

The Future Grid: Virtual Power Plant enabled Distributed Energy Resource

Critical Horizons: Powering the Future of WA

Collie, Western Australia

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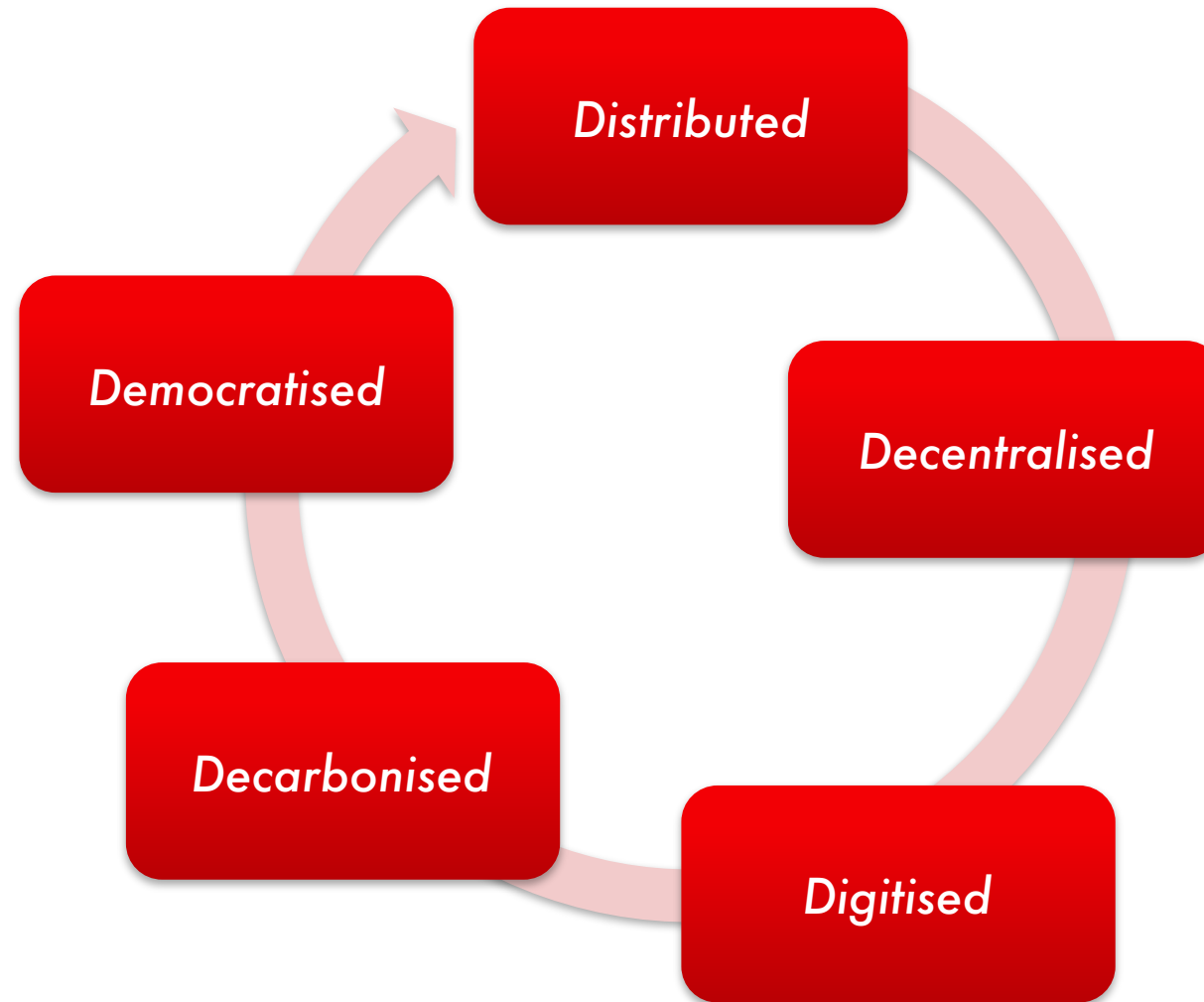
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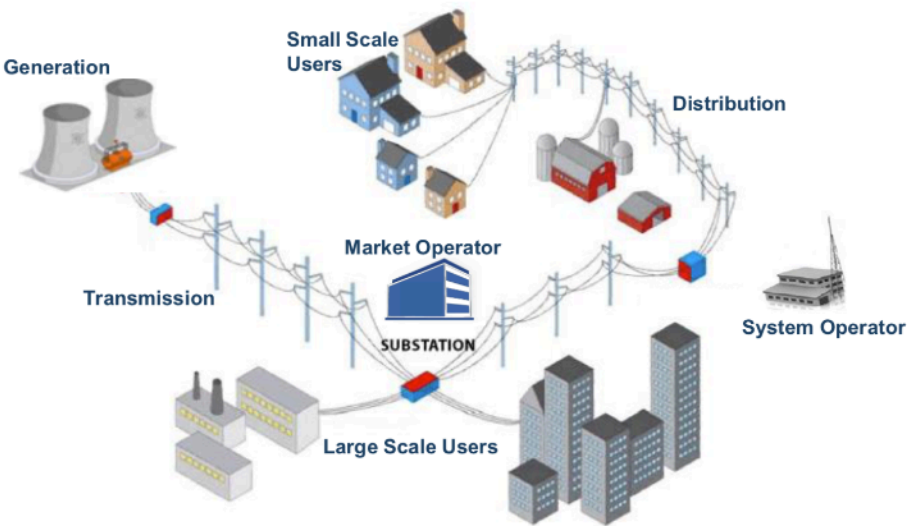


