UNDERSTANDING THE BESS MARKET IN AUSTRALIA

ALVAREZ & MARSAL

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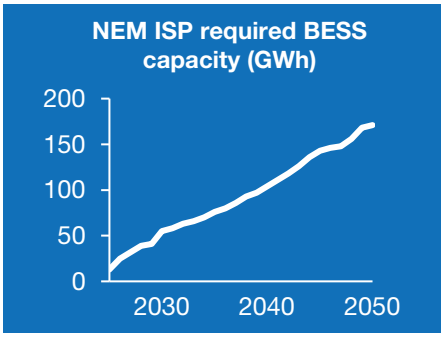
Executive Summary

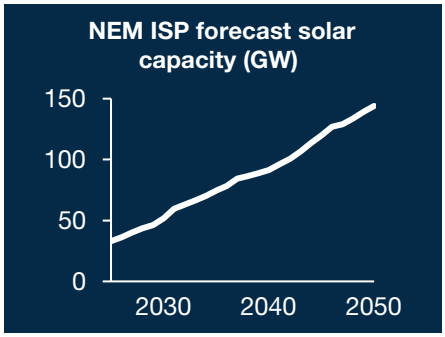
The Australian Battery Energy Storage Systems (BESS) market has attracted significant investment interest due to its crucial role in supporting renewables penetration and ensuring stability for grid expansion. The increase in energy consumption, driven by rapid electrification, data consumption and AI, coupled with Australia's supportive regulatory policies and record low renewable energy capital expenditures (capex) costs, have fuelled a competitive environment for quality BESS projects.

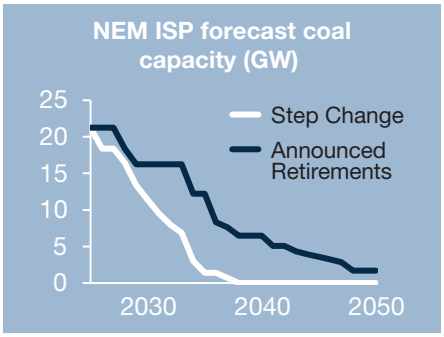
The BESS market has also evolved to offer revenue enhancing business models, such as value stacking and colocation to optimise returns on existing renewables assets. The growing trend of price arbitrage has led to larger and longer duration BESS projects as they are able to commercialise the arbitrage opportunities better than shorter-term batteries. Accordingly, larger scale projects have placed greater importance on the planning phase whilst also shifting the value levers of the supply chain towards unlocking cost out opportunities and efficiencies in the mid to downstream stages.

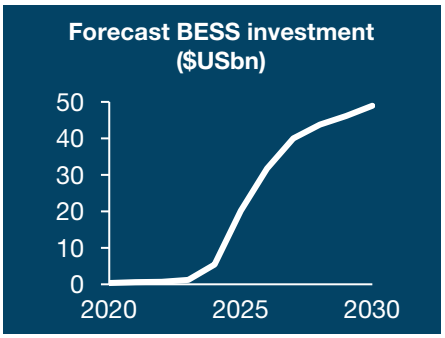
Given the increasingly uncertain economic outlook and continual technological developments, stakeholders must carefully consider the commercial, technical and regulatory challenges that may impact the successful development of these projects. To maximise returns on BESS investments, improve project bankability and mitigate risks, investors should:

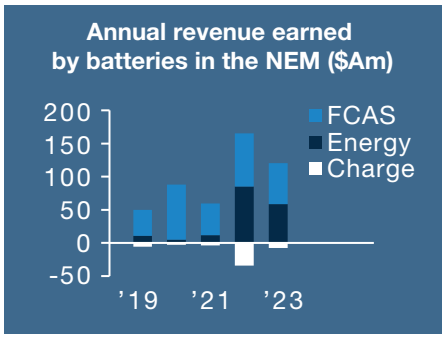
- **Optimise BESS business models** to maximise revenue generation opportunities.
- **Strategically position for market consolidation** via an accelerated delivery strategy.
- **Ensure delivery certainty** by effectively managing capabilities and mitigating supply chain risk.





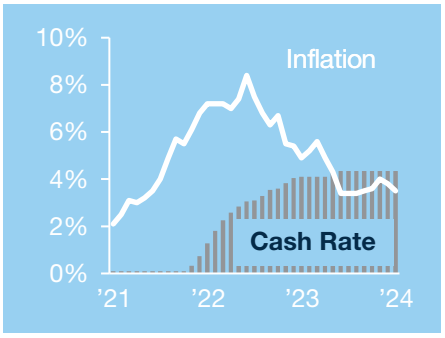


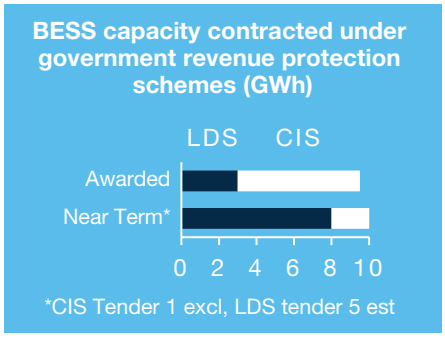


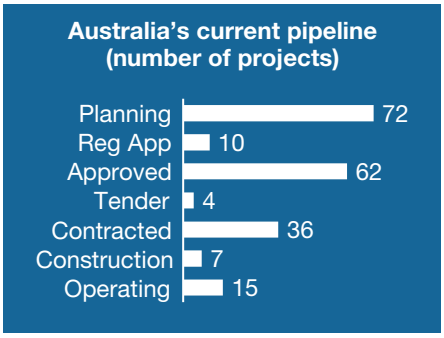


Australia: The world's most volatile energy market

Negative pricing up to 30% of the time and price caps reaching $17,500/MWh







Source: AEMO 2024 ISP Figure 1 Coal Capacity
Source: Market Price Cap AEMC Negative Pricing: Bloomberg NEF 1H 2024 Energy Storage Outlook – Figure 25
Source: A&M Infra Global Market Capex Database (source Energy Industries Council Database) Calculations here
Source: AEMO 2024 ISP – Figure 20 Capacity selected for shallow, medium and coordinated CER storage
Source: A&M Infra Global Market Capex Database (source Energy Industries Council Database) Calculations here
Source: Inflation - Australian Bureau of Statistics Cash Rate: RBA Statistics Target Cash Rate

