Altech Industries Germany GmbH
Green Bond Second Opinion

14 December 2021

Altech Industries Germany GmbH ("Altech") is a producer of high purity alumina (HPA) coated battery materials used for lithium-ion (Li-ion) battery production. It aims to become a leading producer of such materials by developing a 10,000 tonne per annum production facility in the Schwarze Pumpe Industrial Park in Saxony, Germany, leveraging the HPA expertise of its 75% owner, Altech Chemicals Limited. The company has no other operations.

Net proceeds will be used solely to construct a plant for producing a composite anode material that enhances capacity of Li-ion batteries used in hybrid and electric vehicles (EVs) of all sizes and classes. According to Altech, its 20%-silicon, 80%-graphite composite improves batteries' energy capacity per gram by up to 2.5x compared to regular graphite anodes, allowing for EVs with cheaper, lighter battery packs and/or improved range. This helps address key cost and range-related barriers to greater EV adoption, which is crucial for the low-carbon transition. Only capex investments are eligible; these include a fossil fuel element (emergency diesel generators). No offtake contracts are in place yet.

The plant's main feedstocks of silicon and synthetic graphite are energy-intensive in production and also depend on fossil fuel-derived inputs, creating transition risks in Altech's supply chain. Otherwise, Altech has reduced Scope 3 emissions by choosing European suppliers using renewable energy. The plant has near-zero Scope 1 and 2 emissions as the plant's processes, including steam generation, are fully electrified, and it will use renewable electricity sourced from on-site solar panels and renewable energy certificates. The plant also uses chemical feedstocks produced from mined raw materials, e.g. bauxite, that may be associated with adverse environmental and social impacts.

Altech has factored sustainability into supplier selection and expects to develop much-needed supply chain sustainability policies and processes in the future. The company has researched the plant's life-cycle emissions and used the findings to inform its sustainability approach so far. Altech has not started implementing the TCFD recommendations but notes that it will consider doing so moving forwards. The company has outlined a robust reporting approach that includes a commitment to obtaining third-party verification.

Based on the overall assessment of the projects that will be financed under this framework, and governance and transparency considerations, Altech's green bond framework receives a **CICERO Medium Green** shading and a governance score of **Good**. We recommend that Altech implement and enforce robust supplier policies and engage suppliers to develop low-carbon feedstocks. It can further mitigate supply chain risks by setting targets on Scope 3 emissions and recycled material use, and by engaging battery and vehicle manufacturers to improve material recoverability and recyclability. We also recommend that Altech assess and mitigate physical climate risks to its plant and supply chains.

SHADES OF GREEN

Based on our review, we rate Altech's green bond framework **CICERO Medium Green.**

Included in the overall shading is an assessment of the governance structure of the green bond framework. CICERO Shades of Green finds the governance procedures in Altech's framework to be **Good**.

GREEN BOND PRINCIPLES

Based on this review, this Framework is found aligned with the principles.

CICERO Medium Green

°CICERO Shades of Green

Contents

1 Terms and methodology

This note provides CICERO Shades of Green's (CICERO Green) second opinion of the client's framework dated November 2021**.** This second opinion remains relevant to all green bonds and/or loans issued under this framework for the duration of three years from publication of this second opinion, as long as the framework remains unchanged. Any amendments or updates to the framework require a revised second opinion. CICERO Green encourages the client to make this second opinion publicly available. If any part of the second opinion is quoted, the full report must be made available.

The second opinion is based on a review of the framework and documentation of the client's policies and processes, as well as information gathered during meetings, teleconferences and email correspondence.