The Future Grid : Disruption Equals Opportunity



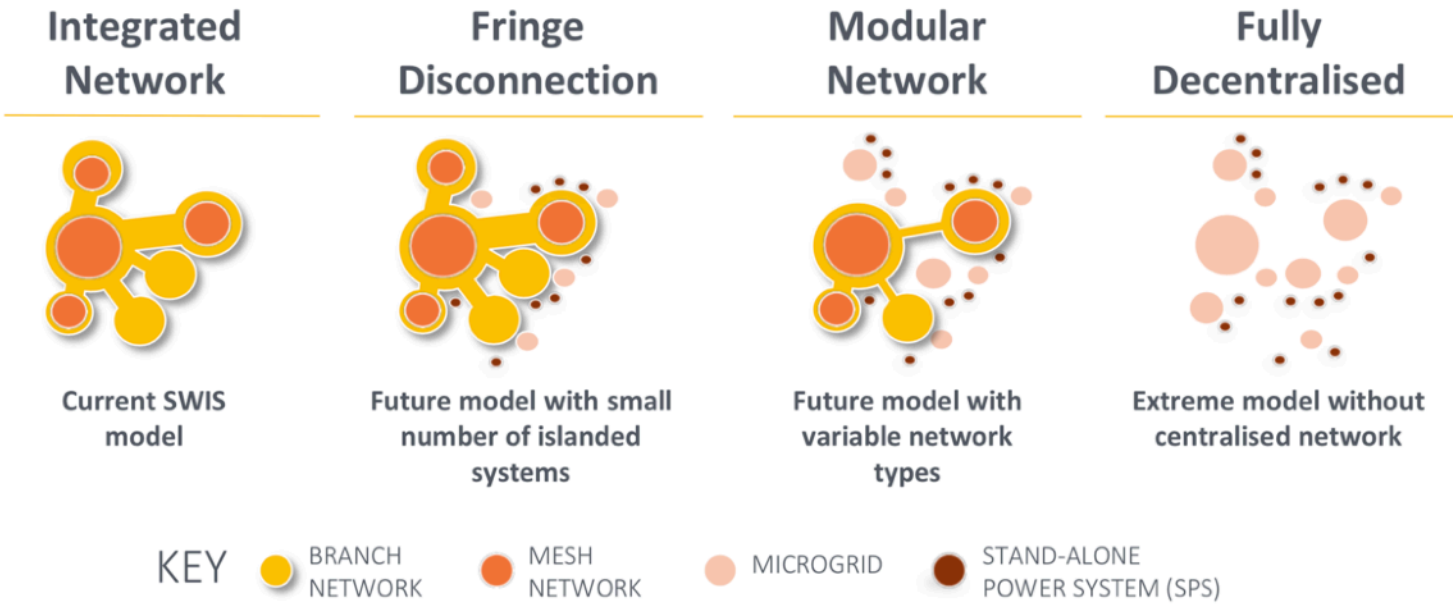
The Future Grid

Traditional Grid Structure



Source: AEMO

Future Grid Structures



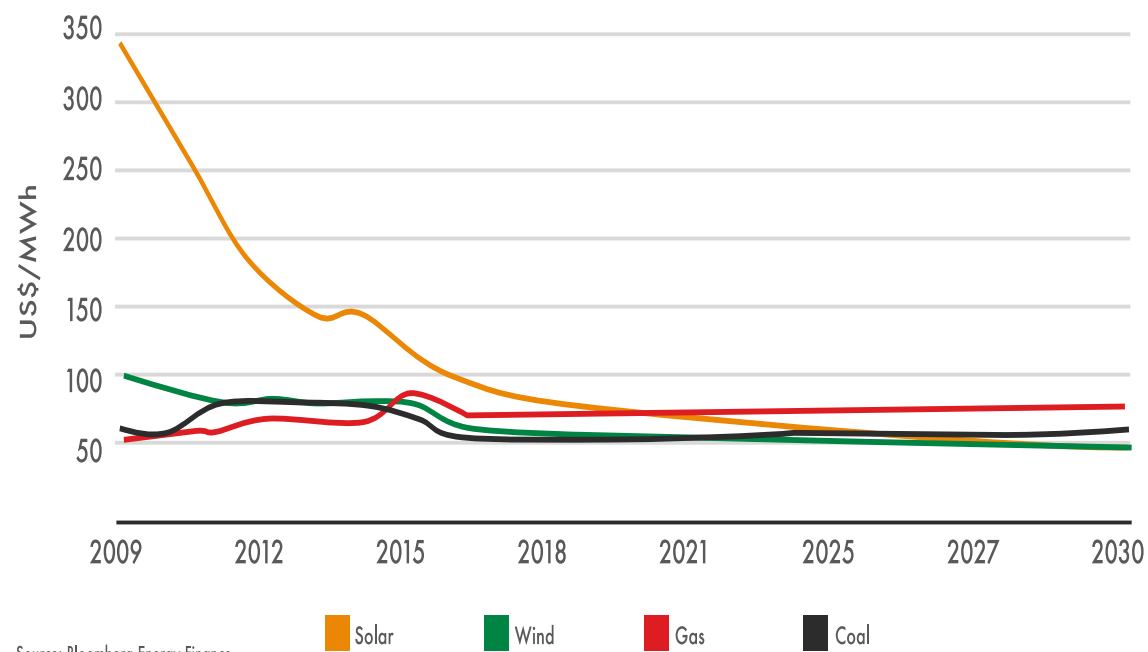
Source: Western Power



Reality. Costs of Renewable Energy continues to fall

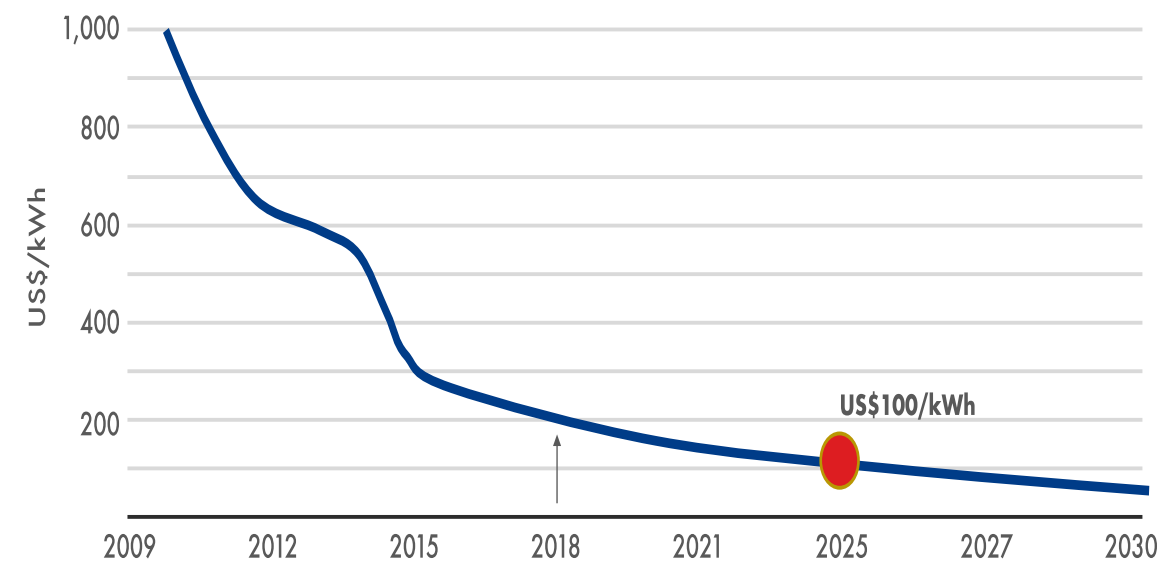
Solar's Price Plunge

Cost per MWh (US\$ 2016) – Globally, Solar power projected to become cheaper than coal in 2024 and wind in 2029

