



# Powering Tomorrow

Sustainable, Affordable, Scalable  
Energy Solutions

IFBF 2025 | Opportunities in Singapore



OUR BACKGROUND

# The VFlowTech Story



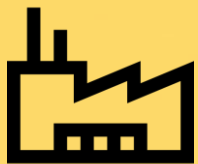
**VFlowTech** is a world-leading long duration energy storage company. Headquartered in Singapore, VFlowTech specialises in **Vanadium Redox Flow Battery (VRFB)** technology and has multi-MWh deployments across 7 countries in the world.

Focusing on

- Utility and grid-scale applications, and
- Commercial and industrial customers

In partnership with developers, IPPs and EPCs worldwide.

Raised US\$34m, with recent closure of US\$20.5m in funding.



**>500MWh**

Output facility in Asia



**Patented IP**

Over 9 patents filed globally



**Strong Team**

Over 97 people across Singapore & India



**R&D and Manufacturing**

12+ years of R&D investment and 2 manufacturing facilities



**Presence in 7 Countries**

Entering EU in 2025

## CASE STUDY

# Decarbonising Oil Terminal in Singapore



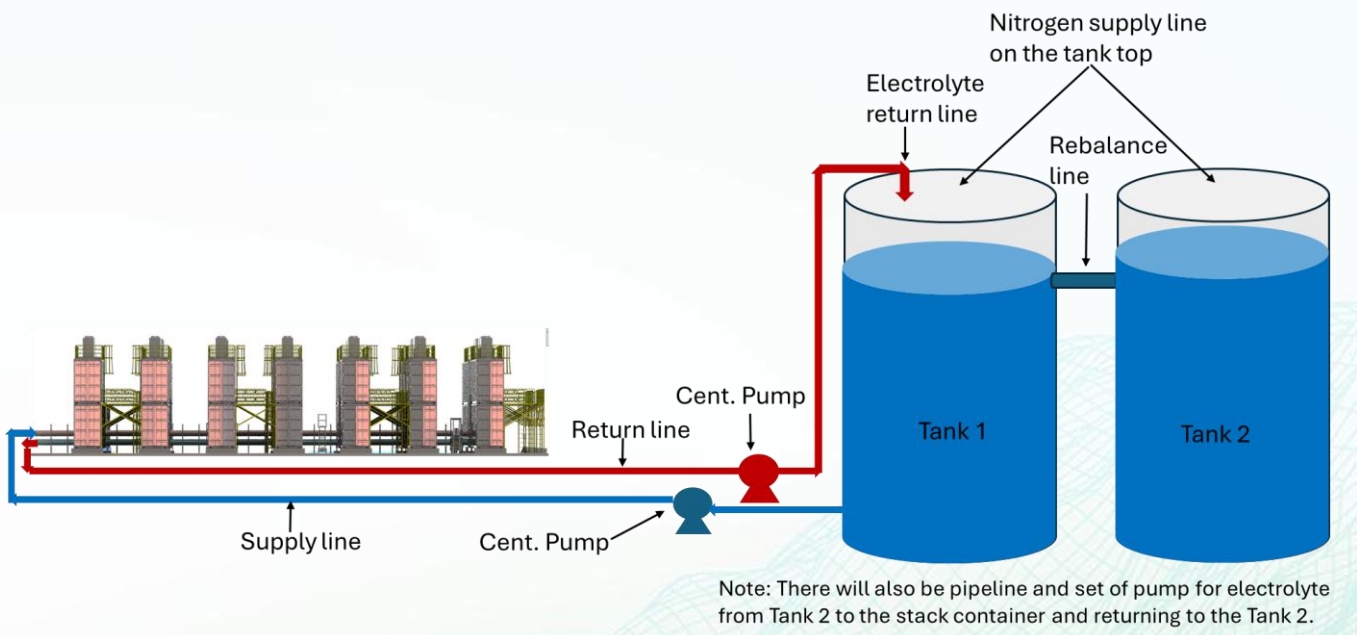
- Project completed with 400 kW-1,600 kWh demonstration in oil terminals of Singapore powering inductive pumps
- 400 kW power with pcs and transformer in single 40' container
- 4 x vertical tanks for electrolyte, metal tanks coated with PE lining
- 558 cells in series string, operated directly with PCS without DCDC, stack impedance & electrolyte quality remains healthy as initial state, in 9 months of operation
- Obtained stable RTE of 70% in Singapore weather (exc. Chiller)
- Managed 4 electrolyte tanks circulated with 2 pumps only, limiting nominal auxiliary <3%
- Gravity-based electrolyte balancing worked effectively, no significant lag on SOC equalisation found due to tank interconnection
- Minimal use of chiller allows electrolyte to operate up to 47°C without additive.

