



CREATING A  
BRIGHTER  
FUTURE.

# Redflow Investor Presentation

December 2015



Redflow is a global market leader in flow battery technology, providing high energy density energy storage solutions with a small footprint.

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TELECOMMUNICATION  
APPLICATIONS



RENEWABLES  
INTEGRATION



ON AND OFF GRID  
REMOTE POWER



MICRO GRID AND  
SMART GRID



TRANSMISSION AND  
DISTRIBUTION DEFERRAL



# ABOUT REDFLOW

**REDFLOW** IS A MARKET LEADER, THE FIRST FLOW BATTERY COMPANY TO OUTSOURCE THE MANUFACTURING OF ITS PRODUCTS.

Redflow ensures continuous product innovation in its R&D centre, located in Brisbane, Australia. The R&D centre is part of its global presence with Redflow offices located in the USA, EU and manufacturing in North America.

Redflow has transitioned its manufacturing to global giant, Flextronics. This ensures scalable manufacturing with rigorous quality management and consistent production.

Redflow's ZBM is sold, integrated and maintained through **system integrators** globally.



# WHY CHOOSE ENERGY STORAGE WITH **REDFLOW**?



**ECONOMIC** BENEFITS



**ENERGY** BUILDING BLOCKS



**INHERENTLY** SAFE AND SMART DESIGN



**MULTI-HOUR** USAGE CAPACITY



**ENVIRONMENTALLY** FRIENDLY



**ROBUST** LONG LIFE BATTERY



**HIGH ENERGY DENSITY** BATTERY

To find out more visit [www.redflow.com/about-us/why-redflow/](http://www.redflow.com/about-us/why-redflow/)



# REDFLOW OVERVIEW

Leading Technology	<b>Leading energy storage company</b> <ul style="list-style-type: none"><li>• Worlds smallest, most advanced flow battery</li><li>• Cost effective, safe energy utilisation and storage solution</li></ul>
Growth Industry	<b>Rapidly growing global energy storage market</b> <ul style="list-style-type: none"><li>• Immediate commercial benefits for early adopters</li><li>• Telecommunications, off grid/remote, integration with solar</li><li>• Residential product 2016</li></ul>
Commercially viable	<b>Over 10 years and \$50m of research and development</b> <ul style="list-style-type: none"><li>• In field testing and demonstration</li><li>• Existing customers and small initial orders received</li><li>• Cost per kWh reduced by over 50% this year with further reductions in 2016</li></ul>
Ready for growth	<b>Sales prospects building with increasing interest</b> <ul style="list-style-type: none"><li>• Recently moved manufacturing to Tier 1 global manufacturer - Flextronics</li><li>• Capability for volume production</li><li>• Focus on marketing and sales</li></ul>

# MARKET SNAPSHOT

Share price chart Nov 2013 – Nov 2015



## Key Executives

Simon Hackett  
Executive Chairman

Stuart Smith  
MD, CEO,  
Company Sec

Dr Alex Winter  
Chief Engineer

Dr. Mike Giulianini  
Chief Technology  
Officer

- Founder of Internode, Director of NBN Co, former Director iiNet
- Extensive experience in early stage disruptive technologies and growing innovative technology businesses.
- Chartered Accountant with previous experience as Chief Executive Officer and director of Cellnet Group.
- Prior experience with AAPT Mobile (Cellular One), Pacific Star (Bell Atlantic and Telecom New Zealand) and Ernst & Young in London.
- Previously with Schlumberger and experience includes over 9 years experience in fluid dynamics and mechanical design.
- Significant experience in various consulting and managerial roles in Austria and Argentina.
- Over 13 years' experience as a systems engineer in development, management and executive positions with Solar Farmers, Integral Electric Technology and SELEX Communications Group in both Italy and Australia.