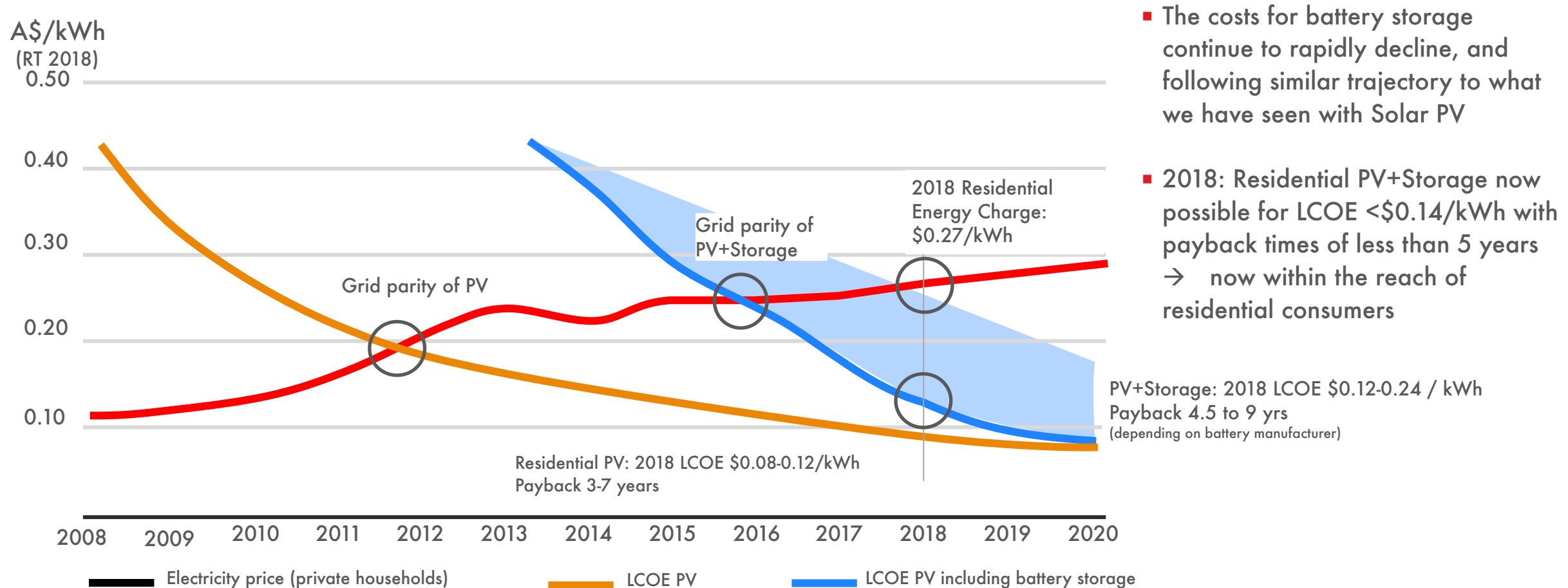


Increasing Battery Efficiency

A \$1,000 battery in 2010 will cost \$73 in 2030



Reality. Grid Parity of Residential PV-Storage in Australia is available

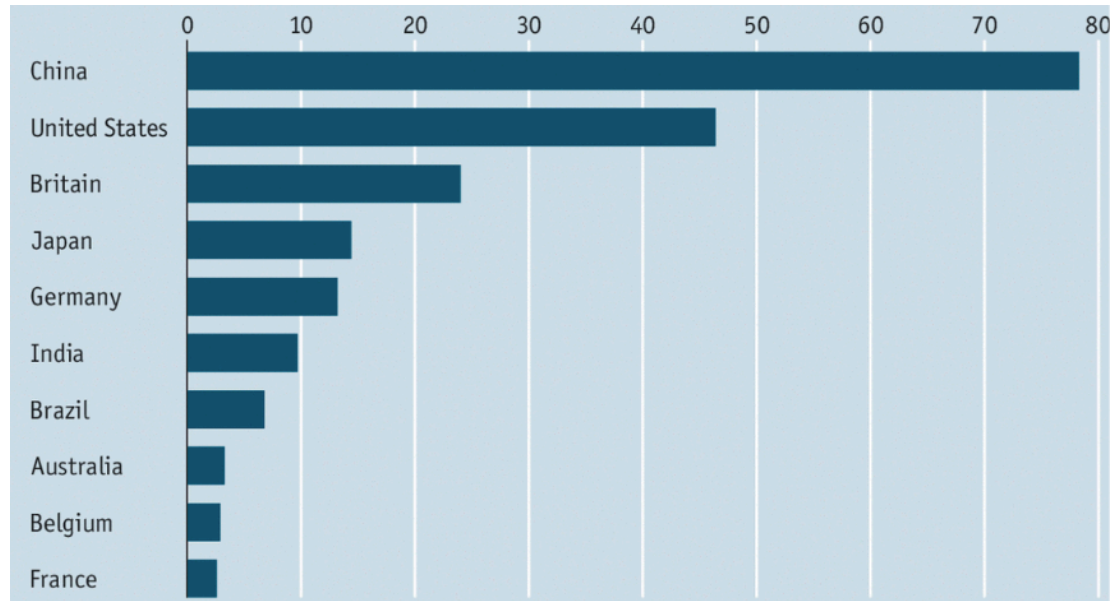


Source: Redback Energy, Synergy A! tariffs, market data



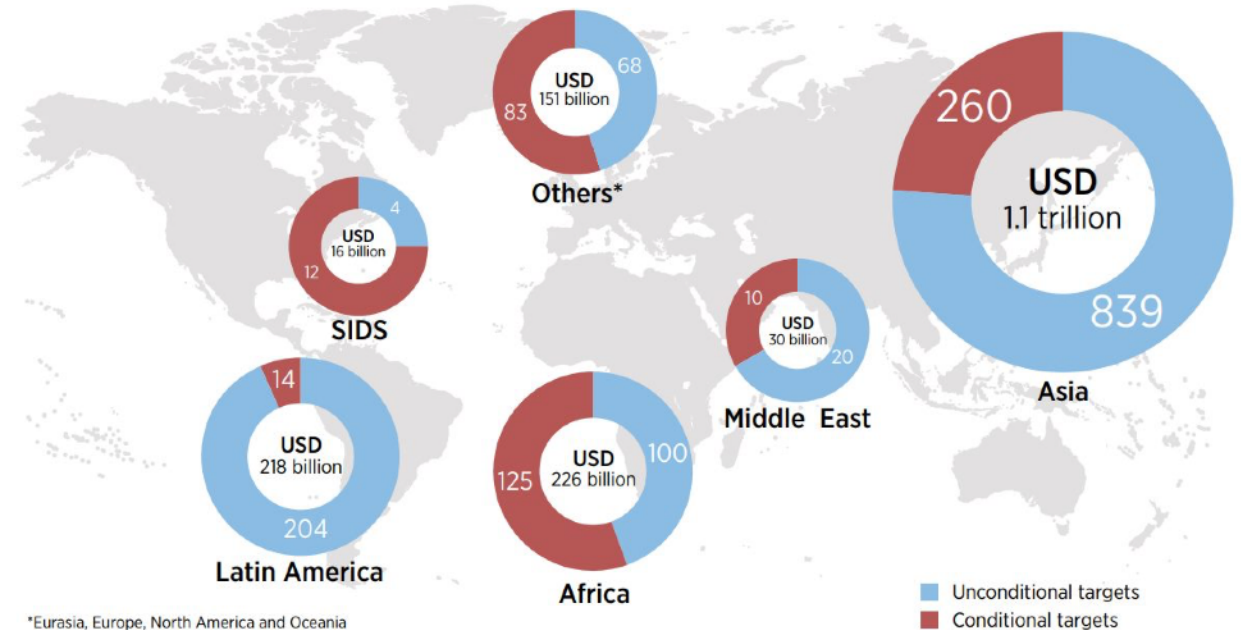
