20 March 2024

ALTECH – EXCELLENT DEFINITIVE FEASIBILITY STUDY FOR 120 MWh FIRST PRODUCTION LINE CERENERGY® BATTERY PROJECT

Highlights

- Highly positive Definitive Feasibility Study (DFS) – 120 GridPacks (1MWh) pa
- Capital cost estimated at €156 million with excellent project economics
- Pre-tax Net Present Value (NPV_9) of €169 million
- Attractive Internal Rate of Return (IRR) of 19%
- Steady state payback period is 3.7 years, with Annual Revenue of €106 million per annum
- EBITDA of €51 million or margin of around 47%
- Altech Board Decision to Proceed to Funding Phase
- Low lifetime levelised cost of storage €0.06/kWh vs lithium-ion batteries at €0.149/kWh
- Grid energy storage market projected to grow by 28% CAGR
- Grant funding applications underway
- Equity and mezzanine financing discussions in progress
- Offtake for 5 years production in progress

Altech Batteries Limited (Altech/the Company) (ASX: ATC and FRA: A3Y) is pleased to announce the excellent results from a Definitive Feasibility Study (DFS) conducted for a CERENERGY® project with an annual capacity of 120 1MWh GridPacks each year, planned for construction on Altech's land in Saxony, Germany. The project is being developed by Altech Batteries GmbH (ABG) (75%) and joint venture partner Fraunhofer IKTS ("Fraunhofer") (25%), an incorporated society affiliated with the German government and partially financed by the German federal government. Altech Batteries GmbH (ABG) is owned 75% by Altech Batteries Limited (listed on ASX:ATC) and Altech Advanced Materials AG (listed on FSE:AMA).

EXCELLENT PROJECT ECONOMICS

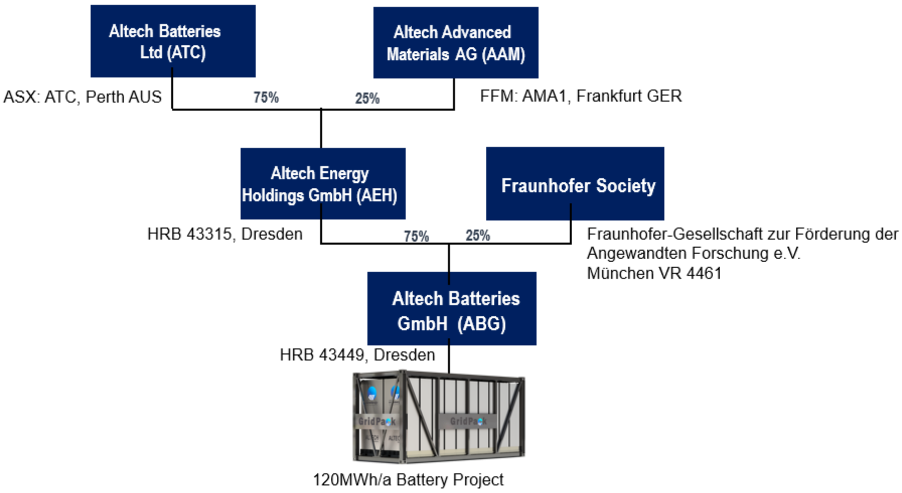
With a conservative investment estimate of €156 million, Altech's DFS not only demonstrates an excellent net present value (NPV) of €169 million (NPV_9) but also generates a significant net cash flow of €51 million annually from operations. The estimated internal rate of return is 19%, ensuring a capital steady state payback in just 3.7 years. At full production capacity of 120 1MWh GridPacks, the anticipated annual revenue is €106 million. With an EBITDA of €51 million (margin of 47%), the project economics is compelling, even at this relatively small first production line capacity. With the anticipated growth of the grid storage market at 28% CAGR, Altech's Board and joint venture partners have enthusiastically given the green light to proceed to the funding phase (Final Investment Decision) for this exciting project.

Watch video of Cerenergy Battery DFS Announcement
https://youtu.be/LLb6DxlHTws

Watch Video
Cerenergy DFS Ann

PROJECT OWNERSHIP STRUCTURE

In September 2022, comprehensive joint venture agreements were executed, marking the commencement of design works. Notably, a fully joint and several joint venture (JV) was established, consolidating all rights and know-how between the Fraunhofer-Gesellschaft, represented by the Institute for Ceramic Technologies and Systems (IKTS), and Altech Energy Holdings GmbH (AEH). This collaborative effort led to the creation of Altech Batteries GmbH (ABG) with 75% ownership by AEH and 25% by Fraunhofer Gesellschaft. AEH, in turn, is 75% owned by Altech Batteries Limited (ASX:ATC) in Perth, Australia, and 25% by Altech Advanced Materials AG (AMA) in Heidelberg, Germany - both publicly listed companies contributing to project funding.



FRAUNHOFER IKTS BACKGROUND

Fraunhofer, based in Germany, is the world's leading applied research organisation. Prioritising key future-relevant technologies and commercialising its technology in business and industry, it plays a major role in the innovation process. Founded in 1949, Fraunhofer 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 that 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. The electrolyte within the CERENERGY® battery is a ceramic product manufactured from alumina.

PROJECT BACKGROUND AND TECHNOLOGY

CERENERGY® Sodium Chloride Solid State (SCSS) batteries (also known historically as sodium nickel chloride batteries) is the grid battery storage of the future. This battery technology, although not novel, has been in existence since the 1990s, finding applications in mobility, telecommunications, and UPS systems. Presently, batteries are manufactured, but typically with cells one-third the size, suited mainly for small-scale power needs. Over the past eight years, Fraunhofer IKTS has pioneered the CERENERGY® technology, featuring cells three times larger, specifically tailored for grid storage applications. This innovation has transformed previous technologies by enabling greater energy capacity and reduced production expenses.

The world's largest SCSS-type batteries in terms of capacity have already been successfully tested in stationary battery modules. Fraunhofer IKTS has spent approximately €35 million in research & development on SCSS batteries and operates a €25 million pilot plant in Hermsdorf, Germany. Fraunhofer IKTS had been looking for an entrepreneurial partner, that possesses the know-how and expertise required for industrial and commercial development, has an industrial site in German available, has access to funding, has a battery background, and has expert technology background in the alumina used in ceramics. Altech fitted the criteria, and the joint venture was formed in September 2022. Altech group will own 75% of the project with Fraunhofer Society 25% free carried. The intellectual property is licensed exclusively to the joint venture.

FRAUNHOFER'S PILOT MANUFACTURING PLANT IN HERMSDORF

Fraunhofer IKTS established a €25 million manual battery cell production facility at its research center in Hermsdorf, Thuringia, as part of advancing the CERENERGY® battery. This move allowed Fraunhofer IKTS to produce cells at a cost-effective level, crucial for further development and testing. Optimisation and validation of the technology ensued, leading to the creation in 2018 of the first CERENERGY® modules with 5 kWh storage capacity. By 2021, Fraunhofer IKTS completed a pilot production line, facilitating increased capacity and the introduction of a 10 kWh prototype battery module in 2022. The Hermsdorf facility boasts comprehensive cell manufacturing capabilities, serving as a cornerstone for industrial commercialisation, with processes refined for scalability and cost efficiency.

Figure 1 - Pilot Manufacturing Plant Fraunhofer Hermsdorf

JOINT VENTURE

The joint venture elected to develop a 120 MWh CERENERGY® battery plant on Altech's site in Saxony, Germany. The target market is specifically focused on the grid (stationary) energy storage market which is expected to grow by 28% CAGR in the coming decades. The global battery energy storage systems market is expected to grow from USD 4.4 billion in 2022 to USD 15.1 billion by 2027. Further out, growth is expected from 20 GW in 2020 to over 3,000 GW by 2050. CERENERGY® batteries can provide high security at low acquisition and operating costs for the stationary energy storage market.

Photo: Prof Alexander Michaelis (Fraunhofer IKTS), Uwe Ahrens (Altech), Iggy Tan (Altech)

The proposed battery plant will produce 518,400 cells; 2,160 Sixty kWh modules; 120 MWh GridPacks per annum. The target GridPack price is competitive and based on market rates of installed lithium-ion batteries and other grid storage technologies. The biggest cost advantage of the CERENERGY® batteries at the 120 MWh plant capacity is the expected low levelised cost of €0.06 per kWh for the life of the battery, compared to lithium-ion batteries at €0.149 per kWh. This is in part due to the fact that the CERENERGY® batteries have no moving parts, cooling fans, nor HVAC (heating, ventilation, air conditioning) systems and do not require a fire protection monitoring system as opposed to lithium-ion battery systems. In addition, costs in relation to CERENERGY® battery production will reduce significantly as capacity increases to GWh production, as foreseen in the joint venture with Fraunhofer once this first industrial and fully automated single production line with an annual capacity of 120 MWh has been put into operation.

TECHNOLOGY ADVANTAGES - CHALLENGES WITH LITHIUM-ION BATTERIES

Fire and Explosion Issues

A notable drawback of lithium-ion batteries is the prevalent risk of thermal runaway, leading to fire and explosions, a concern that has gained significant media attention. Thermal runaway represents a chain reaction within a battery cell that proves challenging to halt once initiated. This phenomenon occurs when the internal temperature of a battery reaches a critical point, triggering a chemical reaction that generates oxygen. Overheating, physical damage, and overcharging are common factors contributing to thermal runaway. Compounding the issue is the fact that contemporary lithium-ion batteries comprise a liquid flammable electrolyte and a combustible plastic separator, further intensifying the risk.

Narrow Operating Temperature Range

Another drawback lies in the limited operational temperature range of lithium-ion batteries, typically ranging from +15 ^{o}C to +35 ^{o}C. At lower temperatures, the liquid electrolyte within the battery thickens, impeding the transfer and reactions of lithium. In fact, a lithium battery operating at 0 ^{o}C can diminish the typical battery capacity by up to 30%. This constraint presents significant challenges when deploying lithium-ion batteries in cold and desert climates. Frequently, a portion of the available battery energy is utilised for heating or cooling purposes to overcome these temperature-related hurdles.

Lithium-ion Battery Lifespan

Thirdly, the lifespan of lithium-ion batteries is confined to approximately 7-10 years, contingent upon specific applications. The degradation of lithium ions occurs with each charge and discharge cycle, a process accelerated by detrimental side reactions, dendrite growth, and the breakdown of anode and cathode structures. This degradation is notably hastened when the battery operates beyond the ideal temperature range. With electric vehicles (EVs), manufacturers typically warrant the battery for around 8 years, guaranteeing performance until the capacity drops below 70%. Meanwhile, for grid storage batteries, a life span of 7-10 years is anticipated. In the context of grid storage, factoring in replacement costs becomes a crucial component of the long-term storage expenses associated with batteries.

Lithium Costs and Availability

The global market for the alkali metal lithium is experiencing rapid growth, accompanied by significant volatility in prices. Lithium, being the most crucial component of lithium-ion batteries, is particularly susceptible to price fluctuations. The spike in lithium prices observed a few years ago exerted upward pressure on the production costs associated with lithium-ion batteries. The production of lithium is predominantly concentrated in four countries: Australia, Chile, China, and Argentina. There is a tangible concern regarding the insufficient development of mines and production capacity to meet the projected demand for electric vehicles (EVs) and stationary energy storage. This situation raises apprehensions about the industry's ability to sustain the anticipated surge in demand.

Cobalt Supply Chain and Ethical Concerns

Cobalt plays a crucial role in enhancing energy density and extending battery life by maintaining the stability of the layered structure as lithium ions are cyclically inserted into and extracted from the cathode during battery operation. However, cobalt is currently deemed the highest material supply chain risk for electric vehicles (EVs) in the short and medium term. Electric vehicle batteries can contain up to 20 kg of cobalt in each 100-kilowatt-hour (kWh) pack, constituting up to 20% of the cathode's weight in lithium-ion EV batteries. The Democratic Republic of Congo (DRC) holds a dominant position, producing approximately 70% of the world's cobalt, exposing the lithium-ion battery industry to precarious supply chain challenges. Additionally, reports detailing harsh and perilous working conditions, child labour, and human rights abuses in the DRC have prompted ethical concerns regarding the sourcing of cobalt for batteries.

Graphite Geo-political Risk

Graphite is a crucial element in driving the global transition toward electric vehicles, representing the largest component in lithium-ion batteries by weight, accounting for 20-30% of each battery. However, due to losses incurred in the manufacturing process, it takes 30 times more graphite than lithium to produce these batteries. The emerging graphite deficit is a consequence of the soaring demand for electric vehicle battery anode ingredients outpacing the available supply, leading to price escalations. Presently, China dominates the world graphite anode material production, contributing to 90% of the global output. This concentration raises concerns about potential geopolitical risks to the industry due to its dependence on a single major producer.

Copper Crunch

Copper serves a primary role as the current collector on the anode part of a lithium-ion battery, and its availability is emerging as a major concern, particularly fuelled by the green energy transition and heightened demand for electric vehicles (EVs). A recent report, titled "Future of Copper," highlights that achieving the 2050 climate objectives will necessitate a substantial increase in copper production in the near and medium term, a challenge in itself. Notably, a battery electric vehicle requires 2.5 times more copper than a standard internal combustion engine (ICE) vehicle. The imminent issue is the inadequate development or expansion of copper mines to meet the demand projected by S&P Global, estimating the sale of 27 million EVs annually by 2030. Consequently, copper scarcity could potentially rival oil as a national energy security concern for certain countries.