DESIGN CONCEPT

# 10 MW-40 MWh Vanadium Redox Flow Battery System



Piping Distance: ~400m, Cable Laying Distance: ~200m

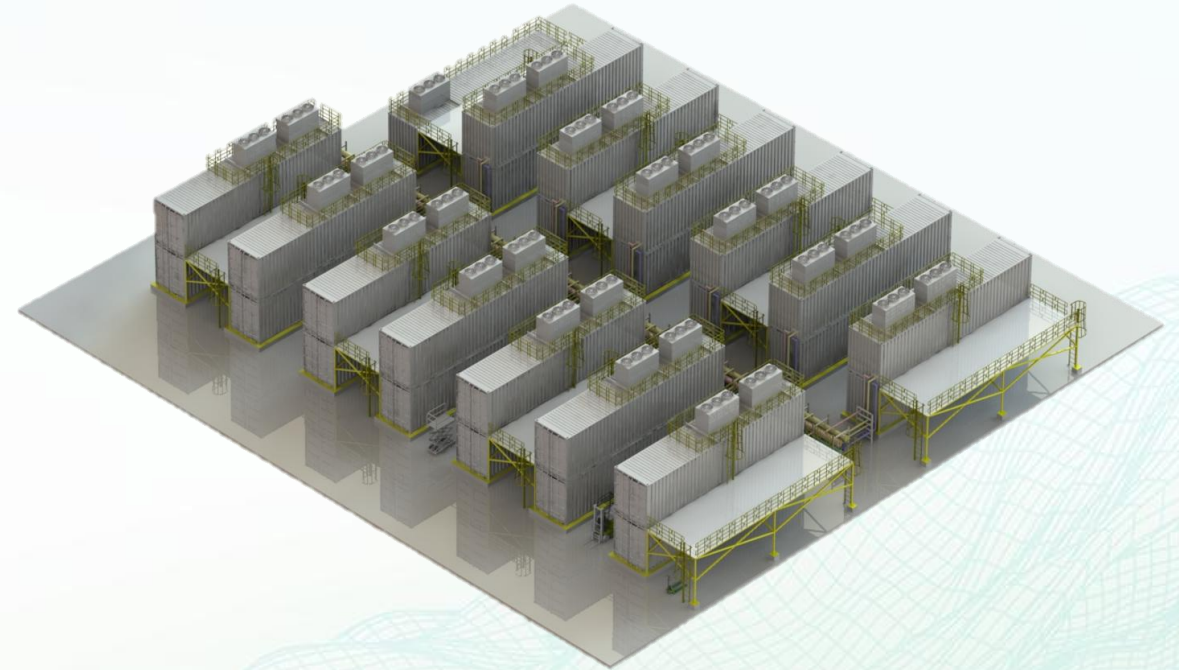
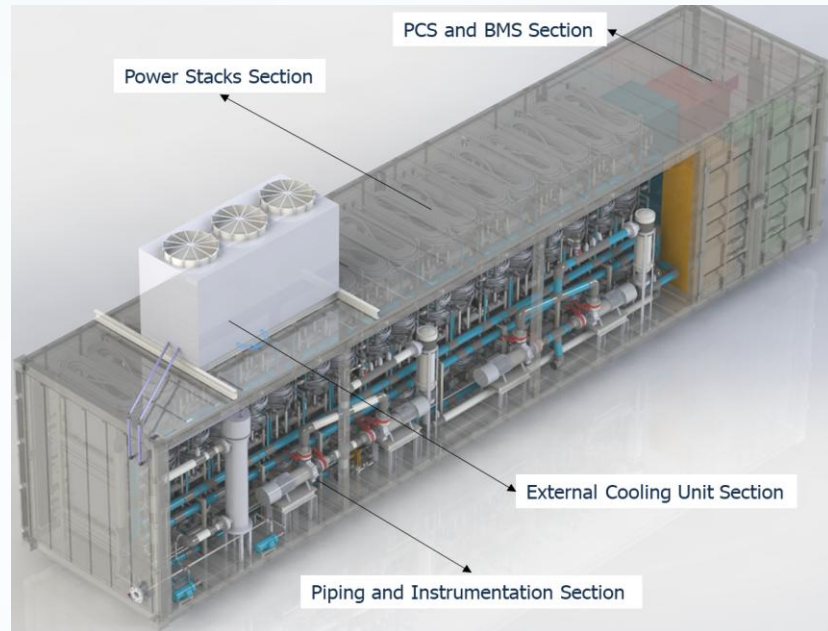


