14 September 2022

ALTECH – TO COMERCIALISE 100 MWh SODIUM ALUMINA SOLID STATE BATTERIES FOR GRID STORAGE

Highlights

- Majority ownership (75%) of a joint venture with Fraunhofer IKTS
- 100 MWh Sodium Alumina Solid State (CERENERGY®) battery project in Saxony
- IKTS developed the technology over 8 years and is ready to commercialize
- €35 million spent on R&D and €25 million on operating pilot plant
- CERENERGY® batteries are fire and explosion proof
- Operates in extreme cold and desert climates
- Ultra-long life sometimes twice the lifespan of lithium-ion batteries
- Uses common salt instead of expensive lithium
- Lithium-free, graphite-free, copper-free, and cobalt free
- Pure solid-state technology for the electrolyte

Altech Chemicals Limited (Altech/the Company) (ASX: ATC) (FRA: A3Y) is excited to announce that it has executed a Joint Venture Shareholders' Agreement with world-leading German battery institute Fraunhofer IKTS ("IKTS") to commercialize IKTS' revolutionary CERENERGY® Sodium Alumina Solid State (SAS) Battery. Altech, inclusive of associated entity Altech Advanced Materials AG, will be the majority owner at 75% of the JV company, which will commercialize a 100 MWh project to be constructed on Altech's land in Schwarze Pumpe, Germany. The SAS CERENERGY® battery uses common table salt and ceramic solid-state technology.

SAS CERENERGY® BATTERIES

Altech believes that Sodium Alumina Solid State (SAS) CERENERGY® batteries are the game-changing grid storage alternative to lithium-ion batteries. CERENERGY® batteries are fire and explosion-proof, have a life span of more than 15 years and operate in extreme cold and desert climates. The battery technology uses table salt and nickel - is lithium-free; cobalt-free; graphite-free; and copper-free, eliminating exposure to critical metal price rises and supply chain concerns.

For more information on the advantages of CERENERGY® batteries watch the following YouTube video https://youtu.be/UBwxxgEJHvo

The SAS technology has been developed by Fraunhofer IKTS over the last eight years and has revolutionized previous technology, allowing higher energy capacity and lower production costs. SAS-type batteries, in terms of capacity, have already been successfully tested in stationary battery modules. The IKTS SAS batteries are in the final phase of product testing and ready to commercialise. IKTS has spent in the region of EUR 35 million on research & development and operates a EUR 25 million pilot plant in Hermsdorf, Germany. The final CERENERGY® battery modules, at 10 KWh each, are specially designed for the grid storage market and have been undergoing extensive performance testing in Germany. These modules are designed to fit in racks housed in sea containers that can be deployed for grid storage.

For more information on the IKTS CERENERGY® pilot facility and final battery modules watch the following YouTube video https://youtu.be/UBwxxgEJHvo

IKTS has been looking for an entrepreneurial partner that has German land available, has access to funding, is a builder of projects, has battery background, and has technology in alumina used in ceramics. Altech fitted the criteria, and the Joint Venture Shareholders' Agreement was executed. Altech group will own 75% of the project with IKTS 25% free carried. The intellectual property will be licensed exclusively to the joint venture.

The joint venture partners have elected to develop a 100 MWh SAS battery plant (Train 1) on Altech's site in Saxony, Germany. The target market for this project will specifically focus on the grid (stationary) energy storage market which is expected to grow by 28% CAGR (Compound Annual Growth Rate) in the coming decades. The global grid energy storage market is expected to grow from USD 4.4 billion in 2022 to USD 15.1 billion by 2027. Or further out, the market is expected to grow from 20 GW in 2020 to over 3,000 GW by 2050. Altech believes that SAS batteries can provide high security, at low acquisition and operating costs, for the stationary energy storage market.

The proposed battery plant will produce 10,000 SAS battery modules per annum, rated at 10 KWh each. These SAS battery modules are expected to sell for between EUR 7,000-9,000 per module, or EUR 700-900 per KWh, at final pack costs. IKTS has estimated that the total cost of production for CERENERGY® batteries will be 40%-50% cheaper than lithium-ion batteries.

The joint venture partners have commenced the planning process for the Bankable Feasibility Study required for the commercialisation process. Once the Train 1 (100 MWh) plant is built and operating, the longer-term vision for the joint venture is to construct additional trains or a Gigawatt battery facility.

