Dear

Redflow is delighted to respond to the **Singapore-Australia Green Economy Agreement initiative** request for support information.

Redflow is a homegrown Queensland company. We see this opportunity with the potential for an exciting long-term partnership to the greater benefit of Singapore and Australia both in terms increased trade with Singapore and supporting Singapores transition to a green economy.

We have been headquartered in Queensland since we were founded in 2005 and we currently employ more than 50 Queenslanders and growing. Our companys extensive experience and scale-up readiness is very well aligned to partnering with Singapores trade and industry and a partnership would have significant benefits for both nations.

Our unique flow-battery technology is also the ideal solutioncompared to competing technologiesfor both long (>4 hour) duration energy storage and for longevity in Singapores environmental conditions. The Redflow technology is perfectly suited to tropical and sub-tropical climate and when managed correctly its capacity does not degrade over time, even in hot conditions.
Attached you will find details of our two core products, the ZBM2 10Kwh battery and the larger scale 200Kwh Redflow Energy Pod.

We remain at your disposal to respond to any questions and to progress with you for the benefit of Australian renewable enterprise and collaboration with Singapore, one of our key trading partners.
There are four core pillars to our response.

1. **A Global Leader in Flow Batteries**

Redflow is a recognised global leader in flow battery solutions. Flow batteries are increasing being recognised as an important form of energy storage solution for stationary applications, especially (but not exclusively) for longer duration.
Redflow was established in 2005 in Brisbane, Queensland and our sole focus has been on designing and developing Zinc Bromine flow battery solutions. This sustained focus on Zinc Bromine technology, has given us unrivalled experience in real-world flow battery projects and deployments, and gives us strong market differentiation across a number of areas, including:

- Robust & proven manufacturing capability. Our wholly-owned production facility, located in Thailand, has achieved ISO 9001 accreditation and is capable of immediate scaling to over 60 MWh per annum. Further accelerated ramp up beyond this capacity is in active planning.

- Low supply chain risk. We control our own supply chain and our use of cheap, abundant minerals and HDPE plastics simultaneously provides a highly attractive cost down profile at scale. We have commissioned independent analysis of our Bill of Materials which confirmed that significant scale cost down opportunities are available to achieve cost parity with comparable Lithium systems at 100 MWh per annum production.

Flow batteries are potentially going to be a big contributor in the stationary energy storage, like the grid-level stationary energy storage
Dr Alan Finkel, Australia Chief Scientist,
AFR, 4 June 2019

- Better performance and lower cost than other flow batteries. Zinc Bromine flow battery technology has a higher energy density, higher efficiency and smaller physical footprint versus other flow battery chemistries such as vanadium.

- The potential to localise supply and manufacturing in markets of high demand at relatively moderate volumes and required investment.

A renewed focus on alternatives to Lithium-Ion energy storage solutions have increasingly been seen in Australia and other large energy storage markets like the United States. The recent Australian Government, Department of Industry, Science, Energy and Resources, Low Emissions technology Statement 2021 noted that:
Zinc bromide batteries offer a number of advantages over other storage technologies. They can be discharged completely, are long-lasting and they are fireproof. In addition, unlike some other battery materials, zinc and bromine are cheap and readily available throughout the world. Australian innovators are positioning Australia to play an important role in a battery-powered world.

2. **A Unique Solution Ideally Suited to next generation storage Requirements**

Redflow's core battery technology and solution has a number of strong differentiating features, notably:

- 100 percent depth of discharge without battery degradation
- Sustained energy output across the battery lifetime
- A core modular approach using a core 10 kWh design which enables implementation across multiple applications and sizes from small kWh system to multiple MWh, operational redundancy and rapid economies of scale
- Flexibility in discharge from a few hours to 12 hours with the ability to place the battery into hibernation at 100% charged for extended periods without self-discharge
- One of the cleanest and greenest energy storage solutions in the market with proven third-party Queensland recyclability and component refresh characteristics
- Excellent tolerance for high temperature conditions up to 50 degrees C without the need for active air or water cooling resulting in lower total capital costs, no parasitic load, lower maintenance and significantly lower operating noise
- High safety with no thermal runaway risk plus separation of power and energy components provides inherent transport and operational management advantages
- A Battery Management System (BMS) that provides real time analysis, reporting and system orchestration and can work across multiple inverter brands, models and site controllers

3. **Proven in the Field and at Scale**

Redflow has a deep level of operational experience across a wide range of applications and operational conditions. Redflow now has over 180 active deployments in Australia and other

international markets such as the US, Israel, South Africa, the UK, New Zealand and Asia. We believe this is the highest number of live and continually operating deployments for any flow battery globally.
Redflow���s current implementation of the zinc bromine flow battery technology has been operating in the field since 2017. In total, Redflow batteries have now delivered over 1.6 GWh of energy to our end customers.
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Selected examples of deployments currently in service include:
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1. A 2 MWh system using Redflow���s Energy Pod concept in California for daily shifting of energy from daytime to peak periods. This project is partly funded by the Californian Energy Commission. This is using 192 10 kWh ZBM batteries.

2. Partnering with Optus in 2021 for extended back up energy for the Australian Federal Governments Strengthening Telecommunications Against Natural Disasters (STAND)��Program with over 20 of these mobile sites now operational in Queensland

3. Redflow systems have been installed in 2 local government childcare facilities in Melbourne Victoria, the goal being to maximise green energy use, provide grid backup and maximise grid independence. Each centre has 18 Redflow batteries per site and one of these sites won the Green architecture category at the 2019 master architecture awards

Throughout this period, Redflow has successfully addressed some of the inevitable technical and manufacturing challenges that a new technology faces as it scales up and gains operational experience across a wide range of real-world and environmental conditions ��� including in harsh environments such as Singapore. This provides the core foundation of the strength of Redflow���s solution and demonstrates our ability to scale whilst maintaining manufacturing quality and continually improving battery performance.
Redflow has defined a scale-up plan that will leverage many of strengths of the core chemistry and our field experience. Our goal is to scale up our manufacturing capability to over 200 MWh per annum in coming 18 months to achieve a price per $ kWh at price below forecasted lithium battery prices. Our scale-up plan includes the capability to localise many aspects of manufacture (including production of some components, final assembly, filling and testing), based on market and customer needs.�� Therefore, an increase in committed demand here in Australia enables us to localise some or all of the mentioned aspects, in direct response to agreed committed volumes.
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4. **A Committed Australian Company Since 2005**

Redflow was established in Brisbane, Queensland in 2005 and has continued to maintain its headquarters here. Our operations in Queensland include core R&D and engineering teams, product development, initial prototyping and production, as well as logistics, distribution and corporate functions.
Our batteries and enclosures are designed and engineered in Australia, meaning they are suitable for countries that experience harsh environment including high temperatures. We are currently actively exploring local sourcing of key materials including zinc and external enclosures from Queensland to fulfil local demand requirements.
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In Summary
Redflow is confident that our market leading flow battery solution has an important role to help achieve Singapore���s energy storage objectives,�� green energy targets and local apsirations. Our years of operational experience ��� including here in Australia and around the globe ���

and product development provide the confidence of a robust solution ready for large-scale deployment. Redflow���s ongoing commitment to advance the world���s renewable energy options since 2005 is indicative of the strong desire to work with Australia���s key trade partners and grow Australia���s local economy.

I have attached an introduction to Redflow for your reference.

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