

Hainan Drinda New Energy Technology Co. Ltd.

Shades of Green assessment



Sector: Semiconductors



Region: China

5 April 2024

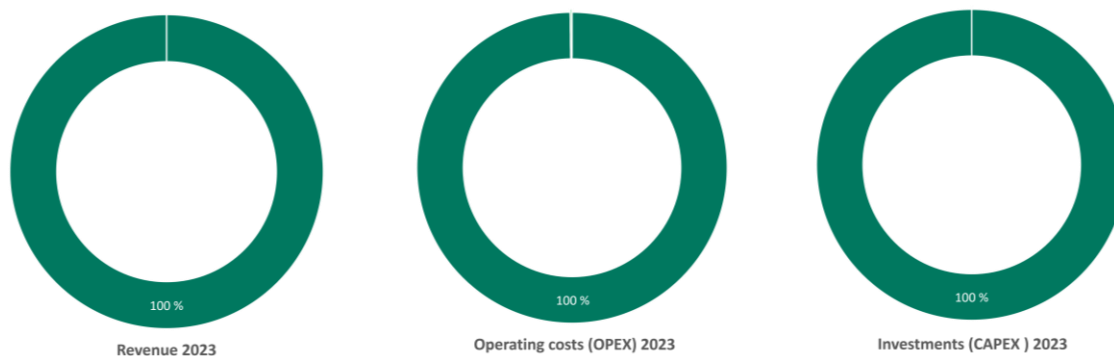
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Executive Summary

Hainan Drinda New Energy Technology Co. Ltd. (“Hainan Drinda” or “the company”) is a Chinese company principally involved in the research, development, manufacture, and sales of solar cells. It is headquartered in Haikou, China, and has three manufacturing bases - in Shangrao, Chuzhou, and Huai’an. As of 2023, it employed 8,267 staff, and reached a production capacity of 17.5 gigawatts (GW), with a sales volume of 10.7GW. The company has recently completed the expansion of the 10GW Chuzhou Phase II project and the 26GW Huai'an Phase I project, with an expectation to reach a total production capacity of 53.5GW by 2024.

Shading of Hainan Drinda’s 2023 revenue, operating expenses, and capital expenditures

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



Source: Shades of Green analysis using Hainan Drinda’s financial data from 2023.

Figure 1: Shading of revenue, operating costs and capital expenditures for Hainan Drinda

In 2023, 100% of Hainan Drinda’s revenue is shaded Dark Green. According to the company, over 95% of its revenues are derived from the sale of solar cells, with the remaining derived from made-to-order manufacturing services of customised solar cells. Hainan Drinda’s solar cells business facilitate the deployment and generation of solar power, which are a key contributor to the energy transition for a low carbon future. Hence, all revenues generated from the sale of solar cells and related manufacturing services are shaded Dark Green. It should be noted that solar energy equipment could contain significant environmental impacts such as waste disposal issues when it reaches the end of its useful life. In addition, crystalline-silicon cells could contain heavy metals, such as lead, cadmium etc. Metals as pollutants can be released from solar panels which contaminate soil properties as leaching duration increases.

In 2023, 99.8% of OPEX is shaded Dark Green, and 0.2% Light Green. The company's OPEX costs mainly consists of administrative costs, such as cost of labour, marketing expenses, costs of materials and utilities. Utilities costs are mainly purchasing electricity for the manufacturing process, however there are also minor costs relating to purchasing liquified petroleum gas (LPG) and natural gas. Utility costs (0.2% of OPEX) are shaded Light Green to reflect that electricity grids in China are predominantly fossil-fuel-heavy, with relatively high emission factors. The remaining OPEX is shaded Dark Green. It should be noted that while material costs are shaded Dark Green, Hainan Drinda sources silicon wafer, silver paste, screens, and quartz pieces, which could be energy and emission-intensive to mine, process, and produce.

100% of CAPEX have been designated a Dark Green shading as they support a pure-play solar cell manufacturing company, aligning with activities needed in a low-carbon climate-resilient (LCCR) future. Hainan Drinda has indicated that the vast majority of CAPEX was allocated towards acquiring electrical manufacturing equipment. While this equipment will initially operate on electricity sources from a grid with a high emission factor, we have allocated a Dark Green shade due to the company's role in supporting the production of solar cells and the minimal lock-in risks. As China's electricity grids decarbonise, the equipment can use renewable energy sources when available. However, during the operational phase, electricity costs associated with powering the equipment will be shaded Light Green to reflect the current emission factor of the grid.