CERENERGY® - THE IDEAL BATTERY

In response to the challenges confronting lithium-ion batteries, coupled with the escalating costs of essential materials and metals, a quest has emerged for a battery technology that addresses these issues. Enter CERENERGY®, a battery that stands as a beacon of safety, impervious to fire and explosions, boasting a lifespan exceeding 15 years, and demonstrating resilience in both frigid and desert climates. What sets this technology apart is its freedom from lithium, cobalt, graphite, manganese, and copper, thus mitigating the risks associated with fluctuating material prices and supply chain uncertainties. CERENERGY® is the battery solution the industry has been searching for.

Based on the above challenges facing lithium-ion batteries and the increasing prices of the critical materials and metals used in these batteries, there has been a search 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 that is lithium free, cobalt free, graphite free, manganese free and finally copper free, which limits the exposure to critical materials prices rises and supply chain concerns.

INTRODUCING ALTECH'S CERENERGY® BATTERIES

CERENERGY® batteries resolve the biggest problems and challenges facing lithium-ion batteries today.

ALTECH cerenergy™

Fire Proof ✓

CERENERGY® Batteries are Fire and Explosion Proof

CERENERGY® batteries present a distinct advantage over lithium-ion batteries by being entirely fire and explosion-proof and immune to thermal runaway. This stems from two primary features. Firstly, CERENERGY® batteries eliminate the use of flammable liquid electrolytes or plastic separators. Instead, they employ a solid, non-flammable ceramic tube as the electrolyte, facilitating the transfer of sodium ions. Secondly, the battery's chemistry precludes the presence of oxides and the generation of oxygen at the cathode, a characteristic observed in lithium-ion batteries during thermal runaway. This enhanced safety profile positions CERENERGY® as an ideal choice for indoor industrial and commercial energy storage installations. The battery is inherently secure, does not react with water, and is particularly sought after in sensitive environments, such as areas susceptible to flooding, where lithium-ion batteries are prohibited due to safety concerns.

Large Temp Range ✓

Large Operating Temperature Range - Cold and Desert climates

The CERENERGY® battery demonstrates exceptional operational efficiency across a wide temperature range, from minus 20°C to +60°C, ensuring high performance and durability in various ambient conditions. This adaptability is attributed to the absence of a liquid electrolyte (replaced by a solid ceramic electrolyte), rendering the battery impervious to adverse effects from ambient temperature fluctuations. Moreover, CERENERGY® batteries function as internally high-temperature batteries, operating within the range of 270-350°C. Despite this internal heat, the battery modules are fully insulated, maintaining an external touch temperature. Unlike lithium-ion batteries, CERENERGY® batteries are self-sustaining in terms of core temperature and do not require external cooling systems. This feature makes them particularly well-suited for grid energy storage in cold and desert climates, addressing a significant drawback of lithium-ion batteries. Consequently, the CERENERGY® battery occupies a specific market niche without direct competition from lithium-ion batteries.

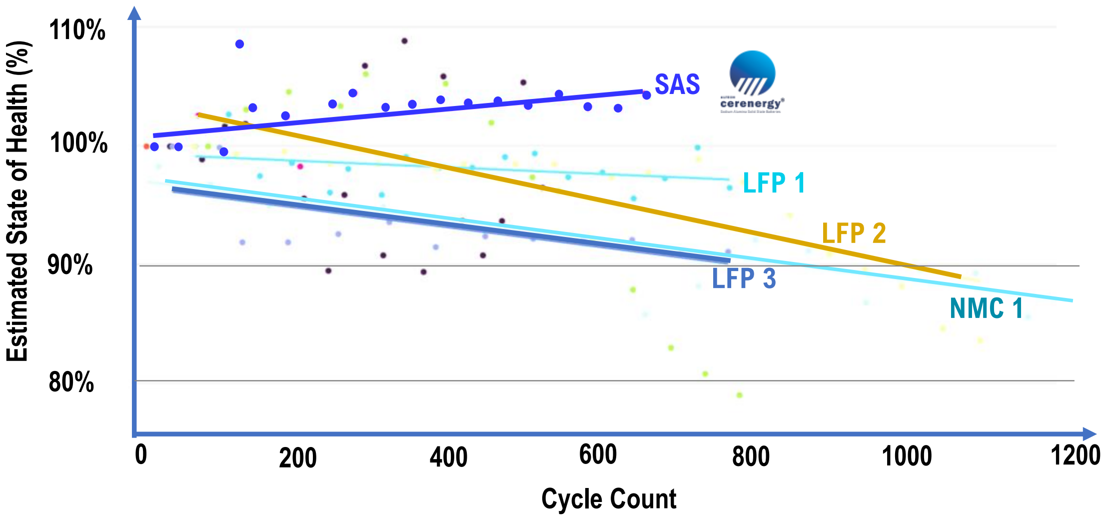
> 15 years life ✓

CERENERGY® Battery Life Span

The CERENERGY® battery stands apart from lithium-ion batteries in that it does not experience sodium ion degradation with each charge and discharge cycle. Notably, there is no first-cycle loss, no detrimental side reactions, no dendrite growth, and no breakdown of anode and cathode structures. The substitution of liquid electrolyte with a solid ceramic eliminates virtually any sodium deterioration in the battery. As a result, the

CERENERGY® battery boasts a lifespan exceeding 15 years. A recent study conducted by ITP Renewables revealed that the Sodium Nickel Chloride battery technology exhibited no deterioration in the estimated state of health during the initial 700 cycles of testing, in strong contrast to the typical deterioration observed in LFP and NMC lithium-ion batteries. (See Figure 2) Furthermore, Sodium Nickel Chloride batteries have demonstrated lifetimes exceeding 2,000 cycles, with full-sized batteries showcasing a remarkable twenty years of functionality. Additionally, cell modules have exhibited over 4,500 cycles and fifteen years of operational performance, reinforcing the robustness and longevity of the CERENERGY® battery.

Figure 2 – Life span testing of various batteries including CERENERGY® type batteries



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

Lithium Free

Lithium Free Battery

CERENERGY® batteries do not contain lithium but use sodium ions from common table salt. 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. CERENERGY® type batteries are also known as “sodium nickel chloride” batteries or “molten sodium” batteries. CERENERGY® technology is different from sodium-ion batteries or sodium sulphur batteries. These batteries are not exposed to rising lithium prices and potential supply constraints of lithium globally.

Cobalt Free

Cobalt Supply Chain and Ethical Concerns

CERENERGY® batteries stand out by completely excluding cobalt from their composition. The cathode, comprising salt and nickel within a sodium aluminum chloride medium, eliminates the need for a layered structure found in lithium-ion batteries, thus circumventing any necessity for cobalt. This distinctive chemistry shields CERENERGY® batteries from ethical concerns and supply chain issues associated with cobalt. Additionally, these batteries boast an impressive specific energy ranging from 110-130 Wh/kg, surpassing the range of 90-160 Wh/kg seen in LFP lithium-ion batteries, thereby showcasing superior energy efficiency.

Graphite Free ✓ Copper Free ✓

Graphite and Copper Supply Risks

Another distinctive feature of the CERENERGY® battery is its absence of graphite or copper in the anode component. Remarkably, there is no designated anode within the CERENERGY® battery structure. Instead, the anode materialises during the charging phase as a molten sodium film between the steel electrode and the outer edge of the ceramic electrolyte. Likewise, the molten sodium anode dissolves during the battery's discharging process. This innovative design contrasts sharply with traditional lithium-ion batteries, where copper serves as the negative collector; in the CERENERGY® battery, a steel canister fulfills this role. Free from graphite and copper, the CERENERGY® battery offers a novel approach to energy storage.

CERENERGY® BATTERY UNIQUE SELLING PROPOSITIONS

Derived from the aforementioned CERENERGY® battery attributes, several notable unique selling propositions (USPs) emerge. These are anticipated to offer exceptional prospects for marketing and business development, providing Altech's CERENERGY® battery technology a sustained competitive edge:

Environmentally friendly:	CERENERGY® batteries do not use any critical minerals but consists only of salt, ceramic and nickel.
Local supply chain:	The raw materials for CERENERGY® batteries are not sourced from distant countries; rather, they are locally available in Germany and Europe.
Service life:	CERENERGY® batteries exhibit remarkable longevity, retaining 100% of their performance even after 10 years of operation. These batteries boast a service life extending beyond 15 years, showcasing their enduring efficiency.
Performance:	CERENERGY® batteries can run multiple cycles within 24 hours without any impact on performance or lifespan.
Any location:	Due to its safety, CERENERGY® batteries can be used anywhere, buildings, public places and others without any fire protection.
All environments:	CERENERGY® batteries can be used in all climatic zones without external cooling or heating.
No self-discharge:	CERENERGY® batteries have no self-discharge and can maintain its charge level for months without loss.
Easy transport:	CERENERGY® batteries are not a dangerous good and can be easily transported using conventional means of transport: truck, train or ship.
Maintenance free:	CERENERGY® batteries are practically maintenance-free and have no wearing parts such as fans or air conditioning systems.

Figure 3 – CERENERGY® cells in battery module

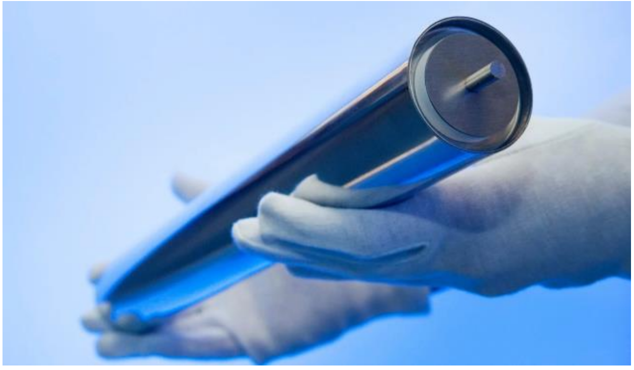


Figure 4 – CERENERGY® individual cell rated at 2.58 V each

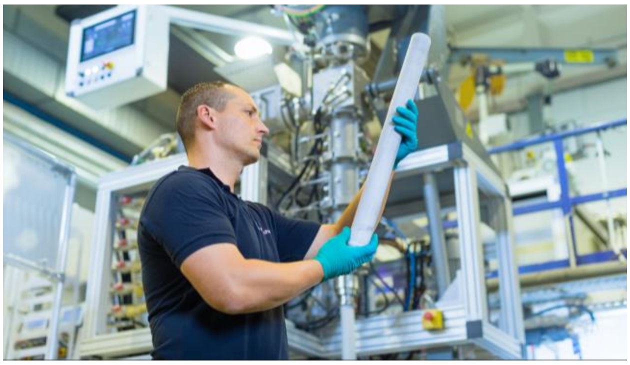


Figure 5 – Ceramic solid state electrolyte at IKTS pilot facility

Figure 6 – CERENERGY® cell with positive and negative terminal

WHAT IS A CERENERGY® BATTERY?

A CERENERGY® battery consists of a ceramic tube (conductive to sodium ions but insulator for electrons) with a positive terminal in the centre of it. (See Figure 7). 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 developed the 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 positive electrode is flooded with molten chloroaluminate ($NaAlCl_4$).

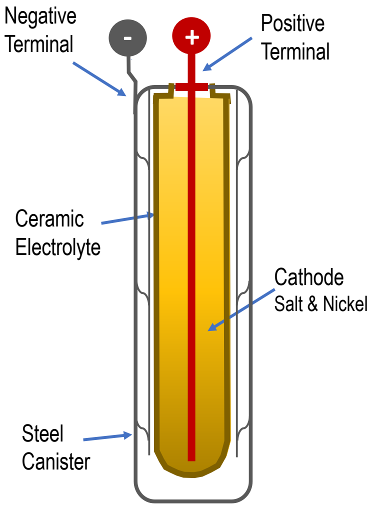


Figure 7 – Components of CERENERGY® battery

The ceramic tube is housed in a stainless-steel canister which acts as the negative terminal, see Figure 8. The positive and negative terminal tabs are at the top of the cell for electrons transfer and connection to other cells. The technology highlights for CERENERGY® batteries are high specific energy at the battery level, immunity to ambient temperature conditions and constant performance and cycle life in harsh operating environments, the possibility of long storage without any degradation, safety, and low environmental impact with fully recyclable materials.

How the Battery Works

Figure 8 – Cross section CERENERGY® Battery cell

When the CERENERGY® battery is being charged, electrons are consumed due to the charging process in the cathode while sodium is formed at the outside of the solid electrolyte. Sodium ions from the salt (sodium chloride) migrate through the solid ceramic electrode towards the negative canister terminal. The chloride ions attach themselves to the nickel to form nickel chloride in the cathode medium. The sodium forms an anode layer on the outside of the ceramic tube, contacting the steel canister, see Figure 9. The battery is fully charged. During discharge, electrons flow back, sodium is oxidized into Na+ ions, and transfer through the solid-state ceramic tube forming sodium chloride. $NiCl_2$ is reduced to metallic nickel.