*Refer to the glossary for expansions of abbreviations

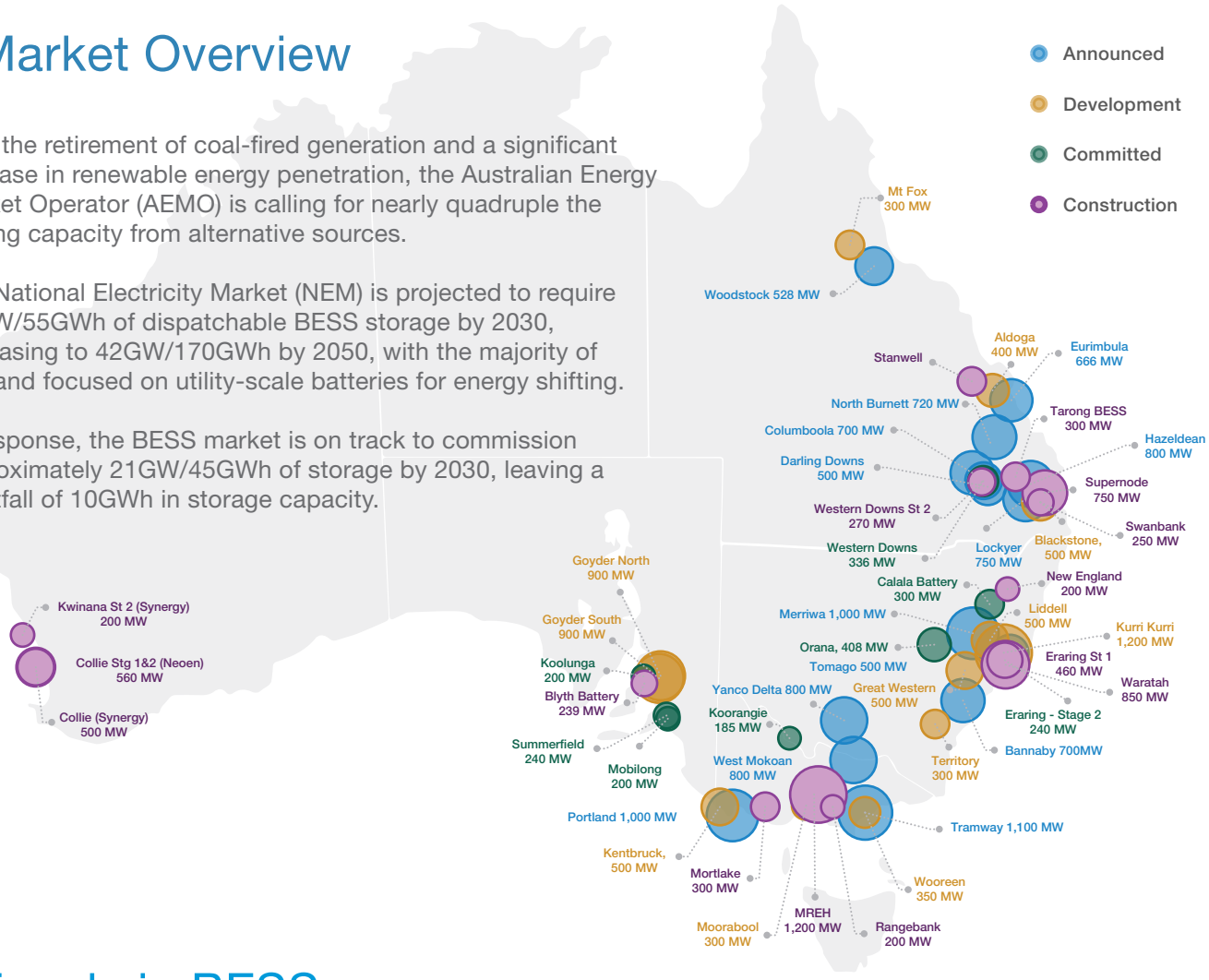
Understanding the BESS market in Australia

Market Overview

With the retirement of coal-fired generation and a significant increase in renewable energy penetration, the Australian Energy Market Operator (AEMO) is calling for nearly quadruple the firming capacity from alternative sources.

The National Electricity Market (NEM) is projected to require 19GW/55GWh of dispatchable BESS storage by 2030, increasing to 42GW/170GWh by 2050, with the majority of demand focused on utility-scale batteries for energy shifting.

In response, the BESS market is on track to commission approximately 21GW/45GWh of storage by 2030, leaving a shortfall of 10GWh in storage capacity.



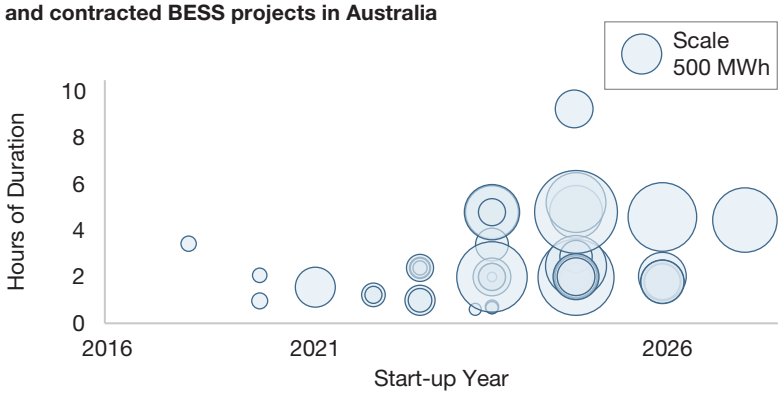
Trends in BESS

Larger-scale projects: Grid-connected utility scale batteries in Australia are increasing in size and duration, with major 4-hour batteries expected to come online between 2024 and 2028.

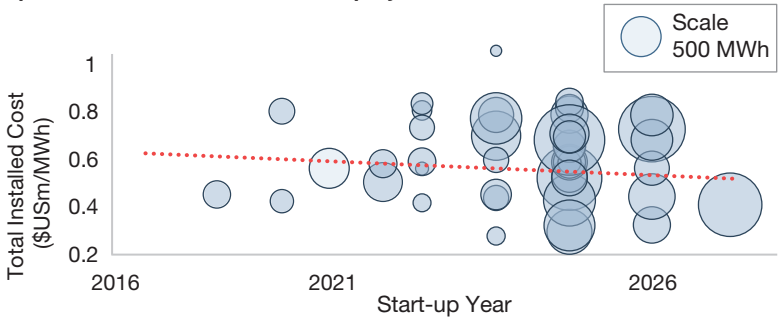
Growth of price arbitrage: These batteries will play a key role in energy shifting, capitalizing on market volatility by charging during low demand or renewable oversupply (particularly rooftop solar) and discharging when prices peak.

Decreasing capex costs: As the size of project increases and the market matures, coupled with technological innovations and abundance in battery supply, total installed costs are decreasing, making large-scale batteries more economically viable.

Duration, operation year and storage capacity for selected operational and contracted BESS projects in Australia



Unit total installed cost, operation year and storage capacity for selected operational and contracted BESS projects in Australia



BESS Opportunities in Australia

To best capitalise on the BESS opportunities, stakeholders must understand the business models available in the BESS value chain and align them with regulatory support mechanisms. However, to fully capture the value of these projects, investors must carefully evaluate the commercial, technical and regulatory requirements, as well as the potential challenges that could impede project development. They face key strategic and delivery challenges that may impact returns.

