

LONGi

2023

Climate Action
White Paper of LONGi





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LONGi Green Energy Technology Co., Ltd. (“LONGi” hereinafter) was founded in 2000. The company upholds its commitment to becoming the most valuable solar technology company in the world and the mission of “To make the best of solar energy to build a green world”. LONGi first put forward the “Solar for Solar” concept at the 24th UN Climate Change Conference (COP24). During the 28th UN Climate Change Conference (COP28), LONGi released the 2023 Climate Action White Paper, which is the third Climate Action report published since 2021.



In July 2023, LONGi’s GHG emissions reduction targets were validated by the Science Based Target initiative (SBTi), and the Scope 1 and 2 target ambition is deemed as in line with a 1.5°C trajectory. As the first Chinese company in the solar photovoltaic industry with validated near-term science-based targets, LONGi is dedicated to building a net zero future while minimising the environmental impact. LONGi is also a member of RE100, EP100, and EV100 initiatives, and has disclosed climate data through CDP since 2020 and water data since 2022, with the aim to promote environmental data transparency.

Working with:



The Carbon Trust provided technical support for this report.

For more information, please contact: csr@longi.com, or call us at (+86) 4008 601012.

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CEO's Message



Li Zhenguo Founder & President, LONGi

Hello everyone!

I am very happy to present our 2023 Climate Action White Paper to you. This is our third climate white paper since 2021.

Looking back on the past period of time, we see that despite the challenges of slow global economic recovery and local conflicts, there is still a global consensus and action on responding to climate change and moving towards a net-zero future. As a global leader in solar technology, we always ask ourselves: what is LONGi's main contribution to global climate action and sustainable development?

Solar power is abundant and renewable, and silicon is its key material. According to calculations, it only takes about 0.4 kWh of direct energy consumption to make one watt of photovoltaic module from quartz ore (silicon material), but each watt of that module can generate about 45 kWh of electricity over its 30-year lifespan. Taking 0.4 kWh to generate 45 kWh, the energy benefit of photovoltaics ultimately produced is 100 times that of its production energy consumption.

From 2012 to 2022, LONGi has produced a total of 290 GW of photovoltaic silicon wafers, which can generate more than 1,140 TWh of clean electricity. This is equivalent to avoiding over 530 million tons of carbon dioxide emissions, or 1.46% of the global energy-related carbon emissions in 2022. We have turned the energy we use to make crystalline silicon photovoltaic products into super "100 times" green energy more and more efficiently. We are a true green energy "amplifier".

LONGi and other photovoltaic companies have improved the conversion efficiency of photovoltaic cells and reduced the cost of photovoltaic power generation through technology research and development and innovation iteration. After more than ten years of continuous efforts, solar energy has become the cheapest source of electricity in most countries in the world. At present, in many regions globally, the cost of solar power generation has dropped to \$1.5 cents per kWh. We have achieved what was once thought impossible through technological innovation.

In 2023, we have proposed that BC cell will soon be the mainstream technology in the crystalline silicon solar cell landscape, and we aim to make "luxury" solar cells products affordable household items in the future, through technological innovation. We want to make it easier and cheaper for people to achieve net zero. We work to make clean energy affordable for everyone in the world, especially for people in developing and underdeveloped countries and regions, contributing to global energy justice! This is how we contribute to global sustainable development.

At the same time, LONGi is also committed to reducing its own environmental impact. At the COP 24 in 2018, we proposed the "Solar for Solar" concept, which means using clean energy to make clean energy products. Now, LONGi is the only Chinese photovoltaic company that has joined RE100, EP100, EV100 and Science-based Targets Initiative (SBTi). And I am delighted to share with you that LONGi has officially passed the SBTi validation this year and became the first company in China's photovoltaic industry to pass the target validation.

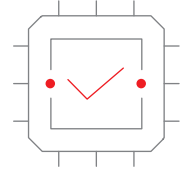
We also noticed that Chinese photovoltaic companies are responsible for most of the global photovoltaic product manufacturing and carbon emissions, to meet the energy transformation and emission reduction needs of countries around the world. And this trend will only accelerate as the global net-zero transition speeds up. Therefore, the solar PV sector's pathway to reducing emissions and achieving net zero should take into account the expected growth of PV products driven by the rapid expansion of renewable energy worldwide. We are honoured to have the opportunity to host Solar+ Pavilion at COP28 and look forward to discussing global fair and sustainable energy transition with stakeholders.

The journey may be extended, but we will eventually reach our destination -- this is what we said in our first white paper, and it still holds true today! We hope to publish a white paper every year to show our firm ambition, pragmatic action and progress in climate action to all stakeholders of society. We also hope to promote a benevolent and fair energy value concept, and advance the world's energy transition and climate action agenda.

2022 Climate Action Highlights

4,279^{GWh}

LONGi consumed 4,279 GWh of renewable electricity in 2022, an increase of 38% compared to 2021.



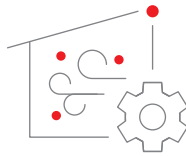
-38.8%

LONGi has achieved 38.8% reductions in operational emissions per unit of revenue compared to 2021.



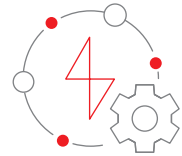
213^{thousand tons}

Over 213 thousand tons of GHG emissions avoided from energy-saving projects and measures in 2022.



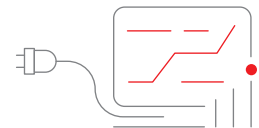
47.18%

Renewables account for 47.18% of all electricity consumed at LONGi in 2022.



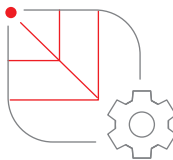
1,140^{TWh}

As of 2022, over 1,140 TWh of estimated renewable electricity generation from PV wafers delivered since LONGi's public listing in 2012.



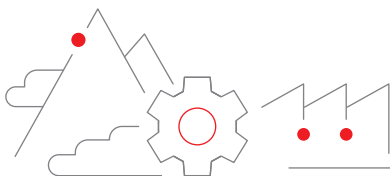
530^{million tons}

Since 2012, an estimated over 530 million tons of CO₂e have been avoided from PV wafers delivered.



No.1

In August 2023, LONGi became the first Chinese company in the solar PV industry to have our near-term target approved by the Science-based Target Initiative (SBTi).



1st time

LONGi adopted the recommendations of Task Force on Climate-related Financial Disclosure (TCFD) and in 2023, for the first time, conducted a comprehensive and systemic assessment and disclosure of climate-related risks and opportunities.

No.1

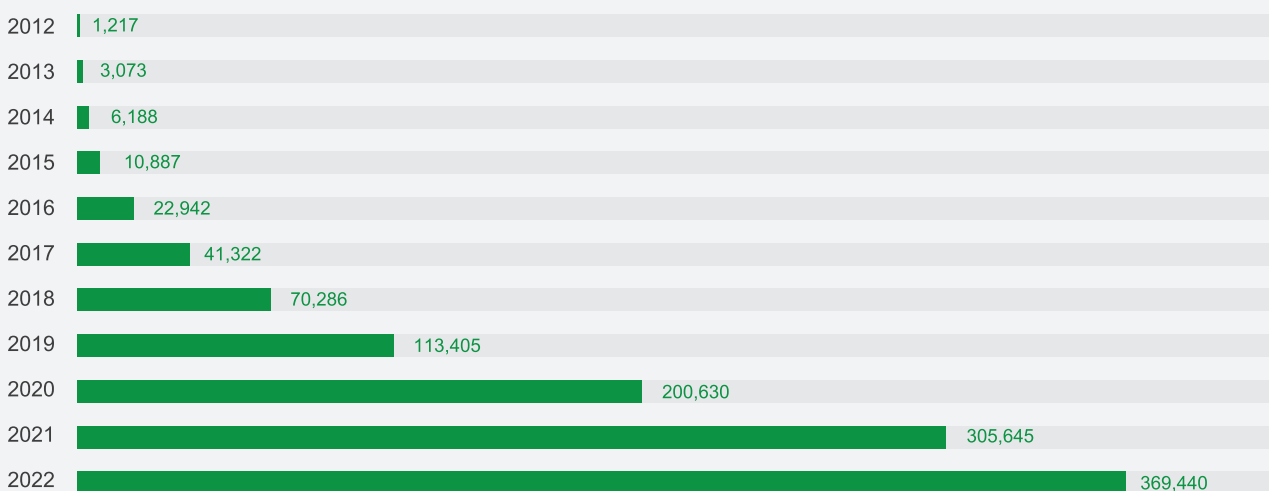
LONGi ranked No.1 in the PV industry, for the third year in a row, in the CATI (Corporate Climate Action Transparency Index) list published by Institute of Public and Environmental Affairs (IPE).



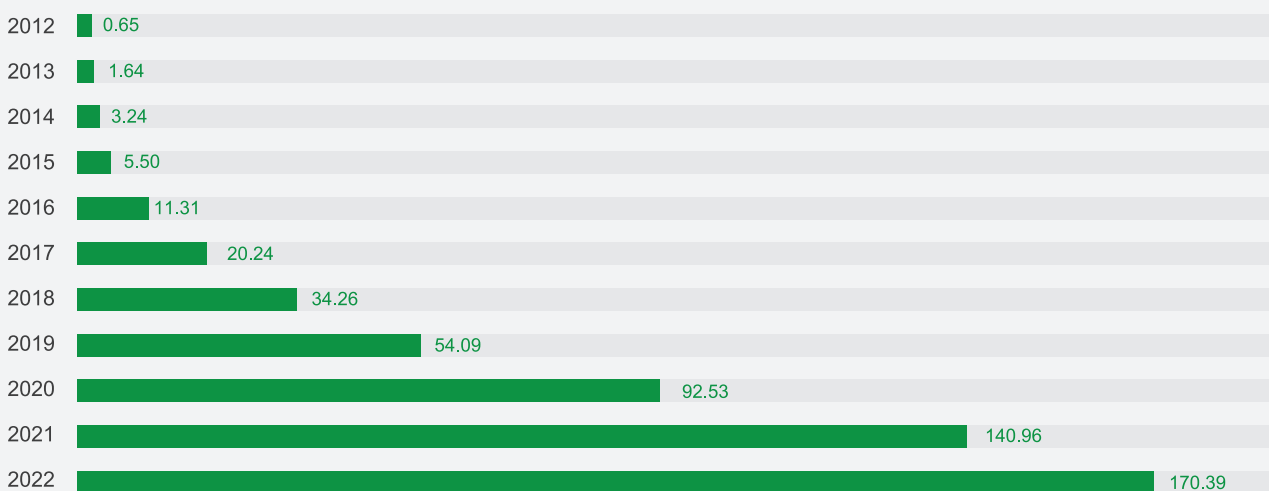
As a world leader in the clean energy transition, LONGi is dedicated to R&D and manufacturing of high-efficiency PV products and aims to generate an abundant supply of green energy for the world.

From LONGi's public listing in 2012 to 2022, the total capacity of PV wafers delivered by LONGi has reached nearly 290GW, which theoretically provides a total of over 1,140 TWh¹ of green electricity supply, translating to approximately 140 million tons of coal equivalent saved². The amount of green electricity supply can avoid emissions of more than 530 million tCO₂e³, equivalent to planting about 2.67 billion trees⁴.

Annual potential power output of PV wafers delivered by LONGi
(Unit: GWh)



Annual enabled emissions reduction from potential power output of PV wafers delivered by LONGi
(Unit: million tCO₂e)



1. The potential power output is based on the assumption of 1500 sun hours per year and 750 for the year 2022 due to an estimated half-year for PV wafer deployment.

2. The conversion factor for tons of coal equivalent used is 0.1229 kgce/kWh, according to GB/T 2589-2020: General rules for calculation of the comprehensive energy consumption.

3. The enabled emissions avoided is calculated using the grid factors published by IEA in 2022.

4. The conversion of trees planted is based on the assumption of 10 kg CO₂ absorbed and stored per tree per year for a period of 20 years, which is a common assumption used in forest carbon sink projects.

01

Task Force on Climate-related Financial Disclosures (TCFD)

In 2023, LONGi conducted a comprehensive and systematic identification and assessment of climate-related risks and opportunities for the first time, in order to better assess the impact of climate change and align to the recommendations of the Task Force on Climate-Related Financial Disclosure (TCFD). LONGi also applied scenario analysis to quantitatively evaluate selected risks and opportunities, with the goal of providing more guidance in developing climate strategies and taking further climate actions.

Governance

Strategy

Risk Management

Climate-related Metrics and Targets

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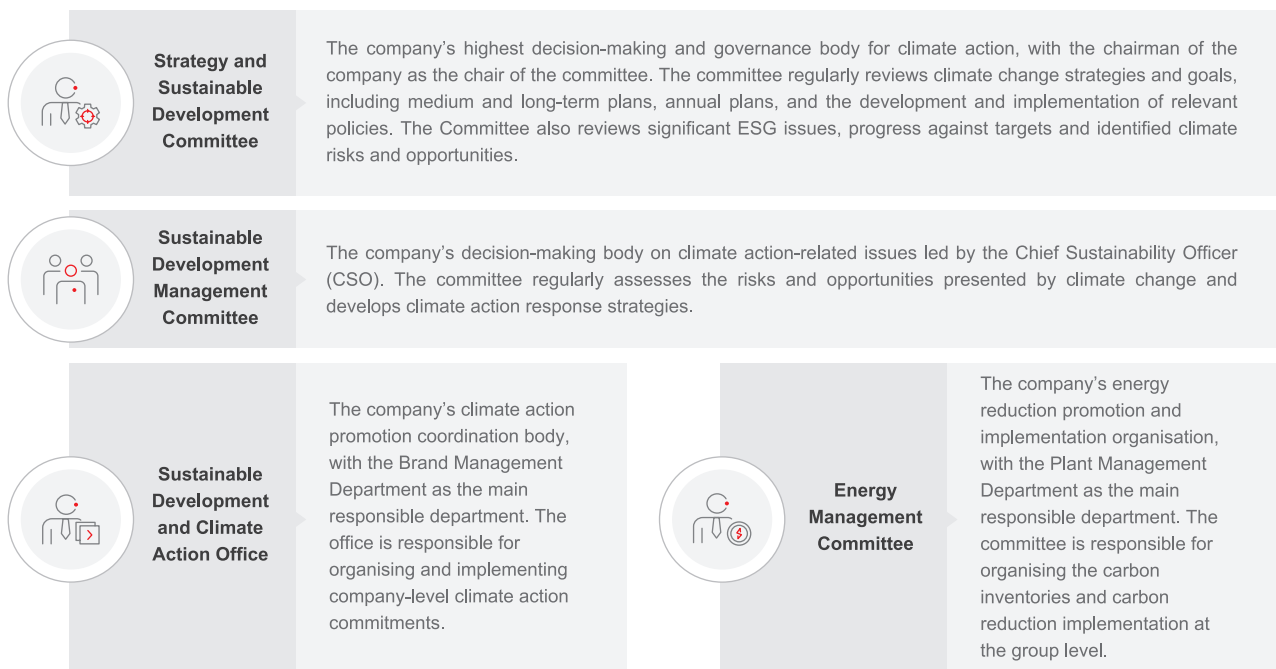
Governance

In order to effectively strengthen climate-related governance and drive implementation efforts, LONGi has established a climate change governance structure under oversight of the board. Board members, leveraging their extensive experience in the fields of photovoltaics and energy, have strong capability to identify and manage climate risks and seize climate opportunities under green transition.

