

Redflow

Investor Presentation
December 2018



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Company Overview

Established in 2005.
Listed in 2010 (ASX: RFX)



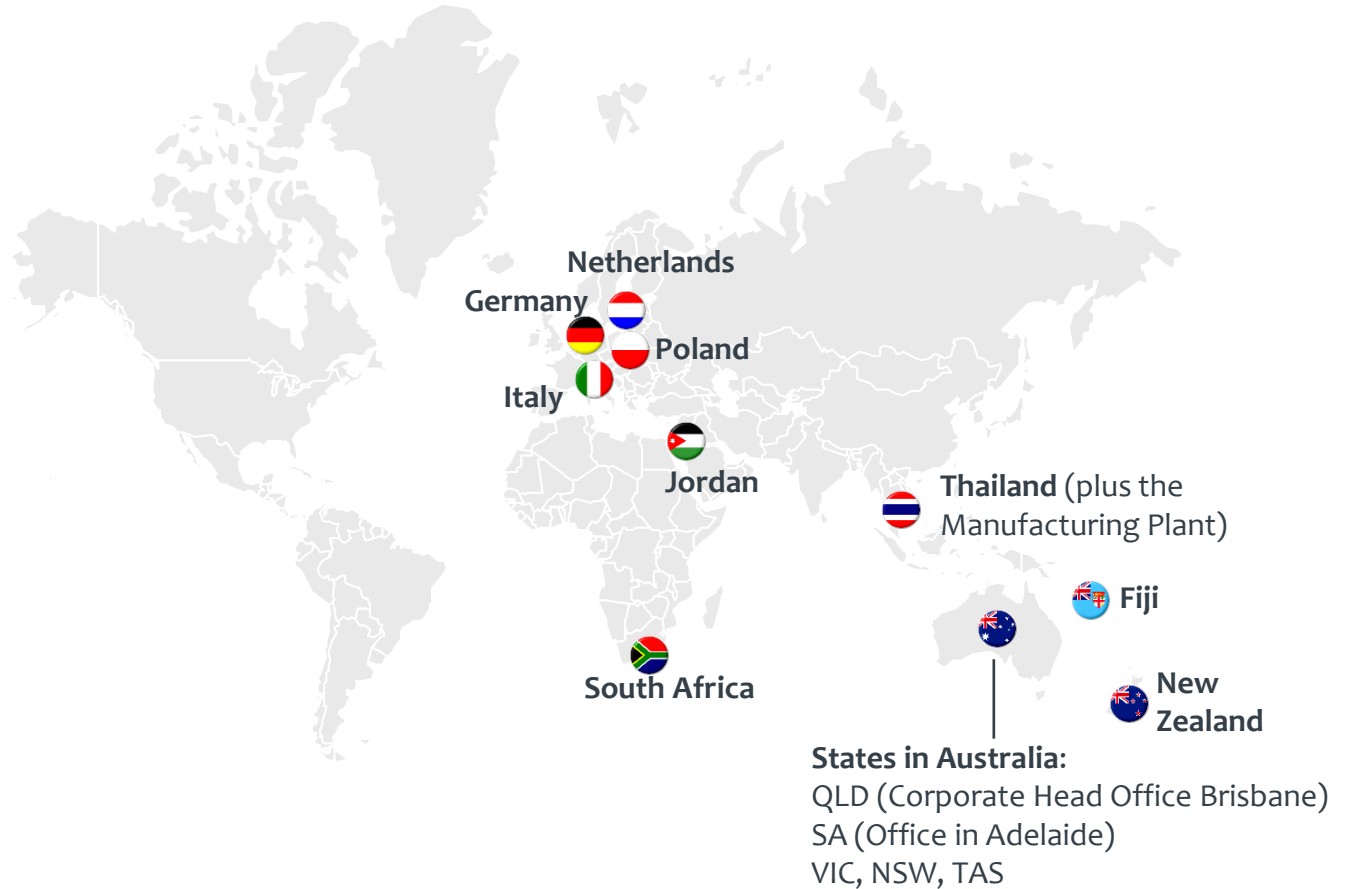
Redflow designs and manufactures the world's smallest zinc-bromine flow batteries



Redflow's head office, R&D and IP in Australia.
Redflow-owned factory in Thailand



