

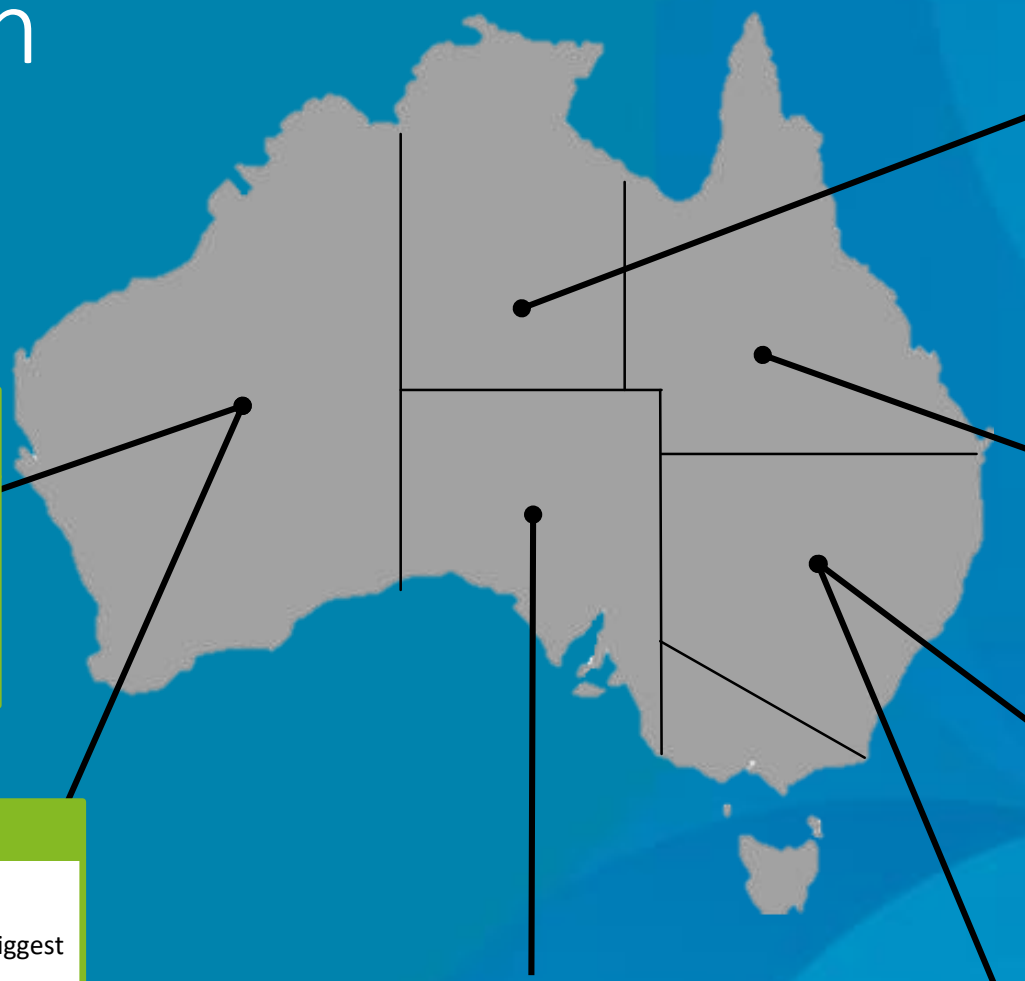
# Synthesis Global

Synergising Success through Partnerships

## Session 5: Largest On-grid Battery Storage

The case of Australia –  
an alternative to a gas peaking plant: cost, benefit, financing  
and lessons learned.


# Select Australian BESS Projects



### ALICE SPRINGS, NT

**Battery**


5 MW/3.3MWh battery under construction in Alice Springs



### KENNEDY ENERGY PARK, QLD

**Battery**


A 2MW/4MWh lithium-ion battery is being constructed alongside a solar wind farm



### STAWELL, VIC

**Battery**


Plans to build 20MW/34MWh battery supporting a glasshouse



### BALLARAT, VIC

**Battery**

30MW Lithium-Ion Battery Customer owned Grid-connected battery improving grid stability.



### YORKTOWN, SA

**Battery**


A 30MW/8MWh battery will be operational in mid-2018, while a 100MW/400MWh battery is planned.



### DEFRUSSA COPPER & GOLD MINE, WA

**Battery**


Sandfire's West Australian mine has a 6MW/1.8MWh battery



### JAMESTOWN, WA

**Battery**

The world's currently biggest lithium-ion battery (10MWH/129MWh) began operating on the 1st of December 2017



# Australia – Leading the World in Energy Storage Solutions

## Hornsedale Power Reserve South Australia (TESLA)

Lithium Ion - 129 MWH + Wind Farm



- Adjacent to the Hornsdale wind farm
- Largest lithium-ion battery in the world
  - Samsung 21700-size cells are used
- This service has reduced the cost of grid services to the Australian Energy Market Operator by 90%