Challenges with Lithium-ion batteries

Fire and Explosion Issues

One of the significant drawbacks of lithium-ion batteries is the risk of thermal runaway, fire, and explosion which have been largely in the news recently. Today's lithium-ion battery contains flammable liquid electrolyte and plastic separators which is the major contributing problem to fire risk. Thermal runaway is a chain reaction within a battery cell that can be very difficult to stop once it has started. It occurs when the temperature inside a battery reaches the point that causes a chemical reaction (producing oxygen) to occur inside the battery. It is often caused by overheating, physical damage, and overcharging.

Narrow Operating Temperature Range

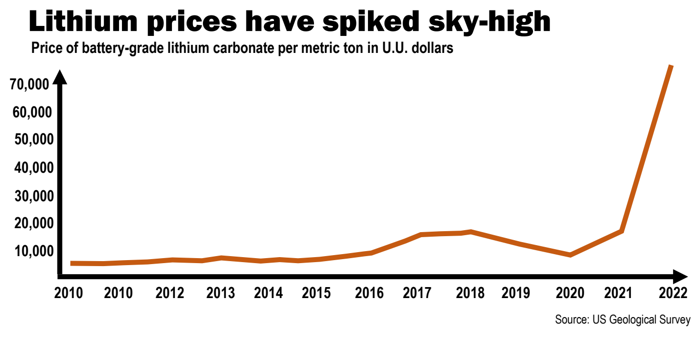
The other drawback of lithium-ion batteries is that they are required to operate in a relatively narrow temperature range which is between +15 ^{C} to +35 ^{o}C. At lower temperatures, the liquid electrolyte in the battery becomes more viscous which slows the lithium transfer and reactions. A lithium battery at 0 ^{C} will reduce a typical battery capacity down to 70%. At higher temperatures, the battery is prone to overheating and requires external cooling to maintain battery efficiency. This makes the application of lithium-ion batteries in cold and desert climates extremely challenging.

Lithium-ion Battery Lifespan

Thirdly, the life of lithium-ion batteries is still limited to between 7-10 years depending on applications. Lithium ions degrade with each charge and discharge cycle. This deterioration is often due to detrimental side reactions, dendrite growth, and the breakdown of anode and cathode structures. This degradation is much faster when the battery is operated outside the ideal temperature range. For electric vehicles (EVs), manufacturers will guarantee a battery for around 8 years when the capacity of the battery drops below 70%. For grid storage batteries, a life span of 7-10 years can be expected. There is still an expectation in the market for a longer battery life span which will help lower the overall long-term unit storage costs in grid storage.

Lithium Costs and Availability

The global market for the alkali metal lithium is growing rapidly. The price of lithium, which is the most critical component of a lithium-ion battery, has risen six-fold since the start of the year. Lithium prices have spiked sky high, putting upward pressure on the production costs associated with lithium-ion batteries. The production of lithium is concentrated in four countries, namely Australia, Chile, China, and Argentina. There is a real concern that there aren't enough mines and production capacity being developed to meet the forecast demand for both EVs as well as the stationary energy storage market.



Cobalt Supply Chain and Ethical Concerns

Cobalt is key for boosting energy density and battery life in lithium-ion batteries because it keeps the cathode layered structure stable during lithium migration and battery operation. Cobalt is considered the highest material supply chain risk for electric vehicles (EVs) in the short and medium term. EV batteries can have up to 20 kg of cobalt in every 100 kilowatt-hours (kWh) pack. The Democratic Republic of Congo (DRC) produces about 70 percent of global cobalt and the LIB industry is exposed to precarious supply chain issues. Stories of the harsh and dangerous working conditions, child labour, and human rights abuses in the DRC have caused ethical concerns about cobalt supply.

Graphite Geo-political Risk

Graphite is thus considered indispensable to the global shift towards electric vehicles. It is also the largest component in lithium-ion batteries by weight, with each battery containing 20-30% graphite. But due to losses in the manufacturing process, it takes 30 times more graphite than lithium to make the batteries. The graphite deficit has started as demand for EV battery anode ingredient exceeds supply, resulting in price increases. Today, China produces 90% of the world graphite anode material which represents a concerning geo-political risk to the industry.

Copper Crunch

Copper is mainly used as the current collector on the anode part of a lithium-ion battery. Copper is looming as the biggest worry, with the biggest driver of scarcity being the energy transition and increased EV demand. A recent report (Future of Copper) notes: "The 2050 climate objectives will not be achieved without a significant ramp-up in copper production in the near and medium term, which will be very challenging." An electric vehicle battery requires 2.5 times more copper than a standard ICE vehicle. The report notes that there simply aren't enough copper mines being built or expanded to provide all the copper needed to produce the 27 million EVs that S&P Global has forecast to be sold annually by 2030. Copper could rival oil as a national energy security concern for some countries.