LONGi has established a Strategy and Sustainable Development Committee under the board, comprising the board chairman, CEO, CFO, and two directors. The aim of the Strategy and Sustainable Development Committee is to enhance the board's oversight of climate change-related topics and the Committee holds meetings at least once a year.

At management level, LONGi has set up a Sustainable Development Management Committee, overseen by the Chief Sustainability Officer (CSO). As the decision-making body for climate actions, the committee receives and discusses annual assessment results of key climate topics from the head of brand management team, EHS manager, the energy manager and heads of main manufacturing sites, to develop and lead the climate actions for the following year. Topics encompass a wide range, such as environmental management, climate-related risks, energy usage, water consumption, and carbon footprint measurement, among others.

At executive level, the Sustainable Development and Climate Action Office collaborates with the Energy Management Committee to jointly oversee departments and subsidiaries of the company to implement climate actions and to achieve carbon reduction goals, and regularly report the progress to the board of directors.



LONGi's Climate-related Governance Structure

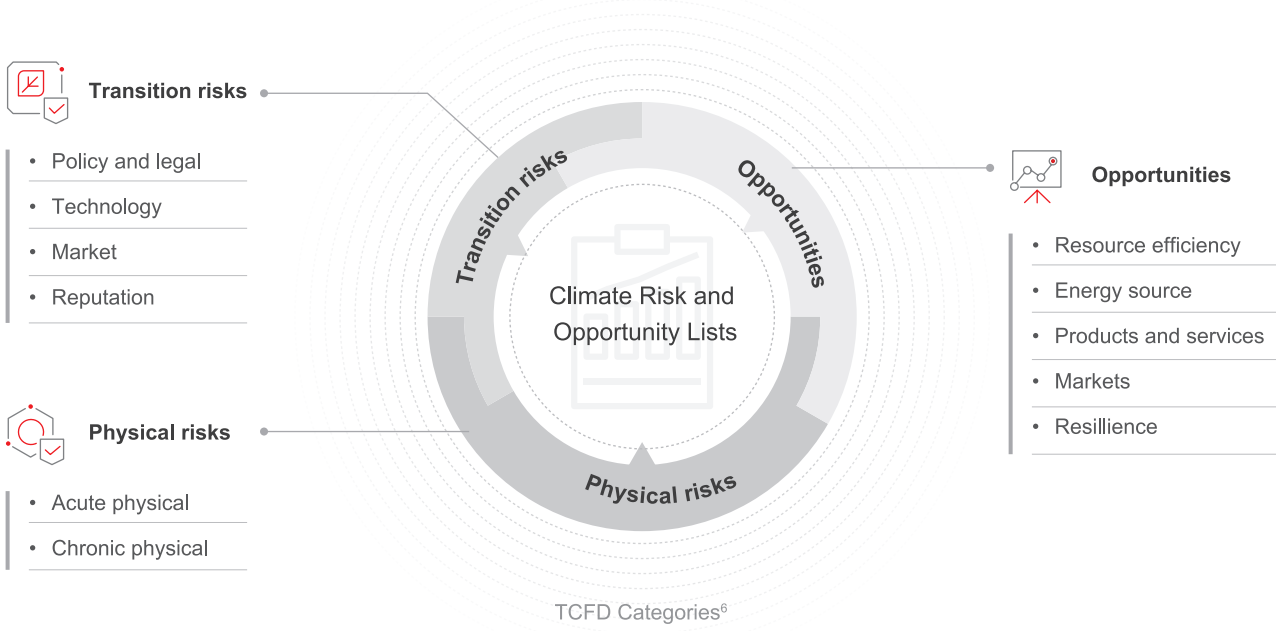
To achieve the ambitious climate commitments and ensure the effective implementation of climate actions, LONGi has issued two documents – ‘the Notice on Energy Management Work Plan of the Group’ and ‘Carbon Emission Management System Manual’. LONGi also encourages all business divisions to actively engage in energy efficiency improvement efforts to ensure the successful achievement of company’s electricity and water consumption targets – reducing electricity consumption per unit by 14.1%-20.4% and water consumption per unit by 18.6%-46.4% for each business unit by 2025. In addition, at group level, LONGi has established a special budget for energy management work and conducts an annual review of energy improvement projects submitted by various business units to select group-level energy improvement projects. In the future, LONGi will continue to explore and set up business-unit level incentive mechanisms to better deploy climate-related KPIs.

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With the frequent occurrence of extreme weather events around the world, various countries have committed Net Zero targets and the market demand for low-carbon transformation has boomed. LONGi is deeply aware of the challenges posed by climate risks to its own operations; at the same time, LONGi also realises that, as a clean energy solution provider, there are also great opportunities for LONGi in the global energy structure transformation. In order to deepen the understanding of climate risks and opportunities within the company and strengthen the overall awareness of climate risk and opportunity management, LONGi has initiated a comprehensive climate risk and opportunity identification and assessment in 2023, with technical support from the Carbon Trust.

Climate Risk and Opportunity Lists




Through value chain analysis, climate risk screening, and industry research, LONGi has identified and analysed climate-risk-sensitive sites and potential opportunities within its value chain. Based on the 11 climate-related risk and opportunity categories suggested by the TCFD framework, LONGi has compiled a long list of climate risks and opportunities. In 2023, a total of 16 transition risks, 65 physical risks⁵, and 15 climate opportunities were identified.








5. Due to the splitting of similar risks across different operating locations, there are a relatively large number of entries related to physical risks.

6. Recommendations of the Task Force on Climate-related Financial Disclosures, TCFD, 2017

We have selected nine typical risks and opportunities for scenario analysis, assessed the potential financial impacts of each risk and opportunity, and proposed mitigation measures to continuously enhance LONGi's resilience in the face of climate risks. In the future, LONGi will continue to monitor other potential factors affecting climate risks and opportunities and adjust strategies as needed to actively mitigate risks and embrace opportunities.

Risk/opportunity type	Root cause	Risk/opportunity Description	Value chain impact	Time horizon	Value driver	Financial impact	Mitigation actions
Physical risk							
 Acute	Floods	Increasingly frequent flooding may damage buildings, factories, facilities and equipment at major production sites, including Yunnan, Zhejiang, Jiangsu provinces in China and Bắc Giang in Vietnam, resulting in asset losses.	Operation	Medium term	Asset	High	<ul style="list-style-type: none"> Investing in flood control equipment and preparing a comprehensive flood control emergency plan; Strengthening inspections of buildings, production equipment, and circuit cables
	Precipitation pattern change	Increasing rainstorm frequency may lead to downtime and loss of production capacity, resulting in lower revenues.	Operation	Short term	Revenue	Medium	<ul style="list-style-type: none"> Improving operational resilience to minimise the impact of extreme weather on production and logistics, such as improving flexibility of overseas warehouses; Establishing an emergency management team and preparing climate change contingency plans.
 Chronic	Water scarcity	Water resource constraints at major production sites (including Shaanxi, Ningxia, Jiangsu and Zhejiang) may lead to an increase in municipal water supply prices, increasing the cost of water.	Operation	Short term	Cost	Low	<ul style="list-style-type: none"> Implementing water conservation initiatives, conducting water saving renovation projects continuously exploring alternative water sources; Improving the utilisation rate of reclaimed water.
	Transition risk						
 Policy and legal	Carbon market and carbon pricing	The power generation sector is included in China's carbon market will increase electricity prices.	Upstream	Short term	Cost	Medium	<ul style="list-style-type: none"> Strengthening energy management, improving energy efficiency and reducing unit of electricity consumption; Using more green electricity to achieve 100% renewable electricity by 2028.

Risk/opportunity type	Root cause	Risk/opportunity Description	Value chain impact	Time horizon	Value driver	Financial impact	Mitigation actions
 Market	Raw material prices change	Higher fuel prices have led to an increase in transport costs (sea and road), thus raising global distribution costs.	Downstream	Long term	Cost	Medium	<ul style="list-style-type: none"> Increasing cargo fill rate; Adjusting transport mode such as choosing vessels using cleaner fuels.
 Reputation	Stakeholder expectation	Increasingly stringent disclosure requirements for environmental performance have increased the associated compliance costs that LONGi uses to maintain or enhance its reputation.	Operation	Short term	Cost	Low	<ul style="list-style-type: none"> Monitoring regulatory and disclosure requirements in various markets and carrying out compliance work; Conducting product carbon footprint measurement and certification.
Opportunity							
 Products and services	Iterative innovation in photovoltaic products	LONGi's leadership in BC (Back Contact) cell technology and BIPV (Building Integrated Photovoltaic) products increase business opportunities	Downstream	Short term	Revenue	High	<ul style="list-style-type: none"> Leading the way in battery conversion efficiency records to achieve technological breakthroughs in BC mass production; Optimising BIPV solutions and household PV building solutions; Enhancing digital intelligence capabilities.
 Markets	Enhancing new business models	"Green Power + Green Hydrogen" solution brings new business growth opportunities for LONGi	Downstream	Short term	Revenue	High	<ul style="list-style-type: none"> Continuously expanding application scenarios of products and exploring multi-industry solutions; Increasing R&D investment on hydrogen.
 Markets	Electrification	Electrification transition across industries and rising demand for green power consumption increase the demand for renewable energy equipment and solutions	Downstream	Short term	Revenue	High	<ul style="list-style-type: none"> Continuous monitoring market demand and adjusting production capacity accordingly; Increasing investment in R&D in renewable energy solutions.

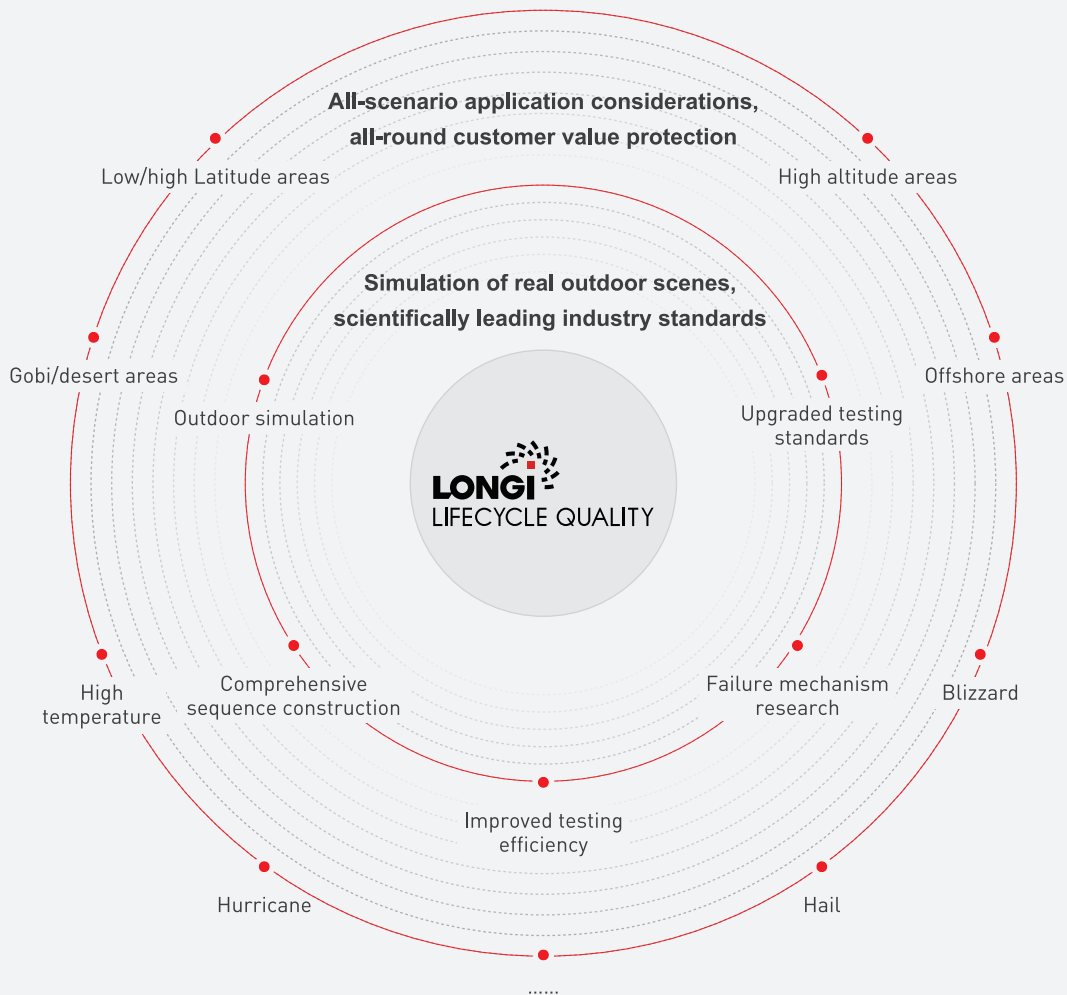


Case study

Seizing climate opportunity, LONGi is establishing a "comprehensive reliability system" to offer customers more climate-resilient products.