## Ballarat Terminal 1 Victoria (Ausnet)

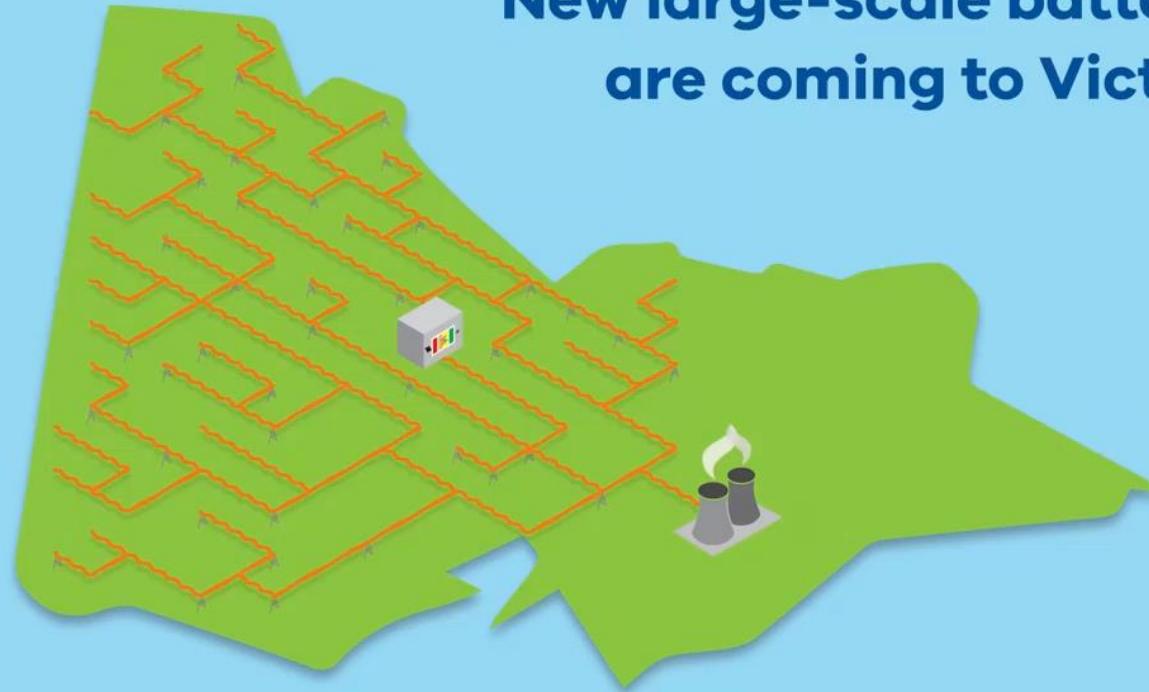
30MW Lithium Ion Battery



- Customer owned
- Grid-connected battery
  - joint venture between Siemens and AES
  - improving grid stability and power quality,
  - Integrating variable renewable energy



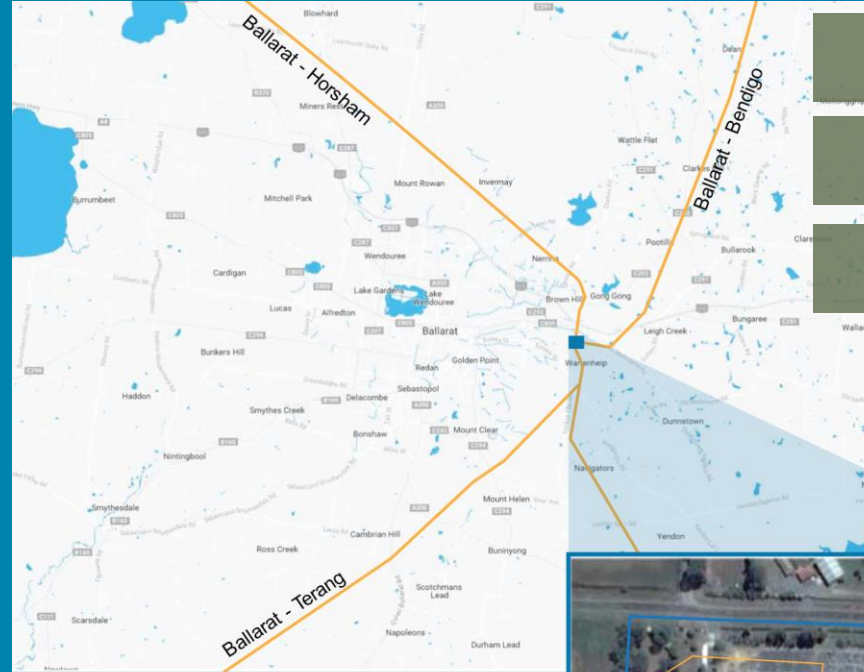
## New large-scale batteries are coming to Victoria



# Ballarat - Largest On-grid Battery Storage.

- 30 Megawatt (MW) 30 Megawatt-hour (MWh) Battery
- Capable of powering 20,000 homes.
- Lithium-Ion batteries,
- Grid stability and support at congested transmission terminal,
- deliver on key objectives from AEMO

(Australian Energy Market Operator)



STRATEGIC LOCATION + CRITICAL TO VICTORIA

PROVEN TECHNOLOGY + PUBLIC / PRIVATE VALUE

RENEWABLES INDEPENDENT + REPLICATION READY

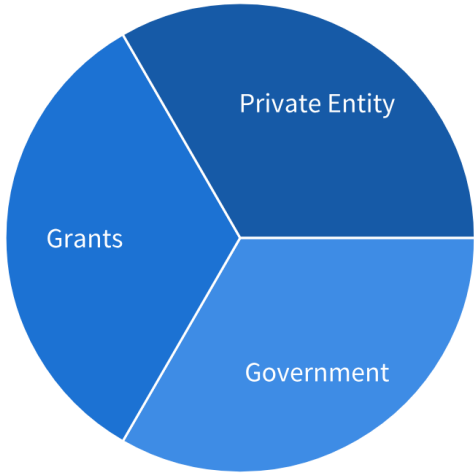


## Timeline

Approximate dates for the project program are as follows:

Milestone	Date
Construction Commencement	08/05/18
Civil Works Completion	30/11/18
Equipment Installations	21/12/18
Practical Completion	26/02/19

# Ballarat - Largest On-grid Battery Storage



“Allows currently unused renewable energy to be stored instead of wasted”



## 1 | Nation First

Provides an Australian first in demonstrating a major battery operating without renewable energy generation.

## 2 | Decongestion

Relieves congestion from multiple renewable energy generation sites.

## 3 | Economics

Gains economies through co-location with other electrical assets.

## 4 | Reliability

Provides reliable supply of FFR and FCAS (without being constrained).

## 5 | Privately Owned

The 30MW/30MWh Transmission-Connected BESS is a privately owned and operated asset.

