capabilities and technology

redflow

$3.0t

$US1.5 to 3.0 trillion in investment

140 TWh

85 to 140 TWh of global LDES demand by 2040

energy storage market transformation

As the world transitions to a carbon-free future, alternative energy storage solutions are absolutely essential to meet growing global energy requirements.

Researchers predict that by 2040, global storage requirements will be 85 to 140 TWh of longer duration (8+ hours) capacity. In the US alone, it's estimated that 10% of all electricity generated will need to be stored with long-duration energy storage (LDES) – requiring $US1.5 to 3.0 trillion in investment.

To meet the rapidly growing demand for longer-duration energy storage, the market must look beyond lithium-ion batteries and include alternative technologies. Safe and sustainable flow batteries, such as Redflow's zinc-bromine systems, are proven and ready today.

about Redflow

Redflow is a global leader in clean energy storage with hundreds of systems operating worldwide. We're paving the way to a sustainable future by delivering one of the world's safest and cleanest energy storage solutions.

For over a decade, our commercially proven zinc-bromine flow battery technology has been helping customers meet their energy storage needs.

With decades of design and operational experience and offices in Australia, the U.S. and a manufacturing facility in Thailand our company is equipped to develop and deliver proven long-duration storage solutions just about anywhere in the world.

our mission

Redflow is leading the renewable energy transition by delivering the world's safest and cleanest energy storage solution.

over 3 GWh of energy delivered

270+ active global deployments in nine countries

2008 First systems installed in 2008

100+ employees worldwide

24m cumulative hours of operation

key projects

Redflow has a proven track record of project success from California to South Australia.

34.4 MWh system for the Valley Children's Hospital in California, USA

4 MWh energy storage solution for Energy Queensland – Queensland, Australia

20 MWh system for the Paskenta Band of Nomalaki Indians - California, USA

1.2 MWh system for the US Department of Defense - New York, USA

6.6 MWh system for the Barona Band of Mission Indians - California, USA

To see case studies, visit: https://redflow.com/case-studies

zinc-bromine flow batteries

Redflow's zinc-bromine (ZBM) flow battery technology is based on a small form factor module that is energy dense, modular, and scalable to meet the needs of a wide range of projects. The batteries are environmentally friendly, fully recyclable, safe to operate, and manufactured from widely available, low-toxicity materials.

Systems are scalable from tens of kilowatt hours to hundreds of megawatt hours and provide system redundancy for reduced risk and ease of maintenance.

Designed for daily, full-depth discharge cycling in medium to long-duration applications, Redflow's zinc-bromine battery is the clear choice for safe and reliable energy storage.

With no risk of thermal runaway and a unique hibernation mode, Redflow's ZBM flow battery can be used in a wide range of applications, from commercial and industrial to utility-scale deployments.

fire safe

recyclable

hibernation mode

100% depth of discharge

Redflow ZBM flow battery size is measured based on usable, deliverable capacity. Our batteries experience minimal capacity degradation (less than 5%) over a 10-year period.

With the highest energy density of any flow battery, the sustained capacity retention eliminates the need for oversizing, ensuring that nameplate capacity is delivered at the end of life without system augmentation.

Redflow battery deployments can operate across a wide range of ambient temperatures with no active heating/cooling needed when operated with electrolyte temperatures between 10° – 45° C / 50° – 113° F. Hot and cold weather packages available for broad range of environmental conditions. Remote monitoring and diagnostics, plus self-protection features, ensure that the battery operates safely at all times.

