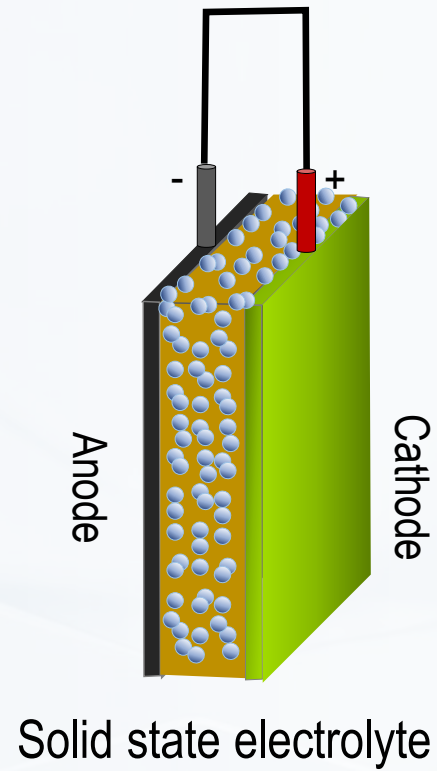
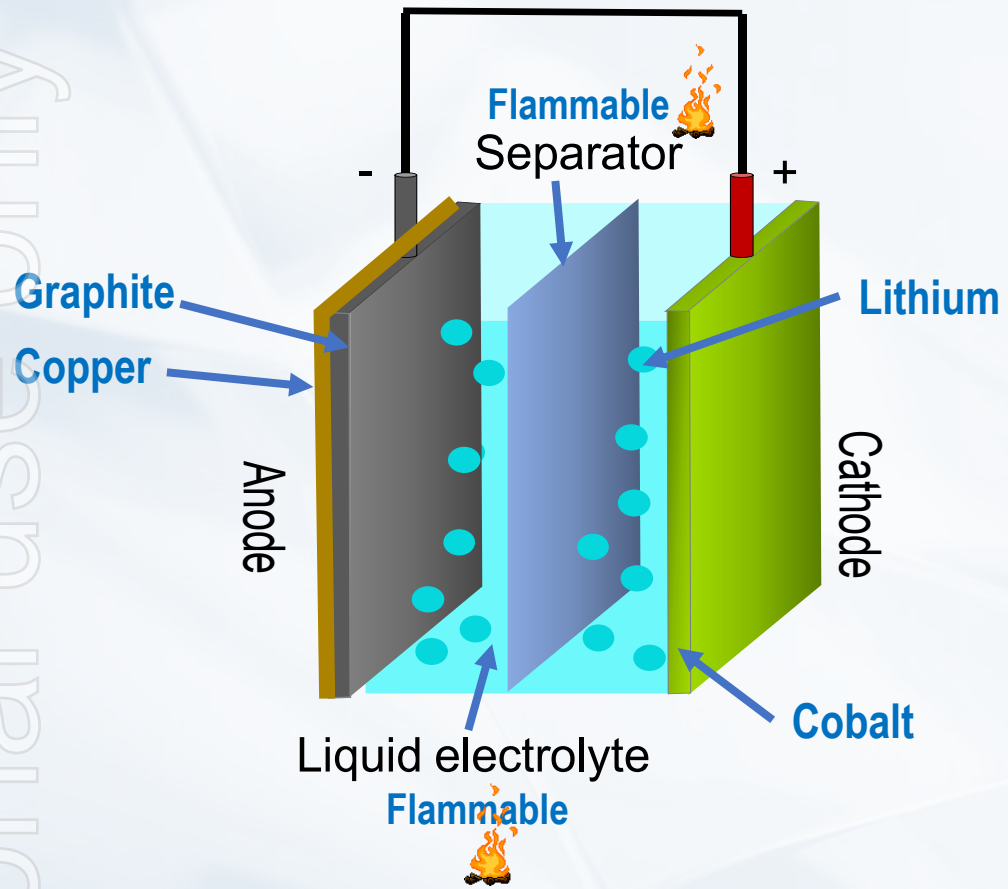


ersonal use only

What's the future of Grid Storage Batteries?



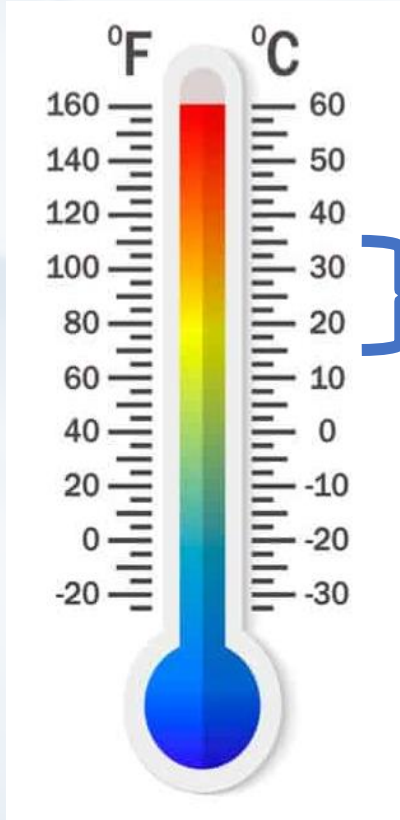
Lithium-ion
Battery
moving to Solid
State



- **Safety issues**
- **Thermal runaway, fire, explosion**
- **Over heating, physical damage, over charging**
- **Flammable organic electrolyte and separator**
- **Self generates oxygen - cathode**
- **Nearly impossible to put out**

**Challenges
with LIB
Fire Explosion**

ersonal use only



- Temp range +15°C to +35°C
- Narrow operating range
- Liquid electrolyte viscous – slows lithium reactions
- @ 0°C capacity reduced to 70%
- Unsuitable in cold and desert climates

Challenges with
LIB
cold/desert
climates





- **Li-ion degrades – each cycle**
- **Detrimental side reactions, dendrite formation**
- **Most EV guarantee 8 years of battery life (70%)**
- **Degrade faster outside operating temps**
- **Grid storage lifespan 7-10 years expected¹**