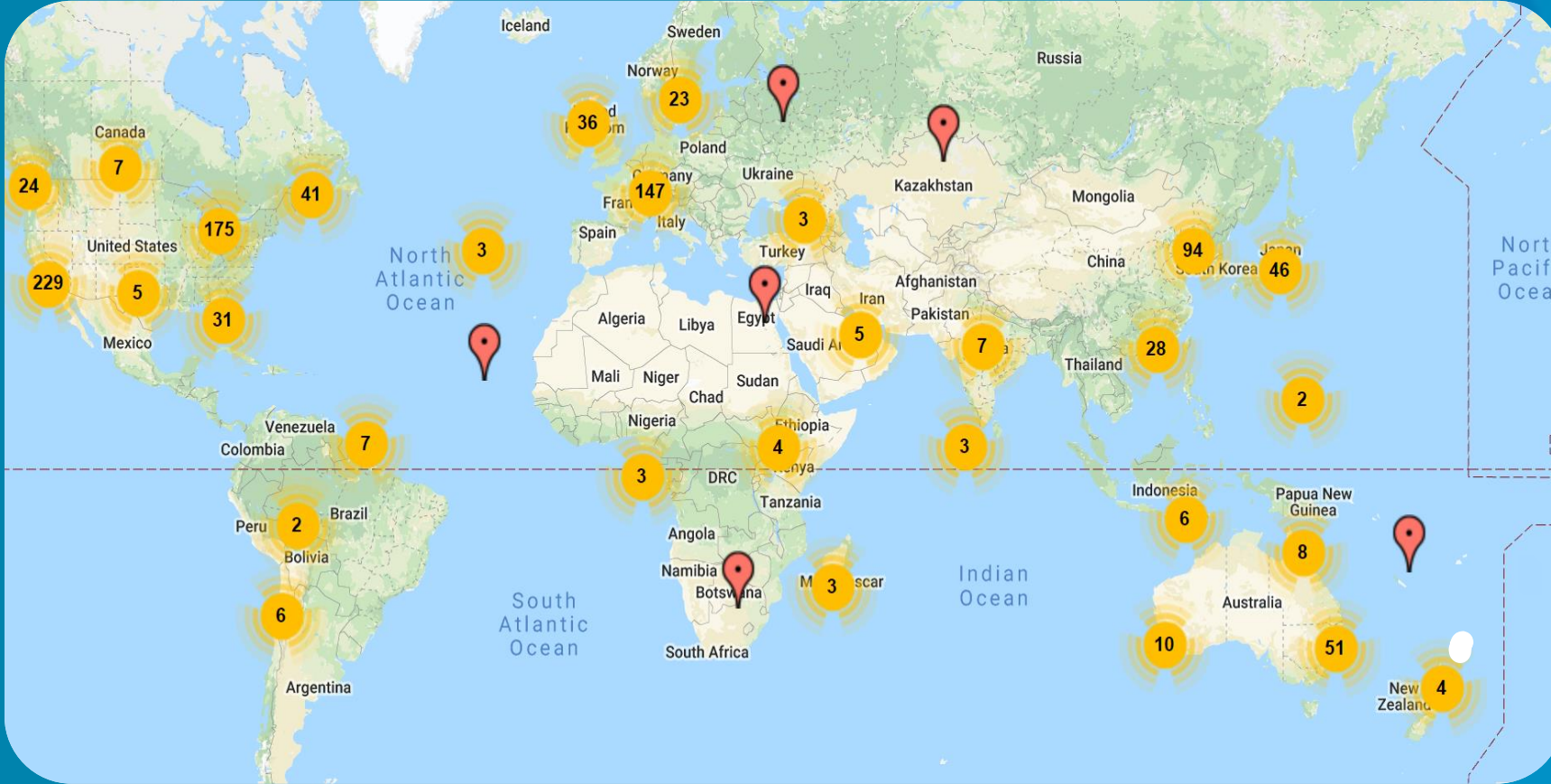
## 6 | Direct

Directly exposed to charging and discharging activity in the market. Demonstrating standalone BESS within a market trading environment.

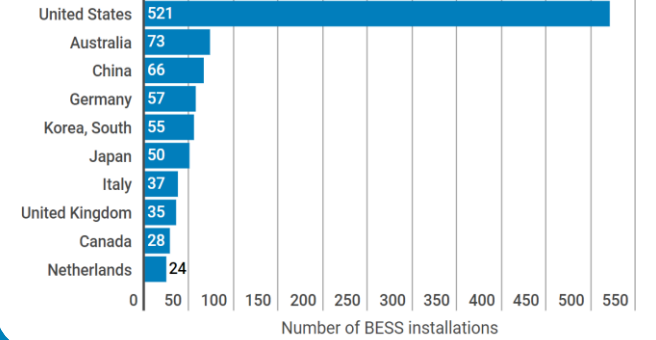
“Injects electricity into the grid at times of peak demand in areas of known transmission congestion”



