



First Solar

ANNUAL REPORT 2022.









First Solar

About First Solar.

First Solar is a leading American solar technology company and global provider of responsibly-produced eco-efficient solar modules advancing the fight against climate change. Developed at R&D labs in California and Ohio, the company's advanced thin film photovoltaic (PV) modules represent the next generation of solar technologies, providing a competitive, high-performance, lower-carbon alternative to conventional crystalline silicon PV panels. From raw material sourcing and manufacturing through end-of-life module recycling, First Solar's approach to technology embodies sustainability and a responsibility towards people and the planet.

To Our Shareholders.

We began 2022 with the expectation that it would be challenging from an earnings perspective, as we faced unprecedented logistics and commodity costs. However, we also expected it to be a year of transition, setting the stage for growth and profitability in 2023 and beyond.

That prediction proved accurate and while earnings were below our expectations, 2022's role as a foundational year surpassed expectations as we exited it in a stronger operational and commercial position than we entered it, with significantly more robust fundamentals underpinning our long-term growth thesis.

We exited the year with a record contracted backlog, a significant pipeline of bookings opportunities, and a defined manufacturing expansion strategy, while largely completing the exit of our legacy systems business. This is in no small measure due to the hard work, commitment, and passion of our purpose-driven associates who stayed focused on long-term goals and delivered results.

Our momentum in 2022 was driven by our points of differentiation, which continue to grow from strength to strength. Combined with the efforts of our people, our differentiated CadTel technology, vertically integrated manufacturing process, strong balance sheet, certainty of demand, and commitment to Responsible Solar, placed us in a position to rapidly respond to emerging opportunities, particularly those enabled by the changing policy environment.



MARK WIDMAR | CEO

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Year in Review.

FINANCIAL REVIEW

From a financial perspective, our full year loss per diluted share for 2022 was $(0.41) cents compared to earnings per diluted share of $4.38 in 2021. Our 2022 earnings per share (EPS) result came in above the midpoint of the guidance range that we provided during the third quarter earnings call.

We ended the year with a gross cash balance of $2.6 billion, or $2.4 billion net of debt, which is an increase to both gross and net cash of $800 million versus the prior year. This puts us in a position of strength to expand our capacity, invest in research, development, and technology improvements, and pursue other strategic opportunities.



RECORD BOOKINGS

The year proved to be a record from a bookings perspective and saw a perceptible shift toward long-term, multi-year module procurement in 2022. This resulted in securing 48.3 gigawatts (GW) of net bookings and we exited the year with a total contracted backlog of 61.4 GW, representing expected future revenue of $17.7 billion with bookings secured into 2029.



This record volume of multi-gigawatt deals spanning multiple years was driven by a combination of competitive pricing and technology, agile contracting, shared values, and trust in our ability to deliver the certainty that our customers are looking for.

Since the beginning of 2022, large developers such as Intersect Power, Lightsource bp, National Grid, Origis Energy, Savion, Silicon Ranch, and Swift Current, among others, have placed orders of at least 2 GW. The fact that many of these transactions are with repeat buyers is an indicator of the trust and shared values that underpin our customer relationships, and is a clear differentiator from the more transactional approach taken by many of our competitors.

Notably, our commercial success in 2022 enabled three key drivers of long-term growth: certainty of demand, access to liquidity, and a strong customer base that understands, trusts, and values our technology.



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INVESTED IN GROWTH

From a manufacturing perspective, we produced a record 9.1 GW in 2022 and exited the year with 9.8 GW of nameplate manufacturing capacity. Even as we prepare to ramp our next generation Series 7 factory in Ohio and remain on track to complete construction and commence the ramp at our Series 7 factory in India during 2023, we are furthering our manufacturing expansion program to meet demand.

In 2022 we announced a new 3.5 GW Series 7 factory in Alabama, and a 0.9 GW increase in nameplate capacity at our Ohio factories, together representing approximately $1.3 billion in investment. By 2026, we expect U.S. nameplate capacity of approximately 10.7 GW and global nameplate capacity of approximately 21.4 GW.

From a technology perspective, we are investing approximately $270 million in a dedicated research and development (R&D) innovation center in Perrysburg, Ohio. The new facility, believed to be the first of its scale in the United States, is expected to accelerate American leadership in the development and production of advanced thin film photovoltaics (PV).

The new R&D center will be located near First Solar's existing Perrysburg manufacturing facility, covering an area of approximately 1.3 million square feet. It will feature a high-tech pilot manufacturing line allowing for the production of full-sized prototypes of thin film and tandem PV modules.

We currently operate a dual-purpose manufacturing line at our Perrysburg facility, which can handle either commercial production or product development efforts at a given point in time. By creating an R&D sandbox separate from our commercial manufacturing operations, we are ensuring that we can accelerate innovation, such as bi-faciality and our copper replacement (CuRe) program, without the cost of taking mission-critical tools offline. The facility is expected to be completed in 2024.

10.7 GW

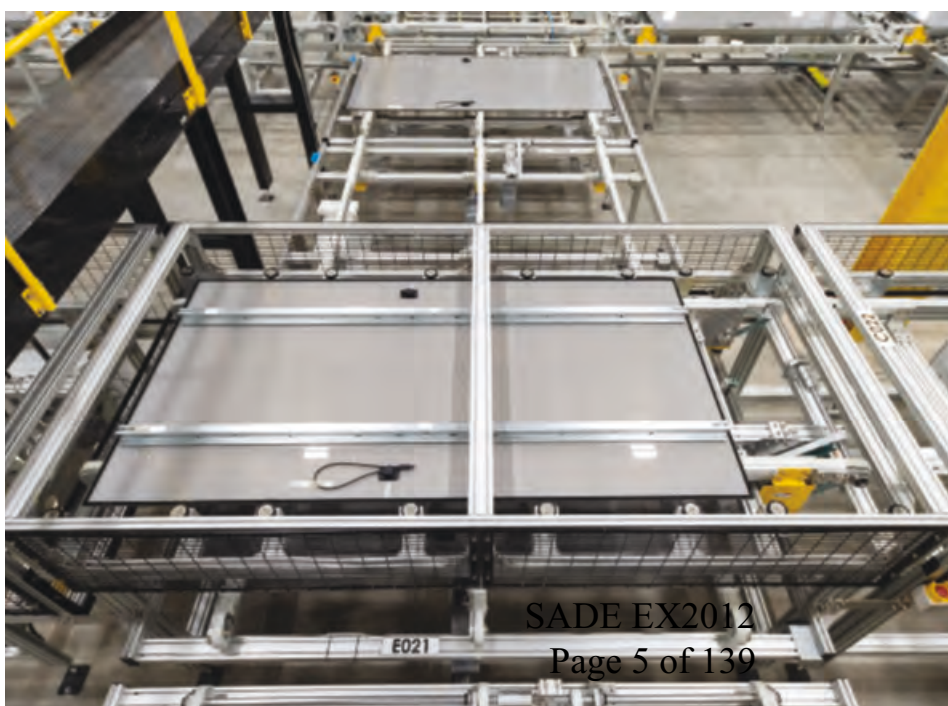
2026 Expected U.S. Nameplate Capacity

21.4 GW

2026 Expected Global Nameplate Capacity

$270M

Dedicated R&D Innovation Center



EVOLVING POLICY ENVIRONMENT

The developments of 2022 were set against a backdrop of a rapidly evolving policy environment.

Broadly speaking, 2022 placed us on the cusp of significant growth in domestic solar manufacturing within our core markets, as policymakers in the United States and leading democracies abroad demonstrated that they are serious about tackling the unhealthy over-concentration of solar supply chains in China and the vulnerabilities that come with it.

In fact, 2022 saw a resurgence in industrial policy designed to incentivize domestic manufacturing, while spurring on investment and creating jobs at scale. The year saw tangible progress in the U.S. with the Inflation Reduction Act, and in India with the Production Linked Incentive program. Europe also moved towards spurring domestic manufacturing with the introduction of a legislative framework for its 'Green Deal Industrial Plan.'







The policy developments of 2022 have significantly changed the equation and enhanced the policy certainty and level playing field needed to catalyze manufacturing growth in key markets.





Furthermore, we have also seen a significant uptick in legislation focused on tackling the issue of forced labor with the implementation of the Uyghur Forced Labor Prevention Act in the U.S., and similar laws and initiatives either implemented or under consideration in Europe, the United Kingdom, Australia, and Japan. It is becoming increasingly apparent that the exposure of Chinese solar supply chains to forced labor represents a significant risk for China's solar industry and its license to operate in key markets.

While solar manufacturers who do not benefit from the Chinese government's support have long had to contend with unfriendly policies in their home markets, the developments of 2022 have significantly changed the equation and enhanced the policy certainty and level playing field needed to catalyze manufacturing growth in key markets.

It is increasingly apparent that we are at the beginning of a journey that could challenge China's near-absolute dominance of global solar supply chains.

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LOOKING TO THE FUTURE

Looking forward to 2023, we are pleased to enter the year with solid fundamentals, including a record backlog of orders and a manufacturing capacity growth plan that is well underway. We are on track to add 6.2 GW of global nameplate manufacturing capacity this year as our new Series 7 factories come online in the U.S. and India. We expect to exit 2023 with 16 GW of annual nameplate capacity.

We are on track to add 6.2 GW of global nameplate manufacturing capacity this year.

We also expect 2023 to be a pivotal year as we build on the foundations established in 2022 to scale manufacturing, invest in R&D, and evolve our technology and product roadmap. Our new Series 7 factories remain on schedule, and once fully ramped, are expected to lead the fleet in terms of module wattage and efficiency, and, regionally, on a cost per watt basis. Based on our current technology roadmap, we see the potential for meaningful improvement in our module performance, with a mid-term goal of achieving a 570-watt monofacial Series 7 module.

Furthermore, we continue to evaluate the opportunity for further investments in incremental manufacturing capacity, including both greenfield expansion and throughput optimization of our currently planned capacity in the United States. While no expansion decisions have been made at this time, the evaluation will require, among other things, an understanding of the anticipated guidance from the U.S. Department of Treasury and the Internal Revenue Service (IRS) with respect to domestic content provisions in the Inflation Reduction Act. The evaluation will also require confidence in the presence of a robust supply chain that supports our expansion objectives.

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A Journey of Transformational Growth.



Just over six years ago, we began our journey to unprecedented, transformational growth when we decided to accelerate our Series 6 module program and successfully introduced and commercialized the world's first large-format thin film module.

Since then, we have taken numerous decisions intended to transform First Solar and continue to position it for growth. This included pivoting away from our legacy engineering, procurement, and construction (EPC), project development, and operations and maintenance (O&M) businesses to focus on our core strengths: technology and manufacturing. We continued investing in R&D to further our technology roadmap, while optimizing our manufacturing model in preparation for scale.

We also took a conscious decision to double down on our commitments to sustainability and Responsible Solar, setting the bar for solar technology that is not simply eco-efficient, but socially responsible. Moreover, even before the policy environment evolved to its current focus on domestic manufacturing, we doubled down on manufacturing expansion in the U.S. and India.

Today, our unique ability to play the long game while rapidly responding to emerging opportunities, and the resulting pathway to growth that we see ahead of us is a direct result of the decisions taken in our journey thus far. And while we entered the current decade from a position of strength, we are focused on exiting it even stronger, setting the stage for longer-term growth and profitability. From our vantage point, a third of a way through this decade, we believe that we are well-positioned to achieve that goal.

As we are poised to take on this next phase in our journey, we would like to thank you, our shareholders, for traveling this road with us. Your support and unwavering belief that we are on a journey to something great has enabled our success.

Together, we are building the company to lead the world's sustainable energy future.

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UNITED STATES SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

Form 10-K

(Mark one)

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**
For the fiscal year ended December 31, 2022

or

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**
For the transition period from to

Commission file number: 001-33156



First Solar, Inc.

(Exact name of registrant as specified in its charter)

Delaware	**20-4623678**
(State or other jurisdiction of incorporation or organization)	*(I.R.S. Employer Identification No.)*

350 West Washington Street, Suite 600
Tempe, Arizona 85288
(Address of principal executive offices, including zip code)

(602) 414-9300
(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading symbol(s)	Name of each exchange on which registered
Common stock, $0.001 par value	FSLR	The NASDAQ Stock Market LLC

Securities registered pursuant to Section 12(g) of the Act:

None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☒ No ☐

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ No ☒

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	☒	Accelerated filer	☐	Non-accelerated filer	☐
Smaller reporting company	☐	Emerging growth company	☐		

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☒

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes ☐ No ☒

The aggregate market value of the registrant's common stock held by non-affiliates of the registrant as of June 30, 2022, the last business day of the registrant's most recently completed second fiscal quarter, was approximately $7.2 billion (based on the closing price of the registrant's common stock on that date). As of February 24, 2023, 106,609,094 shares of the registrant's common stock, $0.001 par value per share, were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

The information required by Part III of this Form 10-K, to the extent not set forth herein, is incorporated by reference from the registrant's definitive proxy statement relating to the Annual Meeting of Shareholders to be held in 2023, which will be filed with the Securities and Exchange Commission within 120 days after the end of the fiscal year to which this Form 10-K relates.

FIRST SOLAR, INC.

FORM 10-K FOR THE YEAR ENDED DECEMBER 31, 2022

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Throughout this Annual Report on Form 10-K, we refer to First Solar, Inc. and its consolidated subsidiaries as "First Solar," "the Company," "we," "us," and "our." When referring to our manufacturing capacity, total sales, and solar module sales, the unit of electricity in watts for megawatts ("MW") and gigawatts ("GW") is direct current ("DC" or "$_{DC}$") unless otherwise noted. When referring to projects or systems, the unit of electricity in watts for MW and GW is alternating current ("AC" or "$_{AC}$") unless otherwise noted.

CAUTIONARY STATEMENT REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K contains forward-looking statements within the meaning of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and the Securities Act of 1933, as amended (the "Securities Act"), which are subject to risks, uncertainties, and assumptions that are difficult to predict. All statements in this Annual Report on Form 10-K, other than statements of historical fact, are forward-looking statements. These forward-looking statements are made pursuant to safe harbor provisions of the Private Securities Litigation Reform Act of 1995. The forward-looking statements include statements, among other things, concerning: effects resulting from certain module manufacturing changes; our business strategy, including anticipated trends and developments in and management plans for our business and the markets in which we operate; future financial results, operating results, revenues, gross margin, operating expenses, products, projected costs (including estimated future module collection and recycling costs), warranties, solar module technology and cost reduction roadmaps, restructuring, product reliability, investments, and capital expenditures; our ability to continue to reduce the cost per watt of our solar modules; the impact of public policies; the potential impact of legislation intended to encourage renewable energy investments through tax credits; our ability to expand manufacturing capacity worldwide; the impact of supply chain disruptions, which may affect the procurement of raw materials used in our manufacturing process and the distribution of our modules; research and development programs and our ability to improve the wattage of our solar modules; sales and marketing initiatives; and competition. In some cases, you can identify these statements by forward-looking words, such as "estimate," "expect," "anticipate," "project," "plan," "intend," "seek," "believe," "forecast," "foresee," "likely," "may," "should," "goal," "target," "might," "will," "could," "predict," "continue," "contingent," and the negative or plural of these words, and other comparable terminology.