Expressing concerns with 'Shades of Green'

CICERO Green second opinions are graded dark green, medium green or light green, reflecting a broad, qualitative review of the climate and environmental risks and ambitions. The shading methodology aims to provide transparency to investors that seek to understand and act upon potential exposure to climate risks and impacts. Investments in all shades of green projects are necessary in order to successfully implement the ambition of the Paris agreement. The shades are intended to communicate the following:

CICERO Shades of Green	Examples
Dark green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Ideally, exposure to transitional and physical climate risk is considered or mitigated.	Wind energy projects with a strong governance structure that integrates environmental concerns
Medium green is allocated to projects and solutions that represent steps towards the long-term vision, but are not quite there yet. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Physical and transition climate risks might be considered.	Bridging technologies such as plug-in hybrid buses
Light green is allocated to projects and solutions that are climate friendly but do not represent or contribute to the long-term vision. These represent necessary and potentially significant short-term GHG emission reductions, but need to be managed to avoid extension of equipment lifetime that can lock-in fossil fuel elements. Projects may be exposed to the physical and transitional climate risk without appropriate strategies in place to protect them.	Efficiency investments for fossil fuel technologies where clean alternatives are not available

Sound governance and transparency processes facilitate delivery of the client's climate and environmental ambitions laid out in the framework. Hence, key governance aspects that can influence the implementation of the green bond are carefully considered and reflected in the overall shading. CICERO Green considers four factors in its review of the client's governance processes: 1) the policies and goals of relevance to the green bond framework; 2) the selection process used to identify and approve eligible projects under the framework, 3) the management of proceeds and 4) the reporting on the projects to investors. Based on these factors, we assign an overall governance grade: Fair, Good or Excellent. Please note this is not a substitute for a full evaluation of the governance of the issuing institution, and does not cover, e.g., corruption.

2 Brief description of Altech's green bond framework and related policies

Altech Industries Germany GmbH ("Altech") is a producer of high purity alumina (HPA) coated battery materials, intended solely for use in the manufacture of lithium-ion batteries for hybrid and electric passenger, commercial and industrial vehicles. It aims to become a leading producer of such materials by developing a 10,000 tonne per annum production facility in the Schwarze Pumpe Industrial Park in Saxony, Germany. No offtake arrangements are in place as of yet, but the company is in dialogue with a number of battery and vehicle manufacturers.

Altech is 75% owned by Altech Chemicals Limited (ATC), which is listed on the Frankfurt and Australian Stock Exchanges, and 25% by Altech Advanced Materials GmbH (AAM), which is listed on the Frankfurt Stock Exchange. Altech is headquartered in Berlin and does not expect its ownership structure to change. It currently has four management board members and less than 20 full-time employees and consultants; it estimates that 109 corporate and operations personnel will eventually staff the battery materials plant.

Environmental Strategies and Policies

Altech informed us that due to its size and minimal level of activity as a start-up, the company has not yet developed a sustainability strategy or formalized any sustainability policies, nor has it started to implement the TCFD recommendations. It has shared that it expects sustainability policies to be a focus of development at a later stage, and that it will consider implementing the TCFD recommendations in the future. However, it aims to comply with all German and European environmental regulations, as well as international standards, such as the Equator Principles and the IFC Performance Standards on Environmental and Social Sustainability. Altech is also developing an Environmental Management System (EMS), which it expects will be certified under the ISO 14001 standard before the plant starts operations. In addition, the company's management team reviews environmental compliance bi-annually.

Altech has developed proprietary processes for producing battery materials that, when used in the manufacture of lithium-ion batteries, improve battery lifetime, capacity, and cyclability. These processes include 1) production of HPA precursor material and 2) using the HPA precursor material to produce a composite material (comprising HPA-coated graphite and silicon) that can be used to make lithium-ion battery anodes. According to the company, these improvements can reduce the carbon footprint of anode material by 52% (for 20% Si content) compared to conventional graphite anodes, when compared on a gCO_2eq/Ah (i.e. capacity-normalized) basis. This improvement stems from gains in battery capacity from use of Altech's materials and allows for batteries that are lighter and/or which have improved capacity. The company has shared that its development of this technology leverages its HPA expertise and the production process used by ATC's HPA plant in Johor, Malaysia.[1]

Altech has shared that the CO_2 footprint from its HPA coated composite anode material is around 6.4 $kgCO_2eq$ per kg of material. 60% of this figure is attributable to Scope 3 emissions from its sourcing of graphite feedstock, and 30% to Scope 3 emissions from its sourcing of silicon feedstock. The remaining 10% is from the use of energy and reagent inputs to the HPA production and coating process itself. See Background section for further information about emissions and impacts from graphite and silicon production.

