

# Solar Foods Shades of Green assessment<sup>1</sup>

11 April 2024



**Sector: Food  
Manufacturing**



**Region: Europe,  
Global**

This report was produced by Shades of Green using Shades of Green Methodology.

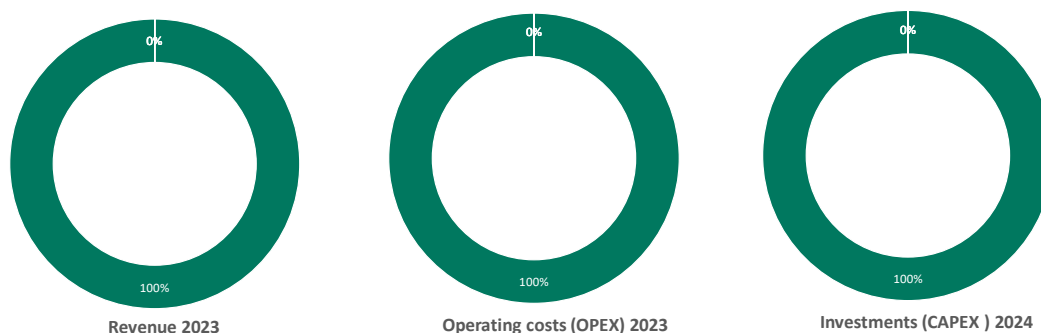
On December 1, 2022, S&P Global acquired Shades of Green from CICERO.

## Executive Summary

Solar Foods is a Finnish food-tech company producing Solein® - a dried microbial biomass rich in protein and intended to replace other sources of protein in the human diet. The company has been operating a pilot facility in Finland since 2019 and is offering products to the Singaporean market. It opened a new demonstration factory in Finland in Q1 2024 and will scale globally over time, regulatory approvals permitting.

## Shading of Solar Foods 2023 revenue, operating expenses, and capital expenditures

■ Dark green ■ Medium green ■ Light green ■ Yellow ■ Red



**Figure 1: Shading of revenue, operating costs and capital expenditures for Solar Foods**

**A Dark green shading has been assigned to the revenues, OPEX and CAPEX of Solar Foods, despite the risks related to the rolling out of its product and the current immature stage of sustainability processes in the company.** The Dark green shading is based on the potential for Solein to replace GHG intensive products for human food consumption (such as dairy, egg, bovine meat and plant-based substitutes). Safe and sustainably produced laboratory substitutes have the potential to reduce pressures on land use and reduce emissions from animal husbandry. However, the shading has been assigned based on an assessment of potential rather than realised results and should be updated as the product is further refined and tested, and its applications monitored. The company’s shading in the future will also depend on how it rolls out its environmental and social policies as the company scales.

## Nasdaq Green Designation<sup>1,2</sup>

S&P Global Ratings Shades of Green assesses that Solar Foods meets the requirements for Nasdaq Green Equity Designation set out in the Nasdaq Green Equity Principles.



<sup>1</sup> Shades of Green is an approved reviewer to assess alignment with the Nasdaq Green Equity Principles, [Nasdaq.com/Solutions/Nasdaq-Nordic-Green-Designations](https://www.nasdaq.com/solutions/nasdaq-nordic-green-designations)

<sup>2</sup> Solar Foods received its Nasdaq Green Designation as a private company. From the day of listing the company’s ‘Nasdaq Green Equity Designation – Private Company’ was replaced by ‘Nasdaq Green Equity Designation’ without an update to this assessment dated 11 April 2024.

**The shading also hinges on the source of electricity used to produce Solein, which is around 90% fossil-free at present.** The main feedstock of Solein is electricity, which the company currently sources from the Finnish grid, with the additional use of guarantees of origin. Ensuring a low-emission electricity supply as the company expands operations to other locations will be key to retaining the shading.

**The key pitfalls of Solar Foods include the sourcing of (renewable) electricity and the absence of governance mechanisms in place to mitigate social and environmental risks in its supply chain** (still not fully mapped). We also note the potential risk related to the non-human uses of its product (they tend to have lower positive sustainability impact) and transport emissions: the long-term strategy of the company is to locate production facilities close to consumers but in the meantime its products may continue to rely on air freight.

### Governance Assessment

**Solar food’s sustainability strategy is clearly articulated. However, the company has yet to demonstrate the governance mechanisms that will allow it to successfully execute on its strategy.** Sustainability governance seems to be primarily concentrated within the CEO’s responsibilities. While this is commensurate with the company’s start-up nature, we have yet to see evidence of how the board manages and monitors sustainability risks. Similarly, other main areas to watch going forward include the establishment of social and environmental targets, including benchmarks for life cycle emissions performance, and the formalisation of social and environmental risk mitigation policies for the supply chain, including screening and auditing procedures.

