



# An Introduction to Redflow

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Tim Harris, CEO & Managing Director

# Redflow profile

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ASX Code: RFX

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Listed: 2010

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Incorporated: 2008

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Headquarters: Brisbane – incl. R&D

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Manufacturing: Thailand

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Employees - Australia: 50

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Employees – ex Australia: 50

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Active Deployments: 250+

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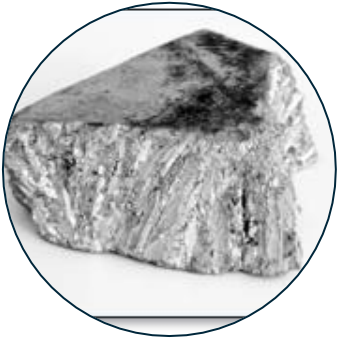
Total Energy Delivered: > 2 GWh

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Countries Serviced: 9

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# A global leader in the alternative energy storage market



## Core ZnBr Chemistry Provides Advantages

- + Core materials profile enables lowest core \$/kWh cost at scale
- + Highest energy density versus other flow chemistries
- + Core materials available through North American sources
- + Inherently fire safe (tested to UL9540a)
- + Recycling pathways already established (including electrolyte)



## Operational profile well suited to addressing peak energy demands

- + 3 – 12+ hour profile
- + Tolerance for high temperature
- + No thermal runaway risk
- + Deep discharge
- + Hibernation mode
- + Easy & proven recycling
- + Limited on site commissioning needs
- + High operational flexibility



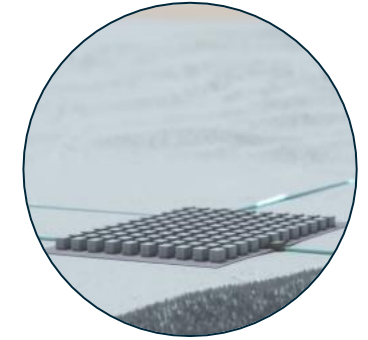
## Proven field performance, including in the US

- + >250 active deployments globally
- + Proven operational experience at MWh scale
- + Over 12 years operational experience & learnings supporting critical infrastructure
- + Over 2M hours operational performance since 2018
- + Over 2 GWh energy delivered to date



## Committed to global growth

- + US team recently established and growing
- + Existing team in Asia
- + Largest project to date (Anaergia) successfully delivered in California and resulted in new commitment from Anaergia for new California project 3x larger
- + UL 1973/9540 certification underway for North American product



## Capable of rapid scale up incl. localization

- + Wholly owned ISO9001 accredited manufacturing facility – 80 MWh p.a.
- + Proven production experience and core battery design / materials drives rapid scale up / cost down
- + Manufacturing profile enables 3rd party / sub assembly model
- + Limited constraints on supply chain

# How does a zinc-bromine battery work?





# Industry leadership developed over many years

**2008**

Redflow formed  
Gen1 developed



**2014**

Gen2.5 launched



**2018**

Redflow Thailand  
Established



**2021**

Energy Pod launch  
for larger systems



**2022**

Gen3 launch  
(end FY22)



Initial prototyping

**2005**



Gen2 battery  
1<sup>st</sup> large scale system

**2010**



Launch Battery  
Management System

**2017**



Gen3  
First customer trial

**2020**



2 MWh system  
implemented in US



US team established

**2022**

# Market is increasingly looking beyond lithium

Global dynamics are moving the industry towards Redflow core strengths and commercial readiness



**Market urgency placing premium on commercially proven and rapidly scalable solutions**



**Structural and energy security challenges accelerating focus on lithium alternatives**



**Lithium fire incidents and safety issues plus whole of life cycle considerations**



**Industry actively looking to next era of medium to longer term energy storage solutions**

# Redflow batteries offer a compelling solution



## MEDIUM TO LONGER DURATION

Up to 12 hours<sup>1</sup> (and potential to extend in hibernation mode)

<1 second response time



## COST & PERFORMANCE

Deep daily discharge and sustained energy output

Long life, multi cycle design

Ability to value stack – frequency control and energy shifting



## FLEXIBILITY

10 kWh modular design – scalable to multi MWh system

Core design allows for redundancy. Expand as needs increase

Hibernation mode allows for extended duration – weeks/months



## SAFETY & DURABILITY

No risk of thermal runaway  
- Non flammable materials

Excellent tolerance for high ambient temperatures w/out external cooling

Remote monitoring and diagnostics plus self-protection features



## SUSTAINABILITY

Abundant low cost materials

Proven recyclable and reusable components

<sup>1</sup> Redflow 10 kWh battery rated at 3kW constant, 5 kW peak. Longer durations may impact total energy capacity. See [redflow.com](https://redflow.com) for further information

