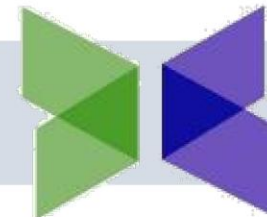




Enabling the renewable energy revolution



April 2022



# A GLOBAL TRACK RECORD OF SUCCESS



21% Ownership



90% Ownership



**Robert Friedland**  
*Chairman and Co-Founder I-Pulse, CEO Ivanhoe Electric, Board Chair, VRB Energy*

- Founder & Executive Chairman of Ivanhoe Mines
- Founder of Turquoise Hill (f/k/a Ivanhoe Mines)
- Founder & former Co-Chairman of Diamond Field Resources

**Laurent Frescaline**  
*CEO and Co-Founder I-Pulse Board Director, I-Pulse*

- Founder and CEO of International Technologies for High Pulsed Power (ITHPP)

**Hirofumi Katase**  
*Executive Vice Chairman & Director General of Industrial Science and Technology, I-Pulse Board Director, VRB Energy*

- Former Japanese Vice Minister for International Affairs at the Ministry of the Economy, Trade and Industry (METI)

**Eric Finlayson**  
*President Ivanhoe Electric Board Director, VRB Energy*

- Former Global Head of Exploration for Rio Tinto
- Former CEO of Rio Tinto Coal Mozambique



**Pichai Chunhavajira**  
*BCPG Chairman Board Director, VRB Energy*

- Former Board Member, Bank of Thailand
- Former Director, PTT Exploration and Production PLC

**Dr. Mianyan Huang**  
*Chief Executive Officer Board Director, VRB Energy*

- Co-Founder of Prudent Energy
- More than 20 patents on membrane, electrolyte and cell stack design

**David Baker**  
*Chief Financial Officer*

- Former VP Treasurer of Ivanhoe Mines and Turquoise Hill
- Adviser - UN Development Program

**Charles Ge**  
*Vice President, China Operations & Legal Counsel*

- Former MD of VanSpar Mining Inc.
- Former Senior Advisor, Zhaojin Mining Industry Co., Ltd.

**Jim Stover**  
*Chief Marketing Officer*

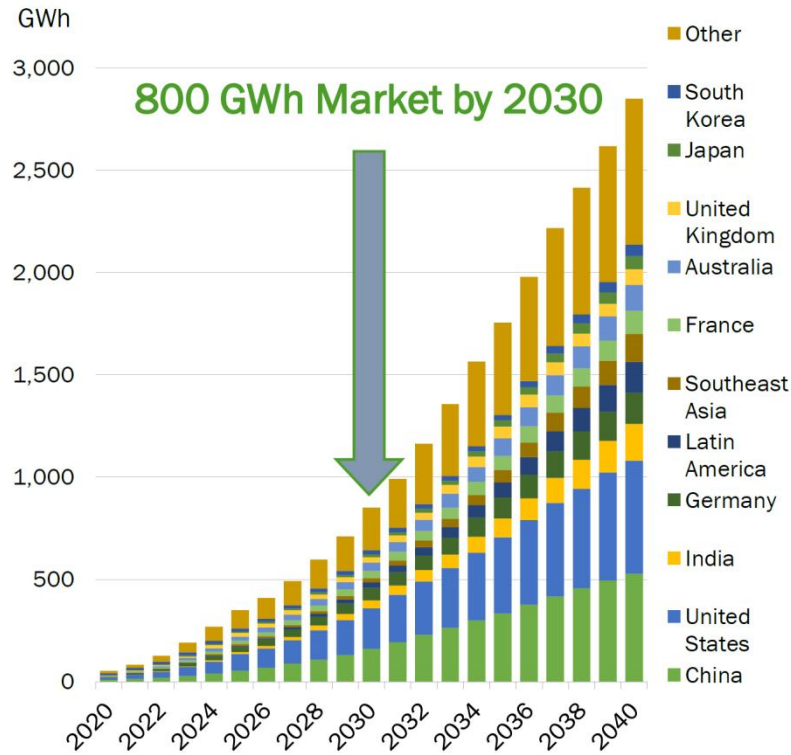
- Former VP, International Operations of Prudent Energy
- Former VP Asia for Northern Power Systems and Distributed Energy Systems Corp.