[1] ATC Chemicals is in the process of raising a green bond to finance its Malaysian HPA plant; Altech has clarified its HPA-coated battery materials are a separate product stream and is not dependent upon the Malaysian plant.

According to Altech, it has designed the HPA coating plant to minimize environmental impacts, principally by minimizing usage of feedstock and other inputs through recovery and reuse of inputs like hydrochloric acid, reducing waste and solid residues, and lowering the plant's overall carbon footprint. The latter includes installing on-site solar panels and sourcing 100% green electricity. It also entails use of electrical heating methods instead of natural gas burners in high temperature process stages such as calcination and flash drying. Altech has shared that it has identified a suitable supplier of electric boilers for steam generation, negating the use of natural gas burners. Altech will dispose of all solid waste streams by hiring licensed and approved waste contractors. Wastewater generated from the plant's processes is neutralized and filtered before discharge into the industrial park's drainage for further treatment.

Although Altech has not yet formalized its sustainability policies, it has shared that its team has so far factored sustainability into supplier selection for feedstock materials (i.e. silicon and graphite) primarily by aiming to source from European production facilities as there would be lower transportation impacts, greater access to renewable energy, and lower environmental risks from being governed by EU environmental, safety and labour regulations. In addition, Altech has factored in whether suppliers have a strong focus on developing low impact battery materials, the relevance of sustainability in their corporate vision, and their sustainability commitments. According to Altech, moving forwards it intends to develop a more structured process for assessing suppliers, which will include third party consultants to assist with developing sustainable supply chain policies and procedures and for initial supplier audits. Anticipated areas of focus for supplier assessment and audits include suppliers':

- Alignment and compliance with Altech's future supply chain sustainability policy;
- Measuring, monitoring and reporting procedures;
- Sustainability benchmarking and performance;
- Processes for reviewing and addressing non-compliance;
- Compliance with local and international laws and regulations;
- Sustainability reporting; and
- Progress against any mutually agreed plans or projects for addressing outstanding sustainability issues.

Altech has further noted that it will reserve the right to terminate supply contracts should its suppliers be found to be in contravention of its future sustainable supply chain policy.

Use of proceeds

Altech will use proceeds from green bond issuances under the framework solely to finance the construction of its new battery materials plant in Saxony, Germany, which according to Altech will feature state of the art process equipment and best available techniques for emissions management. No other investments, e.g., operational and administrative expenses, are eligible under the framework, and proceeds will not be used to source raw materials, fossil fuels, or other inputs. The company does not expect to use proceeds for any refinancing.

Altech has shared that it cannot rule out that fossil fuels will be used during construction phase of the plant. The plant will also feature emergency diesel generators as a standby power source that Altech expects to use rarely due to high grid reliability.

Selection

The selection process is a key governance factor to consider in CICERO Green's assessment. CICERO Green typically looks at how climate and environmental considerations are considered when evaluating whether projects can qualify for green finance funding. The broader the project categories, the more importance CICERO Green places on the governance process.

Altech's framework does not describe any project selection criteria or processes as it has already decided to use the proceeds to construct its Battery Materials HPA Coating Plant in Saxony, Germany. The company informed us that site selection took into account factors such as the location of other Altech plants, availability of renewable energy supply, proximity to product markets, i.e. battery and car production, availability of skilled labour, and the location of suppliers of feedstock, equipment, and engineering, procurement, and construction (EPC) services. Such locational considerations help to minimize transportation impacts in Altech's supply chain. According to Altech, locating the plant in a greenfield site of an established industrial park minimizes chances of local opposition and removes the need for site remediation. Finally, the existence of a supportive investor base and local government were factors as well.

Altech is conducting a prefeasibility study that it expects to complete by end-2021. As part of the study, an environmental due diligence review has been conducted by Arcadis Germany GmbH, an environmental consultancy. This identifies the relevant EU and German regulations and permitting processes applicable to the construction and operation of the plant, and also outlines the steps Altech will take to comply with these requirements. These include Altech's choices around plant design and technology that enable it to comply with regulations pertaining to the management of air emissions, wastewater, solid waste, and noise. Altech has shared that external environmental experts will review the plant's environmental design as part of future feasibility study and front-end engineering and design.

