What’s the future of Grid Storage Batteries?

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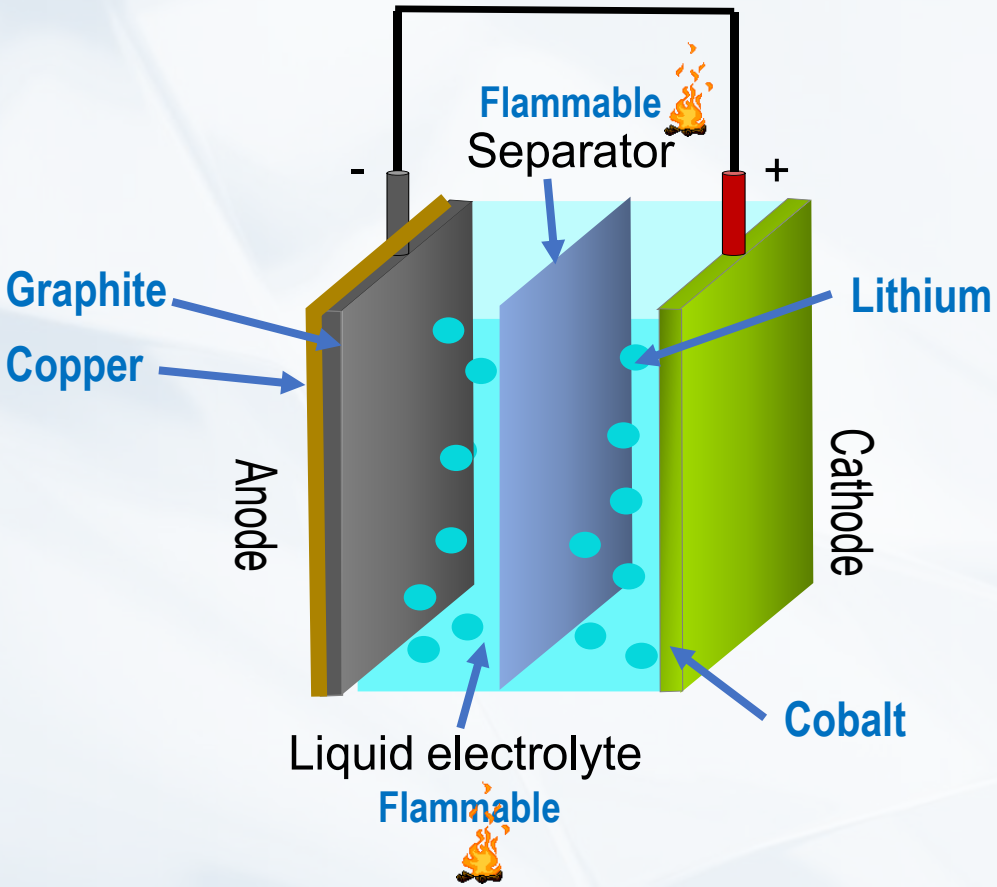
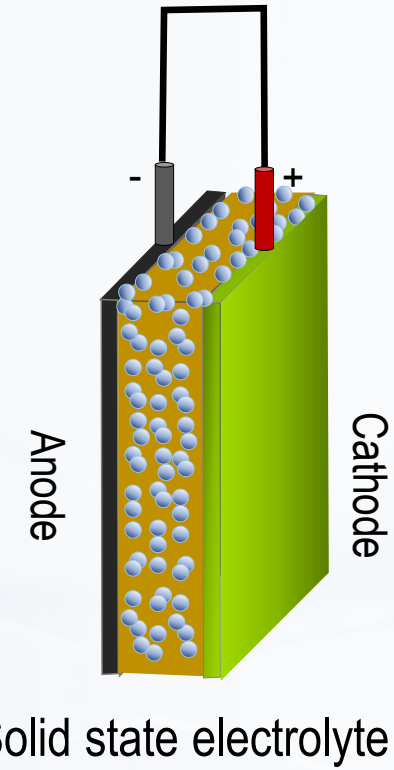
Lithium-ion Battery moving to Solid State





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Challenges with LIB Fire Explosion

- 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

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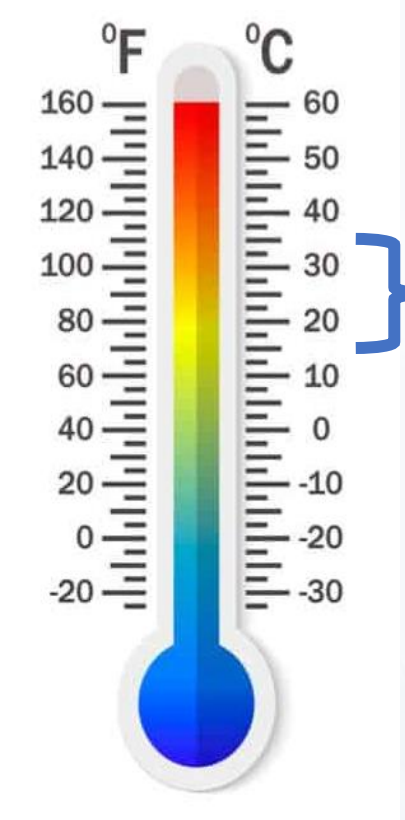