Governance Assessment

Hainan Drinda has demonstrated awareness of environmental, climate, and social concerns. Since completing its business transition in 2022, the company has started developing tracking and reporting mechanisms for its scope 1-3 emissions, which are included in its 2023 ESG report. It has formalised and defined ESG governance roles and responsibilities across the board, senior management, and the ESG execution team. It has established fundamental policies and relevant processes, although they are mostly communicated internally, or among specific stakeholders such as suppliers. It targets to reduce 40% greenhouse gas (GHG) intensity and use 40% renewables in its energy usage mix by 2030. Efforts include using solar renewables, energy efficient installations, and purchase of renewables from third parties. There are some climate risk integrations into the risk management process, which includes reporting qualitatively the identified transition and physical climate risks according to the recommendations by the Task Force on Climate-Related Financial Disclosures (TCFD).

We consider Hainan Drinda's efforts to be positive, where key sustainability concerns have been considered. Moving forward, the company should develop a track record of reporting against the progress towards its targets in each financial year's ESG reporting. A clear strategy to address embodied emissions, such as raw materials processing and manufacturing, solar cell product design and circularity, will inform more transparent decarbonisation commitment, beyond operational efficiency. Hainan Drinda could also further improve by conducting scenario analysis to assess and report the magnitude of climate risk exposure to its assets, operations, and supply chain across different timeframes, and the underlying financial implications. Overall, we rate the governance structure of Hainan Drinda to be **Good**.

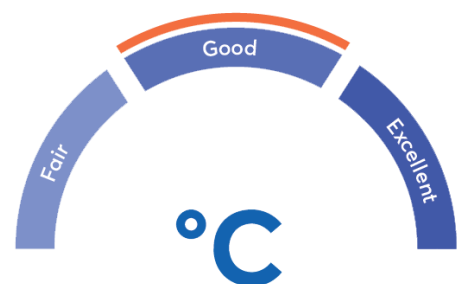


Table 1: Sector specific metrics

<i>Greenhouse gas emissions (tCO_{2eq})</i>	Production Volume (gigawatts)¹	Scope 1	Scope 2	Scope 3
2023	30.4	26,503	986,371	5,610,736
2022	10.8	12,155	300,748	2,321,061

¹ Manufactured solar cell products include P-type 182P PERC Monocrystalline cells, N-type 182N TOPCon Monocrystalline cells, and N-type 182N TOPCon Monocrystalline cells.

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Hainan Drinda sustainability governance

Company description

Established in 2003 and listed on the Shenzhen Stock Exchange in 2017, Hainan Drinda is headquartered in Haikou, China. The company has entered the solar cell business after completing the full acquisition of Shangrao Jietai New Energy Technology Co. Ltd. (Jietai) and selling its automotive trim business (involving the manufacture and sale of dashboards, bumpers, door guards, among other trims) in 2022. In September same year, it changed its company name from originally the Hainan Drinda Automotive Trim Co. Ltd. The company recorded a total revenue of 18.7 billion Chinese Renmini (RMB) (equivalent to 2.6 billion US dollars) in 2023, a 61% increase from 2022.

Hain Drinda's business involves the research, development, manufacture, and sales of solar cells. Through Jietai, the company owns and operates three manufacturing bases - in Shangrao, Chuzhou, and Huai'an. In 2023, it employed about 8,267 staff. Its solar cell business had a production capacity of 17.5 gigawatts (GW) and a sales volume of 10.7GW (>99% to domestic market in China, and <0.5% to overseas market). In 2023, Hainan Drinda has completed the expansion of the 10GW Chuzhou Phase II project and the 26GW Huai'an Phase I project. It expects to reach a total production capacity of 53.5GW by 2024.

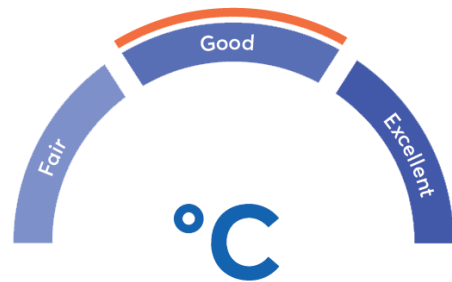
Governance Assessment

When assessing the governance of Hainan Drinda, we look at the overarching structures and procedures for decision making connected to climate risk analysis, climate-related strategy, and policy formulation. Furthermore, the implementation of the policies, including sub-contractors and LCA use, handling resilience issues, and quality of reporting, is assessed. Please note that this is not a substitute for a complete evaluation of the governance of Hainan Drinda and does not cover, e.g. corruption.