## Major Shareholders

Simon Hackett	13.37%
David Oakley	6.03%
Graeme Wood	5.64%
Total Top 20	53.52%

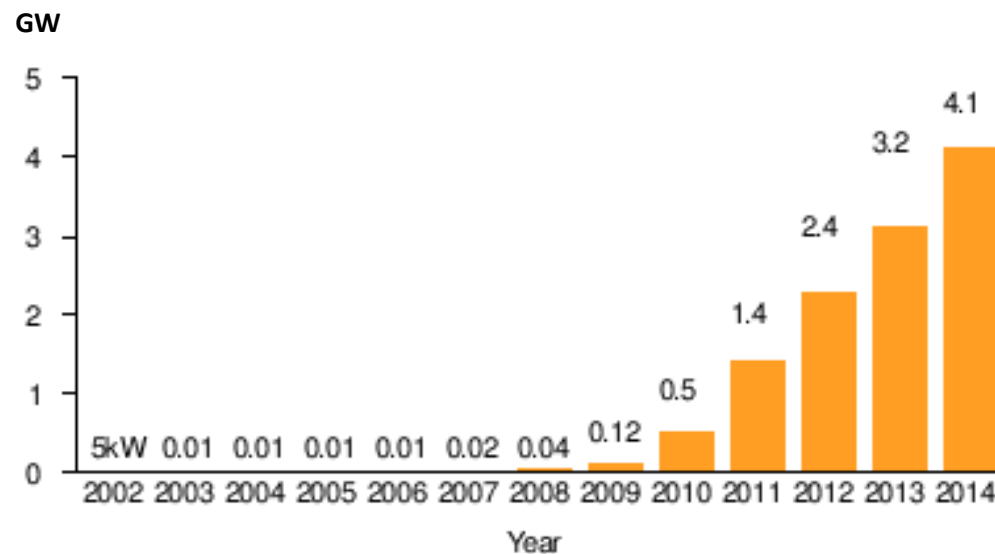
## Key Statistics

ASX code	RFX
30 Day VWAP Price	\$0.24
52 week high / low	\$0.34 / \$0.17
Shares on issue	337,168,020
Options	8,810,000
Market capitalisation	\$80 million

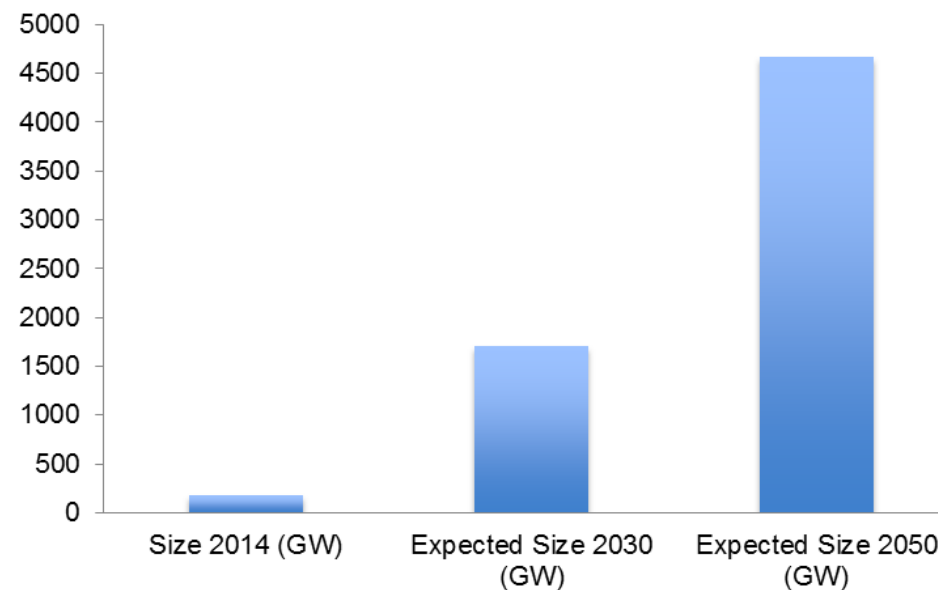
# THE SOLAR REVOLUTION

- Global Solar PV capacity estimated to be 177GW, 3.7x Australia's National Electricity Market
- Exponential growth since 2000, set to expand a further 10 times by 2030
- Growth to be fuelled by Integrated Solar Plus Battery Storage Systems (IPSS) that allows solar to be stored and used