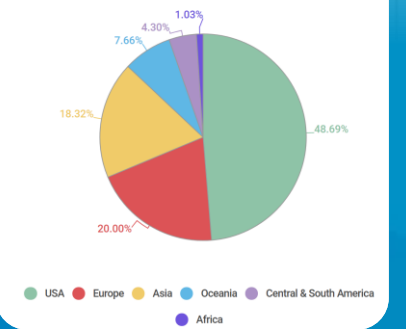
# Global Uptake of BESS



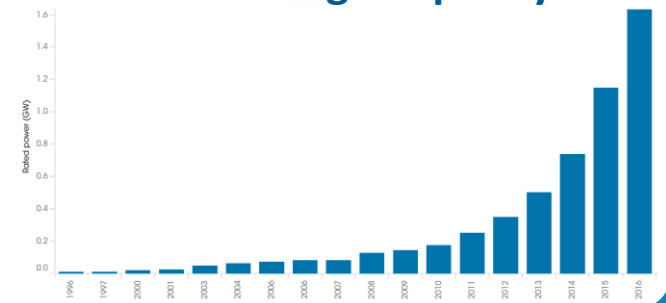
## BESS Ranking Nations



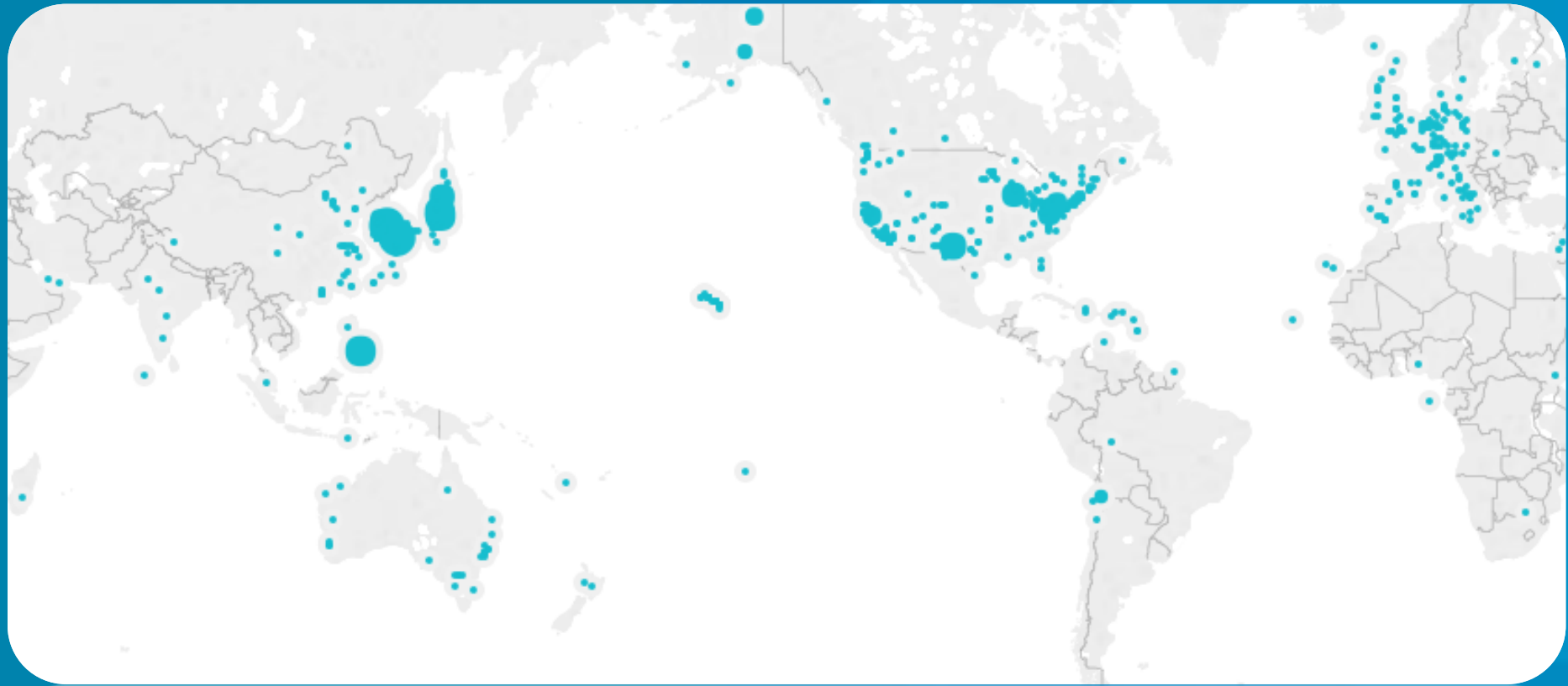
## Distribution of Projects



## Global Storage Capacity



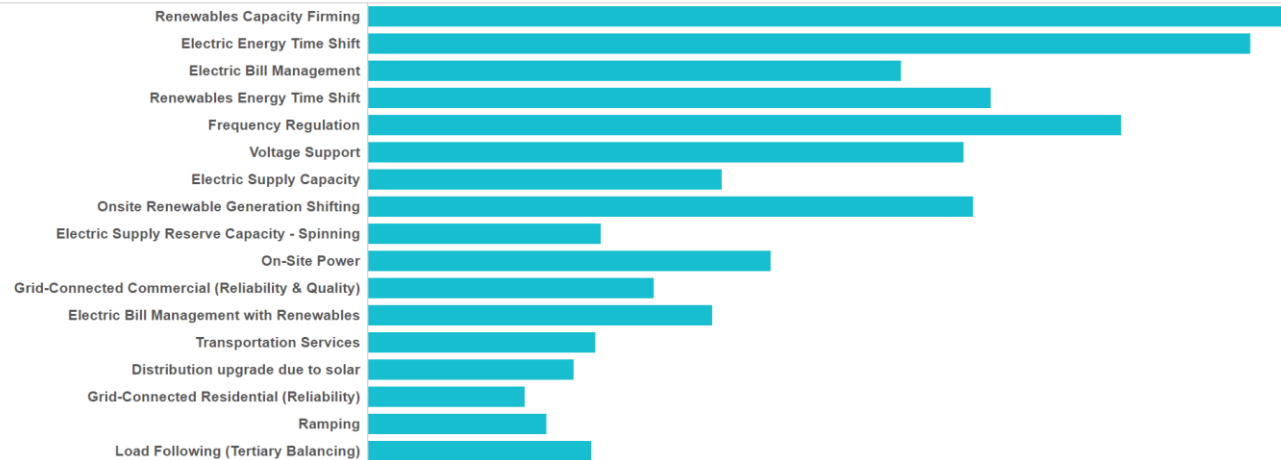
# Global Capacity Installed (Gigawatts)



“[South-East Asia] relies heavily on fossil fuels, both for power generation and transportation. Yet some 65 million people in the region (as of 2017-2018) lack adequate or reliable electricity access.”