The increasing frequency of extreme weather events have led downstream customers to demand higher capabilities of LONGi's products to cope with extreme situations. LONGi seizes climate opportunities and constructs a "comprehensive reliability system" to continuously enhance the reliability testing of its products. This extends from rigorous individual tests to comprehensive aging tests, with a commitment to improving product climate adaptability and safety, providing customers with all-encompassing protection. For instance, in 2022, with the frequent occurrence of extreme high temperatures globally, the component temperature in photovoltaic power plants can exceed 85°C. To ensure the effectiveness of component operation during extreme high-temperature weather, LONGi took the lead in upgrading the component's thermal environment tolerance testing, successfully passing third-party tests like IEC TS63126 and IEC 62892.

Through in-depth research of diverse geographical environments and extreme climate scenarios, scientifically accurate simulations of real-world situations, and the implementation of corresponding sequences of rigorous testing and component product solutions for different environments, LONGi offers comprehensive protection for power plants to its global customers. This helps customers withstand various climate risks in complex environments.



Key Climate Risk Analysis and Action Cases

Transition risk: carbon market and carbon pricing

Risk description: China's national emissions trading scheme (ETS) has now included the power generation sector, which may increase the risk of higher procurement costs of electricity for LONGi due to suppliers' increased compliance costs. The global carbon price is expected to rise steadily and rapidly in the transition scenario. There is a risk that LONGi's upstream suppliers will be included in the carbon market and the additional costs they incur may be passed on downstream.

Climate scenario and financial impact

In order to assess the risks associated with carbon pricing, we have selected projections of China's carbon price (USD/tCO₂) under the Stated Policies Scenario (STEP) and the Net Zero Emissions Scenario (NZE) in 2050, with scenario parameters taken from the Network for Greening the Financial System (NGFS). The financial impact calculations assume that Scope 2 emissions from LONGi's production site (purchased electricity) will be affected by an increasing carbon price.

Responding action

To respond to the risk, LONGi will strengthen energy management, and comprehensively improve energy efficiency. In 2022, LONGi invested RMB123 million to implement energy-saving renovation, with a total of 415 energy improvement projects, of which 288 projects are for electricity saving; the annual electricity saving group-wide amounts to 607 million kWh.



Physical risk: water scarcity

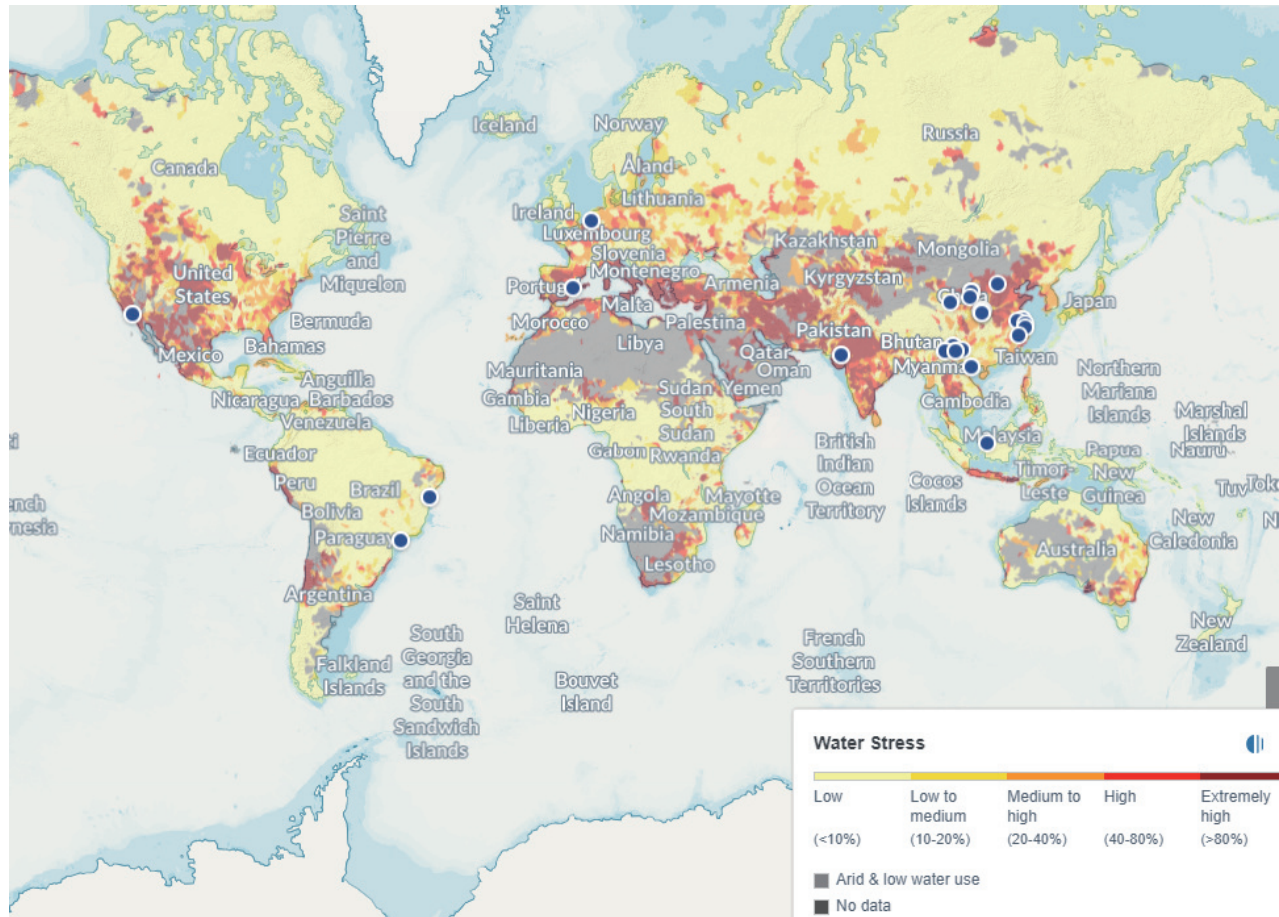
Risk description: Water scarcity is a chronic physical risk and mainly affects LONGI's manufacturing operations. Under the RCP8.5 scenario, persistent water scarcity could lead to an increase in the price of municipal water supply, which would increase LONGI's water costs. The financial impact is initially assessed to be small as water costs represent a relatively small proportion of LONGI's total production and operational costs. Based on the screening results of the coordinates of LONGI's operating locations, the regions affected by water shortage mainly include Ningxia, Jiangsu and Zhejiang.

Climate scenario and financial impact

To assess the likelihood and velocity of water scarcity risk, we selected two scenarios, SSP2-RCP4.5 and SSP3-RCP8.5, from the WRI Aqueduct Water Risk Atlas 3.0 database, with the specific parameter indicator of water stress, and assumed that changes in water prices are proportional to the degree of water stress.

Responding action

LONGI continuously takes actions to save water. In 2022, LONGI invested RMB 10,063,300 to implement water-saving renovation, deepen alternative water source projects, and continuously improve the utilisation rate of reclaimed water (such as rainwater, sewage, and gray water). We have launched actions to reduce water consumption in the core production processes, and customised water conservation projects featuring the characteristics of each production unit (i.e., ingots, wafers, cells, and modules).



Example of water stress risk screening for LONGI's operation sites⁷

7. WRI Water Risk Atlas

Climate Action Tactics

In the era of low-carbon transition, LONGi faces climate opportunities that are far greater than challenges. To become a better practitioner and promoter of the "green energy world", LONGi will continue to take proactive actions to optimise its own operations as well as support the market, and strive to be a leader in the era of clean energy.



LONGi's Climate Action Tactics

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Risk Management

LONGi has integrated climate risks into the company's overall risk management system and established a comprehensive mechanism for climate risk identification, assessment, and response.

Climate risk identification mechanism: In 2023, LONGi initiated a climate risk and opportunity project to identify and evaluate climate risks and vulnerabilities along the value chain and potential opportunities. Regarding physical risks (both acute and chronic), LONGi assessed the exposure and vulnerability of key geographical locations in the value chain, including manufacturing bases, locations of upstream suppliers, and sales market ports. For transition risks and opportunities, a range of key driving factors have been included in the analysis, such as carbon emission hotspots, national "carbon peak and carbon neutrality" policies, industry policies, clean energy technology development, value chain resource utilisation, systemic risks, and stakeholder expectations. In the future, this identification process will be integrated into LONGi's routine risk identification mechanism.

Climate risk assessment and prioritisation mechanism: In this project, LONGi assessed the likelihood, velocity, and financial impact of key risks and opportunities to prioritise the risks identified. By considering parameters and financial data under different climate scenarios, LONGi quantified climate risks, enabling the prioritisation of climate risks with higher financial impacts. In the quantification process, climate risks and opportunities have been evaluated across four time spans: current (0-3 years), short-term (3-5 years), medium-term (5-10 years), and long-term (greater than 10 years). For key climate risks and opportunities, scenario analysis has been conducted, with scenario parameters primarily drawn from mainstream international climate model databases such as IPCC, WRI, NGFS, IEA, and others. When analysing transition risks and opportunities, LONGi used current policy scenarios as the baseline and selected an accelerated transition scenario to evaluate the potential impacts of stricter policies, technological changes, shifts in market and consumer preferences, and other factors in a low-carbon transition policy and economic environment. When analysing physical risks, LONGi used two scenarios, RCP4.5 and RCP8.5, to simulate the potential impacts of rising levels of acute and chronic physical risks in a scenario of increased high-temperature conditions.

	Accelerated transition scenarios (<2 °C/1.5°C)	Current policy scenarios (baseline)	High temperature rise scenario (> 4°C)
<p>Transition risk and opportunity</p>	<ul style="list-style-type: none"> Net Zero 2050 (NGFS) Net zero emissions scenario (IEA) 1.5°C scenario (IRENA) 	<ul style="list-style-type: none"> Current policies scenario (NGFS) Stated policies scenario (IEA-WEO) Planned energy scenario (IRENA) 	
<p>Physical risk</p>		<ul style="list-style-type: none"> Intermediate stability scenarios, RCP 4.5 (CIE&IPCC) Baseline (optimistic) scenario, SSP2, RCP4.5 (WRI) 	<ul style="list-style-type: none"> High emission scenario, RCP 8.5 (CIE) Business-as-usual scenario RCP 8.5 (IPCC) Pessimistic scenario, SSP3, RCP 8.5 (WRI)

Climate risk response mechanism: After the Board of Directors' review and approve the climate risk list, the Sustainable Development and Climate Action Office organise various departments to respond to climate risks, including the establishment of complete environmental and climate risk prevention and control measures, emergency management systems, etc. An example of this is the Xianyang module manufacturing base, who have prepared an emergency response plan for environmental emergencies.

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Climate-related Metrics and Targets

In order to mitigate and adapt to the impacts of climate change, LONGi has set a series of climate-related targets and corresponding metrics to track and manage the effectiveness of climate actions.

Based on the standards of the Science-based Target Initiative (SBTi), LONGi has set near-term science-based targets that are in line with our own business and was validated by SBTi, becoming the first PV company in China to pass the SBTi validation. In addition, LONGi has also set targets for electricity consumption and water consumption to continuously promote energy conservation across the Group.

Climate-related targets	Description	2022 Progress
SBTi target	1) A 60% reduction in operational GHG emissions by 2030 from a 2020 base year; 2) A 52% reduction per ton of purchased materials by 2030 compared to a 2020 base year.	1) In 2022, operational GHG emissions across the Group increased by 20% compared to 2020; 2) Emissions per ton of the largest contributing material – silicon decreased by 9% from a 2020 level.
RE100	Achieve 70% renewable electricity consumption by 2027, and 100% by 2028.	In 2022, renewable electricity usage accounted for 47.18% ⁸ of LONGi's total power usage, achieving a 38.21% increase compared to that of 2021.
EP100	Implement an energy management system (EMS) across all operations by 2025, and improve energy productivity by 35% by 2025, relative to a 2015 baseline.	As of September 2023, a total of 25 manufacturing bases have been certified to ISO 50001 energy management certification, of which 8 have completed the construction of energy management systems (EMS); the overall energy productivity ⁹ group-wide in 2022 was 76.77% higher than that in 2015.
EV100	Install vehicle charging facilities in 100% operational sites by 2030.	The Group organised a group-wide centralised procurement of charging piles, involving 7 provinces, 13 cities, and 23 business sites, and added a total of 214 new charging pile installations during 2023
Electricity consumption intensity target	By 2025, the electricity consumption per unit of product of each manufacturing process will be reduced compared to the base year (2020): • Ingot: 14.1% • Wafer: 14.1% • Cell: 20.4% • Module: 17.2%	Decrease in electricity consumption per unit of product in 2022 compared to 2020: • Ingot: 9.7 % • Wafer: 4.2% • Cell: 10.1% • Module: 25.4%
Water consumption intensity target	By 2025, water consumption per unit of product in each manufacturing process will be reduced compared to the base year (2020): • Ingot: 18.6% • Wafer: 24.3% • Cell: 46.4%	Decrease in water consumption per unit of product in 2022 compared to 2020: • Ingot: 25.3% • Wafer: 22.3% • Cell: 51.5%

8. The total renewable electricity number here also incorporates hydropower, and what qualifies as sustainable hydropower under the updated technical criteria is in discussion between LONGi and RE100.