- Temp range +15°C to +35°C
- Narrow operating range
- Liquid electrolyte viscous – slows lithium reactions
- @ 0°C capacity reduced to 70%
- Unsuitable in cold and desert climates

Challenges with LIB cold/desert climates

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Challenges with LIB Battery Lifespan

- 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 expected[1]

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

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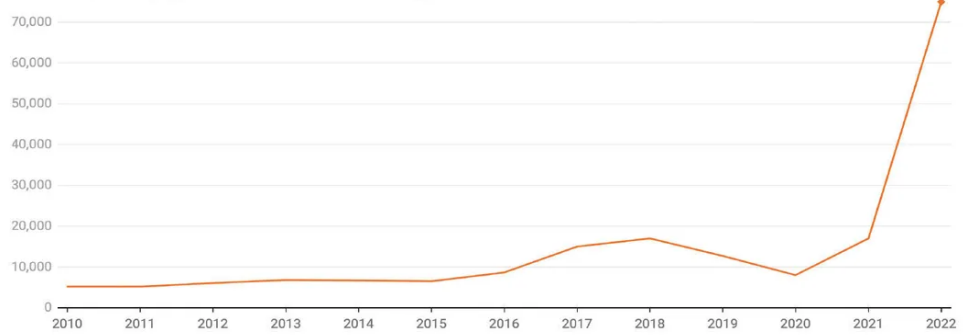
Economy | Climate Crisis

‘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 LIB

Lithium Prices

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Challenges with LIB Ethical Cobalt Supply

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

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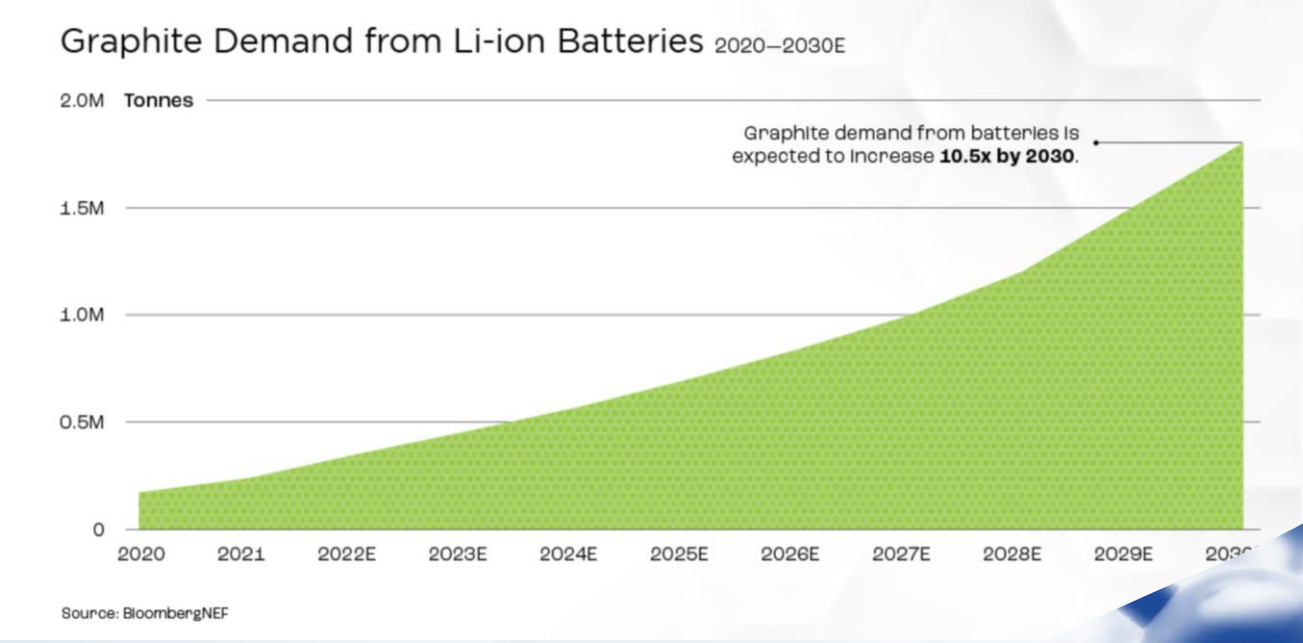
Challenges with LIB

Graphite Supply

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



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Challenges with LIB Looming Copper Crunch

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

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Challenges with LIB

- Fire Proof ?
- Large Temp Range ?
- > 15 years life ?

