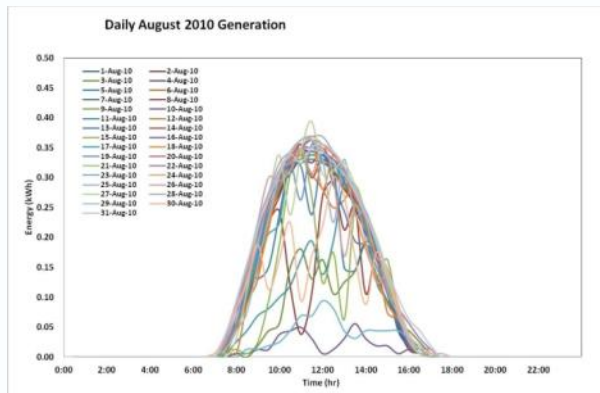
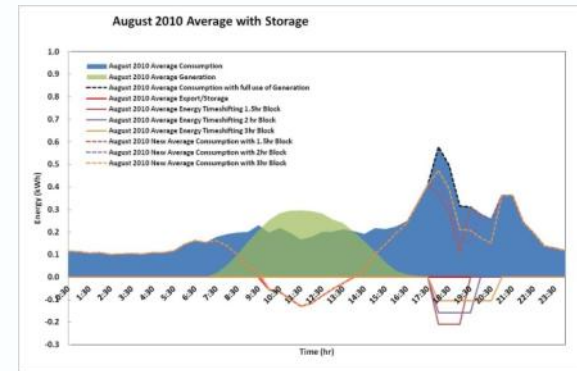
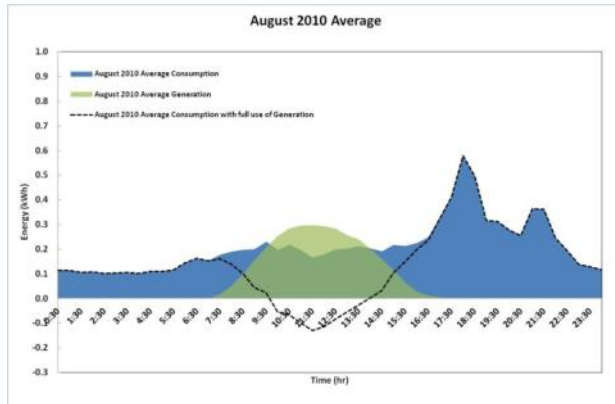