9. Energy productivity in LONGi's EP100 target is the ratio of revenue to energy consumption.

Climate-related metrics ¹⁰	Unit	2022	2021	2020
Scope 1 emissions	tCO ₂ e	158,202	94,750	92,665
Scope 2 (market-based) emissions	tCO ₂ e	2,930,501	3,057,224	2,480,349
Scope 3 emissions	tCO ₂ e	29,747,826	22,683,132	20,920,503
Total GHG emissions (Scope 1, 2, 3)	tCO ₂ e	32,836,529	25,835,106	23,493,517
R&D investment	¥ million	7,141	4,394	2,592
Use of renewable energy	%	47.18	40.19	41.83
Annual electricity savings	million kWh	607	259	27
Total water consumption	tonnes	36,435,426	35,087,619	32,750,659
Water reuse rate	%	63.67	58.75	33.89
Water conserved	10,000 tonnes	959.3	589.7	72.9

10. Scope 1&2 footprinting refer to 'General guideline of the greenhouse gas emissions accounting and reporting for other industrial enterprises' from National Development and Reform Commission (NDRC), and ISO14064-1 'Greenhouse gases — Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals'; Scope 3 footprinting refer to 'GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard' and 'Guidelines for corporate Greenhouse gases verification' from Ministry of Ecology and Environment (MEE). Emission factors used in GHG emissions accounting are mainly default values of common fossil fuels provided in Appendix II of the 'Guidelines on Methodology and Reporting of Greenhouse Gas Emissions Accounting for China's Oil and Gas Producing Enterprises (Trial)' issued by the National Development and Reform Commission (NDRC).

02

Accelerating Operational Emissions Reduction

2022 Scope 1 and 2 Emissions

2022 Progress on reducing operational emissions

Progress on achieving Scope 1 and 2 SBT



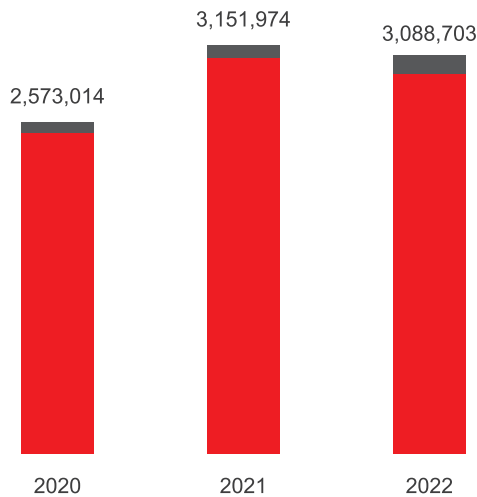
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2022 Scope 1 and 2 Emissions

Overview

LONGi has established an internal greenhouse gas emission accounting system covering the entire value chain (Scope 1, 2, 3) of the company. For operational emission accounting (Scope 1 and 2), we divided the company into several emissions accounting units, developed the internal accounting guidelines and organised capacity building sessions. LONGi has now completed the accounting of its operational emissions for three consecutive years, and the results have been verified by an independent third-party. On the basis of the carbon accounting, LONGi also established a group-level carbon emission management system, and developed the *LONGi Carbon Emission Management System Handbook*.

Operational (Scope 1 and 2) Emissions, 2020-2022
(Unit: tCO₂e)



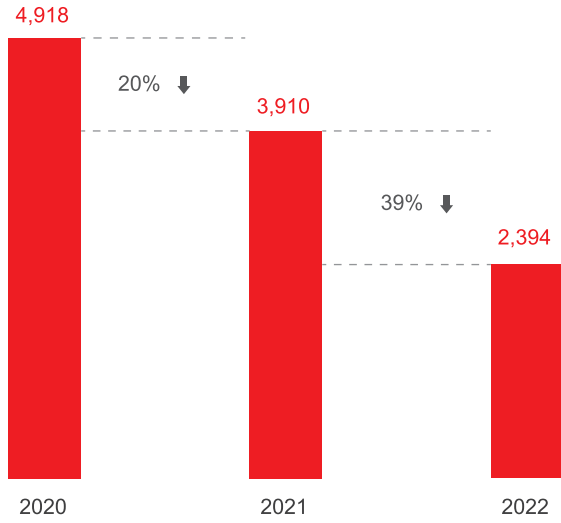
3,088,703 tCO₂e

2.0% ↓

LONGi's operational emission in 2022 is 3,088,703 tCO₂e, representing a decrease of 2.0% compared to 2021.

<p>■ Scope 1</p>	<p>158,202 tCO₂e, contributing to approximately 5.1% of total operational emissions, and representing an increase of 67.0% from 2021; ↑</p>
<p>■ Scope 2 (market-based)</p>	<p>2,930,501 tCO₂e, contributing to approximately 94.9% of total operational emissions, and representing a decrease of 4.1% from 2021. ↓</p>

Scope 1 and 2 emissions intensity (per unit of revenue), 2020-2022
(Unit: tCO₂e/100 million RMB)



38.8% ↓

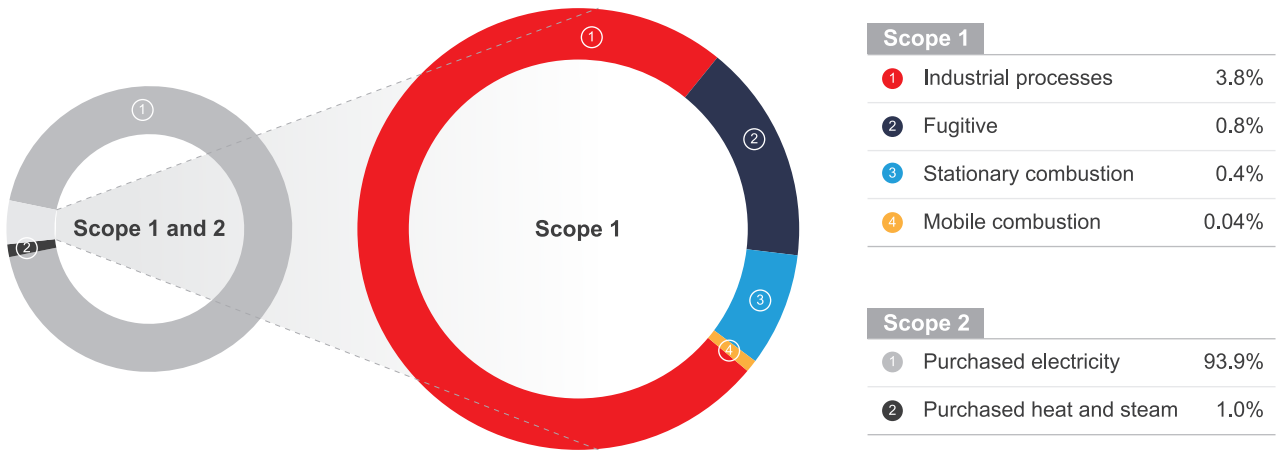
LONGi's emissions intensity has seen a continuous and significant decrease over the past three years since 2020. Compared to 2021, the operational emissions per unit of revenue in 2022 dropped by 38.8%.

**Note: The emission intensity of 2021 has been updated due to the adjustment of LONGi's revenue in 2021*

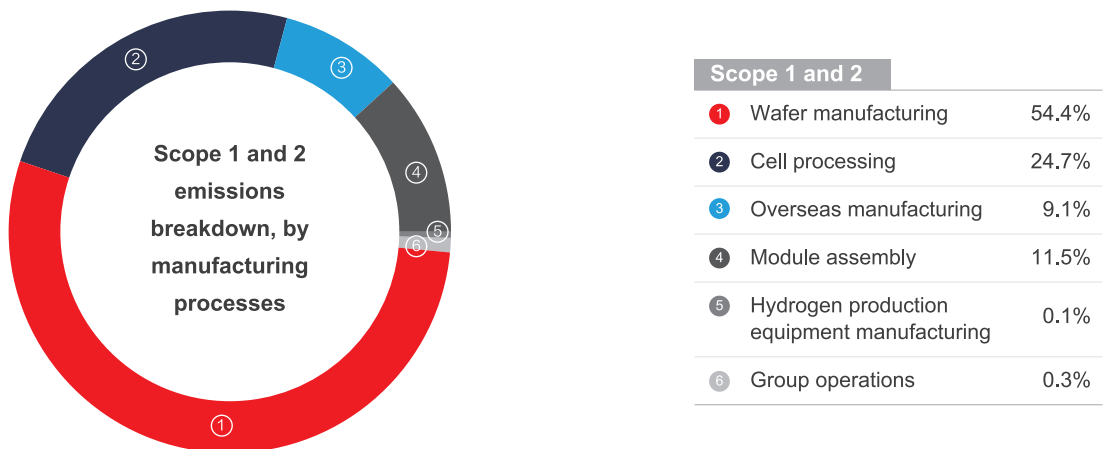


Breakdown

Totalling more than 2.9 million tCO₂e in 2022, LONGi's Scope 2 emissions is the dominant contributor to operational emissions, making up 95% of the total Scope 1 and 2 footprint. In terms of emission sources, purchased electricity accounts for more than 93% of total operational emissions, followed by industrial processes, which accounts for about 3.8%.



Manufacturing contributes more than 99% of the total operational emissions, while group operations contribute to only 0.3%. Over half of operational emissions come from wafer manufacturing, followed by cell processing which accounts for approximately a quarter.



LONGi identified the highest ten manufacturing bases of 2021 and carried out emission reduction actions in 2022 accordingly. By the end of 2022, these ten sites collectively saved 170,557,100 kWh of electricity from 127 emission reduction projects, equivalent to avoiding emissions of 111,693.87 tCO₂e. Compared with 2021, the emissions in 2022 from these ten sites are 199,001.1 tCO₂e, representing a 6% decrease in percentage of total Scope 1 and 2 emissions.

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2022 Progress on Reducing Operational Emissions

Renewable Electricity Consumption

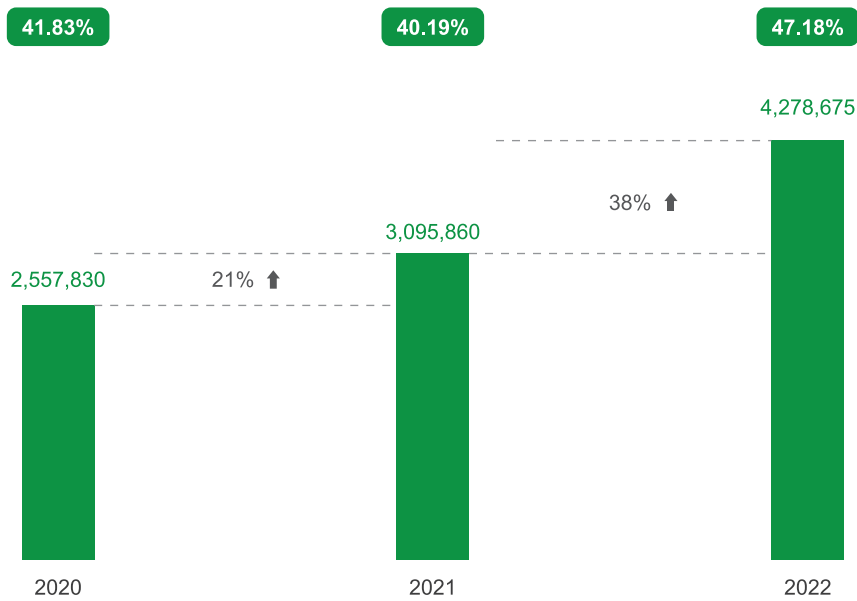
LONGi joined RE100 initiative and committed to 100% renewable electricity use by 2028. In 2022, LONGi consumed a total of 9,068,090.8 MWh of electricity, of which 4,278,675.4 MWh (47.18%)¹¹ is renewable electricity, equivalent to 2,429,288 tCO₂e avoided.

Sources of renewable electricity consumed in 2022



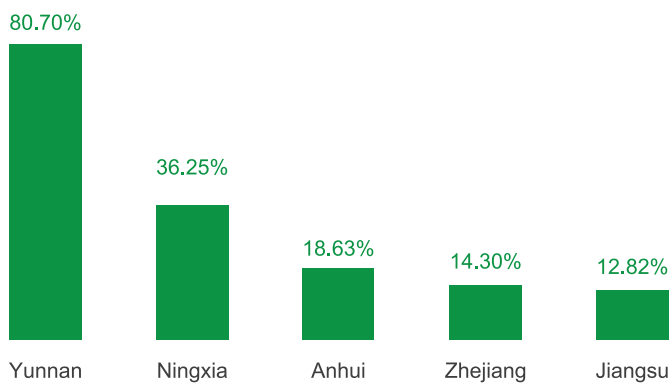
11. The total renewable electricity number here also incorporates hydropower.

Renewable electricity consumption and proportion, 2020-2022
(Unit: MWh)



In 2022, out of the total renewable electricity consumed, 4,187,302.9 MWh was procured through power trading, accounting for approximately 97.86%. The remaining 91,372.5 MWh is generated from on-site distributed renewable facilities, accounting for approximately 2.14%. Compared to 2021, LONGI's renewable energy consumption in 2022 increased by more than 38%, at 1,182,815 MWh.

Top 5 areas with highest proportion of renewable electricity in 2022



80.7%

Yunnan has the highest renewable electricity consumption percentage among all global sites of LONGI, reaching the level of 80.7% in 2022.

Energy Saving and Efficiency

LONGi joined EP100 initiative in 2020 and committed to installing Energy Management System across all operations and improving energy productivity by 35% by 2025 from the 2015 level. In 2022, LONGi has seen an increase of 57.05% in the group-level energy efficiency compared to the 2015 level, through energy management and a series of energy-saving initiatives.

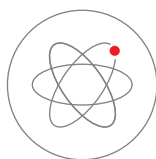
Energy Management

LONGi has developed a group-level implementation plan under the Energy Management System, and carried out a series of actions in 2022, including developing the energy management system and policy, implementing and evaluating annual energy saving activities, and developing the information system. We also established an incentive mechanism, carried out capacity building and knowledge exchange, and launched key energy saving and emissions reducing projects.



Develop energy management system and policy

- At the end of 2022, 17 manufacturing bases had their energy management system verified, with 10 new sites completing the development of energy management system;
- LONGi have introduced policy documents such as *Guideline on evaluating and rewarding energy improvement projects*, *Guideline on using and evaluating Energy Management System*, and *Guideline on tracing and accounting for renewable electricity*.



Implement and evaluate annual energy saving activities

- Required each unit of manufacturing process and subsidiary to develop and implement plans for energy saving projects, to ensure the annual reduction target to be achieved;
- Rewarded extraordinary energy saving projects financially and assessed performance of less advances subsidiaries and units.