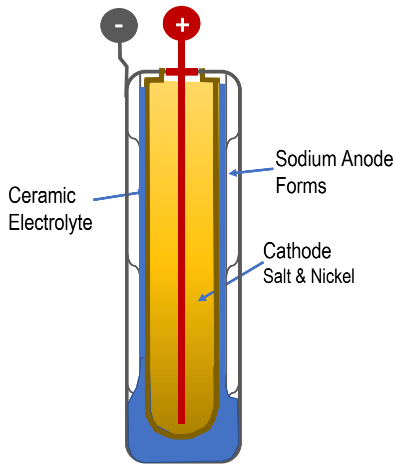


Figure 9 – Fully charged, with sodium anode formed

The electrochemical reaction of the battery is as follows:

$$2\,Na^{+}Cl^{-} + Ni \underset{\text{discharge}}{\overset{\text{charge}}{\rightleftharpoons}} (Ni^{++}Cl^{-})_2 + 2\,Na$$

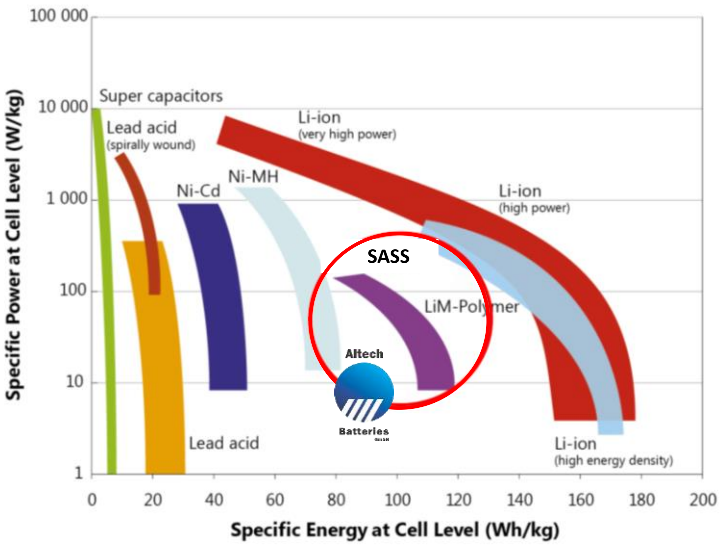
Common Salt + Nickel Metal ⇌ Nickel Chloride + Sodium

Energy Density

CERENERGY® batteries showcase exceptional energy and power density, as illustrated in Figure 10. With an energy capacity ranging from 110-130 Wh/kg and a charging duration of over 8 hours, they rival LFP lithium-ion batteries (90–160 Wh/kg). Offering the ability to discharge 80% of their capacity over 4 hours, these batteries are optimal for efficient "energy shifting." Moreover, with a remarkable power capability, they can discharge by power pulsing 25% of their energy in just 15 minutes, when cells are fully charged. This provides an ideal use case for rapid power surges and contributing to grid stabilisation.

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 required, the cost per power or energy unit is crucial. The relevant metrics to assess the interest of technology for grid-scale storage is the $/Wh (or $/W) rather than the Wh/kg (or W/kg). The joint venture believes that the CERENERGY® battery is ideally suited for grid storage or long-duration energy sector where very high power in a short time (like high power EV) is not required. The battery can be configured to meet greater than 600 V which is required in grid storage. Due to modular structure the voltage can be adapted to customers' requirements.

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



BASIC BATTERY CELLS

CERENERGY® cells exhibit a distinct internal structure, featuring a ceramic solid-state tube at the core, filled with sodium chloride and nickel metal powder granules. The central element is the positive nickel electrode, surrounded by molten chloroaluminate. These cells boast extended lifetimes exceeding 15 years without capacity loss. With a nominal energy capacity of 250 Wh and a voltage ranging from 1.7 to 2.8 volts, the basic CERENERGY® cell undergoes pressure-sealed welding during manufacturing, ensuring no active material loss and promoting enduring performance. The proposed battery plant aims to produce 518,400 cells annually, at a remarkable rate of one cell every 45 seconds.

CERENERGY® - Cell Level	
Voltage range:	1.7 – 2.8 V
Current Capacity:	100 Ah nominal
Nominal Energy Capacity:	0.25 kWh (100% DOD at <C/10)
Discharge Current:	cont. 25 A / trans. 33 A
Operational SoC Range:	20%-100%
Internal Ops Temp.:	min. 270˚C – max. 350 ˚C
Ambient Ops. Temp.:	-20°C to +60°C
IP Rating:	IP65
24h cycle capability:	yes, continuous without interruptions
Cyclability per day:	up to 3 @ 60 Ah / 1.8 FCE[1]

[1]Full cycle Equivalents

60 KWH (AB60) BATTERY PRODUCT

The base unit intended for production by Altech is the 60 kWh (ABS60) battery pack. Within each ABS60 pack, there are five battery modules, each housing 48 cells, resulting in a total of 240 individual cells. The annual production target is set at 2,160 of these 60 kWh battery packs or 120 GridPacks. Figure 11 illustrates the internal structure of the pack casing, featuring five assembly frames holding 48 cells each. All cells are connected in series, enhancing energy capacity and electrical parameters such as voltage.

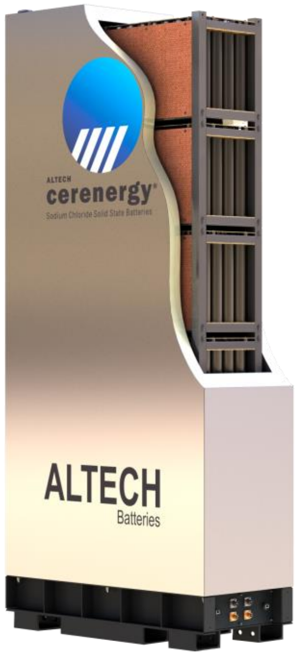


Figure 11 – Five modules in a battery pack

The battery's design showcases a sleek stainless-steel exterior adorned with the prominent CERENERGY® logo on top and "ALTECH Batteries" engraved at the bottom. This stainless-steel finish ensures durability in extreme temperature conditions, whether in snowy or desert environments while maintaining an impeccable appearance. The casing of the battery is equipped with a vacuum-sealed, double-sided enclosure, ensuring optimal insulation and minimising heat transfer loss. Importantly, the exterior is safe for human contact. To facilitate a rapid and flawless connection of busbars to each cell, a large-scale connection system is incorporated within the battery. The base of the battery is reinforced to accommodate high-temperature-resistant electrical cables and connectors, effectively minimizing heat loss to the external environment.

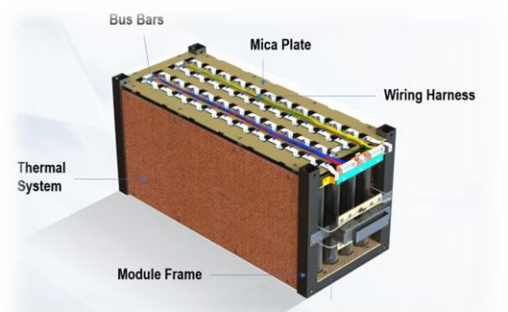
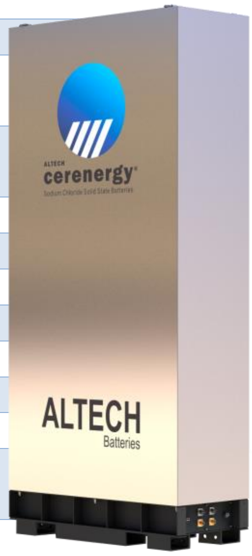


Figure 12 – CERENERGY® Battery module

To facilitate the initial installation from a cold start-up, low-voltage heating pads have been seamlessly integrated into the internal vacuum-packed casing. This heating process generally spans around ten hours, ensuring the comprehensive activation of the battery. Once initialised, the battery adeptly maintains its internal temperature, reducing its dependence on the heating pads. Whenever the battery is used regularly the technology provides a thermal self-sufficiency by generating heat while discharging and cooling while charging.

ABS60 CERENERGY® Battery Specifications

Battery Model	ABS 60 Module
Dimension	500mm x 2499mm x 1145mm
Battery Type	Sodium Nickel Chloride
Nominal Voltage	600 V DC
Operation Voltage	410 V DC (MIN) to 670 V DC (MAX)
Nominal Current Capacity	100 Ah nominal
Nominal Energy Capacity	60 kWh (100% DOD at <C/10)
Nominal Energy Density	42 Wh/l 67 Wh/kg
Rated Power Density	15 W/kg (80% DOD at C/4) 8 W/kg (80% DOD at C/8)
Constant Power Discharge (Rated)	13.8 kW in 3.2h
Maximum Continuous Discharge Current	25A
Maximum Transient Discharge Current	33A
Maximum Charging Rate	25A
Charging Time SOC 20%-80%	5 hours
Operation Temperature Range	-20°C to 60°C
IP Rating	IP65
Life time and design life	Min. 5000 cycles (at 80% DOD) 15 years



1 MWh GridPack

Altech intends to produce for sale the CERENERGY® 1 MWh GridPack (ABS1000) destined for the renewable energy and grid storage market. Based on preliminary discussions with potential off-takers and to minimise on site installation of individual ABS60 60 kWh battery packs, a pre-installed solution has been launched. Each GridPack will have up to eighteen 60 kWh battery packs installed and connected to pack power management system. Every GridPack has a distinct rating of 600 volts DC and 100 Ah, and it can be arranged in series (cluster or array) to achieve the required rating of several thousand KWs for grid functioning.

Figure 13 - 1 MWh GridPack

Figure 14 – Stackable feature of GridPacks

The first product will be a standard 1 MWh container battery referred to as GridPack. Altech has designed an iso-container frame to house the eighteen (18) 60 kWh battery packs that make up the 1 MWh GridPack (ABS 1000). An additional cabinet has been included for power electronics, alongside another cabinet dedicated to the Energy Management System (EMS), both seamlessly integrated into the container.

The open style high cube sea container frame is specially designed for easy transport and simple site installation. The GridPacks will be assembled on the Altech site and then undergo a complete charge and discharge cycle before shipping to customers. These frames are being accredited for use.

The Altech GridPacks have been specifically engineered to adhere to the Ingress Protection (IP) 65 standard (relating to a high level of electrical enclosure sealing), ensuring complete protection from both dust and inclement weather. This means that there is no need for any additional shelters or buildings to house the Altech GridPack batteries, and they can be safely installed outdoors in any weather conditions. The Altech GridPacks will be constructed using a sea container design, which facilitates their easy transportation by sea or road to the installation site, as well as ensuring simple installation.

The "plug and play" feature of the site installation for the GridPacks ensures that they can be easily installed in remote locations. Additionally, the containers have been designed to be stackable, which minimises the battery footprint (refer to Figure 14). Unlike other mega battery pack designs on the market, these GridPacks can be stacked on top of each other. This stackable feature, coupled with the "plug and play" design, makes the GridPacks easily scalable and adaptable to meet future energy storage requirements of the site.

Furthermore, the Altech GridPacks are designed without the requirement for any moving parts such as cooling fans, which are typically found in lithium-ion battery mega packs. This is a notable advantage as end-use customers have concerns about the noise generated by lithium-ion batteries, preventing them from being placed near residential areas. With the absence of any moving parts, the Altech GridPacks are completely noise-free operation, making them an ideal solution for noise-sensitive environments. Finally, GridPacks are extremely low in maintenance costs over the battery life.

Altech's 1 MWh GridPacks are designed to operate in any climate, without the need for thermal management. The battery's internal temperature remains relatively constant throughout the charging and discharging cycles, due to its endothermic and exothermic properties. These 1 MWh GridPacks will offer significant benefits for the fast-growing renewable energy and grid storage sectors. These larger battery packs are capable of storing more energy, resulting in more efficient utilisation of renewable energy sources such as wind and solar power.

Altech believes that the proposed GridPacks are an excellent means of stabilising the grid by providing a source of backup power during periods of high demand or when renewable energy sources are not producing at capacity. They are also a cost-effective solution for storing and distributing renewable energy across a variety of applications, including grid-scale storage, microgrids, and electric vehicle charging.

Moreover, they are non-flammable and pose zero fire and explosion hazards. With a projected lifespan of over 15 years with unlimited cycling and can operate in extreme cold and hot climates. Altech believes that these GridPacks will be the preferred choice for companies seeking a reliable and long-lasting energy storage solution.

ABS1000 CERENERGY® Battery GridPack Specifications

Battery Model	ABS 1000 GridPack
Battery Type	Sodium Nickel Chloride
Nominal Current Capacity	1,800 Ah (100% DOD)
Nominal Energy Capacity	1.0 MWh (100% DOD at <C/10)
Nominal Voltage	600 V DC
Operation Voltage	410 V DC (MIN) to 670 V DC (MAX)
Constant Power Discharge (Rated)	250 kW in 3.2h
Charging Time (SOC 20%-80%)	5 hours
Standard Circuit Design	18 battery packs connected in parallel
Container Frame Dimensions	5,900mm x 2,700mm x 2,400mm
Weight	< 22t
Nominal Energy Density	26 Wh/l 45 Wh/kg
Rated Power Density	11 W/kg (80% DOD at C/4) 6 W/kg (80% DOD at C/8)
Operation Temperature range	-20 to 60°C
IP Rating	IP65
Life time and design life	Min. 5000 cycles (80% DOD) 15 years

LEVELISED COSTS OF STORAGE ANALYSIS

A comprehensive study examined the long-term costs of energy storage across various battery types, encompassing their lifespans, charging, operational and maintenance expenses, as well as replacement and investment costs. This analysis facilitates a direct comparison of battery types, ensuring an "apples-to-apples" evaluation. For instance, large grid storage batteries entail additional costs for cooling fans and air conditioners, impacting energy consumption and maintenance requirements. Replacement costs, especially if a battery requires replacing earlier than another, significantly influence the analysis. These factors collectively shape the energy storage costs throughout the battery's lifespan. Illustrated in the table below, CERENERGY® batteries exhibit a lifetime levelised cost of €0.06 per kWh, contrasted with lithium-ion batteries at €0.149 per kWh.