network services

resilience

performance

energy shifting

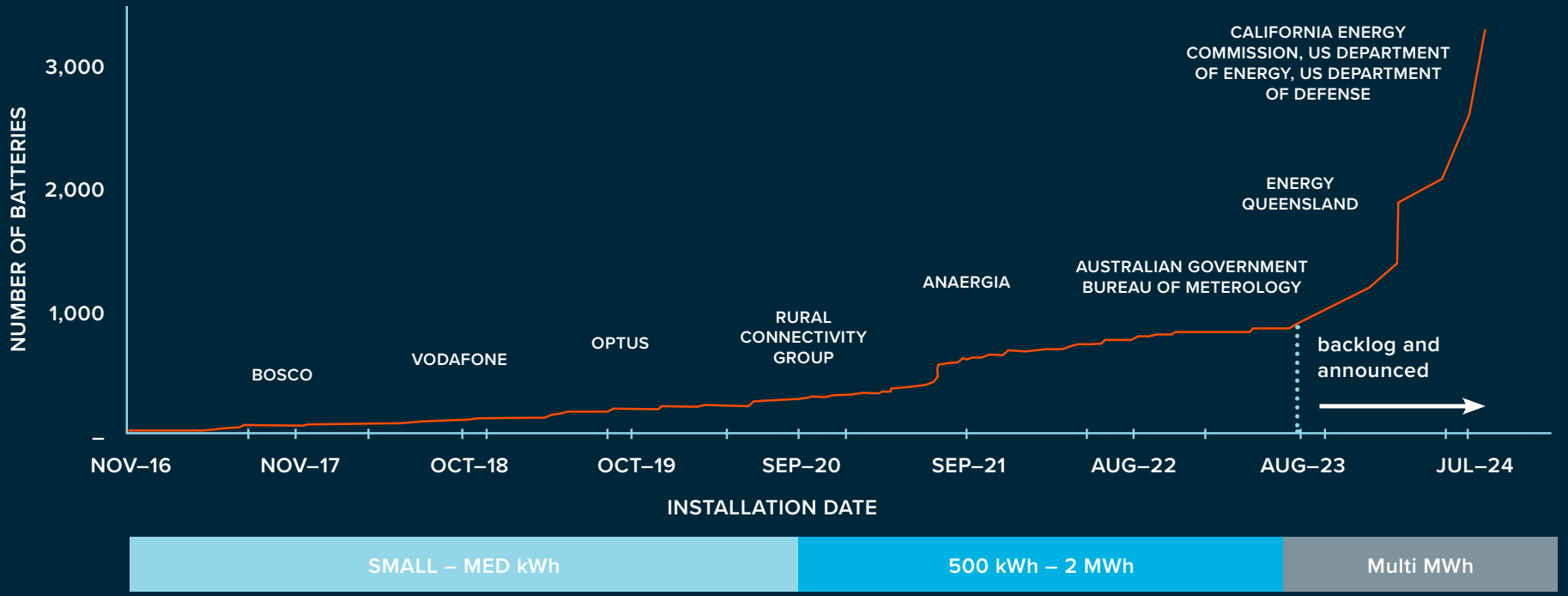
arbitrage

competitive cost

Initial CAPEX is certainly a consideration when evaluating a project, but a thorough levelized cost of storage (LCOS) analysis should include all aspects of CAPEX, OPEX, battery performance, degradation, utilization, and more. Over the lifetime of a system deployment, Redflow's ZBM batteries prove to be an economical choice for C&I and large-scale projects.

Redflow solutions are competitively priced and on track for cost reduction in coming years, as production volume increases and product solutions evolve.

REDFLOW BATTERY INSTALLATIONS 2016–2024



battery comparison

With minimal capacity, no efficiency degradation, higher energy density, 100% depth of discharge, and a more cost-effective round trip efficiency, Redflow's ZBM flow battery is leading the industry in energy storage solutions.

	SCENARIO	LITHIUM-ION BATTERY	REDFLOW ZINC-BROMINE BATTERY
Improved battery performance	Fully battery discharge to zero volts	Damages battery	Benefits battery
	Deep daily discharge	Shortens battery life	No impact on battery life
Manage high cost of power	Energy output from a full charge/ discharge cycle	Declines with cycle count	Sustained
	Extended time in standby	Loses stored energy over time	Retains all stored energy while in standby mode
Safety & Durability	Operating temperature	May need active cooling outside of a narrow operating temperature range	No active heating/cooling needed when operated with electrolyte temperatures between 10° - 45° C (50° - 110° F)
	Risk of thermal runaway	Potential	Minimal. Electrolyte is non-flammable and bromine acts as a fire retardant.
Enable shift to green energy	Environmental impact	Challenging to recycle	Easy to recycle

intuitive battery management

battery management system

Redflow's cloud-based battery management system (BMS) optimises control and operation of our ZBM batteries.