Business Models for Utility Scale BESS

FCAS

Frequency Control Ancillary Services, refers to the services used to maintain the reliability and stability of the electrical grid by managing the frequency of the electricity supply. These services are essential for balancing supply and demand in real-time, ensuring that the grid operates within its required frequency range (typically around 50 Hz)

Price Arbitrage

Price arbitrage refers to the practice of charging BESS batteries during periods of low-cost electricity and discharging the stored energy when demand and prices rise. This can be done in day-ahead (DA) markets or through intraday trading, creating revenue opportunities for BESS

Capacity

Capacity markets provide a reliable revenue stream for capacity providers, serving as a financial foundation for future investments. In exchange for this income, providers must guarantee energy availability during times of system stress, facing potential penalties for failing to fulfill these requirements

BESS Drivers

Tailwinds		Headwinds	
Regulatory Support	The programs above enhance the regulatory stability that investors seek from infrastructure and alternative investments.	**Supply chain vulnerability**	Lack of domestic manufacturing creates over reliance on importation exposing developers to potential geopolitical and energy security risks.
Market Demand	Renewables penetration driven by AI, hyperscale data centres, data consumption and electrification of industry.	**Safety liability**	Fire hazard incidents from lithium batteries have increased importance in tech assessment and risk mitigation strategies.
Technology innovation	Cost of renewables (solar + wind) and OEM components have reduced LCOS cost by over 90% over past 15 years.	**Evolving market**	The energy market is becoming increasingly competitive, with various technologies vying for market share.
Commercialisation opportunities	Rising forecasted energy prices, with increased volatility has created revenue enhancement opportunities.	**Grid infrastructure**	Existing grid infrastructure may not be fully prepared to integrate large-scale energy storage, potentially complicating deployment and operational efficiency.

Stakeholder Mapping

Utility scale, grid connected projects form the majority of BESS installations throughout Australia with the following key stakeholders driving their development, installation and operation.

Stakeholder	Key Drivers	Typical Use Cases (Storage Duration)
Transmission Network Service Providers (TNSPs) Own and operate HV transmission lines connecting power plants to distribution networks	Alleviating transmission constraints and enhancing grid reliability	• Transmission congestion (~2h) • Energy Shifting (passive) (4h+) • FCAS (< 1h)
Distribution Network Service Providers (DNSPs) Manage lower voltage networks delivering electricity from transmission networks to homes and businesses	Reducing distribution network congestion and better utilising existing infrastructure to avoid costly upgrades	• Distribution congestion (~2h) • Energy Shifting (passive) (4h+) • Storage as a service (1-2h)
Retailers Generate/purchase electricity from the wholesale market and sell it to consumers	Increasing revenue through energy arbitrage and customer service offerings (VPPs and distributed storage)	• Energy Shifting/Arbitrage (Active & Passive) (2-4h+) • FCAS (< 1h) • Residential & VPPs (1-2h) • Storage as a service (1-2h)
Renewable Energy Developers Focus on developing, building and operating renewable energy projects, primarily relying on project debt finance secured through PPAs	Maximising renewable energy utilisation and stabilising renewable output	• Energy Shifting (passive) (4h+) • FCAS (< 1h) • VPPs (1-2h)
Technology Providers Develop and supply technologies for battery storage and grid services often partnering with developers	Expanding market for storage technologies and increasing tech adoption	• FCAS (less than 1h) • Energy Shifting (passive) (4–6h) • VPPs (1-2h)
Private Equity & Infrastructure Funds Invest in renewable energy and storage projects for long-term financial returns	Return on investment, diversification of asset portfolios (incl ESG) and vertical integration with commercial operations	• Energy Shifting/Arbitrage (Active) (2h+) • Commercial & Industrial (C&I) (2h+) • FCAS (<1h)
Multinational Energy Corporations Large multinational energy companies engaged in both conventional and renewable energy production	Expanding renewable energy portfolios and decarbonisation strategies	• Energy Shifting (passive) (4h+) • Energy Shifting/Arbitrage (Active) (2h+) • FCAS (<1h)

*Refer to the glossary for expansions of abbreviations

Regulatory Support

The Australian government strongly supports energy storage infrastructure though the Capacity Investment Scheme and NSW Energy Infrastructure Roadmap, with highly competitive biannual tenders offering revenue underwriting to attract investment and ensure financial stability in a volatile market.

Capacity Investment Scheme

The Capacity Investment Scheme (CIS) aims to secure 32GW of new clean generation and storage capacity by 2030 through revenue underwriting.

Tenders have been highly competitive, with the South Australia/Victoria pilot receiving 19 GW of storage proposals for 600 MW and CIS Tender 1 receiving 40 GW of proposals for 6 GW capacity. Assessment is also underway for the latest Wholesale Electricity Market CIS.

CIS Progress

Complete

In Progress (Registration Closed)

NSW Roadmap - Tender 2 (Pilot to CIS)
Bids: ~3.3 GW
Award: 1.1 GW (storage)
Approx 1.8Bn Capex

- Akaysha Energy's Orana Renewable Energy Zone battery (415MW/1,660MWh)
- AGL Energy's Liddell battery (500MW/1,000MWh)
- Iberdrola's Smithfield battery (65MW/130MWh)
- 3 VPPS (95MW)

Pilot – SA/VIC
Bids: ~19GW (storage)
For award: 600MW/2,400MWh (storage)

VIC
- Energy Australia's Wooreen (350MW)
- Project Power's Springvale (115MW)

SA
- Pacific Green Energy's Limestone Coast West (250MW)
- Zen Energy's Solar River (170MW)
- Pacific Blue's Clements Gap (60MW)
- Energy Australia's Hallet (50MW)

CIS Tender 1 - NEM
Bids: ~ 40GW (gen/storage)
For award (gen/storage): 6 GW (NSW 2.2 GW, SA 300 MW, VIC 1.4GW, merit based 1.85 GW)

Stage A – Project Bids/shortlist
- Registration/Bid open – 31 May 24
- Registration Close – 19 Jun 24
- Shortlist & Invitation – Aug/Sep 24

Stage B – Financial value Bids
- Final Bid Close – Sep/Oct 24
- Outcomes – Dec 24

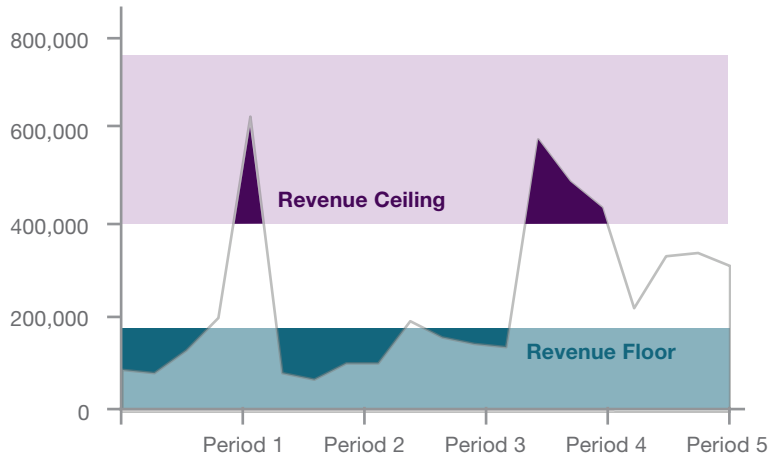
CIS Tender 2 – WEM
Bids: TBC
For award: 500MW/2,000MWh (storage, preferred 4h, min 2h)

Stage A – Project Bids/shortlist
- Registration/Bid open – mid Jul 24
- Registration close – Aug 24
- Bid Close – mid Aug 24
- Shortlist & Invitation – Oct 24

Stage B – Financial value Bids
- Final Bid Close – Oct/Nov 24
- Outcomes – Q1 25

The CIS is typically structured as a contract for difference (CFD), compensating projects if revenue falls below a set (biddable) floor and receiving payments revenues exceed a ceiling.