The environmental review also indicates that Altech is required to complete an environmental impact assessment (EIA) as part of the local authority's environmental approval and permitting process, which will take between 9 and 12 months. The EIA includes a public review and consultation period. Altech will commence the plant permitting and EIA processes once it has completed preliminary engineering for the plant, sometime in 2022. The company does not anticipate any objections to the plant from the local government or community due to the plant's strategic significance for reducing the region's historical economic dependency on coal mining, as well as the synergies the plant will have with the region's existing battery and electric vehicle manufacturers.

Management of proceeds

CICERO Green finds the management of proceeds of Altech to be in alignment with the Green Bond Principles.

Altech informed us that the proceeds shall be deposited into a separate transaction account for traceability of spending, and its CFO will track all contract payments made during plant construction against the green bond proceeds. According to the company, allocation of proceeds will take place over a 12-18 month window following bond issuance. While Altech does not expect any unallocated proceeds, any that do occur will be deposited into short term investments in accordance with Altech's liquidity management policy and cannot be used to finance other projects or plants. According to the company, the short-term investments include money market instruments.

Reporting

Transparency, reporting, and verification of impacts are key to enable investors to follow the implementation of green finance programs. Procedures for reporting and disclosure of green finance investments are also vital to build confidence that green finance is contributing towards a sustainable and climate-friendly future, both among investors and in society.

Altech will report on the use of proceeds and impacts of the green bond until the maturity of the bond via an annual Green Investor Report. The report will include details of the project, a progress update, and unallocated proceeds. It will also include impact indicators including:

- Annual CO_2eq Emissions (tCO_2 eq/t Product)
- Annual CO_2eq Emissions by energy capacity ($kgCO_2$ eq /Ah)
- Comparison of CO_2eq Emissions to Benchmark Products by $kgCO_2$ eq /Ah
- Annual Energy Consumption (GJ/t Product)
- Annual Energy Reduction Initiatives
- Annual CO_2eq Emissions Reduction Initiatives
- Renewable energy Guarantee of Origin (GoO) summary
- On site Renewable Energy Generated

In addition to the above, Altech has shared that it will consider reporting on emissions associated with project implementation and in relation to the company's future emissions reduction strategies, as well as energy consumption by source.

Altech will disclose the methodologies used to calculate impacts. It will also subject its annual reporting to review by an external auditor, which will include assurance that the use and allocation of proceeds are in accordance with the framework. The external assurance will be published in Altech's annual Green Investor Report.

According to Altech, the report will be prepared by its CFO and environmental, health and safety manager, and endorsed by its managing director and board. The report will be published on its company website and circulated electronically to investors. The company expects to publish its first report six months after bond issuance and annually thereafter.

3 Assessment of Altech's green bond framework and policies

The framework and procedures for Altech's green bond investments are assessed and their strengths and weaknesses are discussed in this section. The strengths of an investment framework with respect to environmental impact are areas where it clearly supports low-carbon projects; weaknesses are typically areas that are unclear or too general. Pitfalls are also raised in this section to note areas where Altech should be aware of potential macro-level impacts of investment projects.

Overall shading

Based on the project category shadings detailed below, and consideration of environmental ambitions and governance structure reflected in Altech's green bond framework, we rate the framework **CICERO Medium Green.**

Eligible projects under the Altech's green bond framework

At the basic level, the selection of eligible project categories is the primary mechanism to ensure that projects deliver environmental benefits. Through selection of project categories with clear environmental benefits, green bonds aim to provide investors with certainty that their investments deliver environmental returns as well as financial returns. The Green Bonds Principles (GBP) state that the "overall environmental profile" of a project should be assessed and that the selection process should be "well defined".