Table 1 – Levelised Costs of Storage

	Altech GridPack	Redox Flow	LFP Battery	NGK NaS
Cycles (Calculation basis)**, 100%-cycle in 24h**	1,80	1,75	1,41	1,30
Total Cost per kWh (output) – grid service & storage (Euro)	0,060	0,132	0,149	0,164

GRID STORAGE MARKET

Grid Storage Market

As the global energy sector transitions towards renewable sources, efficient energy storage systems are becoming increasingly vital. Grid storage batteries have emerged as a promising solution to tackle the intermittency and variability of renewable energy sources. In line with this trend, Altech recognises the potential of the grid storage battery market and is exclusively targeting this sector with its innovative CERENERGY® batteries.

Rising Renewable Energy Penetration

Renewable energy sources are experiencing rapid growth globally, with solar and wind energy leading the charge. As these sources become more integrated into the grid, the demand for energy storage solutions rises. Grid storage batteries provide an effective means of storing excess energy during periods of high generation and releasing it during times of low generation. This enables a reliable and stable supply of renewable energy, enhancing grid resilience and reducing reliance on fossil fuels.

Falling Battery Costs

The decreasing costs of battery technologies have been a game-changer for the grid storage sector. Lithium-ion batteries, which dominate the market, have witnessed a significant decline in prices due to economies of scale, technological advancements, and increased production capacity. As costs continue to fall, the affordability and feasibility of deploying grid storage batteries improve. This trend is attracting investments and spurring innovation, leading to further cost reductions and technological advancements.

Government Support and Policies

Government support and favourable policies are instrumental in fostering the growth of the grid storage battery market. Many countries have recognised the importance of energy storage to achieve their renewable energy goals and address climate change. Governments are incentivising the deployment of grid storage batteries through subsidies, tax credits, and favourable regulatory frameworks. Such initiatives provide financial assistance, reduce project risks, and encourage private sector participation. Additionally, research and development grants are driving innovation in battery technologies, enabling the development of more efficient and durable grid storage solutions.

Grid Stability and Reliability

Grid storage batteries play a pivotal role in maintaining grid stability and reliability. Energy fluctuations caused by intermittent renewable sources can strain the power grid, leading to voltage instability and blackouts. Grid storage systems can rapidly respond to fluctuations, ensuring a smooth and consistent energy supply. They act as a buffer, providing instantaneous power to balance supply and demand. This improves grid stability, reduces transmission losses, and minimises the need for costly infrastructure upgrades. With the increasing integration of renewables, grid storage batteries are becoming essential for maintaining a robust and resilient energy infrastructure.

Growing Demand for Electrification

The electrification of transportation, industries, and buildings is a key driver for the grid storage battery market. Electric vehicles (EVs) are gaining traction globally, and their widespread adoption necessitates a robust charging infrastructure. Grid storage batteries can serve as EV charging stations, allowing for rapid charging and managing peak loads. Similarly, industries and buildings are transitioning to green electric power, creating a surge in electricity demand. Grid storage systems facilitate the integration of renewable energy into these sectors, providing reliable and uninterrupted power supply.

Altech's CERENERGY® batteries are targeted to supply to the grid (stationary) energy storage market which is expected to grow by 28% CAGR in the coming decades. The global battery energy storage systems (BESS) 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.

CERENERGY® batteries aim to bridge renewable energy production and energy consumption and to manage grid capacity bottleneck and stability. Whilst energy storage is important for all sectors such as to augmented fast charge stations for EVs, solar energy usage in industry and private households, special industries such as steel and hydrogen to manage peaks and manage total energy cost through low-cost arbitrage, CERENERGY® present sole focus first is utility size battery energy storage system.

For the energy transition in Germany and Europe large substantial energy storage systems are required, the key market for CERENERGY® batteries is the EU followed by the US, once giga watt hour production capacity is reached.

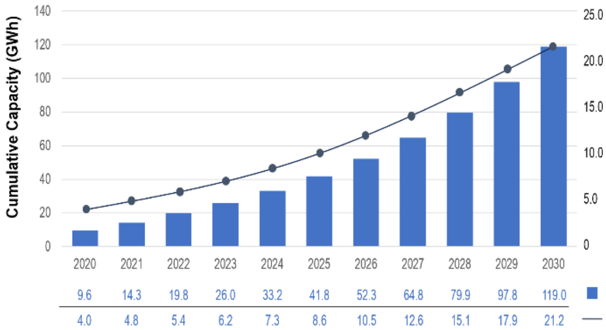


Figure 15 - Grid Energy Storage World Market Development, Source Bloomberg NEF

Market prospects are substantial and agreed by all stakeholders. Bloomberg NEF estimates the world energy storage market at an average CAGR of 26.5% to grow from US$4 billion per annum to US$21.2 billion per annum. The total market is estimated to be US$620 billion until 2040.

PATENT PROTECTION AND SEARCHES

Altech is dedicated to ensuring that the CERENERGY® technology's intellectual property remains free of infringement upon existing patents during the battery's commercialisation phase. Despite Fraunhofer asserting that the battery's chemistry is open technology, there are distinct patents lodged by Fraunhofer concerning internal design. To address this, Altech has enlisted the services of T. Bendele of RUHR-IP Patent Attorneys in Office Partnership (Ruhr-IP). Hence, Altech Batteries GmbH has commissioned T. Bendele of Ruhr-IP to request in May 2023 a Swiss Patent Search Institute to conduct a European Technical Overview Search concerning a Thermal Battery Cell, also known as a ZEBRA battery or sodium nickel chloride battery. This search has identified only three third-party patent families deemed highly relevant, with one having lapsed, another being owned by Fraunhofer, the joint venture partner, and the third involving the use of a glass solder essential for the Battery Cell. Since the required glass solder is already procured from this third party, no patent infringement has been identified in this respect. With these mitigating steps taken, Altech believes that, according to the results of the European Technical Overview Search, the risk of patent infringement is minimal.

TRADEMARK APPLICATION AND REGISTRATION

Trademark applications, integral to the Detailed Feasibility Study (DFS), encompass names like "Altech" and "Altech Batteries," along with the design and name of "GridPack." This proactive step aims to safeguard intellectual property and establish strong product branding, primarily focused on multiple countries, primarily in Europe.

Table 2 – Trademark Applications

Applicant	File no.	Trade Mark	Countries
Altech Batteries GmbH	ATM00001EU	GridPack (Design)	Europe
Altech Batteries GmbH	ATM00001WO	GridPack (Design)	International
Altech Batteries GmbH	ATM00001ZA	GridPack (Design) Class 09	South Africa
Altech Batteries GmbH	ATM00001ZA01	GridPack (Design) Class 42	South Africa
Altech Batteries GmbH	ATM00002EU	Altech	Europe
Altech Batteries GmbH	ATM00002WO	Altech	International
Altech Batteries GmbH	ATM00002ZA	Altech (Class 09)	South Africa
Altech Batteries GmbH	ATM00002ZA01	Altech (Class 42)	South Africa
Altech Batteries GmbH	ATM00003EU	Altech Batteries	Europe
Altech Batteries GmbH	ATM00003WO	Altech Batteries	International
Altech Batteries GmbH	ATM00003ZA	Altech Batteries (Class 09)	South Africa
Altech Batteries GmbH	ATM00003ZA01	Altech Batteries (Class 42)	South Africa

APPLICATION FOR GREEN CERTIFICATION

CICERO has been engaged to conduct an independent evaluation of the Company's CERENERGY® plant that would be located at the Schwarze Pumpe Industrial Park, Saxony, Germany. The plant is being designed with a specific focus on minimising environmental impact and in accordance with prevailing German, European, and International environmental standards. CICERO will be assessing if the project is suitable for future green bond financing.

COMMENCEMENT OF PERMITTING

Altech appointed ARIKON Infrastruktur GmbH (Arikon) to manage the approval process, site infrastructure requirements, and the balance of the plant. Arikon has been responsible for managing the application process and working with relevant regulatory bodies to obtain all necessary approvals for the project. This includes securing necessary permits and licenses, coordinating with local authorities, and arranging utility connections. Additionally, Arikon has been responsible for designing the site infrastructure requirements for the site. Arikon has commenced the permit and environmental application process. The Company has decided to concurrently develop the project while the funding process is underway. The process will likely take until end-2024 and it is important that the Company keeps advancing the project.

PLANT LOCATION - SAXONY GERMANY

The project has secured land in the Schwarze Pumpe Industrial Park (ISP), strategically located at the Brandenburg-Saxony border, approximately 120 km from Berlin and 78 km from Dresden. Positioned in the southern part of the ISP within Spreetal municipality, the chosen CERENERGY® site offers advantages in terms of readiness, size, future expansion potential, logistic integration, renewable energy accessibility, existing facilities, and employee availability. Close proximity to Dresden, strong local stakeholder support, competitive pricing, and potential financial backing from state authorities further enhance the appeal of this greenfield site. It boasts fully developed infrastructure, utilities, and excellent logistics, including an on-site rail connection.

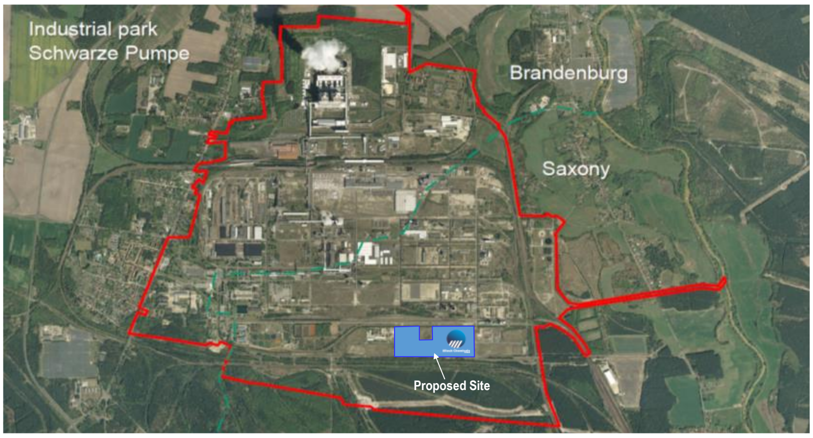


Figure 16 – CERENERGY® Project Location

EPCM CONTRACTOR

Leadec Automation & Engineering GmbH (Leadec) was chosen as the lead engineer for the Definitive Feasibility Study as well as the EPCM contractor during the build of the CERENERGY® 120 MWh Battery project. Leadec is a leading global service specialist for factories across the entire life cycle and related infrastructure. For 60 years, the German company has been supporting customers in the manufacturing industries; from planning, installation, and automation of the factories. Entrusted with detailed engineering, design, and procurement of major equipment, Leadec will ensure a seamless and continuous approach to plant development. In addition to managing structural and balance of plant activities conducted by Arikon, Leadec will serve as the principal owner's representative. This entails overseeing project administration, design production, construction work breakdown, professional and competitive tender management, progress monitoring, contract compliance, estimating, planning, document control, procurement, cost control, financial analysis support, and project closeout activities, showcasing a comprehensive and integrated project management strategy.

The Automation arm of Leadec has been appointed as the contractor to provide advanced electric and automation solutions for the battery plant. This will include intranet-equipped control centres and local operation systems, allowing for centralised monitoring and control of operations. In addition, a SCADA real-time live system, ensuring real-time data acquisition, visualisation, and control will be incorporated. Track and trace functionality along with batch identification will be the key feature of the battery plant.

BUILDING AND INFRASTRUCTURE CONTRACTOR

Arikon AG ("Arikon") has been appointed as the building, infrastructure as well as permitting contractor for the CERENERGY® project. Arikon, a prominent project developer and industrial plant manufacturer, boasts expertise in diverse peripheral works, encompassing architecture, air, wastewater, and building technology. Proficient in overseeing environmental, building, and operational approval procedures, Arikon is well-versed in the specific requirements of the battery industry. Notably, Arikon successfully managed projects of comparable size and complexity, including the Tesla plant in Gruenheide, where it served as the contractor for plant infrastructure and supported permitting applications. With a track record in fast-track projects, adaptability to change, and a capacity to navigate complex process technology for CERENERGY® production, Arikon aligns Altech's approach.

PLANT PROCESS DESCRIPTION

The CERENERGY® production facility comprises dedicated sections for ceramic tube mixing, green tube formation, sintering and cell assembly. The other part involves sodium chloride and nickel granule formation, sodium aluminium chloride preparation for tube filling. The tube is then assembled in metal housing and canisters and welding, manufacturing, cathode sodium chloride production, and cell assembly follows. It undergoes phases such as initialisation, module assembly, battery pack assembly, and concludes with GridPack assembly. The equipment and layout are intricately designed, facilitating the swift completion of a CERENERGY® battery cell in a mere 45 seconds. Automation and robotics are integrated into the facility to meet high production rates efficiently. The following picture shows the general process flow in the production.