Total capacity of Australian PV installations since 2002



IEA's Global Solar PV Capacity Forecasts






- Despite being a smaller market, Australia has the 6<sup>th</sup> highest per capita solar installed capacity and leads the world in residential scale solar
- Australia's Solar PV capacity is expected to grow to 37 GW by 2040 (over 10x from 2014) with residential to be the key area of growth
- Many, including Tesla are looking at the Australian market as the opportunity to prove residential commerciality

# THE BATTERY MARKET

## Overview

- Three main types of batteries, lead acid, lithium-ion and flow batteries.
- Lead acid and lithium-ion have had decades of product improvements, manufacturing optimisation and cost reductions. Flow batteries relatively new.
- Tesla lithium-ion Powerwall battery has ignited interest in home energy storage.
- Lithium-ion is focused on peak power, not energy. Needs active cooling to control temperature and presents some fire risk.
- Lead acid is unable to operate continuously in hot and humid conditions without degradation.
- Redflow's zinc bromine battery is cost-competitive and better suited to harsh conditions and longer term deep cycling.
- Repeated deep cycling other battery types can shorten battery life, degrade performance and damage battery.

## Battery Technology Comparison

	Zinc Bromine Flow	Lithium-ion	Lead Acid
			
Upfront cost USD/kWh	<b>\$800 - \$875</b>	\$350-1,000	\$1,000-2,000
Lifetime Cost USD/kWh (LCOE)	<b>\$0.20-0.30</b>	\$0.15-0.75	\$0.25-0.50
Storage Duration	<b>Medium 3-10h</b>	Short 1-4h	Medium-High 4-100h
Cycles	<b>1,000-10,000*</b>	500-5,000	1,000-5,000
Depth of discharge	<b>100%</b>	75%	50%
Self discharge 1 year	<b>&lt;1%</b>	20-30%	10-20%
Temperature tolerance	<b>10-50°C</b>	5-35°C	5-50°C
Safety	<b>Low risk</b>	Fire risk	Low risk

(\*) ZBM2 expected stack life of 10 years / 40,000 kWh regardless of cycle depth. For example 4000 cycles X 10kWh - or any other combination to the same total.



# REDFLOW ZBM

## ADVANTAGES

## The world's smallest flow battery



### Robust and long-life design

- High temperature tolerance up to 50°C and no active cooling required.
- Inherent 100% depth-of-discharge characteristics prevent battery damage from power outages, unlike traditional battery technologies.
- Can be fully discharged with no maintenance required.
- No trickle charge required when deployed or stored.



### Scalable manufacturing through Flextronics

- Readied for volume manufacture
- Capable of high scale production to world market



### Multi application for a single battery

- Modular and scalable for residential, commercial and grid scale use



### Inherently safe and smart design

- Zinc-bromide electrolyte is a water-based natural fire retardant.
- The intelligent battery self-manages, self-protects and informs via remote monitoring.
- Physical separation of the cell stack and energy storage tank means there is no risk of thermal runaway (fire or explosion).



### Cost efficiency

- LCOE improvements delivered with substantial room to decrease costs



### On-board battery control system

- Self-protecting, self-managing, supports monitoring with real-time data capture and error reporting through MODBUS communications.



### Recyclable

- Made from recyclable materials.



# KEY MILESTONES ACHIEVED

## Technology

- Decreased manufacturing costs by 15% with further cost-downs to be implemented in 2016
- Improved product performance, extending life cycle / longevity through new electrode formulation
- Reduced lifetime cost per kWh delivered by over 50%
- Ready large scale battery (LSB) demonstration for Australian energy distributor (system tested and awaiting shipment)

## Operations

- Now outsourcing 100% of manufacturing to Flextronics with ramp up production to begin in 2016

- Welcomed new Executive-Chairman Simon Hackett to focus on product enhancement
- Focused on productisation, improved user interface and connectivity

## Sales

- Improved stakeholder engagement and education with Government and large commercial organisations
- Implementing global partnering strategy
- Established sales presence in the United States, Europe and South Africa.
- Additional sales staff in Australia.