Category	Eligible project types	Green Shading and some concerns
Eco-efficient and/or circular economy adapted products, production technologies and processes	Construction of Altech's Battery Materials HPA Coating Plant in Saxony, Germany	**Medium to Dark Green** ✓ The shading accounts for the contribution of Altech's battery materials to vehicle electrification and its efforts to minimize emissions, while considering fossil fuel linkages and mining impacts in Altech's supply chains. ✓ This project category is also relevant to the "Clean Transportation" category of the Green Bond Principles. ✓ Altech's battery materials are used exclusively to produce anodes in lithium-ion batteries for hybrid and electric vehicles of all sizes/classes. All are critical to a low-carbon transition, but only battery EVs are part of a 2050 solution. ✓ According to Altech's analysis, its 20%-silicon, 80%-graphite composite battery materials offer a 2.5x improvement in battery capacity per gram of anode material, leading to a 52% reduction in carbon footprint per unit capacity (mAh). This allows for

batteries that are cheaper, lighter and/or have better capacity. Battery capacity and cost are primary limiting factors for electric vehicle adoption.

- ✓ Only physical parts and construction expenses for the specified plant can be financed. This includes fossil fuel used in construction and emergency diesel generators, but no other fossil fuel powered equipment. Operational expenditures are excluded.
- ✓ Over 90% of emissions from the production process come from raw materials sourcing (Scope 3); Altech has shared that it will minimize these impacts by sourcing from suppliers that have European production facilities, use renewable energy, and are committed to developing low-impact battery materials.
- ✓ Both synthetic graphite and silicon, key materials in Altech's supply chain, depend on fossil fuel-based inputs; sourcing these raw materials provides indirect support for fossil fuel sectors.
- ✓ The plant's inputs of silicon and aluminium hydroxide are produced from mined raw materials like quartz and bauxite that may be associated with adverse environmental and social impacts.
- ✓ The plant's CO_2 process emissions are expected to be zero due to use and sourcing of renewable energy and electrification. The plant's electricity will come from rooftop solar panels and from purchasing renewable energy Guarantees of Origin (GoOs). Note that GoOs do not influence the emissions from electricity actually delivered to the plant, and Saxony's energy demand is >90% fulfilled with fossil fuels, with 43% from lignite.[2]
- ✓ According to Altech, the produced battery material can be recovered and recycled using existing processes, but recovered material quality is not suitable for re-use in vehicle batteries; it also notes that the end-of-life impacts and recycling energy demands for the composite material does not differ substantially from existing graphite anodes. Improving the use of recycled materials would be one strategy for addressing supply chain risks highlighted above.
- ✓ We have not assessed in detail the potential for local issues to arise, e.g. from the plant's air and water

[2] https://business-saxony.com/en/about-saxony/infrastructure/raw-materials-energy

	emissions but these will be addressed once Altech moves ahead with the local permitting process.

Table 1. Eligible project categories

Background

Altech has shared that the CO_2 footprint from its HPA coated composite anode material is around 6.4 $kgCO_2eq$ per kg of material. 60% of this figure is attributable to Scope 3 emissions from its sourcing of graphite feedstock, and 30% to Scope 3 emissions from its sourcing of silicon feedstock. The remaining 10% is from the use of energy and reagent inputs to the HPA production and coating process itself.

Environmental impacts of graphite production

Graphite used in anode production can be natural or synthetic. Natural graphite is produced by processing and purifying mined graphite ore. Purification requires the use of chemicals with negative environmental impacts, such as hydrofluoric acid. Synthetic graphite is intrinsically dependent on the fossil fuel sector as it is produced from needle coke, which is obtained primarily as a byproduct from oil refining, with a smaller proportion of global supply coming from the coking of coal for blast-furnace steelmaking.[3] Synthetic graphite is more carbon-intensive to produce than natural graphite due to high-temperature baking and graphitization processes and also produces pollutants such as NO_x, SO_x, and PM10.[4] Carbon emissions from synthetic graphite production consequently depend on the type of electricity used. Synthetic graphite is generally of higher quality than natural graphite which contributes to improved longevity and performance in end applications such as lithium-ion batteries.[5]

In 2019, 50% of synthetic graphite by mass was exported from China. The United States, Japan, Spain and Russia made up the remainder of the top five exporter countries, together accounting for another 23% of global synthetic graphite exports.[6] China is also the largest exporter by mass of natural graphite in flake or powder form, which is the form used for anode manufacturing. In 2018, it accounted for 59% of this market, with Madagascar, Brazil, Germany and Mexico making up the other countries in the top five exporters, accounting for 26% of global exports.[7]