Hypothetical Revenue Earned ($)



Premium Sharing
Project to pay govt **50% of revenue above ceiling,** with annual cap equal to support cap

Pain Sharing
Government to pay project **90% between floor and zero revenue**, with biddable annual support cap

NSW Energy Infrastructure Roadmap – Long Duration Storage

The NSW Energy Infrastructure Roadmap also aims to procure at least 2 GW of clean long-duration storage (LDS) capacity by 2030 through though Long-Term Energy Service Agreements (LTESA) and Renewable Energy Zone (REZ) access rights.

Like CIS, competitive biannual tenders have become intense with Tender 3 receiving 1.6GW/12.8GWh of LDS proposals for 0.55GW/4.4GWh.

LDS Progress

Complete

In Progress (Registration Closed)

NSW Roadmap – Tender 1
LDS Bids: 2,500MW/20,000MWh
LDS for award: 600MW/4,800MWh
LDS awarded: 50MW/400MWh

Stage A – Project Bids/shortlist
Open – Sep 22, Close - Oct 22

Stage B – Financial value Bids
Open – Dec 22, Outcomes - Apr 23

LDS Awarded:
Limondale BESS
50MW/400MWh+

NSW Roadmap – Tender 3
LDS Bids ~1,600MW/12,800MWh
LDS for award: 550MW/4400MWh
LDS awarded:

Stage A – Project Bids/shortlist
Open – May 23, Close - Jun 23

Stage B – Financial value Bids
Open - Aug 23, Outcomes - Dec 23

LDS Awarded:
Silver City Energy Storage
200MW/1,600MWh (A-CAES)
Goulburn River BESS
49MW/392MWh
Richmond Valley BESS
275MW/2,200MWh

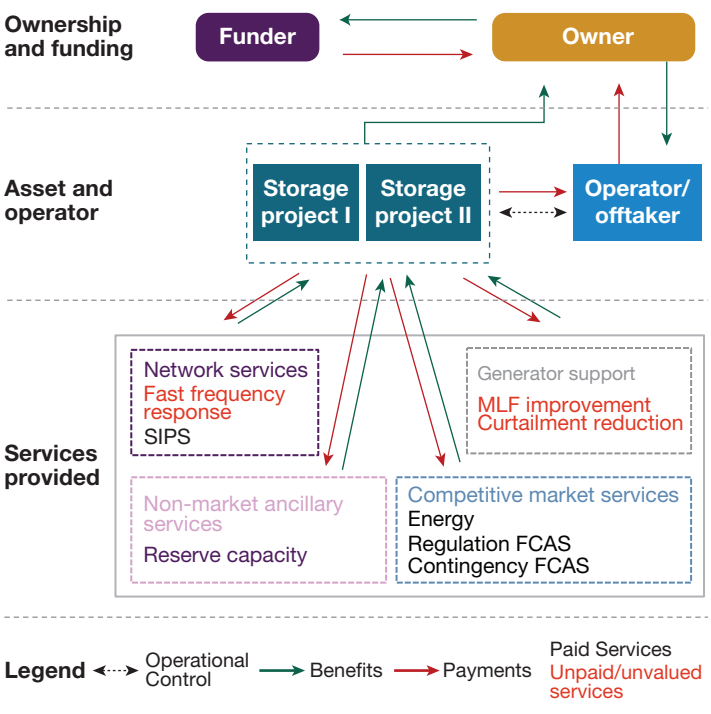
NSW Roadmap – Tender 5
LDS Bids TBC
LDS for award: 1GW/8GWh
LDS awarded: TBC

Stage A – Project Bids/shortlist
Registration/Bid open – 22 May 23
Registration Close – 7 Jun 24
Bid Close – 27 Jun 24
Shortlist & Invitation – Late Aug 24

Stage B – Financial value Bids
Final Bid Close – Late Sep 24
Outcomes – Dec 24/Jan 25

Typical LTESAs are structured as a financial derivative contract protecting operators from low prices while allowing upside from higher prices.

Indicative commercial arrangement



Source: BloombergNEF. Note: SIPS= system integrity protection scheme. MLF = marginal loss factor.

*Non exhaustive

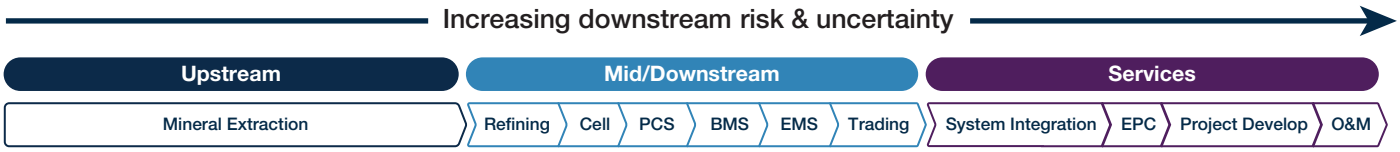
*Refer to the glossary for expansions of abbreviations