### EU taxonomy (including social safeguards)

The EU taxonomy currently does not cover the activities relevant for Solar Foods (food manufacturing). Solar Foods is likely not aligned with the minimum safeguards. There are likely material risks for Solar Foods in the sourcing of certain materials, and to assess such potential risks the company should work with risk assessments on a more continuous basis.

**Table 1: Sector specific metrics**

	Energy consumption (kWh)	Scope 1 & 2 Emissions <sup>2</sup> (tonnes CO <sub>2</sub> e)	Scope 3 Emissions <sup>2</sup> (tonnes CO <sub>2</sub> e)	Solein® production (kg)
2023	409	10	7	143
2022	-	-	-	-
2021	-	-	-	-

<sup>2</sup> Solar Foods has estimated GHG emissions for the purposes of this report. The estimates do not follow the GHG protocol and do likely not provide a comprehensive view of the company’s emissions.

# Contents

---

Executive Summary.....	1
<b>Solar Foods sustainability governance</b> .....	<b>4</b>
Company description.....	4
Governance Assessment.....	4
Sector risk exposure.....	7
<b>Assessment of Solar Food’s activities</b> .....	<b>8</b>
Key issues and metrics.....	8
Shading of Solar Food’s revenue, operating expenses and capital expenditures .....	10
EU Taxonomy.....	11
Nasdaq Green Designation.....	12
<b>Terms and methodology</b> .....	<b>13</b>
Shading corporate revenue and investments.....	13
<b>Appendix 1: Referenced documents list</b> .....	<b>15</b>
<b>Appendix 2: About Shades of Green</b> .....	<b>16</b>

---

## Solar Foods sustainability governance

### Company description

Solar Foods is a Finnish food-tech company producing ingredients and developing production technology for the food sector. Currently, the company operates a hydrogen fermentation facility in Finland, where it manufactures Solein, a protein-rich powder. The production of Solein involves an enhanced fermentation process, wherein water is combined with minerals, carbon dioxide, hydrogen and small amount of oxygen to provide growth condition for a microorganism. This microorganism is then separated and dried from the growth medium resulting a dried microbial biomass rich in protein called Solein®. Solein, was developed as an alternative to more carbon-intensive animal and plant-based protein sources and can be used as a food ingredient in meat and dairy alternatives, to replace egg and fortify food products in nutritional properties.

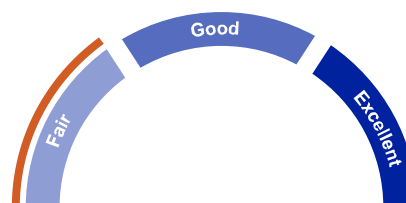
The company sources the main feedstock, renewable electricity, from the Finnish electricity market. CO<sub>2</sub> is sourced from Woikoski's Kokkola road salt production plant as well as from air using direct air capture. Minerals comprise about 5% of Solein's dry weight, they are sourced from Bang & Bonsomer and Algal Chemicals. Currently, Solein is shipped via air to its sole market in Singapore. Solar Foods has recently expanded its production capacity by establishing a new factory in Finland and eventually intends to establish production facilities in proximity to the markets it will be serving - although all expansion is contingent on obtaining regulatory approval (currently only for Singapore). Going forward, the company's reliance on air freight (or not) will depend on the locations and volumes produced where the company manages to establish its production facilities. The company's decisions on the location of new facilities will also include consideration of market demand, regulatory approval, and the availability of renewable electricity. The company has applied for regulatory approval in the US and the EU and concurrently patented the production process of its protein powder for subsequent commercialisation.

### Governance Assessment

While the company demonstrates a strong awareness of environmental and sustainability concerns, it has yet to establish and formalise policies and processes to effectively mitigate issues associated with its supply chain, which includes high environmental risk minerals.

The company conducted a materiality assessment in 2021, pinpointing the most crucial themes as customer and employee health and well-being, human rights, product safety, land and energy use, and ethics. The company monitors KPIs on water and electricity use and is currently in the process of developing targets for its KPIs, including GHG targets. In addition, as the company expands its production capacity, it expects to conduct a new materiality assessment.

The overall assessment of Solar Foods governance structure and processes gives it a rating of Fair. Although the company's sustainability vision is clearly articulated, the company has yet to demonstrate the governance mechanisms that will allow it to execute on its strategy and expand its business without introducing additional environmental and/or social risks.