Launch key energy saving projects

- Introduced advanced energy-saving technologies, such as optimisation of air conditioners and process chillers, gas saving of wafer equipment, and retrofitting of air pressure systems;
- Implemented 288 energy efficiency improvement projects, totaling 337 million kWh of electricity saved.



Capacity building and knowledge exchange

- Organised exchange of energy conservation experience and practice within the group with outstanding project promotion in 23 manufacturing bases during the National Energy Conservation Awareness Week and Low Carbon Day;
- Organised trainings for ISO 14060 GHG accounting, reporting, and verification with over 130 employees participating.



Establish the information system

- 8 manufacturing bases installed the energy management information system, with 1 new base in 2022;
- Established the group-wide online reporting system for energy and emissions data.

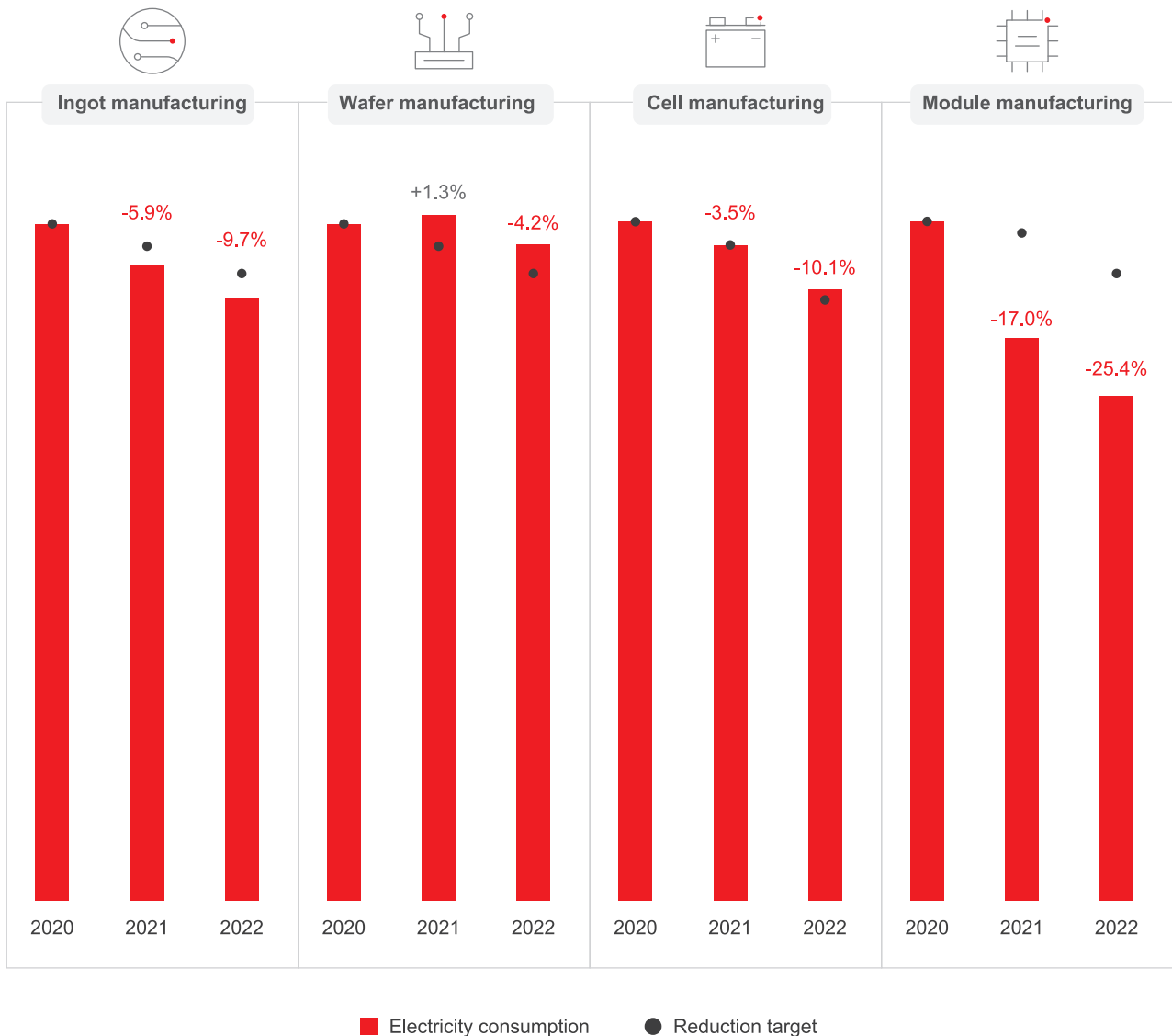
Actions in 2022 under LONGi Energy Management System

Energy Efficiency Improvement

LONGI has boosted investment in environmental conservation, implemented various energy efficiency and technical upgrading projects, in an effort to reduce the intensity of energy and water consumption. In 2022, 415 projects were planned and implemented, aiming to reduce water, electricity, and other types of resources in all manufacturing bases. 288 of the projects were electricity saving projects which in total saved 337 million kWh of electricity, equivalent to approximately 213,248 tCO₂e avoided.

In 2022, the overall electricity consumption per unit of production decreased by 6.73% on the level of 2021. The electricity consumption per unit of production continued to decrease, with the decline in ingot and module manufacturing exceeding the target each year.

Change of electricity consumption per unit of production in 2020-2022, by manufacturing process¹²



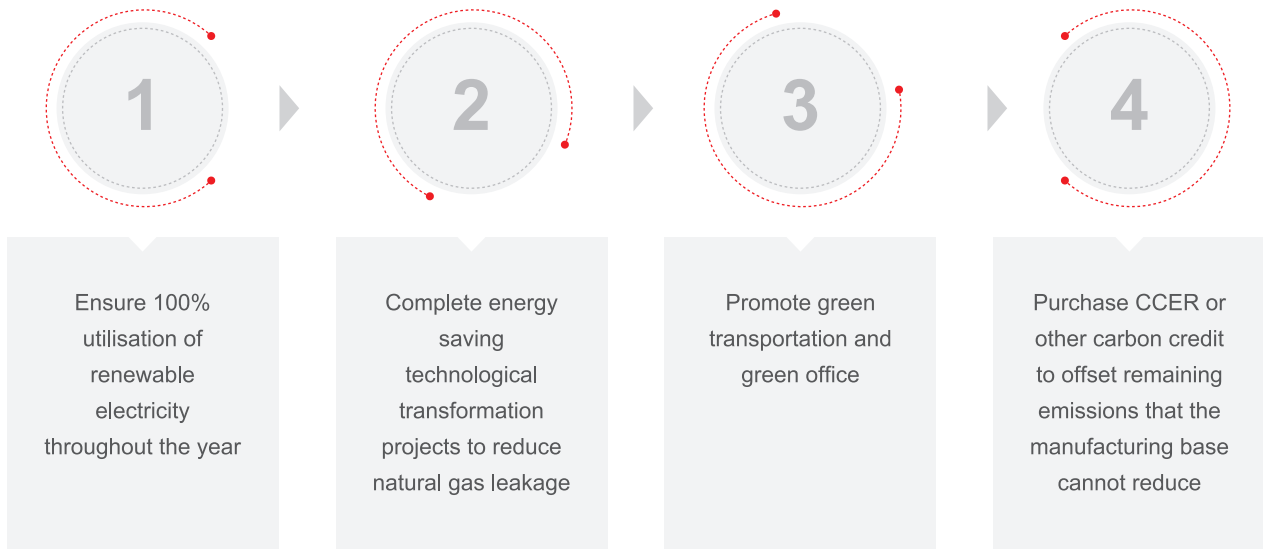
12. The figures in the graph show the percentage change of electricity consumption per unit of production from the base year (2020), where negative and positive figures denote reduction and rise in electricity consumption.

In 2022, LONGi implemented targeted technical upgrades for each manufacturing process:

Manufacturing processes	Technical upgrading project	Project detail	Estimated energy saving
 Ingot	Optimisation of air conditioners and process chiller	Optimised the load efficiency of air conditioning systems by connecting the pipes of air conditioning system and water supply system for process cooling	Annual electricity saving 4.320 million kWh
	Enhancement of thermal field insulation	Enhanced the insulation of thermal field and reduced the power use for crystal induction by optimizing graphite electrodes and adding insulation materials	Annual electricity saving 10.092 million kWh
 Wafer	Residual heat recovery of air compressor	Utilised the residual heat as a high-temperature heat source to curb the energy consumption from the heating process of pure water in the cleaning machine	Annual electricity saving 12.636 million kWh
	Air saving of wafering equipment	Carried out air saving retrofitting for wafering equipment which use a large amount of compressed air and easily leak air resulting from air-control components prone to damage	Annual electricity saving 6.912 million kWh
 Cell	Electricity consumption reduction in the power system	Optimised the ice machine and air compressor of the power system to reduce electricity consumption	Annual electricity saving 2.863 million kWh
 Module	Retrofitting of air pressure systems	Adopted a Room Control Unit (RCU) system in the manufacturing workshops during summertime and an outdoor fresh air fan system during wintertime which replaced the Air Handling Unit (AHU) air conditioning system	Annual electricity saving 4.553 million kWh
	Energy saving and pressure loss reduction of the air compressor system	Retrofitted large-size filter cartridges to extend the lifetime of the cartridge while reducing the pressure difference between the front and rear of the cold dryer filter	Annual electricity saving 4.044 million kWh

Zero Carbon Plant

During Phase 1 of the United Nations Biodiversity Conference (COP15) held in Kunming, Yunnan, LONGi announced that it would build its manufacturing base in Baoshan, Yunnan into the first “Zero-carbon plant” by 2023, achieving carbon neutrality within the operational boundary. To fulfil its commitment, LONGi set “four-step” goals:



In 2022, 99.09% of the total power used in LONGi’s Baoshan manufacturing base was green power. Construction of a rooftop photovoltaic power system has been completed, and the natural gas tail gas recovery project has initiated. In addition, a “zero-carbon theme park” has been built inside the manufacturing base, which enhances the green and visual aspects of the site. Meanwhile, we have completed two sessions of PAS 2060 Carbon Neutral Training to promote all employees’ green and low-carbon awareness and participation. Currently, LONGi’s Baoshan manufacturing base has been verified in accordance with PAS 2060:2014 on the commitment to achieve carbon neutrality by the world’s leading certification company SGS.

In terms of industry institution building, LONGi participated in the development of the group standard *Zero-carbon factory creation with block chain-based evaluation specifications* drafted by organisations including Schneider Electric, which was released at the Carbon Peak & Carbon Neutrality International Forum (CCIF) held in Hainan in September 2023. LONGi is also in the process of developing the *Guideline for Construction and Evaluation of Zero Carbon Plant* to guide the construction of zero carbon plants in the future.

In addition, LONGi’s manufacturing base in Xi’an was listed as one of green factories (the third batch) of Shaanxi Province in 2022, the manufacturing base in Taizhou was recognised as one of the leading enterprises for green development in Jiangsu Province in 2023.



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Progress on Achieving Scope 1 and 2 SBT

LONGi commits to reducing absolute Scope 1 and 2 GHG emissions 60% by 2030 from a 2020 base year. In 2022, LONGi's Scope 1 and 2 emissions increased by 20.0% compared to the base year, mainly due to the rapid expansion of the solar PV industry, hence the higher-than-expected growth rate of LONGi's production activities. Compared with 2020, the production of LONGi's two main products in 2022 – wafers and modules – has increased by 45.77% and 81.16% respectively.

LONGi's Scope 1 and 2 emissions have seen a declining trend in 2022. With the continuous increase of renewable electricity consumption and the roll-out of initiatives to saving energy and reducing carbon emissions, we expect to achieve further reduction in operational emissions in the future.

Scope	Base year 2020 emissions (tCO ₂ e)	Emissions covered by target %	Previous year 2021 emissions (tCO ₂ e)	Current year 2022 emissions (tCO ₂ e)	Change in 2022 from previous year %	Change in 2022 from base year %
Scope 1	92,665	99.9% ¹³	94,750	158,202	67.0%	70.7%
Scope 2 (market-based)	2,480,349	100%	3,057,224	2,930,501	-4.1%	18.1%
Scope 1 and 2 (market-based)	2,573,014	99.9%	3,151,974	3,088,703	-2.0%	20.0%

LONGi also commits to increasing active annual sourcing of renewable electricity to 100% by 2028 through 2030. In 2022, LONGi achieved a significant increase in the proportion of renewable electricity consumed compared to the previous year. In the future, we will also continue to scale up the use of renewable electricity in our production.

Indicators	2020	2021	2022
Renewable electricity consumed (MWh)	2,557,833.5	3,095,858.2	4,278,675.4
Total electricity consumed (MWh)	6,114,251.0	7,702,405.5	9,068,090.8
Proportion of renewables in total electricity consumed (%)	41.83%	40.19%	47.18%

13. Fugitive emissions from fire suppression systems are excluded from LONGi's Scope 1 and 2 target, for having a percentage less than 0.01% of the total Scope 1 and 2 emissions in 2020. However, the Scope 1 and 2 inventory of 2022 includes this emission source.