&

- Lithium Free?
- Cobalt Free?
- Graphite Free?
- Copper Free?
- Manganese Free?

Is such a battery even possible ?


cerenergy®


cerenergy®

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- 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

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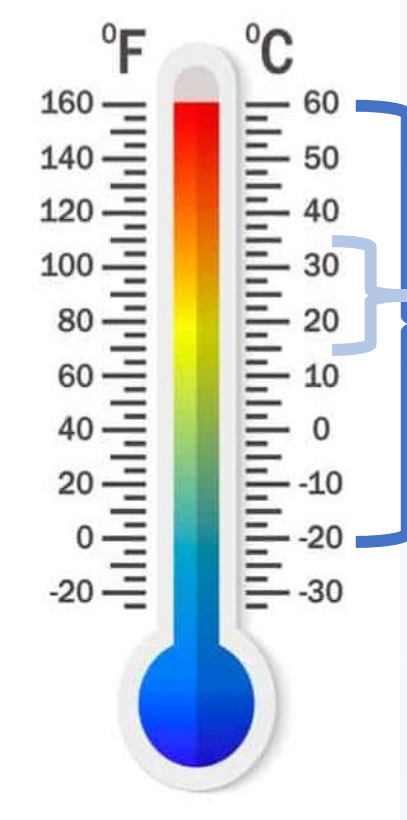

- No liquid electrolyte – solid ceramic
- Large operating range
- Temperature range -40°C to +60°C
- Operates around 270 °C internally
- Fully insulated – touch on outside
- Ideal in cold and desert climates

Large Temp Range ✓

SAS Batteries Cold Desert Climates

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SAS Batteries Ultra long battery lifespan

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

> 15 years life

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- 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)

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SAS Batteries Cobalt Free

- 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

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- 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 ✓

How Does The SAS Battery Works?