Seamless full remote monitoring and control with real-time visibility into battery performance enables long-term data analytics and system optimisation.

Accessible via any smart device, the Redflow BMS can also interface with a range of energy management systems or power plant controllers via industry-standard communications protocols.

hibernation

Redflow's ZBM flow batteries have a unique hibernation feature where a battery can be left at 100% charged state for weeks or months with no performance impact or losses from self-discharge.

The battery can resume operation within 30 seconds when energy is needed. This feature enables system flexibility, dynamic operation, greater resiliency, and energy shifting.

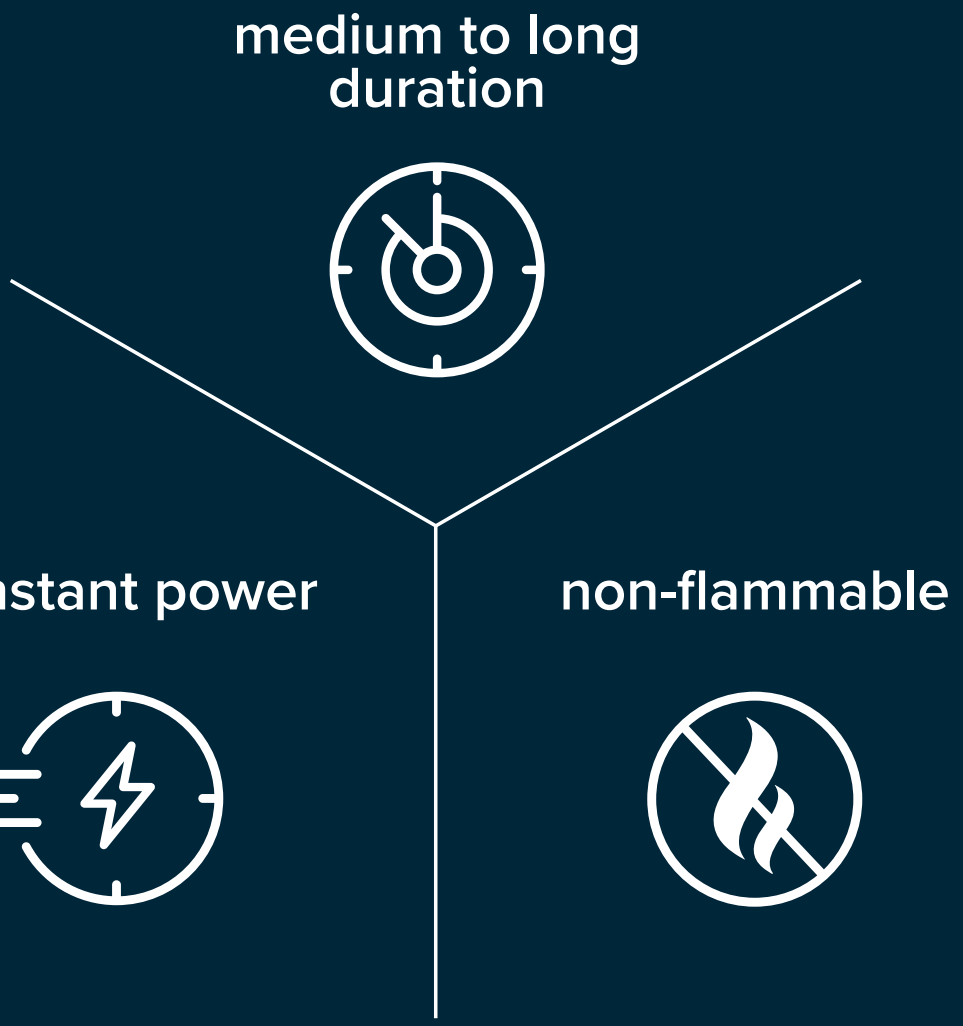
safety

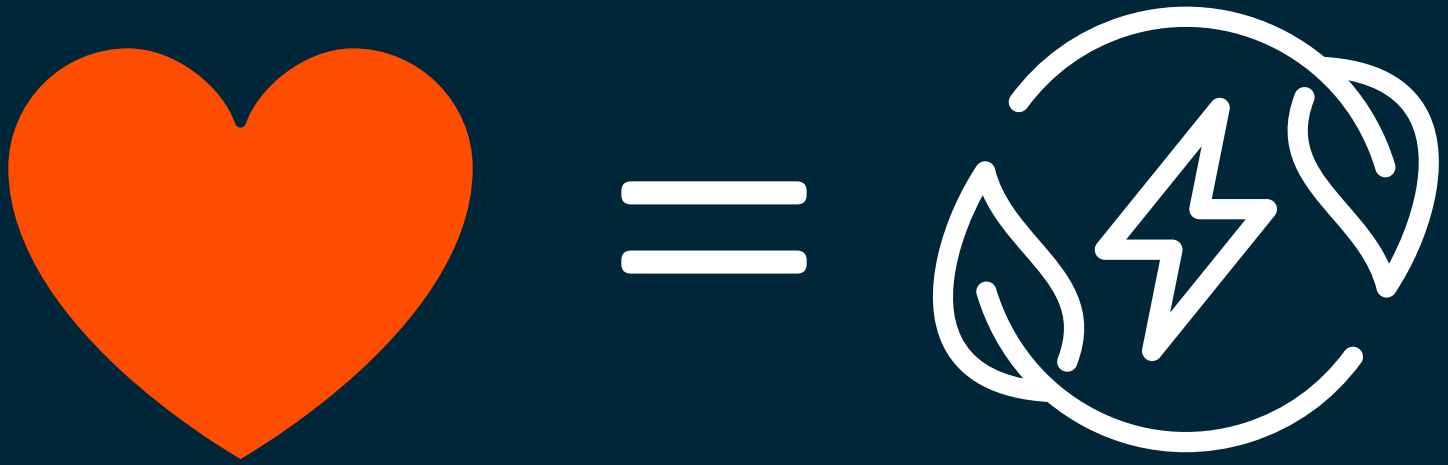
Flow batteries offer safety that's built-in, thanks to their aqueous electrolyte design.

Redflow's ZBM battery contains a bromine-based electrolyte that is non-flammable, eliminating any risk of thermal runaway, unlike lithium-ion chemistries. The battery is constructed out of non-flammable materials and verified to UL9540A – removing the need for fire suppression systems.

UL 1973 | UL 9540A | CE

[pending]