Hainan Drinda demonstrates awareness of environmental and sustainability concerns. It has defined ESG governance roles and responsibilities across the company's board, senior management, and general staff levels. Internal policies and procedures have been established, such as code of conduct for its employees, supply chain management and procurement policies, and environmental, health and safety policies. According to the company, it has established guidelines concerning key social and supply chain considerations. For example, suppliers are required to sign a code of conduct that addresses business conduct issues, among other human rights commitments. Nevertheless, it is less explicit in terms of how it maps and prioritises different climate and social risks along its supply chain.

After its business transition, Hainan Drinda has developed a sustainability disclosure mechanism. This includes publishing its first 2023 ESG report, with identification of material ESG topics and related responsive measures, a qualitative climate risk assessment with reference to the TCFD framework, two-year track progress of material KPIs, and some quantitative targets. For instance, it has consulted third-party auditors to assess its scope 1-3 emissions and has committed to reducing 40% of GHG (scope 1-3) intensity by 2030, supplemented with other targets in relation to renewables usage in energy mix and water saving. The company has also established some social targets in relation to health and safety, and product quality. Although the company has communicated its strategy to address upstream emissions through local sourcing to reduce transportation cost, there is limited information with regards to its plan to reduce the most material upstream emissions from purchased materials, as well as how they view product circularity. This limits our visibility to its ability to reach its 2030 GHG target.

The overall assessment of Hainan Drinda's governance structure and processes gives it a rating of Good. The company is encouraged to continue reporting against the progress towards its targets in each financial year's ESG reporting. We note that the company has included some qualitative reporting of identified climate risks according to the recommendations by the TCFD framework. Hainan Drinda could improve by conducting scenario analysis to fully assess and report the magnitude of climate risk exposure to its assets, operations, and supply chain across different timeframes, and the underlying financial implications.



The overall assessment of Hainan Drinda's governance structure and process gives it a rating of **Good**.

Key strategies, policies, and targets

Through a business transition from manufacturing and selling automotive trims to solar cells, Hainan Drinda aims to facilitate the country's low-carbon transition. It recognizes the increasing demand for renewable energy to meet China's goals to achieve carbon peak and neutrality by 2030 and 2060, and a targeted total 1.2 billion kilowatts (kW) installed capacity from wind power and solar power by 2030. The company also identified strategic advantages along the solar value chain, such as readily available technology, skills, and comparatively low manufacturing and labour cost. By supplying solar cell, an essential component to generate solar power, it aims to play a role to stabilize the photoelectric conversion efficiency (PCE)^{2 3}, and the cost efficiency (cost of solar electricity per kilowatt hour).

In 2023, Hainan Drinda has established quantifiable targets⁴ related to GHG emissions, water consumption, and renewable energy in its consumption mix. Specifically, by 2030 it targets to reduce GHG (scope 1, 2, and 3) intensity per gigawatt (GW) of solar cell produced by 40%, and that of water by 30%. It also targets to use 40% renewables in its energy consumption mix. In addition to reporting the metrics of the afore-mentioned targets, it tracks and reports other environmental KPIs, including energy usage (electricity, natural gas, petroleum, diesel, and liquefied petroleum gas), wastewater (chemical oxygen demand, ammonia nitrogen, and fluoride levels), air pollutants (nitrogen oxides, sulphur oxides, volatile organic compounds, and particular matter), and industrial waste generation (hazardous, and non-hazardous). Hainan Drinda maintains some quantifiable social KPIs in relation to health and safety, and product quality assurance.

The company's policies related to environmental, social, or supply chain procurement are mostly communicated internally, or to specific stakeholders, such as suppliers.

Governance structure

Hainan Drinda had five board-level committees in strategy, budget management, nomination, audit, and remuneration. In 2023, it set up the sixth board-level committee with a focus in sustainability governance. The ESG committee is led by the company's chairman and joined by three independent board of directors. According

² According to Hainan Drinda, its P-type PERC and N-type TOPCon's cell efficiencies reached above 23.8% and 26% respectively in 2022.

³ PCE refers to the portion of energy in the form of sunlight that can be converted via photovoltaics into electricity by the solar cell. It is a crucial factor in determining the overall performance of solar cells. According to the National Renewable Energy Laboratory (NREL)'s Best Research-Cell Efficiencies (2023), the global average conversion efficiency for monocrystalline silicon cell reached 27.6%. <https://www.nrel.gov/pv/cell-efficiency.html>

⁴ According to Hainan Drinda, the targets are set against its baseline year performance in 2022, with reference to Paris Agreement's 1.5-degree objective and China's Action Plan for Carbon Dioxide Peak Before 2030.

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to the company, their responsibilities include reviewing ESG trends, assessing related risks and opportunities, as well as making recommendations to and overseeing the effectiveness of its risk management procedures.

