

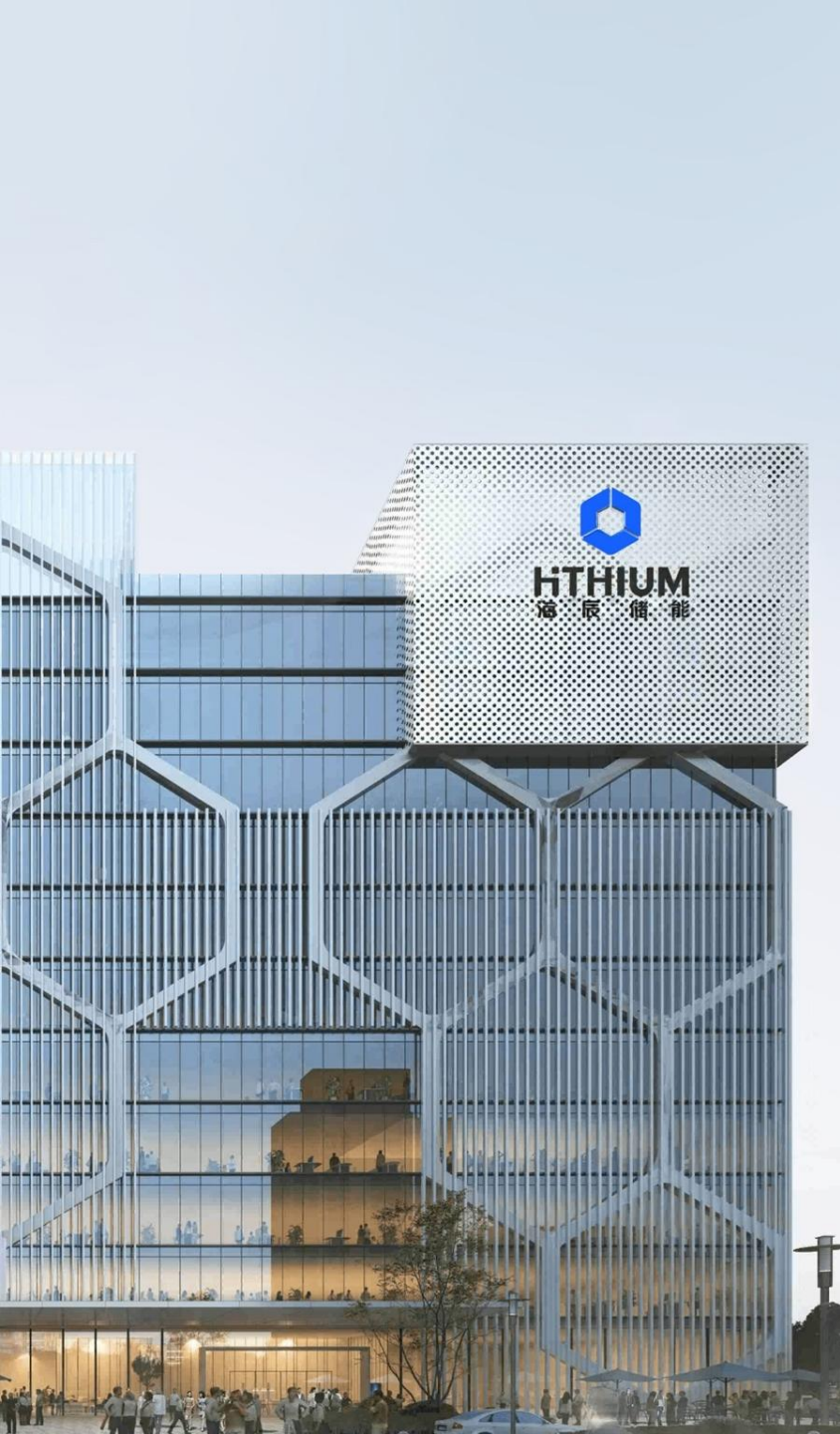


# The Future of BESS: Trends Shaping Next-Generation Battery Energy Storage Systems

Jason Shores  
Senior Application Engineer



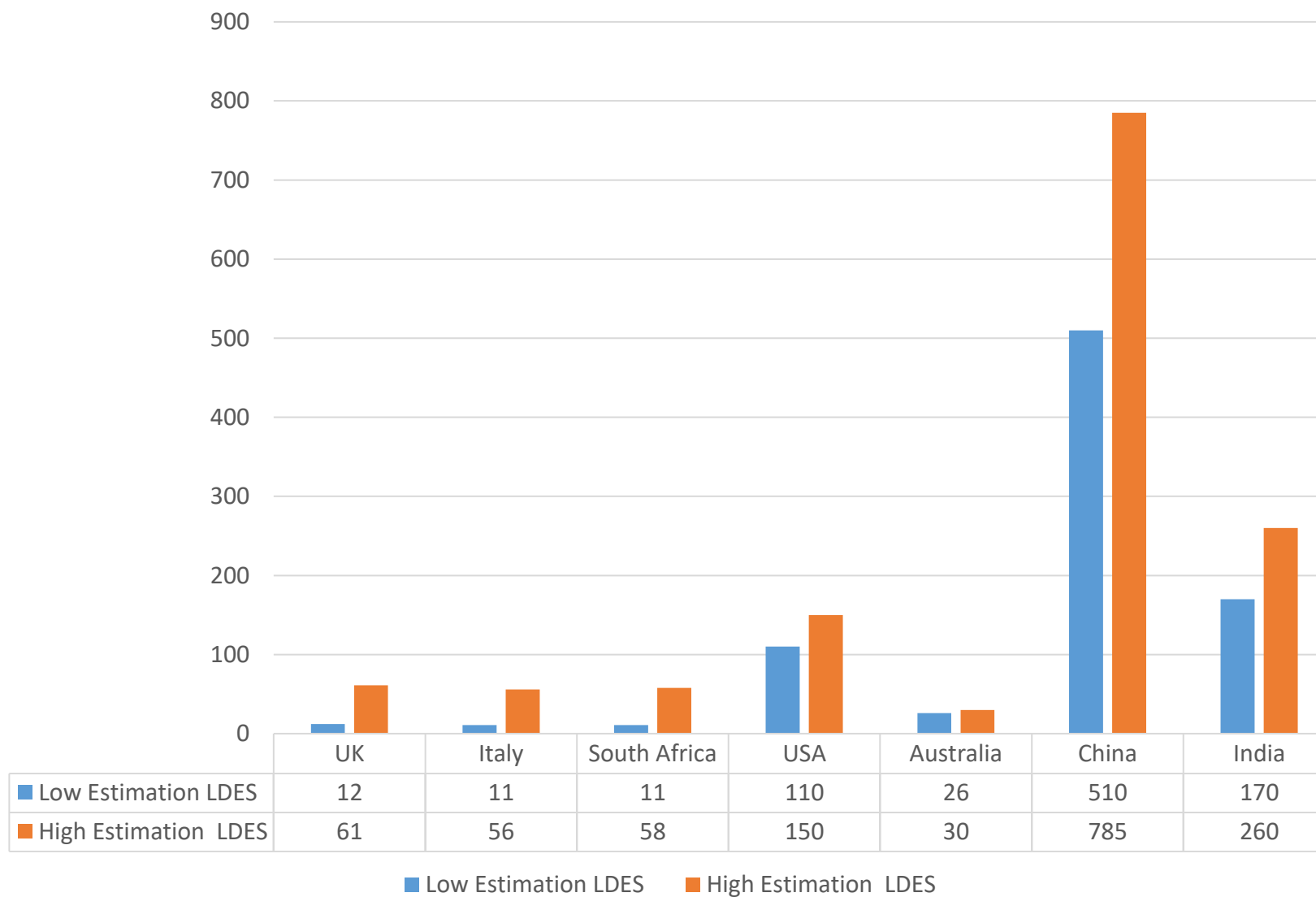




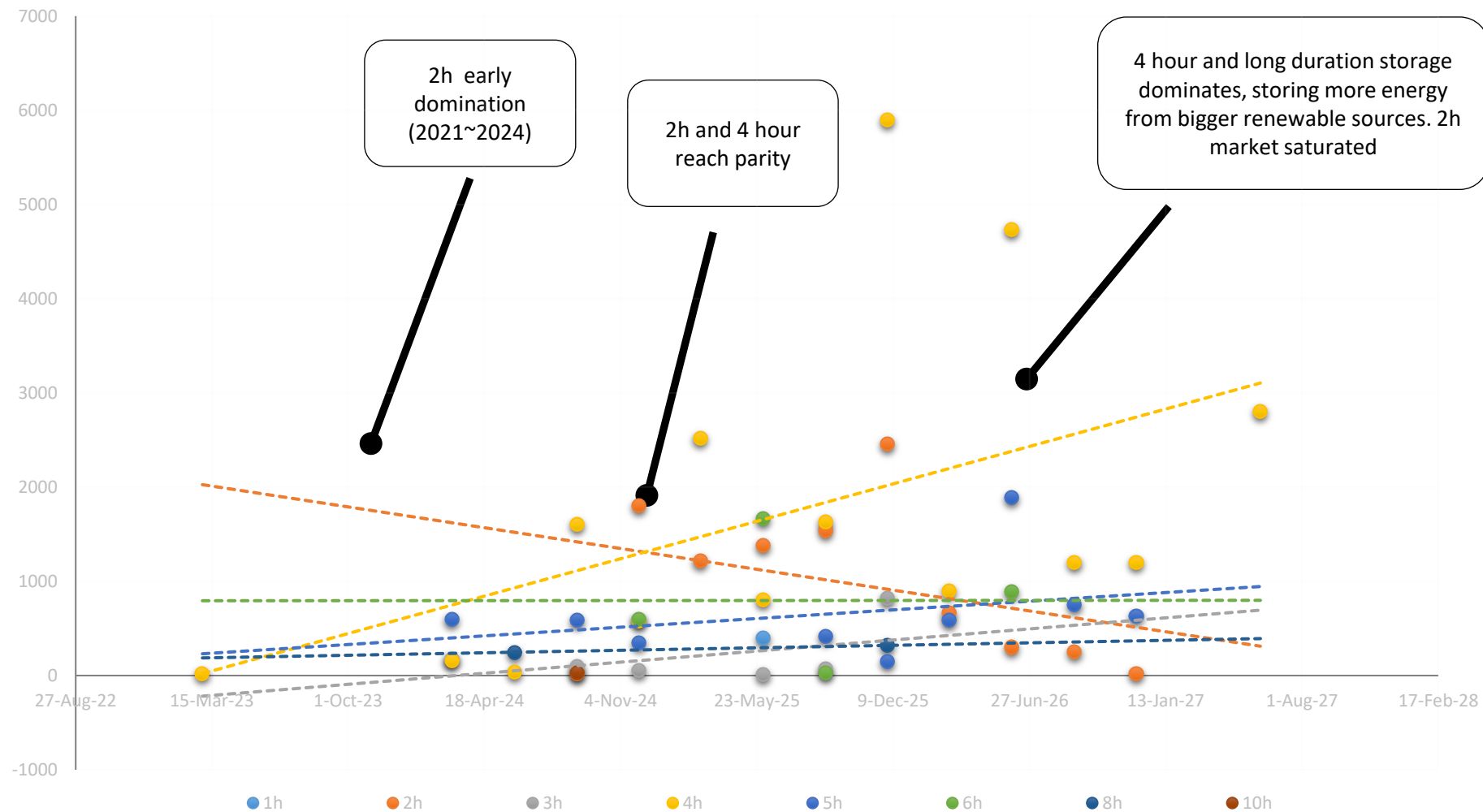