Forward-looking statements are only predictions based on our current expectations and our projections about future events. All forward-looking statements included in this Annual Report on Form 10-K are based upon information available to us as of the filing date of this Annual Report on Form 10-K and therefore speak only as of the filing date. You should not place undue reliance on these forward-looking statements. We undertake no obligation to update any of these forward-looking statements for any reason, whether as a result of new information, future developments, or otherwise. These forward-looking statements involve known and unknown risks, uncertainties, and other factors that may cause our actual results, levels of activity, performance, or achievements to differ materially from those expressed or implied by these statements. These factors include, but are not limited to:

- structural imbalances in global supply and demand for photovoltaic solar modules;
- the market for renewable energy, including solar energy;
- our competitive position and other key competitive factors;
- the reduction, elimination, or expiration of government subsidies, policies, and support programs for solar energy projects and other renewable energy projects;
- the impact of public policies, such as tariffs or other trade remedies imposed on solar cells and modules;
- the passage of legislation intended to encourage renewable energy investments through tax credits, such as the Inflation Reduction Act of 2022;
- our ability to execute on our long-term strategic plans, including our ability to secure financing;
- our ability to execute on our solar module technology and cost reduction roadmaps;
- our ability to incorporate technology improvements into our manufacturing process, including the production of bifacial solar modules and next generation Series 7 modules;

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- our ability to improve the wattage of our solar modules;
- interest rate fluctuations and our customers' ability to secure financing;
- the loss of any of our large customers, or the ability of our customers and counterparties to perform under their contracts with us;
- the severity and duration of public health threats (including pandemics such as COVID-19), including its potential impact on the Company's business, financial condition, and results of operations;
- the satisfaction of conditions precedent in our sales agreements;
- our ability to attract new customers and to develop and maintain existing customer and supplier relationships;
- our ability to construct new production facilities to support new product lines;
- general economic and business conditions, including those influenced by U.S., international, and geopolitical events;
- environmental responsibility, including with respect to Cadmium Telluride and other semiconductor materials;
- claims under our limited warranty obligations;
- changes in, or the failure to comply with, government regulations and environmental, health, and safety requirements;
- effects arising from and results of pending litigation;
- future collection and recycling costs for solar modules covered by our module collection and recycling program;
- supply chain disruptions, including demurrage and detention charges;
- our ability to protect our intellectual property;
- our ability to prevent and/or minimize the impact of cyber-attacks or other breaches of our information systems;
- our continued investment in research and development;
- the supply and price of components and raw materials, including Cadmium Telluride;
- our ability to attract and retain key executive officers and associates; and
- all other matters discussed in Item 1A. "Risk Factors" and elsewhere in this Annual Report on Form 10-K, our subsequently filed Quarterly Reports on Form 10-Q, and our other filings with the Securities and Exchange Commission (the "SEC").

You should carefully consider the risks and uncertainties described under this section.

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PART I

Item 1. *Business*

Company Overview

We are a leading American solar technology company and global provider of photovoltaic ("PV") solar energy solutions. Developed at our research and development ("R&D") labs in California and Ohio, we manufacture and sell PV solar modules with an advanced thin film semiconductor technology that provide a high-performance, lower-carbon alternative to conventional crystalline silicon PV solar modules. From raw material sourcing through end-of-life module recycling, we are committed to reducing the environmental impacts and enhancing the social and economic benefits of our products across their life cycle. We are the world's largest thin film PV solar module manufacturer and the largest PV solar module manufacturer in the Western Hemisphere.

In addressing the overall global demand for electricity, our modules provide energy at a lower levelized cost of electricity ("LCOE"), meaning the net present value of a system's total life cycle costs divided by the quantity of energy that is expected to be produced over the system's life, when compared to traditional forms of energy generation. With over $1 billion in cumulative R&D investments in the last 10 years alone, we have a demonstrated history of innovation and continuous improvement. We believe our strategies and points of differentiation provide the foundation for our competitive position and enable us to remain one of the preferred providers of PV solar modules.

Business Strategy

Advanced Module Technology

Our current module semiconductor structure is a single-junction polycrystalline thin film that uses Cadmium Telluride ("CdTe") as the absorption layer. CdTe has absorption properties that are well matched to the solar spectrum and can deliver competitive wattage using approximately 2% to 3% of the amount of semiconductor material used to manufacture conventional crystalline silicon modules. In terms of performance, in many climates our solar modules provide certain energy production advantages relative to competing crystalline silicon modules. For example, our CdTe solar technology provides:

- a superior temperature coefficient, which results in stronger system performance in typical high insolation climates as the majority of a system's generation, on average, occurs when module temperatures are well above 25°C (standard test conditions);
- a superior spectral response in humid environments where atmospheric moisture alters the solar spectrum relative to standard test conditions;
- a better partial shading response than competing crystalline silicon technologies, which may experience significantly lower energy generation than CdTe solar technologies when partial shading occurs; and
- an immunity to cell cracking and its resulting power output loss, a common failure often observed in crystalline silicon modules caused by poor manufacturing, handling, weather, or other conditions.

In addition to these technological advantages, we also warrant that our solar modules will produce at least 98% of their labeled power output rating during the first year, with the warranty coverage reducing by a degradation factor between 0.3% and 0.5%, depending on the module series, every year thereafter throughout the limited power output warranty period of up to 30 years. As a result of these and other factors, our solar modules can produce more annual energy in real world operating conditions than conventional crystalline silicon modules with the same nameplate capacity.

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Manufacturing Process

Our modules combine our leading-edge CdTe technology with the manufacturing excellence and quality control that comes from being the world's most experienced producer of thin film PV solar modules. With more than 50 GW_{DC} of modules sold worldwide, we have a demonstrated history of manufacturing success and innovation. Our global manufacturing footprint includes facilities in the United States, Malaysia, and Vietnam. We are in the process of expanding our manufacturing capacity by approximately 11 GW_{DC}, including the construction of our third manufacturing facility in the United States, which commenced commercial production of modules in early 2023; our first manufacturing facility in India, which is expected to commence operations in the second half of 2023; our fourth manufacturing facility in the United States, which is expected to commence operations in late 2024; and the expansion of our manufacturing footprint at our existing facilities in Ohio. Our newest factory in the United States began producing and our newest factory in India is expected to produce our next generation Series 7 modules, which combine our thin film CdTe technology with a larger form factor and an innovative steel back rail mounting structure that reduces module installation time.

Our modules are manufactured in a high-throughput, automated environment that integrates all manufacturing steps into a continuous flow process. Such process eliminates the multiple supply chain operators and resource-intensive batch processing steps that are used to produce crystalline silicon modules, which typically occur over several days and across multiple factories. At the outset of our module production, a sheet of glass enters the production line and in a matter of hours is transformed into a completed module ready for shipment.

This proprietary production process includes the following three stages: (i) the deposition stage, (ii) the cell definition and treatment stage, and (iii) the assembly and test stage. In the deposition stage, panels of transparent oxide-coated glass are robotically loaded onto the production line where they are cleaned, laser-mark identified with a serial number, heated, and coated with thin layers of CdTe and other semiconductor materials using our vapor transport deposition technology, after which the semiconductor-coated plates are cooled rapidly to increase glass strength. In the cell definition and treatment stage, we use high-speed lasers to transform the large continuous semiconductor coating on the glass plate into a series of interconnected cells that deliver the desired current and voltage output. In this stage, we also treat the semiconductor film using certain chemistries and processes to improve the device's performance and apply a metal sputtered back contact. In the assembly and test stage, we apply busbars, inter-layer material, and a rear glass cover sheet that is laminated to encapsulate the device. We then apply anti-reflective coating material to the substrate glass to further improve the module's performance by increasing its ability to absorb sunlight. Finally, junction boxes, termination wires, and a frame are applied to complete the module assembly.

We maintain a robust quality and reliability assurance program that monitors critical process parameters and measures product performance to ensure that industry and more stringent internal standards are met. We also conduct acceptance testing for electrical leakage, visual quality, and power measurement on a solar simulator prior to preparing a module for shipment. Our quality and reliability tests complement production surveillance with an ongoing monitoring program, subjecting production modules to accelerated life stress testing to help ensure ongoing conformance to requirements of the International Electrotechnical Commission and Underwriters Laboratories Inc. These programs and tests help assure delivery of power and performance in the field with a high level of product quality and reliability.

Research and Development

Our R&D model differentiates us from much of our competition due to its vertical integration, from advanced research to product development, manufacturing, and applications. We continue to devote substantial resources to our R&D efforts, which generally focus on continually improving the wattage and energy yield of our solar modules. We also have R&D programs to improve module durability and manufacturing efficiencies, including throughput, volume ramp, and material cost reduction. We continue to invest significant financial resources in such initiatives, including approximately $0.3 billion for a dedicated R&D facility in the United States to support the

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implementation of our technology roadmap. We expect such R&D facility to feature a high-tech pilot manufacturing line, allowing for the production of full-sized prototypes of thin film and tandem PV modules. Such R&D facility is expected to be completed in 2024. Based on publicly available information, we are one of the leaders in R&D investment among PV solar module manufacturers.

In the course of our R&D activities, we explore various technologies in our efforts to sustain competitive differentiation in our modules. We primarily conduct our R&D activities and qualify process and product improvements for full production at our Perrysburg, Ohio plant and systematically deploy them to our other facilities. We believe that our systematic approach to technology change management enables continuous improvements and ensures uniform adoption across our production lines. In addition, our production lines are replicas or near replicas of each other and, as a result, a process or production improvement on one line can be rapidly and reliably replicated across other production lines.

We regularly produce research cells in our laboratories, some of which are tested for performance and certified by independent labs, such as the National Renewable Energy Laboratory. Cell efficiency measures the proportion of light converted to electricity in a single solar cell at standard test conditions. Our research cells are produced using laboratory equipment and methods and are not intended to be representative of our manufacturing capability. Our module conversion efficiency has improved on average more than half a percent every year for the last ten years. We currently hold two world records for CdTe PV cell efficiency, achieving an independently certified research cell efficiency of 22.1% and a module aperture area efficiency of 19.7%. We continue to evaluate opportunities to develop and leverage other solar cell technologies in multi-junction applications consisting of CdTe, silicon, or other materials. We believe such applications have the potential to enable our module conversion efficiency to reach 28% by 2030.

Sustainability

We are committed to enhancing the social and economic benefits of our products and reducing our carbon footprint, even as we continue to increase our manufacturing capacity and module throughput. Our thin film modules are manufactured through an integrated process that uses less energy, water, and semiconductor material than conventional crystalline silicon modules. Accordingly, our modules provide an ecologically leading solution to address climate change, energy security, and water scarcity. On a lifecycle basis, our thin film module technology has the fastest energy payback time, smallest carbon footprint, and lowest water use of any competing PV solar technology.

The energy payback time of our module technology, which is the amount of time a module must operate to generate the energy required to produce it, is facilitated by our proprietary and resource efficient production process. Our module energy payback time is approximately four months, which represents a 90-fold energy return on investment over a theoretical 30-year system lifetime and an abundant net energy gain to the electricity grid. Furthermore, our modules have a carbon footprint that is 2.5 times lower and a water footprint that is three times lower than conventional crystalline silicon modules, measured on a lifecycle basis that accounts for the energy and water used for the raw materials, throughout our manufacturing process, and during end-of-life module recycling. In addition, our industry-leading PV solar module recycling process further enhances our sustainability advantage by recovering approximately 90% of the glass for reuse in new glass container products and over 90% of the semiconductor material for reuse in new modules. The module frame is removed and recycled for reuse in aluminum products, and in Malaysia, the recovered laminate material is reused in rubber products. We are the only PV solar module manufacturer with global in-house recycling capabilities.

Our Series 6™ (“Series 6”) and Series 6 Plus™ (“Series 6 Plus”) modules are the world’s first and only PV products to be included in the Electronic Product Environmental Assessment Tool (“EPEAT”) Registry’s Photovoltaic Modules and Inverters product category. The EPEAT Registry enables the identification of credible sustainable electronic products from a broad range of manufacturers based on several factors, including the management of substances in the product, manufacturing energy, water use, product packaging, end-of-life recycling, corporate

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responsibility, and human rights. We have also committed to the RE100 campaign, a collaborative, global initiative of influential businesses committed to 100% renewable electricity, in which we plan to utilize renewable sources to power our manufacturing operations by 2028. We have set science-based targets to reduce our absolute direct (scope 1) and indirect (scope 2) greenhouse gas emissions by 34% by 2028, from a 2020 baseline, and achieve net zero emissions by 2050. As a result of these commitments and our engagement with key suppliers to minimize the carbon footprint of our module components, we expect to reduce our module carbon footprint by more than 65% by 2028, further enabling our customers to achieve their sustainability objectives.

Financial Stability

In addition to our sustainability commitments, we are also committed to creating long-term shareholder value through a decision-making framework that delivers a balance of growth, profitability, and liquidity. This framework has enabled us to fund our module manufacturing and capacity expansion initiatives primarily using cash flows generated by our operations and by maintaining appropriate debt levels based on cash flow expectations. Our financial stability provides strategic optionality as we evaluate how to invest in our business and generate returns for our shareholders. Our financial stability also enables us to offer meaningful warranties, which provide us with a competitive advantage relative to many of our peers in the solar industry. Furthermore, we expect our financial discipline and ability to manage operating costs to enhance our profitability as we continue to scale our business.

Market Overview

Solar energy is one of the fastest growing forms of renewable energy with numerous economic and environmental benefits that make it an attractive complement to and/or substitute for traditional forms of energy generation. In recent years, the cost of producing electricity from PV solar power systems has decreased to levels that are competitive with or below the wholesale price of electricity in many markets. This price decline has opened new possibilities to develop systems in many locations with limited or no financial incentives, thereby promoting the widespread adoption of solar energy. Other technological developments in the industry, such as the advancement of energy storage capabilities, have further enhanced the prospects of solar energy as an alternative to traditional forms of energy generation. In addition to these economic benefits, solar energy has substantial environmental benefits. For example, PV solar power systems generate no greenhouse gas or other emissions and use minimal amounts of water compared to traditional energy generation assets. As a result of these and other factors, worldwide solar markets continue to develop and expand.

Recently enacted government support programs, such as the Inflation Reduction Act of 2022 (the "IRA"), have contributed and are expected to continue to contribute to this momentum by providing solar module manufacturers, project developers, and project owners with tax incentives to accelerate the ongoing transition to clean energy. The provisions of the IRA are generally effective for tax years beginning after 2022 and, based on recent U.S. Treasury Department estimates, are expected to provide aggregate funding of $369 billion to address climate change, of which $270 billion is expected in the form of various tax incentives. Among other things, the IRA (i) reinstates the 30% investment tax credit for qualifying solar projects that meet certain wage and apprenticeship requirements, (ii) extends the production tax credit ("PTC") to include energy generated from solar projects, (iii) provides incremental investment and production tax credits for solar projects that meet certain domestic content and location requirements, and (iv) offers tax credits for solar modules and solar module components manufactured in the United States and sold to third parties. In light of such regulatory developments, we have commenced certain manufacturing expansion activities and continue to evaluate opportunities for future expansion, particularly within the United States, as described below under "Global Markets." For more information about certain risks associated with the IRA, see Item 1A. "Risk Factors – We expect certain financial benefits as a result of tax incentives provided by the Inflation Reduction Act of 2022. If these expected financial benefits vary significantly from our assumptions, our business, financial condition, and results of operations could be adversely affected."

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Although module average selling prices in many global markets have declined for several years, recent module spot pricing has increased, in part, due to trade measures and policies, government regulations, raw material availability, and supply chain disruptions. For example, module spot pricing in the United States has increased, in part, due to elevated commodity and logistics costs and, more recently, due to the rising demand for modules manufactured in the United States as a result of the IRA described above. The duration of this elevated period of pricing is uncertain. In light of such market realities, we continue to focus on our strategies and points of differentiation, which include our advanced module technology, our manufacturing process, our R&D capabilities, the sustainability advantage of our modules, and our financial stability.