Challenges with LIB Battery Lifespan

1. Life Prediction Model for GridConnected Li-ion Battery
Energy Storage System Kandler Smith, Aron Saxon, Matthew Keyser, and Blake Lundstrom
National Renewable Energy Laboratory May 24-26, 2017

ersonal use only

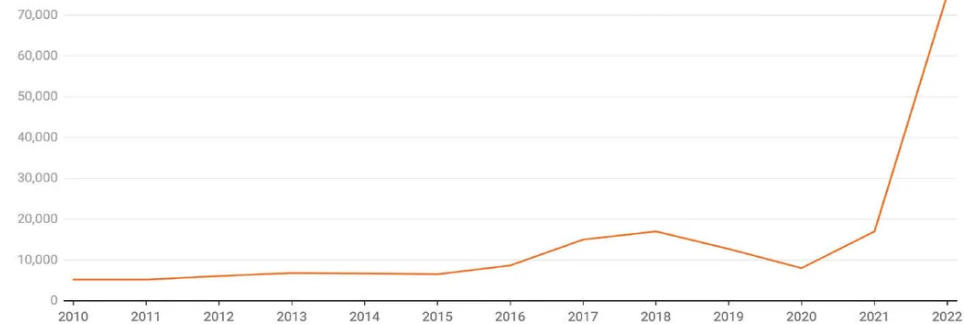
Economy | Climate Crisis

'Insane' lithium price bump threatens EV fix for climate change

The price of the metal used in batteries for electric cars has risen six-fold since the start of the year.

Lithium prices have spiked sky-high

Price of battery-grade lithium carbonate per metric ton in U.S. dollars



Prices for 2010-2021 are annual averages from the U.S. Geological Survey.
Price for 2022 is from S&P Global Commodity Insights on May 4, 2022.

Chart: Canary Media
Source: U.S. Geological Survey

Challenges
with LIR

Lithium Prices

ersonal use only

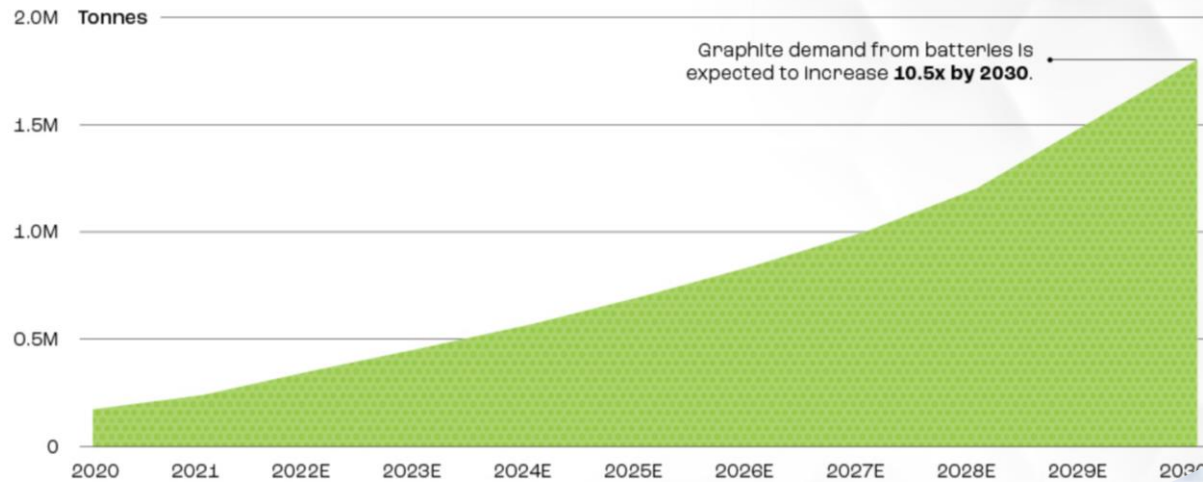
- **70% of world cobalt supply from DRC**
- **Child labour issues**
- **Ethical supply chain concerns for industry**



**Challenges
with LIB
Ethical Cobalt
Supply**

- China produces 90% LIB graphite material
- Geo political supply chain risk
- Environmental & social governance concerns

Graphite Demand from Li-ion Batteries 2020–2030E



Source: BloombergNEF

Challenges
with LIB

Graphite Supply

ersonal use only

The looming copper crunch and why recycling can't fix it

[Nelson Bennett - Business in Vancouver](#) | July 25, 2022 | 11:28 am [Intelligence Canada](#) [Europe](#) [USA](#) [Copper](#)

- Copper is a high priced metal
- EV vehicle requires 2.5 times more copper ICE
- There simply aren't enough copper mines being built
- Not enough copper needed for 27 million EVs

**Challenges
with LIB
Looming Copper
Crunch**

Fire Proof ?

Large Temp Range ?

> 15 years life ?

&

Lithium Free?

Cobalt Free?

Graphite Free?

Copper Free?

Manganese Free?

Challenges
with LIB

Is such a battery even possible ?

Personal use only





- No volatile flammable electrolyte
- Does not contain plastic separator
- Replaced with ceramic tube (solid state)
- Thermal runaway not possible
- Does not generate oxygen in cathode
- Safe in flooding and sensitive environments

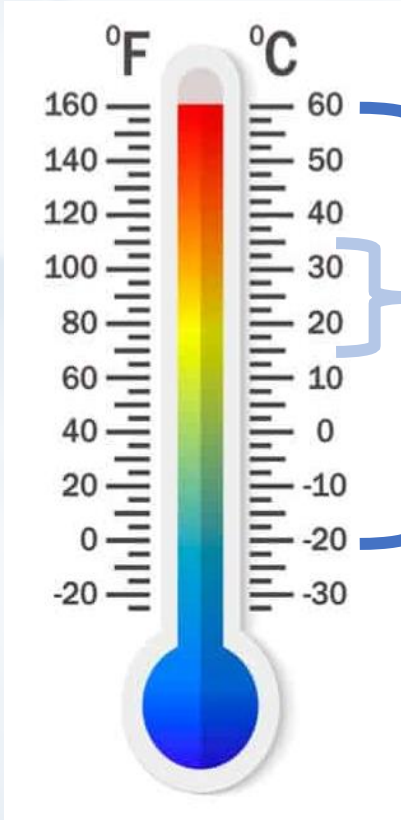
Fire Proof



**SAS Batteries
Fire Explosion
Proof**

cerenergy®

ersonal use only



- No liquid electrolyte – solid ceramic
- Large operating range
- Temperature range -40°C to $+60^{\circ}\text{C}$
- Operates around 270°C internally
- Fully insulated – touch on outside
- Ideal in cold and desert climates

Large Temp Range ✓

SAS Batteries
Cold Desert
Climates





- No liquid electrolyte, no deterioration
- No loss of sodium ions or side reactions
- 5,000 cycles and over fifteen years life

> 15 years life



SAS Batteries
Ultra long
battery lifespan

ersonal use only



- Sodium is next reactive to lithium
- Common salt is cheap and available
- Not exposed to rising lithium prices