01

# Long Duration Energy Storage

# LDES Projected Deployment



# Enquiries for LDES



# HIGH ENERGY DENSITY



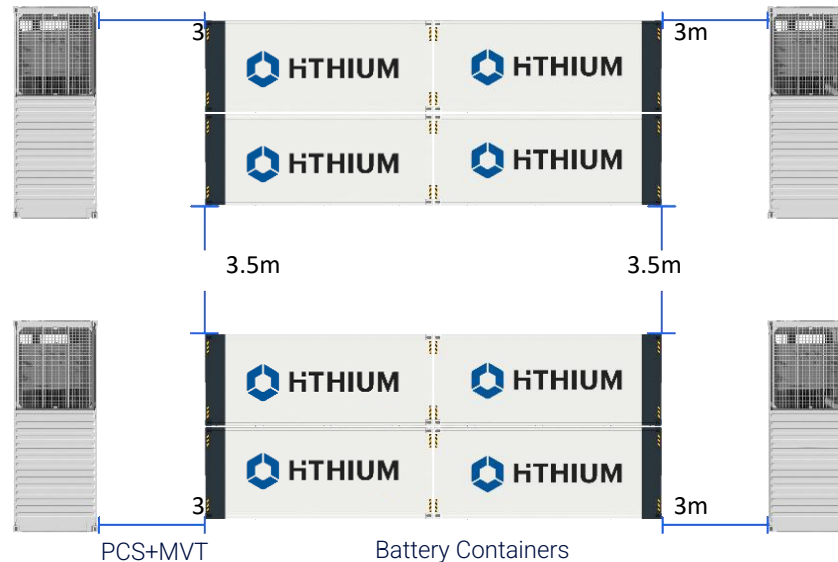
## Footprint reduction:

- By moving to 4 hour systems you double the number of BESS containers per PCS, this raises the overall site energy density. This is made more noticeable by increasing to 6 or 8 hours.

## Plant Level

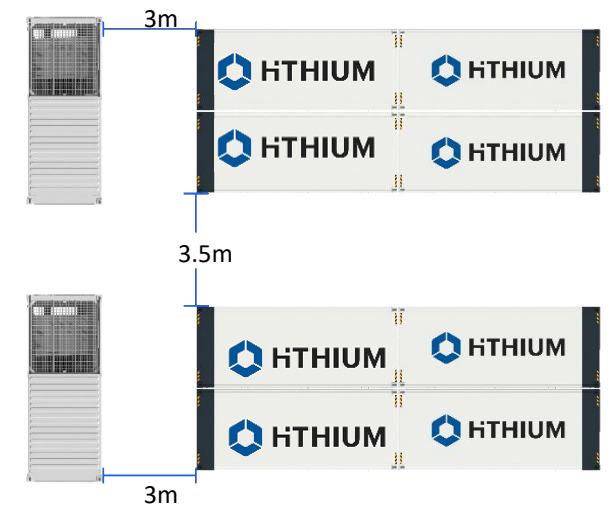
- Small footprint, Flexible layout, side to side and back to back installation possible.