The Ideal Battery?

Based on the above challenges facing lithium-ion batteries and the increasing prices of the critical materials and metals used in these batteries, the industry has been searching for a battery technology that resolves these problems. A battery that is fire and explosion proof, has a lifespan of more than 15 years, and operates in cold and desert climates. A battery technology where it is lithium free, cobalt free, graphite free and finally copper free, which limits the exposure to critical materials prices rises and supply chain concerns. Altech believes that SAS CERENERGY® batteries resolve some of the biggest problems and challenges facing lithium-ion batteries today. SAS CERENERGY® batteries are not designed to replace the successful lithium-ion batteries, but provide an ideal alternative for the stationary storage market.

ALTECH cerenergy®
Sodium Alumina Solid State Batteries

Fire Proof

SAS Batteries are Fire and Explosion Proof

SAS batteries are totally fire and explosion proof and are not prone to thermal runaway - one of the biggest advantages over lithium-ion batteries. Firstly, SAS batteries do not contain flammable liquid electrolyte or plastic separators; the electrolyte is a solid inflammable ceramic tube that allows sodium ions to transfer through it. Secondly, the battery, due to its chemistry does not contain oxides nor generate oxygen at the cathode like a lithium-ion battery does during thermal runaway. Being a much safer battery, it is ideal in indoor industrial and commercial energy storage installations. The battery is totally safe and does not react with water and is highly sort after for sensitive environments e.g. areas subject to flooding, where lithium-ion batteries are banned from these applications.

Large Temp Range

Large Operating Temperature Range - Cold and Desert climates

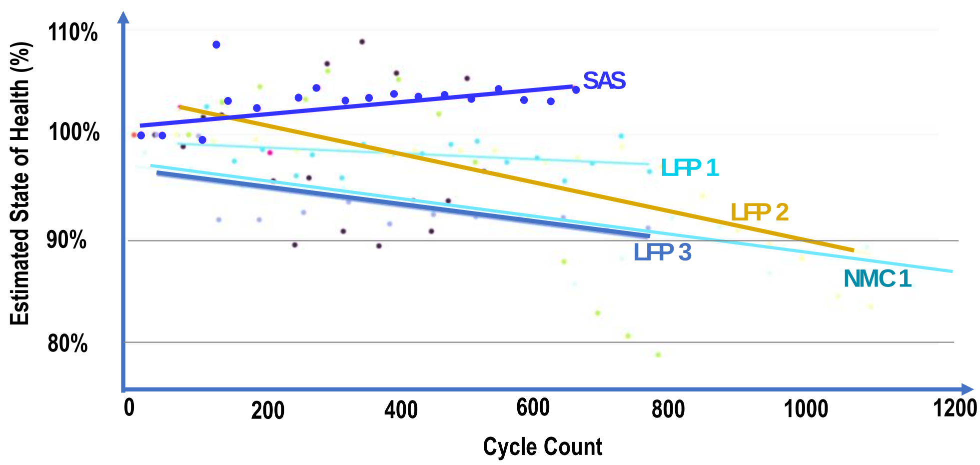
SAS batteries can operate efficiently between minus 20°C to +60 °C range and guarantee high performances and durability regardless of the ambient temperature. Because the SAS battery has no liquid electrolyte (instead solid ceramic electrolyte), ambient temperature does not adversely affect the performance of the battery. In addition, the SAS batteries are internally high temperature batteries (operates at 270-350 ^{o}C) but are fully insulated so the external of the battery module is at touch temperature. The core temperature of the battery is self-sustaining and does not require cooling like lithium-ion batteries. They are ideal grid energy storage for cold and desert climates which is the main disadvantage of the lithium-ion batteries. For this reason, the SAS battery has its own specific market without any competition from lithium-ion batteries.

> 15 years life

SAS Battery Life Span

Unlike lithium-ion batteries, there is no sodium ion degradation with each charge and discharge. There is no first cycle loss, no detrimental side reactions, no dendrite growth, or breakdown of anode and cathode structures. The absence of liquid electrolyte replaced with solid ceramic means there is virtually no sodium deterioration in the battery. The life span of an SAS battery is beyond 15 years. In a recent study by ITP Renewables, the SAS type battery did not show any deterioration in estimated state of health in the first 700 cycles of testing, compared with the normal deterioration in LFP and NMC lithium-ion batteries. See Figure A. SAS type batteries have been reported with lifetimes of over 2,000 cycles and twenty years has been demonstrated with full-sized batteries, and over 4,500 cycles and fifteen years with 10 and 20-cell modules.