Reality. Access - Advances in Renewable Energy Technology are rapidly transferred to market

Renewable Energy Investment: New Investment, 2016, US\$bn



Source: Frankfurt School UNEP, BNEF

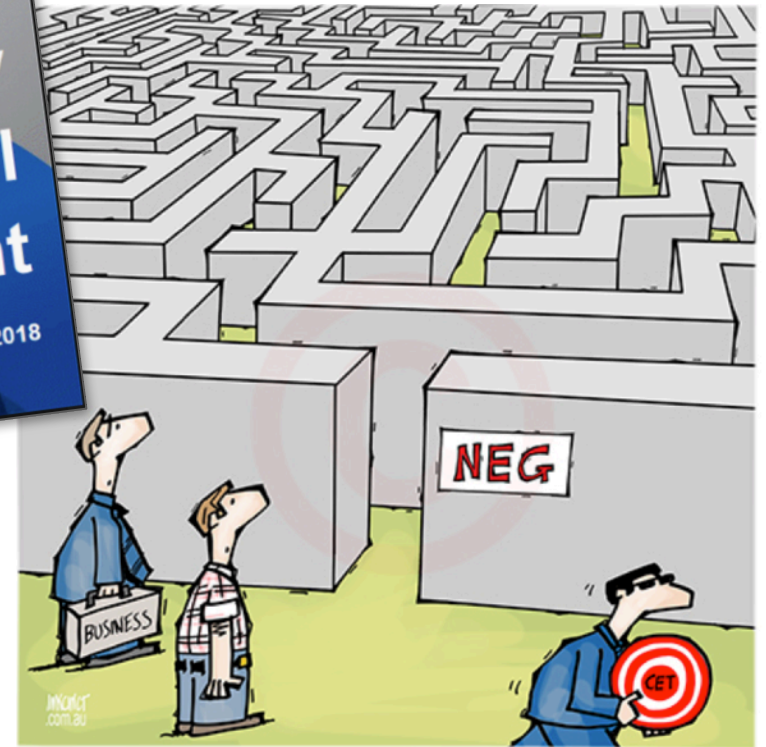
Forecast : Total Investment Need by 2030 for implementation of renewable energy targets in current NDCs (US\$bn)