# Scalable modular approach

Flexible, modular design to suit any project. Not limited by scale or size



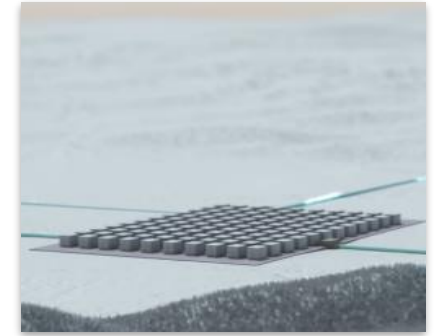
**CORE 10 KWh MODEL**



**QUADPOD**



**POD 200**



**SCALEABLE MWh/ GWh  
SOLUTION**



# Competitive advantages versus non-lithium peers

Redflow is a leader in lithium alternative stationary energy storage solutions



## Highest energy density across all commercial flow battery chemistries

- + Zinc-Bromine is up to 3x higher energy and power density than Iron-Flow, Vanadium and other Zinc-based chemistries<sup>1</sup>



## Active operational experience

- + More than 250 active deployments and over 10 million cumulative hours of field operational since 2018<sup>2</sup>



## Flexibility and agility in deployment and performance

- + Modular approach and hibernation mode maximises design capacity flexibility and aligns energy delivery to need



## Low raw materials cost profile

- + Zinc is the world's 4th most abundant metal – cost and availability advantages
- + Zinc-Bromide cited as one of the lowest estimated cost of raw materials across different battery chemistries on a \$/kWh basis<sup>3</sup>



1. Redflow internal analysis based on core chemistry characteristics and publicly available company information  
2. Redflow internal operational data as of 30th July 2022  
3. See Rocky Mountain Institute, *Breakthrough Batteries*, 2019, Exhibit 20. Important Note – the information in the report is indicative of the estimated relative chemical cost of storage for zinc bromide chemistries. It is not a statement of Redflow's chemical cost of storage, which may differ from their information

# Commercial Advantages

**Fire Safe and tolerance for high temperature:** No need for costly fire suppression systems and HVAC – capital cost, parasitic load and maintenance.

**Local job creation:** Potential across manufacturing, deployment and operations. Local field service enabled through online training of 3<sup>rd</sup> parties.

**Low levelized cost of storage:** Redflow analysis shows up to 20% LCOS advantages versus Lithium at ~200 MWh annual production.

**Pay for what you need:** Design BESS to specifically fit customer requirements with no need for overspecification or augmentation.

**Recyclable and no disposal costs:** Proven recyclability using standard processes. Additional residual value at end of life (est. ~20%).

**Low raw mineral costs:** Use of abundant materials (including zinc) reduces exposure to conflict minerals and enhances product stewardship credentials.

**Low Risk:** Product performance and solvency insurance available - provided through global reinsurer.

**Operational flexibility:** Provides multiple revenue streams incl. ability to defer energy discharge long term without self discharge – ideal for developing countries with intermittent grid.



Redflow installed 160 kWh energy storage system to offset a diesel generator at an Optus telecommunications site in 2019.

- + 65% reduction in generator operation run time
- + 17% Increase in generator efficiency
- + ~6000 L of diesel fuel saved every year
- + 16 tonnes of CO<sub>2</sub> abated per annum
- + Est. savings of >\$10,000 every month