03

Enhancing a Low-carbon Value Chain

2022 Scope 3 Emissions

Progress on Achieving Scope 3 SBT

Value Chain Decarbonisation Actions and Explorations

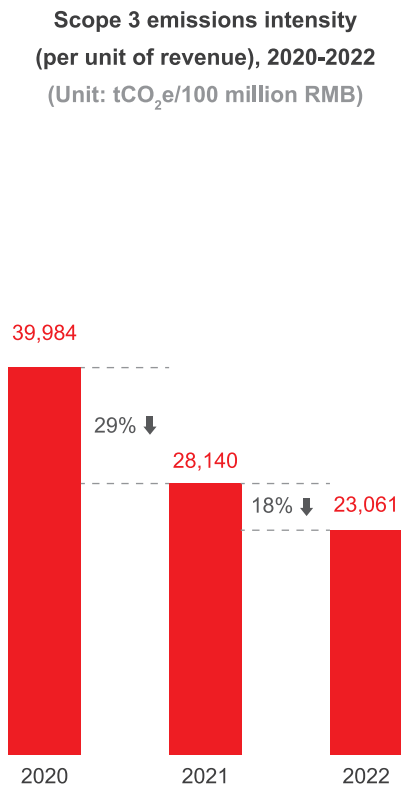
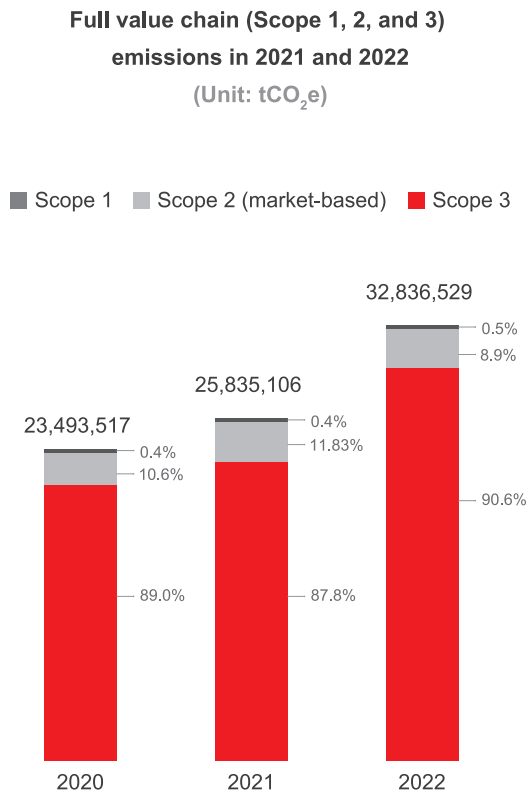
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2022 Scope 3 Emissions

Overview

In 2022, LONGi's Scope 3 emissions amount to 29,747,825.85 tCO₂e, accounting for 90.6% of the full value chain emissions (Scope 1, 2, and 3) and taking precedence of our emission reduction actions. Compared with 2021, Scope 3 emissions in 2022 have increased by 31.15%, mainly due to the rapid growth of LONGi's business, hence increasing production activities, as well as the expansion of the measurement scope. On the other hand, the intensity of Scope 3 emissions decreases significantly in 2022, with emissions per unit of revenue 18.05% lower than in 2021.



18.05% ↓

The intensity of Scope 3 emissions decreases significantly in 2022, with emissions per unit of revenue 18.05% lower than in 2021.

**Note: The emission intensity of 2021 has been updated due to the adjustment of LONGi's revenue in 2021*

Breakdown

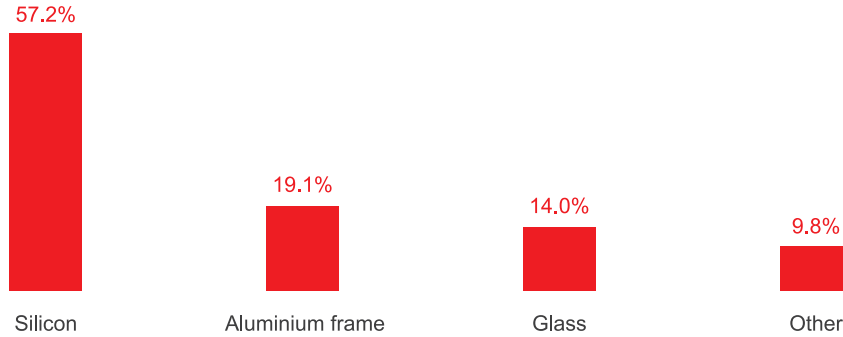
Purchased goods and services (Category 1) is the largest contributor of LONGI's Scope 3 emissions, accounting for more than 95% and mainly made up by upstream emissions of materials such as silicon and glass. The next highest contributing categories include downstream transportation and distribution (Category 9), upstream transportation and distribution (Category 4), and employee commuting (Category 7). These 4 categories collectively make up more than 99% of Scope 3 emissions.

Scope 3 emissions breakdown in 2022, by category
(Unit: tCO₂e)

①	Purchased goods and services				23,284,528	95.08%
③	Fuel- and energy-related activities (not included in Scope 1 or Scope 2)	130,682				0.44%
④	Upstream transportation and distribution	312,399				1.05%
⑤	Waste generated in operations	44,856				0.15%
⑥	Business travel	15,571				0.05%
⑦	Employee commuting	166,812				0.56%
⑨	Downstream transportation and distribution	780,092				2.62%
⑫	End-of-life treatment of sold products	12,886				0.04%

According to the Scope 3 emissions result, the 3 key materials – silicon, aluminium frame and glass – collectively are associated with 25,523,512 tCO₂e, accounting for around 85% of total Scope 3 emissions. LONGi has set a near-term Scope 3 science-based target for purchased goods and services and will develop plans and roadmaps to reduce their associated emissions.

Emissions percentage of key materials in Category 1: Purchased goods and services in 2022



In 2022, LONGi expanded the scope of activities in the Scope 3 accounting and adjusted the calculation methodology, in an effort to enhance the accuracy and completeness of calculation. For Category 1: Purchased goods and services in 2022, we further included chemicals, industrial gases, and auxiliary materials used in manufacturing in the existing inventory; for Category 7: Employee commuting, we adopted activity data on commuting based on employee survey and considered an extensive range of modes of transportation, such as bus and metro. These changes in data and methodology resulted in a significant increase in Scope 3 emissions in 2022 compared to the previous year, representing a more comprehensive understanding and grasp of LONGi’s value chain activities. LONGi will continue to improve the quality of Scope 3 accounting in the future and gradually incorporate more supplier data, in order to establish a more complete and accurate value chain inventory and enable a more comprehensive approach in value chain decarbonisation.

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Progress on Achieving Scope 3 SBT

52%

LONGi commits to reducing Scope 3 emissions from purchased goods and services by 52% per ton of purchased materials by 2030 compared to a 2020 base year¹⁴.

In 2022, emissions per ton of silicon have seen a decrease of approximately 9% compared to 2020 due to suppliers’ adoption of renewable electricity in manufacturing. In the future, LONGi will explore sustainable solutions to achieve continuous reduction for these key purchased materials, including low-carbon and recycled materials, and continue empowering the climate, supply chain climate actions and explore green logistics.

14. With the expanding of scope in activities included in Scope 3 accounting, LONGi will review and update the target according to the requirements of SBTi.

Value Chain Decarbonisation Actions and Explorations

Empowering Supply Chain Climate Actions

In 2022, LONGi launched the “Supply Chain Green Partner Empowerment Program” which aims to improve carbon management awareness and capabilities of the companies in LONGi’s supply chain and upscale their actions to save energy and reduce emissions. The program aims to achieve this through delivering a series of trainings, setting targets and developing roadmaps, and establishing monitoring and evaluation systems.

In September 2023, LONGi concluded the first phase of the “Supply Chain Green Partner Empowerment Program”. During the last training session of this phase, more than 120 supplier representatives took part in the learning and experience exchange on low-carbon fuels, supply chain decarbonisation, environmental and carbon data disclosure, science-based targets setting, and comprehensive energy solutions and practices.




For the next phase, LONGi will, in partnership with Towngas China, support at least 50 suppliers to complete the carbon accounting, and at least 10 suppliers to set science-based targets, and at least 5 key suppliers to carry out energy-saving and emissions-reducing actions, with the aim of creating a greener and more sustainable supply chain.

Green Logistics

Upstream and downstream transportation emissions accounts for around 3.67% of LONGi’s total Scope 3 emissions in 2022, an increase of more than 70% compared to 2021. Therefore, LONGi began to explore reducing the transportation emissions through green logistics.

“Green logistics” refers to the process of reducing the environmental impact of logistics activities by fully utilizing logistics resources, adopting advanced logistics technologies, rationally planning and implementing transportation, storage, packaging, loading and unloading, handling, circulation processing, distribution, information processing and other logistics activities. To adapt to the rapid growth of global orders and the expansion and construction of manufacturing bases, LONGi continuously improves the resource utilisation efficiency of containerisation, storage and transportation, and accelerates the construction of a green, intelligent and information-based logistics industry chain, which helps to improve quality and efficiency and reduce carbon emissions throughout the process.

Green Measures in Each Step of LONGi's Logistics

Step	Measures	Results in 2022
 <p>Containerisation</p>	<p>Circular packaging application: We use circular packaging in the internal transportation of silicon wafers, cells, and modules to reduce the purchase of disposable packaging materials.</p>	<p>Circular packaging has been used for transportation between LONGi's silicon wafer and cell bases. The circular packaging promotion project has reduced carbon emissions by 1,114 tons in 2022.</p>
 <p>Storage</p>	<p>Warehouse and distribution optimisation: We optimise the warehouses' locations and routes to realise LONGi's overall optimal logistics portfolio (e.g., shipping, warehouses, and backend trailers), and improve delivery efficiency.</p> <p>Increase space utilisation: We increase the stacking layers of silicon wafers by changing the transportation packaging to increase the loading capacity of each unit.</p>	<p>Optimised the European warehouse network, allocated resources reasonably within reach, shortened delivery distances, saved warehousing costs, and effectively reduced logistics carbon emissions.</p> <p>Applied in domestic and international transportation for important customers.</p>
 <p>Transportation</p>	<p>Multi-modal transportation: We replace the inland road trailer transportation with river or rail transportation, and facilitate the Yangtze River and sea transportation with a rail-sea transportation mode to reduce logistics carbon emissions.</p> <p>Consolidated shipping: For individual auxiliary materials with low and/or urgent demand, we set up consolidated shipping warehouses at the port of origin to collect and ship the materials after consolidation.</p>	<p>Applied in the outbound logistics transportation of multiple module bases in China, including Taizhou, Chuzhou, Jiaxing, Xi'an, Xianyang, and Datong, and the multi-modal transportation will continue to cover more cities. In terms of international transportation, LONGi cooperated with COSCO to launch Iberian Sea-Rail Express in 2022, providing an efficient and green cross-border logistics solution.</p> <p>Two consolidated shipping warehouses have been set up in two Chinese ports and applied in the logistics transportation of raw materials to Vietnam and Malaysia.</p>

In 2022, LONGi was selected as a case company to participate in the Global Sustainability Supply Chain Student Competition, and is extensively exploring innovative solutions and multiple possibilities in the field of green logistics. In 2023, LONGi applied for ESG China Awards 2023, hosted by British Chamber of Commerce Shanghai. Among total of 150 submissions from 102 businesses, organisations and individuals, LONGi has been announced as the finalist for the category of Green Supply Chain Award.

04

Advancing towards a Zero-carbon Future

Creating Green and Low-carbon Photovoltaic Products

Leading the Trend of Photovoltaic BC Technology

Promoting “Green Power + Green Hydrogen” Solution

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Creating Green and Low-carbon Photovoltaic Products

LONGi considers the environmental impact of the whole life cycle of our products during the design stage, thus helping to determine the direction of design decisions, following the design philosophy of minimizing the environmental impact of the products. Our module design not only reduces costs, improves module efficiency and quality, and enhances product competitiveness from a business perspective; but it also reduces resource consumption and achieves sustainable development strategies from an environmental protection perspective.

We take low-carbon and eco-friendly aspects into consideration in product design and aim to:

	<p>Reduce the carbon footprint of the entire product life cycle, to achieve net zero goals as soon as possible.</p>
	<p>Increase the warranty time of the modules, extend the service life of the modules, thereby improving the economic and environmental benefits of the modules.</p>
	<p>Increase the recyclable components in the modules, reduce the use of non-recyclable components, for example, fluorine-free solar backsheets avoid non-recyclable and costly fluorinated materials, achieving green preparation of green energy equipment.</p>
	<p>Reduce the use of harmful chemicals, reduce the environmental impact of photovoltaic modules in the manufacturing and scrapping stages.</p>



Green module material – fluorine-free backsheet

At present, fluorinated materials are widely used as module backsheets in the industry. In the future module recycling process, toxic fluorides are easily produced, which seriously pollute the environment and endanger personnel safety. LONGi has launched environmentally friendly fluorine-free reinforced PET backsheets after rigorous evaluation of backsheet materials, becoming the first mainstream manufacturer in the industry to use them in large quantities and leading the market.



By improving technology, reduce the amount of silver in the modules, reducing the module cost and enhancing the environmental sustainability of the modules.



Under the premise of ensuring product reliability, continuously improve material utilisation. For example, in the five years from 2018 to 2023, the single consumption of aluminium frame and film in LONGi modules has been reduced by more than 33% and 20% respectively.

Product Carbon Footprint

With the launch of LONGi's latest products in 2023, all of LONGi's mainstream module products passed the French carbon footprint certification in July 2023. At the same time, due to the latest PPE2 carbon footprint standard required under the requirements of the French energy policy "Energy Development Plan", LONGi Hi-MO 5 and Hi-MO 7 also successively obtained the carbon footprint certificate under the PPE2 standard awarded by Certisolis, the French national solar energy carbon footprint certification agency. The updated PPE2 carbon footprint standard is more stringent and comprehensive in terms of data quality, on-site audit and other requirements. Under this requirement, all LONGi modules have a carbon footprint of 450~500 kg eqCO₂/kWc, and continue to reduce their carbon footprints.

The comprehensive and rapid coverage of various products in carbon footprint certification this year has strongly proven LONGi's determination to manage product carbon footprint and enhance product low-carbon competitiveness, demonstrating its industry-leading level of carbon footprint performance.

Evaluation Carbone Simplifiée(ECS) Certification
French independent third-party Certisolis

Hi-MO 7



In May 2023, LONGi modules obtained International Environmental Product Declaration (EPD) certification. The International EPD system is the first, longest-running and most influential EPD system in the world. It was established in 1997 by the Swedish Environmental Protection Agency (SEPA) and the industry as the Swedish EPD system. The system is the inventor of Environmental Product Declaration (EPD) and Product Category Rules (PCR). Following UL EPD and Italian EPD in 2022, LONGi once again obtained International EPD certification, further confirming LONGi’s continuous pace of expanding green and low-carbon certification, which can more comprehensively respond to the green certification needs of different markets and customers around the world.