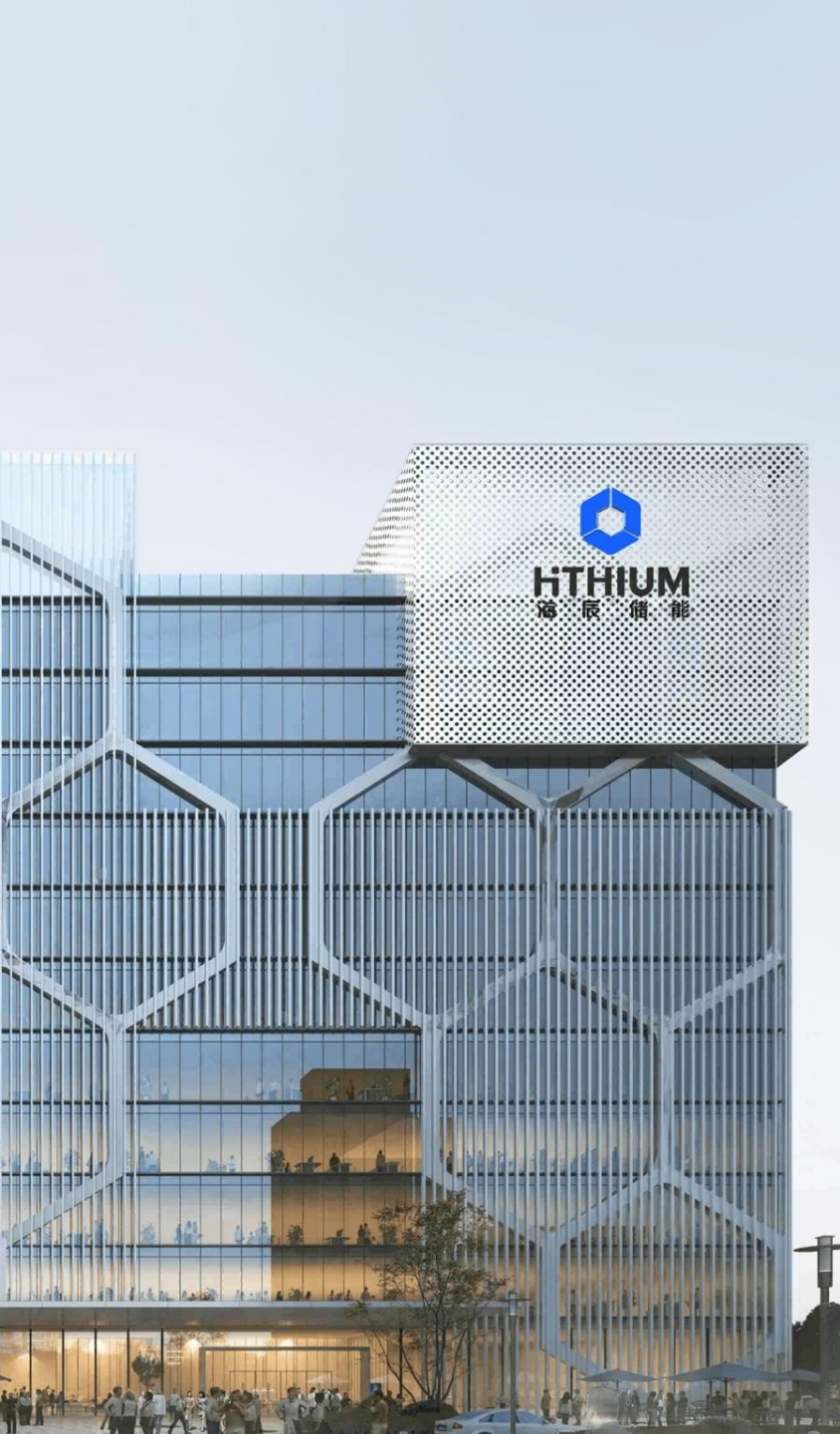
## 2h SYSTEM



## 4h SYSTEM

Land saved by: ~20%+





## 02 Longer lifetime

# LDES Projected Deployment



Energy throughput increased **by ~25% (0.5P).**

For 100MWh project, 124GWh more energy throughput



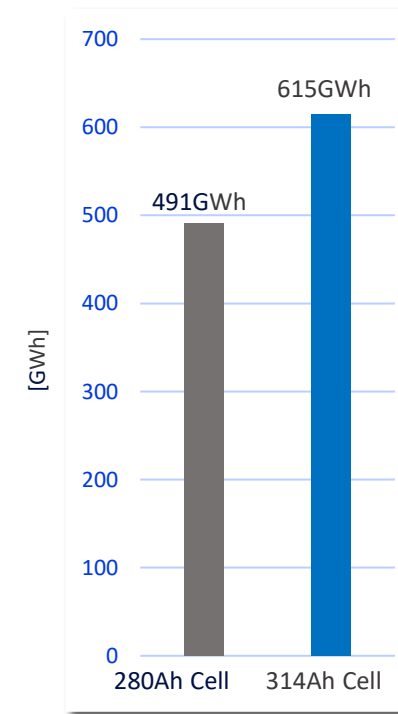
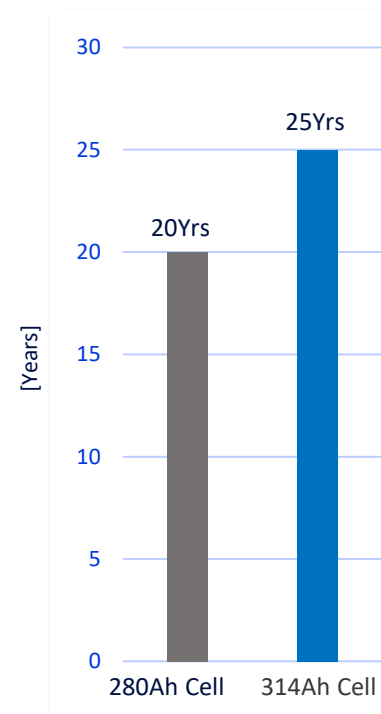
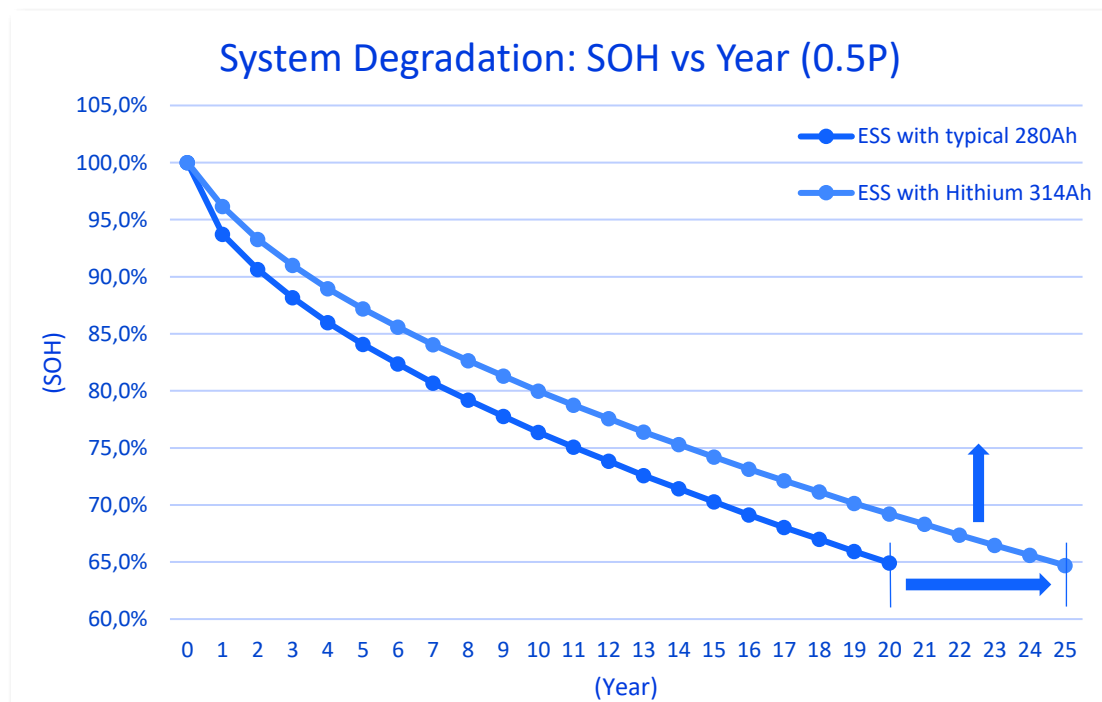
System Cycle Life increased by 25%



Energy Throughput increased by 25%

NOTE: Comparison based on:

- System with typical 280Ah cells VS System with 314Ah cells
- 100MWh, 0.5P, 1cycle/day, 100%DOD, 65%EOL
- For illustration purpose, results may differ with different conditions





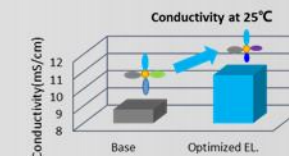
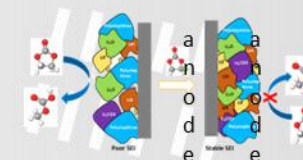
# LDES Projected Deployment



## Energy Efficiency

### Maximum lifetime

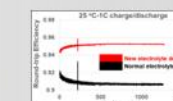
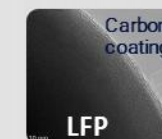
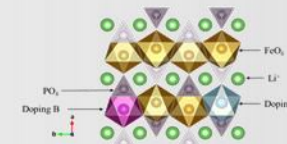
- Active and sustained lithium ions release technology
- Stable SEI and high kinetic solvation



## Lifetime

### Maximum Energy Efficiency

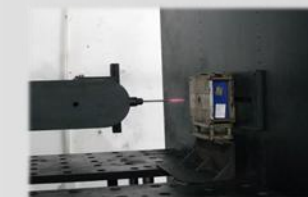
- Multi-element doping design
- Uniform carbon coating
- Low viscosity & High conductivity electrolyte