Figure A – Life span testing of various batteries including SAS-type batteries



Source: ITP Renewables Public Report 11 Lithium-ion Battery Testing Sep 2021

Lithium Free Battery

Lithium Free

SAS batteries do not contain lithium but use sodium ions from common table salt. In fact, the cathode consists of common salt (sodium chloride) and nickel. Sodium is the next reactive alkali metal on the periodic table under lithium (Li is -3.05 V whilst Na is -2.7 V) and is equally ideal for energy storage in batteries. Salt is not a critical element, is many times cheaper than lithium and is readily available everywhere. SAS technology is different from sodium-ion batteries or sodium sulphur batteries. SAS batteries are not exposed to rising lithium prices and potential supply constraints of lithium globally.

Cobalt Supply Chain and Ethical Concerns

Cobalt Free

No cobalt is used in an SAS battery. As mentioned previously, the cathode consists of salt and nickel in a sodium aluminium chloride medium. Due to the chemistry of the battery, there is no requirement for a cathode layered structure like lithium-ion batteries so there is no requirement for cobalt. SAS batteries have no exposure to cobalt's ethical or supply chain issues. SAS batteries have excellent specific energy of 110-130 Wh/kg compared to LFP lithium-ion battery of 90-160 Wh/kg.

Graphite and Copper Supply Risks

Graphite Free

Copper Free

The other unique feature of the SAS battery is that it does not contain any graphite or copper in the anode side of the battery. In fact, there is no anode in the SAS battery. The anode only forms during the charging process as a molten sodium film between the steel electrode and outer edge of the ceramic electrolyte. Similarly, the molten sodium anode dissolves during the discharging process of the battery. Instead of copper as the negative collector in the lithium-ion battery, a steel canister acts as the negative electrode in a SAS battery. The SAS battery is graphite-free and copper-free.

Figure 1 – SAS cells in battery module

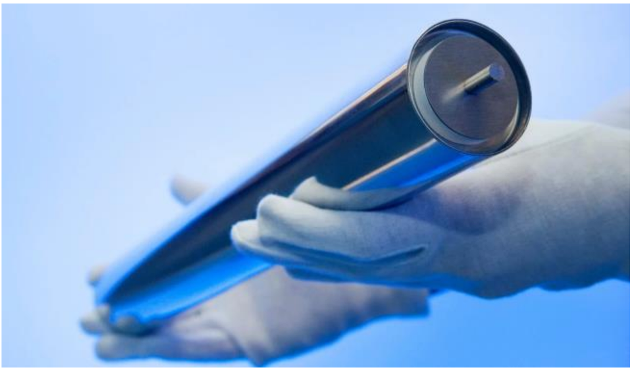


Figure 2 – SAS individual cell rated at 2.58 V each

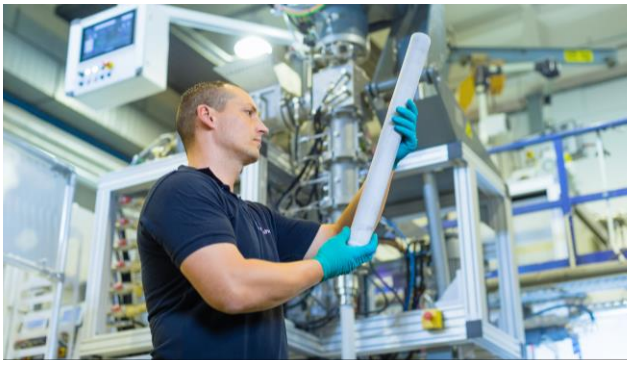


Figure 3 – Ceramic solid-state electrolyte at IKTS pilot facility

Figure 4 – SAS cell with positive and negative terminal

What is a CERENERGY® battery?