Lithium Free



SAS Batteries
uses common
salt (sodium)





- No cobalt is used in the SAS battery
- Cathode is sodium chloride and nickel
- Different chemistry
- No exposure to cobalt supply chain issues

Cobalt Free



**SAS Batteries
Cobalt Free**

ersonal use only



- No graphite or copper in SAS battery
- No anodes - self forming anode when charging
- Sodium anode dissolves on discharge
- Not exposed to graphite and copper supply chain issues

Graphite Free



Copper Free



SAS Batteries
No graphite
copper anodes

cerenergy®

ersonal use only

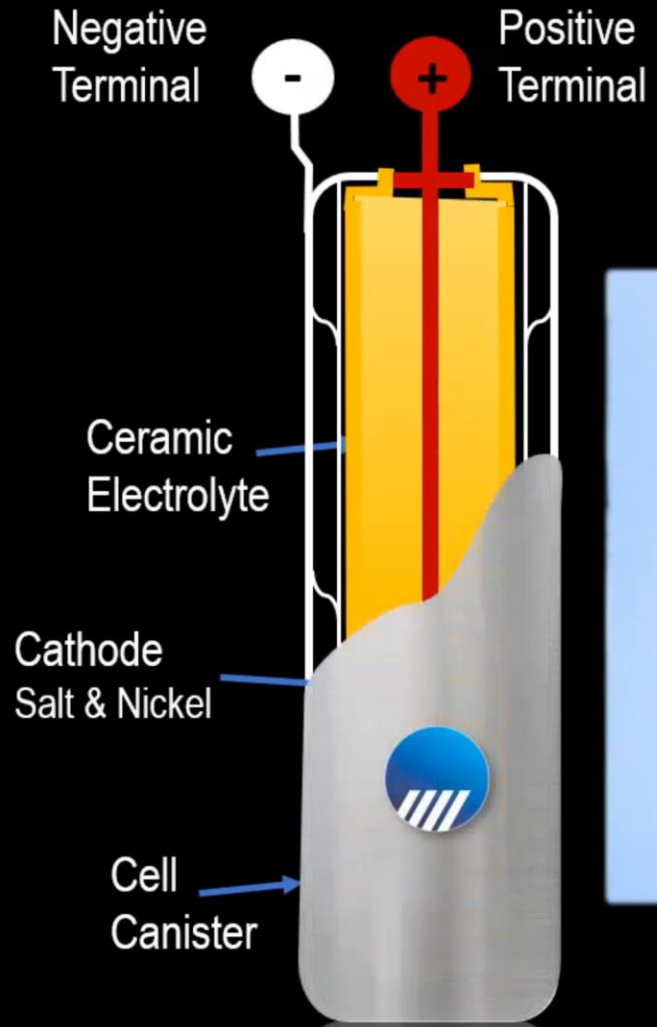
ersonal use only

How Does The SAS Battery Works?