## Challenges to overcome:

- 2 x tanks + 20 x 40' stack containers of each delivering 500 kW
- Electrolyte transport in long distance (400 m) – pumping and piping standards
- Plastic lining of large tanks, each tank is 1350 m<sup>3</sup> capacity
- Maintaining uniform distribution of SOC

## DESIGN CONCEPT

# 10 MW-40 MWh Vanadium Redox Flow Battery System



- Stack container: 700 cells in series, maintaining DC bus from 700 V – 1100 V
- Power output from 1 x 40' container = 500 kW
- Container stacked to reduce area footprint. Fire safety approved to stack the container.
- Long pipeline from tank to stack container aids heat dissipation, reducing chiller run time.

# Demand Response (DR) in Singapore

When is a DR Event Triggered?

A period qualifies if USEP  $\geq 1.5 \times$  Base Vesting Price (BVP)

## Operational Parameters

- Event Duration: 30-minute blocks
- Minimum Reduction Threshold: 0.1 MW
- Pricing: Based on actual market savings
- Example Calculation: Refer to illustration on the left

## Interruptible Load

- Be on standby to reduce the load if called
- Paid for being on standby, even if not activated
- Can be done in the hours not participating in DR

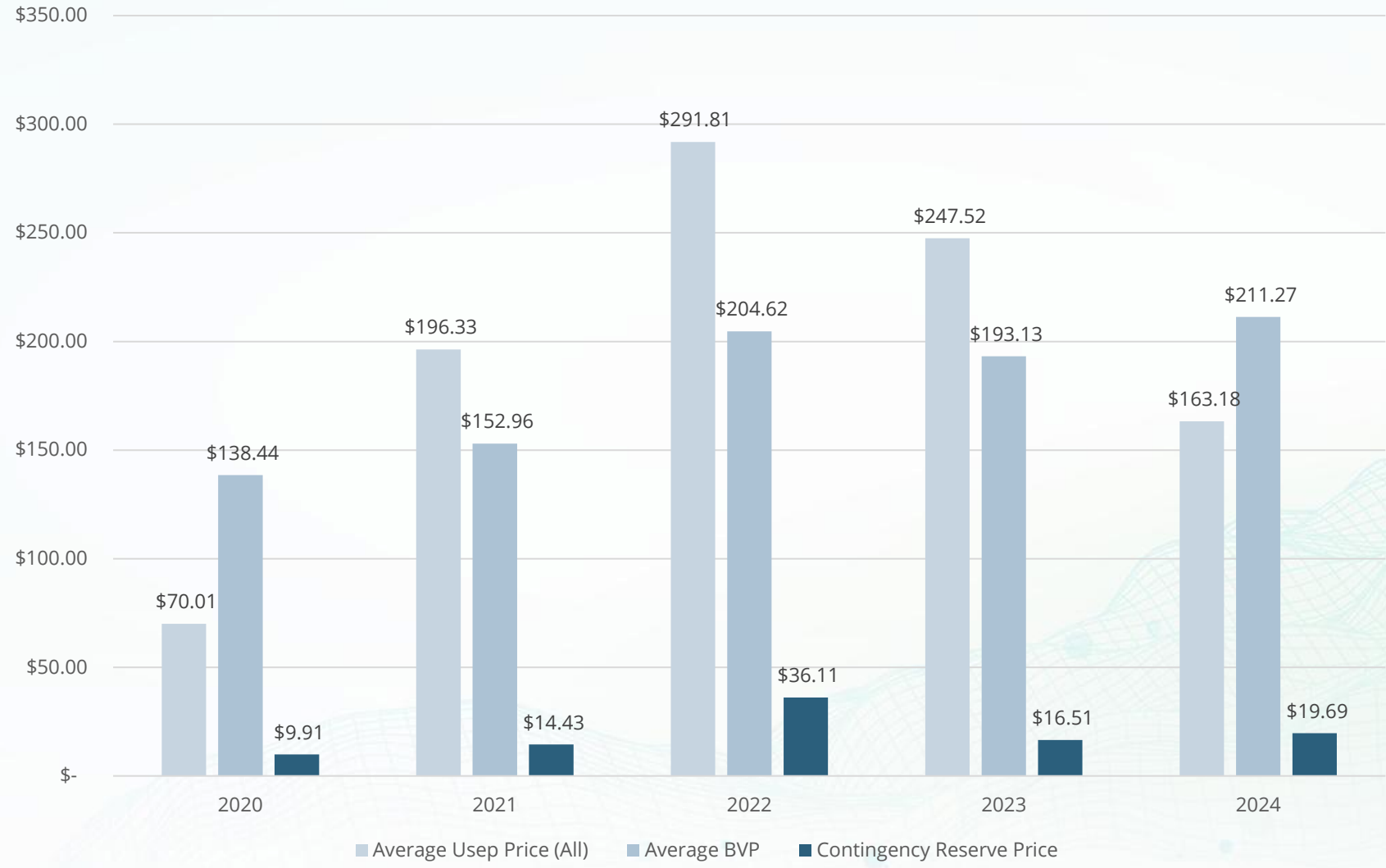
Illustration

Assume system consumes 1,500MWh

Total savings (due to reduction in price)	= 1,500MWh x \$100/MWh
	= \$150,000
1/3 Savings	= \$150,000 / 3
	= \$50,000
Incentive Payment to DR Participant	= \$50,000 / 25MWh
	= \$2,000/MWh

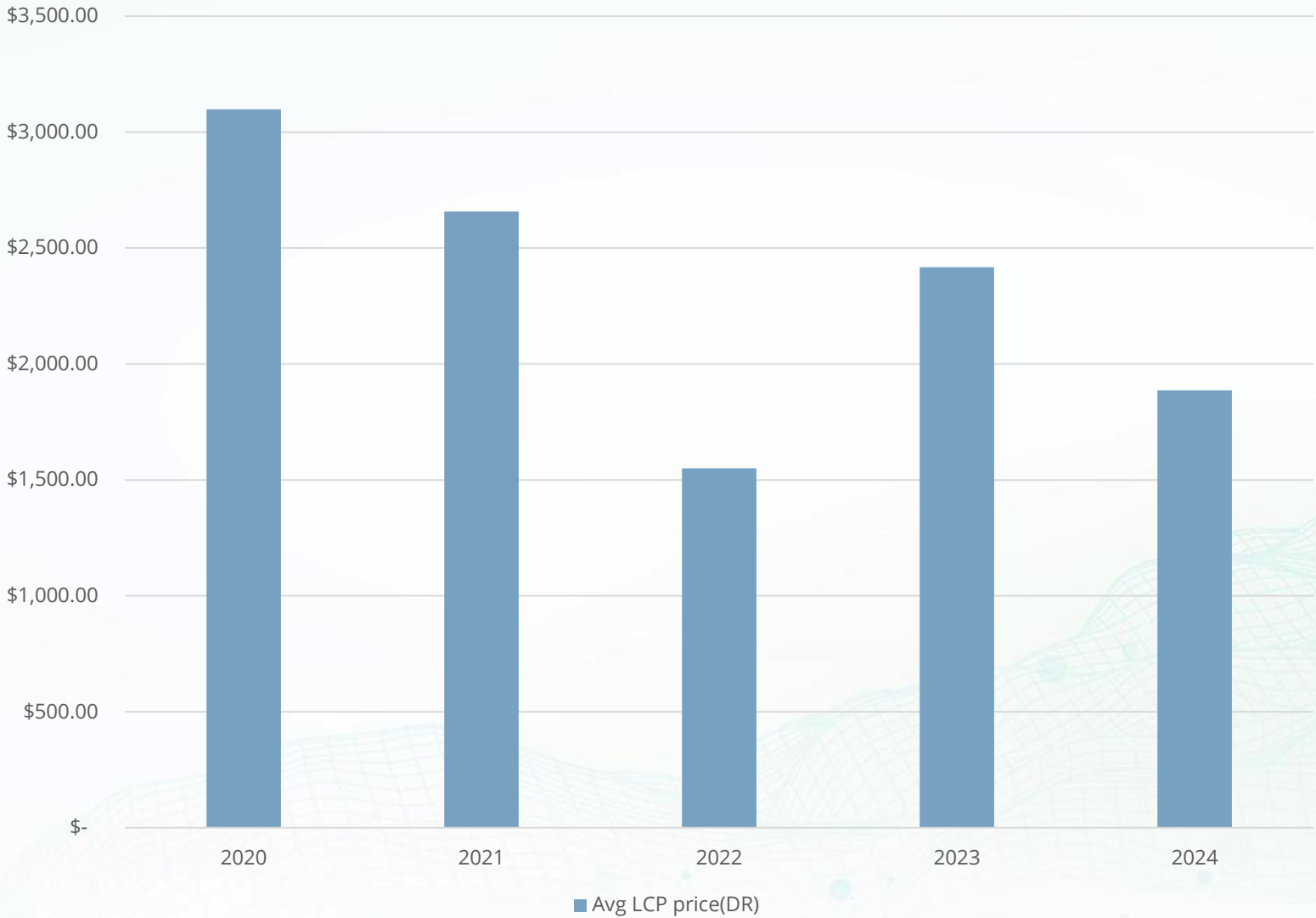
Worked Example: Incentive Calculation for Demand Response Participant