### *Key strategies, policies, and targets*

Although the company has yet to set an overarching sustainability policy, the company's primary sustainability strategy and business priority revolves around providing customers with an alternative food source that addresses nutritional needs but with a substantially lower ecological footprint when contrasted with traditional sources.

The company has not yet set any emission reduction targets. It completed its first internal GHG emissions estimates in 2024, which have not been verified by an external third-party. Nevertheless, the company estimates that in 2031, if its operations achieve a projected production level of around 78.5 thousand tonnes of Solein (protein powder), the avoided emissions could amount to over 8 million tons of CO<sub>2</sub>.<sup>3</sup>

The company expects to conduct a lifecycle emissions analysis based on operational data once it achieves a reasonable production level. As the company's primary objective is to be a low-carbon alternative in the current food market, it also envisions implementing a policy to ensure that its products do not surpass the lifecycle emissions of plant-based alternatives.

The company plans to set KPIs for water use and electricity use in the future.

### *Governance structure*

The current CEO has a sustainability background and is responsible for the implementation of the company's sustainability strategy, but currently there is no dedicated sustainability department at Solar Foods. Similarly, the company's board of directors is composed of industry experts. However, there is no dedicated board committee to oversee sustainability issues and climate-related risks, nor is there executive remuneration linked to such themes.

### *Supply chain*

Solar Foods has a supplier selection policy focused on food quality and safety aspects but has yet to incorporate environmental aspects into its selection policy. It currently only engages with its electricity supplier, even though there are likely high environmental risk suppliers, such as minerals suppliers. Despite not engaging and screening such suppliers, these are subject to a code of conduct.

### *Environmental risk management*

The company has yet to formalise policies to address potential environmental risks of its supply chain, such as biodiversity loss issues during the extraction of minerals that are necessary for the production of Solein. This is a weakness but could be viewed as commensurate with its position as a start-up company.

Solar Foods has assessed its direct operational exposure to physical climate risks (in a greater than 2 °C warming by 2100 scenario in Finland). The company found that, in Finland for this scenario (which could be considered

---

<sup>3</sup> This result uses a CO<sub>2</sub> avoidance emissions factor of 110 from [Järviö et al. 2021](#) and considers the replacement of one ton of Solein for one ton of bovine meat. According to the U.S. Environmental Protection Agency, one cow emits around 154-264 pounds of methane gas or 4,466-7,656 tonnes of CO<sub>2</sub>e per year (source: [Agriculture and Aquaculture: Food for Thought | US EPA](#)). The amount of CO<sub>2</sub>e emissions avoided by Solar foods in 2031 could be the equivalent of reducing the size of a cattle herd by 3 million heads, if production is ramped up as planned. That said, we note that the one-to-one replacement is not directly comparable as Solein is used as an ingredient for cell-based meat production or other food alternatives and not a final product as packaged meat.

conservative given current estimates of warming in 2024), Solar Foods' facilities are 'not expected to be severely disrupted' by physical climate risks.

### *Social risk awareness*

The company has provided the results from a risk assessment made in 2021. The most salient/important risks identified then were occupational health and safety, health and wellbeing, equality, responsible sourcing and traceability and security. The assessment also included risk mitigating measures, such as the use of protective gear to protect eyes, lungs and skin, noise reduction, alert system and measures to avoid heavy lifting. The company confirms that all of these measures have now been implemented. To understand more about the situation for its own workers and to fulfil the requirements in the Finnish "Act on Cooperation within Undertakings" aiming at creating sound working places, the company each year conduct a work community survey. This year's results indicate that workers are in general satisfied with their work situation, and that the level of stress among its employees is not very high and declining.

The risk assessment from 2021 has not been updated and did not seem to cover social issues in the company's value chain. The company's own activities were thoroughly covered, but its upstream or downstream value chains are not covered. The company however states that it follows closely its electricity provider and that is planning to produce its own ammonia.

Solar Foods has a Code of Conduct that is based on ILO conventions and the UN Declaration on Human Rights. The company follows their employees closely through surveys, cooperation and strict requirements to create an equal and safe working environment.

The company has a code of conduct for suppliers. It covers topics/risks related to the workplace, it requires suppliers to ensure i.a. access to clean water, safe and clean meal and rest facilities and protective equipment free of charge. Other requirements cover living wage, employment contracts, regulated working time and a ban against child labour and forced labour. It also states that suppliers must provide access to a whistle blowing channel.

### *Reporting*

Solar Foods expects to publish its first sustainability report in 2025, which will include monitored KPIs, among other information, using 2024 data (the year it is expecting to begin operating a full-scale factory). Currently there is limited public information on the company's sustainability performance and journey.