Global Markets

We have established and continue to develop a global business presence. Energy markets are, by their nature, localized, with different drivers and market forces impacting electricity generation and demand in a particular region or for a particular application. Accordingly, our business is evolving worldwide and is shaped by the varying ways in which our modules can provide compelling and economically viable solutions to energy needs in various markets. We are currently focusing on markets, including those listed below, in which our CdTe solar modules provide certain advantages over conventional crystalline silicon solar modules, including high insolation climates in which our modules provide a superior temperature coefficient, humid environments in which our modules provide a superior spectral response, markets that favor the superior sustainability profile of our PV solar technology, and markets that value responsible sourcing through transparent supply chain reporting and ethical business practices. To the extent our production capacity expands in future periods, we have the potential to extend our focus to additional geographic markets.

United States. Multiple markets within the United States, which accounted for 84% of our 2022 net sales, exemplify favorable characteristics for a solar market, including (i) sizeable electricity demand, particularly around growing population centers and industrial areas; (ii) strong demand for renewable energy generation; and (iii) abundant solar resources. In those areas and applications in which these factors are more pronounced, our PV solar modules compete favorably on an economic basis with traditional forms of energy generation. The market penetration of PV solar is also impacted by certain federal and state support programs described below under "Support Programs." The United States currently has an installed solar generation capacity of approximately 140 GW_{DC}, which is expected to double by 2027 due, in part, to the economic incentives provided by the IRA. In addition, the government has established a net-zero carbon emissions target by 2050. As a result of such market opportunities and renewable targets, we are in the process of expanding our U.S. manufacturing capacity by approximately 7.7 GW_{DC}, including the construction of our third manufacturing facility in the U.S., which commenced commercial production of modules in early 2023, our fourth manufacturing facility in the U.S., which is expected to commence operations in late 2024, and the expansion of our manufacturing footprint at our existing facilities in Ohio.

India. India continues to represent one of the largest and fastest growing markets for PV solar energy with an installed generation capacity of approximately 63 GW_{AC}, approximately 30 GW_{AC} of projects under various stages of construction, and over 19 GW_{AC} of new projects being contracted under active procurement programs. In addition, the government has established aggressive renewable energy targets, which include increasing the country's overall renewable energy capacity to 500 GW_{AC} by 2030 and establishing a net-zero carbon emissions target by 2070. Based on these targets, it is projected that the installed solar energy generation capacity will be 350 GW_{AC} by 2030. The government has also announced a series of policy and regulatory measures to incentivize domestic manufacturing of PV solar modules, as described below under "Support Programs." These targets, policies, and regulatory measures are expected to help create significant and sustained demand for PV solar energy. In addition to these factors, our CdTe solar technology is well suited for the India market given its hot and humid climate conditions. As a result of such market opportunities, we are in the process of expanding our manufacturing capacity by an additional 3.3 GW_{DC} by constructing our first manufacturing facility in India, which is expected to commence operations in the second half of 2023. Such expansion builds upon our existing presence of approximately 2.2 GW_{DC} of modules sold in India.

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Europe. Most markets across Europe reflect strong demand for PV solar energy due to its ability to compete economically with more traditional forms of energy generation and, more recently, as a means to establish greater energy independence. During 2022, European Union ("EU") member states added a combined 41 GW_{DC} of solar capacity, representing the largest annual solar deployment in the region in the last 10 years. Such expansion, which was primarily driven by solar capacity additions in Germany, Spain, Poland, the Netherlands, and France, brings the region's installed generation capacity to approximately 209 GW_{DC}. We continue to pursue module sales activities in many of the countries mentioned above.

Support Programs

Although we compete in markets that do not require solar-specific government subsidies or support programs, our net sales and profits remain subject to variability based on the scope of tax and production incentives, renewable portfolio standards, tendering systems, and other policies or support programs intended to stimulate economies, achieve decarbonization initiatives, and/or establish greater energy independence. Such programs continue to influence the demand for PV solar energy around the world.

United States. In the United States, support programs exist at both the federal and state levels and can take the form of investment and production tax credits, sales and property tax exemptions and abatements, and/or renewable energy targets. Such incentives include the following:

- *Advanced Manufacturing Production Credit*. In August 2022, the U.S. President signed the IRA into law, which is intended to accelerate the country's ongoing transition to clean energy. The provisions of the IRA are generally effective for tax years beginning after 2022. As discussed above, the IRA offers various tax credits, including the advanced manufacturing production credit, pursuant to Section 45X of the Internal Revenue Code (the "IRC"), for solar modules and solar module components manufactured in the United States and sold to third parties. Such credit, which may be refundable or transferable to a third party, is available through 2032, subject to phase down beginning in 2030. For eligible components, the credit is equal to (i) $12 per square meter for a PV wafer, (ii) 4 cents multiplied by the capacity of a PV cell, and (iii) 7 cents multiplied by the capacity of a PV module. Such credit is expected to increase domestic manufacturing of solar modules and solar module components in the near term. For more information about certain risks associated with the benefits available to us under the IRA, see Item 1A. "Risk Factors – We expect certain financial benefits as a result of tax incentives provided by the Inflation Reduction Act of 2022. If these expected financial benefits vary significantly from our assumptions, our business, financial condition, and results of operations could be adversely affected." For more information about pending and ongoing developments related to the IRA, see Item 7. "Management's Discussion and Analysis of Financial Condition and Results of Operations - Certain Trends and Uncertainties."

- *Investment Tax Credit.* At the federal level, investment tax credits for business and residential solar systems have gone through several cycles of enactment and expiration since the 1980s. The current federal energy investment tax credit ("ITC") for solar energy property requires projects to meet certain wage and apprenticeship requirements and to have commenced construction by a certain date, which may be achieved by certain qualifying procurement activities. In 2020, the U.S. Congress extended the 26% ITC through 2022 as part of its COVID-19 relief efforts, and such credit was scheduled to step down to 22% for projects that commence construction in 2023. However, during 2022, the U.S. Congress reinstated the 30% ITC through 2032 as part of the IRA discussed above. Such credit is currently scheduled to step down to 26% for projects that commence construction in 2033, 22% for projects that commence construction in 2034, and will expire thereafter. The ITC has been an important economic driver of solar installations and qualifying procurement activities in the United States, and its extension is expected to contribute to greater long-term demand. The positive impact of the ITC depends on the availability of tax equity for project financing or the ability to transfer the ITC to other taxpayers.

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- *R&D grants*. In July 2022, the U.S. Department of Energy Solar Energy Technologies Office announced the 2022 Solar Manufacturing Incubator Funding Opportunity, which provides up to $27 million for qualifying solar R&D projects, particularly those related to CdTe. These grants are intended to accelerate and expand domestic solar R&D to strengthen U.S. solar manufacturing and contribute to renewable energy targets. Award recipients are expected to be announced in early 2023.

- *Renewable portfolio standards.* Many states have enacted legislation adopting Renewable Portfolio Standard ("RPS") mechanisms. Under an RPS, regulated utilities and other load serving entities are required to procure a specified percentage of their total retail electricity sales to end-user customers from eligible renewable resources, such as solar energy generation facilities, by a specified date. For example, California's RPS program, which is one of the most significant in the United States in terms of the volume of renewable electricity required to meet its RPS mandate, currently requires utilities and other obligated load serving entities to procure 60% of their total retail electricity demand from eligible renewable resources by 2030 and 100% of such electricity demand from carbon-free resources by 2045. Some programs may further require that a specified portion of the total percentage of renewable energy must come from solar generation facilities or other technologies. RPS mechanisms and other legislation vary significantly from state to state, particularly with respect to the percentage of renewable energy required to achieve the state's RPS, the definition of eligible renewable energy resources, and the extent to which renewable energy credits qualify for RPS compliance.

India. In India, incentives at both the federal and state levels have contributed to growth in domestic PV solar module manufacturing and solar energy installations. Such incentives include the following:

- *Production Linked Incentive.* In September 2022, the Indian government announced an expansion of the Production Linked Incentive ("PLI") scheme to INR 195 billion ($2.6 billion), which is intended to promote the manufacturing of high efficiency solar modules in India and to reduce India's dependency on foreign imports of solar modules. Under the PLI scheme, manufacturers are selected through a competitive bid process and receive certain cash incentives over a five-year period following the commissioning of their manufacturing facilities. Among other things, such incentives are based on the efficiency and temperature coefficient of the modules produced, the proportion of raw materials sourced from the domestic market, the extent to which the manufacturer's operations are fully integrated within India, and the quantity of modules sold from such manufacturing operations.

- *Import duty tariffs.* In April 2022, the Indian government began imposing import duty tariffs of 40% on solar modules and 25% on solar cells. In connection with such tariffs, the Indian government has also implemented a regulation mandating that any solar project with federal utility, state utility, or commercial and industrial off-takers that interconnects through government owned transmission lines only use solar modules from an approved list of module manufacturers, and a requirement that all federal procurement of solar modules be only from cells and modules produced domestically.

- *Green hydrogen targets*. In January 2023, the Indian government announced its National Green Hydrogen Mission ("NGHM"), which is intended to make India a hub for the production and export of green hydrogen and to contribute to the broader energy transition from fossil fuels to renewable energy sources. The NGHM provides for an initial outlay of approximately $225 million for pilot projects and R&D, which, among other program investments, is expected to result in 5 million metric tons of annual green hydrogen production capacity and 125 GW_{AC} of incremental renewable energy capacity, among other initiatives, by 2030. The Ministry of New and Renewable Energy ("MNRE") will be responsible for overall coordination and implementation of the NGHM, including formulating programs for financial incentives, and other central and state government agencies will be responsible for implementing various policies, regulations, and compliance standards.

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Europe. In Europe, renewable energy targets, in conjunction with tenders for utility-scale PV solar and other support measures, have contributed to growth in PV solar markets. Renewable energy targets prescribe how much energy consumption must come from renewable sources, while incentive policies and competitive tender policies are intended to support new supply development by providing certainty to investors. Such targets and policies include the following:

- *REPowerEU plan.* In May 2022, the European Commission set forth its REPowerEU plan, which aims to reduce dependence on Russian fossil fuels by 2027. The REPowerEU plan supports the EU's rapid deployment of renewable energy sources, including solar energy, as a means to establish greater energy independence. Such plan sets forth targets for all EU member states, which includes an EU energy mix with a 45% share of energy from renewable sources by 2030. Solar targets for the same period include 300 GW_{AC} installed by 2025 and 600 GW_{AC} by 2030. The REPowerEU plan also aims to facilitate solar deployment through easier access to land and a framework to expedite permitting at national and local levels.

- *Renewable energy tenders.* Certain markets in Europe, such as France, have adopted regulations for public tenders of renewable energy to prioritize PV solar power systems that utilize solar modules produced in low-carbon manufacturing processes. Such regulations require developers to provide information about the carbon footprint of PV solar modules used in their utility-scale projects and precludes the use of module technology that does not meet certain minimum carbon footprint thresholds.

Various proposed and contemplated environmental and tax policies may create regulatory uncertainty in the renewable energy sector, including the solar energy sector, and may lead to a reduction or removal of various clean energy programs and initiatives designed to curtail climate change. For more information about the risks associated with these potential government actions, see Item 1A. "Risk Factors – The reduction, elimination, or expiration of government subsidies, economic incentives, tax incentives, renewable energy targets, and other support for on-grid solar electricity applications, or the impact of other public policies, such as tariffs or other trade remedies imposed on solar cells and modules, could negatively impact demand and/or price levels for our solar modules and limit our growth or lead to a reduction in our net sales or increase our costs, thereby adversely impacting our operating results."

Modules Business

Our primary segment is our modules business, which involves the design, manufacture, and sale of CdTe solar modules, which convert sunlight into electricity. Since the inception of First Solar, our modules have used our advanced thin film semiconductor technology. Each of our currently produced Series 6 and Series 6 Plus modules is a glass laminate approximately 4ft x 6ft in size that encapsulates thin film semiconductor materials. Our Series 7 modules, which we began producing in early 2023 at our newest manufacturing facility in the U.S. and expect to begin producing in India in the second half of 2023, are expected to have a larger form factor of approximately 4ft x 7ft in size. At the end of 2022, our modules had an average power output of 467 watts.

Raw Materials

Our module manufacturing process uses approximately 30 types of raw materials and components to construct a solar module, including CdTe, front glass coated with transparent conductive oxide, other semiconductor materials, organics such as photo resist, tempered back glass, frames, packaging components such as interlayer, cord plate/cord plate cap, lead wire, and solar connectors. Before we use these materials and components in our manufacturing process, a supplier must undergo rigorous qualification procedures, and we continually evaluate new suppliers as part of our cost reduction roadmap and expansion activities. When possible, we attempt to use suppliers that can provide a raw material supply source that is near our manufacturing locations, reducing the cost and lead times for such materials. For more information about the risks associated with our supply chain, see Item 1A. "Risk Factors – Several of our key raw materials and components are either single-sourced or sourced from a limited number of

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suppliers, and their failure to perform could cause manufacturing delays and impair our ability to deliver solar modules to customers in the required quality and quantities and at a price that is profitable to us."

Customers

Our customers include developers and operators of systems, utilities, independent power producers, commercial and industrial companies, and other system owners. During 2022, our third-party module sales represented approximately 93% of our total net sales, and we sold the majority of our solar modules to developers and operators of systems in the United States. During 2022, Intersect Power, Lightsource BP, and NextEra Energy each accounted for more than 10% of our modules business net sales. For more information about risks related to our customers, see Item 1A. "Risk Factors – The loss of any of our large customers, or the inability of our customers and counterparties to perform under their contracts with us, could significantly reduce our net sales and negatively impact our results of operations.

We continue to focus on certain key geographic markets, particularly in areas with abundant solar resources and sizable electricity demand, and additional customer relationships to diversify our customer base. The wholesale commercial and industrial market continues to represent a promising opportunity for the widespread adoption of PV solar technology as corporations undertake certain sustainability commitments. The demand for corporate renewables continues to accelerate, with corporations worldwide committing to the RE100 campaign. We believe we also have a competitive advantage in the commercial and industrial market due to many customers' sensitivity to the sustainability, experience, and financial stability of their suppliers and geographically diverse operating locations. With our sustainability advantage, financial strength, and global footprint, we are well positioned to meet these needs.

Additionally, the increase of utility-owned generation has expanded the number of potential buyers of our modules as such utility customers benefit from a potentially low cost of capital available through rate-based utility investments. Given their long-term ownership profile, utility-owned generation customers typically seek to partner with stable companies that can provide low-cost alternatives to or replacements for aging fossil fuel-based generation resources, including reliable PV solar technology, thereby mitigating their long-term ownership risks.

Competition

The solar energy and renewable energy sectors are highly competitive and continually evolving as participants in these sectors strive to distinguish themselves within their markets and compete within the larger electric power industry. Among PV solar module manufacturers, the principal method of competition is sales price per watt, which may be influenced by several module value attributes, including wattage (through a larger form factor or an improved conversion efficiency), energy yield, degradation, sustainability, and reliability. Sales price per watt may also be influenced by warranty terms and customer payment terms. We face intense competition for sales of solar modules, which may result in reduced selling prices and loss of market share. Our primary source of competition is crystalline silicon module manufacturers, the majority of which are linked to China. Allegations of forced labor in the Chinese solar supply chain have emerged in recent years, which means we also compete on our approach to responsible sourcing and supply chain due diligence. Our differentiated technology, integrated manufacturing process, and tightly controlled supply chain helps limit the risks associated with outsourcing and the multiple supply tiers of conventional crystalline silicon module manufacturing.

We also expect to compete with future entrants into the PV solar industry and existing market participants that offer new or differentiated technological solutions. For additional information, see Item 1A. "Risk Factors – Our failure to further refine our technology and develop and introduce improved PV products, including as a result of delays in implementing planned advancements, could render our solar modules uncompetitive and reduce our net sales, profitability, and/or market share."