The company has established a company-level ESG team, with a dedicated supervisor at each manufacturing base for the execution and reporting of sustainability initiatives. Hainan Drinda communicated that it has embedded some sustainability metrics with the senior management and executives' remuneration incentives, which look largely compliance-based (environmental pollution, and safety compliance). There is less transparency in the specific remuneration-related metrics corresponding to different employees' appraisals.

Supply chain

In the selection of suppliers, the company informs that it prioritises those with closer proximities to its facilities (Please refer to *Materials Sourcing* for more details). On an annual basis, Hainan Drinda screens and monitors all suppliers' performance on quality, delivery, cost, service, and technology during the contract period. Assessment methods include site visits, supplier self-assessments, and reviews of publicly available information, such as annual reports and ESG reports. The company requires their adherence to meet the requirements stipulated in the code of conduct that covers environmental compliance, business ethics, anti-corruption, bribery, and human rights. It has not identified any material labour rights risks in its supply chain in 2023.

The company has recently piloted supplier engagements with an aim to improve the understanding of its value chain's carbon impacts. It targets to have at least 50 suppliers to join this pilot initiatives by 2025, who will attend online webinars, and pledge to report and reduce carbon emissions.

Environmental risk management

Hainan Drinda's enterprise risk management system performs corporate risk identification and assessment across factors related to external markets and internal operations, which also considers environmental risks. It has internal emergency control functions who are responsible for overseeing the procedures in response to environmental hazards and incidents, which includes observing closely the updates from the Ministry of Ecology and Environment. The company has identified some physical and transition climate risks, and the potential impacts that are relevant to its business operations. Nevertheless, it is less explicit in the process of how these climate or other environmental risks were identified, the magnitude of impacts over different time horizons, as well as how these have been considered into its decision-making process.

Hainan Drinda has obtained ISO 14001 environmental management systems certifications for its P-type PERC Bifacial Monocrystalline cells and N-type TOPCon Monocrystalline cells. Accordingly, this requires the implementation of policies and procedures to manage environmental impacts from raw material use, waste management, energy and water consumption, and air pollution management.

Social risk awareness

According to the company's sustainability report, Hainan Drinda respects human rights, and strives to eliminate discrimination on the grounds of gender, age, race, religion, nationality, marital status, health, and other factors. It has strong policies prohibiting the use of child and forced labour and describes that it is working to improve gender pay equality internally, and respects women's rights, e.g. maternity leave.

The company has several policies and one about health and safety for their own workers. A collection of different departments in the company are working with and responsible for social issues, and the Chair of the board has the overarching responsibility.

It has a certified ISO 45001 occupational health and safety management system in place and tracks and monitors health and safety metrics, and maintains targets, namely zero major accidents and zero work-related deaths. It has

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implemented measures to ensure workplace safety, including trainings drills and capacity building for employees to identify and minimize hazards. It has an independent whistleblowing system, which facilitates anonymous reporting of misconduct suspicions.

Regarding the selection of suppliers, the company informs that it prioritizes those with closer proximities to its facilities. It has a supplier code of conduct and describes that it conducts audits to follow up the working conditions of suppliers' workers. It is however not clear how the company maps and prioritises among risks, to be able to concentrate its efforts on the suppliers representing the most salient risks.

The company describes that it works with CSR (corporate social responsibility) under its ESG umbrella, and that it conducts an ESG-based risk assessment of suppliers. It is uncertain what this mean; but it seems that the company assesses both potential suppliers and subcontractors to evaluate their social risk exposure. The company has also described that it discusses both wages, human rights, welfare etc. with them but states that it has not identified any material labour rights risks in it supply chain in 2023. The company makes a reference to the ILO conventions and the OECD Guidelines when describing its sourcing of materials, but it is uncertain whether these have been the basis for the methodology the company uses.

Hainan Drinda explains that it signs official business agreements with its suppliers and subcontractors and does not tolerate any violations of its human rights related policies.

Reporting

Hainan Drinda has shared an ESG report with us for the purpose of this company assessment, with an intention to publish for the first time in 2024. The report documents the company's materiality analysis and provides a range of qualitative and quantitative information regarding key environmental and social issues. The company indicates that the report was prepared with reference to disclosure guidelines including the Global Reporting Initiative (GRI) standards, and the Sustainability Accounting Standards Board (SASB) standards for Solar Technology and Project Developers.