Efforts to produce graphite in a less emissions-intensive and environmentally impactful manner include developing methods for purifying mined graphite that do not depend on hydrofluoric acid[8] and producing synthetic graphite from carbon dioxide at low temperatures.[9]

Environmental impacts of silicon production

Silicon metal used for anode manufacturing is extracted from mined quartz through a reduction process that takes place in submerged electric arc furnaces. Approximately 60% of emissions from silicon production is related to electricity used in the process, with the precise percentage depending on where the silicon is produced and the carbon intensity of the grid. The remaining 40% comes from the production of reducing agents. These include carbon monoxide and hydrogen, which are most commonly produced from fossil materials such as coal, pet coke and coke, or from biobased materials like charcoal and wood chips.[10]

[3] https://www.mining.com/web/imo-2020-evs-steel-perfect-storm-needle-coke-sector/
[4] https://www.minviro.com/battery-grade-graphite-its-not-all-about-carbon/
[5] Ibid.
[6] https://wits.worldbank.org/trade/comtrade/en/country/ALL/year/2019/tradeflow/Exports/partner/WLD/product/380110
[7] https://wits.worldbank.org/trade/comtrade/en/country/ALL/year/2018/tradeflow/Exports/partner/WLD/product/250410
[8] https://www.csiro.au/en/work-with-us/industries/mining-resources/resourceful-magazine/issue-15/graphite-goes-green
[9] https://www.nature.com/articles/s41467-020-20380-0
[10] https://www.silicones.eu/wp-content/uploads/2019/05/SIL_exec-summary_en.pdf

China is the world's largest producer of silicon by far, with 2020 production estimated at 5.4 million metric tonnes, or about 68% of global production. The next largest producers are Russia (6.8%), Brazil (4.3%), Norway (4.1%) and the United States (3.6%).[11]

Decarbonization of silicon production could be achieved by reducing emissions from electricity used in production, e.g. by using renewable energy, and through the use of alternative reducing agents. The latter could include using a mix of hydrogen and methane, although this process requires further development in order to be commercially viable,[12] and both hydrogen and methane would need to be produced without fossil fuel use. Silicon production emissions could also be lessened by using reducing agents made from charcoal and wood chips, although this would require safeguards against direct or indirect land use change and adverse impacts on biodiversity and soil carbon. Alternative processes also include condensation or electrolysis of silicon oxide, although issues remain around the efficiency and technological readiness of both techniques.[13]

Recyclability of battery materials

Battery manufacturing, and hence demand for battery materials, is expected to grow rapidly in order to support the production of electric vehicles required for the low-carbon transition. Academic modeling indicates that closed-loop recycling will play a minor but increasingly important role in the supply of battery materials between now and 2050. Relevant factors to improved recycling include the existing stock of vehicle batteries, the enabling environment (e.g. policy support, collection systems, etc.), as well as the quality of recovered and recycled materials. Battery recycling is challenging due to the number of materials used and their high chemical and energy content, which create various health and environmental risks.[14] Existing processes for battery recycling can recover graphite and silicon anode materials, but these are not battery-grade. Although refining them to battery-grade is possible, the economic viability of doing so remains unclear.[15]

Governance Assessment

Four aspects are studied when assessing the Altech's governance procedures: 1) the policies and goals of relevance to the green bond framework; 2) the selection process used to identify eligible projects under the framework; 3) the management of proceeds; and 4) the reporting on the projects to investors. Based on these aspects, an overall grading is given on governance strength falling into one of three classes: Fair, Good or Excellent. Please note this is not a substitute for a full evaluation of the governance of the issuing institution, and does not cover, e.g., corruption.

As a start-up, Altech does not have a formalized sustainability strategy or policy, although it has indicated that these will be focal areas once it is further established. Similarly, it has not started implementing the TCFD recommendations but will consider doing so in the future. Its sustainability strategy is therefore best assessed by looking at its approaches to the mooted plant's environmental design and supply chain sustainability. In this context, we find that Altech has a well-considered strategy that leverages several ways of reducing Scope 1, 2, and 3 emissions, including electrification of plant processes, producing and sourcing renewable energy, and integrating considerations for emissions into its supplier selection processes. More generally, the integration of sustainability into Altech's business strategy is also evident from its recognition that it can leverage Altech Chemical's expertise in alumina to become a materials supplier to the rapidly growing lithium-ion battery market.