## Sector risk exposure



Solar Foods' direct operations are shielded from the environmental and social risks associated with traditional agricultural practices, such as GHG emissions from land use change and livestock, as the company's business serves as a substitute for these. That said, the company's production process, reliant on water and mineral extraction, as well as having high energy needs, exposes it to risks akin to those in the traditional food manufacturing sector.

**Physical climate risks.** Increased extreme weather events pose risks to the food-tech industry directly via impacts on bioprocessing facilities and distribution facilities, and indirectly on its value chain, especially from the extraction of minerals needed for food ingredients, such as phosphorus and potassium.

**Transition risks.** Changing consumer preferences towards more environmentally friendly products represent a transition opportunity for low carbon food ingredients, such as alternative proteins. This, however, does not guarantee consumer acceptance (of what is perceived as 'engineered' foods) and regulatory approvals for these products also represent a transition risk. Likewise, as cell-based protein production is very energy-intensive, any tightening in emissions regulations could affect the sector considerably.

**Environmental risks.** Environmental risks of food manufacturing exist at the product plant level as well as in the value chain. At the plant level, local waste streams represent one source of pollution, although Solar Foods' current location in Finland provides comfort in terms of a robust regulatory framework which are likely to limit such risks. Risks of high-polluting and energy intensive activities moreover exist both in the supply chain and with end-customers: Manufacturing of ingredients, such as mineral products, can pose biodiversity loss risks depending on the mineral and its extraction method and location. Likewise, at the consumer end, waste - including plastics and food waste - pose a high risk for the sector. We believe that consumers will continue to demand solutions to target lower waste and successful food product companies would be those that can source products that solve the consumer needs for recycled, packaging-less, and more environmentally friendly products.

**Social risks.** The food-tech and ingredients sector rely on the sourcing of fertilisers and minerals, which brings social risk, especially from less well-regulated jurisdictions. Mining activities can imply dangerous or hazardous work and give rise to risks relating to local opposition and interference with the local communities. Although to a much lower extent than traditional agriculture, a global presence and long supply chain can also imply human rights and labour rights risks. We note that Solar Foods has expressed that it will put efforts into trying to ensure a just transition from conventional protein production to this new production process.

# Assessment of Solar Food’s activities

## Key issues and metrics

### GHG Emissions

According to the company, the carbon intensity of Solein, measured by kilograms of greenhouse gas emissions per kilogram of bone-free protein, is 500-fold lower than beef and 17.5 times lower than soy-based meat alternatives. The company estimates that in 2031, if its operations achieve a production level of around 78.5 thousand tonnes of Solein, the avoided emissions could amount to over 8 million tons of CO<sub>2</sub>.<sup>4</sup>

The company started production in 2023 and as such only has one year of data. Solar Foods estimated Scope 1 – 3 emissions of their operations for the purposes of this report. The emissions calculations do not follow the Greenhouse Gas Protocol, nor have they been reviewed by a third-party. The below figures are likely not representative of a comprehensive emissions inventory but give an indication of the scale of emissions.

**Table 2: The table summarises GHG-emissions and main emission reduction targets.**

	Total (tons CO <sub>2</sub> eq <sup>5</sup> )	Scope 1 emissions (tons CO <sub>2</sub> eq)	Scope 2 emissions (tons CO <sub>2</sub> eq)	Scope 3 emissions (tons CO <sub>2</sub> eq)	Emission Intensity (scopes 1 and 2 only)
<b>Main targets</b>					1.6 kg CO <sub>2</sub> / kg product
<b>2023</b>	17	0	10	7	15.95 kg CO <sub>2</sub> / kg product
<b>Main Sources</b>			Electricity	Ammonia Company travel	

The company’s emission intensity was ten times higher than its target in 2023 and the company explains that this was because of the low volumes produced at the piloting stage. The company expects that its future factories will use green ammonia as a replacement to the current use of fossil fuel-based ammonia fertiliser and thus that Scope 3 emissions intensity will decrease.

### Energy

All of Solar Foods’ energy needs are met by electricity.

**Table 3: The table summarises energy mix by energy source**

Energy source	Percent of total	Comments

<sup>4</sup> See comments in Footnote 3.

<sup>5</sup> CO<sub>2</sub>e, carbon dioxide equivalent is a measurement term for greenhouse gas accounting.