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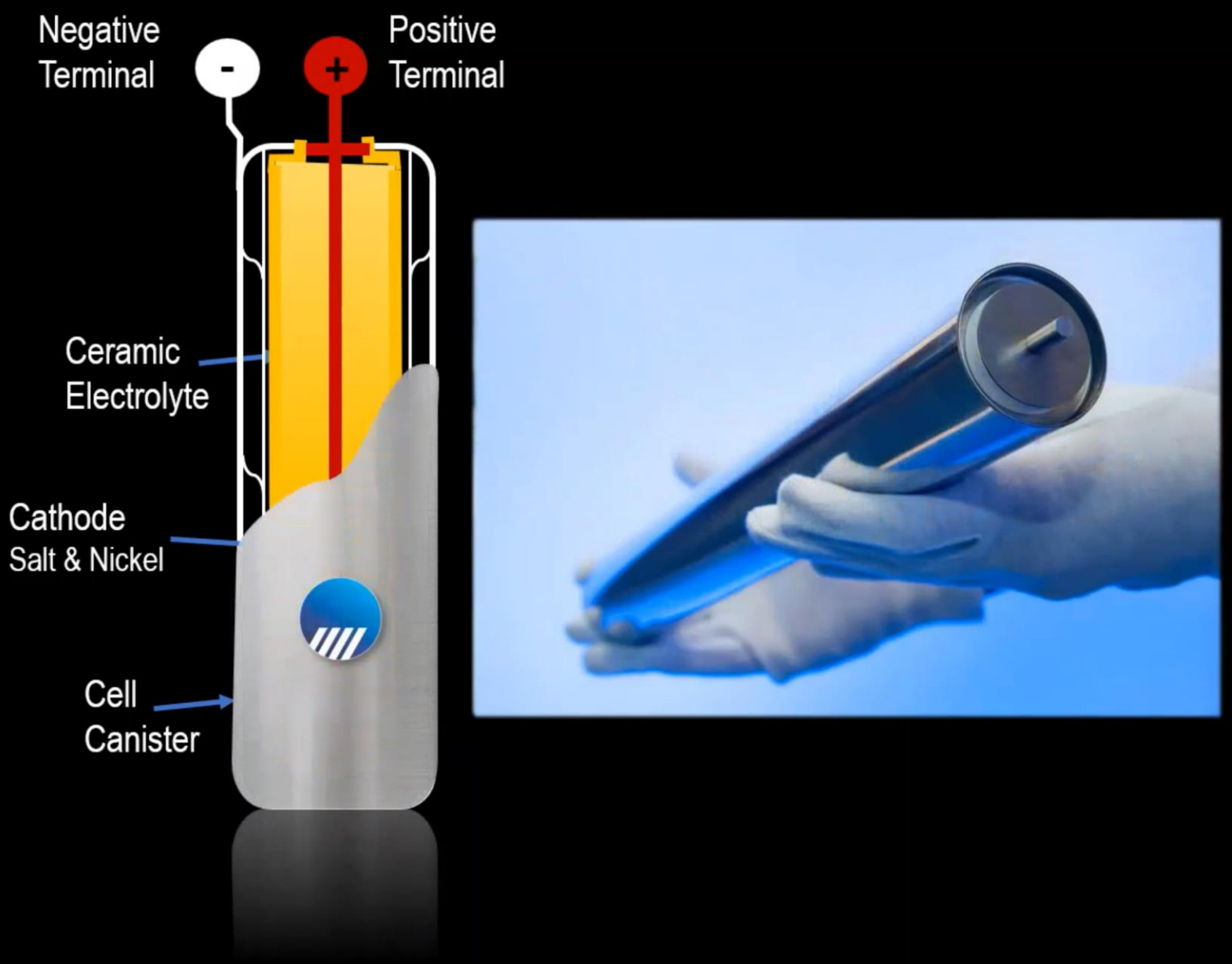
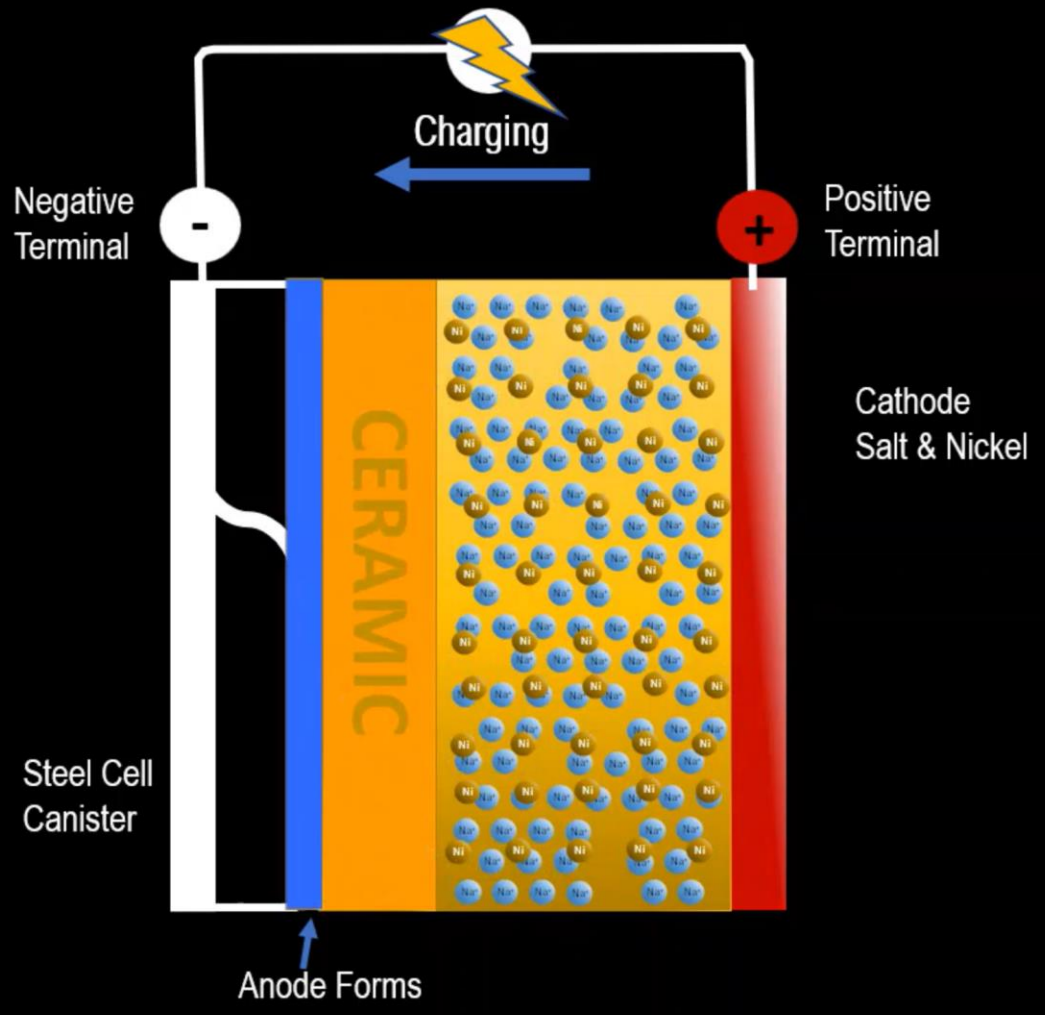
Sodium Alumina Solid State Batteries


Negative
Terminal
-
+
Positive
Terminal
Ceramic
Electrolyte
Cathode
Salt & Nickel
Cell
Canister


Charging
Negative Terminal
Positive Terminal
CERAMIC
Cathode Salt & Nickel
Steel Cell Canister
Anode Forms

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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