Orientation & Value

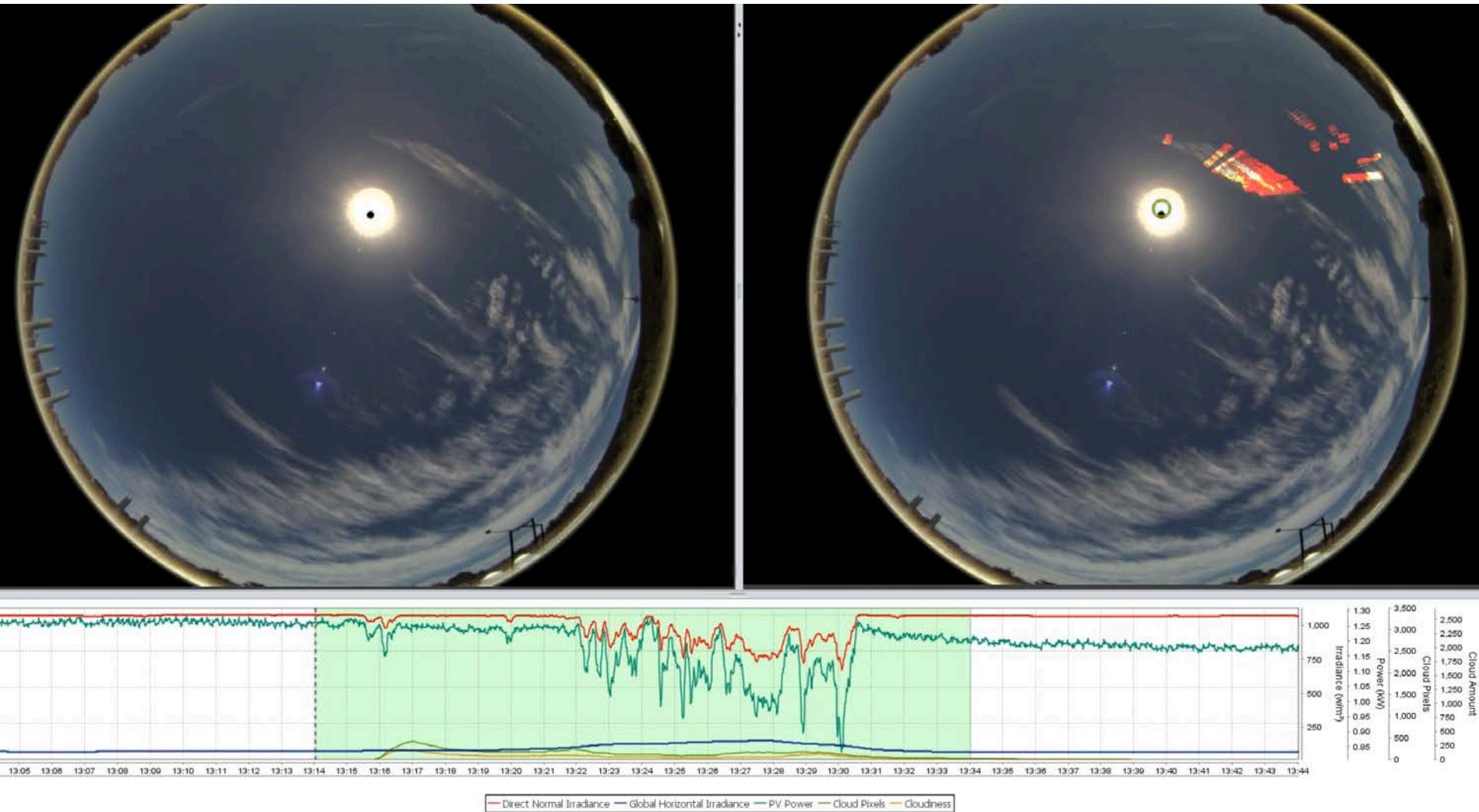


Evaluation load profiles for Energy Storage systems

By having a good understanding of generation and Australian conditions, accurate evaluation protocols can be established to identify ES technologies



Skycam





Australia's Future Grid Forum

✓ **Long-term orientation to 2050**

Identify key policy and technology choices not constrained by near term electoral cycles

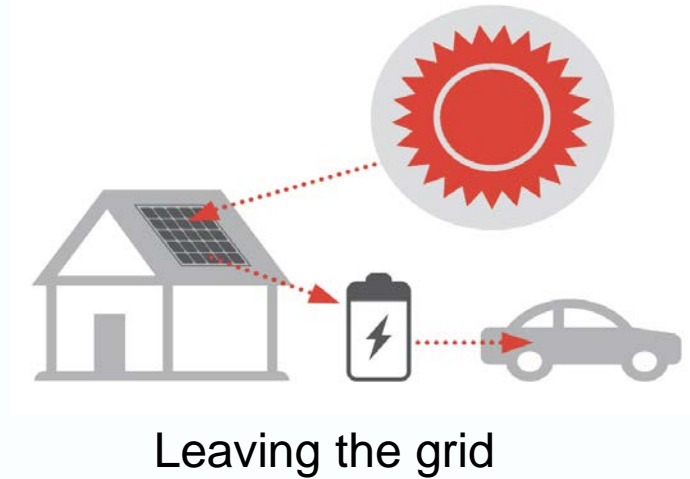
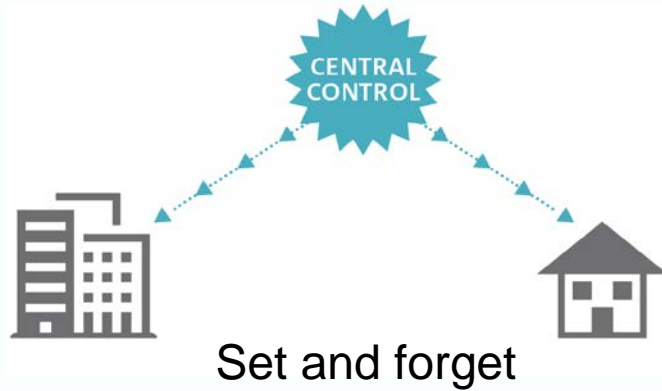
✓ **Whole-of-system**