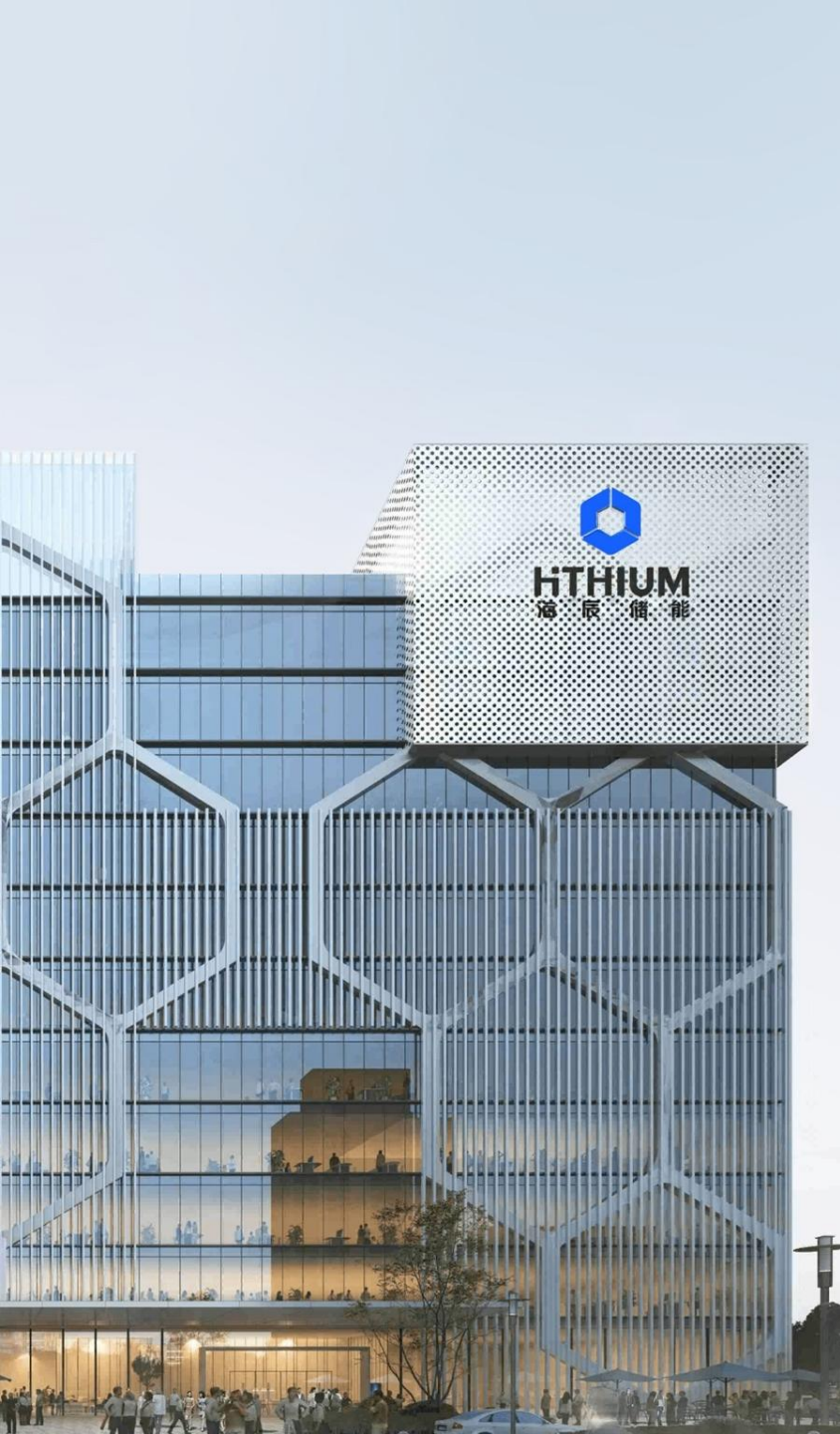
## Safety

### Maximum safety




- Multi-dimensional safety design from materials, to cell and system
- No fire. No explosion.