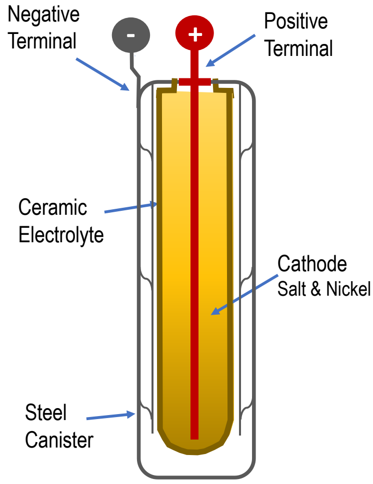


Figure 5 – Components of

A CERENERGY® battery consists of a ceramic tube (conductive to sodium ions but insulator for electrons) with a positive terminal in the center of it. (See Figure 5). The solid ceramic tube (solid state technology) performs the same function as a liquid electrolyte in a lithium-ion battery, allowing sodium ions to transfer through it. IKTS has developed solid-state technology to produce these large solid ceramic tubes with micro-structures that allow fast sodium ion transfer. The ceramic tube is filled with cathode granules consisting of common table salt and nickel. To ensure contact between the solid cathode granules and the ceramic electrolyte tube, the tube is flooded with a sodium aluminium chloride medium.

The ceramic tube is housed in a steel canister which acts as the negative terminal, sees Figure 6. The positive and negative terminal tabs are installed at the top of the cell for electrons transfer and connection to other cells. Each cell operates at 2.58V and a collection of 40 cells are installed in a refractory insulated module casing. Each module is rated at 10KWh and 100 Ah. The technology highlights for CERENERGY® batteries are high specific energy; excellent performance and cycle life in harsh operating environments; ultra-long battery life span and low environmental impact.

How the Battery Works

When the CERENERGY® battery is being charged, electrons flow from the positive terminal to the negative terminal. Sodium ions from the salt (sodium chloride) migrate through the solid ceramic electrode towards the negative canister terminal. The remaining chloride ions attach themselves to the nickel to form nickel chloride in the cathode medium. The sodium forms a molten anode layer on the outside of the ceramic tube, contacting the steel canister (see Figure 7), and the battery is fully charged. During discharge, electrons flow back, molten sodium is oxidized into Na+ ions, and transferred back through the solid-state ceramic tube forming sodium chloride. Nickel chloride is reduced back to metallic Nickel.

The electrochemical reaction of the battery is as follows:

$$\underbrace{2\,Na^{+}Cl^{-}}_{\text{Common Salt}} + \underbrace{Ni}_{\text{Nickel Metal}} \underset{\text{discharge}}{\overset{\text{charge}}{\rightleftharpoons}} \underbrace{Ni^{++}Cl^{-}{}_{2}}_{\text{Nickel Chloride}} + \underbrace{2\,Na}_{\text{Sodium}}$$

Figure 6 – Cross section of CERENERGY® Battery

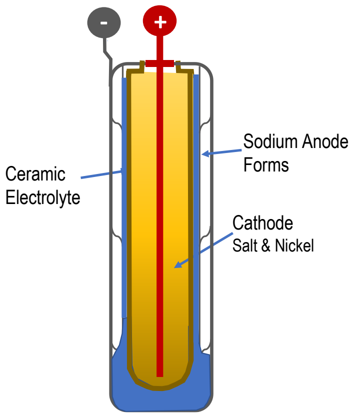


Figure 7 – Fully charged, with sodium anode formed

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For more information on how the IKTS CERENERGY® works watch the following you tube video https://youtu.be/Qb22Ccji-B0

Energy Density

The CERENERGY® batteries provide excellent performance in terms of energy and power density (see Figure 10). The energy capacity is around 110-130 Wh/kg and comparable to LFP lithium-ion batteries (90–110 Wh/kg). CERENERGY® batteries charge over 4-6 hours and discharge over similar times which is ideal for the grid storage market. Contrary to electric vehicle applications, batteries for stationary storage do not suffer from mass or volume constraints. However, due to the large amounts of energy and power implied, the cost per power or energy unit is crucial. The joint venture believes that the CERENERGY® battery is ideally suited for the grid storage or long-duration energy sector where very high power in a short period (like high power EVs) is not required. The battery can be configured to meet greater than 600 V that is required in grid storage.

The battery plant will produce 10,000 battery modules per annum, rated at 10 KWh each. These CERENERGY® modules are expected to sell for between EUR 7,000-9,000 per module or EUR 700-900 per KWh.