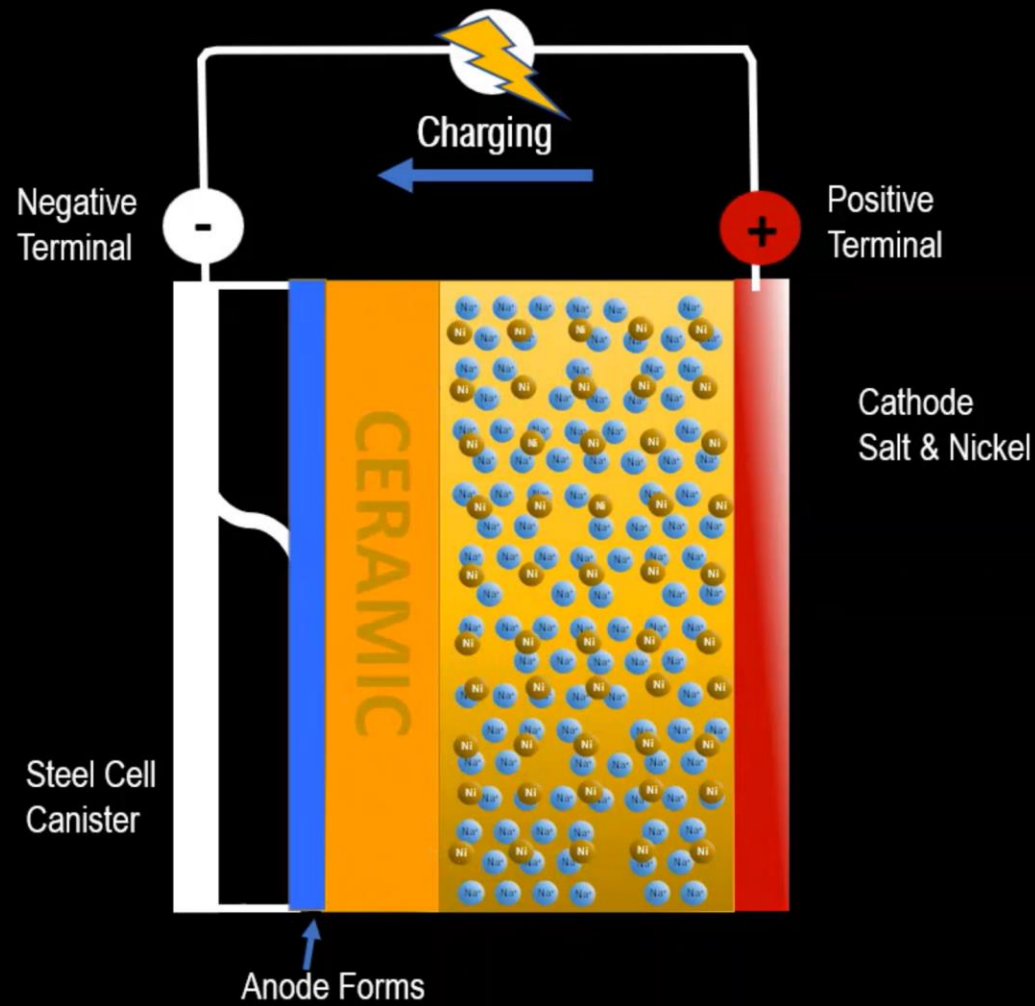


ALTECH
cerenergy[®]
Sodium Alumina Solid State Batteries

ersonal use only



ersonal use only

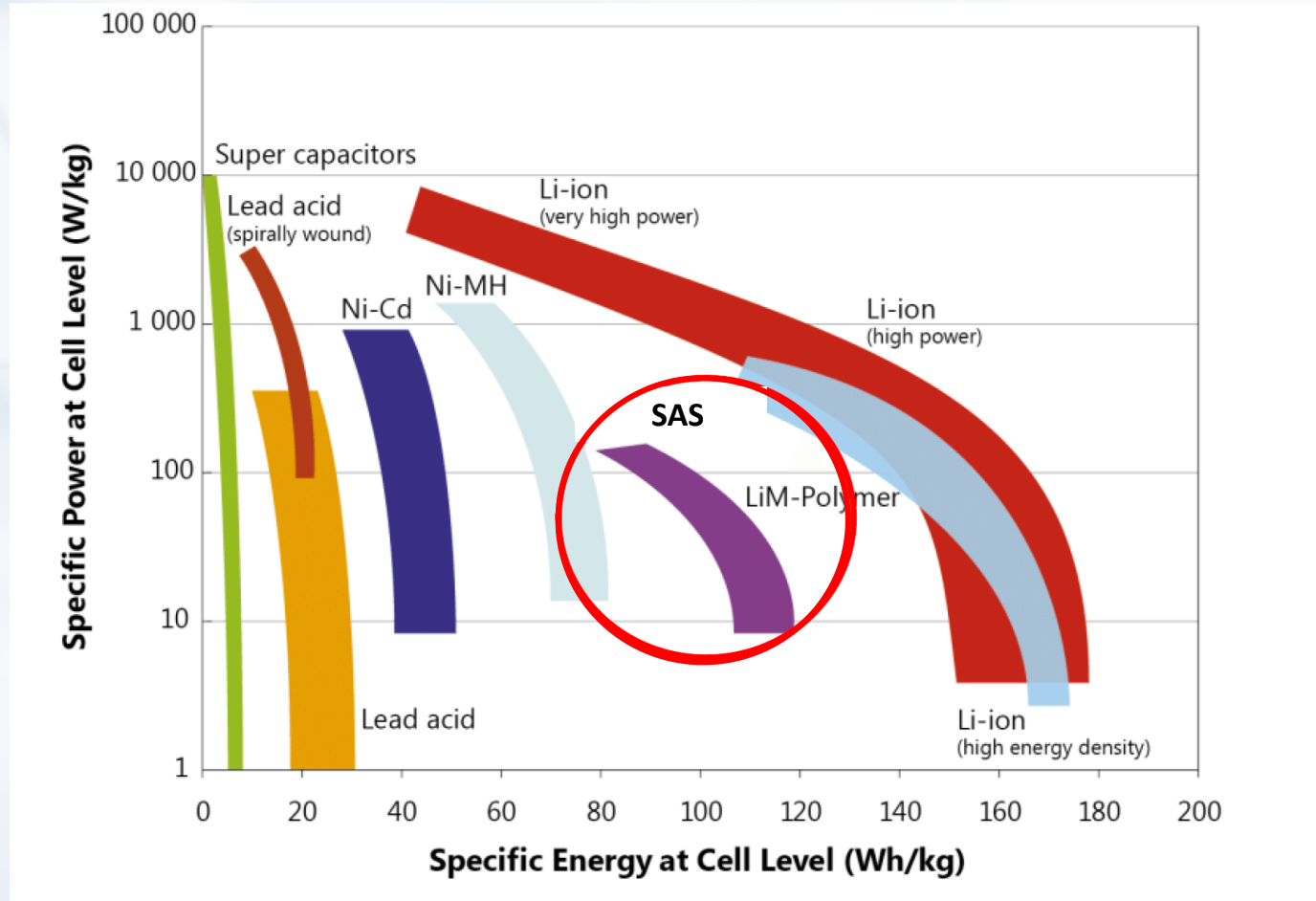




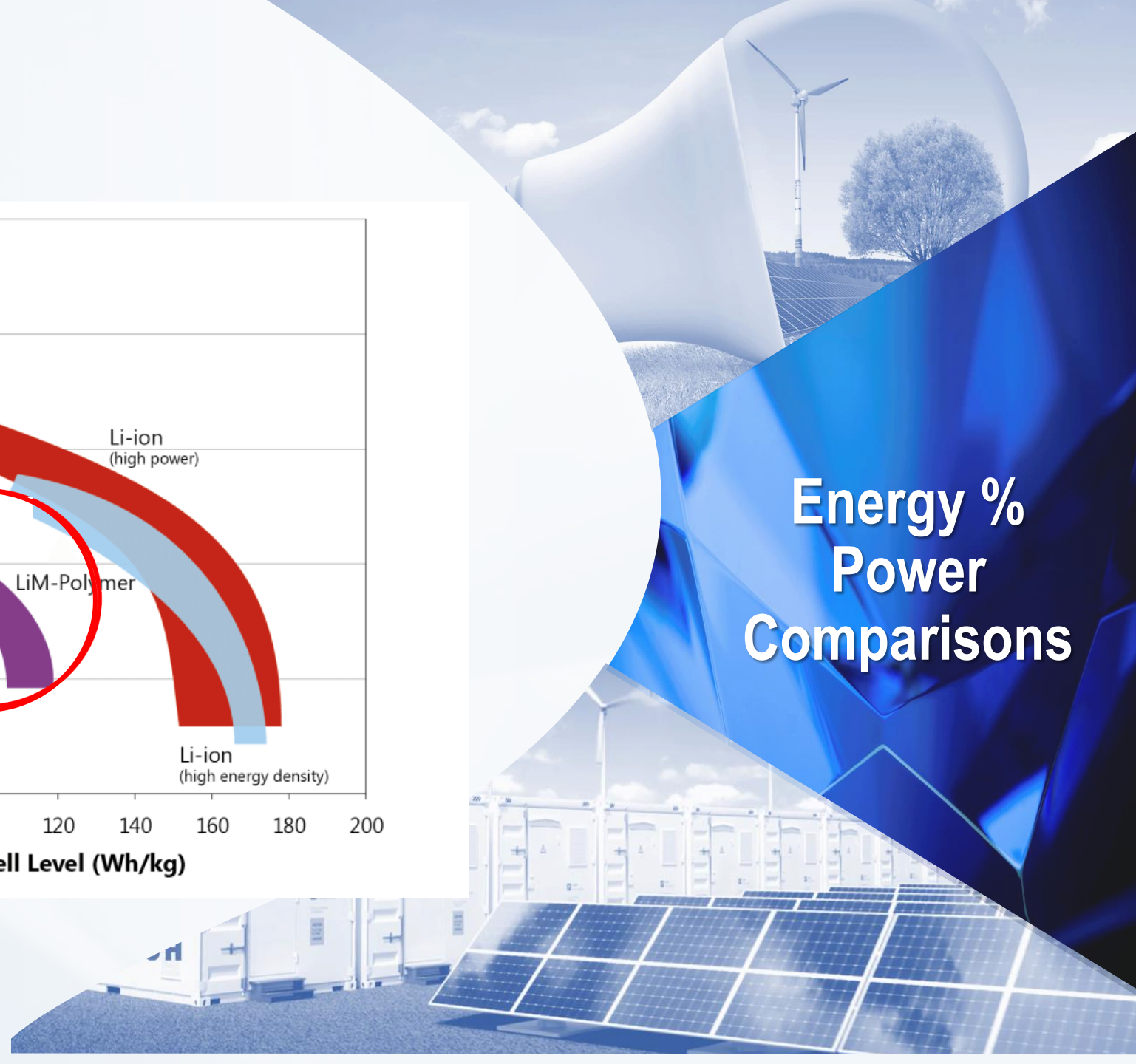
Battery Types Comparison

	Cerenergy Battery		Redox Flow Battery		LFP Battery	
Practical Energy Density (Wh/kg)	100-120	✓	10-25		120-160	✓
Energy Conversion Efficiency	80-85%	✓	70%		75-80%	✓
Cycle Life	>6,000	✓	12,000	✓	3,000 – 5,000	
Safety	Very High	✓	High	✓	Medium	
Capex	Low	✓	High		Medium	✓
Operating Temp (°C)	-40 to 60	✓	Sensitive to temp		15 to 35	✓
Self-discharge, %/day	0	✓	small		0.1-0.3	
Maintenance Cost, USD/kW	minimal	✓	28		10	

ersonal use only



Energy % Power Comparisons





- **SAS equivalent to LFP lithium-ion batteries**
- **Volume and weight less critical**
- **Grid, back up, peak shaving, renewable integration**
- **Grid storage growing at 28% CAGR**
- **US\$4 b in 2021 to grow to US\$15b in 2025**
- **20 GW in 2020 expected to grow 3,000 GW in 2050**