[11] https://www.statista.com/statistics/268108/world-silicon-production-by-country/
[12] https://link.springer.com/article/10.1007/s40831-021-00429-0
[13] Ibid.
[14] https://www.mdpi.com/2075-4701/10/8/1107
[15] https://www.nature.com/articles/s43246-020-00095-x#ref-CR33

Altech has already selected the asset to be financed and has not defined further selection criteria beyond what was described in the paragraph above. Altech is committed to transparent reporting on proceeds and impact; it has specified relevant impact indicators in its framework, will disclose impact calculation methodologies, and has committed to obtaining external assurance of its impact reporting.

The overall assessment of Altech's governance structure and processes gives it a rating of **Good**.

Strengths

Altech's battery materials can be used to improve the performance of anodes in lithium-ion batteries, contributing to improved capacity and cyclability when compared to batteries using conventional graphite anodes. The emissions from producing an anode using Altech's materials is higher than that of a comparable graphite anode. However, the greater capacity gains entailed mean that Altech's battery materials (at 20% silicon content) are 52% less emissions intensive on a per unit capacity (gCO_2eq/mAh) basis, according to Altech. This is notable in and of itself. However, the biggest strength of Altech's battery materials is its contribution to advancing the electrification of transportation and the reduction of emissions and other pollutants from internal combustion engines. Research indicates that battery capacity and vehicle purchase costs are among the major barriers to increased EV adoption.[16] Altech's technology could help address either, owing to the potential 2.5x increase in energy capacity per gram it offers. Vehicle manufacturers could take advantage of this improvement by producing cheaper vehicles with lighter battery packs or vehicles with improved battery capacity and range. Owing to improved battery cyclability, it is also likely that Altech's technology will also contribute to increased reliability of EVs, thereby also supporting their increased adoption.

Altech has taken substantial efforts to reduce the Scope 1, 2 and 3 emissions from its operation of the plant. These efforts include sourcing renewable energy, construction of on-site solar panels, electrifying production processes, and selecting suppliers that maximize renewable energy use and which operate European plants to minimize transportation emissions.

Altech has outlined a robust approach to impact reporting that includes multiple relevant indicators, such as emissions intensity of production (normalized per tonne of materials and per battery unit capacity), energy intensity of production, on-site renewable energy generation, and renewable energy GoO purchases. It will also include comparisons of its emissions intensity against benchmark products such as anodes made from other materials. Altech has also committed to securing external verification of its annual reporting.

Weaknesses

There are no material weaknesses perceived at this time.

Pitfalls

The bulk of emissions (>90%) and other environmental risks and impacts of Altech's plant reside in its supply chains. Altech has addressed a portion of it supply chain emissions and other environmental risks and impacts by sourcing from suppliers that are located in Europe and which maximize renewable energy use. It is possible that supply availability and cost considerations could lead to Altech sourcing from producers outside Europe. Altech however notes that this is very unlikely due to 1) a highly compelling business case even with European supplier

[16] https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9343324

costs, and 2) the existence of multiple other European suppliers that can serve as backups should primary suppliers be unable to deliver.

However, several other risks and impacts remain. Synthetic graphite and silicon production are energy-intensive processes that dependent on fossil fuel-derived inputs, and there appear to be few commercially-viable low-carbon alternatives. The use of these feedstocks therefore poses climate transition risks in Altech's supply chain. Further, inputs into Altech's supply chains depend on mined raw materials. Silicon is refined from quartz, and Altech's supply of aluminium hydroxide is derived from bauxite. Mining, especially in regions with less strict regulations, is associated with substantial environmental and social impacts. One of Altech's identified suppliers of alumininum hydroxide was linked with bauxite mining operations in Guinea that were accused of displacing local communities and impacting their access to water in 2019.[17] Altech has responded by indicating that it will engage with the supplier in question and re-assess other potential European suppliers. More generally, it aims for its future supplier assessment and qualification processes to identify such controversies before supply agreements are made.