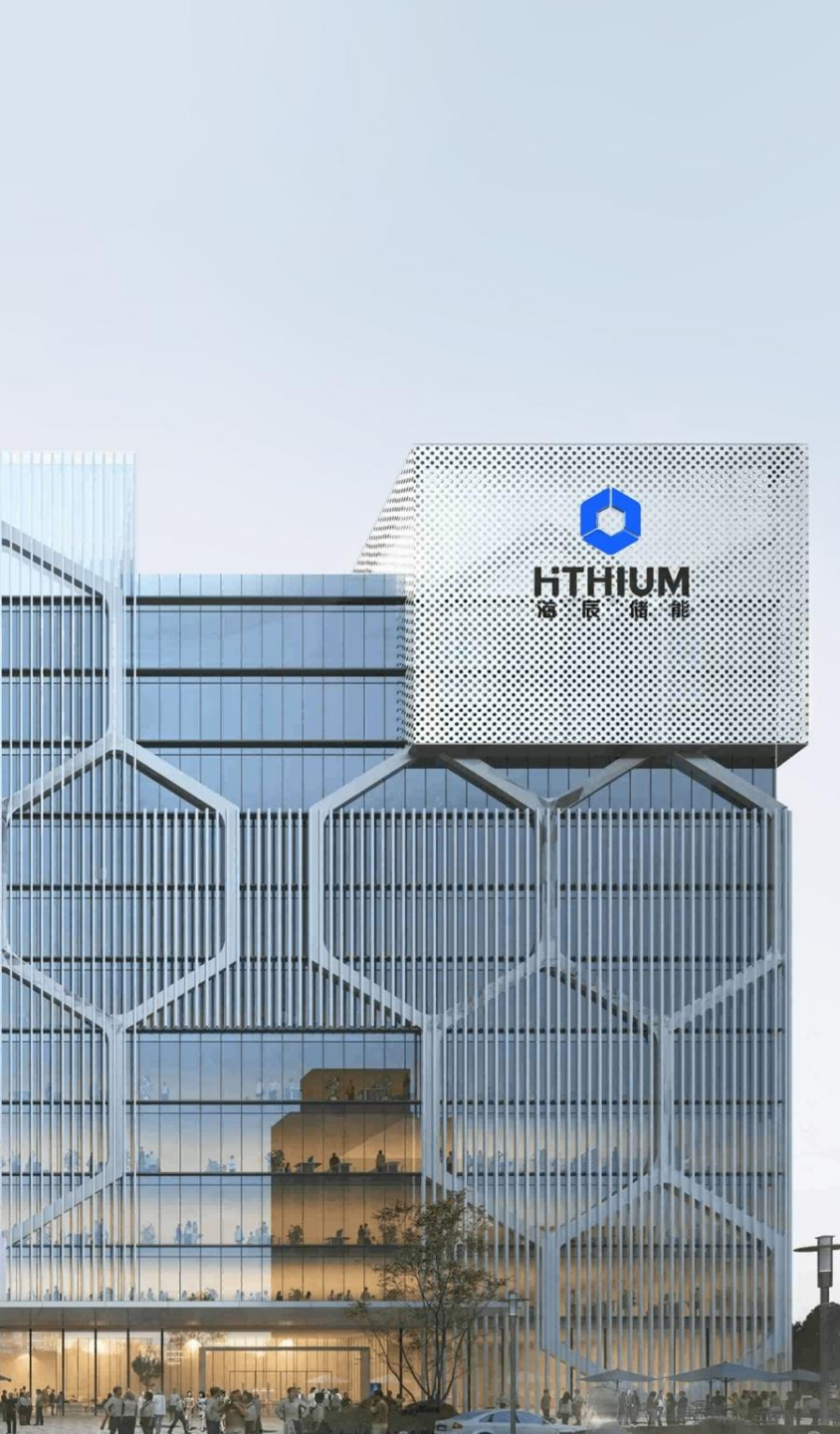






# 03 Alternative Chemistries

	Redox Flow	Sodium ion	Solid State
			
Cycle Life	✓ ✓ ✓	✓ ✓ ✓	✓
High-temperature Stability	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
Volumetric Energy Density	✓	✓	✓ ✓ ✓
Safety	✓ ✓ ✓	✓ ✓ ✓	✓ ✓
BOP integration	✓	✓ ✓ ✓	✓ ✓



# 04 Higher Safety

## | Safety Standards

Quick list of international safety standards

UN38.3	NFPA68
UN3536	NFPA69
UL 9540	NFPA70E
UL9540A	NFPA72
UL1973	AS3000
UL1741	RoHS
IEC62933	EN61000
IEC62619	Reach
IEC63956	
IEC62477	
IEC63056	

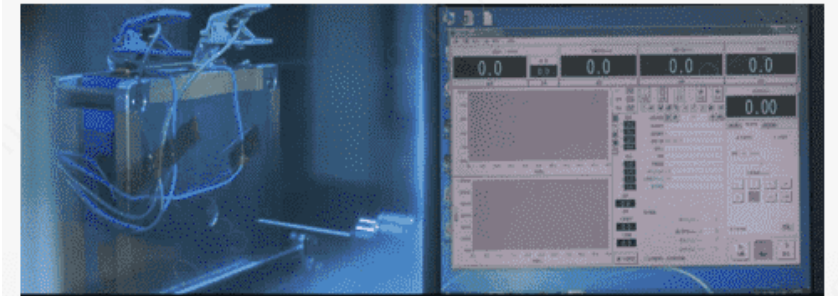
### Nail Penetration Test

- Steel needle, diameter=8mm
- Speed: 25 mm/s
- Penetrates and stays inside the cell
- Rest for 1 hour

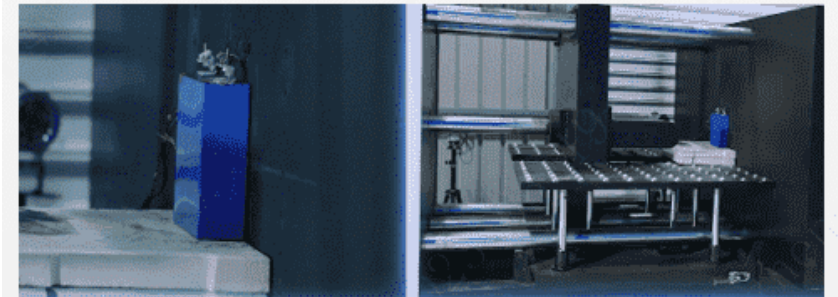
### Crush Test

- Half cylinder, radius = 75 mm
- Speed: 5 mm/s
- Deformation  $\geq 30\%$  or  $U = 0\text{ V}$
- or pressure  $\geq 13\text{ kN}$
- Rest for 1 hour