VRB ENERGY'S PRINCIPALS HAVE RAISED OVER **\$28B** ON WORLD CAPITAL MARKETS

# VRB ENERGY: A 200GWh STORAGE MARKET by 2025

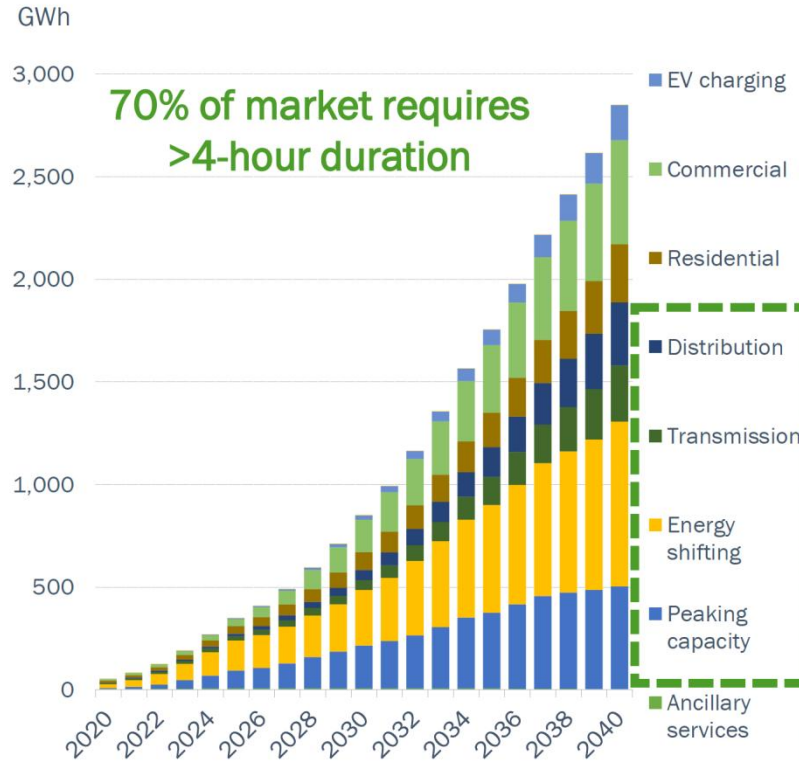


## Global Market is Growing



Source: Bloomberg Long-Term Energy Storage Outlook, July 2019

## Long-Duration is Required

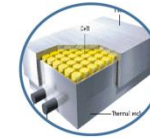


## Vanadium Flow is the Right Choice



### Pumped Hydro

- Long-lead times
- Limited geographically



### Molten Salt

- Does not scale well
- Fire safety risk



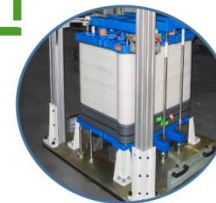
### Lithium Batteries

- Not ideal for >4 hour storage
- Degradation increases cost, reduces revenue
- Fire safety risk, disposal costs



### Zinc Batteries

- Complexity and Efficiency challenges
- Performance degradation issues

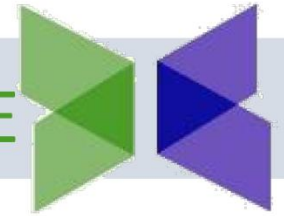


### Vanadium Flow Batteries

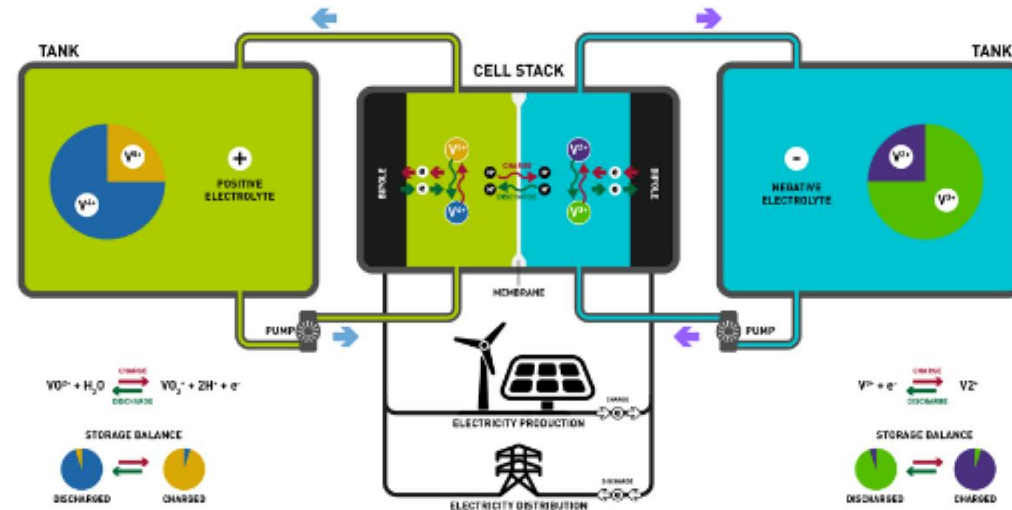
- Safe, lowest LCOE, scalable
- High cycle, deep discharge, long-life suitable for integration of renewables

Long duration storage is increasingly necessary for transition from a reliance on fossil fuel generation to a grid dominated by variable renewable generation. – Navigant Research

# VANADIUM FLOW – UNIQUELY SUITED TO LARGE-SCALE STORAGE



Long-duration and long-life batteries are essential to integrating solar and wind



## SCALABLE

Available with customized power ratings from 10 kilowatts to over 100 megawatts, and scalable energy capacity from four to eight hours or more by adding additional electrolyte.