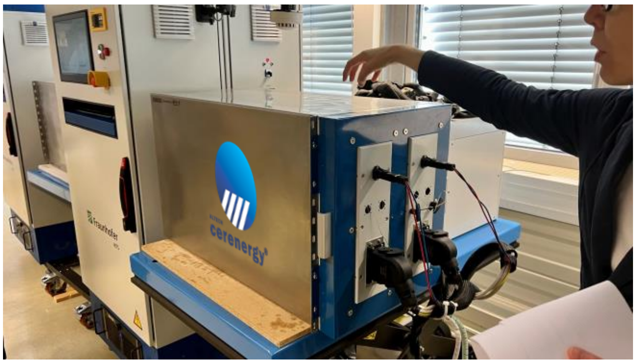


Figure 8 – Configuration of cells in battery module

Figure 9 – CERENERGY® battery module at outside touch temperature

Figure 10 – Energy and power curve showing how CERENERGY® batteries are ideally suited to Grid storage

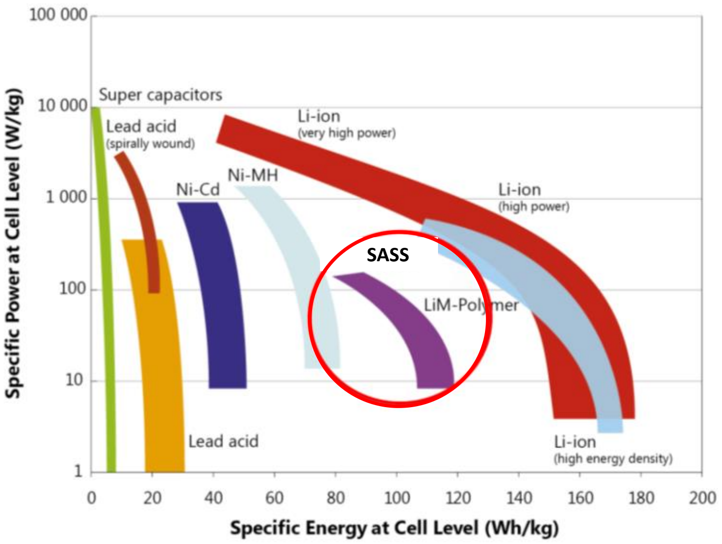


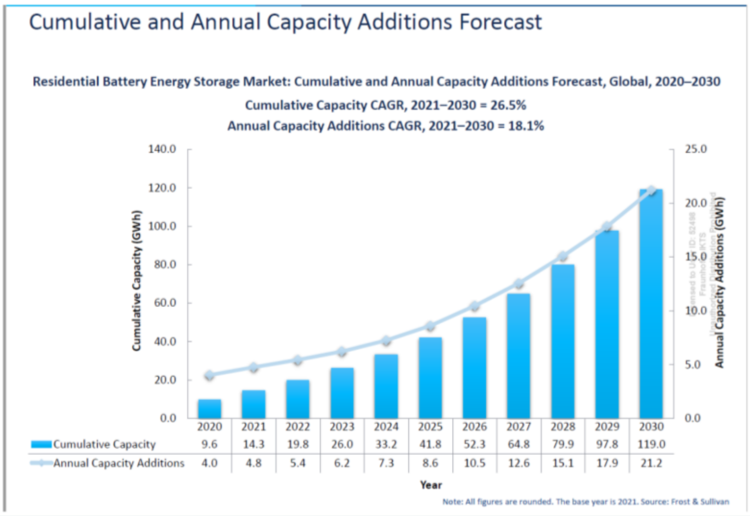
Figure 11 – State of the art pilot plant facilities

Grid Storage Market

Grid energy storage (also called large-scale energy storage) is a collection of methods used for energy storage on a large scale within an electrical power grid. Electrical energy is stored during times when electricity is plentiful and inexpensive (especially from intermittent power sources such as renewable electricity from wind power, tidal power, and solar power) or when demand is low, and later returned to the grid when demand is high, and electricity prices tend to be higher. Developments in battery storage have enabled commercially viable projects to store energy during peak production and release it during peak demand, and for use when production unexpectedly falls giving time for slower responding resources to be brought online.

Altech's CERENERGY® batteries are targeted to supply this grid energy storage market which is expected to grow by a 28% compound annual growth rate in the coming decades. The global grid energy storage market is expected to grow from USD 4.4 billion in 2022 to USD 15.1 billion by 2027. Or further out, growth is expected from 20 GW in 2020 to over 3,000 GW by 2050.