The company's materiality analysis referenced the GRI standards and the United Nations' Sustainable Development Goals (SDGs) to identify a list of material issues. It consulted external stakeholders, including customers, suppliers and business partners, regulators, the community, non-governmental organizations, and media, as well as internal stakeholders, such as shareholders and investors, and employees. Topics flagged as most material to both internal and external stakeholders included corporate governance, information security and privacy protection, product quality assurance, employee rights, as well as R&D and innovation.

Hainan Drinda disclosed some physical climate and transition risks referencing the recommendations from the TCFD framework. Nevertheless, the reporting looks largely qualitative, and does not include assessments against different scenarios or quantification of business impacts. The sustainability report has not yet been audited or subject to other forms of external review.

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



Physical climate risks. Science shows that extreme weather events are becoming more frequent and intense, that incremental climatic changes are highly likely to happen, and that their impacts are expected to grow more severe over the coming years and decades. Hainan Drinda's operations and facilities could be impacted by coastal sea level rise, storms, flooding, heat, and other extreme weather conditions. It is therefore critical to assess physical climate risks when selecting operating sites. Furthermore, Hainan Drinda's supply chains may be directly impacted, increasing the risk of complexity and general disruption to the procurement and delivery of materials and inputs, and the technologies necessary to manufacture solar cells. Correspondingly, insurance premiums may increase as extreme weather events increase the likelihood of resulting loss and damages to key facilities.

Transition risks. Due to the profound changes needed to limit global warming to 2°C, transition risk affects all sectors. While stricter climate policies are expected to favour renewable energy, regulatory requirements regarding greenhouse gas emissions are expected to increase significantly in the future for the semiconductors sector, especially pollutions and emissions standards, which apply across the solar value chain. The solar industry may experience supply chain challenges as the market size and demand for critical minerals and rare earth metals are projected to grow almost sevenfold between 2020 and 2030⁵.

Environmental risks. The increasing need for scarce metals and minerals for the manufacture of solar cells will demand a simultaneous increase in mining. Operation of existing mines and opening of new mines may lead to local environmental concerns and potentially lead to roadblocks from regulatory issues or community protests. Ongoing natural capital loss and degradation may lead to disruption of supply chains and distribution networks, as well as damage to physical assets, e.g., from landslides, while reducing resilience to physical climate impacts.

Social risks. The semiconductor sectors' supply chains are highly labour-intensive. Issues related to labour rights, wages, working hours and poor working conditions at manufacturers and suppliers can affect many workers, sometimes severely. Extraction of raw materials needed to produce solar cells poses a significant social risk stemming from child labour, forced labour and exploitation of workers. Many companies have historically mitigated these risks by working closely with their suppliers to ensure that codes of conduct are applied throughout their extensive supply chains. Entities may have to invest more heavily in supply chain tracking and traceability systems, as well as more rigorous social risk monitoring and remediation, due to strengthened requirements in the market.

⁵ [International Energy Agency \(IEA\). Net Zero by 2050 - A Roadmap for the Global Energy Sector.](#)

Assessment of Hainan Drinda's activities

Key issues and metrics

GHG Emissions

Table 2: The table summarises GHG-emissions⁸ and main emission reduction targets.

	Total (tonnes CO ₂ eq ⁶)	Scope 1 emissions	Scope 2 emissions	Scope 3 emissions	GHG intensity per GW of solar cell produced ⁷
Main targets	-	-	-	-	Reduce 40% by 2030 (against 2022 baseline)
2022	2,633,963.7	12,155.1	300,748.1	2,321,060.5	243,434.7
2023	6,623,611.1	26,503.2	986,371.5	5,610,736.4	217,667.1
Change 2023- 2022	+151%	+118%	+228%	+142%	-10.6%
Main Sources	-	Natural gas, petroleum, diesel, and LPG	Electricity, cooling, and heating	Business travel, manufacturing and transportation of raw material, transportation of end-products, waste and wastewater, and other fuel and energy-related activities	-

Hainan Drinda has completed third-party carbon audits covering its scope 1, 2, and 3 emissions for 2022 and 2023, following the ISO 14064-1:2018 Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. The quantification methodology referenced the conversion factors from the IPCC 6th Assessment Report (scope 1), China's regional power grid emission factors (scope 2), the UK Government GHG Conversion Factors for Company Reporting (scope 3 upstream and downstream activities).

The company recorded a 2.5X increase in total GHG emissions in 2023, mainly due to the expanded scope of accounting (only two manufacturing bases included in 2022, versus all three) in 2023, and more comprehensive inclusion of scope 3 categories in 2023 (excluded emissions related to transportation of raw materials and end-products 2022). Scope 3 emissions contributed to 85% of the total emissions, which mainly stemmed from suppliers' manufacturing of raw materials (i.e. silicon and silver paste) and the embodied emissions from silane (an essential component to produce silicon layer in solar cell). Scope 2 (15% of total emissions) were associated

⁶ CO₂e, carbon dioxide equivalent is a measurement term for greenhouse gas accounting.