Reality. Political and Regulatory Process can either support or hinder, but cannot stop the increasing adoption of renewable energy



ABC, May 2017: SA Premier Jay Weatherill says "It's a disgrace the way in which the Federal Government has treated our SA"

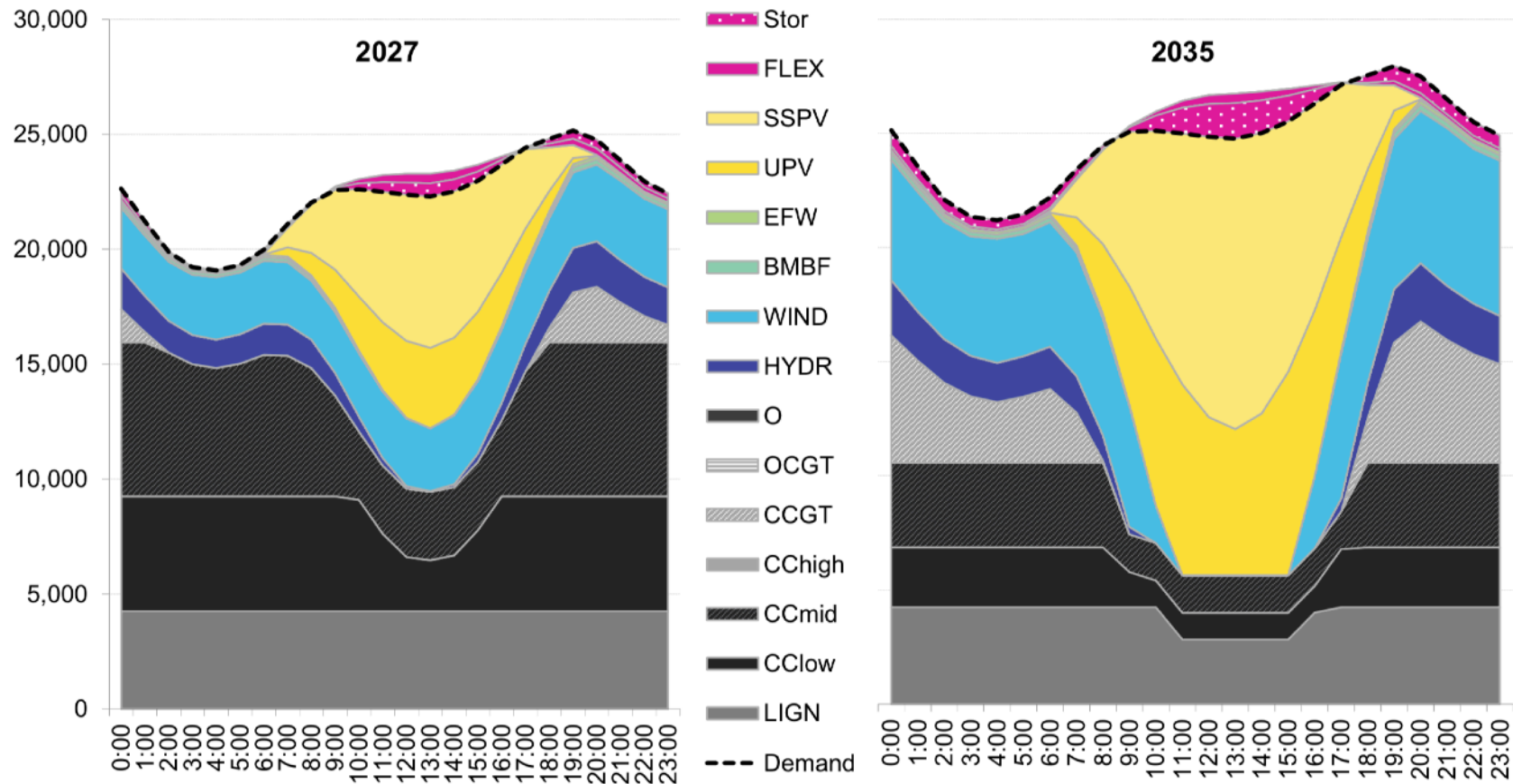


REPLACING THE CLEAN ENERGY TARGET WITH THE NATIONAL ENERGY GUARANTEE



Grid Stability: Unconstrained Wind and Solar energy can make power system management more complex.... but there is a solution