Process Steps

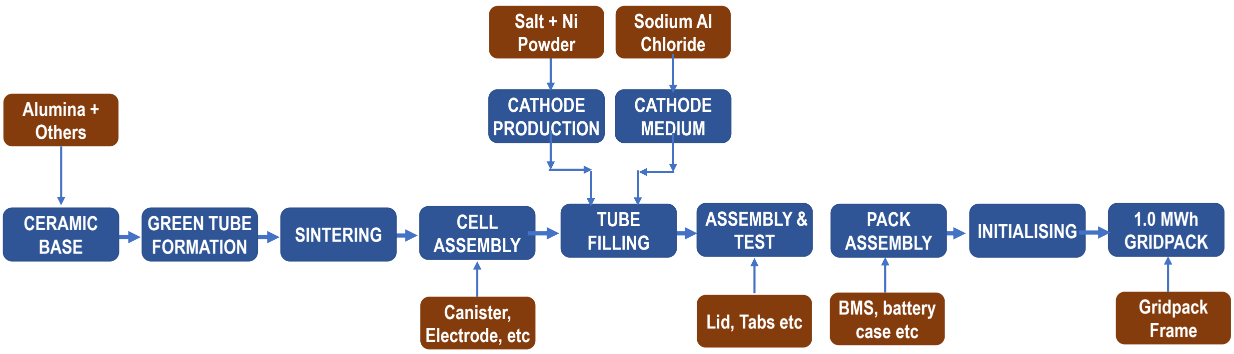


Figure 17 – Basic process steps in CERENERGY® battery production

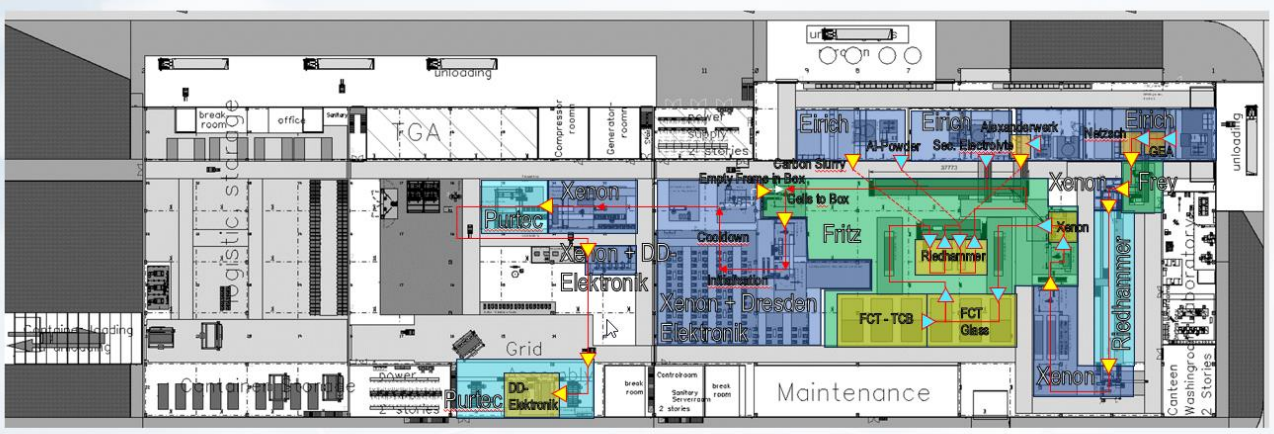
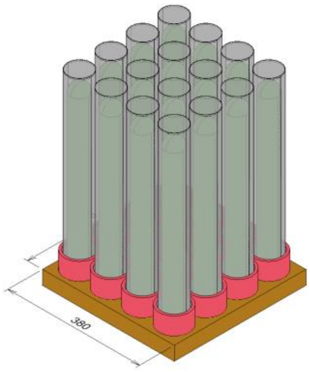


Figure 18 - CERENERGY® battery plant layout

The aim of the ceramic tube manufacturing section involves raw material powder receival and handling, and production of the sodium ion conductive ceramic tube based on beta aluminium oxide. The overall process is divided into the following processes:

1. Mixing and Slurry Preparation
2. Slurry Milling
3. Spray Drying
4. Green Tube Pressing
5. Setter Pressing
6. Loading Green tube + Setter on kiln tray
7. Sintering
8. Q-Gate: Optical Check (incl. Drop-off)
9. Buffer: Sintered Tubes (incl. Emergency Drop-off/-in)



In the Mixing and Slurry preparation phase, powdery materials are blended into a high-quality ceramic slurry, dosed in the correct order into a specified aqueous phase while simultaneously mixing. Slurry Milling, an internal cyclic process, establishes the required grain size distribution through grinding with zirconium dioxide media. Altech has contracted Maschinenfabrik Gustav Eirich GmbH & Co KG (Eirich), a highly experienced German company that provides advanced ceramic powder mixing and granulation equipment and technology (See Figure 19). Eirich will also provide equipment and technology for granulating salt and nickel, essential for battery cathodes.

Figure 19 - Eirich mixing machines

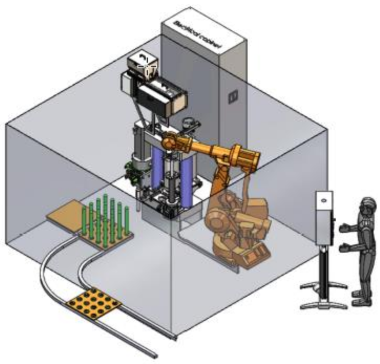


Figure 20 - Freys Isostatic Pressing Unit

The next step is the Spray Drying process where the slurry is transformed into ceramic granules, adhering strictly to grain size and residual moisture specifications. The dried ceramic granules are pressed into ceramic tubes at high pressure using an isostatic press to shape the ceramic tubes (green tubes). Frey Systeme GmbH (Frey) has been selected to provide isostatic machines for producing green ceramic tubes at the required production rate. Frey's advanced technology (See Figure 20) enables high-speed filling of rubber moulds and applies high pressure to produce green tubes. With robotic technology, this will achieve a remarkable production rate of one tube every 45 seconds.

The next step of the process is loading the green tubes onto kiln trays, mechanically stabilising them, and covering them with a magnesium spinel protective shell for sintering. Sintering at 1600 degrees celsius is accomplished in a specially designed tunnel kiln, exclusively powered by electricity in contrast to the conventional use of gas in tunnel kilns. In the furnace, the ceramic green body tube undergoes chemical conversion at a precise temperature program, becoming a finished sodium ion-conductive beta-aluminate tube. Altech has contracted Riedhammer GmbH (Riedhammer), a world leading German ceramic kiln plant provider, who will provide the electrically heated tunnel kiln for sintering of ceramic tubes (See Figure 21). The use of renewable electricity for heating will dramatically reduce the carbon footprint of the CERENERGY® battery. This innovative approach results in substantial environmental benefits, as approximately 480 tons of CO_2 emissions can be saved when compared to traditional gas-powered batch kilns.

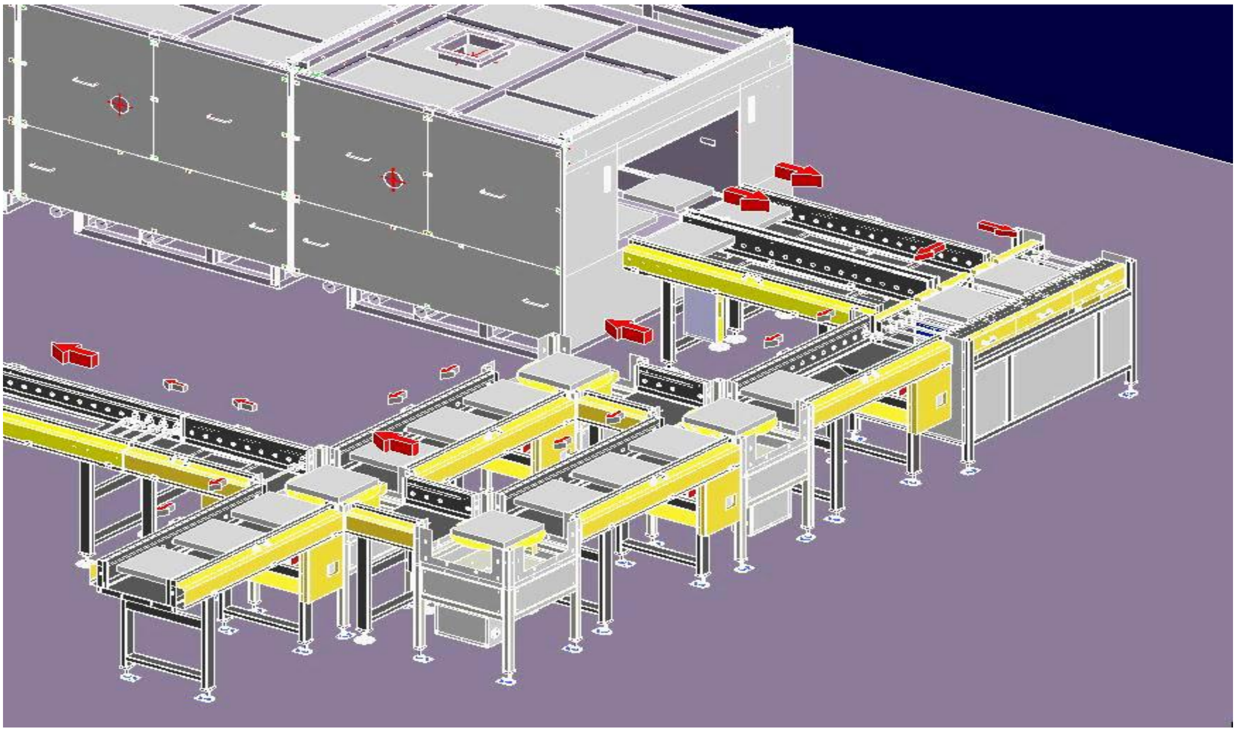


Figure 21 – Tunnel kiln technology from Riedhammer

At the exit of the sintering, ceramic tubes are cooled and optical quality control ensures defect-free, dimensionally accurate calcined ceramic tubes. Altech has contracted Xenon Automatisierungstechnik GmbH (Xenon) to implement comprehensive quality checks for completed sintered ceramic tubes, ensuring that there are no cracks or faults. Xenon's technology will involve optical and ultrasonic tests to detect faults.

Additionally, Xenon and Dresden Elektronik have designed the initialisation process for completed cells, which involves subjecting them to a full charge and discharge cycle.

Fully completed ceramic tubes are stored in a high-capacity buffer, strategically designed to minimise the production line's reliance on the kiln. This buffer serves to decouple dependencies, allowing for smoother and more flexible workflow management. The next step is the tube-cutting process. The objective of the cutting process is to trim the ceramic tube to the specified length and to separate the setter piece from the main tube. Precision is crucial in guiding the cutting plane, especially considering the slight bending of the ceramic tube within strict tolerances after the sintering process. The bottom of the ceramic tube must align precisely with the bottom of the canister. Beta-Aluminate tubes from the cutting process undergo a thorough visual inspection for defects like cracks, outbreaks, and damages. Geometric tests, including diameter, length, height, and straightness, are conducted. Tubes not meeting specifications are ejected separately.

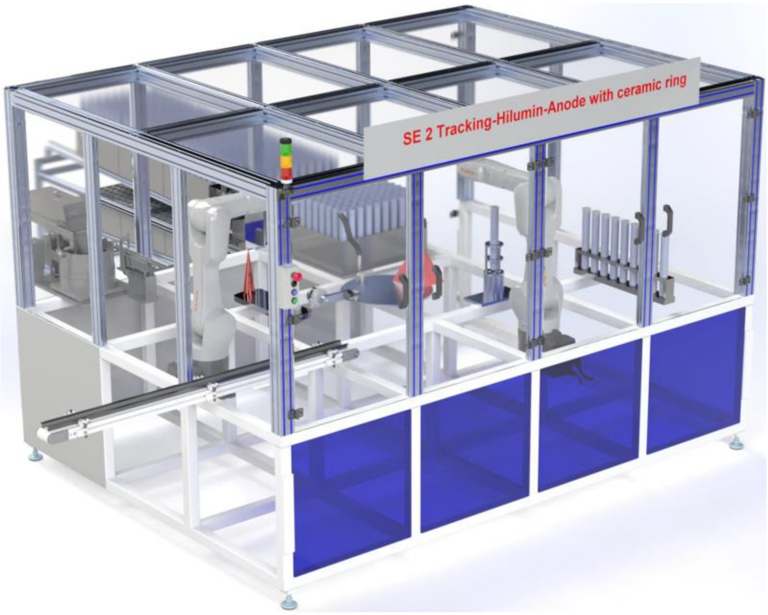


Figure 22 – Themo compression bonding step

The subsequent stage involves bonding ceramics with two nickel flanges to ensure the leak tightness of the entire battery cell. This is achieved through a distinctive Thermo Compression Bonding method, attaining a leak density of 10^{-8} mbar*l/s. See Figure 22. The process, facilitated by specialised stacking tools, occurs in a high-temperature environment, ensuring a robust and effective assembly. To verify the characteristics of the sealing a Helium Leak Test is used in the process.