<p><b>Electricity: renewables, nuclear and fossil sources</b></p>	<p>100</p>	<p>Solar Foods currently has a grant from the European Commission’s Important Projects of Common European Interest (IPCEI). As a result, the company’s electricity expenses are to a large extent covered by the EU Commission’s recovery and resilience fund.</p> <p>The electricity is sourced from VENI Energy, an electricity trading company in Finland, which purchases electricity from the grid. Finland’s grid is based on 55% hydro-, wind- and other renewables, 35% nuclear and 10% fossil fuels (mostly coal)<sup>6</sup>.</p>
---	------------	---

Energy is a key sustainability issue for microbial protein producers such as Solar Foods, as their production is energy-intensive<sup>7</sup>. A fossil-fuel intensive grid would affect the climate impact of Solar Foods’ product substantially. Solar Foods draws electricity from the Finnish grid (connected to the Nordpool market), which is 90% fossil-fuel free. It also utilizes guarantees of origins to make further claims about its emission profile. Note that guarantees of origin and other certifications ensures a certain amount of low emission electricity exists in the grid but do not influence the emissions from electricity delivered. Therefore, we view guarantees of origin as one of the weaker electricity emissions abatement strategies<sup>8</sup>.

*Climate Resilience*

Climate change can impact food manufacturing companies via physical risk of extreme weather events on manufacturing plants, on supply chains and distribution channels as well as longer-term temperature and drought-related changes on the availability of inputs.

According to Solar Foods, its focus until now has been on starting operations of what it believes will be a food ingredient and technology with significant positive environmental and climate benefits and that climate resiliency has not been a focus.

**Table 4: Shades of Green assessment of Solar Food’s management of key environmental issues**

Key issue	Shades of Green comments
GHG emissions	<ul style="list-style-type: none"> <li>✓ Solein has the potential to significantly reduce the emissions of the final food products where it is used as an ingredient.</li> <li>✓ Solar Foods is in the very beginning phase of calculating the emissions from its own operations and has estimated Scope 1 – 3 emissions for the purposes of this report</li> </ul>
Energy	<ul style="list-style-type: none"> <li>✓ SolarFoods’ strategy is to source 100% of its energy needs from renewable energy and has identified energy use as a KPI. Since energy has been identified as the most material environmental issue for the sector/company, this commitment is reassuring</li> <li>✓ Note that the company’s current strategy for claiming renewable electricity sourcing relies on the use of guarantees of origin, which do not necessarily influence the emissions from electricity delivered. Therefore, we do not consider that the company sources 100% of its energy needs from renewable energy but rather that it reflects Finland’s grid</li> </ul>

<sup>6</sup> Source: IEA <https://www.iea.org/countries/finland>

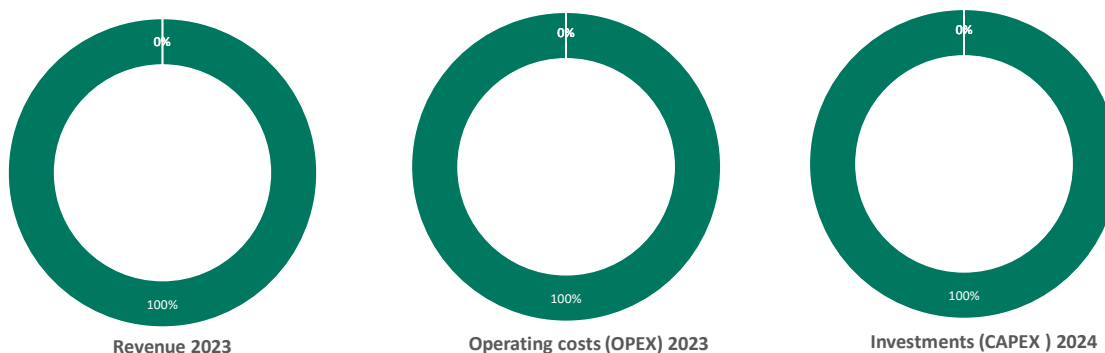
<sup>7</sup> See e.g. Järviö et al. (2021), *An attributional life cycle assessment of microbial protein production: A case study on using hydrogen-oxidizing bacteria*

<sup>8</sup> Purchased Energy Emissions In Second Party Opinions And ESG Evaluations, S&P Global Ratings, March 23, 2023

composition. We view guarantees of origin as one of the weaker electricity emissions abatement strategies.

Climate Resilience ✓ The company has identified climate resilience as an issue in its operations but has not yet developed a strategy around the issue. It has undertaken an assessment of its current production facility but has not analysed climate resiliency issues related to its supply chain.