GLOBAL MANUFACTURING PARTNER

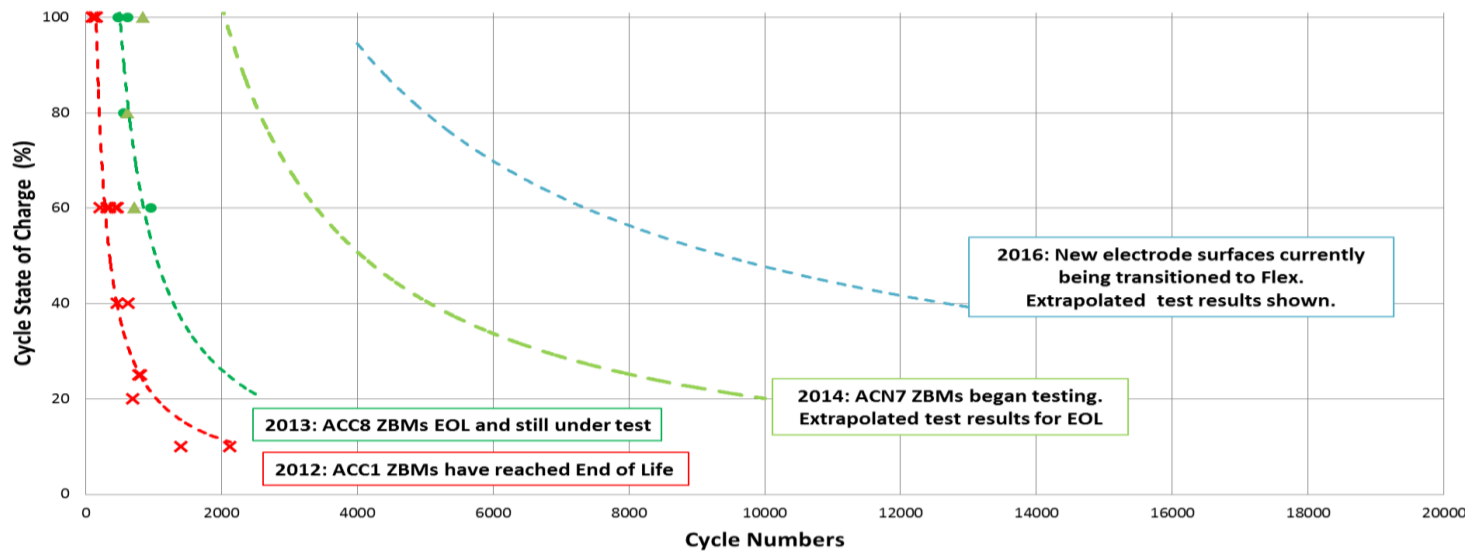
**Flextronics**

**FLEXTRONICS**

LEARN MORE

# CONTINUED IMPROVEMENTS

Redflow Long Term Test Results



## Research and Development

- 100% daily charge and discharge cycles with no degradation
- Battery now expected to exceed 4,000 cycles at the above rate
- Ongoing continued improvements in R&D

## FLEXTRONICS®

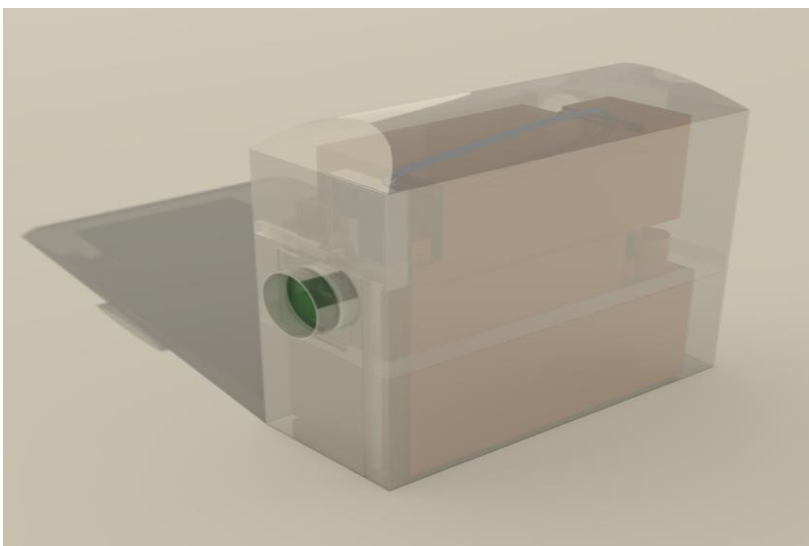
### Global Manufacturing Partner

- Outsourced to tier 1 global manufacturer Flextronics
- Executed over past two years and electrode transfer in progress
- Full scale operation resumes in March 2016
- Incentives in place to decrease costs