## LONG LIFE

VRB Energy's proprietary all-vanadium electrolyte does not degrade, resulting in more than 20 years of life and lower lifecycle costs.



## RECYCLABLE

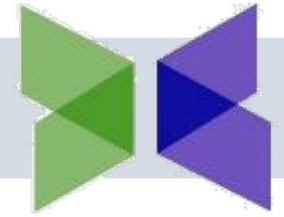
At the end of 20 or more years of successful project lifetime, the electrolyte can be reused in another battery, or recycled, and the other components can be recycled.



## SAFE

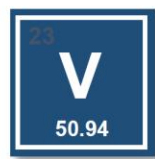
VRB Energy's VRB<sup>®</sup> contains no heavy metals such as lead, nickel, zinc or cadmium. The liquid electrolyte is non-toxic, non-flammable and is 100% reusable.

LITHIUM BATTERIES DEGRADE IN 3-5 YEARS, VRB-ESS LAST >25 years



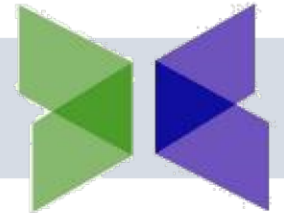
# VANADIUM IS THE SUPERIOR STORAGE SOLUTION

**Lasts 3x longer, zero fire risk, lowest lifecycle cost of energy, 100% recyclable**



Cycle-Life	Not limited	2,000-4,000
Usable Capacity	100%	80%
Safety	Inherently safe	Fire risk
Recyclability	100%	Disposal liability
Scalability	GWh projects	MWh projects
Duration	> 4 hours	1-4 hours
Efficiency	70-85%	80-95%
Lifetime	30 yrs	5-10 yrs
Raw Material Sourcing	Unconstrained, waste sources available	Li, Ni, Co constrained
LCOE	Lowest	Moderate





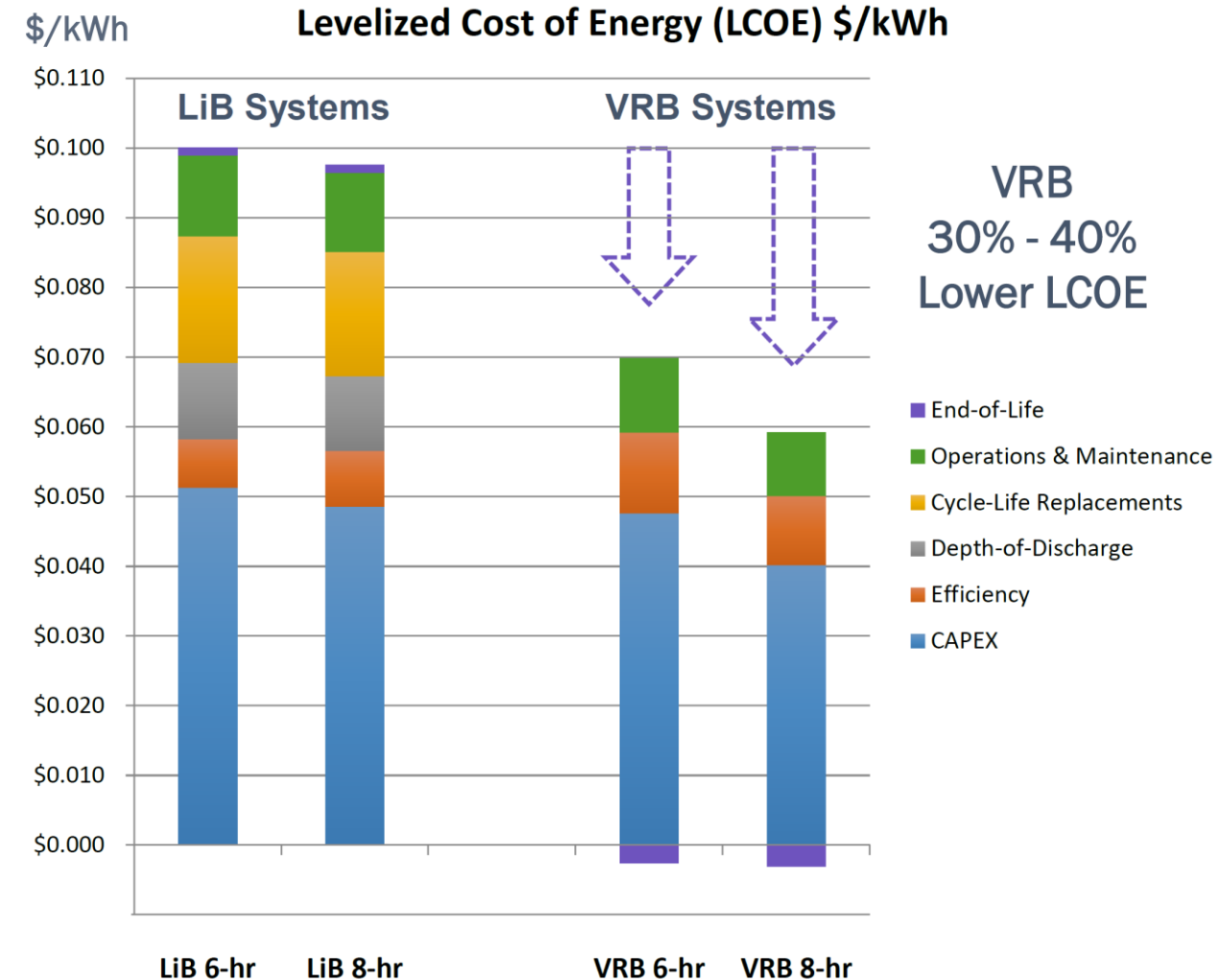
# LOWEST LIFETIME SYSTEM COST AT ANY DURATION