Provide credible projections and quantitative analytics especially of the future role of networks

✓ **Industry-led**

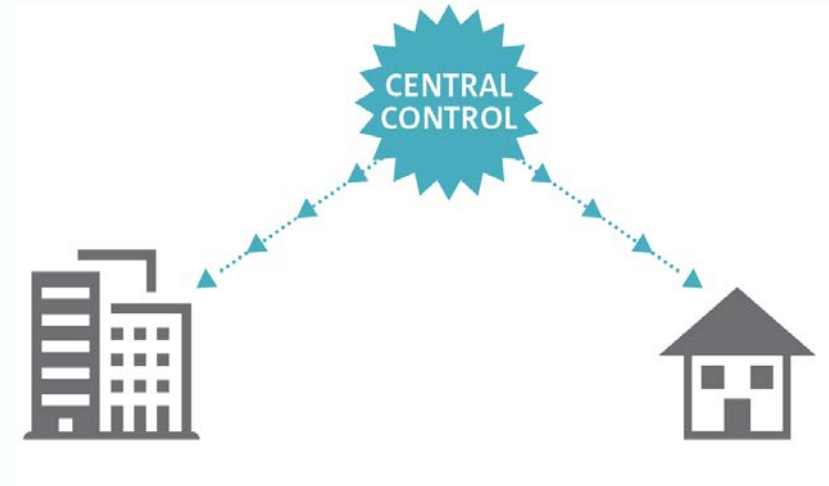
Enable bold and informed discussion that examines benefits and drawbacks of different outlooks

Four 2050 scenarios



Scenario 1: *Set and forget*

- Closest to a linear path of evolution from the present
- Generation:
 - 30% from renewable sources
 - 19% from distributed sources
- Modest uptake of energy storage and electric vehicles
- Widespread adoption of ‘set and forget’ demand management solutions offered by networks



Scenario 2: *Rise of the prosumer*

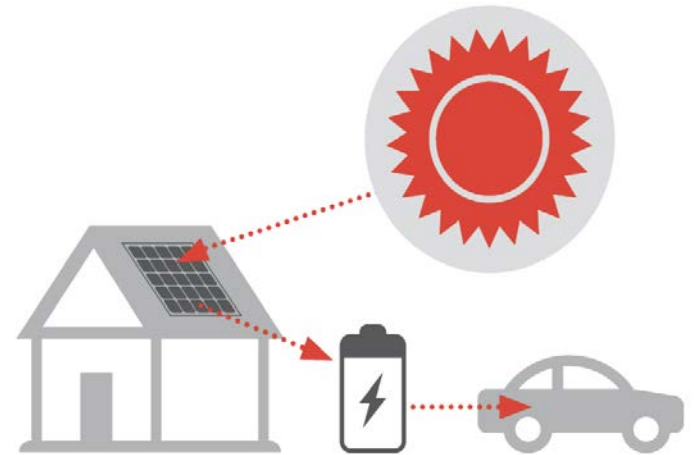
- Extensive transition to distributed energy networks
- Generation:
 - 41% from renewable sources
 - 46% from distributed sources
- Modest uptake of energy storage and electric vehicles
- Majority see value proposition of remaining grid-connected
- Networks now 'transact' electrons between thousands of sites



Customer-centric model
where customers consume, trade,
generate and store electricity.