⁷ The company had a total solar cell production volume of 30.4 GW in 2023, a 181% increase to 2022's production volume of 10.8 GW.

⁸ According to Hainan Drinda, the quantification of GHG accounting referenced the IPCC's 6th Assessment Report. Its 2022 reporting included only the Shangrao and Chuzhou bases. In 2023, it expanded its accounting coverage to include all three manufacturing bases – in Shangrao, Chuzhou, and Huai'an.

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with the indirect emissions from purchased electricity, cooling, and heating; and the remaining scope 1 (<0.5%) came from direct emissions from the combustion of natural gas, diesel, petroleum, and liquefied petroleum gas.

Hainan Drinda targets to reduce 40% of its GHG intensity by 2030. The 30% renewable energy target and supporting energy efficiency initiatives (see below) are expected to help reinforce its decarbonisation goal. The result of some energy efficiency measures, together with a 2.8X increase in solar cell production volume, has led to a 11% reduction in GHG intensity in 2023 (comparing to 2022). The company’s absence of specific strategy or targets to decarbonise its most material upstream emissions (suppliers’ manufacturing of raw materials), as well as its short track record of GHG accounting are some areas to watch.

Table 3: The table summarises energy mix by energy source

Energy source	Percent of total	Comments
Electricity	98.8%	China’s electricity grid is primarily reliant on thermal coal. Hainan Drinda operates across the country, with some variances in the regional electricity mixes.
Natural gas	1.2%	Boilers and communal kitchens’ stoves.
Petroleum		Company-owned vehicles for business travels
Diesel		Company-owned trucks/ sweeper trucks; backup generators
LPG		Communal kitchens’ stoves.

Hainan Drinda’s main energy usage is associated with the electricity consumed at its three production sites, which amounted 1,729.5 GWh in 2023 (3.3X increase from 2022). It currently procures all electricity from the grid. Other energy uses (less than 1.5% of total energy consumption mix) included natural gas, petroleum, diesel, and LPG.

The company’s primary measures to energy consumption include the installation of energy efficient lighting systems, and regulating the cooling, steam, and heating regulating systems. According to Hainan Drinda, its energy efficiency initiatives have resulted in total energy savings of over 3,000 megawatt hours (MWh), equivalent to reducing 2,434 tCO2e per year. Hainan Drinda intends to have 40% renewable energy in its consumption mix by 2030. The company is planning to integrate solar power in its production bases to reduce fossil fuel energy use. It has recently completed the installations of PV solar farms in its Chuzhou and Shangrao bases. It has also communicated a plan to purchase renewable electricity after examining the demand and its goals.

Climate Resilience

Hainan Drinda has assessed and reported physical climate risks referencing the TCFD recommendations. It recognizes acute climate events, such as typhoons, rainstorms, and snowstorms as material to its operations and logistic chains. Similarly, gradual rise in sea levels and water stress issues may impose threats to its physical assets and disruptions to manufacturing process. It has also identified some measures in response to these risks, including the establishment of emergency management team and formulation of related plans. The company is yet to systematically assess the magnitude of climate risks under various scenarios and the financial implications, as well as to formalize a strategy to enhance climate resilience. It is also unclear to what extent physical climate risks have been considered as part of the company’s screening and strategic decision-making process.

Materials Sourcing

Hainan Drinda is working to minimize GHG emissions in the procurement of raw materials. For instance, it prioritizes local suppliers in the sourcing of raw materials, such as silicon wafer, silver paste, screens, and quartz pieces. Among 539 suppliers in 2023, nearly 99% were based in China, and 64% were based in the same provinces of production sites (Anhui, Jiangsu, and Jiangxi). The company communicated that it adheres to the Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises in the sourcing of

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raw materials e.g. silicon wafers, silver paste, screens, and quartz pieces. Hainan Drinda carries out supplier risk assessments and reviews and has a documented procedures in overseeing supply chain risks pertaining to governance and business conduct. It is less clear in the process how it identifies and manages material sourcing risks pertaining to climate and environmental impacts.

Circular economy

Hainan Drinda assessed and reported wastes generated from its production sites (including industrial and other general waste), which are classified into hazardous and non-hazardous wastes in accordance with its internal waste management guidelines. According to the company’s documentations, non-hazardous wastes (such as packaging wood pallets and barrels) are collected and categorised, which will either be recycled and reused internally, or sold externally. Its hazardous waste includes activated carbon, chemical product packaging, acid and alkali filters wastes, chemical-contaminated gloves, waste mineral oil and liquids. They will be stored in a dedicated warehouse, for the management and processing by third party contractors. In 2023, the company generated 61,704 tonnes of waste (around 99.9% were non-hazardous wastes), of which all packaging wood pallets and barrels were resold to third parties for repurposing.