Project generation profiles for low demand day in summer, NEM

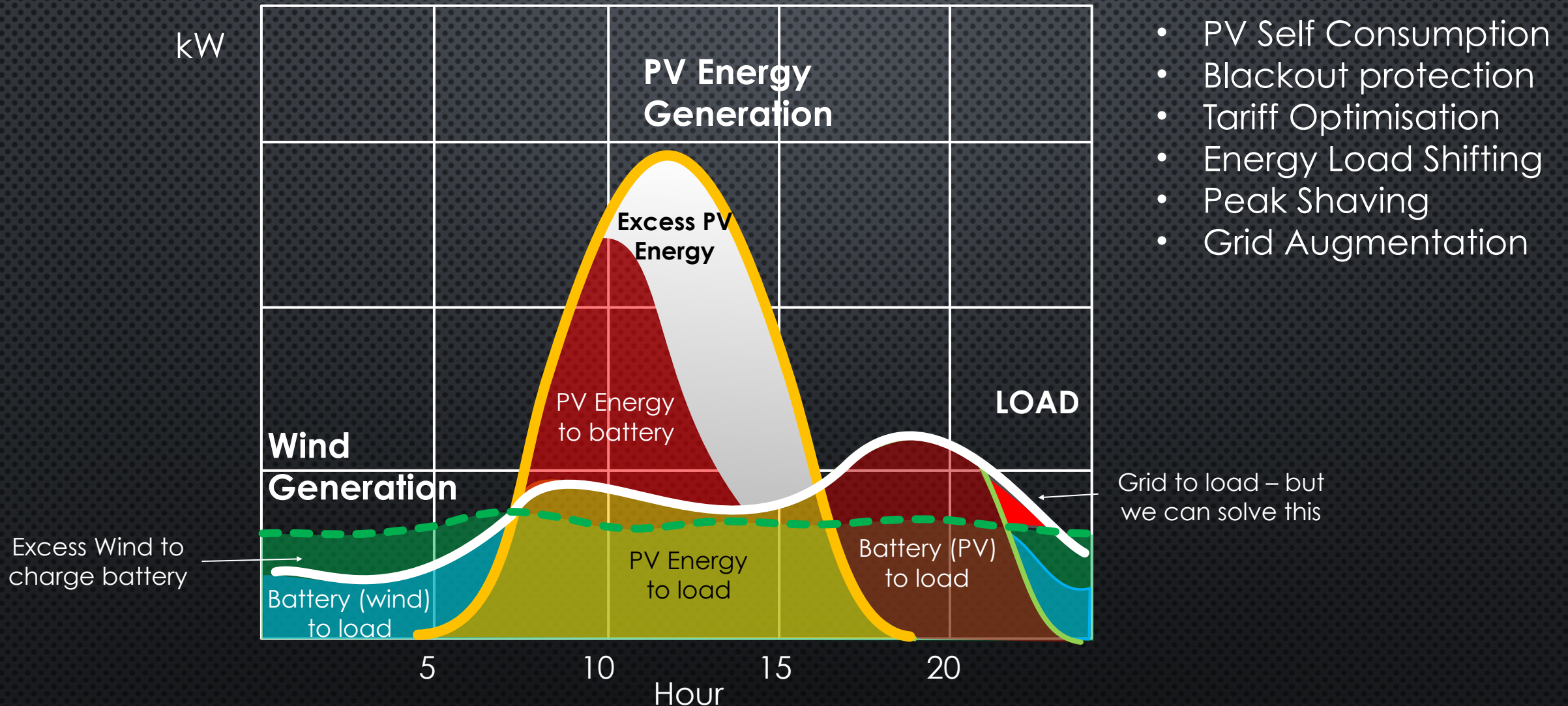


Note: Indicative generation profile for the National Electricity Market (NEM). LIGN – Lignite, CC – Coal, CCGT – Combine Cycle Gas Turbine, OCGT – Open Cycle Gas Turbine, O – Oil, BMBF – Biomass/Biofuelled, EFW – Energy From Waste, SSPV – Small-scale PV, UPV – Utility PV. For details see: [New Energy Outlook 2016: Australia Seminar](#)