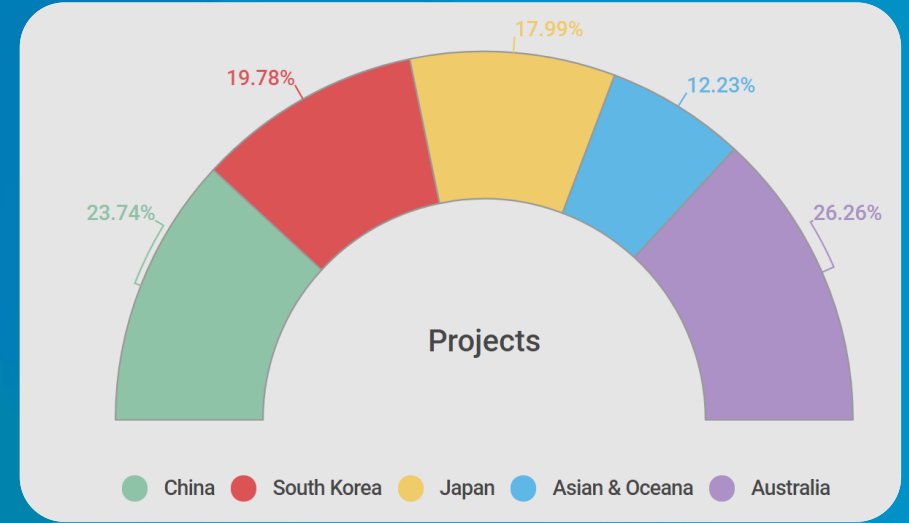
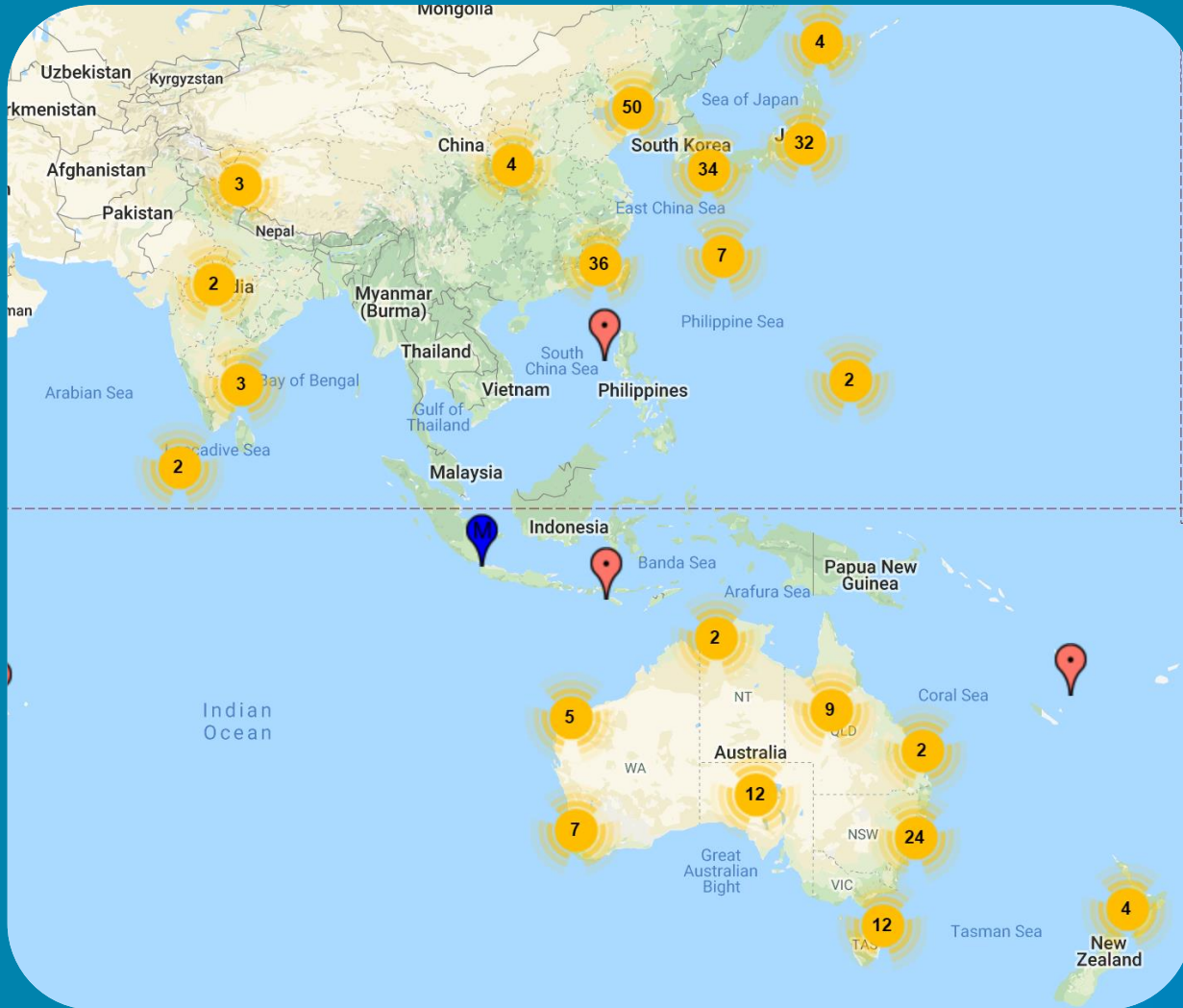
- IRENA

## Top Use Cases





# BESS Uptake across Indo-Pacific



“South -East Asia’s energy demand has grown by 60% in the past 15 years.”

- International Energy Agency

# International Comparison

## World



7.4 Billion

Population



1,070

Total Number of  
Projects



4,673

Total MWH



0.06

MW / 100,000  
People

## Australia



24.1 Million

Population



73

Total Number of  
Projects



580

Total MWH



2.4

MW / 100,000 People

## Asia



3.2 Billion

Population



144

Total Number of  
Projects



670

Total MWH



0.02

MW / 100,000  
People

# Benefits

## 1 | Energy Storage Quality

Energy storage can smooth out or firm wind- and solar-farm output; that is, it can reduce the variability of power produced at a given moment

## 2 | Grid Scale Economic Benefit

The incremental price for firming wind power can be as low as two to three cents per kilowatt-hour. Solar-power firming generally costs as much as ten cents per kilowatt-hour, because solar farms typically operate for fewer hours per day than wind farms.

## 3 | Frequency Regulation

Storage systems are particularly well suited to frequency regulation because of their rapid response time and ability to charge and discharge efficiently.

## 4 | Reduce Peak Consumption

Energy storage can be used to lower peak consumption

## 5 | Optimization

as storage costs fall, not only does it make economic sense to serve more customers, but the optimum size of energy storage increases for existing customers.