# Singapore Electricity prices 2020-2024



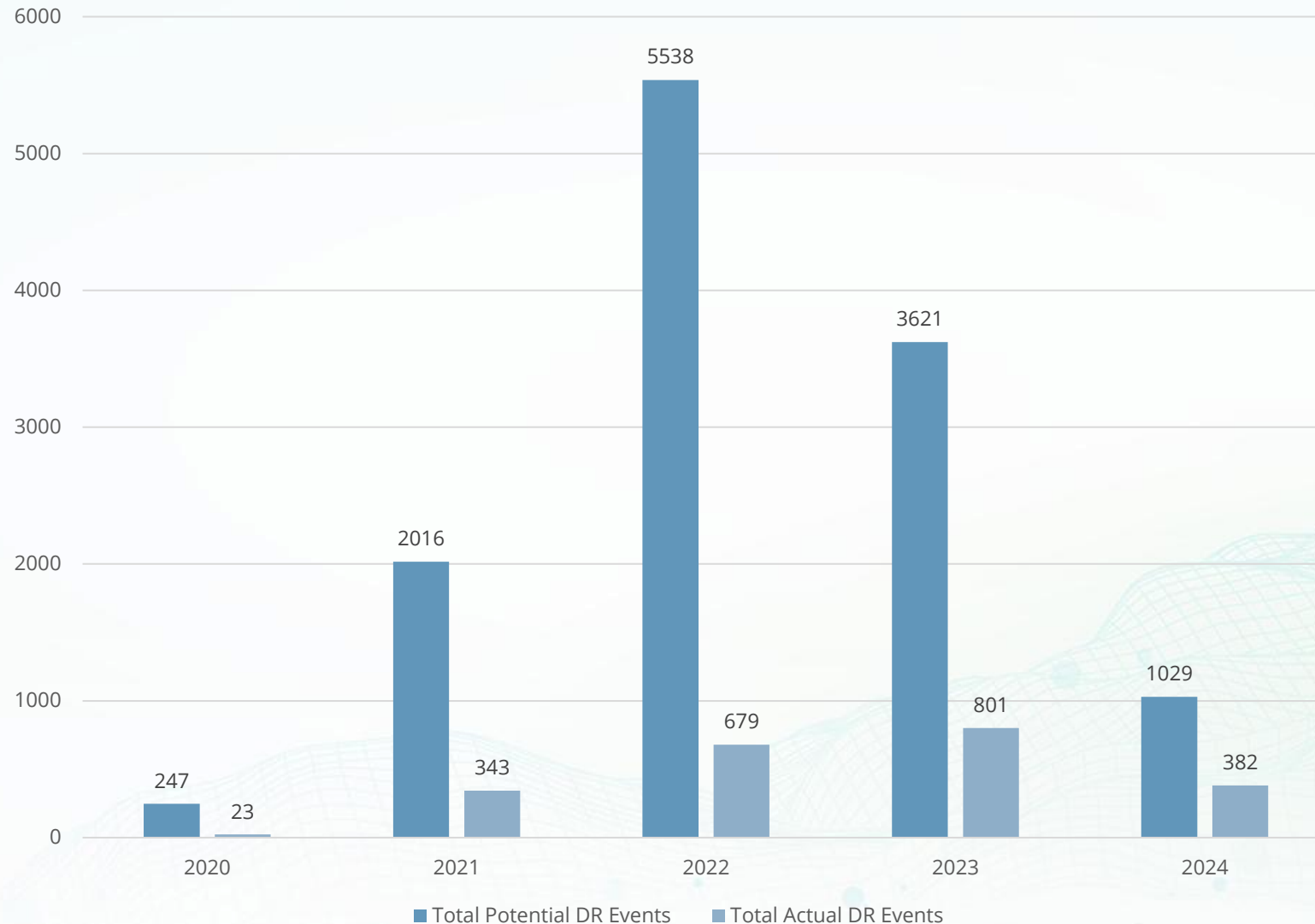
- Electricity prices fluctuated from 2020–2024, driven by geopolitical and fuel market volatility
- Average Uniform Singapore Energy Price (USEP) was ~SGD\$194/MWh, peaking at over SGD\$290/MWh in 2022