Source: Bloomberg New Energy Finance



Solution : PV+Battery Storage brings flexibility and value



Solution

Supplementary



Wind



Pumped
Hydro



Wave

Community Virtual Power Plant

Tx & Dx



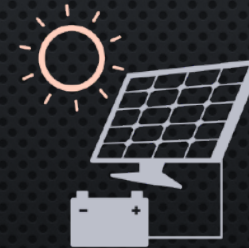
VPP



Residential



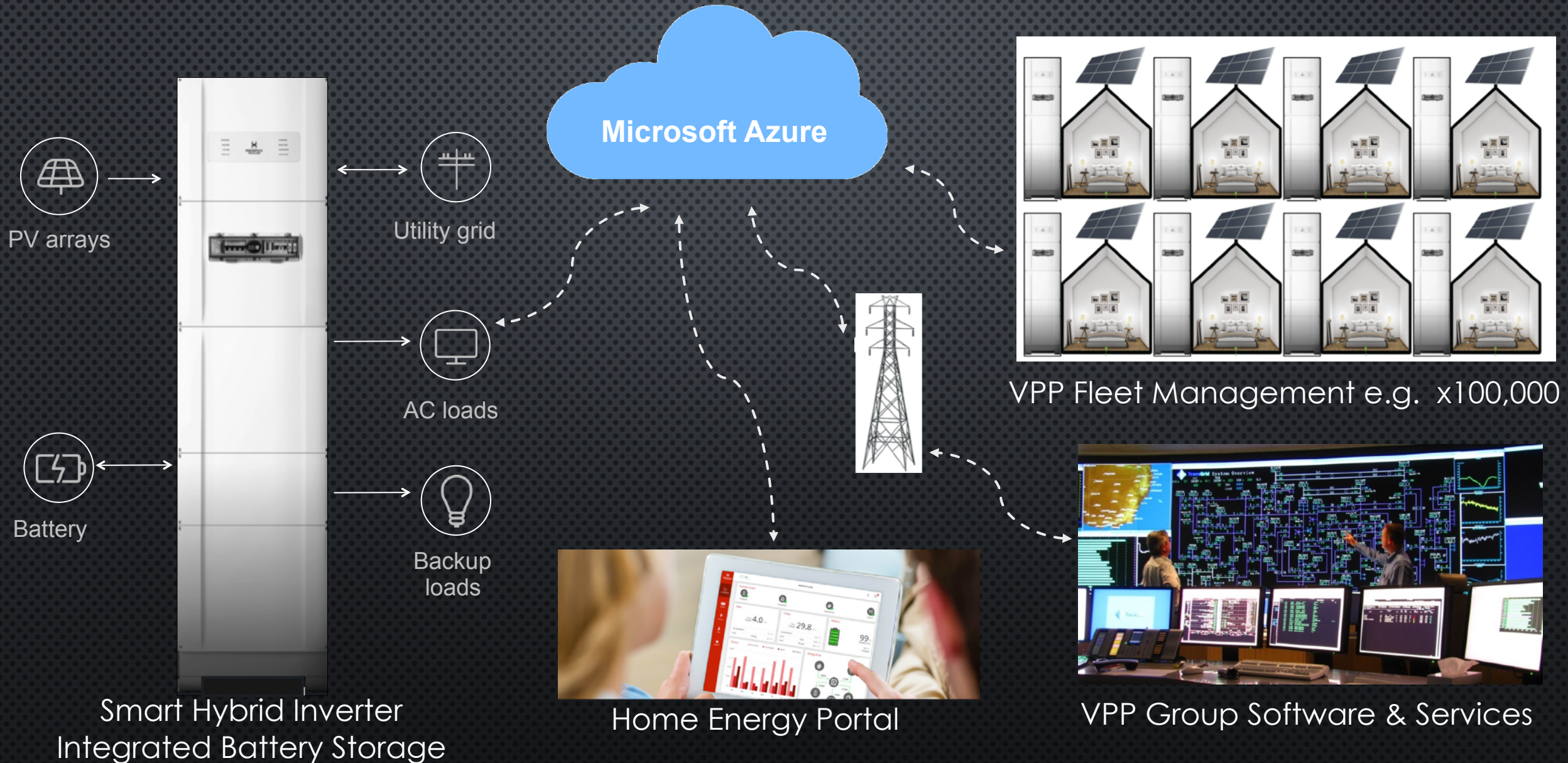
Commercial



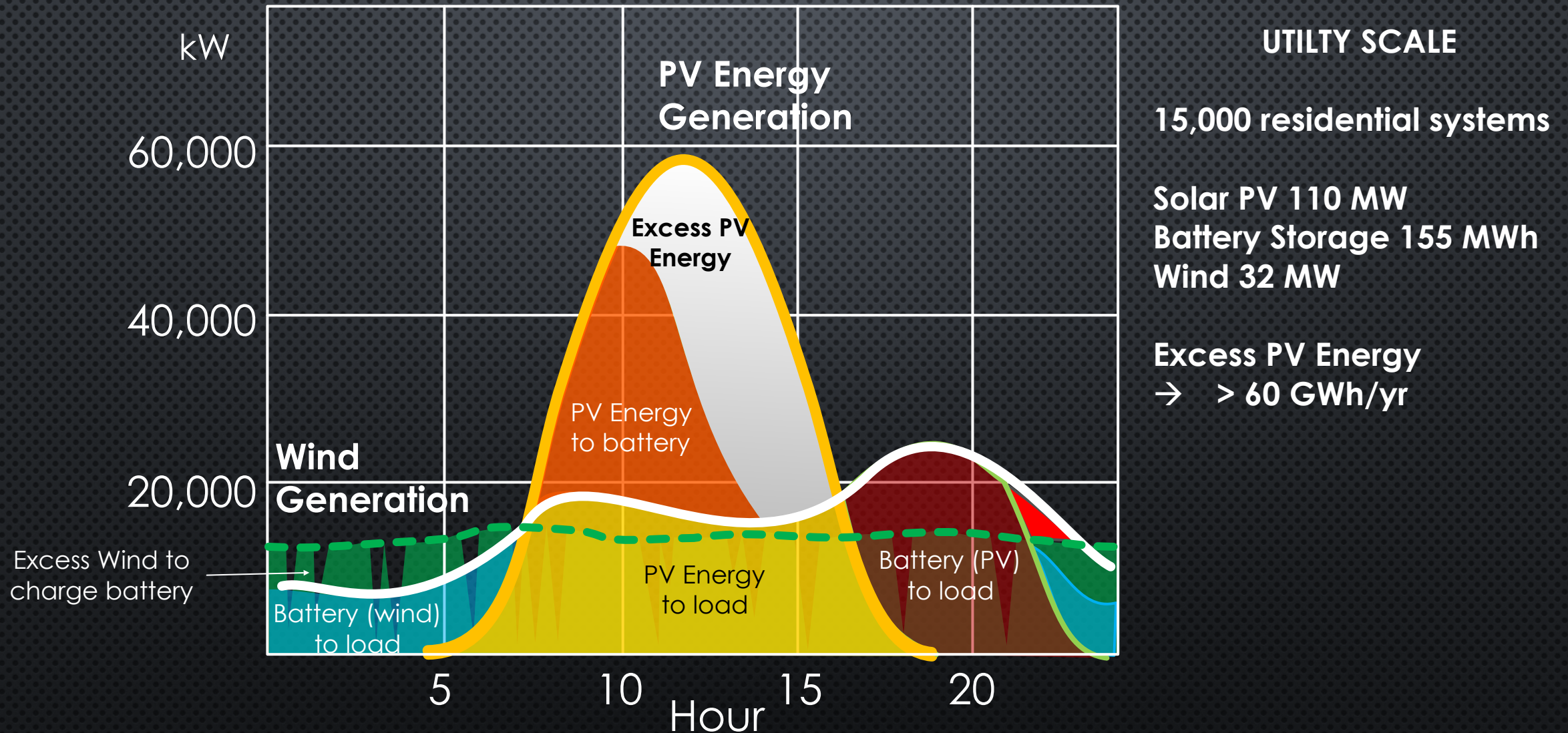
Stand-Alone Power Systems

Virtual Power Plant

Secure Integrated Cloud Services



Community Scale VPP = Utility Scale Delivery



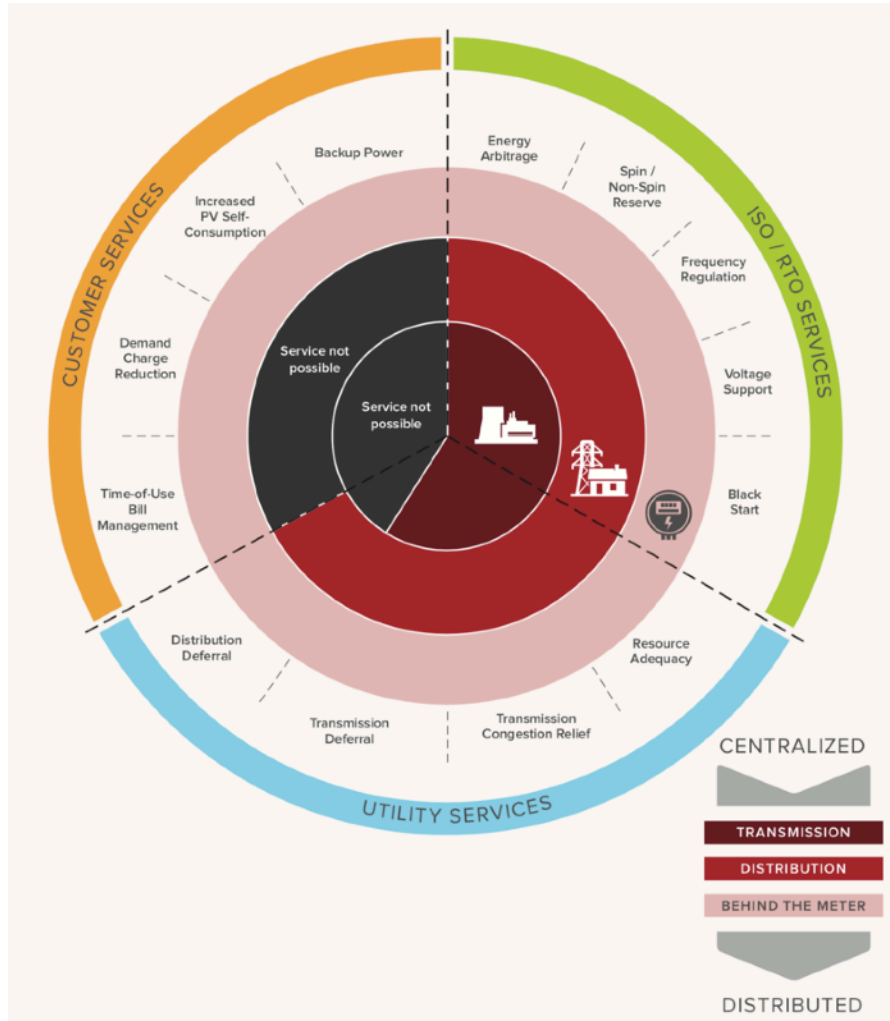
Project Comparisons : DER VPP vs. large-scale Solar+Battery & CST

Metric	Solar PV + Battery		Concentrated Solar Thermal		Redback Virtual Power Plant	
System Size	190 MW, 280 MWh battery		150 MW Salt / Steam		190 MW, 280 MWh battery	
Annual Energy Dispatch	369,327 MWh/yr		495,000 MWh/yr		369,326 MWh/yr	
System Footprint	270 - 380 Ha		620 - 750 Ha		Rooftop - 0 sqm's	
System Cost	\$335-410 mln		\$600-650 mln		\$282 mln	
Development Approvals	Environmental Council – Land use zoning Geotechnical Community Sensing Heritage / Native Title	Time: 1-2 yrs	Environmental – Birds, Flora, Council – Land use zoning Community Sensing Geotechnical Heritage / Native Title CASA flight zone	Time: 1-2 yrs	ALREADY APPROVED	Time: 0
Energy Offtake	PPA - linked to financing Merchant at \$50/MWh – with No LGC's?		PPA – linked to financing Merchant at \$50/MWh – with No LGC's?		Up to \$270/MWh for 70% of energy Households needs	
Grid Connection	Western Power Studies upfront – Very High Penetration study risk HV/MV system augmentation required	Time: 1-2 yrs	Western Power Studies upfront WP not familiar HV/MV system augmentation required	Time: 2 yrs	ALREADY APPROVED Distributed & incremental Benefits & reinforces existing network	Time: 0
EPC Risk	MED-HIGH - Largest In Australia Complex integration, contracting		HIGH - Never built before in Australia		LOW – CEC installers	
Market Services	Dispatchable Capacity		Dispatchable Capacity		Dispatchable Capacity	