**Grid storage of
the future**

ersonal use only

ersonal use only

Ready to Commercialise



ALTECH

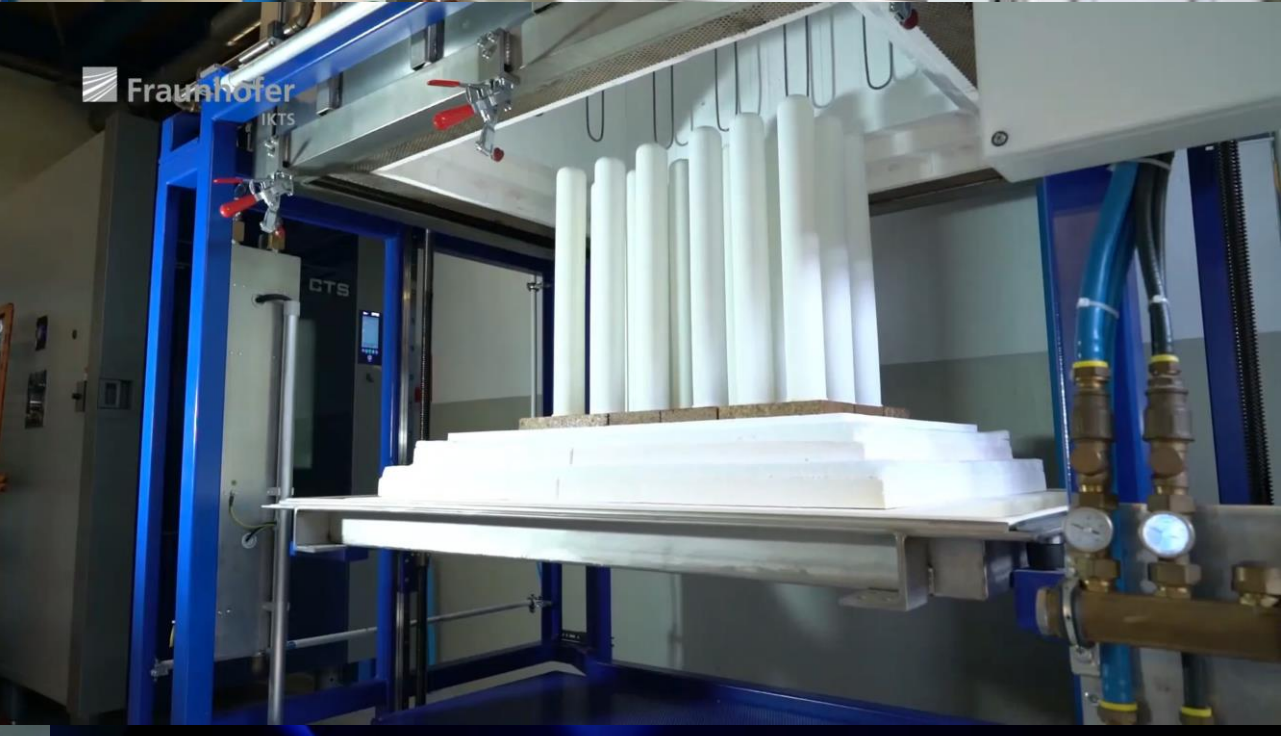
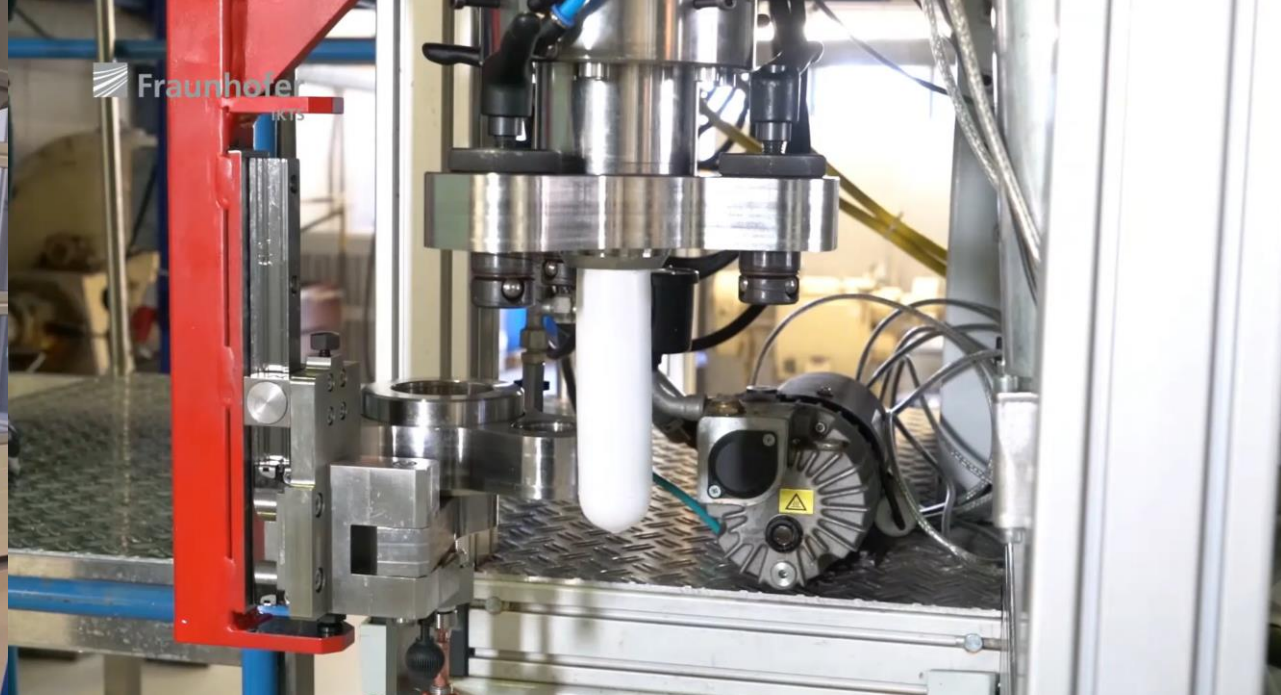
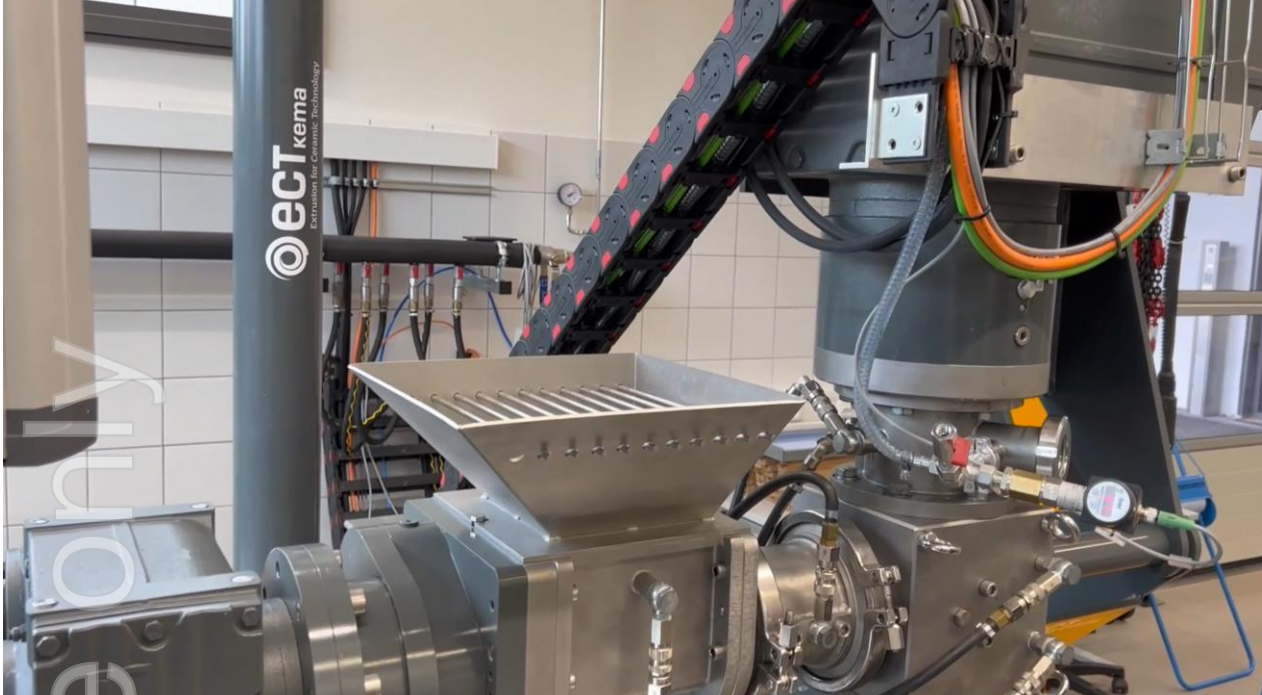
cerenergy[®]

