Grid-Forming Batteries

The current state of play

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Australian Government
Australian Renewable Energy Agency

ARENA 10 YEARS

ARENA’s Purpose

ARENA is the Australian Renewable Energy Agency.

The Agency was established by the Australian Government in July 2012.

Our purpose is to support the global transition to net zero emissions by accelerating the pace of pre-commercial innovation, to the benefit of Australian consumers, businesses and workers.

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Strategic Priorities

OPTIMISE THE TRANSITION TO RENEWABLE ELECTRICITY

COMMERCIALISE CLEAN HYDROGEN

SUPPORT THE TRANSITION TO LOW EMISSIONS METALS

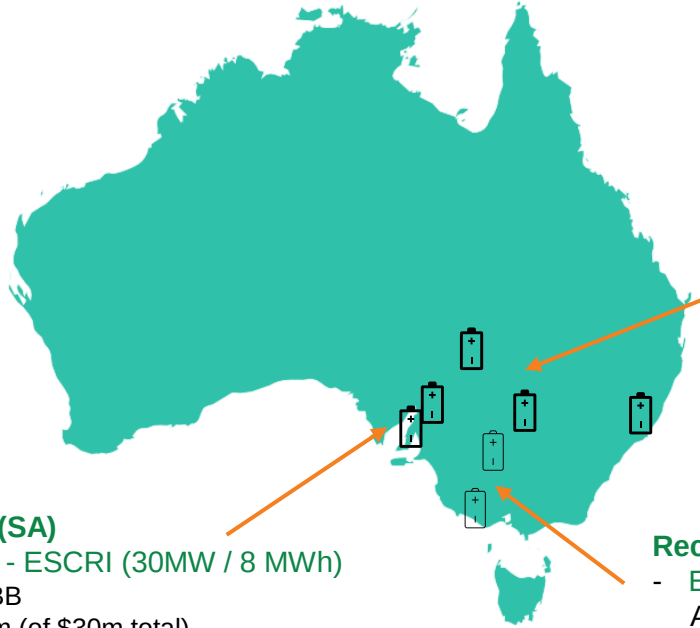
DECARBONISE LAND TRANSPORT

Market context – Big Batteries

Snapshot of ARENA's Grid-Forming Battery portfolio

ARENA GFM portfolio

- 5 projects (430 MW)
- $51m grants
- 2x operational
- 1x awaiting 5.3.9 (Wallgrove)
- 2x under construction



Operational (SA)

1) ElectraNet - ESCRI (30MW / 8 MWh)
   Inverter: ABB
   Grant: $12m (of $30m total)
2) Neoen - HPRx (150MW / 193 MWh)
   Inverter: Tesla
   Grant: $8m (of $71m for 50MW expansion)

Coming soon (NSW)…

3) Transgrid Wallgrove (50MW / 75MWh)
   Inverter: Tesla
   Grant: $10m (of $65.5m total)
4) AGL Broken Hill (50MW / 50MWh)
   Inverter: EPC Power (working with Fluence)
   Grant: $14.8m (of $41.2m total)
5) Darlington Point/Riverina (150MW / 300MWh)
   Inverter: Tesla
   Grant: $6.6m (of $37.5m total)

Recently announced (not ARENA-funded, pre-FC)

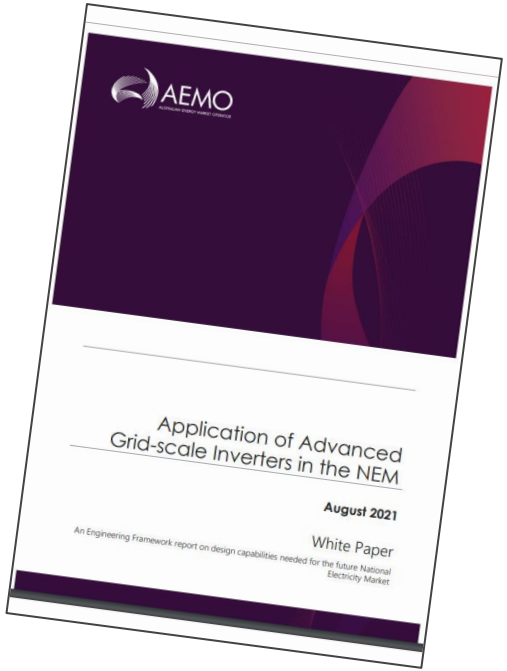
- Edify Koorangie (125 MW / 250 MWh)
  AEMO contract executed
- FRV Terang (100 MW / 200 MWh)
  $7m Victorian Government funding

What is AEMO saying about Advanced Inverters?