### Shading of Solar Food’s revenue, operating expenses and capital expenditures



A dark green shading has been assigned to the revenues, CAPEX and OPEX of Solar Foods, based on Solein’s potential to replace GHG intensive products for human food consumption (such as dairy, egg, bovine meat and plant-based substitutes).<sup>9</sup> The company’s current revenues come from the sale of a product where Solein is used as a dairy substitute. Producing nutrient substitutes in a laboratory has several positive advantages over farming alternatives, the most prominent ones being reduced pressures on land use (with consequences for both carbon emissions and biodiversity) reduced emissions from ruminating animals, as well as lower use of freshwater. The most prominent ‘ingredient’ in the production of Solein is electricity. The company has a policy of sourcing

<sup>9</sup> According to the IPCC Sixth Assessment Report, GHG emissions intensities of protein food products – measured using attributional lifecycle assessment and considering the full supply chain – are generally highest for ruminant meat, cheese, and certain aquaculture species (e.g., farmed shrimp and prawns, trawled lobster). See full breakdown below (not an extensive list) expressed as CO<sub>2</sub>-eq per kg of product or per kg of protein ( kgCO<sub>2</sub>-eq per 100 g protein). Solein can be used as a food ingredient for the production of alternative protein or dairy food, such as cell-based meat and no-milk ice-cream respectively, that tend to be at the low end of the protein GHG intensity spectrum.:

- Beef (beef cattle): 17-94 kgCO<sub>2</sub>-eq per 100 g protein
- Lamb and Mutton: 11-23 kgCO<sub>2</sub>-eq per 100 g protein
- Cheese: 4.—16 kgCO<sub>2</sub>-eq per 100 g protein
- Milk: 5-12.5 kgCO<sub>2</sub>-eq per 100 g protein
- Pork: 4.8-12 kgCO<sub>2</sub>-eq per 100 g protein
- Eggs: 2.5-7 kgCO<sub>2</sub>-eq per 100 g protein
- Tofu: 2-4 kgCO<sub>2</sub>-eq per 100 g protein

electricity from renewables, which mitigates the risks of replacing one source of emissions (land use, animal husbandry) with another (energy use).

Notwithstanding the above positive considerations, the shading has been assigned based on a potential and pilot studies/manufacturing plants and should be updated as the product is further refined and tested, and its applications monitored. What appears promising today may have unintended consequences or side-effects that are difficult to foresee at present.

A potential pitfall is the company's sourcing of electricity; the GHG savings potential of its product compared to alternatives significantly depends on the carbon emissions of its electricity use. Another pitfall are the potential emissions from transport: If – as the company scales – it is successful in establishing production facilities near consumers these emissions are likely to be low however if the product is airfreighted transport emissions could become a material component of overall emissions. Finally, our assessment of Solein partly depends on its application: substituting for animal feed or other non-food uses could be considered less impactful and would not necessarily receive a Dark green shading (Solar Foods says this would not be economically efficient and do not envisage this as a possibility).

The company's shading in the future will also depend on how it rolls out its environmental and social policies as the company scales: Solar Foods currently has very few policies and procedures in place and these policies will be crucial as the company grows – e.g., supply chain policies with environmental criteria, robust resilience planning with respect to climate risks throughout the supply chain, etc. Consequences along any of these dimensions have the potential to lead to a reassessment of the company's shading.

Investors should note that our assessment is based on data reported or estimated by the company and has not always been verified by a third party. We analyse revenue, operating costs and capital expenditures, however there is typically not an explicit link between sustainability and financial data<sup>10</sup>. Our shading often requires allocating line items in financial statements to projects or products, for this we rely on the company's internal allocation methods. In addition, there are numerous ways to estimate, measure, verify and report e.g., data on emissions, which may make direct comparisons between companies or regulatory criteria difficult and somewhat uncertain.

## **EU Taxonomy**

The EU taxonomy currently does not cover the activities relevant for Solar Foods (food manufacturing).

*Alignment with minimum safeguards* To qualify as a sustainable activity under the EU regulation certain minimum safeguards must be complied with. Shades of Green has assessed the company's safeguards with a focus on human and labour rights. We take the sectoral, regional and judicial context into account and focus on the risks likely to be the most material social risks. Shades of Green concludes that Solar Foods is likely not aligned with the minimum safeguards. There are likely material risks for Solar Foods in the sourcing of certain materials, and to assess such potential risks the company should work with risk assessments on a more continuous basis.

---

<sup>10</sup> Most accounting systems do typically not provide a break-down of revenue and investments by environmental impact, and the analysis may therefore include imprecisions and may not be directly comparable with figures in the annual reporting

**Nasdaq Green Designation**

Shades of Green confirms that Solar Foods meets the requirements for Nasdaq Green Equity Designation set out in the Nasdaq Green Equity Principles.