Scenario 3: *Leaving the grid*

- Extensive transition toward user autonomy underpinned by distributed generation and storage
- Generation:
 - 64% from renewable sources
 - 31% from distributed sources
- Moderate uptake of electric vehicles
- ~30% are not convinced of grid value proposition and have entirely disconnected by 2050

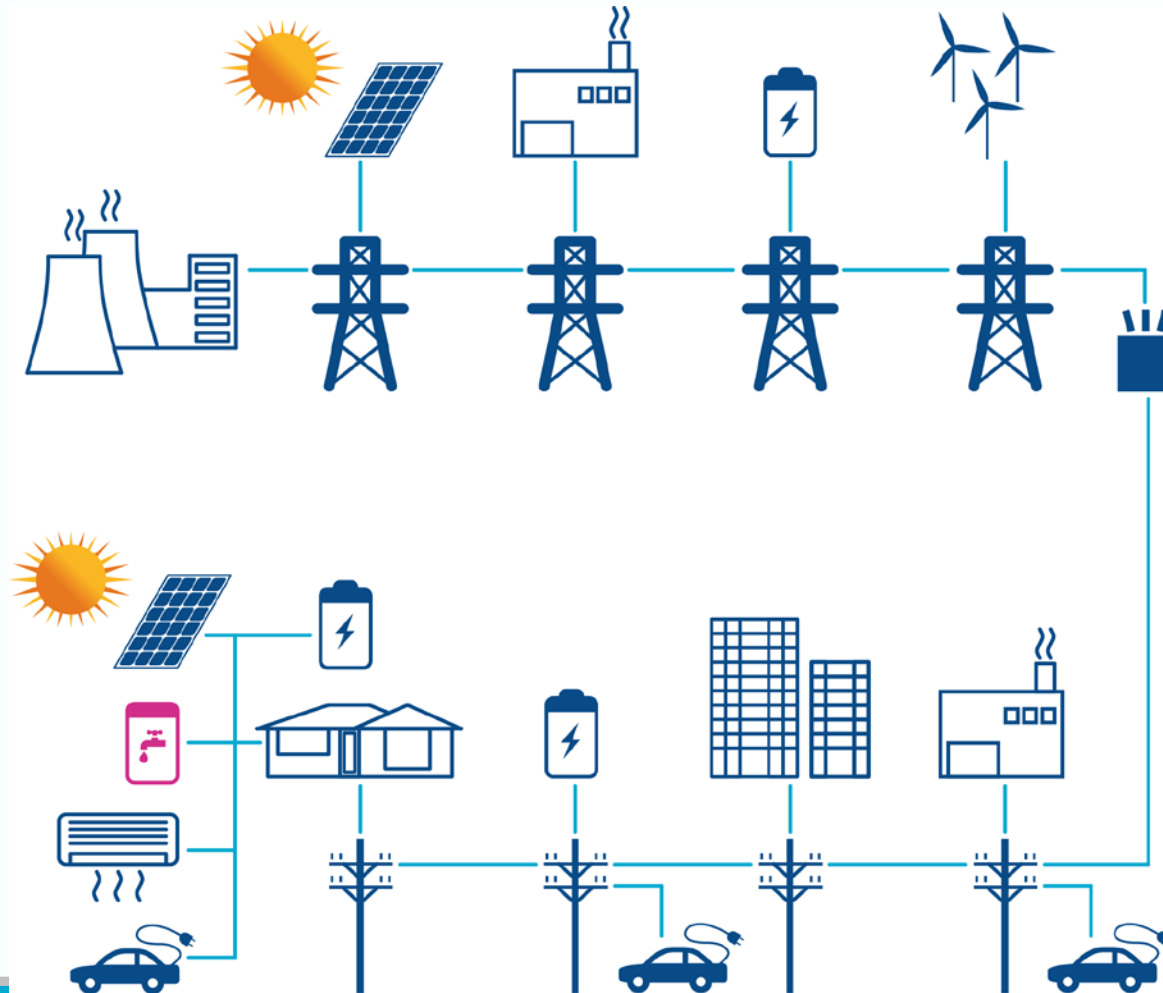