Solar energy equipment could contain significant environmental impacts such as waste disposal issues when it reaches the end of its useful life. In addition, crystalline-silicon cells could contain heavy metals, such as lead, cadmium etc. Metals as pollutants can be released from solar panels which contaminate soil properties as leaching duration increase. Although the company has communicated that they have allocated resources in research and development of product design, it is less explicit in terms of the extent of circularity and how its end-use consumers could take into account the end-of-life process of their solar cells.

Water

Table 4: The table summarises water consumptions and reduction target.

	Total (tonnes)	Water intensity per GW of solar cell produced
Main targets	-	Reduce 30% by 2030 (against 2022 baseline)
2022	5,270,325.0	487,091.0
2023	12,498,500.0	410,730.5
Change 2023- 2022	+137%	-15.7%

Hainan Drinda’s use of water is mainly sourced from municipalities, and is primarily associated with manufacturing (e.g. texturing, alkali polishing, and cleaning), wastewater treatment, firefighting, and domestic usage. It recorded a total water consumption of 12,499 thousand tonnes in 2023 (5,270 thousand tonnes in 2022). According to the company, it was due to the sizable production volume expansion in its Chuzhou base.

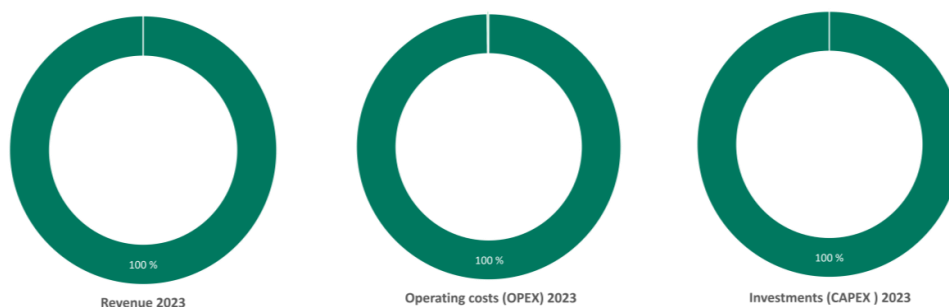
The company has recently assessed its exposure to water stress risks referencing the World Resources Institute’s mapping tool and identified the Shangrao production site as materially exposed to water stress risks. In response, it has equipped two emergency water supply reservoirs for each production site. In addition, the company adopts various measures to support its 30% water intensity reduction target by 2030, such as recording water usage (for pure water stations and cooling towers) once every six hours, establishing annual water budget after each year’s water usage evaluation, wastewater treatment, recycling, and reuse. According to Hainan Drinda’s documentation, its Chuzhou base has recycled around 120,719.7 tonnes (341,840 cubic metres) of water in 2023.

Table 5: Shades of Green assessment of Hainan Drinda's management of key environmental issues

Key issue	Shades of Green comments
GHG emissions	<ul style="list-style-type: none"> ✓ Hainan Drinda has tracked its scope 1-3 emissions for all its manufacturing sites in 2023 and established a 40% GHG intensity reduction target to be achieved by 2030. ✓ It has some renewable energy and energy efficiency initiatives, which address scope 1 and 2 emissions. To manage the most material scope 3 emissions, the company should engage with suppliers on their emissions and sustainable sourcing practices. Absolute emissions will increase as the company scales its activities, but every effort should be made to manage them.
Energy	<ul style="list-style-type: none"> ✓ Hainan Drinda's main energy usage came from electricity, which is used to power its manufacturing activities. Other fuels to power its vehicles, kitchen stoves, and backup generators include LPG, natural gas, diesel, and petroleum. ✓ We view positively that it has a 40% renewable energy usage target by 2030. The company will seek to achieve this through solar power, and renewable purchases. We encourage their targeted actions to achieve a fossil-free operation.
Climate resilience	<ul style="list-style-type: none"> ✓ Hainan Drinda has assessed and reported qualitatively its exposure to some physical climate risks to assets and its operations but has not fully assessed the magnitude of these risks across different scenarios and the quantitative impacts. ✓ We encourage the company to carry out a comprehensive climate risk assessment with scenario analysis, to identify and quantify the magnitude of these climate risks and the financial implications to its assets, operations, and supply chain over different time horizons.
Materials sourcing	<ul style="list-style-type: none"> ✓ Hainan Drinda mainly relies on local sourcing to minimise emissions in the transportation of raw materials. ✓ The company conducts annual supplier risk assessment to ensure suppliers' compliance to safety, governance, and business conduct requirements. Given its critical position in the value chain, we encourage the company to define and communicate a clearer process in the identification and management of material sourcing risks pertaining to climate and environmental impacts.
Circular economy	<ul style="list-style-type: none"> ✓ Hainan Drinda has maintained procedures to collect, classify, and document, and handle wastes generated from its operations. It mainly recycles non-hazardous waste (packaging wood pallets and barrels) by reselling to third parties. ✓ It is unclear in terms of the extent of circularity and how its end-use consumers could take into account the end-of-life recyclability of Hainan Drinda solar cells. We encourage the company to communicate these aspects more transparently moving forward.
Water	<ul style="list-style-type: none"> ✓ Hainan Drinda has documented its water usage for all three manufacturing sites and conducted water risk assessment referencing the World Resources Institute's mapping tool to identify high water stress region. ✓ We view positively that the company introduced a 30% water reduction target by 2030 and implemented relevant actions to support this target. Given the semiconductor industry is highly water-intensive, we encourage Hainan Drinda to continue explore water saving innovations and opportunities.