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Certain of our existing or future competitors, including many linked to China, may have direct or indirect access to sovereign capital or other forms of state support, which could enable such competitors to operate at minimal or negative operating margins for sustained periods of time. Our results of operations could be adversely affected if competitors reduce module pricing to levels below their costs, bid aggressively low prices for module sale agreements, or are able to operate at minimal or negative operating margins for sustained periods of time. We believe the solar industry may experience periods of structural imbalance between supply and demand, which could lead to periods of pricing volatility. For additional information, see Item 1A. "Risk Factors – Competition in solar markets globally and across the solar value chain is intense and could remain that way for an extended period of time. The solar industry may experience periods of structural imbalance between global PV module supply and demand that result in periods of pricing volatility, which could have a material adverse effect on our business, financial condition, and results of operations."

Solar Module Warranties

We provide a limited PV solar module warranty covering defects in materials and workmanship under normal use and service conditions for up to 12.5 years. We also typically warrant that modules installed in accordance with agreed-upon specifications will produce at least 98% of their labeled power output rating during the first year, with the warranty coverage reducing by a degradation factor every year thereafter throughout the limited power output warranty period of up to 30 years. Among other things, our solar module warranty also covers the resulting power output loss from cell cracking. For additional information on our solar module warranty programs, refer to Item 1A. "Risk Factors – Problems with product quality or performance may cause us to incur significant and/or unexpected contractual damages and/or warranty and related expenses, damage our market reputation, and prevent us from maintaining or increasing our market share."

Solar Module Collection and Recycling

We are committed to mitigating the environmental impact of our products over their entire life cycle. As part of such efforts, we offer recycling services to help module owners meet their end-of-life ("EOL") obligations. In 2005, we voluntarily established the industry's first global and comprehensive module collection and recycling program, and in 2013 we implemented a "pay-as-you-go" recycling service. We continue to invest in module recycling technology improvements to increase recycling efficiency and reduce recycling prices for our customers. Our module recycling process is designed to maximize the recovery of materials, including the glass and encapsulated semiconductor material, for use in new modules or other products and enhances the sustainability profile of our modules. Approximately 90% of each collected First Solar module can be recycled into materials for reuse. We currently operate recycling facilities at our manufacturing sites in the United States, Malaysia, and Vietnam and at our former manufacturing facility in Germany.

For certain legacy customer sales contracts that were covered under the 2005 module collection and recycling program, which has since been discontinued, we agreed to pay the costs for the collection and recycling of qualifying solar modules, and the end users agreed to notify us, disassemble their solar power systems, package the solar modules for shipment, and revert ownership rights over the modules back to us at the end of the modules' service lives.

For modules covered under our program that were previously sold into and installed in the EU, we continue to maintain a commitment to cover the estimated collection and recycling costs consistent with our historical program. The EU's Waste Electrical and Electronic Equipment ("WEEE") Directive places the obligation of recycling (including collection, treatment, and environmentally sound disposal) of electrical and electronic equipment products upon producers and is applicable to all PV solar modules in EU member states. As a result of the transposition of the WEEE Directive by the EU member states, we have adjusted our recycling offerings, as required, to ensure compliance with specific EU member state WEEE regulations.

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Intellectual Property

Our success depends, in part, on our ability to maintain and protect our proprietary technology and to conduct our business without infringing on the proprietary rights of others. We rely primarily on a combination of patents, trademarks, and trade secrets, as well as associate and third-party confidentiality agreements, to safeguard our intellectual property. We regularly file patent applications to protect inventions arising from our R&D activities in the United States and other countries. Our patent applications and any future patent applications may not result in a patent being issued with the scope of the claims we seek, or at all, and any patents we may receive may be challenged, invalidated, or declared unenforceable. In addition, we have registered and/or have applied to register trademarks and service marks in the United States and a number of foreign countries for "First Solar."

With respect to proprietary know-how that is not patentable and processes for which patents are difficult to enforce, we rely on, among other things, trade secret protection and confidentiality agreements to safeguard our interests. We believe that many elements of our PV solar module manufacturing processes, including our unique materials sourcing, involve proprietary know-how, technology, or data that are not covered by patents or patent applications, including technical processes, equipment designs, algorithms, and procedures. We have taken security measures to protect these elements. Our R&D personnel have entered into confidentiality and proprietary information agreements with us. These agreements address intellectual property protection issues and require our associates, to the extent permitted by law, to assign to us all of the inventions, designs, and technologies they develop during the course of their employment with us that are directed towards our actual or anticipated business. We also require our customers and business partners to enter into confidentiality agreements before we disclose sensitive aspects of our modules, technology, or business plans.

Regulatory, Environmental, Health, and Safety Matters

We are subject to various federal, state, local, and international laws and regulations, and are often subject to oversight and regulation in accordance with national and local ordinances relating to building codes, safety, and other matters. The impact of these laws and requirements may increase our overall costs and may delay, prevent, or increase the cost of manufacturing PV modules. As we operate in the U.S. and internationally, we are also subject to the application of U.S. trade laws and trade laws of other countries. Such tariffs and policies, or any other U.S. or global trade remedies or other trade barriers that apply to us given our global operations, may directly or indirectly affect our business, financial condition, and results of operations. See Item 1A. "Risk Factors – Existing regulations and policies, changes thereto, and new regulations and policies may present technical, regulatory, and economic barriers to the purchase and use of PV solar products, which may significantly reduce demand for our modules."

We are also subject to the application of various anti-bribery laws, some of which prohibit improper payments to government and non-government persons and entities, and others (e.g., the U.S. Foreign Corrupt Practices Act (the "FCPA") and the U.K. Bribery Act) that extend their application to activities outside their country of origin. From time to time, we may compete against companies for contracts in China, India, South America, and the Middle East, which require substantial government contact and where norms can differ from U.S. standards, and not all competitors are subject to compliance with the same anti-bribery laws. See Item 1A. Risk Factors – "We could be adversely affected by any violations of the FCPA, the U.K. Bribery Act, and other foreign anti-bribery laws."

We are also subject to various federal, state, local, and international laws and regulations relating to the protection of the environment, including those governing the discharge of pollutants into the air and water; the use, management, and disposal of hazardous materials and wastes; occupational health and safety; and the cleanup of contaminated sites. Our operations include the use, handling, storage, transportation, generation, and disposal of hazardous materials and wastes. Therefore, we could incur substantial costs, including cleanup costs, fines, and civil or criminal sanctions and costs arising from third-party property damage or personal injury claims as a result of violations of, or liabilities under, environmental and occupational health and safety laws and regulations or non-compliance with environmental permits required for our operations. We believe we are currently in substantial compliance with applicable environmental and occupational health and safety requirements and do not expect to

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incur material expenditures for environmental and occupational health and safety controls in the foreseeable future. However, future developments such as the implementation of new, more stringent laws and regulations, more aggressive enforcement policies, or the discovery of unknown environmental conditions may require expenditures that could have a material adverse effect on our business, financial condition, or results of operations. See Item 1A. "Risk Factors – Environmental obligations and liabilities could have a substantial negative impact on our business, financial condition, and results of operations."

From time to time, we may also be subject to government policies or laws intended to protect human rights. For example, in late 2021 the U.S. President signed the Uyghur Forced Labor Prevention Act, which bans the import of goods from China's Xinjiang region into the United States due to concerns about forced labor practices in the region, which provides approximately half of the world's polysilicon supply. While we do not use polysilicon in our solar modules, which mitigates the potential supply chain disruptions and human rights risks associated with such import ban, the implementation of similar restrictions or trade embargoes on the purchase of certain materials or equipment necessary to sustain our manufacturing operations may require expenditures and process changes to ensure our supply chain remains free of such materials, which could have a material adverse effect on our business, financial condition, or results of operations. We are committed to protecting human rights, enforcing fair labor practices, and addressing the potential risks of forced labor across our own operations and the operations of our suppliers.

Human Capital

As of December 31, 2022, we had approximately 5,500 associates (our term for full and part-time employees), including approximately 4,700 in our modules business that work primarily in the United States, Malaysia, and Vietnam. The remainder of our associates are in R&D, sales and marketing, and general and administrative positions.

Our company's success depends, to a significant extent, on our ability to attract, train, and retain management, operations, sales, and technical talent, including associates in foreign jurisdictions. We strive to attract, hire, and retain qualified individuals globally to further our mission of providing cost-advantaged solar technology through rigorous safety practices, innovation, customer engagement, industry leadership, and operational excellence. We take a consciously inclusive approach to our hiring practices, which we monitor through a review of applicant and new-hire metrics on a quarterly basis. We prohibit discrimination based on race, color, religion, sex, age, national origin, veteran status, disability, sexual orientation, or gender identity. As part of our global talent management process, we engage in succession planning by prioritizing the development and retention of associates in critical roles.

We follow a pay-for-performance model in which associates are compensated for achieving goals and associated metrics and demonstrating First Solar values. We review associate compensation on a regular basis to ensure internal and external equity, including, among other things, minimum wage and living wage assessments across our global operations. We offer competitive compensation and benefits to our associates, including, for example, health care and other insurance benefits, retirement programs, paid time off, paid parental leave, flexible work schedules, and education assistance, depending on eligibility.

We are committed to developing and providing career growth opportunities for our associates. We believe a strong culture of inclusiveness is essential to the success of our company. We gather and respond to associate feedback in a variety of ways, including through anonymous, periodic associate engagement and inclusion surveys, pulse surveys, and one-on-one interactions. Additionally, we support career advancement, mentorship, and leadership development programs to ensure the professional growth of our diverse talent.

None of our associates are currently represented by labor unions or covered by a collective bargaining agreement. As we continue to expand domestically and internationally, we may encounter regional laws that mandate union representation or associates who desire union representation or a collective bargaining agreement. We recognize that

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in the locations where we operate, employees have the right to freely associate or not associate with third-party labor organizations, along with the right to bargain or not to bargain collectively in accordance with local laws.

Available Information

We maintain a website at www.firstsolar.com. We make available free of charge on our website our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, proxy statements, and any amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act, as soon as reasonably practicable after we electronically file such materials with, or furnish them to, the SEC. The information contained in or connected to our website is not incorporated by reference into this report. We use our website as one means of disclosing material non-public information and for complying with our disclosure obligations under the SEC's Regulation FD. Such disclosures are typically included within the Investor Relations section of our website at investor.firstsolar.com. Accordingly, investors should monitor such portions of our website in addition to following our press releases, SEC filings, and public conference calls and webcasts. The SEC also maintains a website at www.sec.gov that contains reports and other information regarding issuers, such as First Solar, that file electronically with the SEC.

Information about Our Executive Officers

Our executive officers and their ages and positions as of February 28, 2023 were as follows:

Name	Age	Position
Mark R. Widmar	57	Chief Executive Officer
Alexander R. Bradley	41	Chief Financial Officer
Georges Antoun	60	Chief Commercial Officer
Michael Koralewski	51	Chief Supply Chain Officer
Kuntal Kumar Verma	50	Chief Manufacturing Officer
Patrick Buehler	45	Chief Product Officer
Markus Gloeckler	49	Chief Technology Officer
Caroline Stockdale	59	Chief People and Communications Officer
Jason Dymbort	45	General Counsel and Secretary

Mark R. Widmar was appointed Chief Executive Officer in July 2016. He joined First Solar in April 2011 as Chief Financial Officer and also served as First Solar's Chief Accounting Officer from February 2012 through June 2015. From March 2015 to June 2016, Mr. Widmar served as the Chief Financial Officer and through June 2018, served as a director on the board of the general partner of 8point3 Energy Partners LP ("8point3"), the joint yieldco formed by First Solar and SunPower Corporation in 2015 to own and operate a portfolio of selected solar generation assets. Prior to joining First Solar, Mr. Widmar served as Chief Financial Officer of GrafTech International Ltd., a leading global manufacturer of advanced carbon and graphite materials, from May 2006 through March 2011. Prior to joining GrafTech, Mr. Widmar served as Corporate Controller of NCR Inc. from 2005 to 2006, and was a Business Unit Chief Financial Officer for NCR from November 2002 to his appointment as Controller. He also served as a Division Controller at Dell, Inc. from August 2000 to November 2002. Mr. Widmar also held various financial and managerial positions with Lucent Technologies Inc., Allied Signal, Inc., and Bristol Myers/Squibb, Inc. He began his career in 1987 as an accountant with Ernst & Young. Mr. Widmar holds a Bachelor of Science in business accounting and a Master of Business Administration from Indiana University.

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Alexander R. Bradley was appointed Chief Financial Officer in October 2016. He joined First Solar in May 2008, and previously served as Vice President of both Treasury and Project Finance, leading or supporting the structuring, sale, and financing of over $10 billion and approximately 2.7 GW_{DC} of the Company's worldwide development assets, including several of the largest PV power plant projects in North America. From June 2016 to June 2018, Mr. Bradley also served as an officer and board member of the general partner of 8point3. Prior to joining First Solar, Mr. Bradley worked at HSBC in investment banking and leveraged finance, in London and New York, covering the energy and utilities sector. He received his Master of Arts from the University of Edinburgh, Scotland.

Georges Antoun was appointed Chief Commercial Officer in July 2016. He joined First Solar in July 2012 as Chief Operating Officer before being appointed as President, U.S. in July 2015. Mr. Antoun has over 30 years of operational and technical experience, including leadership positions at several global technology companies. Prior to joining First Solar, Mr. Antoun served as Venture Partner at Technology Crossover Ventures ("TCV"), a private equity and venture firm that he joined in July 2011. Before joining TCV, Mr. Antoun was the Head of Product Area IP & Broadband Networks for Ericsson, based in San Jose, California. Mr. Antoun joined Ericsson in 2007, when Ericsson acquired Redback Networks, a telecommunications equipment company, where Mr. Antoun served as the Senior Vice President of World Wide Sales & Operations. After the acquisition, Mr. Antoun was promoted to Chief Executive Officer of the Redback Networks subsidiary. Prior to Redback Networks, Mr. Antoun spent five years at Cisco Systems, where he served as Vice President of Worldwide Systems Engineering and Field Marketing, Vice President of Worldwide Optical Operations, and Vice President of Carrier Sales. Prior to Cisco Systems, he was the Director of Systems Engineering at Newbridge Networks, a data and voice networking company. Mr. Antoun started his career at Nynex (now Verizon Communications), where he was part of its Science and Technology Division. Mr. Antoun serves as a member of the board of directors of Marathon Digital Holdings. He is also the Chairman of the University of Louisiana's College of Engineering Dean's Advisory Council board. He earned a Bachelor of Science degree in engineering from the University of Louisiana at Lafayette and a Master's degree in information systems engineering from NYU Poly.

Michael Koralewski was appointed Chief Supply Chain Officer in November 2022 and is accountable for maintaining executive oversight of First Solar's strategic global supply chain. He previously served as First Solar's Chief Manufacturing Operations Officer and provides over 25 years of global operational experience to the executive leadership team. Mr. Koralewski joined First Solar in 2006, serving in several senior roles in operations and quality management, including Senior Vice President, Global Manufacturing since 2015; Vice President, Global Site Operations and Plant Manager since 2011; and Vice President, Global Quality since 2009. In all of these roles Mr. Koralewski has been significantly involved since the beginning of First Solar's manufacturing scaling and expansion from site selection through sustaining operations and supply chain development. Prior to joining First Solar, Mr. Koralewski worked at Dana Incorporated where he held several positions with global responsibility in operations and quality management. He earned a Bachelor of Science in chemical engineering from Case Western Reserve University and a Master of Business Administration from Bowling Green State University.