In 2023, 100% of Solar Foods's turnover came from assets with some Shade of Green, exceeding the 50% threshold for green activities for company turnover. The sum of OPEX and CAPEX allocated a Shade of Green is 100%. This exceeds the 50 % threshold for investments, defined as the sum of CAPEX and OPEX. In 2023, Solar Foods had no turnover assessed shaded Red, meeting the threshold of less than 5% of the company's turnover being derived from fossil fuel activities.

In addition, this report provides transparency on alignment of the company's activities with the EU Taxonomy and transparency on the company's environmental targets and KPIs is provided.











## Terms and methodology

The aim of this analysis is to be a practical tool for investors, lenders and public authorities for understanding climate risk. Shades of Green encourages the client to make this assessment publicly available. If any part of the assessment is quoted, the full report must be made available. Our assessment, including on governance, is relevant for the reporting year covered by the analysis. This assessment is based on a review of documentation of the client’s policies and processes, as well as information provided to us by the client during meetings, teleconferences and email correspondence. In our review we have relied on the correctness and completeness of the information made available to us by the company.

### Shading corporate revenue and investments

Our view is that the green transformation must be financially sustainable to be lasting at the corporate level. We have therefore shaded the company’s current revenue generating activities, as well as investments and operating expenses.

The approach is an adaptation of the Shades of Green methodology for the green bond market. The Shade of Green allocated to a green bond framework reflects how aligned the likely implementation of the framework is to a low carbon and climate resilient future, and we have rated investments and revenue streams in this assessment similarly. We allocate a shade of green to the revenue stream and investments according to how these streams reflect a alignment of the underlying activities to a low carbon and climate resilient future and taking into account governance issues.

Shading		Examples
	<b>Dark green</b> Is allocated to projects and solutions that corresponds to the long-term vision of a low-carbon and climate resilient future.	 Solar power plants
	<b>Medium green</b> Is allocated to projects and solutions that represent significant steps towards the long-term vision but are not quite there yet.	 Energy efficient buildings
	<b>Light green</b> 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.	 Hybrid road vehicles
	<b>Yellow</b> Is allocated to projects and solutions that do not explicitly contribute to the transition to a low carbon and climate resilient future. This category also includes activities with too little information to assess.	 Health care services
	<b>Red</b> Is allocated to projects and solutions that have no role to play in a low-carbon and climate resilient future. There are the heaviest emitting assets, with the most potential for lock in of emissions and highest risk of stranded assets.	 New oil exploration

In addition to shading from dark green to red, Shades of Green also includes a governance score to show the robustness of the environmental governance structure. When assessing the governance of the company, Shades of Green looks at five elements: 1) strategy, policies and governance structure; 2) lifecycle considerations including supply chain policies and environmental considerations towards customers; 3) the integration of

climate considerations into their business and the handling of resilience issues; 4) the awareness of social risks and the management of these; and 5) reporting. 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.

In March 2020, a technical expert group (TEG) proposed an EU taxonomy for sustainable finance that included a number of principles including “do-no-significant-harm (DNSH)-criteria” and safety thresholds for various types of activities<sup>11</sup>. In April 2021, EU published its delegated act to outline proposed criteria for climate mitigation and adaptation, which it was tasked to develop after the EU Taxonomy Regulation entered into law in July 2020. Shades of Green has assessed the mitigation criteria in the EU taxonomy that includes specific thresholds for activities relevant for the company<sup>12</sup>.

Do-No-Significant-Harm criteria include measures such as ensuring resistance and resilience to extreme weather events, preventing excessive water consumption from inefficient water appliances, ensuring recycling and reuse of construction and demolition waste and limiting pollution and chemical contamination of the local environment, as well as restriction on the type of land used for construction (no arable or forested land).

Shades of Green has assessed potential alignment against the mitigation thresholds and the DNSH criteria in the delegated acts published in April 2021.

In order to qualify as a sustainable activity under the EU regulation 2020/852 certain minimum safeguards must be complied with. The safeguards entail alignment with the OECD Guidelines for Multinational Enterprises and UN Guiding Principles on Business and Human Rights, including the International Labour Organisation’s (‘ILO’) declaration on Fundamental Rights and Principles at Work, the eight ILO core conventions and the International Bill of Human Rights. Shades of Green has completed a light touch assessment of the above minimum safeguards with a focus on human rights and labor rights risks<sup>13</sup>. We take the sectoral, regional and judicial context into account and focus on the risks likely to be the most material social risk.

Our assessment of alignment against the EU Taxonomy is based on a desk review of the listed source documents against the Taxonomy Delegate Act and following our own shading methodology.