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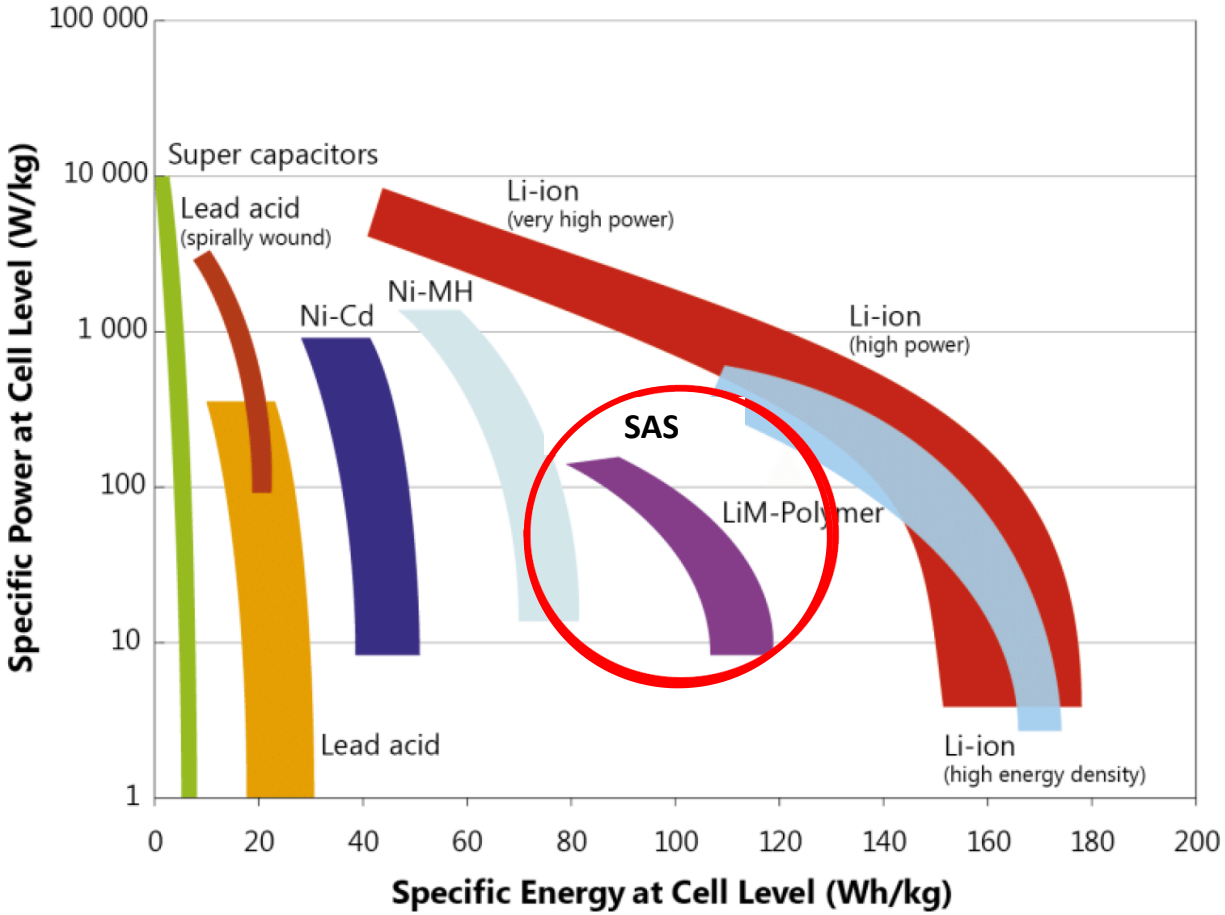