Shading of Hainan Drinda’s 2023 revenue, operating expenses and capital expenditures

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



Source: Shades of Green analysis using Hainan Drinda’s financial data from 2023.

The Shade of Green assigned to an activity reflects its overall climate risk and environmental impact. In assigning a shade of green to Hainan Drinda’s revenue streams and costs, we have considered Hainan Drinda’s Governance Score of Good, the company’s management of key environmental concerns, and how its activities are aligned to a low-carbon and climate-resilient (LCCR) future.

A Dark Green shading has been awarded to 100% of Hainan Drinda’s revenues. According to the company, over 95% of its revenues are derived from the sale of solar cells, with the remaining derived from made-to-order manufacturing services of customised solar cells. Hainan Drinda’s solar cells business facilitate the deployment and generation of solar power, which are a key contributor to the energy transition for a low carbon future.

The company’s OPEX costs mainly consists of admin costs such as cost of labour, marketing expenses, costs of materials and utilities. Utilities costs are mainly purchasing electricity for the manufacturing process, however also minor costs relating to purchasing of liquified petroleum gas and natural gas. Utility costs (0.2% of OPEX) are shaded Light Green to reflect that electricity grids in China are predominantly fossil-fuel-heavy, with relatively high emission factors. The remaining OPEX is shaded Dark Green. It should be noted that while material costs are shaded Dark Green, Hainan Drinda sources silicon wafer, silver paste, screens, and quartz pieces, which could be energy and emission-intensive to mine, process, and produce.

100% of CAPEX have been designated a Dark Green shading as they support a pure-play solar cell manufacturing company, aligning with activities needed in a LCCR future. Hainan Drinda has indicated that the vast majority of CAPEX was allocated towards acquiring electrical manufacturing equipment. While this equipment will initially operate on electricity sources from a grid with a high emission factor, we have allocated a Dark Green shade due to it supporting the production of solar cells and the minimal lock-in risks. As China’s electricity grid decarbonise, the equipment can use renewable energy sources when available. However, during the operational phase, electricity costs associated with powering the equipment will be shaded Light Green to reflect the current emission factor of the grid.

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

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is typically not an explicit link between sustainability and financial data⁹. 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.

⁹ 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.











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 alignment of the underlying activities to a low carbon and climate resilient future and taking into account governance issues.

Shading		Examples
	Dark green Is allocated to projects and solutions that corresponds to the long-term vision of a low-carbon and climate resilient future.	 Solar power plants
	Medium green Is allocated to projects and solutions that represent significant steps towards the long-term vision but are not quite there yet.	 Energy efficient buildings
	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.	 Hybrid road vehicles
	Yellow 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
	Red 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

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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.

Appendix 1: Referenced documents list

Document Number	Document Name	Description
1	2022 and 2023 Annual Report	Public financial disclosures
2	2023 ESG Report	Publication dated in 2024, including targets and KPIs.
3	2023 Prospectus	Non-public document
4	Carbon audit reports 2022 and 2023	Non-public documents, for its three manufacturing bases
5	Environment, Occupational Health and Safety Monitoring and Measurement Control Procedure	Non-public document, dated 2022.
6	Product Identification, Protection and Traceability Control Procedures	Non-public document, dated 2022
7	Procurement Management Program	Non-public document, dated 2022
8	Supplier Management Procedure	Non-public document, dated 2022

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

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