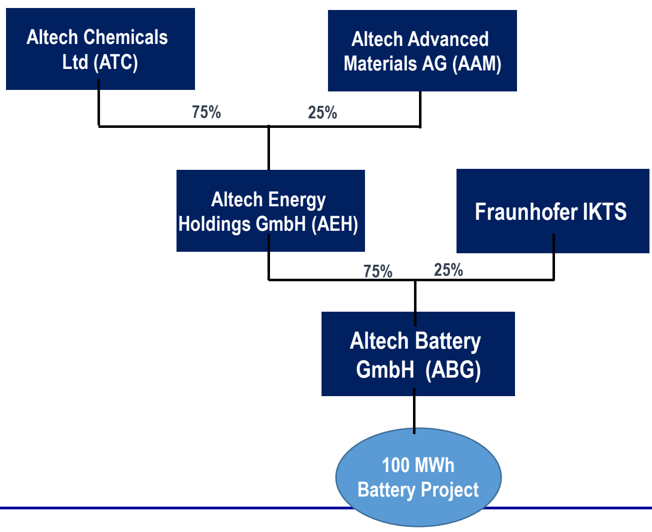
Figure 14 – Residential Battery Energy Storage Market



There are several deployments of battery energy storage systems for large-scale grid applications. One example is the Hornsdale Power Reserve, a 100 MW/129 MWh lithium-ion battery installation, the largest lithium-ion grid storage in the world, which has been in operation in South Australia since December 2017. The Hornsdale Power Reserve provides two distinct services; energy arbitrage; and contingency spinning reserve. The facility can bid 30 MW and 119 MWh of its capacity directly into the market for energy arbitrage, while the rest is withheld for maintaining grid frequency during unexpected outages until other, slower generators can be brought online (AEMO 2018). In 2017, after a large coal plant tripped offline unexpectedly, the Hornsdale Power reserve was able to inject several megawatts of power into the grid within milliseconds, arresting the fall in grid frequency until a gas generator could respond. By arresting the fall in frequency, the facility was able to prevent a likely cascading blackout.

Details of Joint Venture Agreement

- Altech Energy Holdings GmbH (AEH) and Fraunhofer entered into a JV Shareholders' Agreement to commercialize a 100 MWh sodium alumina solid state (CERENERGY®) battery project in Saxony, Germany.
- The JV Company, Altech Batteries GmbH (ABG) has been founded and will be registered in Dresden, Germany.
- The ownership of the JV Company (ABG) is 75% owned by AEH and 25% by Fraunhofer.
- Altech Energy Holdings GmbH ("AEH") is a holding company owned by Altech Chemicals Limited (ATC) (75 %) and Altech Advanced Materials AG (25%) and will be registered in Dresden, Germany. See structure diagram below.
- Upon incorporation of ABG, ABG will execute Licence and Intellectual Property Transfer Agreements ("License") with Fraunhofer where ABG will be granted the exclusive worldwide use of the intellectual property (IP) and know-how associated with CERENERGY® Batteries.
- As part of the agreement, Fraunhofer will provide access to the pilot plant, trials and technical expertise associated with the CERENERGY® technology.
- ABG will also have the exclusive right to use the CERENERGY® trademark.
- ABG will execute a Research & Development Agreement (Service Agreement) with Fraunhofer for a period of 4 years, to progress a DFS, funding, construction, commissioning and start-up of a commercial 100 MWh CERENERGY® Battery plant.
- In exchange for the exclusive license, Fraunhofer will be awarded a 25% "free carried" interest of the 100 MWh project (Train 1) with no royalties payable.
- The Altech Group will provide land for the 100 MWh battery project at Schwarze Pumpe, Saxony at market conditions and on an arms' length basis.
- Upon final payment of the Service Development Agreement, Fraunhofer shall transfer the rights to all CERENERGY® IP to ABG.
- From then on, ABG will be the owner of all CERENERGY® Battery technology, IP and trademark.
- At any time, ABG may proceed to expansion of the project to Train 2 or a Gigawatt battery facility subject to appropriate feasibility studies and funding.
- Should ABG decide to proceed to Train 2 or a Gigawatt battery facility, Fraunhofer has the right, but not the obligation, to maintain its 25% interest in the expanded project.
- Fraunhofer has the option to convert its 25% interest in the expanded project to a 1.5% royalty of all future battery module sales.



Staying focused on the Silumina Anodes™ Project

It is important that Altech stays focused on the Silumina Anodes™ project also situated on the same site in Saxony, Germany. There will be a separate team allocated to the SAS project mainly staffed by IKTS team members and a separate engineering company. Altech will provide the land at Schwarze Pumpe, as well as overall guidance and supervision to the SAS project, but a service contract with IKTS will be the main way of developing the SAS project without losing focus on the current Silumina Anodes™ Project.