Batteries currently deployed across nine countries



Redflow is positioned to redefine energy storage in our target markets



Our Growth Drivers

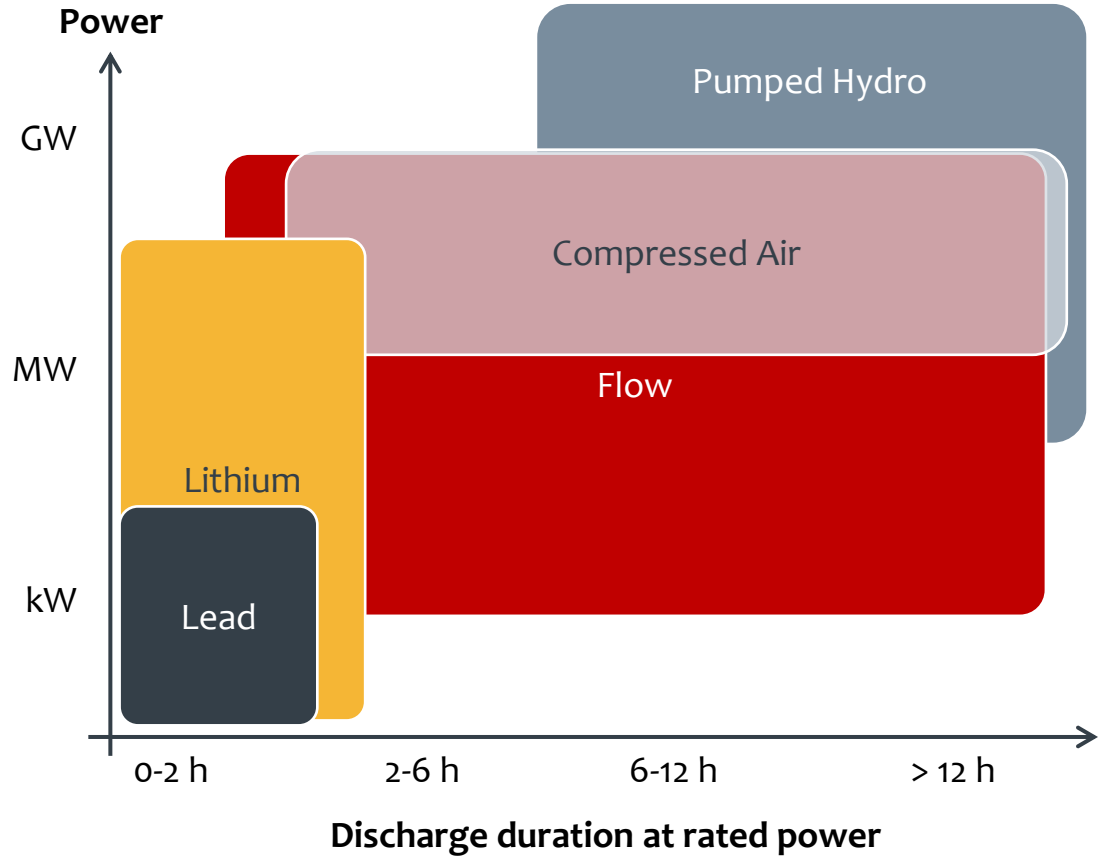
- Both developed and developing economies are transitioning to lower carbon, lower cost renewable energy systems
- Energy storage sits at the core delivering reliable, affordable, zero-carbon energy
- Flow batteries deliver unique benefits in the stationary energy storage ecosystem

Market for redox flow batteries forecast to be worth

US\$4.5 billion
by 2028

Source: IDTechEx Aug 2018









Stationary storage market by type



Redflow Zinc-Bromine Flow Battery Benefits – Redefining the Battery







Redflow solution:

-  World's smallest zinc-bromine flow battery that **retains its full 10kWh energy storage capacity, even with daily use**
-  Optimised for applications needing constant energy delivery rates & **100% daily depth of discharge with no damage to battery**
-  **Tolerance for high ambient temperatures** as hot at 50 degrees C (122 degrees F) without external cooling
-  Modular design enables scalability from one battery to grid-scale
-  Redflow BMS (Battery Management System) enables Internet-based remote performance, monitoring, and diagnostics
-  Constructed from components and non-toxic materials that are **easily recycled or re-used**
-  Built-in battery self-protection features. Standby Power System (SPS) mode stores energy until needed.
-  Battery performance warranted for 10 years or 36,500 kWh delivered energy which ever comes first. *