## Levelized cost of energy (LCOE) of VRB systems are much lower than LiB systems

Lithium battery CAPEX is not the full story as it does not include:

- Extra cost for oversizing; LiB are not typically discharged below 20% Depth of Discharge (DOD)\*
- Replacement cost after 2,000 - 4,000 cycles
- End-of-life disposal cost, because LiB are not recyclable and carry an environmental disposal cost

LCOE difference is even greater if used more than one cycle per day (e.g. time shifting + frequency regulation)



Source: Bloomberg Energy Storage System Costs Survey 2019, October 14, 2019, LiB 2022 pricing; VRB estimates internal. Assumes 1 cycle per day, 25-year project, 5% Discount Rate.

\* Depth-of discharge(DoD) for LiB typically limited under warranty provisions to 80% in order to prevent accelerated degradation. Assumes LiB replacement in year 10 at 50% of original cost.

# VRB TECHNOLOGY – STATE GRID **VALIDATED** and **COMMERCIALIZED**



## China State Grid, Zhangbei Microgrid



2MW/8MWh Gen1 system for the largest utility in the world at the 500MW National Solar-Wind-Storage demonstration project.

Validated by the State Grid Corporation of China (SGCC) and achieved 100% availability in rigorous testing for:

- Frequency regulation
- Renewables smoothing
- Peak power management
- Microgrid operation

## Pingfan, Hubei PV Integration

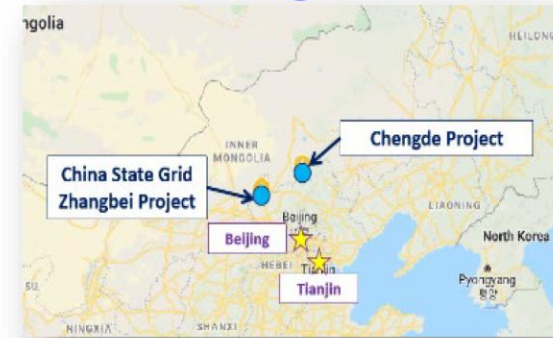


Phase 1: Gen2, 1MW/4MWh  
Commissioned

Phase 2: Gen2, 2MW/8MWh  
In construction

Phase 3: Gen3, 100MW/500MWh  
Expected commercial operation in Q2 2023

## Chengde, Hebei PV Integration



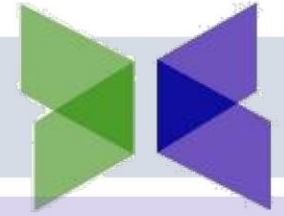
Project 1: Gen2, 2MW/8MWh  
Installed

Project 2: Gen2, 5MW/20MWh  
Under negotiation

Project 3: Gen3, 100MW/400MWh  
Anticipated 20MW/100MWh kick-off in 2H 2022

**Commercial Projects** for renewables integration and peak power management

# 100MW “PV+VRB” Projects are the Next Wave



## Largest solar battery in China - construction start 2022

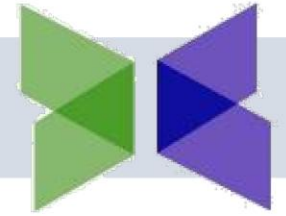
- Model ‘Peaker Plant’: 100MW PV with 100MW/500MWh VRB-ESS®
- Agreement includes ‘Gigafactory’ and R&D center