# CONTINUED IMPROVEMENTS

## Improved Aesthetics for Residential Market



*Preliminary enclosure design image*

- External enclosure
- Self supporting, outdoor rated
- Plug-and-play installation
- Appealing to consumer market

## Improve Functionality and Usability



- Battery Management System (BMS)
- Victron Energy is launch integration partner
- Easy WiFi/Smartphone configuration
- Easy integration with products from other energy system vendors



# OUR PRODUCTS



## ZBM Zinc Bromide Module

Store and shift renewable energy, manage peak grid load, support off-grid power systems and telecommunications, with the Redflow ZBM.

All products are  
**0.34m<sup>2</sup> or 3.7ft<sup>2</sup>** -  
making them **the**  
**world's smallest flow**  
**battery**



### ZBM

IDEAL FOR SUPPORTING  
TELECOMMUNICATIONS

High energy density at 8kWh  
Warranted total energy throughput 10MWh  
Ideal for telecommunications  
applications at 48Vdc  
Power Rating 3kW (5kW peak)

RRP US\$7,000



### ZBM 2

IDEAL FOR SUPPORTING TELECOMMUNICATIONS  
AND COMMERCIAL PROJECTS

High energy density at 10kWh  
Warranted total energy throughput 20MWh  
Ideal for telecommunications  
applications at 48Vdc  
Power Rating 3kW (5kW peak)

RRP US\$8,000



### ZBM 3

IDEAL FOR SUPPORTING  
COMMERCIAL PROJECTS

High energy density at 11kWh  
Warranted total energy throughput 22MWh  
Suitable for parallel or series  
configurations  
Power Rating 5kW (7.5kW)

RRP US\$8,800



# KEY APPLICATIONS



## TELECOMMUNICATION APPLICATIONS

Mobile phone towers in remote and rural areas without robust electricity grids (consistent outages)

- Fuel savings / CO2 reduction
- Long lasting and robust
- Day in day out cycling – no degradation from constant outage
- Mitigates cooling and maintenance costs



## RENEWABLES INTEGRATION

Cost effective energy storage for on or off grid applications, including residential and commercial

- Access to energy without grid connection
- Combats high energy prices and zero to low feed in tariffs
- Enables self-consumption



## ON AND OFF GRID REMOTE POWER

Reducing the need and costs of diesel generators in remote areas to improve reliability

- Fuel savings / CO2 reducing
- Long lasting and robust
- Day in day out cycling – no degradation from constant outage
- Mitigates cooling and maintenance costs



## MICRO GRID AND SMART GRID

Better control of energy storage and distribution during peak consumption times

- Energy security
- DC only micro-grids in developing countries



## TRANSMISSION AND DISTRIBUTION DEFERRAL

Reduces the impact of peak demand, delaying the need for expensive equipment upgrades

- Reduced cost for utilities
- Enables community self-consumption

# CHANNEL SALES PARTNERS

- Disrupting the status quo requires new technology to be significantly better than the existing solution
- Since 2013, Redflow has engaged with a number of large global companies who have significant reach and channels to market
- Orders for our ZBM products have recently been received from Europe and Australia, with further progressive orders expected
- Manufacturing will be ready in March 2016 to resume fully outsourced production



## SYSTEM INTEGRATORS

Product Trials Underway



# KEY INTEGRATION PARTNERS

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- Distributor for Redflow in the New Zealand utility and remote area power systems market since 2010
- Winner of the Deloitte Electricity Innovation Award in 2011, for its BASEPOWER stand-alone power units
- Core product is RedFlow's integrated battery energy storage units



- Global leader in maximising reliability, deployment speed and operational efficiency for telecommunications networks
- Formed partnership with Redflow in 2013 to undertake trials to apply Redflow's technology into new markets in the telecommunications sector



- Specialise in providing complete off-grid electrification (with or without backup) to rural and undeveloped communities in South Africa and other African countries.
- Their off-grid solar electrification projects provide an effective and renewable energy source that meets the highest safety and design specifications.