The continuous updates of product certification enable customers to better understand the environmental impact and sustainability characteristics of LONGi products throughout their life cycle, providing authoritative data support for customers in project ecological design, green procurement, green consumption and other aspects.

LONGi

EPD[®]
THE INTERNATIONAL EPD[®] SYSTEM

ECO PLATFORM
EPD
VERIFIED

Environmental Product Declaration

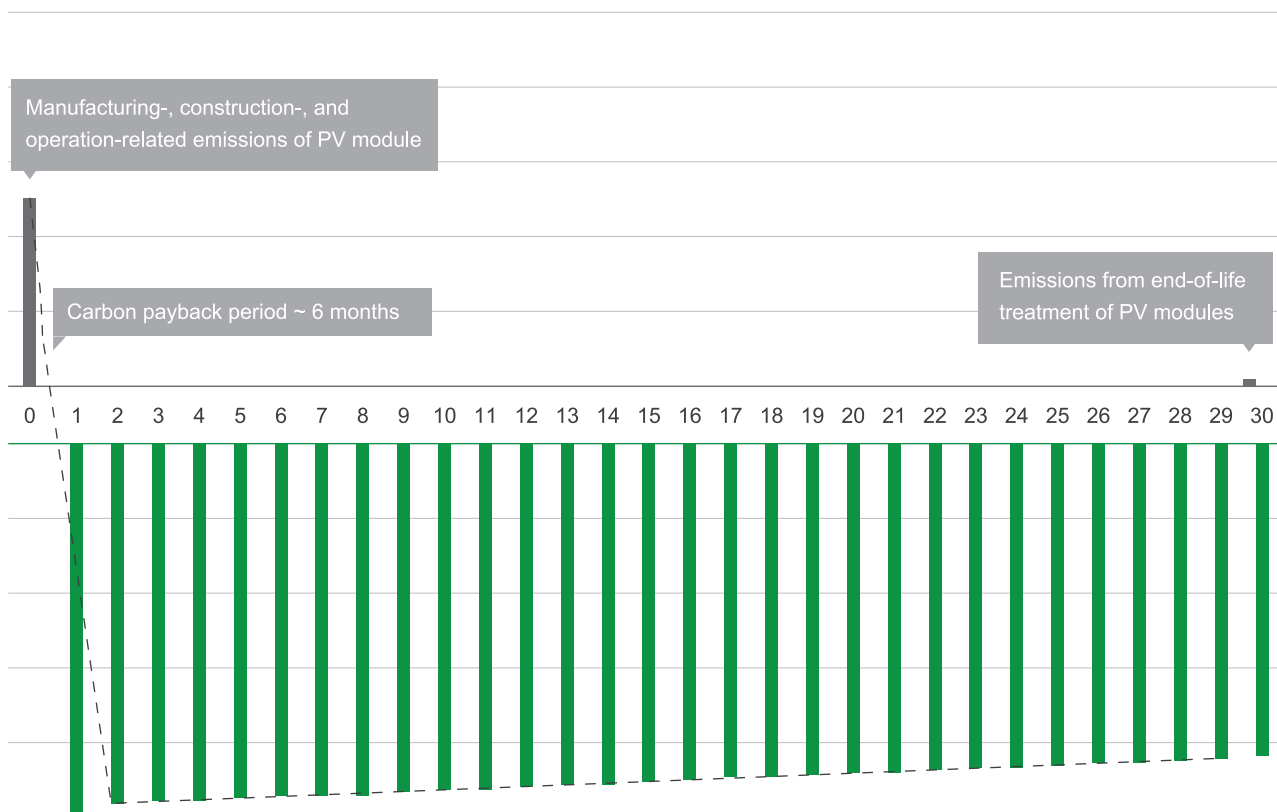
In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC: 2021

Programme:	The International EPD [®] System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-09079
Publication date:	18/04/2023
Revision date:	29/05/2023 (version 2)
Valid until:	18/04/2028



LONGi also assessed the enabled emissions reduction and the carbon footprint of PV products throughout its whole lifecycle, and found that the carbon payback period can be as short as 6 months. The below figure illustrates the enablement effect of a 200MW PV solar power station in Datong city, Shanxi Province of China, built with LONGi Hi-MO 7 dual-glass modules during its expected lifetime. The lifecycle emission intensity of the PV modules is only 1.9% of the local power grid. During the 30 years of operation, the enabled emissions reduction from the supply of green electricity net of emissions generated from the lifecycle of PV modules amounts to 7.62 million tCO₂e, equivalent to planting 25.42 million trees, and the carbon payback period is less than 7 months.

Enablement effect of PV modules during the 30-year operation



Boosting Low-Carbon Products with a Circular Economy (waste module recycling)

Establish Product Circular Utilisation Goals and Strategies

LONGi and its partners have established a sustainable recycling and reuse channel for waste photovoltaic panels by implementing the development of pioneering technologies. LONGi advocates the use of best practices and the most advanced technologies, combining technology, environment, economy and society aspects, to build a more circular photovoltaic industry. In the recycling process, in addition to paying attention to the reuse value of products, it also pays attention to the emission of pollutants and carbon in the processing process, and proposes to achieve the reduction, resource utilisation and harmless development of photovoltaic modules from the whole life cycle.

Carry out Product Circular Recycling Project

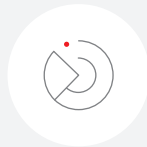
At present, LONGi is working with partners to help customers collect, group, process and prepare waste photovoltaic solar panels. LONGi is a global member of PV Cycle, and has cooperative relationships with Soren, Open, 3Drivers. It has registered waste electronic recycling in Belgium, Britain, France, Germany, Italy, Netherlands, Portugal and Spain. In 2022, 43% of the modules sold by LONGi to these eight countries were declared and paid for WEEE according to the extended producer responsibility system. Due to the long lifetime of photovoltaic modules, large-scale recycling will not take place in present times, but the damaged modules in the transportation and installation process have been properly recycled according to relevant regulations.

Our partners opt for cutting-edge technologies to establish highly efficient recycling channels, with the goal of attaining superior recycling quality and purity while addressing both environmental and economic concerns in a coordinated manner. The average recycling rate of photovoltaic modules based on crystalline silicon and aluminium frame reaches 94%, and the purpose of processing operation is to separate different material parts that make up photovoltaic panels, so as to inject them back into production circuit and form a true circular economy.



Silicon-based modules

achieved 93.5% recycling rate.



EVA packaging

cannot be recycled for producing new materials or products, but enters energy recovery.



The disposal of chemicals used in waste treatment process must comply with Industrial Emissions Directive IED 2010/75/EU and relevant Best Available Techniques Reference Documents issued by Joint Research Center of European Commission. The disposal or exchange of chemicals is carried out by specialised third parties to ensure that the recycling of photovoltaic panels is harmless to the environment throughout the process.

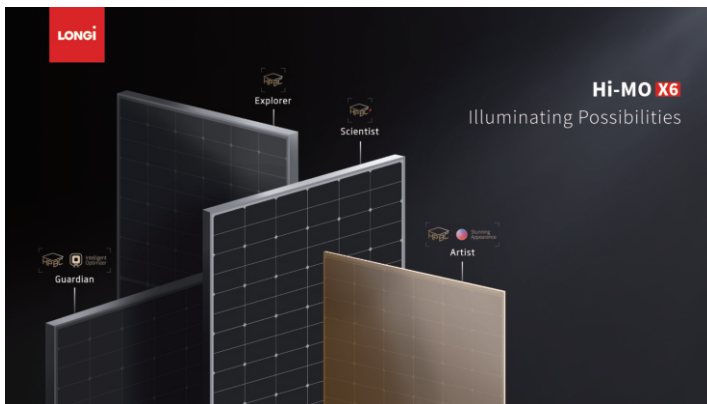
CLIMATE ACTION

Leading the Trend of Photovoltaic BC Technology

PV conversion efficiency is a key measure for PV technology. LONGi always puts customer value at the centre, and continuously improves the efficiency of PV products through technology research and development, and innovation. Since April 2021, LONGi has broken the world record of PV cell conversion efficiency 15 times across various technology pathways, especially the world record of 26.81% efficiency in 2022 was the first world record set by a Chinese PV technology company since the advent of crystalline silicon technology. In October 2023, LONGi launched the perovskite-silicon tandem solar cell with a new record of 33.9% efficiency.

In September 2023, LONGi officially announced BC (Back Contact) cell as the next-generation of cell technology pathway. LONGi believes that BC technology is an epoch-making technology following the PERC era, being the “pearl on the crown” of the crystalline silicon photovoltaic technologies, and has the advantage over other technologies in terms of potential for efficiency enhancement and performance in solar-cell conversion. Products built with BC cell technology extend the usability to various scenarios due to their innovative appearance.

HPBC (Hybrid Passivated Back Contact) cell technology, which LONGi has been researching since 2018, is a pivotal technology pathway within the BC technology. It is a next-generation high-efficiency technology, featuring no grid lines on the front side of the PV cell. It took years of research of the scientists at LONGi for the HPBC technology to reach the stage of commercialisation, which pushed the BC technology to achieve cost parity and economical accessibility to a wider range of people.



- In November 2022, LONGi released the Hi-MO 6 module, a new-generation PV module product based on the high-efficiency HPBC cell technology, achieving a 23.3% maximum efficiency in mass production.
- In October 2023, LONGi released the Hi-MO X6 dust-proof module, which aims to address the customer needs and pain points in distributed scenarios and lead the development trend of the global distributed PV market.

The efficiency of the upgraded HPBC cell in mass production exceeds 25.5%. Under the same conditions, module products built with HPBC technology can increase power generation by 10% compared to PERC cells and 2%-3% compared to TOPCon cells. For the 240GW of newly installed global PV capacity in 2022, every 0.01% increase in conversion efficiency of PV cells can bring about an additional power generation of 140 million kWh per year, producing a significant effect for emission reduction. LONGi will continue leading the way in progress of PV technology innovation, and actively act upon the mission and responsibility of driving down the costs of achieving a net-zero future.

CLIMATE ACTION

Promoting “Green Power + Green Hydrogen” Solution

Green hydrogen is deemed as one of the key pillars for decarbonising the global energy system, according to the International Energy Agency (IEA). Clean technologies for hydrogen production – water electrolysis being one of the most important – enables hydrogen to play a significant role in hard-to-abate sectors, such as heavy industry and long-haul transportation.

LONGi launched the “Green Power + Green Hydrogen” solution in 2021 and continues to build on its technological edge and ramp up investment in R&D through the years, with the dedication to becoming the global leading solution provider for green hydrogen technology and equipment. To address the key challenge of high costs in hydrogen deployment, LONGi focuses on steadily reducing LCOH (levelised cost of hydrogen: unit hydrogen production cost), contributing to a more cost-effective hydrogen industry. In 2022, LONGi Hydrogen operated with a total production capacity for alkaline water electrolyser of 1.5GW, ranking the first in the world.



In February 2023, LONGi released the ALK Hi1 series alkaline water electrolyser product with energy efficiency outperforming existing commercial options. The energy consumption of this series reaches 4.0 kWh/Nm³, meaning an over 10% reduction in DC power consumption and a reduction in LCOH in various usage scenarios. In September 2023, LONGi released the ALK G series alkaline water electrolyser product with the upsized capacity of single electrolyser, reaching 3,000 Nm³/h. This helps reduce LCOH through saving costs from equipment investment and civil engineering.

LONGi has been actively exploring the green hydrogen solution in "multi-technology route + multi-scenario application" in a wide range of sectors, including petrochemical, power, iron and steel, transportation sectors. Leveraging on four technological advantages – energy efficiency, automatic control, intelligent manufacturing, and real-time monitoring of operation – LONGi supported the high-quality development of the green hydrogen industry and the delivery of large-scale projects globally:

World's largest Green Power + Green Hydrogen demonstration project of SINOPEC, China

LONGi Hydrogen supported the delivery of SINOPEC's demonstration project in Northwestern China's first solar green hydrogen facility and the largest green facility operating in the country. The facility began operating and producing green hydrogen since June 2023:

LONGi provided 16 sets of 1000Nm³/h electrolyzers, accompanying 1 gas-liquid separation equipment for each 4 sets of electrolyzers.

The plant installed 300 MW of PV to generate solar power to electrolyse water, and realised an annual capacity of 20,000 tons of green hydrogen.

The project is expected to avoid CO₂ emissions of 500,000 tons per year by replacing hydrogen production from natural gas.

World's largest Green Power + Green Ammonia demonstration project in Da'an, China

In May 2023, LONGi Hydrogen signed a procurement contract to provide electrolyzers for the Da'an Wind and Solar Green Hydrogen Synthesis Ammonia Integration Demonstration Project – the world's largest green ammonia project this year:

LONGi Hydrogen will provide 15 sets of 1000Nm³/h electrolyzers.

The facility is expected to produce 32,000 tons of hydrogen and 180,000 tons of ammonia per year, with the first phase due to start operations in 2024.

The project is expected to avoid CO₂ emissions of 650,000 tons per year after its completion.

Hydrogen Park Murray Valley project in Australia

In July 2023, LONGi Hydrogen officially joined the Hydrogen Park Murray Valley project – the largest renewable hydrogen facility on the east coast in Australia.

The project is about to deliver an up to 10% hydrogen blend into existing natural gas supply to approximately 40,000 households and 20 industrial sites, with an estimated emissions avoidance of up to 4,000 tons per year.