Kuntal Kumar Verma was appointed Chief Manufacturing Officer in November 2022 and previously served as First Solar's Chief Manufacturing Engineering Officer. He is responsible for First Solar's global manufacturing operations and engineering, including its performance and improvement roadmap, global technology scaling, new plant start-ups, and strategic initiatives. Mr. Verma joined First Solar in 2002, serving in progressively more senior roles in engineering and manufacturing, including Vice President, Global Manufacturing Engineering since 2012. Prior to joining First Solar, Mr. Verma held several engineering and operations positions at Reliance Industries Limited, India. He is a Master Black Belt in Six Sigma/Lean Manufacturing with an expert certification in Taguchi Methods (Robust Engineering) and a Certification in Production and Inventory Management from American Production and Inventory Control Society. He earned a Bachelor of Science in mechanical engineering from the National Institute of Technology in India, a Master of Science in industrial engineering from the University of Toledo, and a Master of Business Administration from Bowling Green State University.

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Patrick Buehler was appointed Chief Product Officer in December 2022, having previously served as Chief Quality and Reliability Officer. Mr. Buehler has over 20 years of operational and technical experience. In his role, Mr. Buehler is responsible for all aspects of product lifecycle management, including understanding market demands, technology trends, and competition to facilitate implementation of new or enhanced products. Mr. Buehler maintains global leadership responsibility for quality and reliability, environmental, health, safety, and security, recycling technology process development and operations, customer service, program management, and strategic initiatives. Mr. Buehler joined First Solar in 2006, serving in progressively more senior technical and operations roles, including Vice President, Quality and Reliability since 2019. Prior to joining First Solar, Mr. Buehler held several roles in manufacturing, engineering, maintenance, and product development at DuPont de Nemours, Inc. and Cummins, Inc. He earned a Bachelor of Science in mechanical engineering from the University of Cincinnati and a Master of Science in mechanical engineering from Purdue University.

Markus Gloeckler was appointed Chief Technology Officer in November 2020 after being appointed Co-Chief Technology Officer in July 2020. He is focused on driving First Solar's thin film PV module technology. Mr. Gloeckler has extensive experience guiding strategic research and development activities and served First Solar as Vice President and Chief Scientist before being promoted to Senior Vice President, Module Research and Development. He was instrumental in enabling First Solar's achievement of various world records relating to conversion efficiency for CdTe solar cells. In his role as Vice President of Research, he led the thin film technology transfer from General Electric to First Solar following the intellectual property acquisition in 2013. He joined First Solar in 2005 in an engineering function supporting First Solar's technology development after the initial launch of the Series 2 module. Mr. Gloeckler holds an undergraduate degree in microsystems engineering from the Regensburg University of Applied Sciences in Germany, and a Doctor of Philosophy in physics from Colorado State University.

Caroline Stockdale joined First Solar in October 2019 as Executive Vice President, Human Resources and Communications and was appointed Chief People and Communications Officer in October 2020. Prior to joining First Solar, she served as the Chief Executive Officer for First Perform, a provider of human resources services for a variety of customers, from Fortune 100 companies to cyber start-ups. Previously, she served as Chief Human Resources Officer for Medtronic from 2010 to 2013 and Warner Music Group from 2005 to 2009. Before joining Warner Music Group, she served as the senior human resources leader in global divisions of American Express from 2002 to 2005 and General Electric from 1997 to 2002. Ms. Stockdale is a member of the Forbes Human Resources Council. Ms. Stockdale holds a Bachelor of Arts in political theories and institutions, and philosophy, from the University of Sheffield, England.

Jason Dymbort joined First Solar in March 2008, serving in a broad range of legal roles before being appointed General Counsel and Secretary in July 2020. Between 2015 and 2018, Mr. Dymbort served as General Counsel and Secretary for the general partner of 8point3 Energy Partners, then a publicly-traded yieldco and affiliate of First Solar. Before joining First Solar, Mr. Dymbort was a corporate attorney at Cravath, Swaine & Moore LLP. He holds a Juris Doctor degree from the University of Pennsylvania Law School, where he was a member of the Penn Law Review, and a bachelor's degree from Brandeis University.

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Item 1A. ***Risk Factors***

An investment in our stock involves a high degree of risk. You should carefully consider the following information, together with the other information in this Annual Report on Form 10-K, before buying shares of our stock. If any of the following risks or uncertainties occur, our business, financial condition, and results of operations could be materially and adversely affected and the trading price of our stock could decline.

Summary of Risk Factors

The following is a summary of the principal risks and uncertainties that could materially adversely affect our business, financial condition, and results of operations and make an investment in our stock speculative or risky. You should read this summary together with the more detailed description of each risk factor contained below.

Risks Related to Our Markets and Customers

- Competition in solar markets globally and across the solar value chain is intense and could remain that way for an extended period of time. The solar industry may experience periods of structural imbalance between global PV module supply and demand that result in periods of pricing volatility. If our competitors reduce module pricing to levels near or below their manufacturing costs, or are able to operate at minimal or negative operating margins for sustained periods of time, or if global demand for PV modules decreases relative to installed production capacity, our business, financial condition, and results of operations could be adversely affected.

- The reduction, elimination, or expiration of government subsidies, economic incentives, tax incentives, renewable energy targets, and other support for on-grid solar electricity applications, or other public policies could negatively impact demand and/or price levels for our solar modules. The imposition of tariffs on our products could materially increase our costs to perform under our contracts with customers, which could adversely affect our results of operations.

- The loss of any of our large customers, or the inability of our customers and counterparties to perform under their contracts with us, could significantly reduce our net sales and negatively impact our results of operations.

Risks Related to Our Operations, Manufacturing, and Technology

- We face intense competition from manufacturers of crystalline silicon solar modules; if global supply exceeds global demand, it could lead to a further reduction in the average selling price for PV solar modules, which could reduce our net sales and adversely affect our results of operations.

- Problems with product quality or performance may cause us to incur significant and/or unexpected contractual damages and/or warranty and related expenses, damage our market reputation, and prevent us from maintaining or increasing our market share.

- Our failure to further refine our technology and develop and introduce improved PV products, including as a result of delays in implementing planned advancements, could render our solar modules uncompetitive and reduce our net sales, profitability, and/or market share.

- Several of our key raw materials and components, in particular CdTe and substrate glass, and manufacturing equipment are either single-sourced or sourced from a limited number of suppliers, and their failure to perform could cause manufacturing delays, especially as we expand or seek to expand our business, and/or impair our ability to deliver solar modules to customers in the required quality and quantities and at a price that is profitable to us.

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- Our failure to effectively manage module manufacturing production and selling costs, including costs related to raw materials and logistics services, could render our solar modules uncompetitive and reduce our net sales, profitability, and/or market share.

- Our future success depends on our ability to effectively balance manufacturing production with market demand, effectively manage our cost per watt, and, when necessary, continue to build new manufacturing plants over time in response to market demand, all of which are subject to risks and uncertainties.

- We may be unable to generate sufficient cash flows or have access to the sources of external financing necessary to fund planned capital investments in manufacturing capacity and product development.

Risks Related to Regulations

- We expect certain financial benefits as a result of tax incentives provided by the Inflation Reduction Act of 2022. If these expected financial benefits vary significantly from our assumptions, our business, financial condition, and results of operations could be adversely affected.

- Existing regulations and policies, changes thereto, and new regulations and policies may present technical, regulatory, and economic barriers to the purchase and use of PV solar products, which may significantly reduce demand for our modules.

Risks Related to Our Markets and Customers

Competition in solar markets globally and across the solar value chain is intense and could remain that way for an extended period of time. The solar industry may experience periods of structural imbalance between global PV module supply and demand that result in periods of pricing volatility, which could have a material adverse effect on our business, financial condition, and results of operations.

In the aggregate, we believe manufacturers of solar cells and modules have significant installed production capacity, relative to global demand, and the ability for additional capacity expansion. For example, we estimate that in 2022 approximately 160 GW_{DC} of capacity was added by solar module manufacturers, primarily in China. We believe the solar industry may from time to time experience periods of structural imbalance between supply and demand, and that excess capacity will continue to put pressure on pricing. Although module average selling prices in many global markets have declined for several years, recent module spot pricing has increased, in part, due to trade measures and policies, government regulations, raw material availability, and supply chain disruptions. There may be additional pressure on global demand and average selling prices in the future resulting from fluctuating demand in certain major solar markets, such as China. If our competitors reduce module pricing to levels near or below their manufacturing costs, or are able to operate at minimal or negative operating margins for sustained periods of time, or if global demand for PV modules decreases relative to installed production capacity, our business, financial condition, and results of operations could be adversely affected.

The reduction, elimination, or expiration of government subsidies, economic incentives, tax incentives, renewable energy targets, and other support for on-grid solar electricity applications, or the impact of other public policies, such as tariffs or other trade remedies imposed on solar cells and modules, could negatively impact demand and/or price levels for our solar modules and limit our growth or lead to a reduction in our net sales or increase our costs, thereby adversely impacting our operating results.

Although we believe that solar energy will experience widespread adoption in those applications where it competes economically with traditional forms of energy without any support programs, in certain markets our net sales and profits remain subject to variability based on the availability and size of government subsidies and economic incentives. Federal, state, and local governmental bodies in many countries have provided subsidies in the form of feed-in-tariff structures, rebates, tax incentives, and other incentives to end users, distributors, system integrators,

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and manufacturers of PV solar products. Many of these support programs expire, phase down over time, require renewal by the applicable authority, or may be amended. A summary of certain recent developments in the major government support programs that may impact our business appears under Item 1. "Business – Support Programs." To the extent these support programs are reduced earlier than previously expected, are changed retroactively, or are not renewed, such changes could negatively impact demand and/or price levels for our solar modules, lead to a reduction in our net sales, and adversely impact our operating results.

Current regulatory policies, or any future changes or threatened changes to such policies, may subject us to significant risks, including the following:

- a reduction or removal of clean energy programs and initiatives and the incentives they provide may diminish the market for future solar energy off-take agreements, slow the retirement of aging fossil fuel plants, including the retirements of coal generation plants, and reduce the ability for solar project developers to compete for off-take agreements, which may reduce PV solar module sales;

- any limitations on the value or availability to manufacturers or potential investors of tax incentives that benefit solar energy production, sales, or projects, such as the Section 45X advanced manufacturing production credit, ITC, and PTC, could result in reducing such manufacturers' or investors' economic returns and could cause a reduction in the availability of financing, thereby reducing demand for PV solar modules;

- any incentives contingent upon domestic production of modules, such as tax incentives set forth under the IRA, could limit our ability to sell modules manufactured in certain foreign jurisdictions, which may adversely impact our module average selling prices and could require us to record significant charges to earnings should we determine that the manufacturing equipment in such foreign jurisdictions is impaired; and

- any effort to overturn federal and state laws, regulations, or policies that are supportive of solar energy generation or that remove costs or other limitations on other types of electricity generation that compete with solar energy projects could negatively impact our ability to compete with traditional forms of electricity generation and materially and adversely affect our business.

Application of trade laws may also impact, either directly or indirectly, our operating results. In some instances, the application of trade laws is currently beneficial to the Company, and changes in their application could have an adverse impact. Recent developments include the following:

- *United States — Tariffs on certain imported crystalline silicon PV cells and modules*. The United States currently imposes different types of tariffs and/or other trade remedies on certain imported crystalline silicon PV cells and modules from various countries. In February 2022, the U.S. President proclaimed a four-year extension of a global safeguard measure imposed pursuant to Section 201 of the Trade Act of 1974 that provides for tariffs on imported crystalline silicon solar modules and a tariff-rate quota on imported crystalline silicon solar cells. Thin film solar cell products, such as our CdTe technology, are specifically excluded from the tariffs. Moreover, the extension measure does not apply tariffs to imports of bifacial modules. The extension measure's tariff rate was originally set at 14.75%, with annual reductions of 0.25 percentage points over the remainder of its four-year term. The current rate is 14.5%. The extension measure also provides an annual tariff-rate quota, whereby tariffs apply to imported crystalline silicon solar cells above the first 5.0 GW_{DC} of imports.

- *United States — Antidumping and countervailing duties on certain imported crystalline silicon PV cells and modules*. The United States currently imposes antidumping and countervailing duties on certain imported crystalline silicon PV cells and modules from China and Taiwan. Such antidumping and countervailing duties can change over time pursuant to annual reviews conducted by the U.S. Department

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of Commerce ("USDOC"), and a decline in duty rates or USDOC failure to fully enforce U.S. antidumping and countervailing duty laws could have an adverse impact on our operating results. In March 2022, the USDOC initiated inquiries concerning alleged circumvention of antidumping and countervailing duties on Chinese imports by crystalline silicon PV cells and module imports assembled and completed in Cambodia, Malaysia, Thailand, and Vietnam. In June 2022, the U.S. President declared an emergency with respect to threats to electricity generation capacity and authorized the U.S. Secretary of Commerce to consider permitting the importation of crystalline silicon PV products from those four countries free of antidumping and countervailing duties for 24 months, or until the emergency has terminated. The USDOC has issued regulations implementing that moratorium on antidumping and countervailing duties in the event that it finds circumvention with respect to crystalline silicon PV products assembled and completed in those four countries. In December 2022, the USDOC issued affirmative preliminary determinations finding "country-wide" circumvention with respect to those four countries, but it also found that certain companies were not circumventing the antidumping and countervailing duties. The USDOC is scheduled to issue its final circumvention determinations in May 2023, subject to possible extension. We cannot predict what further actions the USDOC will take with respect to these circumvention inquiries. Our operating results could be adversely impacted if the USDOC makes negative circumvention determinations or refrains from imposing antidumping and countervailing duties on imports covered by affirmative circumvention determinations. Conversely, affirmative final circumvention determinations could positively impact our operating results.

- *United States — Tariffs on certain Chinese imports*. The United States currently imposes tariffs on various articles imported from China at a rate of 25%, including crystalline silicon solar cells and modules, based on an investigation under Section 301 of the Trade Act of 1974. In May 2022, the Office of the United States Trade Representative initiated a statutory four-year review of those tariff actions, which could result in the termination or modification of the tariffs. The review remains pending, and we cannot predict its outcome. Our operating results could be adversely impacted if the review results in a termination or reduction in tariffs on crystalline silicon solar cells and modules from China.

- *United States — Tariffs on certain foreign-imported aluminum and steel.* The United States currently imposes tariffs on certain imported aluminum and steel articles from certain foreign jurisdictions, generally at rates of 10% and 25%, respectively, under Section 232 of the Trade Expansion Act of 1962. Such tariffs and policies, or any other U.S. or global trade remedies or other trade barriers, may directly or indirectly affect U.S. or global markets for solar energy and our business, financial condition, and results of operations.

- *India — Domestic and foreign imports.* India maintains an Approved List of Module Manufacturers ("ALMM"), which is set by the MNRE. Only PV modules and module manufacturers listed on the ALMM can be used for certain solar projects in India, including government projects or government-assisted projects. Our ability to sell modules in the Indian market depends on the inclusion of our modules on the ALMM, and we currently expect that we will be included in the ALMM once we begin manufacturing solar panels in India. However, our operating results could be adversely impacted if the ALMM restriction is significantly relaxed to allow modules to be imported from countries that are part of the Association of Southeast Asian Nations.

- *European Union — Foreign subsidies*. In January 2023, the EU adopted the Foreign Subsidies Regulation ("FSR"), which was established to provide the European Commission with authority to investigate financial contributions granted by foreign governments to businesses operating within the EU. Because the FSR is not effective until July 2023 and the European Commission has not yet issued any application guidance, it is not currently clear whether, and to what extent, the FSR could impact our business, financial condition, or results of operations.