No fire, No Explosion



No fire, No Explosion

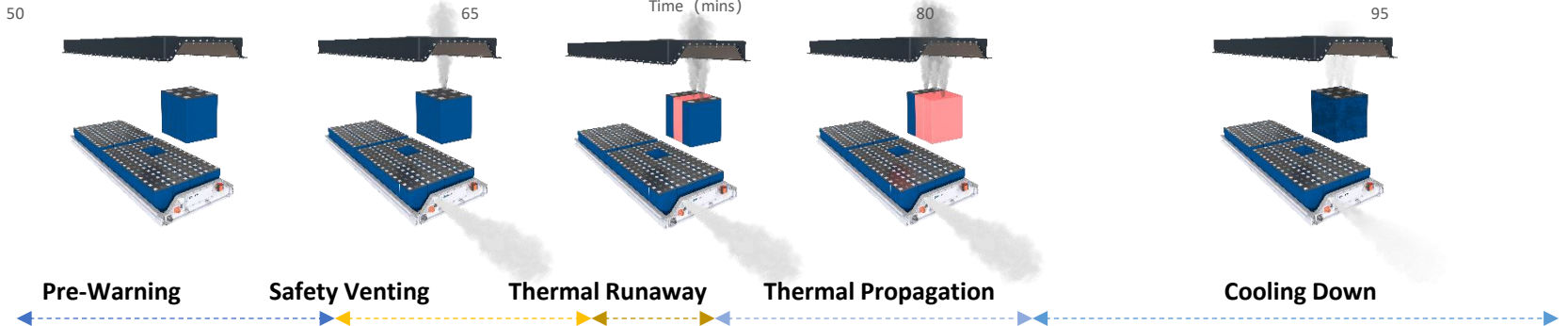
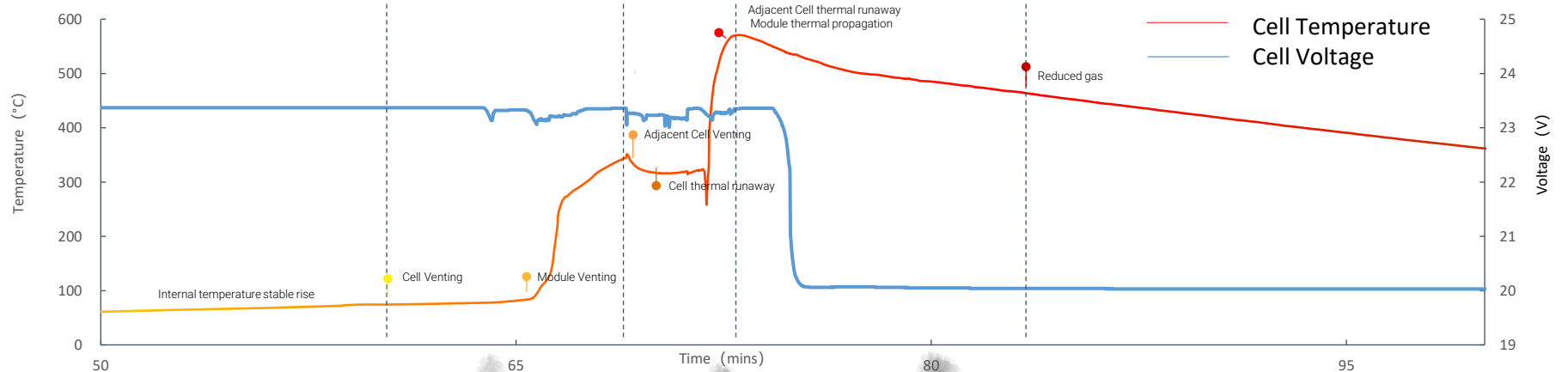




# ACTIVE SAFETY: BMS PREVENTION & PROTECTION

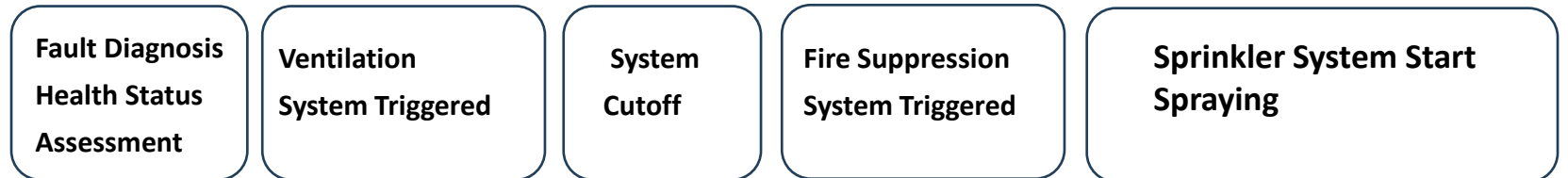


BMS



- Early intervention is the key

- Prevention of thermal propagation is the last defense line



### Design in accordance with NFPA855 Authorized 3<sup>rd</sup> Party Safety Validation



**National Fire  
Protection Association:**  
Standards for stationary  
storage battery systems

- NFPA 68 Analysis
- NFPA 69 Analysis
- NFPA 70E Assessment
- NFPA 72 Compliant Alarm System
- ESS Fire Extinguishing/ Suppression System Design Review
- Hazard Mitigation Analysis



All key components with UL and/or CE