*subject to warranty conditions

Customer Drivers and Advantages of the Redflow Zinc-Bromine Flow Battery

	Scenario	Lithium-ion battery	Zinc-bromine flow battery
 <p>Improved battery performance</p>	Full battery discharge to zero volts	Damages battery	✔ Benefits battery
	Deep daily discharge	Shortens battery life	✔ No impact on battery life
 <p>Manage high cost of power</p>	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
 <p>Durability in harsh conditions</p>	High ambient temperature	May need active cooling to avoid life reduction	✔ Ambient/free air cooling sufficient unless sustained ambient temperature is greater than 50C (122F)
	Risk of thermal runaway	Potential	✔ Minimal as the electrolyte is inherently non-flammable
 <p>Enable shift to green energy</p>	Environmental impact	Challenging to recycle	✔ Easy to recycle

Our Target Market



Telco

- 2.7m cell towers in Asia-Pacific
- Power a major cost component
- Growth in infrastructure-sharing and tower companies
- 5G expected to drive power and sites development
- Theft is a common occurrence

Off-grid or backup power supply requirements for remotely located telco towers. Enables renewable penetration



Commercial and industrial

- Multiple industries where stable and affordable power is critical
- Key challenges include intermittent power, high peak demand tariffs and desire for renewable energy solutions

Reduce energy costs by replacing / supplementing grid power and avoiding demand tariffs through storing off peak energy



Residential

- Consumers want to shift their own solar energy, reduce energy costs and mitigate the impact of power grid blackout
- Significant increase in battery subsidy programs – QLD, SA, VIC

On-grid or off-grid solutions for greater energy independence, solar self-consumption and backup

Our sweet spot...

Moderate power demand

Predictable and constant need

Benefits from deep and regular discharge

Target Sector Highlights – Commercial Contracts



Telco

Australia

Optus – six ZBM2s for mobile phone tower in environmentally sensitive Daintree Rainforest

South Africa

Leading telco - 37 ZBM2s to power remote mobile phone towers for South African telco

Fiji

Fiji Govt - 160 ZBM2s to store power for digital TV network in remote island locations.



Commercial & Industrial

Australia

Knox City – 32 ZBM2s save \$280,000 in energy costs for children centres in Melbourne

Australia

Darling Building - Six ZBM2s meet peak power demands and avoid energy costs

South Africa

Bosco Printed Circuits - 14 ZBM2s beat power cuts for leading manufacturer



Residential

Queensland

Six ZCells let pastoral property near Roma avoid grid charges and go completely off-grid

Canberra

One ZCell works with lithium battery to model hybrid grid in home energy storage system

Adelaide

Two ZCell storage system cuts suburban home electricity costs by 80%



Company owned Manufacturing Plant in Thailand

- Relocation completed in April 2018
- Provides a robust and stable manufacturing base to support growth
- Ownership ensures supply chain control, end-to-end quality assurance, scalability and flexibility to meet demand
- Mass production model will require different approach – volume and cost benefits

Phase 1

- First Thai stacks produced in January 2018 / 81 units produced in Oct 2018
- Ramped up to 70 FTE with minimal turnover
- A fully documented quality assurance and battery testing facility
- Strong quality metrics
- A full end-to-end supply chain management system

Units /
month

~80

Phase 2

- Target 150 Dec 2018
- Clear plan to scale to 250 based on sales growth
- Current focus on incremental improvements immediately available
- Execution of cost-down and efficiency program
- Deliver ISO 9001 accreditation program

~250

Phase 3

- Demand-driven scale plan
- Analysis indicates factory capable of up to 450 units/month
- Volume, yield and cost benefits identified
- Requires additional shifts and moderate capital
- Target selected automation in key processes

~450



Where Redflow Sits Today



Proven Technology

- World-leading zinc-bromine flow battery in commercial deployment
 - Technology protected by a combination of patents and trade-secret technology
 - Remote management, monitoring and optimisation of battery operation through BMS
 - Small modular size compared to other flow batteries opens unique access to more markets
-



Valued Features

- Superior performance from battery capacity, temperature range and discharge features
 - New Standby Power System (SPS) innovation recently launched
 - Modular design allows scalability from single battery to grid-scale deployments
 - Non-toxic chemistry, non-flammable, low risk of theft and ease of recycling
-



Scalable Manufacturing

- Thailand factory now established and producing high-quality batteries
 - Scalable model for immediate demand (250 batteries/month)
 - Focus on incremental yield and efficiency improvements
 - 30% cost-down program underway
-



Customer & Markets

- Energy storage demand growing rapidly
- Recent commercial deployments across all target market sectors
- Re-energised and extended partner ecosystem
- Growing pipeline of sales opportunities with customers and partners
- Currently engaged with multiple parties around China market