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These examples show that established markets for PV solar development face uncertainties arising from policy, regulatory, and governmental actions. While the expected potential of the markets we are targeting is significant, policy promulgation and market development are especially vulnerable to governmental inertia, political instability, the imposition or lowering of trade remedies and other trade barriers, geopolitical risk, fossil fuel subsidization, potentially stringent localization requirements, and limited available infrastructure.

The loss of any of our large customers, or the inability of our customers and counterparties to perform under their contracts with us, could significantly reduce our net sales and negatively impact our results of operations.

Our customers include developers and operators of systems, utilities, independent power producers, commercial and industrial companies, and other system owners, who may experience intense competition at the system level, thereby constraining the ability for such customers to sustain meaningful and consistent profitability. The loss of any of our large customers, their inability to perform under their contracts, or their default in payment could significantly reduce our net sales and/or adversely impact our operating results. While our contracts with customers typically have certain firm purchase commitments and may include provisions for the payment of amounts to us in certain events of contract termination, these contracts may be subject to amendments made by us or requested by our customers. These amendments may reduce the volume of modules to be sold under the contract, adjust delivery schedules, or otherwise decrease the expected revenue under these contracts. Although we believe that we can mitigate this risk, in part, by reallocating modules to other customers if the need arises, we may be unable, in whole or in part, to do so on similar terms or at all. We may also mitigate this risk by requiring some form of payment security from our customers, such as cash deposits, parent guarantees, bank guarantees, surety bonds, or commercial letters of credit. However, in the event the providers of such payment security fail to perform their obligations, our operating results could be adversely impacted.

An increase in interest rates or tightening of the supply of capital in the global financial markets (including a reduction in total tax equity availability) could make it difficult for customers to finance the cost of a PV solar power system and could reduce the demand for our modules and/or lead to a reduction in the average selling price for our modules.

Many of our customers depend on debt and/or equity financing to fund the initial capital expenditure required to develop, build, and/or purchase a PV solar power system. As a result, an increase in interest rates, or a reduction in the supply of project debt financing or tax equity investments, could reduce the number of solar projects that receive financing or otherwise make it difficult for our customers to secure the financing necessary to develop, build, purchase, or install a PV solar power system on favorable terms, or at all, and thus lower demand for our solar modules, which could limit our growth or reduce our net sales. For additional information, see the Risk Factor entitled, "The reduction, elimination, or expiration of government subsidies, economic incentives, tax incentives, renewable energy targets, and other support for on-grid solar electricity applications, or the impact of other public policies, such as tariffs or other trade remedies imposed on solar cells and modules, could negatively impact demand and/or price levels for our solar modules and limit our growth or lead to a reduction in our net sales or increase our costs, thereby adversely impacting our operating results." In addition, we believe that a significant percentage of our customers install systems as an investment, funding the initial capital expenditure through a combination of equity and debt. An increase in interest rates could lower an investor's return on investment in a system, increase equity return requirements, or make alternative investments more attractive relative to PV solar power systems and, in each case, could cause these customers to seek alternative investments.

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We may be unable to fully execute on our long-term strategic plans, which could have a material adverse effect on our business, financial condition, or results of operations.

We face numerous difficulties in executing on our long-term strategic plans, particularly in new foreign jurisdictions, including the following:

- difficulty in competing against companies who may have greater financial resources and/or a more effective or established localized business presence and/or an ability to operate with minimal or negative operating margins for sustained periods of time;
- difficulty in competing successfully with other technologies, such as hybrid perovskites, tandem solar cells, or other thin films;
- difficulty in accurately prioritizing geographic markets that we can most effectively and profitably serve with our solar module offerings, including miscalculations in overestimating or underestimating addressable market demand;
- adverse public policies in countries we operate in and/or are pursuing, including local content requirements, the imposition of trade remedies, the removal of trade barriers, or capital investment requirements;
- business climates, such as that in China, that may have the effect of putting foreign companies at a disadvantage relative to domestic companies;
- unstable or adverse economic, social, and/or operating environments, including social unrest, currency, inflation, and interest rate uncertainties;
- the possibility of applying an ineffective commercial approach to targeted markets, including product offerings that may not meet market needs;
- difficulty in generating sufficient sales volumes at economically sustainable profitability levels;
- difficulty in timely identifying, attracting, training, and retaining qualified sales, technical, and other talent in geographies targeted for expansion;
- difficulty in maintaining proper controls and procedures as we expand our business operations in terms of geographical reach, including transitioning certain business functions to low-cost geographies, with any material control failure potentially leading to reputational damage and loss of confidence in our financial reporting;
- difficulty in competing successfully for market share in overall solar markets as a result of the success of companies participating in other solar segments in which we do not have significant historical experience, such as residential;
- difficulty in establishing and implementing a commercial and operational approach adequate to address the specific needs of the markets we are pursuing;
- difficulty in identifying effective local partners and developing any necessary partnerships with local businesses on commercially acceptable terms; and
- difficulty in balancing market demand and manufacturing production in an efficient and timely manner, potentially causing our manufacturing capacity to be constrained in some future periods or over-supplied in others.

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Refer also to the Risk Factors entitled, "Our substantial international operations subject us to a number of risks, including unfavorable political, regulatory, labor, and tax conditions in the United States and/or foreign countries," "The reduction, elimination, or expiration of government subsidies, economic incentives, tax incentives, renewable energy targets, and other support for on-grid solar electricity applications, or the impact of other public policies, such as tariffs or other trade remedies imposed on solar cells and modules, could negatively impact demand and/or price levels for our solar modules and limit our growth or lead to a reduction in our net sales or increase our costs, thereby adversely impacting our operating results," and "We may be unable to generate sufficient cash flows or have access to the sources of external financing necessary to fund planned capital investments in manufacturing capacity and product development."

Risks Related to Our Operations, Manufacturing, and Technology

We face intense competition from manufacturers of crystalline silicon solar modules; if global supply exceeds global demand, it could lead to a further reduction in the average selling price for PV solar modules*, *which could reduce our net sales and adversely affect our results of operations.

The solar and renewable energy industries are highly competitive and are continually evolving as participants strive to distinguish themselves within their markets and compete with the larger electric power industry. Within the global PV solar industry, we face intense competition from crystalline silicon module manufacturers. Existing or future module manufacturers might be acquired by larger companies with significant capital resources, thereby further intensifying competition with us. In addition, the introduction of a low-cost disruptive technology could adversely affect our ability to compete, which could reduce our net sales and adversely affect our results of operations.

We expect to compete with future entrants into the PV solar industry and existing market participants that offer new or differentiated technological solutions. For example, while conventional solar modules are monofacial, meaning their ability to produce energy is a function of direct and diffuse irradiance on their front side, most module manufacturers offer bifacial modules that also capture diffuse irradiance on the back side of a module. Such technology can improve the overall energy production of a module relative to nameplate efficiency when applied in certain applications, which could potentially lower the overall LCOE of a system when compared to systems using conventional solar modules, including the modules we currently produce. Additionally, certain module manufacturers have introduced n-type mono-crystalline modules, such as tunnel oxide passivated contact ("TOPCon") modules, which are expected to provide certain improvements to module efficiency, temperature coefficient, and bifacial performance, and claim to provide certain degradation advantages compared to other mono-crystalline modules. Finally, many of our competitors are promoting modules with larger overall area based on the use of larger silicon wafers. While the transition to such larger wafers would increase nameplate wattage, we believe the associated production cost would not improve significantly.

Even if demand for solar modules continues to grow, the rapid manufacturing capacity expansion undertaken by many module manufacturers in China and certain parts of Southeast Asia, particularly manufacturers of crystalline silicon wafers, cells, and modules, has created and may continue to cause periods of structural imbalances between supply and demand. For additional information, see the Risk Factor entitled, "Competition in solar markets globally and across the solar value chain is intense and could remain that way for an extended period of time. The solar industry may experience periods of structural imbalance between global PV module supply and demand that result in periods of pricing volatility, which could have a material adverse effect on our business, financial condition, and results of operations." In addition, we believe any significant decrease in the cost of silicon feedstock or polysilicon would reduce the manufacturing cost of crystalline silicon modules and lead to further pricing pressure for solar modules and potentially an oversupply of solar modules.

Our competitors could decide to reduce their sales prices in response to competition, even below their manufacturing costs, in order to generate sales, and may do so for a sustained period. Certain competitors, including many in China, may have direct or indirect access to sovereign capital or other forms of state support, which could enable such competitors to operate at minimal or negative operating margins for sustained periods of time. As a result, we may

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be unable to sell our solar modules at attractive prices, or for a profit, during any period of excess supply of solar modules, which would reduce our net sales and adversely affect our results of operations. Additionally, we may decide to lower our average selling prices to customers in certain markets in response to competition, which could also reduce our net sales and adversely affect our results of operations.

Problems with product quality or performance may cause us to incur significant and/or unexpected contractual damages and/or warranty and related expenses, damage our market reputation, and prevent us from maintaining or increasing our market share.

We perform a variety of module quality and life tests under different environmental conditions upon which we base our assessments of future module performance over the duration of the warranty. However, if our thin film solar modules perform below expectations, we could experience significant warranty and related expenses, damage to our market reputation, and erosion of our market share. With respect to our modules, we provide a limited warranty covering defects in materials and workmanship under normal use and service conditions for up to 12.5 years. We also typically warrant that modules installed in accordance with agreed-upon specifications will produce at least 98% of their labeled power output rating during the first year, with the warranty coverage reducing by a degradation factor every year thereafter throughout the limited power output warranty period of up to 30 years. Among other things, our solar module warranty also covers the resulting power output loss from cell cracking. As an alternative form of our standard limited module power output warranty, we have also offered an aggregated or system-level limited module performance warranty. This system-level limited module performance warranty is designed for utility-scale systems and provides 25-year system-level energy degradation protection. This warranty represents a practical expedient to address the challenge of identifying, from the potential millions of modules installed in a utility-scale system, individual modules that may be performing below warranty thresholds by focusing on the aggregate energy generated by the system rather than the power output of individual modules. The system-level limited module performance warranty is typically calculated as a percentage of a system's expected energy production, adjusted for certain actual site conditions, with the warranted level of performance declining each year in a linear fashion, but never falling below 80% during the term of the warranty. As a result of these warranty programs, we bear the risk of product warranty claims long after we have sold our solar modules and recognized net sales.

If any of the assumptions used in estimating our module warranties prove incorrect, we could be required to accrue additional expenses, which could adversely impact our financial position, operating results, and cash flows. Although we have taken significant precautions to avoid a manufacturing excursion from occurring, any manufacturing excursions, including any commitments made by us to take remediation actions in respect of affected modules beyond the stated remedies in our warranties, could adversely impact our reputation, financial position, operating results, and cash flows.

Although our module performance warranties extend for up to 30 years, our oldest solar modules manufactured during the qualification of our pilot production line have only been in use since 2001. Accordingly, our warranties are based on a variety of quality and life tests that enable predictions of durability and future performance. These predictions, however, could prove to be materially different from the actual performance during the warranty period, causing us to incur substantial expense to repair or replace defective solar modules or provide financial remuneration in the future. For example, our solar modules could suffer various failures, including breakage, delamination, corrosion, or performance degradation in excess of expectations, and our manufacturing operations or supply chain could be subject to materials or process variations that could cause affected modules to fail or underperform compared to our expectations. These risks could be amplified as we implement design and process changes in connection with our efforts to improve our products and accelerate module wattage as part of our long-term strategic plans. In addition, if we increase the number of installations in extreme climates, we may experience increased failure rates due to deployment into such field conditions. Any widespread product failures may damage our market reputation, cause our net sales to decline, require us to repair or replace the defective modules or provide financial remuneration, and result in us taking voluntary remedial measures beyond those required by our standard warranty terms to enhance customer satisfaction, which could have a material adverse effect on our operating results.

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In resolving claims under both the limited defect and power output warranties, we typically have the option of either repairing or replacing the covered modules or, under the limited power output warranty, providing additional modules to remedy the power shortfall or making certain cash payments; however, historical versions of our module warranty did not provide a refund remedy. Consequently, we may be obligated to repair or replace the covered modules under such historical programs. As our manufacturing process may change from time-to-time in accordance with our technology roadmap, we may elect to stop production of older versions of our modules that would constitute compatible replacement modules. In some jurisdictions, our inability to provide compatible replacement modules could potentially expose us to liabilities beyond the limitations of our module warranties, which could adversely impact our reputation, financial position, operating results, and cash flows.

In addition to our limited solar module warranties described above, for PV solar power systems we have constructed for customers in prior periods, we have provided limited warranties for defects in engineering design, installation, and balance of systems ("BoS") part workmanship for a period of one to two years following the substantial completion of a system or a block within the system. BoS parts represent mounting, electrical, and other parts used in PV solar power systems. In resolving claims under such BoS warranties, we have the option of remedying the defect through repair or replacement. As with our modules, these warranties are based on a variety of quality and life tests that enable predictions of durability and future performance. Any failures in BoS equipment beyond our expectations may also adversely impact our reputation, financial position, operating results, and cash flows.

In addition, our contracts with customers may include provisions with particular product specifications, minimum wattage requirements, and specified delivery schedules. These contracts may be terminated, or we may incur significant liquidated damages or other damages, if we fail to perform our contractual obligations. In addition, our costs to perform under these contracts may exceed our estimates, which could adversely impact our profitability. Any failures to comply with our contracts for the sale of our modules could adversely impact our reputation, financial position, operating results, and cash flows.

Our failure to further refine our technology and develop and introduce improved PV products, including as a result of delays in implementing planned advancements, could render our solar modules uncompetitive and reduce our net sales, profitability, and/or market share.

We need to continue to invest significant financial resources in R&D to continue to improve our module conversion efficiencies and otherwise keep pace with technological advances in the solar industry. However, R&D activities are inherently uncertain, and we could encounter difficulties in commercializing our research results. We seek to continuously improve our products and processes, including, for example, certain planned improvements to our CdTe module technology and manufacturing capabilities, such as the increase to our module form factor (which we refer to as Series 7), and the resulting changes carry potential risks in the form of delays, performance, additional costs, or other unintended contingencies. For example, the successful launch of our Series 7 module technology, which we began producing at our third manufacturing facility in the U.S. and we expect to produce at our first manufacturing facility in India, is sensitive to changes in the final product size and module mounting structure, among others. While we believe that we will be able to manage these uncertainties, we may encounter unanticipated challenges as we implement design and process changes in connection with this new module series.

We may expand our portfolio of offerings to include solutions that build upon our core competencies but for which we have not had significant historical experience, including variations in our traditional product offerings or other offerings related to certain markets. There can be no guarantee that our significant R&D expenditures will produce corresponding benefits. Other companies are developing a variety of competing PV technologies, including advanced mono-crystalline silicon cells, advanced p-type crystalline silicon cells, high-efficiency n-type crystalline silicon cells, and new emerging technologies such as hybrid perovskites, tandem solar cells, or other thin films, which could result in solar modules that prove to be more cost-effective or have better performance than our solar modules. If we are unable to achieve the necessary technology improvements to remain competitive, our overall growth and financial performance may be limited relative to our competitors and our operating results could be adversely impacted.

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We often forward price our products in anticipation of future technology improvements. Furthermore, certain of our contracts with customers may include transaction price adjustments associated with future module technology improvements, including new product designs and enhancements to certain energy related attributes. Accordingly, an inability to further refine our technology and execute our module technology roadmap, or changes to the expected timing such technology improvements are incorporated into our manufacturing process, could adversely affect our operating results.

Some of our manufacturing equipment is customized and sole sourced. If our manufacturing equipment fails or if our equipment suppliers fail to perform under their contracts, we could experience production disruptions and be unable to satisfy our contractual requirements.