The joining process of the electrolyte tube with the metal ceramic sub-assembly is missing. Employing an automated roller-application system, the tube undergoes drying before advancing to subsequent assembly stations. The metal cell case is readied for ceramic tube mounting, followed by electrode installation and filling with prepared cathode material. Simultaneously, the secondary electrolyte is readied and introduced into the cell. Combining the metal case, ceramic tube, electrode, cathode material, and secondary electrolyte, the cell is welded shut. The canister's bottom is filled with a specified amount of aluminum powder to enhance stability and electrical conductivity between the solid electrolyte tube and battery cell canister. The metal shim is slid onto the solid electrolyte tube. Altech has contracted Fritz Automation GmbH

(Fritz) as the supplier for the cell assembly plant that encompasses various tasks such as tube cutting, ceramic ring assembly, ceramic to cell case assembly, electrode assembly and welding, cathode granules and medium filling, as well as cell and battery pack assembly. Fritz will also provide systems for cell initialisation and performance testing. Fritz have designed the advanced automation systems which will ensure efficient and precise execution of each step of the cell assembly process.

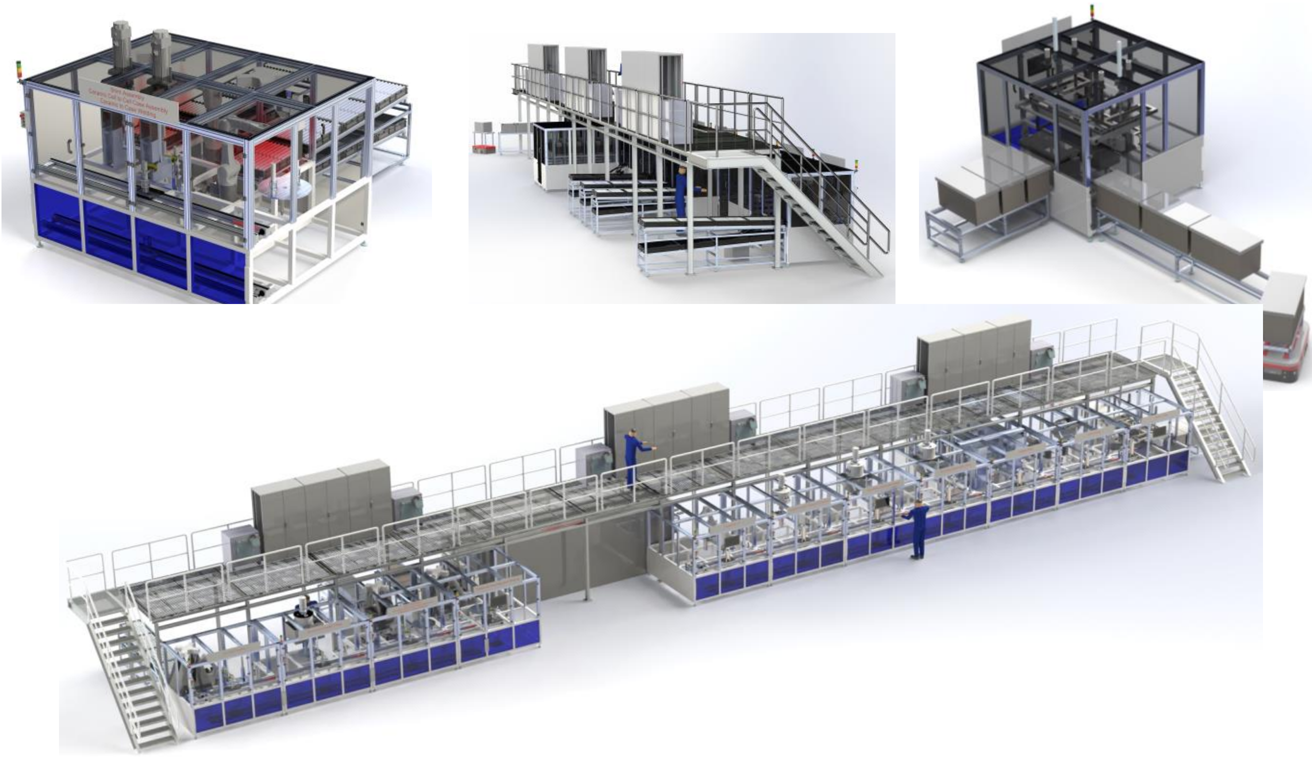


Figure 23 – Cell Assembly systems to be provided by Fritz Automation

Upon completion of cell assembly, multiple cells are grouped and stored in a larger thermal box. In this phase, each cell within the thermal boxes undergoes its inaugural full charge and discharge. Throughout the entire initialisation process, individual cell behaviors are meticulously logged. Essential electrical, electrochemical, and spectrometric parameters are automatically recorded and compared against predefined target conditions. For the cell initialisation and subsequent performance testing of completed battery cells, Dresden Elektronik GmbH has been selected to provide automation and robotics around this manufacturing step. The unit is designed to efficiently collect test data and perform charge and full discharge cycles to ensure the proper functioning of the cells. Tracking each individual cell during the manufacturing process is critical to the proposed battery facility.

The subsequent step involves assembling cell connectors and welding the bus bars. In the welding process, all bus bars mounted on top of the Cell Connection System (CCS) are individually welded to their associated cells. Subsequently, a resistance weld checking mechanism examines all welding seams. If any failures are identified, cells can be reworked by removing the bus bars from the affected cell. Following successful inspection through the fifth Q-Gate, the modules are buffered until a batch of five is available. This set of five modules is then forwarded to the Battery Pack Assembly station. Altech has selected Hofer Powertrain GmbH (Hofer), a leading German supplier of connector plates used for battery busbar connections and wire connections. Hofer's expertise lies in designing and manufacturing efficient and reliable solutions for battery cell mounting. With its advanced connector plate technology, Hofer Powertrain will help secure and seamless connections between battery cells.

During battery pack Assembly, a vacuum-insulated housing is assembled. König Metall GmbH (König) has been chosen as the supplier for the insulated battery pack cases for the 60 KWh battery packs. These battery packs are designed with excellent vacuum insulation, ensuring that the exterior remains safe to touch. The cases are designed to IP 65 standards, which allow the batteries to operate in all weather conditions. The metal casings are designed for BMS and connector wiring at the bottom of each unit.

The Battery Management System (BMS) is inserted into the housing's socket, and five battery modules are stacked and connected using safety pins and bolts. Heaters are mounted and wired, and pre-configured harnesses are connected to the Cell Connection System (CCS) and BMS. The vacuum casing covers the entire assembly, secured with bolts. The end-of-line test verifies the battery pack's functionality, including cells, heaters, BMS, CCS, sensors, and safety requirements.

Altech has partnered with IAV GmbH Ingenieurgesellschaft Auto und Verkehr (IAV) to provide an advanced Battery Management System (BMS) design for its 60 kWh battery pack and 1 MWh GridPack. The BMS allows seamless integration with site panel software control and enables remote operation when connected to customer grid control systems. It ensures optimal performance and safety of the battery packs and provides users with efficient management and monitoring capabilities. The proposed BMS design also offers remote control capabilities, optimising energy storage and utilisation based on real-time demand and supply dynamics.

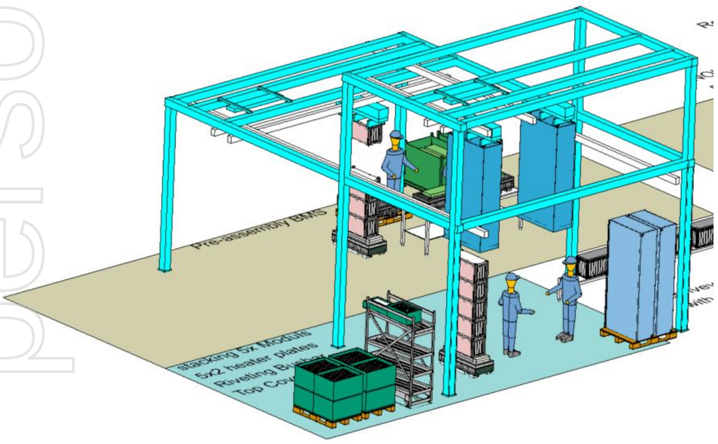


Figure 24 – Assembly of 60 KWh battery packs

Figure 25 – Assembly 1 MWh GridPack

Figure 26 – Completed 1 MWh GridPack ready for shipping

DFS - PROJECT ECONOMICS

With a capital investment of €156 million and working capital of €23 million, Altech's DFS predicts a net present value (NPV_9) of €169 million and annual EBITDA of €51 million from operations. The estimated internal rate of return stands at 19%, with a steady state capital payback period of 3.7 years. At full production capacity of 120 1MWh GridPacks, the expected annual revenue is €106 million, boasting an EBITDA margin of around 47%. Considering the projected growth of the grid storage market at 28% CAGR, Altech Batteries Limited and its joint venture partners have approved the funding phase (Final Investment Decision) for this project.

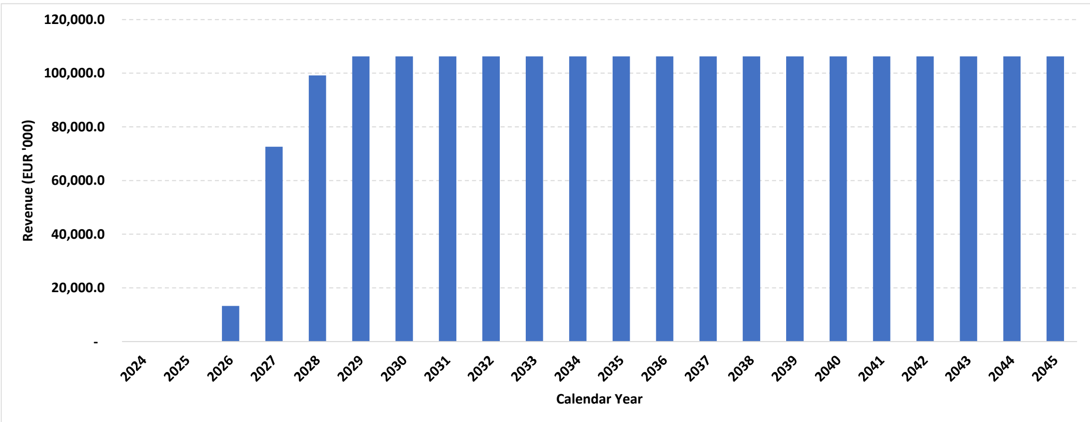


Figure 27 – Projected revenue flow in financial modelling

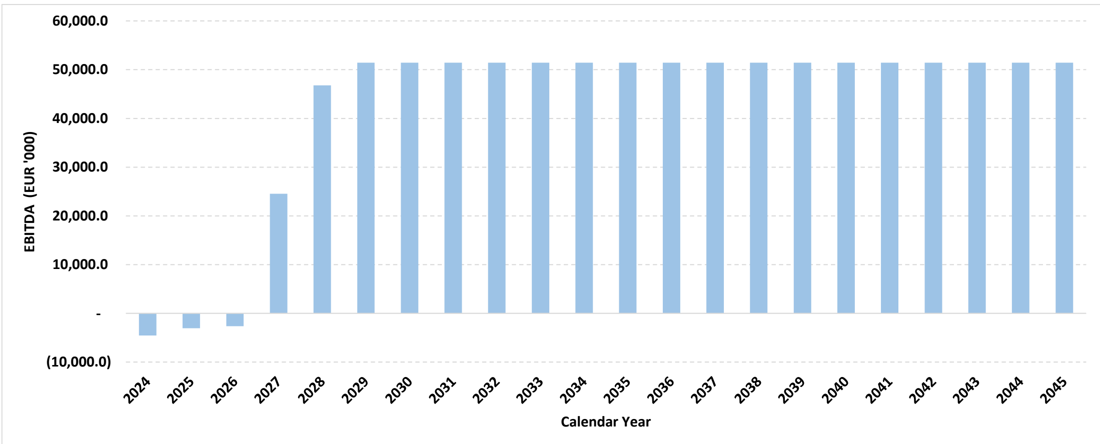


Figure 28 – Projected EBITDA flow in financial modelling

LIFE OF THE PROJECT

The life of the project, as reflected in the financial model, is twenty (20) years, being typical of battery manufacturing plants. With regular maintenance and sustaining capital every year, these plants often last beyond 30 years. The model assumes annual sustaining capital expenditure of around EUR 3.1 million per annum over the life of the project.

CAPITAL COSTS ESTIMATION

The capital costs for the CERENERGY® project are estimated at €156 million (See Table 3). The major capital cost component for the project is the construction of the CERENERGY® facility and the associated site infrastructure, such as the administration building, maintenance workshop, and on-site QA laboratory. The engineering design and cost estimate for the CERENERGY® facility has been based on the process design and equipment required to produce 120 MWh GridPacks per annum utilises equipment design and building layouts specifically developed during the DFS. ABG has assessed its capital estimate for the CERENERGY® plant to be accurate to ± 15% and can be defined as an Authorisation Budget class Estimate (AACE Class 3).