Energy % Power Comparisons

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Grid storage of the future

- 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

Ready to Comercialise

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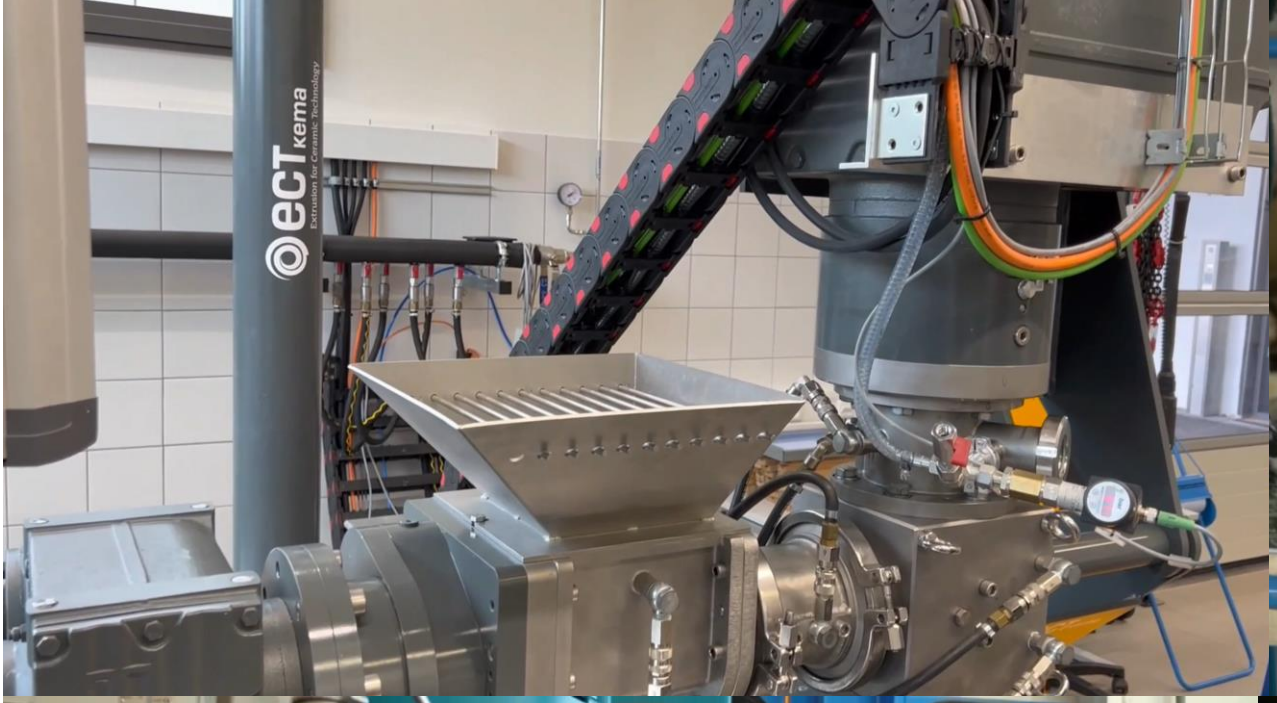
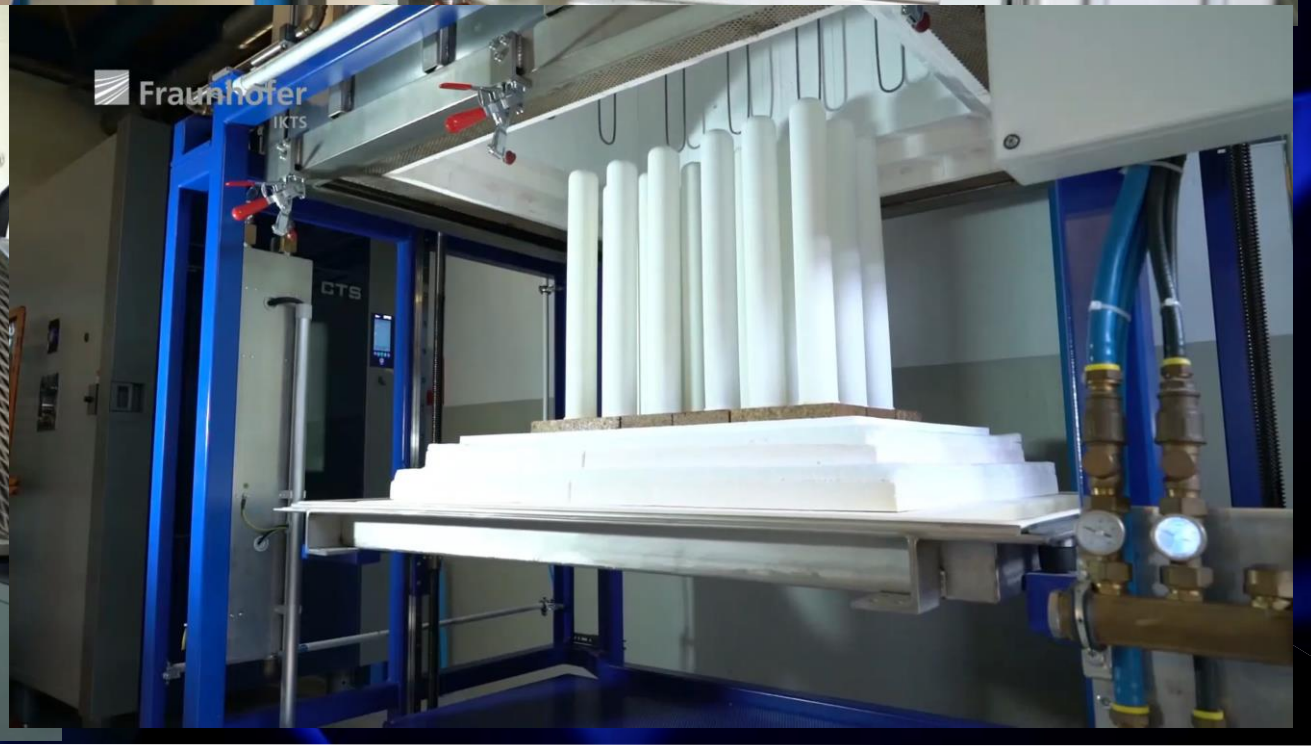
Sodium Alumina Solid State Batteries