"*AEMO sees advanced inverter technology as a **key enabler** of the future power system and it is **imperative that its potential capability be realised** to support the system as it transitions to lower levels of synchronous generation online*"

*"there is a **rare window of opportunity** to build grid-forming capabilities into this battery fleet today"*

*"The **top priority** should be demonstrating and proving advanced inverter technology capabilities **at scale**, and maximising the inherent capabilities of all new grid-scale batteries."*



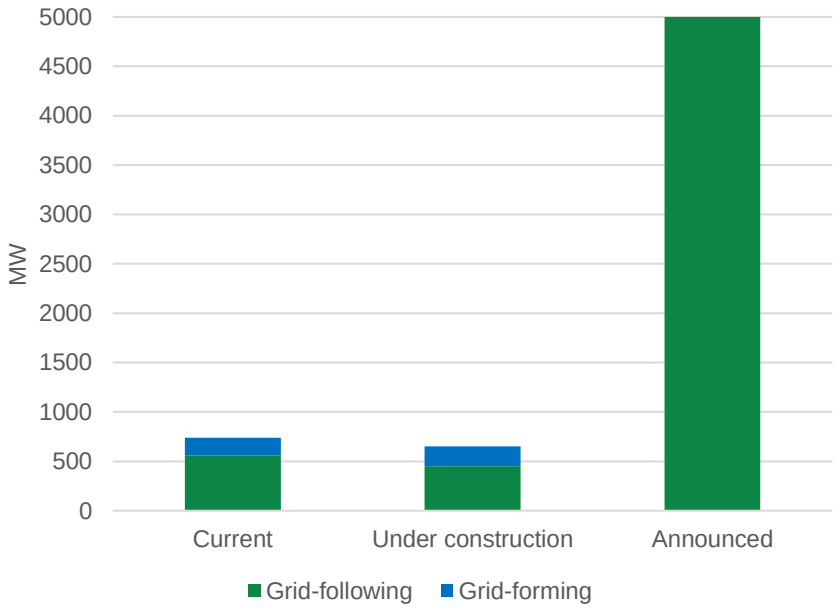
Why did we need a Funding Round?

1. **AEMO Inverter White Paper:** AEMO's paper describes a "rare window of opportunity" and says demonstration of grid-forming inverters **at scale** is the **top priority**

2. **Enabler to 100% renewables**: Grid-forming batteries are viewed as being a key enabler to operating the whole NEM regions at 100% instantaneous renewables.

3. **Growing pipeline**: Battery projects were starting to progress without grant funding and a large pipeline of projects emerged (>5GW). However, most projects are not proposing to use advanced inverters.

4. **Barriers to GFM:** No reason for developers to chose GFM. No additional revenue, only increased risks.
    1. Delays – connection approval, commissioning
    2. Increased capex (2-8%)
    3. Revenue impact (?)

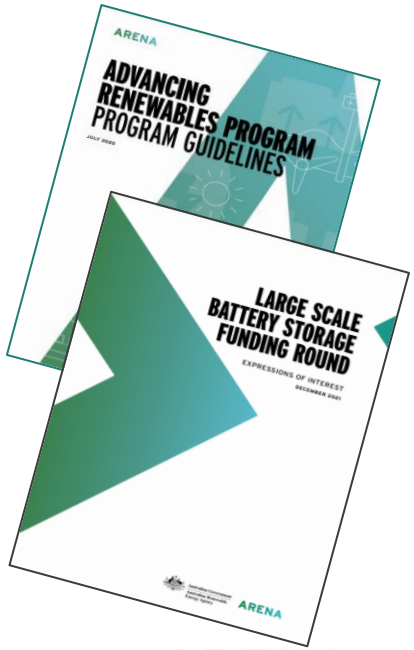


What is the Battery Funding Round?

What is the Large-Scale Battery Storage Funding Round?

The Large Scale Battery Storage Funding Round (Funding Round) is a $100 million competitive round to be conducted under the ARP Guidelines. It seeks to provide funding to grid scale battery energy storage projects equipped with advanced inverters.

Item	Description
ARENA grant Funding	$100 million
Method	• Competitive round • 2-stage competitive process
Eligibility	• Must use advanced inverters (e.g. grid-forming) • NEM or WEM connected • Minimum 70 MW project size • Maximum grant request of $35m • Financial close by 31 December 2023
Status	• Applications received and assessed • Preparing no notify applicants



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Objectives

1. Accelerate demonstration of advanced inverter capabilities on LSBS projects at scale
2. Overcome barriers that prevent LSBS projects from incorporating advanced inverter capabilities
3. Improve industry understanding of the potential role of advanced inverters in supporting system stability during periods of very high inverter-based generation
4. Reduce the reliance on synchronous generators and/or synchronous condensers for system stability
5. Demonstrate the capability of advanced inverters (at scale) in multiple states and across multiple inverter types, such that they can be relied upon for critical system services in power system planning
6. Inform the market regulatory bodies to facilitate the efficient delivery of services from Grid-Forming Batteries

What is the status of the Funding Round?

Process and status

We are here

- 54 EOIs received
- >10 GW of projects

- 12 applications invited
- 3 GW of projects
- $3.7 billion

- Approval of funding

- Negotiate Funding Agreements
- FC required by 31 December 2023
- Projects operational in 2024-25

Funding Round Observations

Willing market

54 EOIs demonstrated

10 GW of projects submitted

Battery capex

c.30% increase in the last 12 months

Diverse views

Risk premium (delays)

Capex premium

Possible revenue impact (?)

Inverter OEMs

Convergence on OEM preferences

Q&A