- Announced supply agreement in 2014 with SMS Global Technologies Inc, based in the Philippines
- SMS are an IT and telecoms systems integrator and solutions provider



- Announced non-exclusive supply agreement in 2014 with BlueSky Energy GmbH based in Austria

# KEY INTEGRATION PARTNERS

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- Specialised power supplier to heavy duty mining and construction industry through a national dealer network
- Announced In 2014 Redflow non-executive system integrator partner in South Africa
- Probe also distributes maintenance-free batteries for industrial applications including backup power supplies for the electronic industry, UPS, radio and telecommunication industries



- In 2015 Redflow announced Green Stealth as a system integrator
- Green Stealth aim to not only assume the role of a systems integrator, but also be active as a marketer of integrated systems
- Green Stealth integrate the highest quality renewable components into fully sustainable and centrally controlled systems using only truly plug-and-play modules



- In 2015, Redflow announced Jaladri Prima Intertrade (JPI) as system integrator and sales distributor for green and innovative technology in Indonesia
- JPI have expertise in energy management, electricity and telecommunication sectors, as well a strong government relationships

# KEY MARKET TELECOMMUNICATIONS

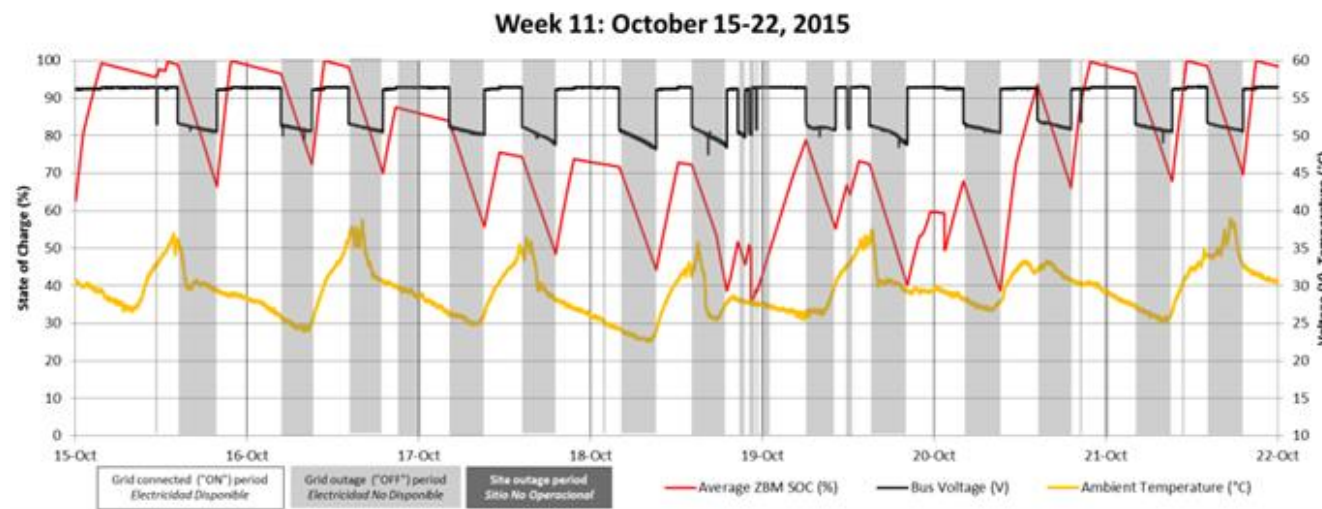
## Current Market State

- 5 million cell towers estimated globally
- Approximately 1.18m new towers, 390,000 off-grid and 790,000 in bad-grid locations to be deployed by 2020.
- Majority powered by diesel generators.
- India – telecom tower sites consumed an estimated 3.2 billion litres of diesel in 2011.
- Africa – more than 50% of towers are off-grid and the remainder rely on unreliable grid power.



## Redflow's ZBM Offers

- Reduce diesel consumption.
- No need for air conditioning (as with lead acid and lithium).
- No need for constant site maintenance.
- Lower operating expenses.
- Energy can discharge over a longer period of time.
- Reduced chance of theft due to unique design.