- IKTS spent EUR 35 m on R&D over 8 years
- Operating pilot plant EUR 25 m in Hermsdolf, 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


ect kema
Extrusion for Ceramic Technology


Fraunhofer
IKTS


Fraunhofer
IKTS


Fraunhofer
IKTS
CTS


Fraunhofer
IKTS
Stack 17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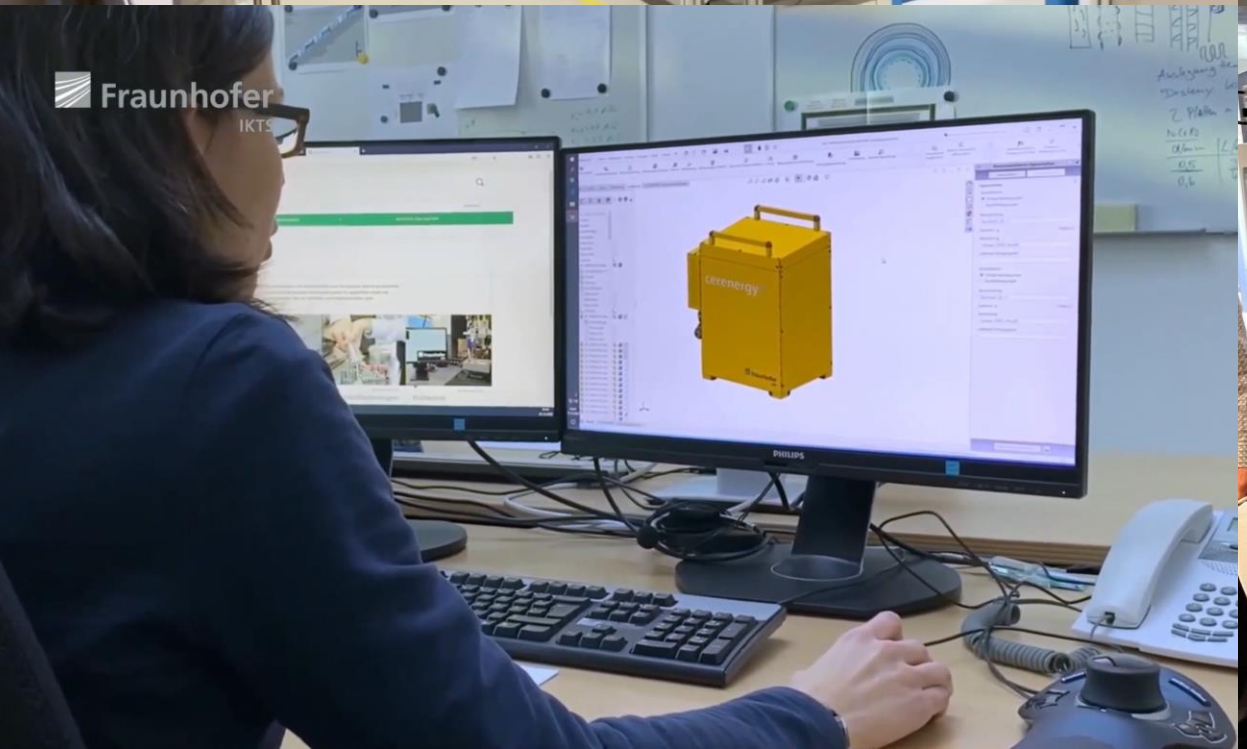
Fraunhofer
IKTS
cerenergy
PHILIPS