Scenario 4: *Renewables thrive*

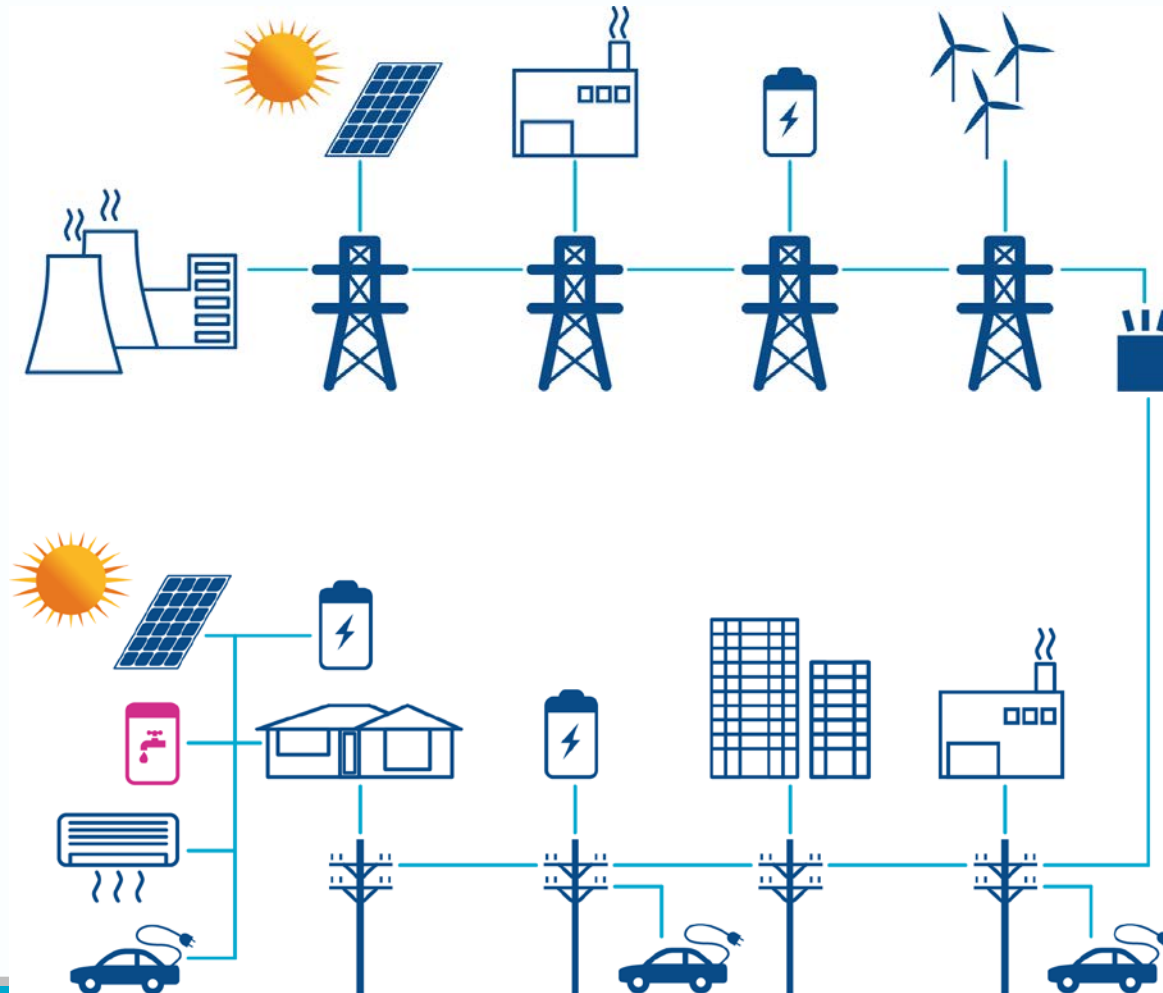
- Extensive transition to centralised renewables
- Generation:
 - 86% from renewable sources
 - 26% from distributed sources
- Centralised generation primarily from renewable sources + large-scale storage
- System is supported by extensive uptake of electric vehicles and modest uptake of DG and DS



Transacting Energy?