Some of our manufacturing equipment is customized to our production lines based on designs or specifications that we provide to equipment manufacturers, which then undertake a specialized process to manufacture the custom equipment. As a result, the equipment is not readily available from multiple vendors and would be difficult to repair or replace if it were to become delayed, damaged, or stop working. If any piece of equipment fails, production along the entire production line could be interrupted. In addition, the failure of our equipment manufacturers to supply equipment in a timely manner or on commercially reasonable terms could delay our expansion or conversion plans, otherwise disrupt our production schedule, and/or increase our manufacturing costs, all of which would adversely impact our operating results.

Several of our key raw materials and components are either single-sourced or sourced from a limited number of suppliers, and their failure to perform could cause manufacturing delays and impair our ability to deliver solar modules to customers in the required quality and quantities and at a price that is profitable to us.

Our failure to obtain raw materials and components that meet our quality, quantity, and cost requirements in a timely manner could interrupt or impair our ability to manufacture our solar modules, or increase our manufacturing costs. Several of our key raw materials and components, in particular CdTe and substrate glass, are either single-sourced or sourced from a limited number of suppliers. As a result, the failure of any of our suppliers to perform could disrupt our supply chain and adversely impact our operations. In addition, some of our suppliers are smaller companies that may be unable to supply our increasing demand for raw materials and components as we expand or seek to expand our business. We may be unable to identify new suppliers or qualify their products for use on our production lines in a timely manner and on commercially reasonable terms. A constraint on our production may result in our inability to meet our capacity plans and/or our obligations under our customer contracts, which would have an adverse impact on our business. Additionally, reductions in our production volume may put pressure on suppliers, resulting in increased material and component costs.

A disruption in our supply chain for CdTe, other key raw materials, or equipment could interrupt or impair our ability to manufacture solar modules and could adversely impact our profitability and long-term growth prospects.

A key raw material used in our module production process is a CdTe compound. Tellurium, one of the main components of CdTe, is mainly produced as a by-product of copper refining, and therefore, its supply is largely dependent upon demand for copper. If our competitors begin to use or increase their demand for tellurium, our requirements for tellurium increase, new applications for tellurium emerge, or adverse trade laws or policies restrict our ability to obtain tellurium from foreign vendors or make doing so cost prohibitive, the supply of tellurium and related CdTe compounds could be reduced and prices could increase.

Furthermore, our supply chain could be limited if any of our current or future suppliers fail to perform or are unable to acquire an adequate supply in a timely manner or at commercially reasonable prices. If our current or future suppliers cannot obtain sufficient raw materials or key equipment, they could substantially increase prices or be unable to perform under their contracts. Additionally, we may also be unable to effectively manage fluctuations in the availability and cost of logistics services associated with the procurement of raw materials or equipment used in

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our manufacturing process. If we are unable to pass such cost increases to our customers, a substantial increase in prices or any limitations or disruptions in our supply chain could adversely impact our profitability and long-term growth objectives.

Our failure to effectively manage module manufacturing production and selling costs, including costs related to raw materials and logistics services, could render our solar modules uncompetitive and reduce our net sales, profitability, and/or market share.

Certain of our key raw material purchase contracts include variable pricing terms, which are driven by underlying indices for certain commodities, including aluminum, steel, and natural gas, among others. Fluctuations in such underlying commodity indices may increase our raw material costs. Additionally, an increase in price levels generally, such as inflation related to the cost of raw materials, key manufacturing equipment, labor, and logistics services, could adversely impact our profitability. From time to time, we may utilize derivative hedging instruments to mitigate price changes related to our raw materials or key manufacturing equipment. Our profitability could be adversely impacted if we are unable to effectively hedge such prices or pass these cost increases through to our customers. We often forward price our products in anticipation of future cost reductions, and thus, an inability to execute our cost reduction roadmap could adversely affect our operating results.

Our future success depends on our ability to effectively balance manufacturing production with market demand, effectively manage our cost per watt, and, when necessary, continue to build new manufacturing plants over time in response to market demand, all of which are subject to risks and uncertainties.

Our future success depends on our ability to effectively balance manufacturing production with market demand, effectively manage our cost per watt, and increase our manufacturing capacity in a cost-effective and efficient manner. If we cannot do so, we may incur damages under our contracts with our customers or be unable to decrease our cost per watt, maintain our competitive position, sustain profitability, expand our business, or create long-term shareholder value. Our ability to effectively manage our cost per watt or successfully expand production capacity is subject to significant risks and uncertainties, including the following:

- failure to reduce manufacturing material, labor, or overhead costs;
- an inability to increase production throughput or the average power output per module, or minimize manufacturing yield losses;
- failure to effectively manage the availability and cost of logistics services associated with the procurement of raw materials or equipment used in our manufacturing process and the shipping, handling, storage, and distribution of our modules;
- delays and cost overruns as a result of a number of factors, many of which may be beyond our control, such as our inability to secure economical contracts with equipment vendors;
- our custom-built equipment taking longer and costing more to manufacture than expected and not operating as designed;
- delays or denial of required approvals by relevant government authorities;
- an inability to hire qualified staff;
- capital expenditures exceeding our initial estimates with respect to expanding and building our manufacturing and R&D facilities;

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- difficulty in balancing market demand and manufacturing production in an efficient and timely manner, potentially causing our manufacturing capacity to be constrained in some future periods or over-supplied in others; and

- incurring manufacturing asset write-downs, write-offs, and other charges and costs, which may be significant, during those periods in which we idle, slow down, shut down, or otherwise adjust our manufacturing capacity.

We may be unable to generate sufficient cash flows or have access to the sources of external financing necessary to fund planned capital investments in manufacturing capacity and product development.

Our business and our future plans for expansion are capital-intensive, and we anticipate that our operating and capital expenditure requirements may increase. To develop new products, support future growth, and maintain product quality, we may need to make significant capital investments in manufacturing technology, facilities and capital equipment, and research and development. Consequently, we may seek to raise additional funds through the issuance of equity, equity-related, or debt securities or through obtaining credit from financial institutions to fund, together with our traditional sources of liquidity, the costs of developing and manufacturing our current or future products. We cannot be certain that we will be able to generate sufficient cash flows, or that additional funds will be available to us on favorable terms when required, or at all. If we cannot fund the required investments from our operating cash flows or raise additional funds when we need them, we may be unable to fully execute our business plan and our financial condition, results of operations, and business prospects could be materially and adversely affected.

If our estimates regarding the future costs of collecting and recycling CdTe solar modules covered by our solar module collection and recycling program are incorrect, we could be required to accrue additional expenses and face a significant unplanned cash burden.

As necessary, we fund any incremental amounts for our estimated collection and recycling obligations on an annual basis based on the estimated costs of collecting and recycling covered modules, estimated rates of return on our restricted marketable securities, and an estimated solar module life of 25 years less amounts already funded in prior years. We estimate the cost of our collection and recycling obligations based on the present value of the expected future cost of collecting and recycling the solar modules, which includes estimates for the cost of packaging materials; the cost of freight from the solar module installation sites to a recycling center; material, labor, and capital costs; by-product credits for certain materials recovered during the recycling process; the estimated useful lives of modules covered by the program; and the number of modules expected to be recycled. We base these estimates on our experience collecting and recycling solar modules and certain assumptions regarding costs at the time the solar modules will be collected and recycled. If our estimates prove incorrect, we could be required to accrue additional expenses and could also face a significant unplanned cash burden at the time we realize our estimates are incorrect or end users return their modules, which could adversely affect our operating results. Participating end users can return their modules covered under the collection and recycling program at any time. As a result, we could be required to collect and recycle covered CdTe solar modules earlier than we expect.

Our failure to protect or successfully commercialize our intellectual property rights may undermine our competitive position, and litigation to protect our intellectual property rights or defend against third-party allegations of infringement may be costly.

Protection of our proprietary processes, methods, and other technology is critical to our business. Failure to protect and monitor the use of our existing intellectual property rights or to successfully commercialize future intellectual property rights could result in the loss of valuable technologies. We rely primarily on patents, trademarks, trade secrets, copyrights, and contractual restrictions to protect our intellectual property. We regularly file patent applications to protect certain inventions arising from our R&D and are currently pursuing such patent applications in various countries in accordance with our strategy for intellectual property in that jurisdiction. Our existing patents

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and future patents could be challenged, invalidated, circumvented, or rendered unenforceable. Our pending patent applications may not result in issued patents, or if patents are issued to us, such patents may not be sufficient to provide meaningful protection against competitors or against competitive technologies.

We also rely on unpatented proprietary manufacturing expertise, continuing technological innovation, and other trade secrets to develop and maintain our competitive position. Although we generally enter into confidentiality agreements with our associates and third parties to protect our intellectual property, such confidentiality agreements are limited in duration and could be breached and may not provide meaningful protection for our trade secrets or proprietary manufacturing expertise. Adequate remedies may not be available in the event of unauthorized use or disclosure of our trade secrets and manufacturing expertise. In addition, others may obtain knowledge of our trade secrets through independent development or legal means. The failure of our patents or confidentiality agreements to protect our processes, equipment, technology, trade secrets, and proprietary manufacturing expertise, methods, and compounds could have a material adverse effect on our business. In addition, effective patent, trademark, copyright, and trade secret protection may be unavailable or limited in some foreign countries, especially any developing countries into which we may expand our operations. In some countries, we have not applied for patent, trademark, or copyright protection.

Third parties may infringe or misappropriate our proprietary technologies or other intellectual property rights, which could have a material adverse effect on our business, financial condition, and operating results. Policing unauthorized use of proprietary technology can be difficult and expensive. Additionally, litigation may be necessary to enforce our intellectual property rights, protect our trade secrets, or determine the validity and scope of the proprietary rights of others. We cannot ensure that the outcome of such potential litigation will be in our favor, and such litigation may be costly and may divert management attention and other resources away from our business. An adverse determination in any such litigation may impair our intellectual property rights and may harm our business, prospects, and reputation. In addition, we have no insurance coverage against such litigation costs and would have to bear all costs arising from such litigation to the extent we are unable to recover them from other parties.

If any future production lines are not built in line with committed schedules, it may adversely affect our future growth plans. If any future production lines do not achieve operating metrics similar to our existing production lines, our solar modules could perform below expectations and cause us to lose customers.

If we are unable to systematically replicate our production lines over time and achieve operating metrics similar to our existing production lines, our manufacturing capacity could be substantially constrained, our manufacturing costs per watt could increase, our growth could be limited, and we may be in breach of our contracts with customers for failure to deliver modules. Such factors may result in lower net sales, and/or lower net income than we anticipate. Future production lines could produce solar modules that have lower conversion efficiencies, higher failure rates, and/or higher rates of degradation than solar modules from our existing production lines, and we could be unable to determine the cause of the lower operating metrics or develop and implement solutions to improve performance.

We are in the process of expanding our manufacturing capacity by approximately 11 GW_{DC} including the construction of our third manufacturing facility in the United States, which commenced commercial production of modules in early 2023; our first manufacturing facility in India, which is expected to commence operations in the second half of 2023; our fourth manufacturing facility in the United States, which is expected to commence operations in late 2024; and the expansion of our manufacturing footprint at our existing facilities in Ohio. If we cannot successfully execute on our current capacity expansion plans, we may incur significant costs in excess of our current plans to invest approximately $2.7 billion in the aggregate for these new facilities. If we are not able to effectively manage current or future expansion activities or realize their anticipated benefits, it may adversely impact our results of operations.

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Our substantial international operations subject us to a number of risks, including unfavorable political, regulatory, labor, and tax conditions in the United States and/or foreign countries.

We have significant manufacturing, sales, and marketing operations both within and outside the United States and expect to continue to expand our operations worldwide. Our global business requires us to respond to rapid changes in market conditions worldwide. Our overall success depends, in part, on our ability to succeed in differing legal, regulatory, economic, social, and political conditions. We may not be able to timely develop and implement policies and strategies that will be effective in each location where we do business. Risks inherent to international operations include, but are not limited to, the following:

- difficulty in enforcing agreements in foreign legal systems;
- varying degrees of protection afforded to foreign investments in the countries in which we operate and irregular interpretations and enforcement of laws and regulations in such jurisdictions;
- foreign countries may impose additional income and withholding taxes or otherwise tax our foreign operations, impose tariffs, or adopt other restrictions on foreign trade and investment, including currency exchange controls;
- fluctuations in exchange rates may affect demand for our products and services and may adversely affect our profitability and cash flows in U.S. dollars to the extent that our net sales or our costs are denominated in a foreign currency and the cost associated with hedging the U.S. dollar equivalent of such exposures is prohibitive; the longer the duration of such foreign currency exposure, the greater the risk;
- anti-corruption compliance issues, including the costs related to the mitigation of such risk;
- risk of nationalization or other expropriation of private enterprises;
- changes in general economic and political conditions in the countries in which we operate, including changes in government incentive provisions;
- unexpected adverse changes in U.S. or foreign laws or regulatory requirements, including those with respect to environmental protection, import or export duties, and quotas;
- opaque approval processes in which the lack of transparency may cause delays and increase the uncertainty of project approvals;
- difficulty in staffing and managing widespread operations;
- difficulty in repatriating earnings;
- difficulty in negotiating a successful collective bargaining agreement in applicable foreign jurisdictions;
- trade barriers such as export requirements, tariffs, taxes, local content requirements, anti-dumping regulations and requirements, and other restrictions and expenses, which could increase the effective price of our solar modules and make us less competitive in some countries or increase the costs to perform under our existing contracts; and
- difficulty of, and costs relating to, compliance with the different commercial and legal requirements of the overseas countries in which we offer and sell our solar modules.

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Risks Related to Regulations

We expect certain financial benefits as a result of tax incentives provided by the Inflation Reduction Act of 2022. If these expected financial benefits vary significantly from our assumptions, our business, financial condition, and results of operations could be adversely affected.

In August 2022, the U.S. President signed the IRA into law, which is intended to accelerate the country's ongoing transition to clean energy. The provisions of the IRA are generally effective for tax years beginning after 2022. We continue to evaluate the extent of benefits available to us, which we expect will favorably impact our results of operations in future periods. For example, we currently expect to qualify for the advanced manufacturing production credit under Section 45X of the IRC, which provides certain specified benefits for solar modules and solar module components manufactured in the United States and sold to third parties. For eligible components, the credit is equal to (i) $12 per square meter for a PV wafer, (ii) 4 cents multiplied by the capacity of a PV cell, and (iii) 7 cents multiplied by the capacity of a PV module. Based on the current form factor of our modules, we expect to qualify for a credit of approximately 17 cents per watt for each module produced in the United States and sold to a third party. Such credit may be refundable or transferable to a third party and is available from 2023 to 2032, subject to phase down beginning in 2030.

There are currently several critical and complex aspects of the IRA pending technical guidance and regulations from the Internal Revenue Service ("IRS") and U.S. Treasury Department, including, but not limited to, the following:

- *Total credit under Section 45X.* The guidance is expected to confirm that a vertically-integrated solar module manufacturer is entitled to the sum of the credit amounts for each eligible component that is integrated into the solar module, including the credit amounts for the PV wafer, cell, and module, provided such components are produced in the United States. This clarification may impact to what extent we qualify for a credit of approximately 17 cents per watt based on the current form factor of our modules.

- *Standardization of per-watt measurements.* The guidance is expected to confirm and/or clarify the method by which wattage is calculated to determine the applicable credit amounts for PV cells and modules. Our current evaluation of the benefits available to us is based on the use of industry-wide standard test conditions to determine the nameplate capacity of PV cells and modules. The guidance is expected to create meaningful consistency for credit calculation by standardizing the process for determining solar module nameplate capacity. These clarifications may impact the extent of the credit available to us for eligible PV cells and modules.