“Storage is starting to play a broader role in energy markets, moving from niche uses such as grid balancing to broader ones such as replacing conventional power generators for reliability, providing power-quality services, and supporting renewables integration”

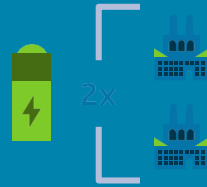
- McKinsey Consulting



# Benefits



RENEWABLE INTEGRATION



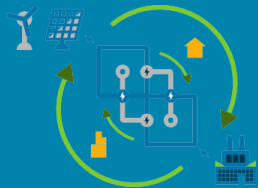
TWICE THE RESOURCE



INCREASED RELIABILITY



CLEAN ENERGY



GRID EFFICIENCY



With Australia's world-class renewable energy resources, battery storage represents a huge opportunity to generate even more of our electricity from renewables, and rely less on fossil fuels like coal, gas and oil.

## BATTERY STORAGE

COST SAVINGS & THE POTENTIAL TO USE MORE RENEWABLE ENERGY



ROUND-THE-CLOCK, RELIABLE, LOW CARBON ENERGY SUPPLY

Sources: Engineering.com 2014; Adelaide City Council 2015; AECOM 2015; AEMO 2015; IRENA 2015; Muenzel et al 2015; NSW Government 2015; RenewEconomy 2014c

### THE BENEFITS

#### HOUSEHOLDS

- access the cheapest retail electricity prices
- use more cheap, self-generated solar power

#### BUSINESSES

- purchase less expensive peak electricity, avoiding peak charges
- use more self-generated solar power

#### ISLANDS, REMOTE AREAS

- reduce reliance on imported diesel or LPG which is expensive to transport and store
- use more local, cheap renewable electricity

#### ELECTRICITY NETWORKS

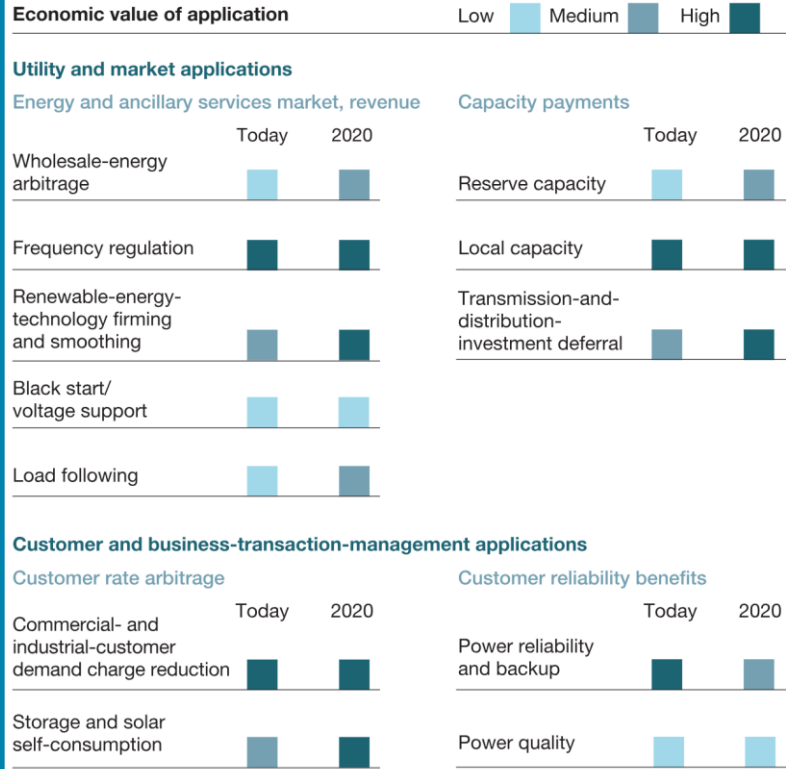
- cost-effective alternative to meeting peak demand
- avoid the need for network upgrades
- enable higher percentages of renewable electricity in the grid, especially distributed solar PV in a given area

#### ELECTRIC VEHICLES

- quiet • less air pollution • less maintenance
- recharging cheaper than re-fuelling with petrol
- car battery can also be used for household electricity storage
- less reliance on fossil fuels if powered by renewable energy

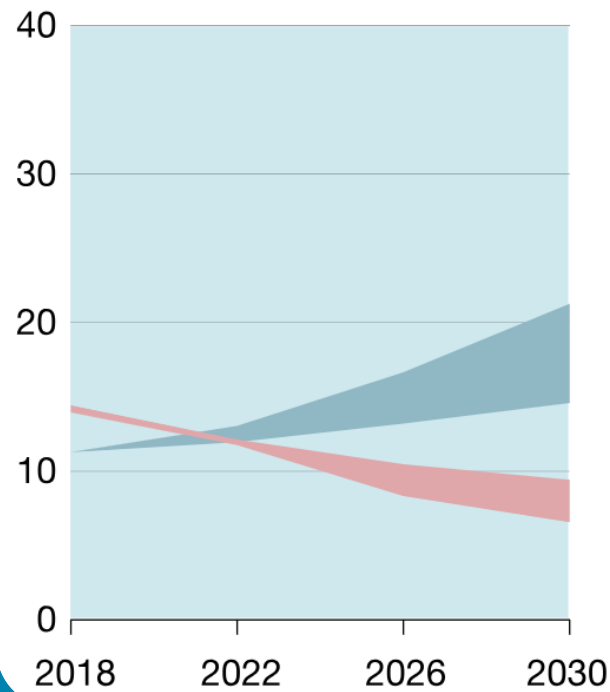
# Battery Storage Economics

Battery storage economic value varies by application and is expected to evolve and grow.