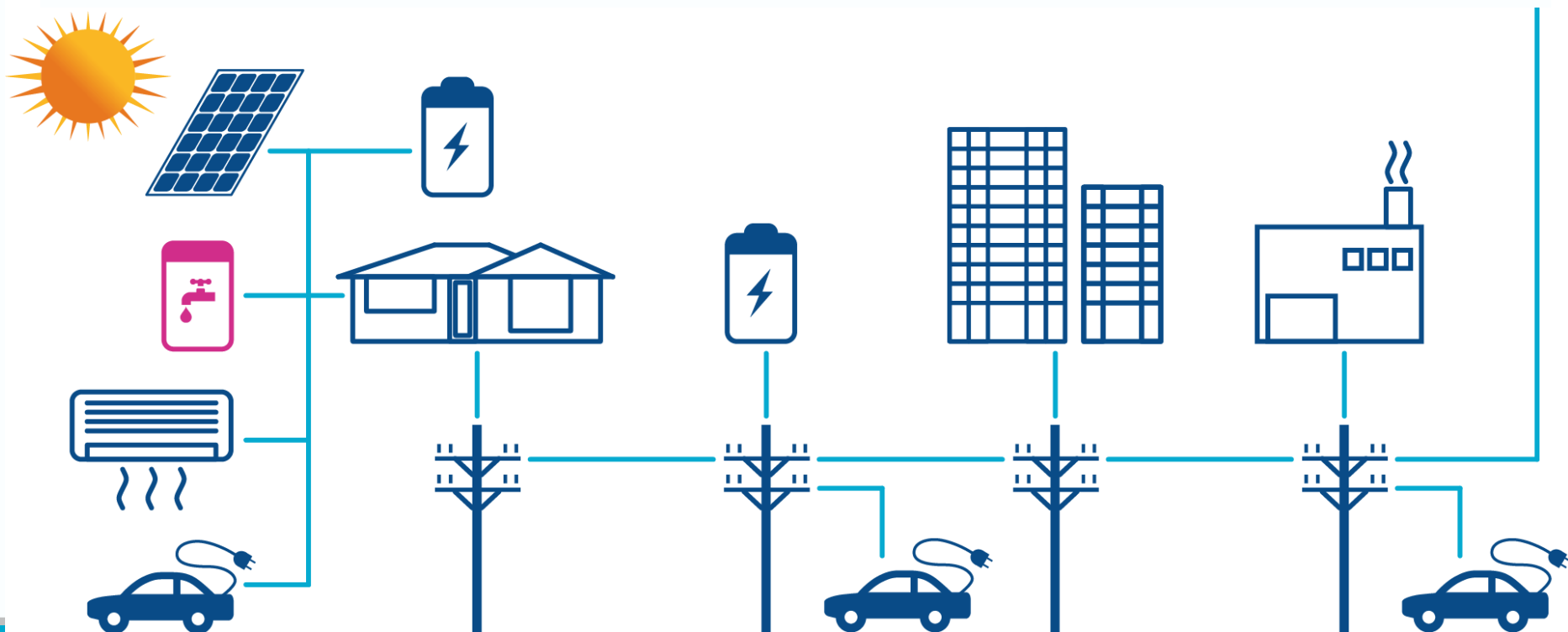


Transacting Energy?



Transacting Energy?

- *AS/NZS 4777 & 4755*
- *AS/NZS 5033 & IEC 62109*
- *AS/NZS 5139, BCA, UNECE*



Thank you

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