Source: Redflow Analysis







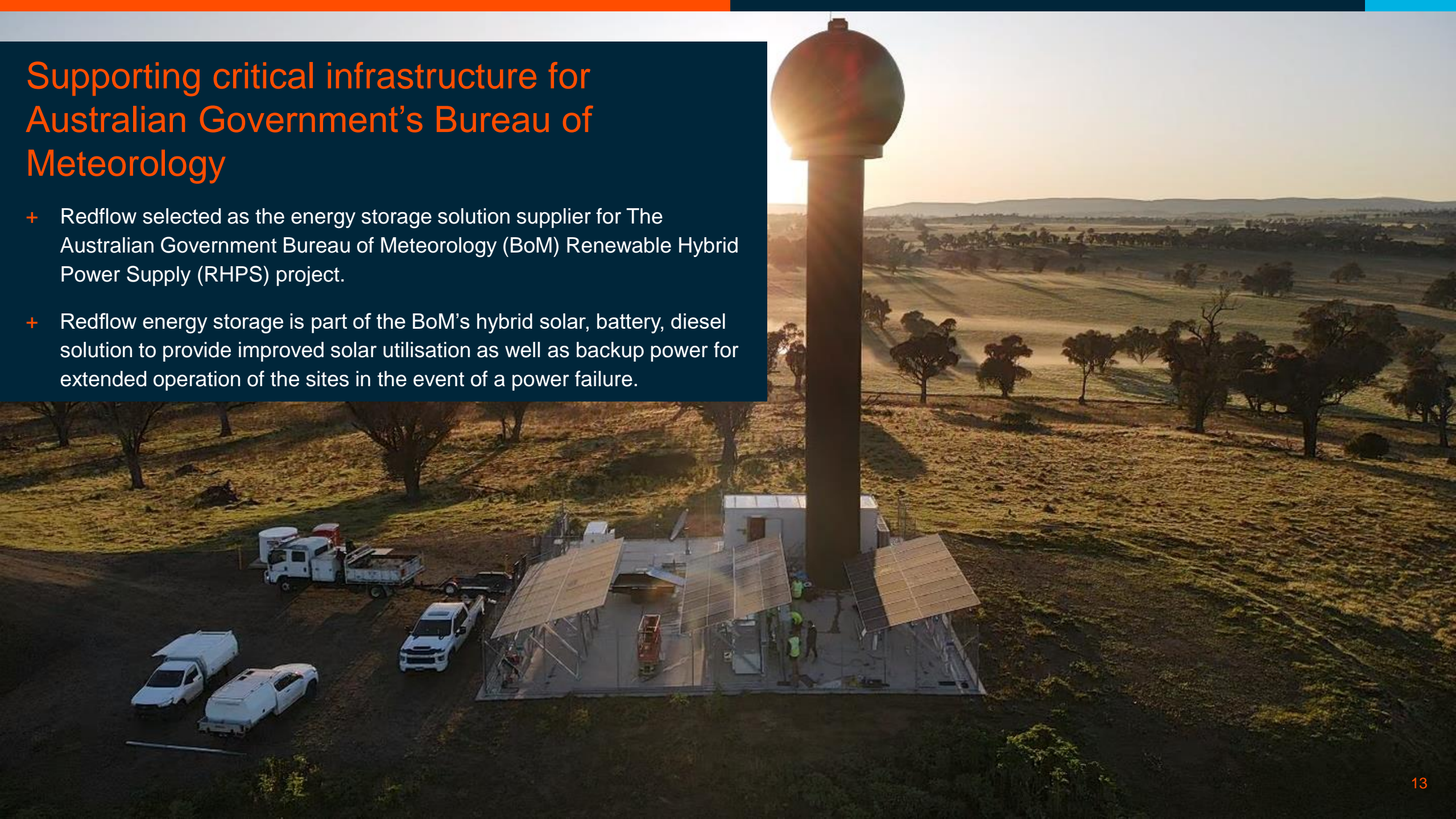
## Supporting telco sites in South Africa since 2018

- + Able to support longer duration during load shedding – full discharge without damage
- + Demonstrated theft reduction characteristics v Lead Acid and Lithium



# Supporting critical infrastructure for Australian Government's Bureau of Meteorology

- + Redflow selected as the energy storage solution supplier for The Australian Government Bureau of Meteorology (BoM) Renewable Hybrid Power Supply (RHPS) project.
- + Redflow energy storage is part of the BoM's hybrid solar, battery, diesel solution to provide improved solar utilisation as well as backup power for extended operation of the sites in the event of a power failure.







## 2 MWh California deployment

- + 2 MWh energy storage system at Anaergia's Rialto Bioenergy Facility in California.
- + The energy storage system contains 192 zinc-bromine flow batteries, designed to reduce the microgrid's peak energy use.
- + Successfully met California Energy Commission goals for project.



#### **Redflow Head Office**

Redflow Limited  
27 Counihan Road,  
Seventeen Mile Rocks,  
Brisbane QLD 4073  
Australia

Phone: + 61 7 3376 0008  
Fax: + 61 7 3376 3751

Sales: [sales@redflow.com](mailto:sales@redflow.com)  
General: [info@redflow.com](mailto:info@redflow.com)  
Media: [marketing@redflow.com](mailto:marketing@redflow.com)

**redflow.com**