Appendix 1 - Energy and Emissions Data

Table: Energy consumption in 2020-2022

Energy type	Unit	2022	2021	2020
Electricity	MWh	9,068,091	7,702,405	6,114,251
Renewable Electricity	MWh	4,278,675	3,095,858	2,557,834
	%	47.18%	40.19%	41.83%
Heat and steam	GJ	277,978	78,362	65,612
Natural gas	Nm ³	5,743,577	5,296,479	9,529,365
Diesel	Ton	300	372	291
Petrol	Ton	195	179	177
LNG	Ton	0.6	4.6	-
LPG	Ton	63	78	-
Acetylene	Ton	-	0.1	-
Ethanol	Ton	-	-	16
Biofuel	Ton	-	-	107

Table: Scope 1 and 2 emissions in 2020-2022

Emission source	2022 Emissions (tCO ₂ e)	Percentage of Scope 1 and 2 emissions (%)	2021 Emissions (tCO ₂ e)	Percentage of Scope 1 and 2 emissions (%)	2020 Emissions (tCO ₂ e)	Percentage of Scope 1 and 2 emissions (%)
Scope 1	158,202	5.1%	94,750	3.0%	92,665	3.6%
Stationary combustion	13,209	0.4%	12,173	0.4%	39,918	1.6%
Mobile combustion	1,121	0.04%	1,514	0.05%		
Industrial processes	118,460	3.8%	42,279	1.3%	/	/
Fugitive: Refrigerant leakage	227	0.01%	38,784	1.2%	52,747	2.1%
Fugitive: Leakage from fire suppression systems	21,705	0.7%	/	/	/	/
Fugitive: Wastewater treatment for septic systems	3,480	0.1%	/	/	/	/
Scope 2 (market-based)	2,930,501	94.9%	3,057,224	97.0%	2,480,349	96.4%
Purchased electricity	2,899,923	93.9%	3,048,604	96.7%	2,473,131	96.1%
Purchased heat and steam	30,578	1.0%	8,620	0.3%	7,217	0.3%
Total	3,088,703		3,151,974		2,573,014	

*Note: Due to rounding, figures might not correspond after summing up.

Table: Scope 3 emissions in 2020-2022

Category	2022 Emissions (tCO ₂ e)	Percentage of Scope 1 and 2 emissions (%)	2021 Emissions (tCO ₂ e)	Percentage of Scope 1 and 2 emissions (%)	2020 Emissions (tCO ₂ e)	Percentage of Scope 1 and 2 emissions (%)
① Purchased goods and services	28,284,528	95.08%	21,619,240	95.31%	20,314,408	97.10%
③ Fuel- and energy-related activities (not included in Scope 1 or Scope 2)	130,682	0.44%	112,689	0.50%	82,162	0.39%
④ Upstream transportation and distribution	312,399	1.05%	317,096	1.40%	353,090	1.69%
⑤ Waste generated in operations	44,856	0.15%	302,212	1.33%	2,848	0.01%
⑥ Business travel	15,571	0.05%	3,228	0.01%	Not included	/
⑦ Employee commuting	166,812	0.56%	1,448	0.01%	Not included	/
⑨ Downstream transportation and distribution	780,092	2.62%	316,722	1.40%	163,437	0.78%
⑫ End-of-life treatment of sold products	12,886	0.04%	10,498	0.05%	4,558	0.02%
Total	29,747,826		22,683,132		20,920,503	

*Note: Due to rounding, figures might not correspond after summing up.

Appendix 2 - GHG Accounting Boundary and Methodology

Reporting period January 1, 2022 – December 31, 2022.

Organisational boundary Organisational boundary defines the businesses and operations that constitute the company for the purpose of accounting and reporting GHG emissions. Companies can account for 100 percent of the GHG emissions from operations over which it has control (operational control or financial control), or according to its share of equity in the operation. LONGi follows the operational control to account for GHG emissions, covering all its subsidiaries and holding companies.

Operational boundary Setting operational boundaries involves identifying emissions associated with its operations and categorizing them as direct and indirect emissions, which are defined as the follows:

Direct GHG emissions	Scope 1: direct emissions occur from sources owned or controlled by the company
Indirect GHG emissions	<p>Indirect emissions occur from sources not directly owned or controlled by the company, and can further broken down into:</p> <ul style="list-style-type: none"> • Scope 2: indirect emissions from the generation of purchased electricity and heat • Scope 3: indirect emissions as a result of the company's operations but not owned or controlled by the company. <i>The Corporate Value Chain (Scope 3) Accounting and Reporting Standard</i> identified 15 categories in the value chain.

The emission sources of Scope 1 and 2 and categories of Scope 3 with exclusions and their justifications are follows:

Table: The list of emission sources and justification of specific exclusions for Scope 1 and 2

Emission sources	Is included	Justification if excluded
Combustion	Included	/
Industrial processes	Included	/
Refrigerant leakage	Included	/
Leakage from fire suppression systems	Included	Emissions from leakage from fire suppression systems start to be included in 2022
Wastewater treatment	Included	Emissions (methane) from wastewater treatment for septic systems start to be included in 2022
Purchased electricity	Included	/
Purchased heat and steam	Included	/

Table: The list of categories and justification of specific exclusions for Scope 3

Categories	Is included	Justification if excluded
① Purchased goods and services	Included*	/
② Capital goods	Excluded	Not included in 2022 Scope 3 inventory due to data availability
③ Fuel- and energy-related activities (not included in Scope 1 or Scope 2)	Included	/
④ Upstream transportation and distribution	Included	/
⑤ Waste generated in operations	Included	/
⑥ Business travel	Included	/
⑦ Employee commuting	Included	/
⑧ Upstream leased assets	Excluded	Not relevant
⑨ Downstream transportation and distribution	Included	/
⑩ Processing of sold products	Excluded	Not included in 2022 Scope 3 inventory due to data availability
⑪ Use of sold products	Excluded	Not relevant
⑫ End-of-life treatment of sold products	Included	/
⑬ Downstream leased assets	Excluded	Not relevant
⑭ Franchises	Excluded	Not relevant
⑮ Investments	Excluded	Not relevant

* Note: The current inventory includes only the major materials. LONGi is committed to improving the completeness and accuracy of Scope 3 emissions accounting by expanding the scope of materials accounted for over time.

Emission factor sources

Emission factor represents the level of GHG emissions of a unit of available activity data. The emission factors used by LONGI combines primary and secondary data, where emission factors obtained from suppliers or calculated from specific activities of LONGI are prioritised, and when they are not available, default factors retrieved from globally recognised databases or published by national governments are chosen instead.

Emission sources and categories	Emission factor sources
Scope 1	
Diesel	
Petrol	<ul style="list-style-type: none"> • GB/T 2589-2020: <i>General rules for calculation of the comprehensive energy consumption</i>
LPG	<ul style="list-style-type: none"> • IPCC 2006 V2_2_Ch2_Table 2.3
Natural gas	<ul style="list-style-type: none"> • IPCC 2006 V2_3_Ch3_Table 3.2.1, Table 3.2.2
LNG	
Industrial processes: methane (CH ₄)	<ul style="list-style-type: none"> • 2006 IPCC Guidelines for National Greenhouse Gas
Industrial processes: nitrous oxide (N ₂ O)	
Industrial processes: trimethylaluminum	<ul style="list-style-type: none"> • Mass balance of carbon (C)
Refrigerant leakage	<ul style="list-style-type: none"> • IPCC AR6
Leakage from fire suppression systems	<ul style="list-style-type: none"> • 2006 IPCC Guidelines for National Greenhouse Gas
Wastewater treatment for septic systems	<ul style="list-style-type: none"> • 2006 IPCC Guidelines for National Greenhouse Gas
Scope 2	
Purchased electricity	<ul style="list-style-type: none"> • National Development and Reform Commission (NDRC), <i>Average CO₂ emission factors of regional power grids in China, 2011 and 2012</i>
Purchased heat and steam	<ul style="list-style-type: none"> • National Development and Reform Commission (NDRC), <i>General guideline of the greenhouse gas emissions accounting and reporting for other industrial enterprises</i>
Scope 3	
① Purchased goods and services	<ul style="list-style-type: none"> • Ecoinvent 3.8 Database • Gabi Database • Supplier questionnaire • 2006 IPCC Guidelines for National Greenhouse Gas • GB/T 2589-2020: <i>General rules for calculation of the comprehensive energy consumption</i> • GB/T 51161-2016: <i>Standard for energy consumption of building</i> • National Development and Reform Commission (NDRC), <i>Average CO₂ emission factors of regional power grids in China, 2011 and 2012</i>
③ Fuel- and energy-related activities (not included in Scope 1 or Scope 2)	<ul style="list-style-type: none"> • GB/T 2589-2020: <i>General rules for calculation of the comprehensive energy consumption</i> • IPCC AR6 • <i>China Statistical Yearbook 2022</i>

④ Upstream transportation and distribution	<ul style="list-style-type: none"> • Ecoinvent 3.8 Database • China Products Carbon Footprint Factors Database
⑨ Downstream transportation and distribution	<ul style="list-style-type: none"> • GHG Protocol transportation emission tool
⑤ Waste generated in operations	<ul style="list-style-type: none"> • Ecoinvent 3.8 Database • Gabi Database
⑥ Business travel	<ul style="list-style-type: none"> • Ecoinvent 3.8 Database • China Products Carbon Footprint Factors Database • GHG Protocol transportation emission tool
⑦ Employee commuting	<ul style="list-style-type: none"> • <i>2006 IPCC Guidelines for National Greenhouse Gas</i> • <i>GB/T 2589-2020: General rules for calculation of the comprehensive energy consumption</i> • <i>GB 17930-2016: Gasoline for motor vehicles</i> • <i>GB 19147-2016: Automobile diesel fuels</i> • <i>National Development and Reform Commission (NDRC), Average CO₂ emission factors of regional power grids in China, 2011 and 2012</i>
⑫ End-of-life treatment of sold products	<ul style="list-style-type: none"> • <i>IEA PVPS, Life Cycle Assessment of Current Photovoltaic Module Recycling</i>

Appendix 3 · Third-party Verification

ISO 14064-3:2019 verification for LONGI full value chain emissions in 2022



核查声明

温室气体排放核查

兹证明：
隆基绿能科技股份有限公司
中国
陕西省
西安市经济技术开发区
尚苑路 8369 号
邮编：710016
注册地址：
西安市长安区航天中路 388 号

LONGI Green Energy Technology Co., Ltd.
No. 8369, Shangyuan Road
Xi'an Economic and Technological Development
Zone, Xi'an
Shaanxi
710016
China
Registration address:
No. 388, Hangtian Middle Road, Chang'an District,
Xi'an

持有声明编号： CFV 789043

As a result of carrying out verification procedures in accordance with ISO 14064-3:2019, it is the opinion of BSI with Reasonable assurance that:

依据 ISO 14064-3:2019 核查流程执行的结果，BSI 出具合理保证等级声明如下：

- The total Greenhouse Gas Emissions for the year 2022 of LONGI Green Energy Technology Co., Ltd. as below, including:
隆基绿能科技股份有限公司 2022 年温室气体排放情况如下，包括：
 - Direct GHG emissions 直接温室气体排放：158202.15 tonnes CO₂e. 158202.15 吨二氧化碳当量。
 - Indirect GHG emissions from imported energy 输入能源间接温室气体排放：2930501.01 tonnes CO₂e. 2930501.01 吨二氧化碳当量。
 - Indirect GHG emissions from transportation 交通运输的间接温室气体：1270551.63 tonnes CO₂e. 1270551.63 吨二氧化碳当量。
 - Indirect GHG emissions from products used by organization 组织使用产品的间接温室气体排放：28333706.39 tonnes CO₂e. 28333706.39 吨二氧化碳当量。
 - Indirect GHG emissions associated with the use of products from the organization 使用本组织产品相关的间接温室气体排放：12885.71 tonnes CO₂e. 12885.71 吨二氧化碳当量。
 - Indirect GHG emissions from other sources 其他来源的间接温室气体排放：130682.11 tonnes CO₂e. 130682.11 吨二氧化碳当量。
- No material misstatements for the year 2022 Greenhouse Gas Emissions calculation were revealed.
2022 年温室气体排放计算未发现实质性错误陈述。
- Data quality was considered acceptable in meeting the principles as set out in ISO 14064-1:2018.
温室气体数据质量经验证符合 ISO 14064-1:2018 的要求。

BSI 代表：

张翼翔，董事总经理，英标管理体系认证（北京）有限公司

首次发证日期： 2023-05-10

最新发证日期： 2023-05-10

...making excellence a habit.™

PAS 2060:2014 validation statement of commitment to carbon neutrality - LONGi Baoshan manufacturing base



Statement CN23/00005877

Validation Statement of Commitment to Carbon Neutrality

The Operating activities at the organizational level of

Baoshan LONGi Silicon Materials Co. Ltd

Silicon Industrial Park, Changling Gang, Xinjie Country, Longyang District, Baoshan City, Yunnan Province, P.R. China

has been verified in accordance with ISO 14064-3:2019, confirmed that a carbon footprint management plan has been developed, commitment to achieve carbon neutrality from 2024-01-01 to 2024-12-31 as meeting the requirements of

PAS 2060:2014

This statement is valid from 2 November 2023 until 1 November 2024

Issue date: 2 November
Version:1

Authorized by
David Xin
Sr. Director - Knowledge

SGS-CSTC Standards Technical Services Co., Ltd.
16F Century YuHui Mansion, No. 73 Fucheng Road, Beijing, P.R. CHINA 100142
t +86 (0)10 58251188 www.sgsgroup.com.cn

Approved science-based target



info@sciencebasedtargets.org
www.sciencebasedtargets.org



Approved science-based target

The Science Based Targets initiative has validated that the corporate greenhouse gas emissions reduction target(s) submitted by

LONGi Green Energy Technology Co., Ltd.

have been deemed to be in conformance with the SBTi Criteria and Recommendations (version 5.0). The SBTi's Target Validation Team has classified your company's scope 1 and 2 target ambition and has determined that it is in line with a 1.5°C trajectory.

The official target wording is:

LONGi commits to reduce absolute scope 1 and 2 GHG emissions 60% by 2030 from a 2020 base year. LONGi also commits to increase active annual sourcing of renewable electricity from 15% in 2019 to 100% by 2028 through 2030. LONGi further commits to reduce scope 3 emissions from purchased goods and services 52% per tonne of purchased materials by 2030 from a 2020 base year.

Date of issue: July 2023

Certificate Number: LONG-CHI-001-OFF

An initiative by



LONGi

LONGi Green Energy Technology Co., Ltd.
Block A, No.8369 Shangyuan Road, Xi'an, Shaanxi, China.
Tel: +86-4008601012
Fax: +86-29-81566685
E-mail: csr@longi.com
Web: www.longi.com