UniBaT
Fraunhofer

100 MWh Project, Saxony
Altech 75%
Fraunhofer 25%

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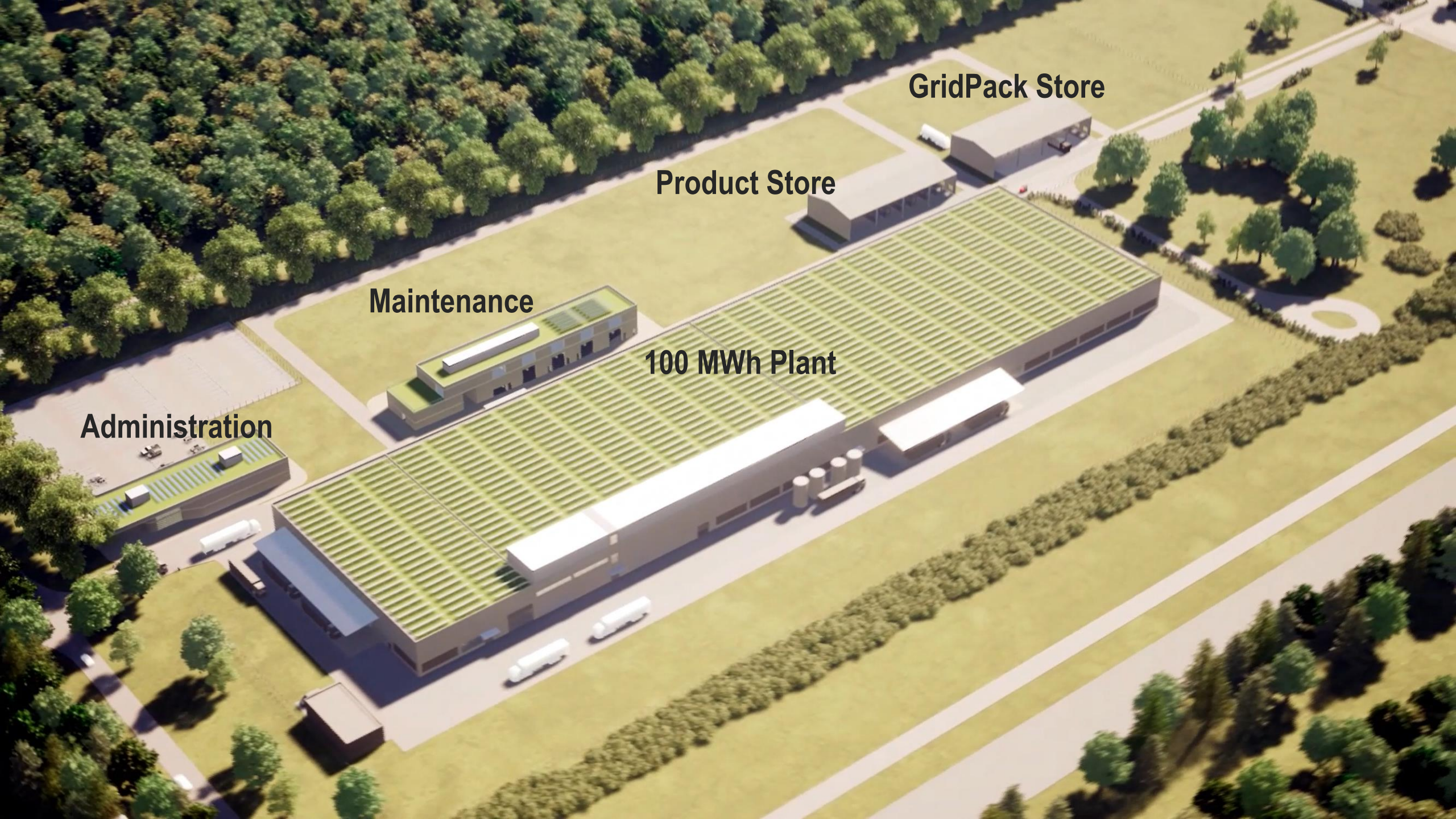
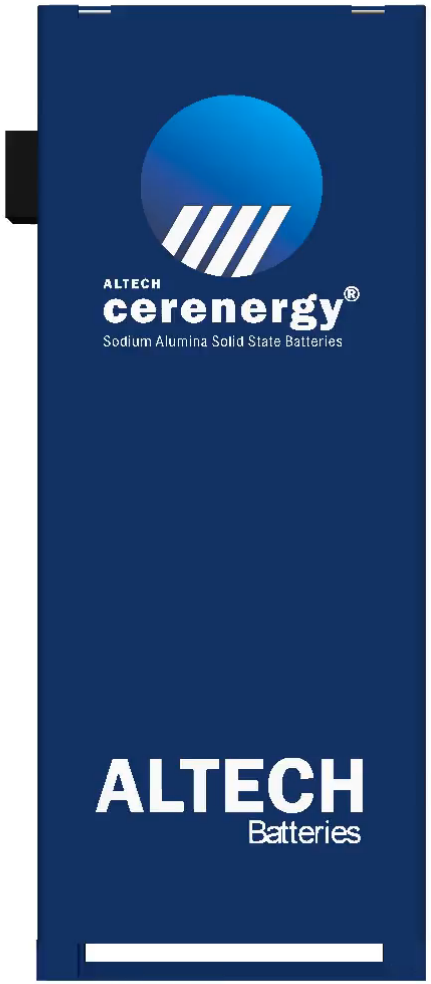
Sodium Alumina Solid State Batteries


Cerenergy
Battery Plant
Leipzig
Dresden
Germany
Saxony
Poland


GridPack Store
Product Store
Maintenance
100 MWh Plant
Administration



240 cells
5 x 48 cells

60 KWh
100 Ah
620 volts

Launch of 60 KWh Battery Pack (ABS60)

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Problems with Grid storage Li-ion batteries

- 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


GridPack
GridPack
GridPack
GridPack
GridPack
GridPack
GridPack
GridPack


GridPack
ALTECH

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Launch of 1MWh GridPack

- 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

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.