Fraunhofer IKTS Background

The Fraunhofer-Gesellschaft based in Germany is the world's leading applied research organisation. Prioritizing key future-relevant technologies and commercializing its findings in business and industry, it plays a major role in the innovation process. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 76 institutes and research units with over 30,000 employees throughout Germany.

Fraunhofer Institute for Ceramic Technologies and Systems IKTS is one of the 76 institutes which conducts applied research on high-performance ceramics. The Institute's three sites in Dresden and Hermsdorf (Thuringia), Germany, collectively represent Europe's largest R&D institute dedicated to the study of ceramics. The annual budget of IKTS is € 83 million and it has 800 employees. As a research and technology service provider, Fraunhofer IKTS develops advanced high-performance ceramic materials, industrial manufacturing processes as well as prototype components and systems in complete production lines up to the pilot-plant scale

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About Altech Chemicals Ltd (ASX:ATC) (FRA:A3Y)

CERENERGY® Batteries Project

Altech Chemicals Ltd is a specialty battery technology company that has a joint venture agreement with world leading German battery institute Fraunhofer IKTS ("IKTS") to commercialise the revolutionary CERENERGY® Sodium Alumina Solid State (SAS) Battery. CERENERGY® batteries are the game-changing alternative to lithium-ion batteries. CERENERGY® batteries are fire and explosion-proof; have a life span of more than 15 years and operate in extreme cold and desert climates. The battery technology uses table salt are is lithium-free; cobalt-free; graphite-free; and copper-free, eliminating exposure to critical metal price rises and supply chain concerns.

The joint venture is commercialising its CERENERGY® battery, with plans to construct a 100Mwh production facility on Altech's land in Saxony, Germany. The facility intends to produce 10,000 10Kwh CERENERGY® battery modules per annum to provide grid storage solutions to the market.

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Sodium Alumina Solid State Batteries

Altech Chemicals ("Altech" or "Company") is a specialty battery materials technology company that has licenced its proprietary high purity alumina coating technology to 75% owned subsidiary Altech Industries Germany GmbH (AIG), which has commenced a definitive feasibility study for the development of a 10,000tpa silicon/graphite alumina coating plant in the state of Saxony, Germany to supply its Silumina Anodes™ product to the burgeoning European electric vehicle market.

This Company recently announced its game changing technology of incorporating high-capacity silicon in lithium-ion batteries. Through in house R&D, the Company has cracked the "silicon code" and successfully achieved a 30% higher energy battery with improved cyclability or battery life. Higher density batteries result in smaller, lighter batteries and substantially less greenhouse gases, and is the future for the EV market. The Company's proprietary silicon graphite product is registered as Silumina Annodes™.

The Company is in the race to get its patented technology to market and recently announced the results of a preliminary feasibility study (PFS) for the construction of a 10,000tpa Silumina Anode™ material plant at AIG's 14-hectare industrial site within the Schwarze Pumpe Industrial Park in Saxony, Germany. The European graphite and silicon feedstock supply partners for this plant will be SGL Carbon and Ferroglobe. The project has also received green accreditation from the independent Norwegian Centre of International Climate and Environmental Research (CICERO). To support the development, AIG has commenced construction of a pilot plant adjacent to the proposed project site to allow the qualification process for its Silumina Anodes™ product. AIG has executed NDAs with two German automakers as well as a European based battery company.

Silumina Anodes™

HPA Project

Altech is also further aiming to become a supplier of 99.99% (4N) high purity alumina (Al_2O_3) through the construction and operation of a 4,500tpa high purity alumina (HPA) processing plant at Johor, Malaysia, and has finalised Stage 1 and Stage 2 construction of its HPA plant in Johor, Malaysia. Feedstock for the plant will be sourced from the Company's 100%-owned near surface kaolin deposit at Meckering, Western Australia and shipped to Malaysia. The HPA project is significantly de-risked with a bankable feasibility study completed, senior lender project finance from German government owned KfW IPEX-Bank approved, and a German EPC contractor appointed – with initial construction works at the site completed. In addition to the senior debt, conservative (bank case) cash flow modelling of the HPA plant shows a pre-tax net present value of USD 505.6million at a discount rate of 7.5%. The project generates annual average net free cash of ~USD76million at full production. Altech is in the final stages of project finance with a potential raising of US$100m of secondary debt via the listed green bond market. In addition, US$100m of project equity is being sought through potential project joint venture partners.