Key Priorities in 2019

Sales and Business Development

- Develop and secure regular volume orders for the telco sector
- Target 1-2 further lighthouse projects for commercial and industrial sectors
- Progress discussions for participation in Government subsidy programs for ZCell residential product
- Increase qualified partners in Australia and Asia Pacific
- Implement China strategy and potential partnership opportunities

Manufacturing

- Regularly producing 250+ batteries per month from current facility, matched to sales demand
- Execute on incremental improvement plans to increase yield
- Execute on ISO 9001 certification program for Thai factory
- Finalise demand-driven scale plan for up to 450+ per month production
- Develop plan and options to achieve volume production

Financial Management

- Prudent management of cash and working capital
- Progress various financing options

Engineering

- Execute on cost-reduction program to end 2019
- Finalise development of single-stack Gen 3 battery

Supply Chain

- Diversify and expand quality supplier base
- Reduce delivery times on long lead time materials



Key Takeaways



Leading flow battery producer in rapidly growing global energy storage market



Technology leadership protected by a combination of patents and trade-secrets



Unique set of features highly valued by target market



Clear focus on target market, industries and applications



Established and scalable high quality manufacturing platform



Growing list of customers in target markets

Appendix

Board of Directors



Brett Johnson

Non-Executive Chairman

More than 10 years' director experience of listed companies including Scott Corp Ltd and Helloworld Ltd. More than 25 years experience as General Counsel of listed Australian companies, including Qantas Airways.



Jenny Macdonald

Non-Executive Director & Audit Committee Chair

Extensive experience working with ASX listed and global companies at CFO and general management level. Jenny currently serves as a Non-Executive Director on the Boards of API Ltd., Redbubble Ltd. and Bapcor Ltd.



David Knox

Non-Executive Director

Current CEO & MD of Australian Naval Infrastructure. Previous CEO and MD of Santos Ltd. from 2008-2015. David was also previously MD for BP Developments in Australasia from 2003 to 2007 and worked for BP in the U.K. and Pakistan.



John Lindsay

Non-Executive Director

Previously held senior technology leadership roles including CTO at iiNet Ltd, CTO at Internode and GM of Chariot Internet. Since Feb 2017, John has been a board member of the Australian Telecommunication Industry Ombudsman.



David Brant

Non-Executive Director

An experienced businessman with strategic manufacturing expertise, is a Fellow of the Australian Institute of Company Directors with more than two decades of manufacturing and corporate experience in Australia and countries in Asia.

Management Team and Technical Experts



Tim Harris
Chief Executive
Officer & Managing
Director



Richard Aird
Chief Operating
Officer



Trudy Walsh
Chief Financial
Officer



Dr. Mike Giulianini
Chief Technology
Officer



Ben Shepherd
Chief Commercial
Officer



Simon Hackett
System Integration
Architect



Dr. Alex Winter
Consulting Engineer

ZBM2 Technical Specifications

ZBM2 Technical Specifications	
Voltage	48 Volt DC nominal batteries (typical operating range 40-60V)
Capacity	Maximum 10kWh energy output per daily cycle No reserved battery capacity requirement – full 10kWh cycle depth available
Dimensions	845 L x 823 H x 400 W (mm) 33 L x 32 H x 16 W (in)
Weight	240 kg (530 lb) with electrolyte 90 kg (198 lb) without electrolyte
Electrolyte volume	100 L (26Gal)
Energy efficiency	80% DC-DC Max
Internal (electrolyte) operating temperature	Operating electrolyte temperature range of 15°C to 50°C (59°F to 122°F), ZBM2 can typically operate at ambient temperatures outside this range for extended periods
Communication	MODBUS RS485
Safety data sheet	DG Class 8 for electrolyte
Power rating	3kW (5kW peak) 3kW continuous: current up to 75A (40V disconnection point) *1 5kW duration depending on the State of Charge (SOC): current up to 125A (40V disconnection point) *1, 2
Regulatory compliance marks	CE and RCM
Warranty	Battery performance warranted for 10 years or 36,500 kWh delivered energy (whichever comes first) *3 No cycle depth limitations – battery performance and lifetime is not sensitive to cycle depth



- * 1 Values reported for ZBM2 at 100% state of health (SOH) and room temperature
- * 2 Redflow internal testing shows a 5kW supply for approximately 45 minutes before disconnection, for a ZBM2 starting at 100% state of charge (SOC)
- * 3 See full warranty document for details, Terms and Conditions apply

Source: <https://redflow.com/products/redlow-zbm2/>