---

<sup>11</sup> Taxonomy: Final report of the Technical Expert Group on Sustainable Finance, March 2020. [TEG final report on the EU taxonomy \(europa.eu\)](https://ec.europa.eu/easf/document/eu-taxonomy-final-report-technical-expert-group)

<sup>12</sup> [taxonomy-regulation-delegated-act-2021-2800-annex-1\\_en.pdf \(europa.eu\)](https://eur-lex.europa.eu/eli/reg/2021/2800/annex_1/oj)

<sup>13</sup> S&P Global Ratings Shades of Green is in the process of further developing its assessment method to ensure that it encompasses the object and purpose of the minimum safeguards.

## Appendix 1: Referenced documents list

Document Number	Document Name	Description
1	PHYSICAL CLIMATE RISKS ON SOLAR FOODS' BUSINESS - EU Taxonomy DNSH Assessment According to Appendix A, June 2022	EU Taxonomy DNSH assessment (physical climate risks)
2	Food Safety at Factory 01	Presentation on company's food safety considerations for its first factory
3	The microbial food revolution, Graham et al. (2023), Nature Communications	Academic article
4	An attributional life cycle assessment of microbial protein production: A case study on using hydrogen-oxidizing bacteria, Jarvio et al. (2021), The Science of the Total Environment	Academic article
5	Liberating Protein Production	Presentation of company (for investors)
6	Solar Foods Code of Conduct	
7	Solar Foods Quality and Food Safety Policy	
8	Purchased Energy Emissions In Second Party Opinions And ESG Evaluations	S&P Ratings commentary on its approach to evaluating emissions from purchased energy (scope 2)
9	International Energy Agency (IEA): Finland Country Profile	
10	IPCC Sixth Assessment Report: Mitigation of Climate Change	

## Appendix 2: About Shades of Green

S&P Global Ratings Shades of Green 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 Company Assessments indicate the greenness of a company by providing a shading of revenues, operating costs and capital expenditures, as well as an assessment the company’s governance structure. Shades of Green also provides second opinions on institutions’ frameworks and guidance for assessing and selecting eligible projects for green, sustainability and sustainability-linked bond investments. 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 company being assessed, 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 assessments.



ESG Opinion Provider of the Year



Largest External Review Provider in Number of Deals for Shades of Green



ESG Assessment Tool of the Year - Ratings



External Assessment Provider of the Year



All information, text, data, analyses, opinions, ratings, scores and other statements ("Content") herein has been prepared solely for information purposes and is owned by or licensed to S&P Global and/or its affiliates (collectively, "S&P"). The Content shall not be used for any unlawful or unauthorized purposes. S&P and any third-party providers, as well as their directors, officers, shareholders, employees or agents (collectively S&P Parties) do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Parties are not responsible for any errors or omissions (negligent or otherwise), regardless of the cause, for the results obtained from the use of the Content, or for the security or maintenance of any data input by the user. The Content is provided on an "as is" basis. S&P PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Parties be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special or consequential damages, costs, expenses, legal fees, or losses (including, without limitation, lost income or lost profits and opportunity costs or losses caused by negligence) in connection with any use of the Content even if advised of the possibility of such damages.

Credit-related and other analyses, including ratings, and statements in the Content are statements of opinion as of the date they are expressed and not statements of fact. S&P's opinions and analyses are not recommendations to purchase, hold, or sell any securities or to make any investment decisions, and do not address the suitability of any security. S&P assumes no obligation to update the Content following publication in any form or format. The Content should not be relied on and is not a substitute for the skill, judgment and experience of the user, its management, employees, advisors and/or clients when making investment and other business decisions. S&P does not act as a fiduciary or an investment advisor except where registered as such. While S&P has obtained information from sources it believes to be reliable, S&P does not perform an audit and undertakes no duty of due diligence or independent verification of any information it receives.

S&P keeps certain activities of its business units separate from each other in order to preserve the independence and objectivity of their respective activities. As a result, certain business units of S&P may have information that is not available to other S&P business units. S&P has established policies and procedures to maintain the confidentiality of certain non-public information received in connection with each analytical process. S&P may receive compensation for its ratings and certain analyses, normally from issuers or underwriters of securities or from obligors. S&P reserves the right to disseminate its opinions and analyses.

See additional Disclaimers and Terms of Use at <https://www.spglobal.com/en/terms-of-use>

This disclaimer is updated and modified from time to time. Make sure that you check this page every time you access this Web page or other Web pages maintained by S&P Global.

Copyright© 2023 S&P Global Inc. All rights reserved.

This report does not constitute a rating action.