Table 3 - Project Capital Cost Estimate

	Capital Cost EUR	
Production Process Equipment	73.0	Million
Building & Infrastructure	59.0	Million
Mobile Equipment & Fit Out	4.6	Million
Plant Electrical & IT Systems	7.4	Million
Contingency	12.0	Million
Total	156.0	million

BASIS OF ESTIMATE

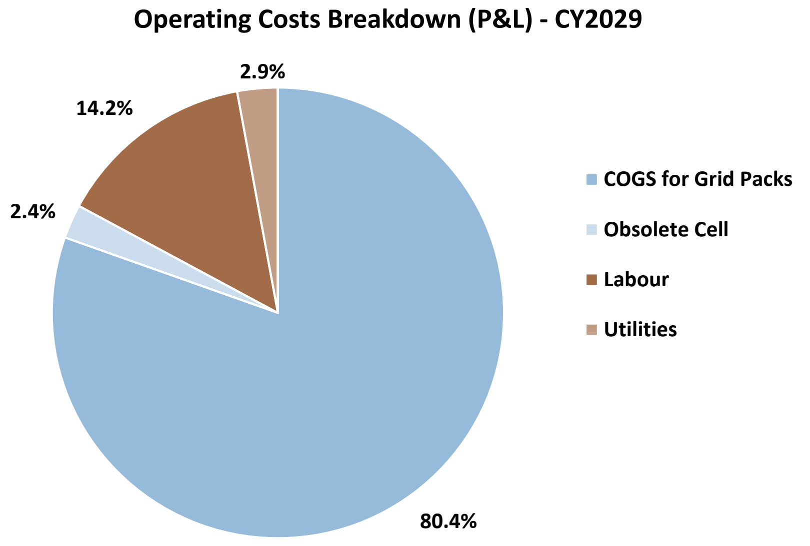
The basis for the Schwarze Pumpe plant capital cost estimate is the mechanical process equipment required for the CERENERGY® facility. Leadec Automation & Engineering GmbH (Leadec), a German-based engineering consultancy, was selected as the EPCM partner for the DFS, responsible for all process equipment design, specification, and estimating. Altech and Leadec selected equipment 45 various sub-contractors to design and quote on the various process operations required for the manufacturing plant. Process flow sheet and mass balance, which was used to develop plant Process and Instrumentation Diagrams (P&IDs), and mechanical equipment lists, with pricing enquiries sent to equipment suppliers in Germany and Europe for the majority of items. Vendor quotations were reviewed, and total equipment pricing compiled. Costs associated with the preparation of the site and construction of plant buildings were engineered and generated by a local preferred Contractor Arikon AG. Arikon has been engaged due to their extensive local design and construction experience and their intimate knowledge of local and state permitting authorities and processes.

ESTIMATING METHODOLOGY

The capital cost estimate has been prepared according to German Cost Engineers Class 3 Standards for engineering studies, with estimates calculated to a degree of accuracy of +/- 15%. The estimate has been developed based on detailed process equipment costs per the mechanical equipment list. Material take-off (MTO) estimates and detailed engineering for the various disciplines of earthworks, civil and structural, were completed based on the plant configuration at Schwarze Pumpe. These material quantity estimates were provided to several nominated construction contractors who then provided local unit rates to develop total capital costs for these areas. The remainder of the plant's direct costs have been estimated by discipline, as is appropriate for the level and accuracy of the study being completed.

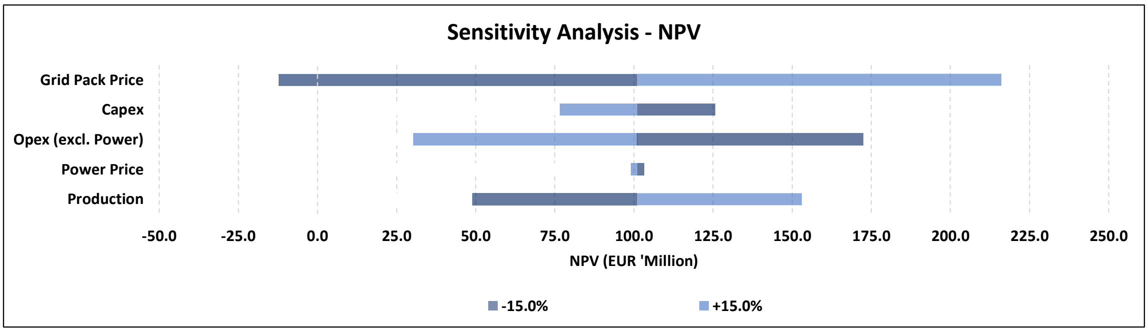
OPERATING COSTS BREAKDOWN

The breakdown indicates that 80% of the cost of goods sold arises from various consumables and components constituting the cell and, consequently, the GridPack. The labour component contributes 14%, while overall electricity accounts for 2.9%.



SENSITIVITY ANALYSIS

A sensitivity analysis of the project's forecast cashflows which forms the basis of NPV, demonstrates significant elasticity of earnings relative to the underlying GridPack price. Operational expenditures (excluding power price) are the second key sensitivity to earnings, followed by production and capital expenditures, while the project's earnings sensitivity to power price is marginal.



WATER MANAGEMENT

The plant design incorporates connectivity of all sealed surfaces to a centralised system, channeling produced water into designated retention facilities. This greywater is subsequently utilised within the sanitary process or directed for irrigation purposes. An integrated closed water cycle has been established across the entire production process, facilitating the potential reuse of up to 90% of the water employed in various processes. Any residual wastewater undergoes treatment by the local supplier, ASG Spremberg GmbH, before being discharged into public waters following purification measures. This comprehensive water management approach ensures efficiency, sustainability, and adherence to environmental standards.

HAZARDOUS MANAGEMENT

The operational mode and selected materials enable the sourcing of all raw materials and semi-finished products within Germany or Europe. This approach eliminates the need for environmentally hazardous substances and circumvents problematic extraction processes. Consequently, the supply chain is characterised by short delivery routes and straightforward material extraction, aligning with sustainability goals. The intended logistic delivery and distribution via rail further contribute to the overall eco-friendly footprint of the product, reinforcing a commitment to environmentally responsible practices throughout the production and distribution process.

RENEWABLE ENERGY USE

The factory design is committed to a fossil fuel-free production process, particularly with a novel electric kiln eliminating natural gas use. Renewable electricity supply has been finalised by a provider. The annual energy consumption, approximately 20.5 million kWh, will be secured sustainably. Through this initiative, the CO_2 reduction potential during production is significant, with an estimated 6.32 kg CO_2/kWh, achieved by utilising renewables like PV solar and wind, resulting in an annual reduction of 6.42 million kg CO_2. This emphasises Altech's pursuit of green accreditation with CICERO, showcasing their dedication to environmentally conscious manufacturing practices and sustainable energy use.

MECHANICAL EQUIPMENT COSTS

The capital cost estimate for mechanical equipment is based on vendor quotations received for all major equipment items after inquiries were sent during 2023. Equipment sizing has been determined from process data for the 120 GridPacks per annum design basis. The mechanical equipment installation hours/costs have been estimated based on the equipment lists and industry experience, norms, and Leadec's current construction industry knowledge and experience.

EARTHWORKS, CONCRETE AND STRUCTURAL WORKS

Concrete and structural steel quantities have been calculated using material take-offs developed from the 3D plant layout design and supporting design calculations for concrete, structural steel, platforms, walkways and cladding. Estimates for bulk earthworks, access road, and in-plant road quantities have also been based on the DFS 3D plant layout. Local material and labour rates have been prepared by Arikon and have then been used to develop the total costs for these areas. Site building cost estimates have been determined using unit rates developed during the design and engineering phase supplied by Arikon. These costs include the construction of administration offices with complete staff facilities, process operations offices, control rooms, a laboratory, and the maintenance workshop/warehouse. Costs associated with the fitout of the plant QA laboratory equipment have been based on vendor quotations from German suppliers and are also included in this direct cost item.

ELECTRICAL & INSTRUMENTATION EQUIPMENT COSTS

The capital cost estimate for electrical equipment is based on vendor quotations received for all major equipment items after inquiries were sent during 2023. Equipment sizing has been determined from process data for the 120 GridPacks per annum design basis. The electrical equipment installation hours/costs have been estimated based on the equipment lists and industry experience, norms, and Leadec's current construction industry knowledge and experience.

Power Supply

The plant's power supply system is divided between medium voltage and low voltage, with Arikon handling medium voltage and Leadec overseeing low voltage excluding lightning and building infrastructure. A 12m x 24m, two-floor switchgear building is planned, housing medium voltage supplies on the lower floor and low-voltage switchgears and control cabinets on the second floor. Technical values include redundant 30 kV feeds, coupling switches, four transformers for medium voltage, and features like TN-S low voltage, emergency generators, redundant 400 V UPS, and busbar power for package units.

Switchgear Rooms

The switchgear room, designed as a 12m x 24m structure within the plant, features two floors housing medium voltage and low-voltage equipment. Air conditioning with fresh outside air ensures component runtime, and a raised, column-designed floor manages cabling. Low-voltage switchgears provide optimal electrical protection, including main switches for transformer feeding and consumer distribution (e.g., package units).

Manufacturing ERP

The design includes MES software components in the battery plant, including the MES core system for central control, Production Documentation System (PDS) for data collection, Analytics and Reporting System (ARS) for production optimisation, and LAB Information Management System (LIMS) for chemical processes. Interfaces include SCADA, ERP, package units, and identification devices.

IT Systems

The plant design incorporates IT infrastructure encompassing user perspectives, network structure, hardware (servers, clients, data centers), software systems (MES, SCADA, engineering), data security, privacy, disaster recovery, and software licensing.

DIRECT COSTS OTHER DISCIPLINES

Direct costs for the remaining disciplines and ancillary items have been included but have generally been based on a factor applied to the total installed mechanical equipment cost where material take offs have not yet been developed as part of the detailed engineering design. Additional direct costs included are:

- Critical spares - Factored as 4% of installed equipment costs;
- Mobile Equipment – Estimated from equipment price database from previous quotations for forklifts; and
- First Fills – Calculated for major reagents from vendor minimum order quantities and unit costs.

INDIRECT COSTS

Indirect project costs have been calculated using factors in line with those typical for battery manufacturing facilities of similar size and complexity. The factor used to calculate total freight cost considered the location of the site and the high proportion of process equipment and construction materials which would be sourced locally from German companies or neighbouring European countries. EPCM costs have been estimated based on the DFS scope, final equipment selection and the execution strategy.

CONTINGENCY

The contingency has been calculated on a line-by-line equipment basis, with allowances included for estimated design growth, pricing accuracy factors, and overall equipment/area scope contingency required, based on the level of engineering, equipment quotations received, and associated project risk. The estimate has been built up from first principles, based on the process design and equipment list, with significant vendor and contractor quotations and input. The contingency accounts for variations that may result from minor adjustments to the plant flowsheet expected during the detailed phase of engineering, geotechnical conditions of the Schwarze Pumpe site or local building regulations that require modification to the civil and structural design, and price fluctuations during procurement negotiations. The capital cost as presented includes a contingency of €12 million.

FEEDSTOCK, REAGENT AND UTILITY COSTS

Project operating costs for the supply of ceramic feedstock, all major process reagents, electricity, and potable water have been based on quotations from local suppliers or utility providers, received during 2023. All raw material suppliers have been secured and are readily available to supply the necessary quantities required for the first line production of 120 MWh annual production. In totality, twenty-one (21) different raw materials are used in the production of the CERENERGY® cell. However, four (4) key items represent the majority of the raw material purchase value and amount to 72.7%.

ELECTRICITY SUPPLY COSTS

The Schwarze Pumpe facility plans to be operated using 100% green electricity. This is most commonly provided to industrial consumers by way of power purchase agreements (PPAs), or by the supply of Guarantees of Origin (GoOs) as part of a supply agreement with any of the energy retailers in the market. Due to the nature of the CERENERGY® plant demand, with high availability requirements for its nominal load, GoOs are proposed as the most appropriate method to purchase green electricity supply to the plant.

LABOUR COSTS

A detailed manning schedule for the plant during both the construction and operations phases has been developed, including operators, process engineering staff, administration, maintenance, and management. Operating costs have subsequently been determined using local German labour rates provided by labour consultants, including all on-costs for items such as health, pension, unemployment, and LTI benefits required under German labour laws.

SUSTAINING CAPITAL

Sustaining capital of approximately 1.5% per annum of the initial plant buildings; 3% on process plant and equipment and equipment; 6% on mobile equipment. The total sustaining capital per annum is €3.1 million per annum.

FINANCING CONCEPT

The CERENERGY® battery development project, positioned as a sought-after global investment, has chosen the European market, particularly Germany, for its initial development. Leveraging German technology, CERENERGY®'s strategic move aligns with the region's focus on renewable energy, evident in the energy transition, making Germany keen to acquire essential technologies and resources. The project's proposed location in Spreetal, Saxony, aligns with funding opportunities in GRW Zone C, defined by economic power below the European average, a higher unemployment rate, population decline, and proximity to Polish and Czech borders.

The funding landscape includes diverse opportunities at the European, German federal, and Saxony state levels. The European Investment Bank (EIB), European Innovation Council (EIC), and federal and regional grants play pivotal roles in supporting the battery sector. Notably, the EU parliament's recent announcement of the zero valley concept designates certain regions as special economic zones, fast-tracking their development and financial support. The grant application process has commenced with these different groups.