100% uptime at site with Redflow ZBM data from site in Latin America

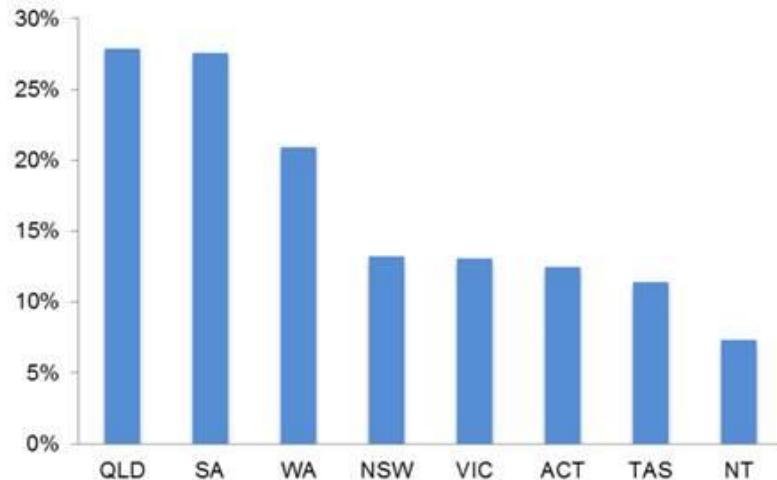


# KEY MARKET RESIDENTIAL

## Current Market State

- Australia's installed PV network has attracted global interest
- Tesla and others are looking at Australia to prove commerciality
- Retrofit to existing installed solar (PV) or install with new PV
- Our fully installed system will be competitively priced to similarly sized lead acid and lithium based systems
- Higher real operational capacity (no reserved energy capacity required in battery), longer expected lifetime, and robust capability for daily 100% energy cycling

% of Australian dwellings with a solar PV system



Source: APVI

[www.redflow.com](http://www.redflow.com)

## Our Strategy

- Residential houses under trial in Africa and Netherlands (trial data illustrated)
- Building a deployment channel strategy for Australia
- Europe next likely market
- Demonstrating suitability for residential application

## Residential test data



# KEY MARKET

## COMMERICAL/GRID SCALE

### About the LSB (Large Scale Battery)

- The LSB is high density array of up to 60 Redflow ZBM's in a 20 foot shipping container.
- One LSB can store up to 660kWh (0.66 MWh) of energy. Multiple LSB's can be clustered for grid scale applications.
- Key advantages over other technologies include high availability in a high density form factor, intrinsic safety (no risk of thermal runaway) and requiring only ambient-air cooling.
- Individual ZBM's can be taken offline or replaced if required with no impact to the rest of the energy system, without replacing an entire battery 'string' (as with lead acid and lithium).

### Sales and Demonstrations

- Demonstration LSB with one of Australia's largest energy distributors to be deployed in December 2015/January 2016.
- Simon Hackett has also purchased a LSB to support his office, 'Base64', delivery expected February 2016.



# REDFLOW

## ORGANISATIONAL OUTLOOK

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### **The hardest part has been done, we are readying for scale with focussed, key deliverables for 2016**

- Technology proven with over 10 years of R&D
- Transfer of 100% of production to Flextronics with commercial scale ready to resume in March 2016
- Managing production to the sales rate as closely as possible
- Demonstration systems about to be deployed in significant markets
- Increasing commercial sales by converting trials in Asia Pacific, Africa, Europe, USA, Central and South America
- Large global companies are engaged with significant reach and channels to market
- Sales team in place in USA, Asia Pacific and Europe with prospects building
- Current/recent trials to be converted to sales in Asia Pacific, Africa, Europe, USA, Central and South America, and the Philippines
- Sales cycle to be reduced through productisation improvements and completion of the plug and play, easy to install and use application
- Release of a packaged residential solution
- Further reductions in cost and improvements in price/performance to continue in 2016

# OFFICE LOCATIONS

Find out more visit  
[www.redflow.com/locations](http://www.redflow.com/locations)



## REDFLOW OFFICES

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USA

**Europe Office**  
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# THANK YOU

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