# Load Curtailment Pricing (LCP) For Demand Response



- Average LCP over 5 years is SGD\$2,321/MWh
- LCP peaked at SGD \$3,099/MWh in 2020 and dropped to a low of SGD\$1,550/MWh in 2022

# DR Opportunities & Events 2020-2024



- System peak demand is expected to grow 3.1%–5.5% annually through 2030\*
- Rising solar generation increases the need for flexible demand-side resources like DR and IL
- 2020–2024 average: 446 actual DR events per year out of 2,490 potential periods
- LDES has potential to capture more DR events to generate revenue

# DR Scenarios

Scenario	LCP (SGD/MWh)	USEP (SGD/MWh)	Contingency Reserve (SGD/MWh)	DR Periods Participated
<b>Base Case</b>	\$ 2,322	\$ 194	\$ 19.3	450
<b>High Price</b>	\$ 3,000	\$ 250	\$ 25	450
<b>Low Price</b>	\$ 1,500	\$ 125	\$ 12.5	450

- Base Case reflects 5-year average prices
- High Price scenario assumes stronger market signals, driving up LCP, USEP and Contingency Reserve prices
- Low Price scenario models lower prices

# Business Case Summary

Metric	Base Case	High Price	Low Price
<b>Total Revenue (SGD)</b>	\$ 171,271,467	\$ 221,343,750	\$ 110,671,875
<b>Est. CAPEX (SGD)</b>	\$ 27,000,000	\$ 27,000,000	\$ 27,000,000
<b>Est. OPEX (SGD)</b>	\$ 34,283,182	\$ 42,291,563	\$ 24,520,781
<b>Net Present Value (NPV) (SGD)</b>	\$ 43,046,802	\$ 64,555,515	\$ 17,052,005
<b>Project IRR</b>	20.1%	26.5%	12.0%
<b>ROI</b>	5.1	6.6	3.2

- High Price scenario delivers the strongest returns, with NPV of \$64.5M and IRR of 26.5%
- Base Case remains robust, showing a 5.1x ROI and \$43M in NPV
- Low Price scenario is still viable

# Business Case Summary



VFlowTech is one such trailblazer who is developing

Advario  
Singapore Chemical



# Thank You

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