The financing concept integrates equity, grants, and debt-like venture capital loans, acknowledging the importance of both financial and non-financial support for project success. The concept involves contributions from entities such as the European Investment Bank, the Ministry of Economics and Environment, the European Innovation Council, and various federal and regional initiatives. Engaging supportive partner banks with a track record in the battery industry adds another layer of assurance for successful project implementation. In summary, the CERENERGY®' battery production plant aims to secure a robust financial structure through a comprehensive mix of funding sources, ensuring the realisation of this pivotal renewable energy project.

Since 2015, the Altech Group has strategically engaged European banks, fostering collaboration to understand Altech's products and build confidence in its management. Selecting banks with a proven track record in the battery industry reflects Altech's approach. Ongoing discussions suggest that equity and mezzanine financing are vital components for successful implementation, complementing equity and grant contributions for this significant renewable energy endeavour.

OFFTAKE DISCUSSIONS WITH POTENTIAL CUSTOMERS

Altech has strategically forged non-disclosure agreements (NDAs) with major utility conglomerates in Germany, showcasing a keen interest in acquiring CERENERGY® 1 MWh GridPack batteries. Currently engaged in advanced discussions, Altech is aiming to pre-sell the entire initial production line for five years to two prominent utility companies. These visionary entities are actively involved in expanding renewable power production and possess diverse requirements for grid storage solutions. Altech's focus in the upcoming period is to solidify these promising partnerships, navigating negotiations to secure offtake agreements, thereby reinforcing the shared commitment to advancing sustainable energy solutions within the German utility sector.

DFS PROJECT RISKS

Altech undertook an expert workshop on 8 March 2024 with engineers, designers, safety managers, Altech management, and experts of key suppliers to identify, and review each risk associated with the project. Each risk item is assigned a consequence, exposure, and probability ranking. The following sections discuss the major risks associated with the success of the CERENERGY® project.

Production and Market Risks

In addressing production and market risks, Altech systematically assessed conventional industrial operational risks, identified matrix-based risks, and implemented mitigation measures. Technical risks associated with CERENERGY® battery performance and plant production capacity are deemed low due to mature battery chemistry, extensive pilot plant operations at IKTS, and collaboration with reputable German contractors. The sales risk is reflected in the sensitivity analysis.

Ramp Up Risks

Failure to meet utilisation targets during operations poses a risk to capacity, potentially elevating unit costs and impeding profitability, leading to delayed positive cash flow. Altech, cognisant of this, has developed a resilient plant design, incorporating scheduled preventative maintenance and accounting for potential downtime scenarios such as power loss. Risk mitigation is further achieved through a conservative utilisation design and Altech's effective preventative maintenance programs. Additionally, a gradual ramp-up over the initial two years has been strategically planned to enhance operational stability and mitigate potential setbacks.

Substitution Risks

The potential threat of sudden technological substitution is considered a moderate risk, prompting continuous market surveillance for emerging energy systems. Purchasing from a start-up entails high financing and warranty risks; thus, pre-selling the initial production, strategic partnerships, and market establishment aim to mitigate this concern. Altech actively manages price risks in the competitive market, ensuring long-term cost-effectiveness and competitiveness through continuous optimisation.

Sub Contractor Risks

Project Development Risks are effectively managed by an experienced team and top-tier contractors in Germany/Europe, ensuring they are deemed low and controllable. A notable medium risk involves potential issues with subcontractors, such as insolvency or a change in commercial standing. To mitigate this, Altech's project management has identified alternate subcontractors for each work package. Operational challenges include the high risk of employee availability, prompting proactive engagement in human resource programs to attract qualified individuals to the region. Medium-level risks related to the supply of raw materials are closely monitored, with a focus on responsible sourcing and logistics management to guarantee continuous operations.

Risks of Finance

The ongoing Ukraine crisis has created challenges in the global banking and equities markets, potentially impacting project finance for our new product. Uncertainties surrounding product risks may delay debt processes. Despite these challenges, Altech is in discussions with European banks, armed with a well-defined development plan, marketing strategy, and continuous communication leading up to our next capital raising. The robust results from the Detailed Feasibility Study (DFS) instil confidence that Altech can secure project funding and seamlessly transition into project execution.

Legal and Compliance Risks

Altech, supported by expert patent lawyers and legal advisors, gives comfort to operate without infringing on third-party rights. A thorough global search, aligning with industry norms, indicates low risks. Legal compliance, especially concerning permits, poses a medium risk due to potential work stoppages from non-compliance. Altech addresses this through stringent procedures, direct top management involvement, and close collaboration with authorities to manage necessary adaptations and requirements efficiently.

Ownership and Loss of Key Personnel Risks

As a start-up, two medium risks—change of ownership and loss of key personnel—pose potential challenges for project delivery. In response, detailed operational procedures are being established and reflected in an Enterprise Resource Planning (ERP) software system. This strategic approach guarantees seamless business continuity and facilitates the smooth transfer of responsibilities to mitigate the impact of these identified risks on the company's ability to deliver the project.

Social Impact Risks

The Social Impact assessment revealed several low risks, continually monitored for potential significance. However, the cultural risk for international employees is regarded as a medium risk, as their confidence, happiness, and sense of security are crucial for successful employment. Altech plans proactive measures. Training programs, language classes, and vigilant monitoring aim to support employee integration, ensuring a positive working environment amid evolving cultural dynamics and potential challenges.

Human Resource Risks

The shortage of skilled workers that is emerging across Europe is one of the potential risks for the construction of new plants. Since May 2023, Altech has been running an initiative together with the Economic Development Agency of Saxony and Brandenburg, the Cottbus and Bautzen employment offices and the Lausitzrunde (Panel of Mayors of Lausitz) with the collaboration of the district office. The aim is to design the soft location factors and social environments that encourage an influx of foreign skilled workers.

Health and Safety Risks

The Company prioritises Health, Safety, and Environment, overseen by top management. Stringent Standard Operating Procedures (SOPs) are consistently developed, reviewed, and updated. Despite these measures, the inherent risk of accidents is acknowledged and addressed through emergency procedures, regular risk assessments, and mandatory employee training. This proactive approach ensures a comprehensive and evolving framework to manage and mitigate potential health, safety, and environmental risks within the organisation.

Environment Risks

With the environment being a primary concern, Altech ensures that all necessary and available monitoring and safety measures will have been implemented in compliance to the relevant regulations and the Federal Emission Control Act ("BimSchG" Bundes-Immissions-schutzgesetz) approval. Altech expert assessment has not identified any medium or high risk in relation to environment.

PROTOTYPE MANUFACTURE

The manufacturing of two 60 kWh prototype batteries dedicated to customer performance testing commenced last year. Altech's joint venture partner, Fraunhofer IKTS, had initially been developing battery packs with capacities of 5 kWh and 10 kWh units. However, with the establishment of the joint venture with Altech, a significant upgrade was undertaken, resulting in the transformation of the battery pack into a substantial 60 kWh unit specifically designed for the grid storage market. In the previous year, the production of two of these substantial 60 kWh battery packs was initiated for the purpose of conducting performance tests and qualifying them for customer use.

The pilot line at Fraunhofer IKTS, situated in Hermsdorf, Germany, has undergone a comprehensive redesign to facilitate the manufacturing of 60 kWh battery prototypes. Innovative tools and machinery have been developed and implemented specifically for producing the battery cells required for the 60 kWh prototypes. The battery pack is composed of 240 CERENERGY® cells, each rated at 2.5 V. These cells are organised in 4 rows, each comprising 12 cells, and stacked 5 modules high. The dimensional specifications of the battery packs are 2.5 meters in height, 1.15 meters in length, and 0.5 meter in width. Ensuring adherence to the Ingress Protection (IP) 65 standard, the packs are designed to be dust and weatherproof, reflecting high levels of sealing effectiveness for electrical enclosures.

Up to now, all prototype materials have been procured from specific suppliers. The crucial stages in cell production involve blending ceramic components, high-pressure pressing, tube formation, and ultimately sintering at 1,600 degrees celsius over a span of several days. The IKTS Hermsdorf pilot plant facility successfully handled the entire ceramic tube production, with half of the required tubes currently manufactured. The battery cathode electrolyte, comprising sodium chloride and nickel powder granules, was produced using the mixing and pelletising equipment at the Hermsdorf pilot plant. The process of cell assembly, encompassing vacuum filling, heating, and welding, is ongoing, resulting in the completion of approximately half of the cells. To facilitate the infiltration of cathode material into multiple battery cells simultaneously, a vacuum chamber was developed. Promising pass results were obtained from laser welding tests on the battery cells conducted at Precitec GmbH & Co. KG

Figure 29 – Production of battery cells at IKTS Hermsdorf pilot plant facility

To confirm the precise alignment of all components following the welding closure of each prototype cell, a thorough examination is conducted using an industrial micro-computed tomography (µCT) scanning system. This ensures the verification of filling height, composition, alignment, and the behavior of cathode material post-cell initialisation. Upon successful completion of the µCT quality assurance, individual cells undergo charge and discharge performance tests, all of which have demonstrated satisfactory and expected results thus far. As of now, fifty percent of the necessary cells have been successfully produced, showcasing excellent progress. Reject or defect rates have been low and with expected limits.

Figure 30 – Some of the completed battery cells waiting performance testing

Module Frames and Cell Contacting System (CCS)

Once the cells are finalized, they are integrated into a module frame and welded to the specially crafted Cell Contacting System (CCS). This system, designed by Hofer AG, a supplier for Altech, facilitates pins and bus bar contact with all cells within an electrical isolation frame arrangement. Hofer AG has successfully completed the development of the CCS, delivering the initial prototype designs for the 60 kWh prototypes. Altech and Fraunhofer have meticulously validated all electrical specifications and tolerances of the CCS, and the electrical isolating material has demonstrated reliable performance.

Battery Casing

König Metall GmbH has produced and delivered two casings for the 60 kWh battery houses. Fraunhofer IKTS, situated in Dresden, will furnish the testing racks for charge and discharge cycling to assess the battery performance. Simultaneously, the battery housings are undergoing heating cycles to evaluate the heat loss parameters of the vacuum-insulated casings. Specialised software has been developed to facilitate access to the parameters that the CERENERGY® Battery pack will furnish during testing. The assembly of cells into the battery housing will be undertaken once all cells are finalised which is expected by mid 2024.

Figure 31 - Delivery of the battery casing and heat loss testing at Fraunhofer IKTS Dresden

Collaboration with Potential Customers

Once the prototypes are completed, Altech intends to give access to prototypes to select potential customers. This collaboration is aimed at demonstrating the practical applications and benefits of the ABS60 series in various industries, while also securing offtake agreements.

CAUTIONARY AND FORWARD-LOOKING STATEMENTS

The DFS contains forward-looking statements based on the estimates provided by independent consultants and engineering firms. The forward-looking statements are not historical facts but rather are based on the Company's current expectations, estimates and projections about the grid storage battery industry, and beliefs and assumptions regarding the Company's future performance.

The statements are subject to a number of known and unknown risks, uncertainties and other factors that may cause actual results to differ materially from those anticipated in the forward-looking statements. Factors that could cause such differences include changes in global grid storage battery supply, equity markets, technological advancements in battery materials, costs and supply of materials relevant to the project, and changes to regulations affecting them. Although Altech believes that the expectations reflected in these forward-looking statements to be reasonable, Altech does not guarantee future results, levels of activity, performance or achievements.

Although the forward-looking statements contained in the DFS are based upon what management of the Company believes are reasonable assumptions, the Company cannot assure investors that actual results will be consistent with these forward-looking statements. The forward-looking statements are made as at the date of the DFS being published, and are expressly qualified in their entirety by this cautionary statement. Subject to applicable securities laws, the Company does not assume any obligation to update or revise the forward-looking statements contained within the DFS to reflect events of circumstances occurring after the date of the DFS.

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Authorised by: Iggy Tan (Managing Director)

Altech's Interactive Investor Hub

Altech's interactive Investor Hub is a dedicated channel where we interact regularly with shareholders and investors who wish to stay up-to-date and to connect with the Altech Batteries leadership team. Sign on at our Investor Hub https://investorhub.altechgroup.com or alternatively, scan the QR code below.

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

CERENERGY® Batteries Project

Altech Batteries Ltd is a specialty battery technology company that has a joint venture agreement with world leading German government battery institute Fraunhofer IKTS ("Fraunhofer") to commercialise the revolutionary CERENERGY® Sodium Chloride Solid State (SCSS) 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 and 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 120 MWh production facility on Altech's land in Saxony, Germany. The facility intends to produce CERENERGY® battery modules to provide grid storage solutions to the market.

ALTECH
cerenergy®
Sodium Chloride Solid State Batteries

Silumina Anodes™ Battery Materials Project

Altech Batteries has licenced its proprietary high purity alumina coating technology to 75% owned subsidiary Altech Industries Germany GmbH (AIG), which has finalised a Definitive Feasibility Study to commercialise an 8,000tpa silicon alumina coating plant in the state of Saxony, Germany to supply its Silumina Anodes™ product to the burgeoning European electric vehicle market.

This Company's game changing technology incorporates high-capacity silicon into 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 product is registered as Silumina Anodes™.

The Company is in the race to get its patented technology to market, and recently announced the results of a Definitive Feasibility Study for the construction of a 8,000tpa Silumina Anodes™ material plant at AIG's 14-hectare industrial site within the Schwarze Pumpe Industrial Park in Saxony, Germany. The European silicon feedstock supply partner for this plant will be 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 German and North American automakers and battery material supply chain companies.

Silumina Anodes™