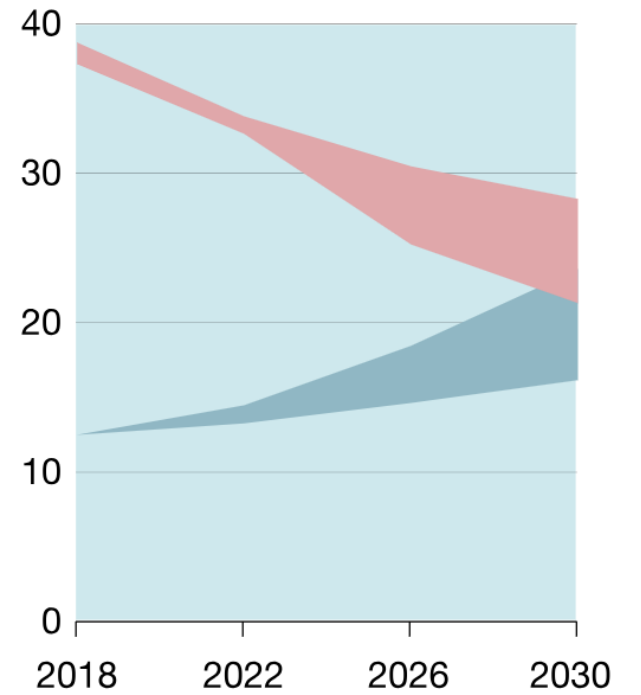
McKinsey&Company

**Partial grid-defection scenario,<sup>2</sup>**  
cents per kilowatt-hour



2018      2022      2026      2030

**Full grid-defection<sup>1</sup> scenario,**  
cents per kilowatt-hour



2018      2022      2026      2030



## Wholesale markets

Embedded Benefits

Capacity Markets

Reserve

Frequency Response

System Services

**Wholesale market:** Price arbitrage, including intraday trading, is feasible but requires high spreads to justify the battery deterioration that follows from constant cycling.

**Embedded benefits:** Distribution-connected batteries are not liable for a number of generation network charges. Although significantly reduced, they can also secure payments for reducing suppliers' net demand and network charges.

**Capacity market:** Batteries can secure a capacity market agreement lasting up to 15 years for new build. Capacity market units are required to respond during system stress events.

**System services:** Batteries can provide a number of system support services, such as frequency response, reserve and transmission constraint management. Their technical properties make them best suited for services procured on a short time scale. New system services definitions are expected in 2018.



# Value Streams

## Capacity Revenue

- Ability to either sell capacity contracts to third parties or avoid having to buy capacity contracts to defend a retail position

## Energy Arbitrage

- Taking advantage of price arbitrage in the market by charging at low prices (overnight) and discharging at high prices

## Ancillary Services

- Ancillary services are purchased by AEMO to ensure power system security in the NEM.
- The BESS has been optimised for capacity firming, which is a higher value market, and therefore this is not a significant incremental value stream.

## Constraint Reductions

- If the projected volume of new generation in Western Victoria connects into the grid, individual generators (both new and existing) may be constrained or disconnected, mainly due to thermal and system strength limitations of the transmission system in Western Victoria.

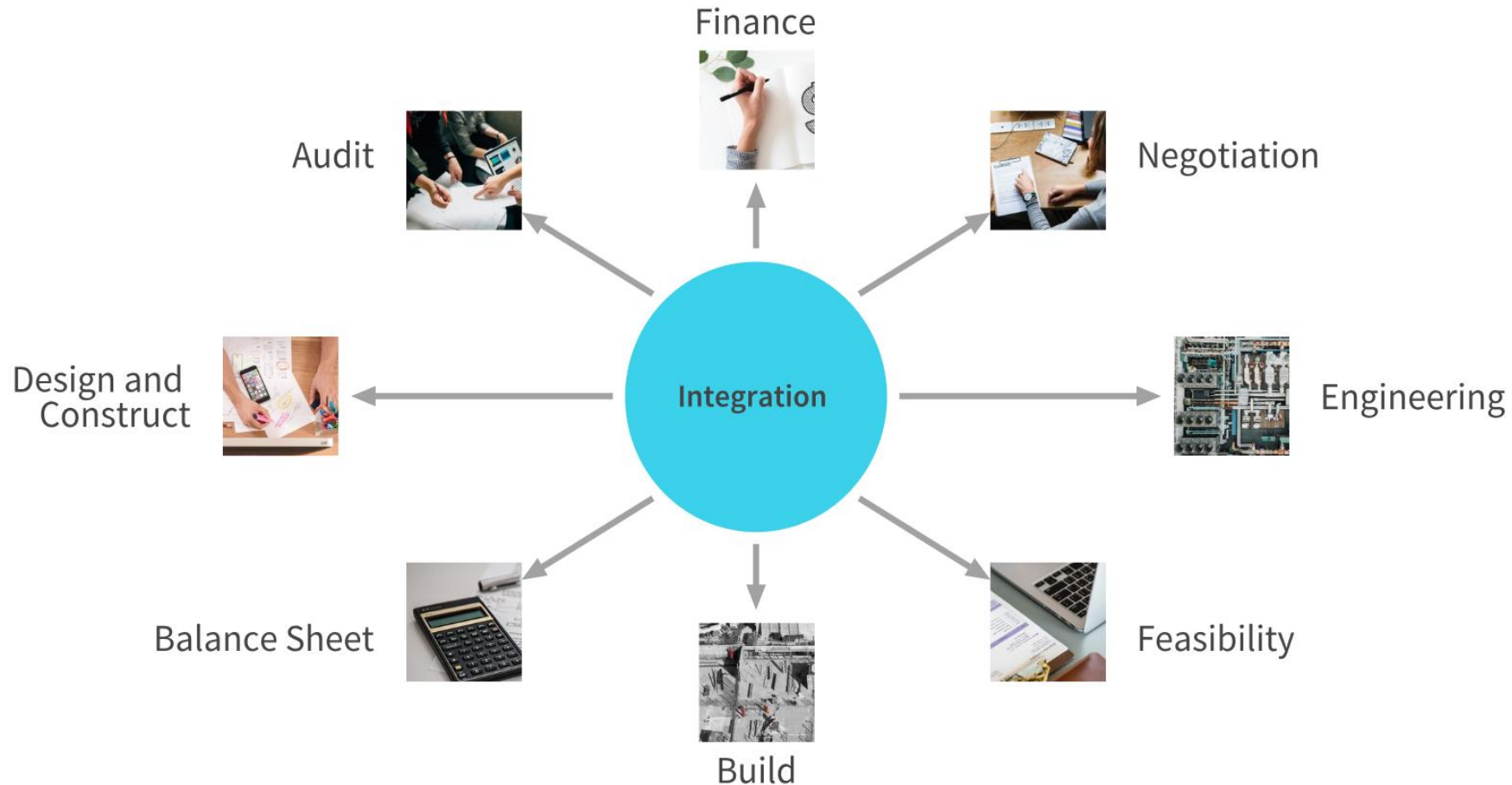
## Unserved Energy

- With the removal of Hazelwood from the Victorian energy system there is expected to be a higher risk of energy shortfall this summer. AEMO's Energy Supply Outlook estimates the reduction in unserved energy in the state as a result of the two new battery energy storage projects to be supported by the State.