## Pending Projects

- Ningxia 100MW/400MWh
- Beijing Jingneng 200MW/1GWh
- China Resources Beijing 200MW/1GWh
- China resource Guangzhou 200MW/800MWh
- China State Grid Hunan 20MW/100MWh
- Beijing 10MW/60MWh for Embassy District
- Hebei 2MW/8MWh Phase 2 for China State Grid
- Australia 50MW/200MWh
- California 32MW/256MWh
- Illinois 20MW/80MWh





## Right Technology

Lowest cost of energy for large-scale storage integration of solar and wind



## Proven Product

15 years and \$100 million spent on R&D, 1,000,000 hours of operation, validated by China State Grid



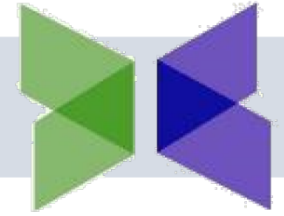
## Green ESG Solution

Vanadium from petrochemical wastes, converted into electrolyte, enabling renewable energy, and 100% recyclable



Growing needs for **renewables** and a **modernized grid** will drive demand for **longer-lasting, safe, and reliable** high-performance batteries.

# CONTACT INFO



**Dr. Mianyan Huang, Chief Executive Officer**  
[mianyan.huang@vrbenergy.com](mailto:mianyan.huang@vrbenergy.com)

**Jim Stover, Chief Marketing Officer**  
[jim.stover@vrbenergy.com](mailto:jim.stover@vrbenergy.com)

**David Baker, Chief Financial Officer**  
[davidbaker@ivancorp.net](mailto:davidbaker@ivancorp.net)

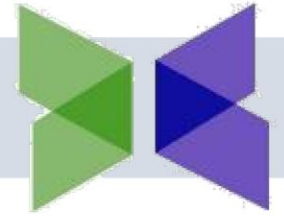


@VRB\_Energy



@ThinkVRB

# DISCLAIMER



This presentation may not be reproduced, disseminated or referred to, in whole or in part, without the prior written consent of VRB Energy (the Company). The Company assumes no responsibility or obligation to verify the information in this presentation, and no representation or warranty is made as to the accuracy or completeness of such information. The Company assumes no obligation or responsibility to correct or update this presentation or any of the information contained herein. This presentation does not contain all information that may be required to evaluate, and does not constitute a recommendation with respect to, any transaction or matter. Any recipient of this presentation should conduct its own independent analysis of the matters referred to herein. The information in this presentation is for informational purposes only, and readers should not rely on such information for any purpose other than to gain general knowledge of the Company. This information is not intended to be, and should not be construed as, part of an offer to sell or a solicitation of an offer to buy any securities.

Certain statements and information in this presentation (including, without limitation, the projected performance information contained herein) constitute “forward-looking statements” or “forward-looking information” within the meaning of applicable securities laws. Such statements are based on certain assumptions and involve known and unknown risks, uncertainties and other factors which may cause the actual results, performance or achievements of VRB Energy, or industry results, to be materially different from any future results, performance or achievements expressed or implied by such forward-looking statements or information. Such statements and information can be identified by the use of words such as “may”, “would”, “believe”, “plan”, “estimate”, and other similar terminology, or by wording to the effect that certain actions, events or results “may” or “would” be taken, occur or be achieved.

The forward-looking statements and information in this presentation (including, without limitation, the projected performance information contained herein) are based on a number of assumptions that may or may not prove to be correct, and involve significant risks and uncertainties, and accordingly should not be read as guarantees of future performance, achievements or results, and will not necessarily be accurate indicators of whether or not such performance, achievements or results will be achieved. A number of factors could cause actual performance, achievements and results to differ materially. The forward-looking statements and information contained in this presentation are based upon the Company’s current expectations and are made as of the date of this presentation, and the Company assumes no obligation to update or revise such forward-looking statements or information to reflect events or circumstances occurring after such date.

The forward-looking statements and information in this presentation (including, without limitation, the projected performance information contained herein) are expressly qualified in their entirety by the foregoing cautionary statements.