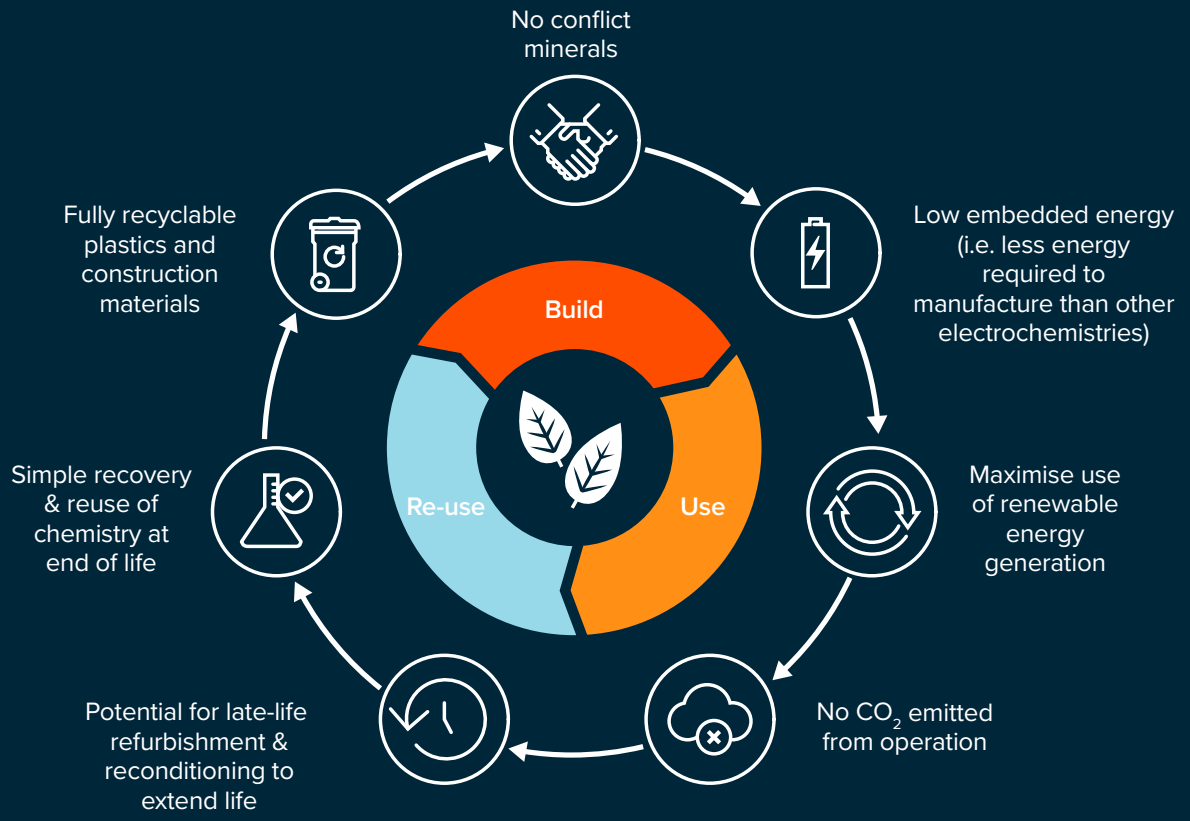


environment, social and governance

A sustainable, carbon-free future is at the heart of all that we do. We understand that as the world transitions to zero emissions our energy storage solution will play a vital role and we take our responsibilities seriously.

We are proud that we can make a difference on a global scale by delivering a unique energy storage solution.

environmentally responsible



We are proud to produce one of the most environmentally friendly energy storage solutions; our batteries are fully recyclable and manufactured from widely available, low-toxicity materials.

We are dedicated to a sustainable, carbon-free future, and we are proud that our flow battery technology will help to build the energy storage systems of today, as well as tomorrow.

- Battery is made from HDPE plastic which is commonly recycled into plastic bottles.
- Electronics – follows standard pathway for electronics recycling.
- Electrolyte – R&D program to recondition electrolyte for reuse.
- Minerals sourced from non-conflict areas.
- No CO^2 emitted from battery operation.

environmental and social standards

We are a tightknit team of passionate people from diverse cultural backgrounds who are all committed to delivering a solution that we believe will change the world. We embrace cultural and gender diversity and promote these values within the business.

We are committed to ensuring that our business is undertaken in accordance with international standards.

Our approach to sustainability aligns with the United Nations Sustainable Development Goals, which are recognised as the global blueprint for a sustainable future.

Our business approach contributes to five goals that we feel are most relevant to operating our business responsibly and where we can have the biggest impact:

warranty and services

Redflow offers a full operation and maintenance solution to maximise returns over the project life through tailored solutions designed to meet your needs.

We also offer an optional extended warranty backed up by a long-term service agreement (LTSA), covering all planned and unplanned maintenance for up to ten years.

We can also extend the LTSA to support customers with long-term power purchase agreements or energy storage requirements.

Warranty options include capacity and availability guarantees, and performance reinsurance backed by creditworthy financial institutions.

certification

Redflow's ZBM flow battery is designed and developed in Australia and is CE certified.

Redflow's battery is inherently fire safe per UL 9540A and meets relevant US and international codes and standards.

DNV, an independent testing facility, has validated Redflow's ZBM battery's performance and capabilities.

UL 9540A

about Redflow

Redflow designs and manufactures long-duration zinc-bromine flow batteries for stationary commercial, industrial, and utility applications. Our energy storage solutions have been in use for more than a decade at over 270 sites.

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redflow

Redflow is proud to be one of the world's longest commercially successful flow battery storage companies, delivering long-duration storage solutions to meet the world's energy storage needs.

www.redflow.com