“Southeast Asia offers compelling examples of the synergies between renewable energy and socio-economic development, whether in rural, urban or island settings.”

- ARENA

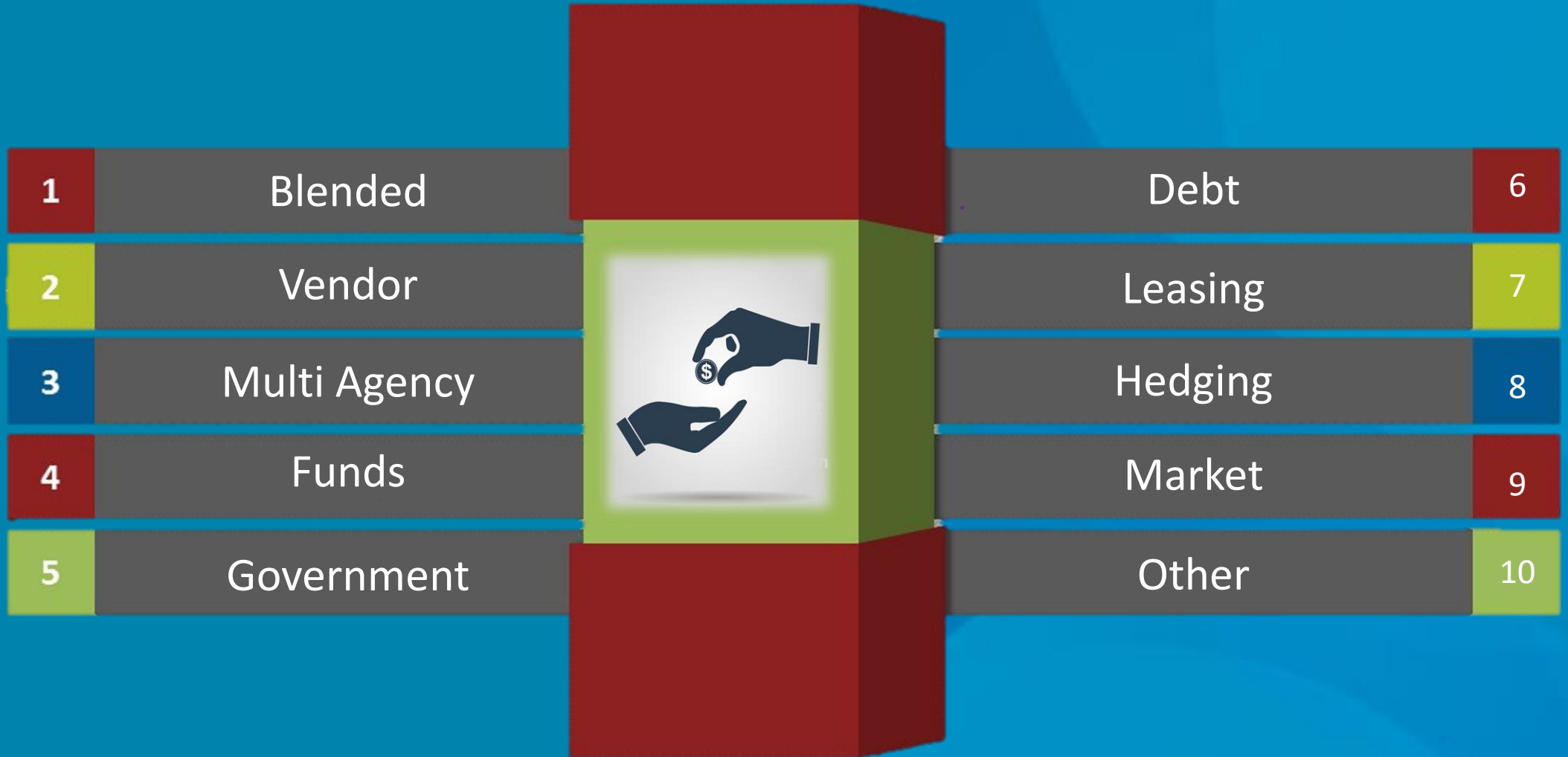
# Integration



“Our research shows considerable near-term potential for stationary energy storage. One reason for this is that costs are falling”

- McKinsey Consulting

# Financing





# Syntheses Partnership

## SOLUTIONS: COMPETENCE WITH CREDIBILITY

### OPPORTUNITY



The need for infrastructure across the globe to support social and economic development is substantial and growing.



PPPs are a preferred method of infrastructure delivery – as these are best equipped to address funding gaps.

### THE PROBLEM



Investment funding is available but, without suitable structures in place, this availability is not converting into closed transactions.



There is a gap between infrastructure investment requirements and expertise in deal development.

### HOW WE CAN HELP



External funding solutions.



Social infrastructure facility optimisation: public and private assets.



Strategy and deal integration.



Cost optimisation: fixed and variable cost value maximisation.



Transaction consulting.



Outsourced project management.

“As governments set market forces to work, electricity storage is poised to play a decisive role in the transition to a sustainable energy future.”

- **Adnan Z. Amin** -  
Director-General;  
International Renewable  
Energy Agency (IRENA)

# Thank you



[synthesisglobal.com](https://synthesisglobal.com)