Considering the above pitfalls, we encourage Altech to implement and enforce a robust supply chain sustainability policy, as well as to engage with its suppliers to address their sustainability impacts. It is therefore encouraging that Altech has shared it intends to do both and has already identified suppliers that it believes to have a high level of sustainability commitment and performance. Altech's response to the bauxite-related controversy we identified in its aluminum hydroxide supply chain has also been positive. Although its initial offtake will be small, Altech believes it will be able to influence its suppliers due to the opportunity it gives them to break into the rapidly growing battery materials market. Such engagement will also be vital to driving the technological innovation needed to address the supply chain risks mentioned above. We recommend that Altech engage with its suppliers to develop low-carbon approaches to silicon and synthetic graphite production. Altech can also further mitigate supply chain risks by setting targets on Scope 3 emissions and recycled material use, as well as by engaging battery and vehicle manufacturers to improve material recoverability and recyclability.

Beyond the pitfalls immediate to Altech's own supply chain, it is a pitfall that substantial increases in electric vehicle production could lead to increased pressure on rare earth material sourcing and other environmental impacts that might occur, especially in regions with environmental regulation that is less strict than in the EU.

CICERO Shades of Green recognizes individual modes of zero-emission transportation as part of a 2050 solution. However, the largest amount of carbon savings come from switching from inefficient modes of transport (e.g., private cars) to mass transit. In this regard, it is positive that Altech's battery materials can be used for electric vehicles of all types and classes, including mass transit. At the same time, it is a pitfall that they could contribute to adverse environmental impacts depending on the end use, e.g. hybrid vehicles and heavy duty vehicles like hybrid mining trucks.

It is a pitfall that Altech has not explicitly considered physical climate risks, e.g. in its selection of the Schwarze-Pumpe Industrial Park as the site for the specified plant, nor has it assessed the likelihood and impact of supply chain disruptions from physical climate risks. We recommend that Altech rapidly implement the TCFD recommendations, balancing its considered approach to climate mitigation with a greater focus on adaptation and resilience.

[17] https://www.inclusivedevelopment.net/wp-content/uploads/2020/12/CBG_CAO-Request-for-Mediation_FINAL-EN.pdf

Appendix 1:
Referenced Documents List

Document Number	Document Name	Description
1	Altech Green Bond Framework (Nov 2021)	Altech's green bond framework
2	White Paper – Green Credentials of Altech High Purity Alumina Coating Process	Altech white paper describing the environmental benefits of its composite HPA coated battery material, manufacturing process, and environmental aspects of the plant's design
3	Battery Material Coating Plant Prefeasibility Study Section 6 – Environmental Requirements	Draft section from Altech's prefeasibility study that outlines EU and German environmental regulatory requirements and Altech's approach to ensuring compliance

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Green

Appendix 2:
About CICERO Shades of Green

CICERO Green is a subsidiary of the climate research institute CICERO. CICERO is Norway's foremost institute for interdisciplinary climate research. We deliver new insight that helps solve the climate challenge and strengthen international cooperation. CICERO has garnered attention for its work on the effects of manmade emissions on the climate and has played an active role in the UN's IPCC since 1995. CICERO staff provide quality control and methodological development for CICERO Green.

CICERO Green provides second opinions on institutions' frameworks and guidance for assessing and selecting eligible projects for green bond investments. CICERO Green is internationally recognized as a leading provider of independent reviews of green bonds, since the market's inception in 2008. CICERO Green is independent of the entity issuing the bond, its directors, senior management and advisers, and is remunerated in a way that prevents any conflicts of interests arising as a result of the fee structure. CICERO Green operates independently from the financial sector and other stakeholders to preserve the unbiased nature and high quality of second opinions.

We work with both international and domestic issuers, drawing on the global expertise of the Expert Network on Second Opinions (ENSO). Led by CICERO Green, ENSO contributes expertise to the second opinions, and is comprised of a network of trusted, independent research institutions and reputable experts on climate change and other environmental issues, including the Basque Center for Climate Change (BC3), the Stockholm Environment Institute, the Institute of Energy, Environment and Economy at Tsinghua University, the International Institute for Sustainable Development (IISD) and the School for Environment and Sustainability (SEAS) at the University of Michigan.