Key Risks to BESS

	Key trends impacting risk on BESS opportunities	Potential mitigation
Technical	**Technological maturity:** Rapid advancements in battery technology can raise concerns about obsolescence over the project's lifespan or even during the development phase.	Partner with suppliers to access latest tech, use flexible systems and implement future-proof design.
	Safety Hazard: Operating BESS safety risks include, thermal runaway, fires, toxic gas emissions and electrical hazards.	Mitigate risks through careful design, robust Battery Management System (BMS), fire suppression and safety protocols.
	Supply chain instability: BESS projects face supply chain risks that can impact costs and timelines. In 2024, 91% of projects used LFP batteries, reducing dependency on cobalt and nickel dependency.	Build partnerships, diversify suppliers, and capitalise on oversupply.
Commercial	**Industry consolidation & competitive auction process:** Competitive Mergers and Acquisitions (M&A) and auctions require early investment decisions.	Conduct thorough modelling to mitigate entry price risks and ensure revenue certainty.
	Revenue uncertainty: BESS revenue streams, like energy arbitrage and ancillary services, are unpredictable due to rapid market evolution, volatility and fluctuating prices.	Diversify revenue streams (e.g., FCAS, shifting) though flexible contracts, complementary technical setups (e.g., duration, hardware) and detailed modelling/sensitivity testing.
	Grid upgrade costs: Projects often face significant, escalating costs for grid upgrades required for connection, driven by unexpected operator demands.	Control escalating connection costs through early, comprehensive connection studies and proactive engagement with grid operators.
	Shifting contracting models: The move from turnkey EPC contracts to split contracts increases risks in contractor coordination, integration and project financing, as developers grapple with rising Engineering, Procurement, and Construction (EPC) premiums and complex Operations and Maintenance (O&M) and warranty demands.	Improve in-house delivery capabilities and processes to manage increased client-side contracting risks.
Regulatory	**Grid connection delays:** BESS projects often face delays due to complex grid integration and long lead times for equipment. As of March 2024, over 593 projects are in the connection queue, with approvals taking 300-400 days and often facing indefinite delays. New rule changes from July 2024 aim to streamline connections by removing barriers, improving transparency, and setting clear assessment/response timeframes, supported by additional staff to address the backlog.	Conduct thorough connection studies and engage early with grid operators. Prioritise grid connection agreements when purchasing development projects.
	Planning approvals: BESS regulatory approvals, while simpler than solar or wind, still take 12-18 months due to environmental compliance and community consultation.	Comprehensively plan projects, scheduling early and proactively for environmental compliance, community engagement, and approval submissions.
	Market rules uncertainty: The complex and evolving National Electricity Market (NEM) rules create uncertainty around how storage systems participate in energy markets and provide grid services.	Remain closely updated on relevant, evolving NEM rules and incorporate flexible market participation strategies.

*Refer to the glossary for expansions of abbreviations

Australian BESS Project Supply Chain Risks



Market Volatility

Critical mineral market volatility caused by supply shocks, geopolitical issues and periods of oversupply can lead to price spikes, drops and underinvestment. Long-term lithium prices are expected to remain low.

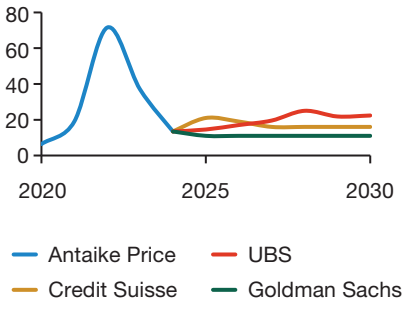
Supply chain vulnerability

Concentrated material refining and manufacturing give key regions power and leave buyers vulnerable to supply shocks. These regions are forecast to remain dominant for the foreseeable future.

Risk reallocation to developers

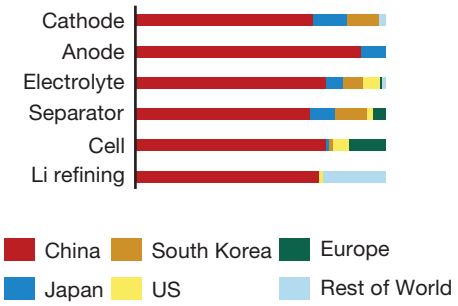
Rack costs will drop, but EPC, BoP and services will represent a larger share of total costs. Contractor limitations remain a key bottleneck, and split contracts add complexity and delays. Annual builds are expected to increase by 50% by 2025.

Lithium Carbonate Price (kUSD/T)



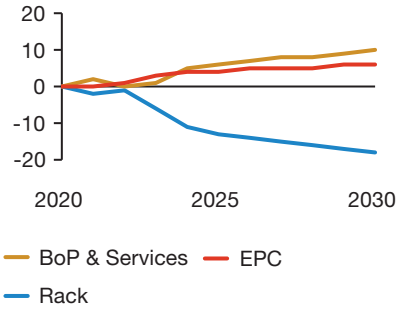
Source: Refinitiv, Longzhong, Antaike, UBS, Credit Suisse, Goldman Sachs, Canaccord

Global battery component manufacturing & metals refining



Source: Bloomberg NEF -The battle to break China's battery-making supremacy

Forecast change in percentage of total installed cost (%)

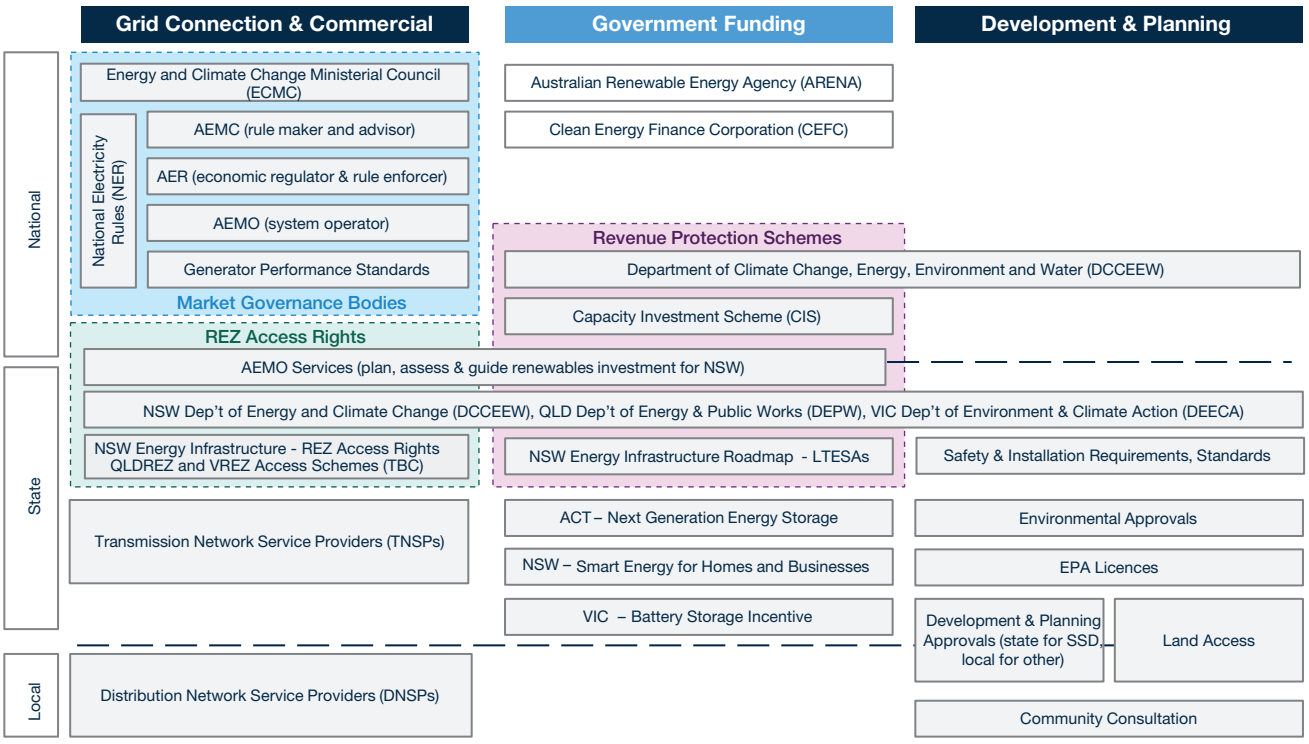


Source: Bloomberg NEF 1H 2024 Energy Storage Outlook

*Refer to the glossary for expansions of abbreviations

Australia's BESS regulations

Australia's BESS regulations are both complex and continuously evolving. Navigating this landscape requires deep understanding of market trends, government funding initiatives and compliance requirements.