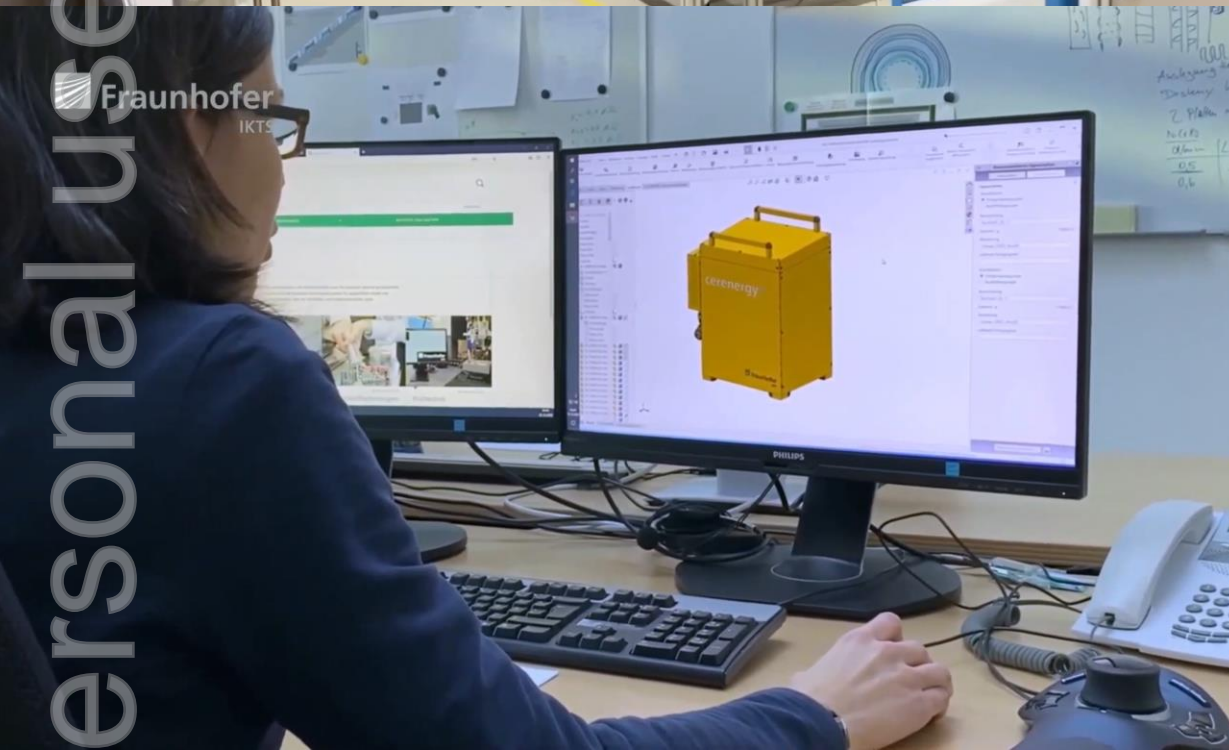
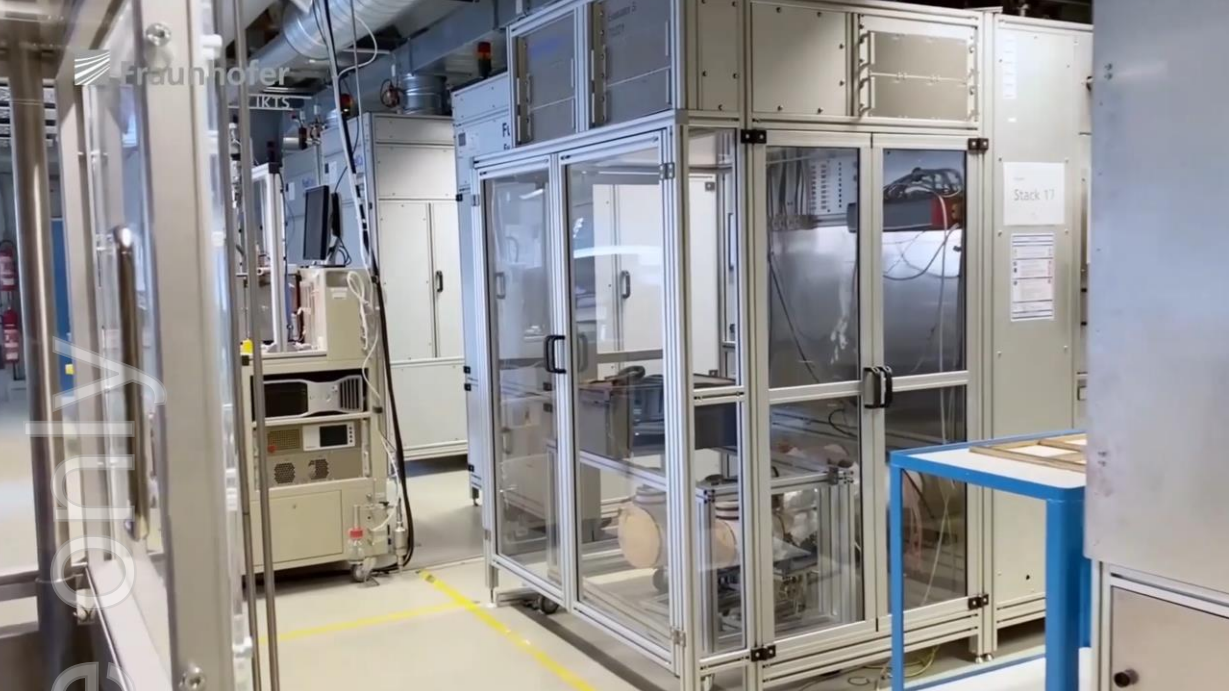
Sodium Alumina Solid State Batteries

- **IKTS spent EUR 35 m on R&D over 8 years**
- **Operating pilot plant EUR 25 m in Hermsdorf, Germany**
- **Produced operating battery modules**
- **Successful and ready to commercialize**
- **Partner with land, funding, entrepreneurship, project builders**
- **Altech met that criteria and the Joint Venture was formed**