DSR services	None		None		Interruptible Loads	
Network Services	Non Network Deferral		Non Network Deferral		Non Network Deferral LV Voltage mgmt. Safety monitoring	
System Resilience/Security	Med-Low system & network grid failure impacts all		Med-Low system & network grid failure impacts all		HIGH– individual UPS backup	
Time to Build / Commission	2-5 yrs		3-5 yrs		Start: 2-3 months / Full system: 2 yrs	
O&M	\$25-40/kW/yr		? >> \$30/kW/yr		\$25-35/kW/yr / local jobs	
Future Scalability	Limited - New Project required		New Project required		Fully scalable Phased deployment / Grow with city	
Legacy	Large industrial project requiring decommissioning		Large industrial project requiring decommissioning		Every house & business has individual reliable “green” lowest	



Realising VPP Enabled Distributed Energy Resource Potential

- Battery Storage provides > 13 services to > 3 stakeholder groups



Source: Rocky Mountain Institute

- VPP-enabled DER systems are not new
- Full VPP DER value streams
 - available on eastern Australia NEM
 - not yet fully accessible in WA
 - WEM Capacity Market structure
 - Non-Contestable Residential-Small Commercial loads < 50 MWh market held by Synergy
- Contact Redback Energy for more details relevant to Western Australia market



Community VPP : Job Growth and New Business Development

[illegible]

The beginning....

- The transition to a future grid with increasing “Distributed” Renewable Energy is occurring....
 - Cheaper, clean energy
 - Energy independence, resilience
 - Value begins with the home owner and community
- Virtual Power Plant “VPP” enabled DER provides optimal structure
 - Managing energy and harnessing excess energy is critical
 - value for individual and community
 - Grid stability
 - New jobs and skills growth
 - New business opportunities
- The transition will take time
 - Opportunity to plan
 - Develop new skills and business





Creating, building and
managing the future grid.