Disclaimer: Regulations outlined above are not exhaustive and are subject to change in an evolving environment

*Refer to the glossary for expansions of abbreviations

Key Success Factors to BESS investments

1 Seizing BESS Market Opportunities

The BESS market has evolved to present two main commercialisation opportunities

a. Revenue-enhancing opportunities through value stacking.
b. Cost out opportunities from colocation.

a. Value stacking – Finding the optimal mix in revenue streams

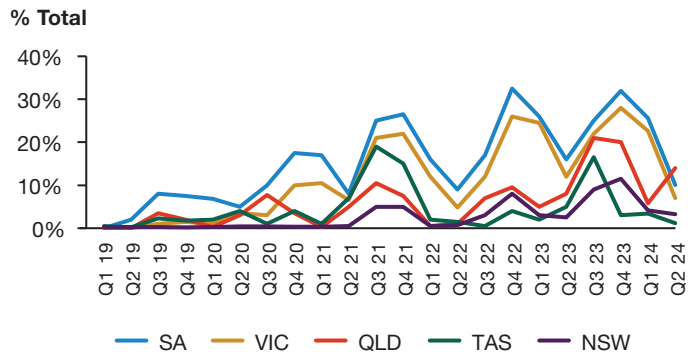
BESS offers investors with the flexibility of enhancing revenue via stacking the business models mentioned above. However one of the challenges with value stacking is finding the optimum balance between the battery's capabilities and ensuring the revenue model is aligned with regulatory and technological limitations.

Market trends show an increasing usage of BESS for price arbitrage over FCAS. 2022 saw revenue from price arbitrage $85m upend revenue from FCAS $80m. Q1& Q2 in 2024, also saw arbitrage accounting for over 60% of NEM revenue.

Australia's world leading solar penetration has fuelled negative pricing due to daytime over supply. Coupled with unplanned coal power plant outages and extreme weather events, Australia has the most volatile electricity market in the world creating an ideal environment for arbitrage.

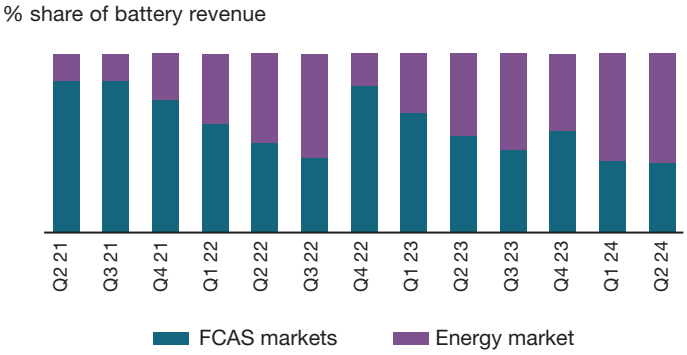
Finding the optimal balance will involve a strong understanding of discharge regulations and forecasting of energy market dynamics.

Proportion of negative price hours



Source: Bloomberg NEF

Industry trends show an increasing proportion of BESS revenue from price arbitrage



Source: AEMO Quarterly Energy Dynamics Q2 2024

b. Optimization of existing assets via colocation

Colocation involves installing BESS alongside other energy generation resources, such as solar or wind farms, within the same site or facility. This approach maximizes the efficiency and utilization of the combined resources.

Overall, colocation for BESS helps to maximize the value of both the energy storage and generation assets while contributing to a more flexible and reliable energy system.

Benefits of Colocation:

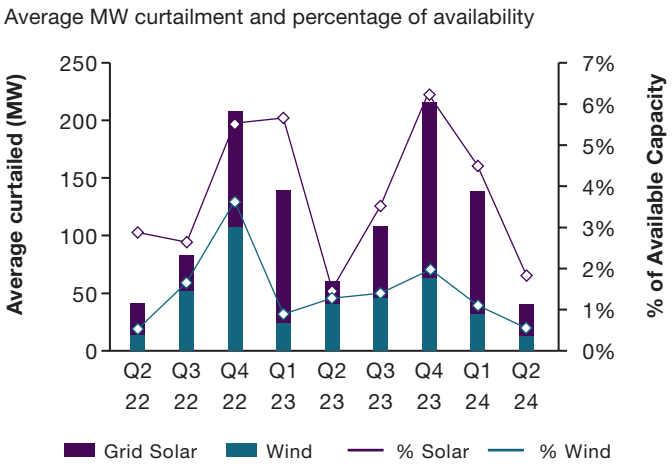
I. **Synergy with Renewables:** Co-locating BESS with renewables particularly solar improves energy integration, allowing excess energy storage during peak production for later use.

II. **Reduced Costs:** Sharing infrastructure like grid connections lowers capital and operational expenses compared to separate installations.

III. **Enhanced Grid Stability:** Co-located BESS can provide services such as frequency regulation and load balancing, contributing to grid stability and reliability.

IV. **Optimized Energy Management:** Co-located BESS enables better energy flow control, demand response participation and energy arbitrage.

BESS can optimise exacerbating solar curtailment issues

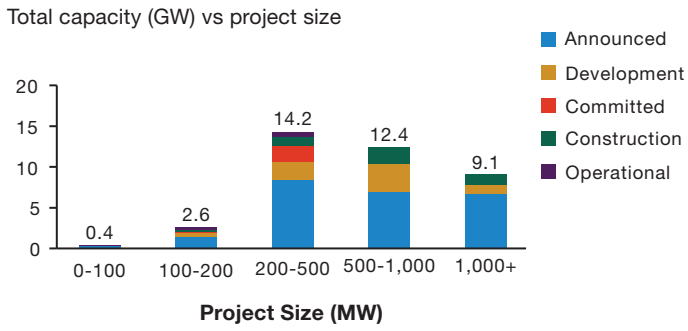


Source: AEMO Quarterly Energy Dynamics Q2 2024

2 Accelerating Project Delivery for Competitive Advantage

The BESS market is young, led by larger developers with mature pipelines, followed by smaller players with ambitious and less developed projects. Success will favour those who act swiftly, create bankable projects, and hone execution, leveraging favourable market conditions over the next decade. Early adopters with robust balance sheets are poised to benefit.

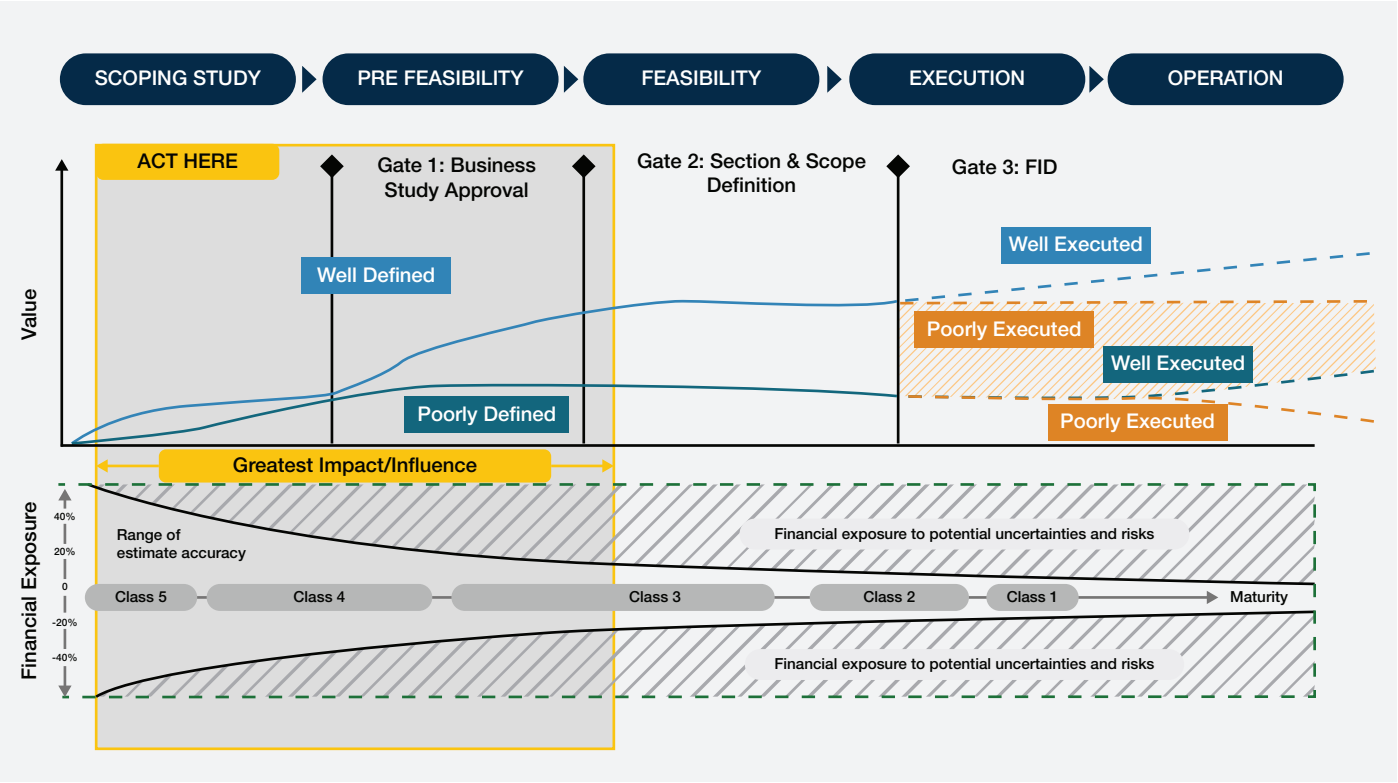
Top 18 BESS Developers (Pipeline >1GW)



a. **Prepare early for scaling:** Build in-house capabilities for development, construction, and O&M, alongside a robust pipeline and strong supplier relationships. This maximises project quality and deployment efficiency during periods of favourable market conditions and incentives.

b. **Accelerate through acquisitions:** Once in-house capabilities are established, accelerate development pipelines through strategic acquisitions, leveraging a proven model across multiple projects during favourable market conditions.

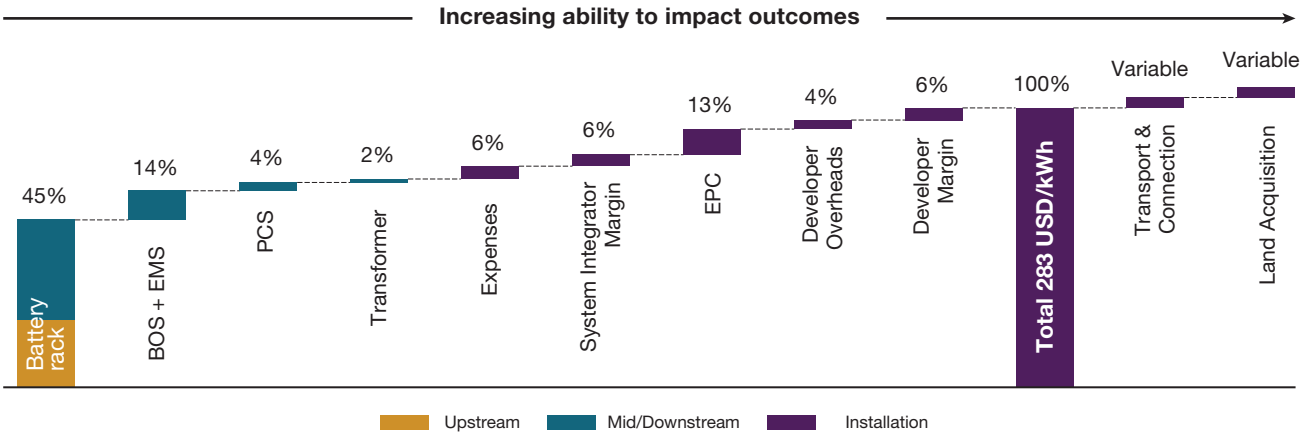
Value levers in the project lifecycle



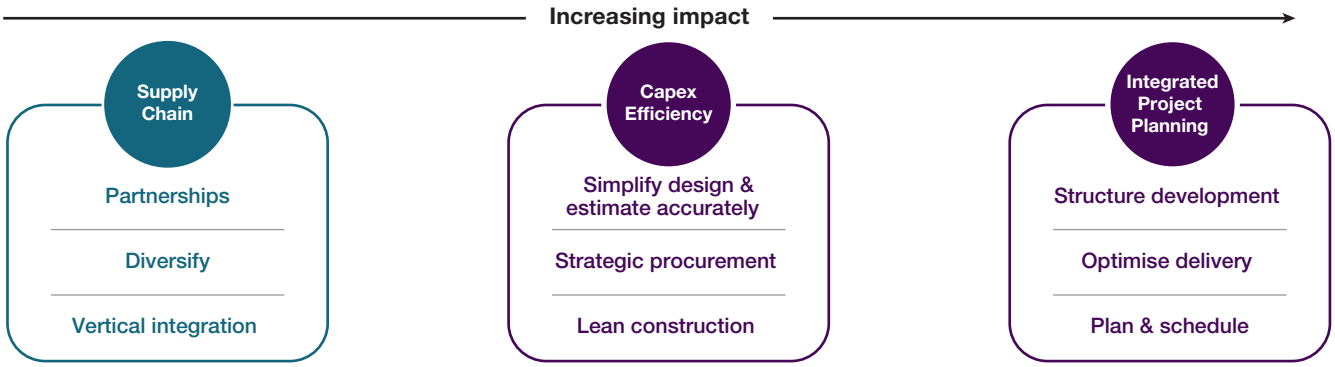
*Refer to the glossary for expansions of abbreviations

With capital costs making up approximately over 95% of the Levelized Cost of Storage (LCOS), rack costs decreasing, and BoP and EPC cost rising as a larger portion of project value, identifying CapEx savings are crucial to accelerating scale. Efficient CapEx strategies and robust project planning can cut costs, especially as BESS projects scale and integrate with other assets. These should be applied early in the project lifecycle, when they have the greatest impact, particularly as most BESS projects remain in early development stages.

CapEx Breakdown for 4-hour BESS (2024)

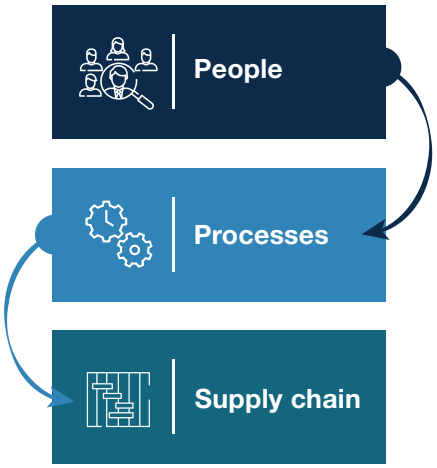


Key value levers



3 Building In House Development and Execution Capability to Enhance Delivery Certainty

Be proactive about building 'fit for purpose' in house development and delivery capabilities. Leading in the rapidly evolving BESS market requires developers to be proactive, agile and strategic to navigate the unique challenges and capitalise on emerging opportunities.



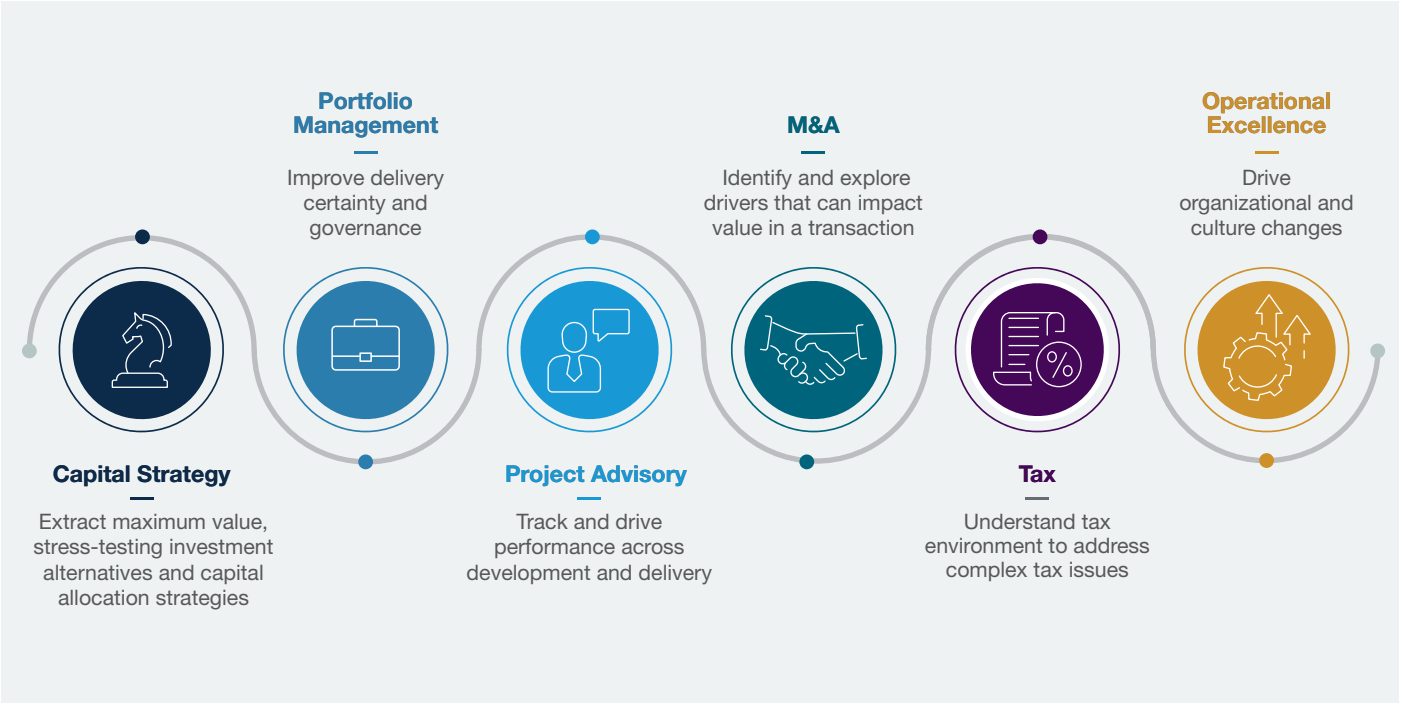
Be proactive: People are the foundation to scaling and improving development and delivery capability. Assess gaps, hire skilled talent and train quickly to get ahead in a competitive market.

Stay agile: With the market changing rapidly, companies must quickly adapt, and flexible governance and streamlined processes are essential to enable this.

Be strategic: Address shifting risks to buyers. Supply chain complexity also brings opportunity. Build partnerships, diversify suppliers, capitalise on oversupply and prepare for contractor shortages and changing models.

How A&M Can Help

A&M offers a comprehensive range of services for clients pursuing BESS opportunities, with tailored solutions that meet the client's unique needs in Australia's competitive BESS landscape.



Leverage our deep expertise in the BESS and energy sector, along with a team of skilled professionals specializing in investment strategy, value creation and delivery optimisation to drive successful transformation outcomes.

Glossary

Abbreviation	Expansion
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ARENA	Australian Renewable Energy Agency
BMS	Battery Management System
BoP	Balance of Plant
CapEx	Capital Expenditure
CEFC	Clean Energy Finance Corporation
CIS	Capacity Investment Scheme
DCCEEW	Department of Climate Change, Energy, Environment and Water
ECMC	Energy and Climate Change Ministerial Council
EMS	Energy Management System
EPA	Environment Protection Authority
EPC	Engineering Procurement & Construction
FCAS	Frequency Control Ancillary Services
FID	Final Investment Decision
ISP	Integrated System Plan
LCOS	Levelized Cost of Storage
LDS	Long Duration Storage
LFP	Lithium Iron Phosphate
MLF	Marginal Loss Factor
NEM	National Energy Market
NER	National Electricity Rules
DCCEEW	Department of Climate Change, Energy, the Environment and Water
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
PCS	Power Conversion System
QLD DEPW	Queensland Department of Energy and Public Works
QLD REZ	Queensland Renewable Energy Zones
Reg App	Regulatory Approvals
SIPS	System integrity protection scheme
SSD	State Significant Development
VIC DEECA	Victoria Department of Energy, Environment and Climate Action
VPP	Virtual Power Plant
VREZ	Victoria Renewable Energy Zones

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