**Well advanced
& ready to
commercialize**







ersonal use only

100 MWh Project, Saxony
Altech 75%
Fraunhofer 25%



ALTECH
cerenergy[®]
Sodium Alumina Solid State Batteries

ersonal use only



Germany

Leipzig

Dresden

**Cerenergy
Battery Plant**

Saxony

Poland

ersonal use only

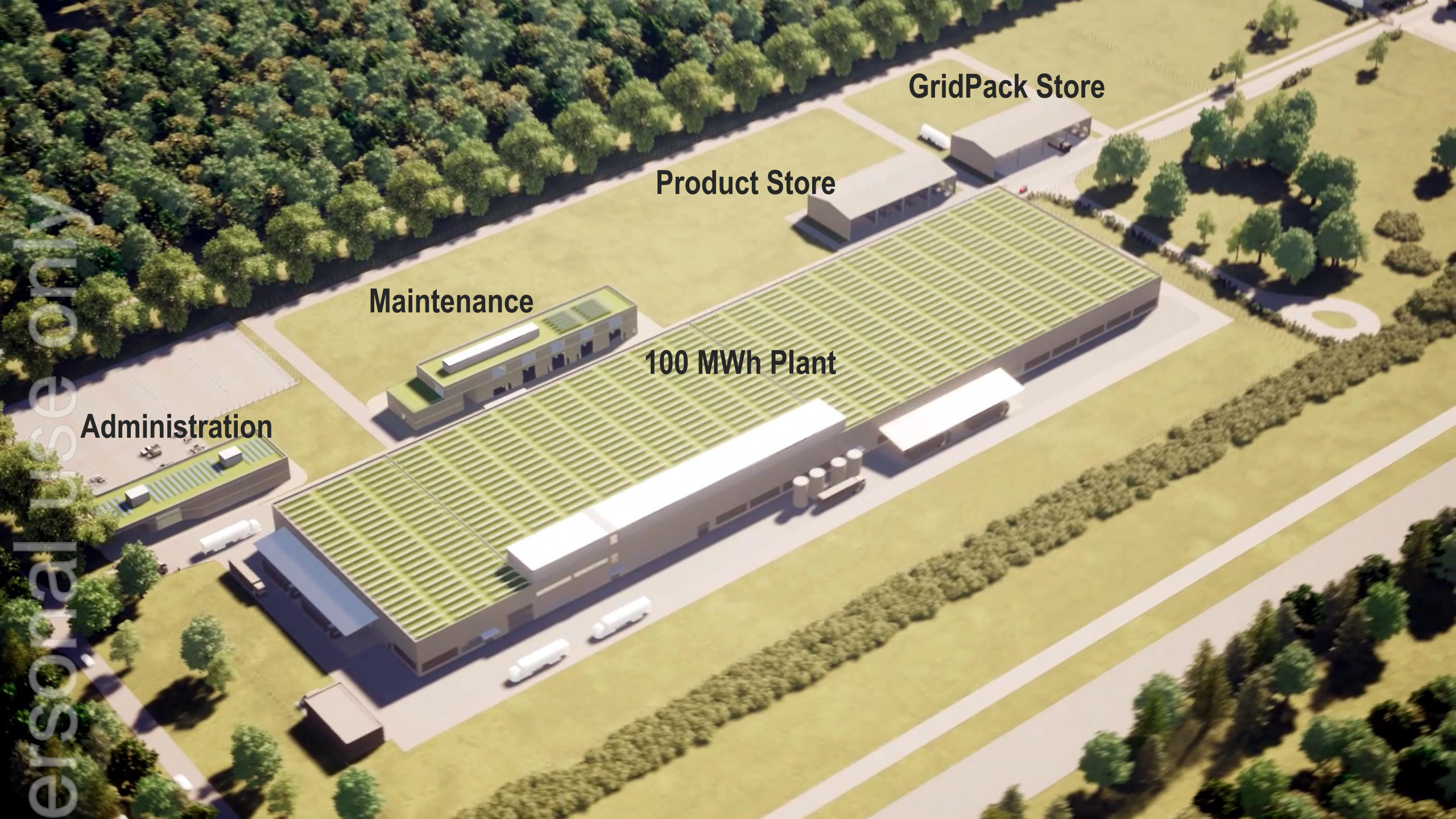
Administration

Maintenance

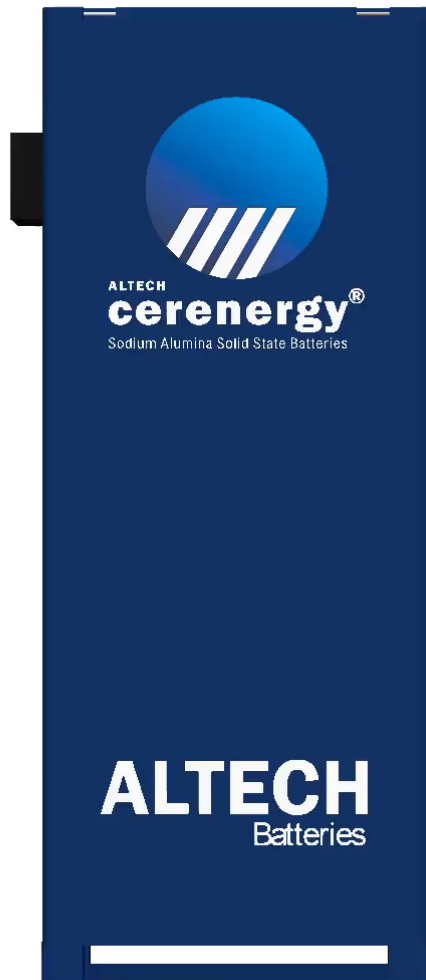
100 MWh Plant

Product Store

GridPack Store



ersonal use only



240 cells
5 x 48 cells

60 KWh
100 Ah
620 volts

**Launch of 60
KWh Battery
Pack (ABS60)**



- **Extensive time to install**
- **Complex configuration and connection**
- **Noisy from cooling fans**
- **Take up lots of valuable space**
- **Requires regular maintenance**
- **Costs of installed batteries**

**Problems with
Grid storage
Li-ion batteries**

ersonal use only



GridPack

GridPack

GridPack

GridPack

ALTECH

ALTECH

ALTECH

ALTECH

GridPack

GridPack

GridPack

GridPack

ALTECH

ALTECH

ALTECH

ALTECH

Personal use only





- **Plug and play solution**
- **Installed batteries in sea container**
- **Pre-configured and connected to Power Mge System**
- **No noise, no maintenance**
- **Stackable - reducing battery footprint**
- **Robust, meets all weather conditions**

**Launch of
1MWh
GridPack**

ersonal use only

ersonal use only

*Within 5 mins of arriving you
can have 1 MWh battery
connected to your system*



Forward Looking Statements

Forward-looking Statements

This announcement contains forward-looking statements which are identified by words such as 'anticipates', 'forecasts', 'may', 'will', 'could', 'believes', 'estimates', 'targets', 'expects', 'plan' or 'intends' and other similar words that involve risks and uncertainties. Indications of, and guidelines or outlook on, future earnings, distributions or financial position or performance and targets, estimates and assumptions in respect of production, prices, operating costs, results, capital expenditures, reserves and resources are also forward looking statements. These statements are based on an assessment of present economic and operating conditions, and on a number of assumptions and estimates regarding future events and actions that, while considered reasonable as at the date of this announcement and are expected to take place, are inherently subject to significant technical, business, economic, competitive, political and social uncertainties and contingencies. Such forward-looking statements are not guarantees of future performance and involve known and unknown risks, uncertainties, assumptions and other important factors, many of which are beyond the control of our Company, the Directors and management. We cannot and do not give any assurance that the results, performance or achievements expressed or implied by the forward-looking statements contained in this announcement will actually occur and readers are cautioned not to place undue reliance on these forward-looking statements. These forward looking statements are subject to various risk factors that could cause actual events or results to differ materially from the events or results estimated, expressed or anticipated in these statements.

The green bonds terms referred to in this ASX announcement are indicative in nature; are non-binding; and contain the general terms of proposed a transaction. Any future commitment for the bonds will be subject to and is contingent upon all internal approvals of the structuring agent as well as the satisfactory completion of detailed due diligence (including but not limited to HPA market, legal and technical due diligence) and legally binding documentation including senior lender and inter-creditor agreements. There is no certainty that the green bond facility will be approved or that a transaction will be concluded based on what is contemplated in the term sheet. The Company makes no representations or warranties whatsoever as to the outcome of the green bond finance process.

Competent Persons Statements – Meckering Kaolin Deposit

The information in this announcement that relates to Mineral Resources and Ore Reserves is extracted from the report entitled "Maiden Ore Reserve at Altech's Meckering Kaolin Deposit" released on 11 October 2016; the report is available to view on the Company's website www.altechchemicals.com. The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and, in the case of estimates of Mineral Resources and Ore Reserves, that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcement.