



Elkem ASA

Green Bond Second Opinion

21 August 2023

Executive Summary

Elkem ASA (“Elkem”) is a vertically integrated advanced silicon materials manufacturer. Headquartered in Oslo and operating globally, this public company is engaged across the silicon value chain from quartz mining and carbon reductant¹ processing through high temperature silicon smelting and other chemical processes to produce silicones, silicon products, and carbon solutions. With an operating income in 2022 of NOK 45.9 billion, Elkem’s end markets include both important contributions to the climate transition, such as electric mobility, battery storage, and solar panels and wind turbines, as well as applications in sectors with higher potential climate and environmental risks, including oil and gas, chemicals, metals production, construction, and manufacturing.

In its green bond framework, Elkem seeks to finance or refinance silicon smelter waste heat recovery plants, biocarbon reductant production facilities, energy efficiency measures, carbon capture for silicon smelters, and R&D related to biocarbon reductants and circular waste solutions. The issuer expects initial proceeds to go towards 100% refinancing, with 80% allocated to waste heat recovery in Norwegian operations and 20% going to a biocarbon reductant pilot plant in Canada. In future issuances, proceeds may be allocated increasingly to biocarbon reductant production at scale or waste heat recovery in Chinese operations. Capital expenditures, operating expenditures (excluding any fossil inputs), and equity investments (where at least 90% of associated revenues come from activities eligible under the framework) by Elkem, its subsidiaries, or partnership arrangements are eligible.

We rate the framework **Medium Green** and give it a governance score of **Good**. Waste heat recovery facilities and biocarbon substitutes for fossil reductants are important contributions to a low carbon future while entailing value chain risks that must be managed carefully to ensure benefits. Dark Green elements include carbon capture technology, while Light Green aspects include waste heat links to fossil reductants while biocarbon substitutes are still being phased in. In its governance, Elkem has developed climate targets for its operational emissions, regular physical climate risk assessments, robust supplier engagement systems, and clear processes for selection and reporting in its green bond framework but could further strengthen its absolute Scope 3 emissions targets at company level, incorporate lifecycle considerations in green project selection, and undertake external review of its green bond impact reporting.

SHADES OF GREEN



CICERO
Medium Green

GOVERNANCE ASSESSMENT



GREEN BOND PRINCIPLES

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

¹ Reductants, or reducing agents, help facilitate chemical reactions. In the case of silicon production, carbon from fossil or biogenic sources is used as a reductant to break silicon and oxygen bonds in quartz at high temperatures in silicon smelters to create silicon end products.



Strengths

It is a strength that Elkem's green financing will focus on waste heat recovery facilities with low lock-in risks. These facilities capture silicon smelting energy that would otherwise go unused, avoiding the need for additional initial energy production and associated climate emissions and other environmental impacts such as local pollution or biodiversity disruptions. Elkem informs us that these facilities are compatible with both lower emissions biocarbon reductant substitutes for fossil reductants as well as processes that recycle carbon reductants that may have substantially lower emissions but are not yet commercially available, limiting risks of locking in conventional technologies or intermediate steps towards decarbonized silicon smelting.

We view Elkem's efforts to develop a biocarbon reductant supply chain as a positive innovation to reduce climate emissions in a difficult to decarbonize sector. Lower emissions biogenic substitutes that delink silicon smelting from fossil reductants has good potential to reduce climate risks and impacts. We are encouraged by Elkem's efforts to innovate and develop solutions in this area while continuing to explore future technologies with potential for even lower emissions such as processes that recycle carbon reductants.

Pitfalls

Although waste heat recovery is positive from a climate emissions and energy perspective, initial energy production is associated with coal and coke fossil reductant materials used in smelting, while potential receivers of the recovered energy may be industries with their own climate and environmental risks. The waste heat that will be recovered is initially generated by a combination of electricity and reductant reactions in silicon smelters, creating links to coal and coke fossil reductants (80% of total reductants as of 2022) and associated climate emissions where Elkem is still phasing in lower emissions biocarbon as a substitute (20%). While direct connections for distributing the recovered energy will not be made to any oil and gas customers, which is positive, they could include provision to diverse industries, which have their own value chain sustainability challenges. Other potential waste heat recovery direct connections, such as electricity to Elkem's own operations or as district heating to local municipalities, have lower additional climate or environmental concerns.

Elkem's biocarbon reductant sourcing criteria could be strengthened to reduce risks of lifecycle climate emissions and other environmental impacts. Elkem's requirements of SFI, FSC, or PEFC certification combined with supplier auditing and a preference for waste-based inputs are positive. At the same time, these measures do not necessarily fully address risks of climate and biodiversity impacts from direct and indirect land use change, emissions from reductant transportation and processing, the potential for use of whole logs rather than wastes, or unintended effects from waste valorisation and diversion. To ensure full benefits from biocarbon reductant substitution, careful management of these concerns is important.



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1 Elkem’s environmental management and green bond framework

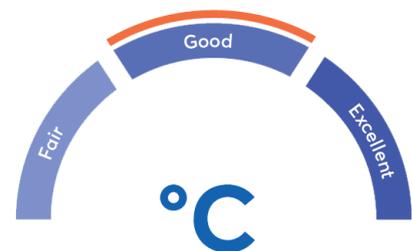
Company description

Elkem ASA (“Elkem”) is a public company operating globally to produce advanced silicon-based materials. Elkem is vertically integrated across the silicon value chain from raw material production, including quartz mining and biocarbon reductant processing, through high temperature or chemical processes to produce silicones, silicon products, and carbon solutions. Its product end markets include both aspects important to the green transition, such as electric mobility, energy storage, and solar panels and wind turbines, as well as applications in sectors with higher potential environmental risks, including oil and gas, chemicals, steel, iron and aluminium production, construction, and textile, electronics and paper manufacturing. Other product applications that are more neutral to achieving a low-carbon future include digital communications and health and personal care.

Headquartered in Oslo, Norway and traded on the Oslo Stock Exchange, Elkem has over 7,300 employees and its operating income in 2022 was NOK 45.9 billion. Its 31 production sites are concentrated in Europe and China, but it also has production and sales locations in the Americas, Africa, and elsewhere in Asia. Bluestar Elkem International Co. Ltd S.A is a majority shareholder of Elkem (52.91%²) and in turn owned by a Chinese state-owned enterprise.

Governance assessment

Elkem’s environmental strategies and policies include positive nearer-term and longer-term climate targets for Scope 1 and 2 emissions in a difficult to decarbonize sector without the use of offsets as well as regular climate scenario analysis to assess physical climate risk. It has outlined clear implementation steps to achieve its climate goals, developed a range of sustainability policies covering other material topics, created robust supplier due diligence and monitoring systems, and provided good transparency to stakeholders by following TCFD, GRI, and CDP standards. Areas for potential improvement include strengthening its climate targets related to absolute Scope 3 emissions representing 69% of its total footprint, implementing climate adaptation and resilience measures for identified risks, and incorporating quantitative sustainability requirements such as lifecycle emissions performance into supplier engagement processes.



In terms of green project selection, Elkem has developed a clear process with environmental competence and veto power. While this process includes a review for compliance with standard company sustainability policies, it does not factor in additional criteria specific to the green bond framework such as lifecycle analyses or resilience.

Elkem’s commitment to annual public allocation and impact reporting with relevant impact indicators and transparency on methodologies and baselines is positive. Reporting could be strengthened through external review of impact reporting in addition to allocation reporting.

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

² [Elkem’s Largest Shareholders](#).



Sector risk exposure

Physical climate risks. In global silicon production, greater frequency and severity of extreme weather events such as floods, heatwaves, droughts, landslides, fires, or storms, may lead to increased damage to physical assets. Insurance coverage may become more expensive or unobtainable for the most exposed infrastructure. Operational disruptions, including associated with decreased water availability impacting production processes, are also possible. Supply chains, particularly for quartz mining or biocarbon reductant sourcing relying on forestry inputs, also face physical climate risks, such as more extreme weather events, droughts, and wildfires.

Transition risks. Due to the profound changes needed to limit global warming to well-below 2°C, transition risk affects all sectors. Given the emissions- and energy-intensive nature of silicon materials mining and smelting, companies in the sector are substantially exposed to carbon pricing and other stricter climate regulation. Access to some silicon smelting inputs, such as coal and coke reductants, may be reduced as fossil fuels are phased out. Ongoing efforts to reduce emissions among the wide range of silicon end users increases market pressure for silicon producers to decarbonize, and failure to meet expectations could lead to declining market share and revenues.

Environmental risks. Silicon materials mining and production are sources of multiple potential environmental impacts, including ecosystem conversion and biodiversity loss, local pollution (e.g., dust, nitrogen oxides, sulfur dioxide), and wastewater discharges. Silicon and carbon material production involves multiple hazardous substances, such as high temperature coal tar pitch used in the manufacture of electrode paste or D4, D5 and D6 intermediates in the production of silicones-based polymers. Mining and production processes are also dependent on substantial water inputs, potentially impacting surrounding ecosystems.

Social risks. Silicon material mining and production involving high temperatures and chemical reactions as well as exposure to associated pollutants could pose risks to employee health and safety. Silicon dust, for example, can lead to silicosis, a lung disease. There is also potential for corruption and human rights or workers' rights violations in silicon material value chains, such as in association with upstream conflict mineral sourcing or downstream solar panel production. Silicon and carbon material producers may also face the risk of being engaged in legal proceedings associated with health impacts from designated substances of very high concern (SVHC) involved in some processes, such as high temperature coal tar pitch.

Environmental strategies and policies

Climate change and energy

As part of its climate roadmap released in 2021, Elkem has set a long-term target to achieve carbon neutral production through a 95% reduction in its Scope 1 and Scope 2 emissions globally by 2050 relative to a 2020 base year.³ Nearer-term goals the company intends to achieve by 2031 include:

³ According to the issuer, biogenic and Scope 3 emissions are excluded from this target, while non-CO₂ greenhouse gases generated in Scope 1 and Scope 2 are included. The company does not plan to use offsets to achieve this target.



- Reducing absolute Scope 1 and 2 emissions by 28% relative to a 2020 baseline. Elkem's total climate emissions fell by 7.5% in 2022 compared to 2021, with 3-4% increases in Scope 1 and 2 emissions during that period.
- Improving its "product group carbon footprint"⁴ by 39% relative to a 2020 baseline. Product group carbon footprint declined from 7.4 CO₂e/kg in 2021 to 6.9 CO₂e/kg in 2022.
- Increasing the share of biocarbon reductants used in smelting processes as a substitute for coal to 50%. In 2022, its share of biocarbon reductants was 20%.
- Increasing its supplies of advanced materials to green transition markets, such as electric vehicles and renewable energy, by 5-10% per year.

In 2022, Elkem reported 10.74 million tonnes CO₂e in total climate emissions. Its Scope 1 emissions accounted for 2.42 million tonnes CO₂e, or 23% of total emissions. Over 70% of Scope 1 emissions were attributable to silicon smelting where carbon from coke, coal or biocarbon reacts with the oxygen in quartz to produce silicon or ferrosilicon. This process creates a carbon monoxide by-product, which then reacts with oxygen in the atmosphere to create carbon dioxide. The remainder of Scope 1 emissions are from other production processes, fossil fuel use, and methane emissions. Scope 2 emissions are from electricity used in Elkem's power-intensive processes and totalled 941,656 tonnes CO₂e, or less than 9% of total emissions. Its Scope 3 emissions, totalling 7.38 million tonnes CO₂e, or less than 69% of total emissions, come primarily from purchased goods and services, use of products and end of life treatment in diverse end markets, capital goods, and transportation.

As of 2022, Elkem's high temperature electric arc furnaces use around 6.5 TWh electricity per year, 81% of which comes from renewable sources. The company also consumes approximately 1.4 TWh of other types of energy, primarily fossil-based, in the use of its vehicles and heating or cooling of facilities and processes. Elkem does not have specific fossil fuel phase-out, energy intensity, or renewable energy targets.

To achieve its 2031 climate targets, Elkem plans to improve energy efficiency and recovery, increase substitution of biocarbon for coal as a reductant in silicon smelting, source materials with lower carbon footprints such as lower embodied emissions concrete and steel, review transportation emissions across the value chain to identify reduction opportunities, and use more renewable electricity, particularly in China. Achieving net zero for Scope 1 and 2 emissions by 2050 will likely require the company to use carbon capture and storage (CCS) technologies at smelters and other difficult to decarbonize aspects of operations. In 2022, Elkem piloted the first carbon capture pilot for silicon smelters at its site in Rana, Norway, commissioned a pilot plant in Canada to produce biocarbon reductant materials, initiated a low carbon silicon sourcing strategy in China, and incorporated its climate roadmap targets into bonus structures for top management. Elkem has also begun conducting cradle-to-gate lifecycle impact assessments of select products.⁵ Over the next three to five years, the issuer informs us that it will also likely undertake steps to reduce fossil fuel use, such as phasing in electric trucks, substituting biomass as an energy source in steam generation, and converting to electric heating for drying processes.

Longer term, Elkem informs us it is exploring silicon smelting technologies that would not require new reductant inputs, and instead capture up to 90% of the carbon dioxide released by the process and continuously recycle that carbon as a reductant. Recirculating a large share of the carbon reductant would reduce the need for new fossil or biogenic reductant inputs, avoiding potential climate transition and land use change emissions risks. However, according to the issuer, this type of system is not yet demonstrated in an industry-relevant environment or

⁴ This measure refers to Elkem's main products' average fossil fuel carbon dioxide emissions footprint in CO₂e/kg produced material. It includes Scopes 1, 2, and 3 emissions from upstream production of silicones and tapped silicon and ferrosilicon metal, which together represented 93% of Elkem's total operating income in the 2021 base year.

⁵ According to the issuer, there are limited industry analyses for downstream lifecycle emissions from silicon products, making footprint estimates and target-setting challenging in this area.



commercially available. Elkem therefore currently views biocarbon reductant substitution as both a near-term and longer-term strategy for decarbonizing its smelting processes.

In 2022, Elkem undertook a project to evaluate and map acute and chronic physical climate risks facing the company, including in its own operations and value chain. It identified extreme precipitation, heatwaves, droughts, and flooding as the most common risks based on Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathway (RPC) 8.5 warming scenarios. The issuer informs us that no immediate investments or other risk mitigation measures have been taken given that risks are not currently acute. Physical climate risk is integrated into the company's risk management processes and updated on an annual basis.

Biocarbon reductant feedstock sourcing

As part of its biocarbon reductant sourcing policy, Elkem only accepts feedstocks of waste wood or wood from sustainably managed plantations and forests or naturally degraded forests and non-native trees. It requires national legal compliance as well as management based on the principles FSC and PEFC certification systems⁶, chain-of-custody traceability systems, and periodic third-party audits to confirm ongoing compliance. Wood from old growth or any other protected forests as well as any threatened species of wood listed by International Union for Conservation of Nature (IUCN), or the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are excluded from sourcing.

Other supply chain engagement

To manage supply chain risks, the company has established a code of conduct for its business partners covering high-level principles on environment, health and safety, social safeguards related to working conditions and non-discrimination, and anti-corruption and regulatory compliance. For higher risk suppliers and contractors engaging in activities such as mining, Elkem includes additional more detailed contract requirements on health and safety, working conditions, and environmental topics.

Based on these policies, Elkem's procurement function undertakes initial supplier screening and risk assessment, with additional due diligence measures such as integrity due diligence for higher risk potential suppliers. The company then follows up through audits and inspections, including unannounced visits and external audits by third parties, to assess ongoing compliance. In the event of any violations, Elkem issues warnings and requests for improvements, with escalation to improvement plans, financial penalties, or contract termination if issues are not resolved. In 2023, Elkem will implement a new supplier relationship management system to ensure global consistency in its supplier vetting, monitoring, and risk management processes.

Other environmental topics

Elkem has a code of conduct including high-level environmental principles as well as additional targets and strategies related to reducing air pollutants including silicon dust; improving water intensity and wastewater treatment particularly in water-stressed areas; promoting circular solutions, waste reduction and recycling; and avoiding risks to biodiversity through environmental impact assessments and other measures, particularly at its quartz mining sites.

Reporting

Elkem provides annual public sustainability reporting based on the Global Reporting Initiative (GRI) core standard. It also publishes disclosures in line with the recommendations of the Taskforce on Climate-Related Financial Disclosures (TCFD) and reports to CDP on its climate, forests, and water security performance, receiving an A-, A-, and B score respectively in 2022.

⁶ While all biocarbon feedstocks financed under the framework will be formally certified by FSC, PEFC or SFI, note that this is not necessarily the case for all biocarbon feedstocks used by Elkem.



Green bond framework

Based on this review, this framework is found to be aligned with the Green Bond Principles. For details on the issuer's framework, please refer to the green bond framework dated August 2023. While this use of proceeds framework is not an update, Elkem secured a EUR 1 billion sustainability-linked loan in December 2022. Key performance indicators and sustainability targets relate to health and safety as well as carbon footprint reduction.⁷

Use of proceeds

For a description of the framework's use of proceeds criteria, and an assessment of the categories' environmental impacts and risks, please refer to section 2.

Selection

Elkem's ESG Steering Committee (ESG SC) includes its Chief Financial Officer, SVP Technology (who the issuer informs us has relevant sector decarbonization expertise), SVP Human Resources, and VP HSE. The ESG SC will select projects eligible for green financing under the framework. In addition to alignment with framework criteria, the ESG SC will ensure projects comply with company standards, including human rights due diligence, minimum social safeguards, and ESG policies. For larger projects, the issuer informs us this sometimes includes environmental risk and impact assessments and consultation with environmental experts and local stakeholders. Decisions will be made in consensus.

Management of proceeds

Green bond proceeds are tracked by the issuer on a portfolio basis using a green register. Any unallocated proceeds will be temporarily placed in Elkem's liquidity reserve and cannot be used for investments in entities with a business plan focused on fossil energy generation, research and/or development within weapons and defence, gambling, pornography, or tobacco.

Reporting

Elkem will provide annual allocation and impact reporting on its website until full allocation and in the event of any material developments. Reporting will be on an aggregated basis across all green bonds issued. Allocation but not impact reporting will be reviewed by an independent external party. In its allocation reporting, Elkem will provide the size of the project portfolio, a list of all projects financed and allocated amounts, amount of green bonds outstanding and any temporary holdings, breakdown by project category, and share of financing vs. refinancing. Impact reporting will be undertaken on an aggregated basis within project categories and based on Elkem's financing share of each project. It will include any relevant descriptions of calculation methodologies, baselines, and assumptions. Impact indicators may include, depending on data availability and type of project:

Renewable energy and energy efficiency

- New energy recovery capacity installed (GWh/year)
- Annual energy recovery (GWh)
- Annual energy use reduced/avoided (GWh)
- Estimated annual GHG emissions reduced/avoided (tonnes of CO₂e emissions)
- Type of R&D project

Pollution prevention and control

- Biocarbon share of CO₂ emissions (%)
- Product carbon footprint (CO₂e/kg product)
- Estimated annual fossil GHG emissions reduced/avoided (tonnes of CO₂e emissions)
- Type of R&D project

⁷ [Elkem ASA closes final terms on first sustainability-linked loan agreement.](#)



2 Assessment of Elkem’s green bond framework

The eligible projects under Elkem’s green bond framework are shaded based on their environmental impacts and risks, based on the “Shades of Green” methodology.

Shading of eligible projects under Elkem’s green bond framework

- Net proceeds from green bonds issued under the framework may finance or refinance, in part or in whole, capital expenditures, operating expenditures and equity investments by Elkem, its subsidiaries, or partnership arrangements. Equity investments are eligible where at least 90% of associated revenues can be attributed to the project categories.
- According to the issuer, in any equity investment, subsidiary, or partnership, it would undertake ESG due diligence prior to engagement and its operational influence would remain strong to allow for monitoring compliance with its sustainability policies, green bond framework criteria, and reporting requirements. In the event of any noncompliance, it would remove the project from its green project portfolio. The issuer informs us that among these potential structures eligible for green financing, it will most likely either own subsidiaries 100% or pursue joint ventures on issues such as biocarbon reductant production that are not core to its business but can benefit from additional access to expertise and capital. Elkem would directly manage subsidiaries or would be represented on the boards of joint ventures to ensure ongoing sustainability oversight. It has not yet identified specific partners.
- Refinancing is defined as allocated amounts financed prior to the reporting year, with a maximum look-back period of three years prior to the issuance date of the green bond.
- Elkem anticipates allocating initial green bond proceeds to 100% refinancing, with 80% going to the Renewable Energy & Energy Efficiency project category for waste heat recovery initiatives in Norwegian operations and 20% going to Pollution Prevention and Control for a biocarbon reductant pilot plant based in Canada. In future issuances, proceeds may be allocated increasingly to Pollution Prevention and Control as biocarbon reductant production scales or waste heat recovery in Chinese operations.
- Elkem explicitly excludes from framework eligibility projects for which the purpose is fossil energy production, weapons and defence, gambling, pornography, or tobacco. According to the issuer, these exclusions apply to all equity investments, including the up to 10% of revenues that may not be attributed to the project categories. The issuer further informs us that no green proceeds allocated to OPEX would be used for purchasing fossil inputs, such as coal reductants or gasoline or diesel used in transport.

Category	Eligible project types	Green Shading and considerations
Renewable Energy & Energy Efficiency 	Financing and refinancing of capital and operating expenditures dedicated to: <ul style="list-style-type: none"> • Develop, build, and operate facilities for waste heat recovery (“energy recovery plants”) for the production of electricity, steam and hot water • Upgrading energy recovery plants for the purpose of improving the efficiency 	Medium Green to Light Green Energy recovery plants ✓ Waste heat recovery facilities, efficiency improvements, and maintenance are positive from a climate perspective in that they capture energy that would otherwise be unused and avoid emissions and other environmental risks from additional electricity production. The electricity generated by waste heat recovery typically corresponds to 25-30% of Elkem plant consumption.



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- Repair and maintenance of energy recovery plants
 - Energy efficiency improvements in targeted areas of existing facilities and equipment by at least 30%
 - R&D targeting the development of new solutions for renewable energy and energy efficiency
- ✓ The issuer informs us that waste heat will be recovered from its electric arc furnaces used in silicon smelting. The initial source of the waste heat is thus a combination of electricity and fossil and biogenic reductants.
 - ✓ Significant emissions are associated with ongoing fossil reductant use, as coke and coal currently account for 80% of reductants, although Elkem has a target to increase the use of biocarbon to 50% by 2030. Also note the biogenic reductant climate and environmental risks and benefits described in detail in the Pollution Prevention and Control project category below.
 - ✓ Over 80% of Elkem’s electricity is from renewable sources, with higher levels in Norway where waste heat recovery plants are expected to be refinanced in initial allocations. Waste heat recovery can reduce initial electricity use and any associated emissions. At the same time Projects with higher emissions associated with the initial electricity used in smelting prior to waste heat recovery are possible, such as in China, where a grid mix is used.
 - ✓ According to the issuer, waste heat recovery facilities have a low risk of locking in higher emissions technologies. Waste heat recovery technologies are independent of whether fossil or biogenic reductants are used, as well as whether current technologies or potentially lower emissions innovations that recycle carbon reductants are used.⁸ We view this compatibility with lower emissions inputs and technologies as a strength of the waste heat recovery projects that reduces lock-in risks.
 - ✓ Other upstream considerations include that construction of new energy recovery plants will involve materials with high embodied emissions, such as cement and steel. Elkem informs us it will increasingly consider embodied emissions in its construction materials sourcing.
 - ✓ Downstream, Elkem’s silicon products, whose generation drives waste heat production, are associated with a diverse range of climate and environmental risks and benefits in their ultimate use. We are encouraged by Elkem’s stated business strategy and targets to move increasingly into greener sectors but note ongoing risks related to product end use.
 - ✓ According to the issuer, energy from recovered waste heat will be used in its own facilities (sometimes circulated via the grid) as well as sold externally. Hot water and steam are currently delivered to municipalities for district heating or industrial customers, such as an aluminium plant or fish and chicken farming and processing. The issuer confirms that it does not have any direct connections to oil and gas customers and these facilities are not near its potential distribution areas, making future connections unlikely. This is positive, as any such direct
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⁸ See [Environmental strategies and policies](#) section, Climate change and energy sub-section for further details on these technology options and emissions implications.



connections to oil and gas facilities would not be Green.

- ✓ The issuer informs us that energy efficiency measures for energy recovery plants may involve improving boilers, turbines, generators, insulation, and system automation. While there is not a quantitative performance standard for efficiency gains, Elkem expects improvements of around 5-10% relative to current operations.

Energy efficiency improvements in existing facilities

- ✓ According to the issuer, energy efficiency improvements to existing facilities and equipment cover all operations excluding the electric arc furnace waste heat recovery plants. Potential measures include automation, electric motor improvements and variable speed drives, or smaller waste heat recovery projects such as from air compressors.
- ✓ The issuer informs us that these efficiency measures will not include improvements in fossil fuel-powered machinery, which are not common at its primarily electrified facilities, reducing potential lock-in risks.
- ✓ It is positive that Elkem has set a 30% quantitative performance threshold for these efficiency measures.

R&D

- ✓ We view research and development to support renewable energy and energy efficiency as a positive contribution to developing solutions for a low carbon future.
- ✓ According to the issuer, R&D will focus on biocarbon reductant supply. See the Pollution Prevention and Control project category below for further details on the risks and benefits of these projects.

Pollution Prevention and Control



Financing and refinancing of capital and operating expenditures dedicated to:

- Develop, construct and operate facilities for the production of biocarbon reduction materials for which the feedstock is based on wood-based waste and/or side streams from forestry and industry, or wood-based materials from certified sources in accordance with the SFI, FSC or PEFC⁹
- Develop, construct and operate carbon capture facilities related to silicon smelters
- R&D targeting the development of new solutions for circular economy and to significantly improve the product carbon footprint

Medium Green

Biocarbon reductant facilities

- ✓ Elkem's work to develop biocarbon reductant supply chains to replace fossil coal and coke inputs is an important contribution towards reducing climate emissions in a difficult to decarbonize sector. According to the issuer, there is not currently a robust market or fully developed technologies for biocarbon reductant substitutes, a challenge it aims to address through this project category.
- ✓ The issuer informs us that plants converting wood materials into biocarbon reductants would likely be based in Canada, the United States, or Norway and wood feedstocks would be sourced locally to reduce transport costs and climate emissions. While there are no set lifecycle emission requirements for biocarbon reductants, Elkem will work with suppliers to assess total emissions and reduce that footprint going forward.

⁹ [Sustainable Forestry Initiative \(SFI\)](#), [Forest Stewardship Council \(FSC\)](#), and the [Programme for the Endorsement of Forest Certification \(PEFC\)](#).



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- ✓ Sustainable sourcing is crucial for biogenic materials. Risks include potential direct and indirect land use change, declines in forest carbon stocks and species diversity, fossil fuel and chemical use in forestry operations, and impacts on water and biodiversity.
 - ✓ According to Elkem, its main strategy for managing these risks in its biocarbon reductant supply chains is SFI, FSC, or PEFC certification confirmed through its supplier engagement policies and processes, including auditing. It does not have specific additional sourcing criteria related to land use change.¹⁰ SFI, FSC, and PEFC certifications require more sustainable forestry practices, such as measures to manage biodiversity, water and soil, pollution, waste, and climate emissions, as well as community relations and workers' rights. FSC certification is generally seen as the most robust global standard for forest management,¹¹ but PEFC, under which SFI sits, has important complementary properties (e.g., greater supply chain scrutiny). Concerns remain around the stringency and real benefits of forest certifications, both in relation to the requirements (most reasonably run companies are likely to qualify) and application (audits seldomly lead to suspension of certification).
 - ✓ Waste-based wood materials represent lower potential climate and environmental risks than other wood feedstocks such as whole logs. The issuer informs us it plans to source wood wastes and side streams, will select plant locations based on sufficient supplies of these feedstocks, and is unlikely to source whole logs due to competing demand for this input for higher value products. While this clear preference for waste-based inputs is positive, sourcing of whole logs remains possible under the framework. Additionally, waste-based feedstocks may indirectly support unsustainable activities if they enable the valorisation of their waste streams. Waste diversion from previous uses may have unintended knock-on effects, such as increases in fossil fuel use if waste was previously used for bioenergy. The transition to a low carbon future is significantly increasing demand for biomaterials, creating pressure to unsustainably intensify or expand land use.
 - ✓ Biogenic material supply chains can be significantly exposed to physical climate risks, such as droughts, wildfires, and increased pests. Elkem's risk assessment processes and scenario analyses will incorporate these considerations.
 - ✓ In biocarbon reductant plant operations, energy sourcing and efficiency as well as pollution and waste management practices are important considerations. According to the issuer, plants will primarily be electrified, with initial electricity sourcing from hydropower in the Canadian pilot project. Construction of new facilities can involve materials such as cement and steel with high embodied emissions, fossil fuel use in construction equipment,

¹⁰ The issuer informs us that biocarbon used as a reductant is considered a process input under the EU Emissions Trading System (ETS) and is therefore rated as zero emissions under associated regulations. Renewable Energy Directive II (RED II) criteria related to sustainable sourcing certification and direct and indirect land use change safeguards do not apply.

¹¹ E.g., as per [WWF's Forest Certification Assessment Tool \(CAT\)](#).

and potential local pollution and biodiversity impacts. Elkem informs us it will consider the lifecycle impacts of construction materials in future procurement and manage other risks through its sustainability policies and processes.

Carbon capture facilities

- ✓ CCS is a critical component of a sustainable low carbon future, particularly in difficult to decarbonize industries such as silicon production. Investment in and application of this technology advances much-needed innovation that can have broad, positive impacts.
- ✓ The issuer informs us that CCS projects would likely be focused on capturing emissions from fossil and biogenic reductant reactions.
- ✓ According to the issuer, it has piloted amine-based¹² CCS approaches and would likely pursue this CCS technology going forward. Note that amine-based CCS is energy intensive and generates degraded amine solvent waste that must be managed. Elkem informs us it would likely power this process using electricity and recovered waste heat and it will consider potential waste management and long-term carbon storage impacts if taken forward.

R&D

- ✓ The issuer informs us that R&D in this project category would be focused on recycling or upcycling wastes and side-streams from Elkem or its customers or replacing raw materials with circular solutions in existing or new production processes. We view innovations in these areas as positive in terms of reducing the climate and environmental impacts from landfilling and incineration as well as avoiding additional raw material inputs.
- ✓ According to Elkem, it would follow the waste hierarchy in project design, such as through measures to reduce or prevent waste as well as repurpose it, which is positive. Energy sourcing and efficiency, waste transport emissions, and management of any potential local pollution from waste processing are additional considerations that require management.

Table 1. Eligible project categories

¹² This type of CCS uses a solvent (amine) to separate and capture carbon dioxide from flue gas. See, e.g., [Review on CO2 Capture Using Amine-Functionalized Materials \(2022\)](#).



3 Terms and methodology

This note provides Shades of Green’s second opinion of the client’s framework dated August 2023. 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. Shades of 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.

‘Shades of Green’ methodology

Shades of 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:

Shading	Examples
 <p>Dark Green is allocated to projects and solutions that correspond to the long-term vision of a low-carbon and climate resilient future.</p>	 Solar power plants
 <p>Medium Green is allocated to projects and solutions that represent significant steps towards the long-term vision but are not quite there yet.</p>	 Energy efficient buildings
 <p>Light Green is allocated to transition activities that do not lock in emissions. These projects reduce emissions or have other environmental benefits in the near term rather than representing low carbon and climate resilient long-term solutions.</p>	 Hybrid road vehicles

The “Shades of Green” methodology considers the strengths, weaknesses and pitfalls of the project categories and their criteria. 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, including potential macro-level impacts of investment projects.

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. Shades of 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.



Assessment of alignment with Green Bond Principles

Shades of Green assesses alignment with the International Capital Markets' Association's (ICMA) Green Bond Principles. We review whether the framework is in line with the four core components of the GBP (use of proceeds, selection, management of proceeds and reporting). We assess whether project categories have clear environmental benefits with defined eligibility criteria. The Green Bonds Principles (GBP) state that the "overall environmental profile" of a project should be assessed. The selection process is a key governance factor to consider in Shades of Green's assessment. Shades of 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 Shades of Green places on the selection process. Shades of Green assesses whether net proceeds or an equivalent amount are tracked by the issuer in an appropriate manner and provides transparency on the intended types of temporary placement for unallocated proceeds. Transparency, reporting, and verification of impacts are key to enable investors to follow the implementation of green finance programs.



Appendix 1: Referenced Documents List

Document Number	Document Name	Description
1	Elkem Green Bond Framework	Dated August 2023
2	Elkem ESG Report	Dated 2022
3	Elkem TCFD Report	Dated 2023
4	Policies, strategies and reporting	Elkem website on sustainability topics
5	Statements and positions	Elkem website with sustainability policies
6	Corporate Standard for Sourcing of Bio-Carbon (Wood and Charcoal)	Elkem policy dated 2016



Appendix 2: About Shades of Green

Shades of Green, now a part of S&P Global and formerly part of CICERO, provides independent, research-based second party opinions (SPOs) of green financing frameworks as well as climate risk and impact reporting reviews of companies. At the heart of all our SPOs is the multi-award-winning Shades of Green methodology, which assigns shadings to investments and activities to reflect the extent to which they contribute to the transition to a low carbon and climate resilient future.

Shades of Green is internationally recognized as a leading provider of independent reviews of green bonds, since the market's inception in 2008. Shades of 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. Shades of Green operates independently from the financial sector and other stakeholders to preserve the unbiased nature and high quality of second opinions.

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- ★ **2021 Largest External Reviewer**, Climate Bonds Initiative Awards
 - ★ **2020 External Assessment Provider Of The Year**, Environmental Finance Green Bond Awards
 - ★ **2020 Largest External Review Provider In Number Of Deals**, Climate Bonds Initiative Awards
 - ★ **2019 External Assessment Provider Of The Year**, Environmental Finance Green Bond Awards
 - ★ **2019 Largest Green Bond SPO Provider**, Climate Bonds Initiative Awards
 - ★ **2018 External Assessment Provider Of The Year**, Environmental Finance Green Bond Awards
 - ★ **2018 Largest External Reviewer**, Climate Bonds Initiative Awards
 - ★ **2017 Best External Assessment Provider**, Environmental Finance Green Bond Awards
 - ★ **2016 Most Second Opinions**, Climate Bonds Initiative Awards