- *Direct payment and transfer elections.* The guidance is expected to clarify whether a taxpayer's direct payment election with respect to the Section 45X credit applies only to a single 5-year period or whether the taxpayer is entitled to make a second direct payment election for a subsequent 5-year period during the 10-year credit period. This clarification will impact whether we can monetize the credit in the form of cash payments directly from the government throughout the 10-year credit period, or whether we would be required to monetize the credit through a sale to another taxpayer or taxpayers during the subsequent 5-year period. The guidance is also expected to clarify whether the taxpayer is entitled to make the direct payment election on a facility-by-facility basis, especially with respect to new manufacturing facilities that commence production after the taxpayer has made the initial direct payment election. Such clarification may impact the extent to which we will be able to make additional direct payment elections across multiple years for multiple manufacturing facilities. Furthermore, the guidance is expected to address (i) how and when the credit is claimed by the taxpayer, including the type of information necessary to verify the credit amount, (ii) whether the credit must be applied as a reduction to any quarterly estimated tax payments or as an offset to any taxes that are reported on the taxpayer's income tax return for any taxable year in which a direct payment election is made, and (iii) the degree of review or examination by the IRS or any other agency, including whether such review or examination would be a condition to receiving any direct payment. These clarifications may impact the timing and extent of cash benefits available to us and, if the

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direct payment election cannot be made a second time, our ability to transfer the tax credits to another taxpayer or taxpayers, which depends on the future demand for such credits.

- *Domestic content requirements.* The guidance is expected to confirm that domestic content rules are applied separately with respect to steel and iron as compared to manufactured products, which would require that only a certain percentage of the total costs of such manufactured product components are of U.S. origin. These clarifications may impact whether our modules meet domestic content requirements, which is a key value proposition for current and future customers. Alternatively, if the domestic content rules as defined by the final guidance are defined broadly, we may face significant additional competition for module sales within the U.S. If our modules manufactured in the U.S. do not meet the domestic content requirements as defined by the final guidance or if the guidance definition is defined broadly, this may adversely impact demand and/or price levels for our solar modules and future expansion plans within the United States.

Any modifications to the law or its effects arising, for example, through (i) technical guidance and regulations from the IRS and U.S. Treasury Department, including the certain aspects disclosed above, (ii) subsequent amendments to or interpretations of the law, and/or (iii) future laws or regulations rendering certain provisions of the IRA less effective or ineffective, in whole or in part, could result in changes to the expected and/or actual benefits in the future, which could have a material adverse effect on demand and/or price levels for our solar modules, our net sales, and future expansion plans within the United States, and/or otherwise adversely impact our business, financial condition, and results of operations.

Existing regulations and policies, changes thereto, and new regulations and policies may present technical, regulatory, and economic barriers to the purchase and use of PV solar products, which may significantly reduce demand for our modules.

The market for electricity generation products is heavily influenced by federal, state, local, and foreign government regulations and policies concerning the electric utility industry, as well as policies promulgated by electric utilities. These regulations and policies often relate to electricity pricing and interconnection of customer-owned electricity generation. In the United States and certain other countries, these regulations and policies have been modified in the past and may be modified again in the future, which could deter end-user purchases of PV solar products. For example, without a mandated regulatory exception for PV solar power systems, system owners are often charged interconnection or standby fees for putting distributed power generation on the electric utility grid. To the extent these interconnection standby fees are applicable to PV solar power systems, it is likely that they would increase the cost of such systems, which could make the systems less desirable, thereby adversely affecting our business, financial condition, and results of operations. Another example is the effect of governmental land-use planning policies and environmental policies on utility-scale PV solar development. The adoption of restrictive land-use designations or environmental regulations that proscribe or restrict the siting of utility-scale solar facilities could adversely affect the marginal cost of such development.

Our modules are often subject to oversight and regulation in accordance with national and local ordinances relating to building codes, safety, environmental protection, and other matters, and tracking the requirements of individual jurisdictions is complex. Any new government regulations or utility policies pertaining to our modules may result in significant additional expenses to us or our customers and, as a result, could cause a significant reduction in demand for our products. In addition, any regulatory compliance failure could result in significant management distraction, unplanned costs, and/or reputational damage.

We could be adversely affected by any violations of the FCPA, the U.K. Bribery Act, and other foreign anti-bribery laws.

The FCPA generally prohibits companies and their intermediaries from making improper payments to non-U.S. government officials for the purpose of obtaining or retaining business. Other countries in which we operate also have anti-bribery laws, some of which prohibit improper payments to government and non-government persons and

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entities, and others (e.g., the FCPA and the U.K. Bribery Act) extend their application to activities outside their country of origin. Our policies mandate compliance with all applicable anti-bribery laws. We currently operate in, and may further expand into, key parts of the world that have experienced governmental corruption to some degree and, in certain circumstances, strict compliance with anti-bribery laws may conflict with local customs and practices. In addition, due to the level of regulation in our industry, our operations in certain jurisdictions where norms can differ from U.S. standards, including China, India, South America, and the Middle East, require substantial government contact, either directly by us or through intermediaries over whom we have less direct control, such as subcontractors, agents, and partners (such as joint venture partners). Although we have implemented policies, procedures, and, in certain cases, contractual arrangements designed to facilitate compliance with these anti-bribery laws, our officers, directors, associates, subcontractors, agents, and partners may take actions in violation of our policies, procedures, contractual arrangements, and anti-bribery laws. Any such violation, even if prohibited by our policies, could subject us and such persons to criminal and/or civil penalties or other sanctions potentially by government prosecutors from more than one country, which could have a material adverse effect on our business, financial condition, cash flows, and reputation.

Environmental obligations and liabilities could have a substantial negative impact on our business, financial condition, and results of operations.

Our operations involve the use, handling, generation, processing, storage, transportation, and disposal of hazardous materials and are subject to extensive environmental laws and regulations at the national, state, local, and international levels. These environmental laws and regulations include those governing the discharge of pollutants into the air and water, the use, management, and disposal of hazardous materials and wastes, the cleanup of contaminated sites, and occupational health and safety. As we expand our business into foreign jurisdictions worldwide, our environmental compliance burden may continue to increase both in terms of magnitude and complexity. We have incurred and may continue to incur significant costs in complying with these laws and regulations. In addition, violations of, or liabilities under, environmental laws or permits may result in restrictions being imposed on our operating activities or in our being subject to substantial fines, penalties, criminal proceedings, third-party property damage or personal injury claims, cleanup costs, or other costs. While we believe we are currently in substantial compliance with applicable environmental requirements, future developments such as more aggressive enforcement policies, the implementation of new, more stringent laws and regulations, or the discovery of presently unknown environmental conditions may require expenditures that could have a material adverse effect on our business, financial condition, and results of operations.

Our solar modules contain CdTe and other semiconductor materials. Elemental cadmium and certain of its compounds are regulated as hazardous materials due to the adverse health effects that may arise from human exposure. Based on existing research, the risks of exposure to CdTe are not believed to be as serious as those relating to exposure to elemental cadmium due to CdTe's limited bioavailability. In our manufacturing operations, we maintain engineering controls to minimize our associates' exposure to cadmium compounds and require our associates who handle cadmium compounds to follow certain safety procedures, including the use of personal protective equipment such as respirators, chemical goggles, and protective clothing. Relevant studies and third-party peer reviews of our technology have concluded that the risk of exposure to cadmium or cadmium compounds from our end-products is negligible. In addition, the risk of exposure is further minimized by the encapsulated nature of these materials in our products, the physical properties of cadmium compounds used in our products, and the recycling or responsible disposal of our modules. While we believe that these factors and procedures are sufficient to protect our associates, end users, and the general public from adverse health effects that may arise from cadmium exposure, we cannot ensure that human or environmental exposure to cadmium or cadmium compounds used in our products will not occur. Any such exposure could result in future third-party claims against us, damage to our reputation, and heightened regulatory scrutiny, which could limit or impair our ability to sell and distribute our products. The occurrence of future events such as these could have a material adverse effect on our business, financial condition, and results of operations.

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The use of cadmium or cadmium compounds in various products is also coming under increasingly stringent governmental regulation. Future regulation in this area could impact the manufacturing, sale, collection, and recycling of solar modules and could require us to make unforeseen environmental expenditures or limit our ability to sell and distribute our products. Examples of such regulations include the following:

- European Union Directive 2011/65/EU on the Restriction of the Use of Hazardous Substances ("RoHS") in electrical and electronic equipment (the "RoHS Directive") restricts the use of certain hazardous substances, including cadmium and its compounds, in all electronic equipment sold into the European market, unless excluded from the law. Currently, PV solar modules are explicitly excluded from the scope of RoHS (Article 2), as adopted in June 2011. Other jurisdictions have adopted similar legislation or are considering doing so. The next revision of the RoHS Directive is expected in 2025. If PV modules were to be included in the scope of future RoHS revisions without an exemption, we would be required to redesign our solar modules to reduce cadmium and other affected hazardous substances to the maximum allowable concentration thresholds in the RoHS Directive in order to continue to offer them for sale within the EU. As such actions would be impractical, this type of regulatory development would effectively close the EU market to us, which could have a material adverse effect on our business, financial condition, and results of operations.

- In November 2022, the government of India, through its Ministry of Environment, Forest and Climate Change and MNRE, introduced legislation intended to expand the scope of existing electronic waste ("e-waste") regulations, including PV solar modules. This regulation, as subsequently amended in January 2023, will also create extended producer obligations for mandatory recycling of PV solar waste at the end of its useful life. These regulations are expected to come into effect on April 1, 2023. At this time, the recycling targets, monitoring mechanism, and determination of who finances the recycling costs are unclear, and, depending on the final procedures and rules, such regulations could negatively impact our financial condition and results of operations in India.

General Risk Factors

Cyber-attacks or other breaches of our information systems, or those of third parties with which we do business, could have a material adverse effect on our business, financial condition, and results of operations.

Our operations rely on our computer systems, hardware, software, and networks, as well as those of third parties with which we do business, to securely process, store, and transmit proprietary, confidential, and other information, including intellectual property and personally identifiable information. We also rely heavily on these information systems to operate our manufacturing lines. These information systems may be compromised by cyber-attacks, computer viruses, and other events that could be materially disruptive to our business operations and could put the security of our information, and that of the third parties with which we do business, at risk of misappropriation or destruction. In recent years, such cyber incidents have become increasingly frequent and sophisticated, targeting or otherwise affecting a wide range of companies. While we have instituted security measures and procured insurance to mitigate the likelihood and impact of a cyber incident, there is no assurance that these measures, or those of the third parties with which we do business, will be adequate in the future. If these measures fail, valuable information may be lost; our operations may be disrupted; we may be unable to fulfill our customer obligations; and our reputation may suffer. Additionally, any cyber incident affecting our automated manufacturing lines could adversely affect our ability to produce solar modules or otherwise affect the quality and performance of the modules produced. We may also be subject to litigation, regulatory action, remedial expenses, and financial losses beyond the scope or limits of our insurance coverage. These consequences of a failure of security measures could, individually or in the aggregate, have a material adverse effect on our business, financial condition, and results of operations.

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The severity and duration of public health threats (including pandemics such as COVID-19 or similarly infectious diseases) could materially impact our business, financial condition, and results of operations.

The COVID-19 pandemic continues to impact various countries throughout the world, including those in which we do business or have operations, though the scope and severity of COVID-19 continues to evolve. With the exception of certain manufacturing charges incurred in 2020 and 2021, the COVID-19 pandemic and its effects on the economy did not materially impact our business, financial condition, and/or results of operations. However, the extent to which public health threats (including pandemics such as COVID-19 or similarly infectious diseases) could impact us in the future is highly uncertain and cannot be predicted, and will depend largely on subsequent developments, including but not limited to (i) the severity and duration of any public health threat, (ii) measures taken to contain the spread of any public health threat, such as restrictions on travel and gatherings of people and temporary closures of or limitations on businesses and other commercial activities, (iii) the timing and nature of policies implemented by governmental authorities, and (iv) any future variants of any public health threat, which may surge over time.

As a result of any public health threat and any related containment measures and reopening policies, we may be subject to significant risks, which have the potential to materially and adversely impact our business, financial condition, and results of operations, including the following:

- we may at any time be ordered by governmental authorities, or we may determine, based on our understanding of the recommendations or orders of governmental authorities, that we have to curtail or cease business operations or activities, including manufacturing and R&D activities; and

- the failure of our suppliers or vendors to supply materials or equipment, or the failure of our vendors to install, repair, or replace our specialized equipment, due to any public health threat and related containment measures, may idle, slowdown, shutdown, or otherwise cause us to adjust our manufacturing capacity, and the availability and cost of logistics services associated with the procurement of raw materials or equipment used in our manufacturing process and the shipping, handling, storage, and distribution of our modules may require us to adjust our module manufacturing plans or module delivery commitments, which may result in additional unplanned charges.

If we are unable to attract, train, retain, and successfully integrate key talent into our management team, our business may be materially and adversely affected.

Our future success depends, to a significant extent, on our ability to attract, train, and retain management, operations, sales, and technical talent, including associates in foreign jurisdictions. Recruiting and retaining capable individuals, particularly those with expertise in the PV solar industry across a variety of technologies, are vital to our success. We are also dependent on the services of our executive officers and other members of our senior management team. The loss of one or more of these key associates or any other member of our senior management team could have a material adverse effect on our business. Although we have a succession planning process in place, we may not be able to retain or replace these key associates in a timely manner. Several of our current key associates, including our executive officers, are subject to employment conditions or arrangements that contain post-employment non-competition provisions. However, these arrangements permit the associates to terminate their employment with us upon little or no notice. In addition, on January 5, 2023, the U.S. Federal Trade Commission ("FTC") voted to issue a notice of proposed rulemaking that, if adopted, would ban non-competition provisions. The proposed rule would make it illegal for an employer to enter into, attempt to enter into, or maintain a non-competition provision. It would also require an employer to rescind any existing non-competition provisions. The proposed rule is subject to a public comment period through March 10, 2023, after which the FTC may vote to implement the proposed rule or may update or revise it based on the comments received and the FTC's further analysis of the issue. Although it is uncertain if the rule will be adopted or what the final language of the rule, if adopted, will be, the implementation of a ban on non-competition provisions could make it more difficult for us to retain qualified associates.

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There is substantial competition for qualified technical and manufacturing personnel, and while we continue to benchmark our organization against a broad spectrum of businesses in our market space to remain economically competitive, there can be no assurances that we will be able to attract and retain technical personnel. As we continue to expand domestically and internationally, we may encounter regional laws that mandate union representation or associates who desire union representation or a collective bargaining agreement. If we are unable to attract and retain qualified associates, or otherwise experience unexpected labor disruptions within our business, we may be materially and adversely affected.

We may be exposed to infringement or misappropriation claims by third parties, which, if determined adversely to us, could cause us to pay significant damage awards or prohibit us from the manufacture and sale of our solar modules or the use of our technology.

Our success depends largely on our ability to use and develop our technology and know-how without infringing or misappropriating the intellectual property rights of third parties. The validity and scope of claims relating to PV solar technology patents involve complex scientific, legal, and factual considerations and analysis and, therefore, may be highly uncertain. We may be subject to litigation involving claims of patent infringement or violation of intellectual property rights of third parties. For example, during 2022, we received various indemnification demands from certain customers, for whom we provided EPC services, regarding claims that such customers' PV tracker systems infringe, in part, on patents owned by Rovshan Sade ("Sade"), the owner of a company called Trabant Solar, Inc. See Note 12. "Commitments and Contingencies – Legal Proceedings" to our consolidated financial statements for more information on our legal proceedings. The defense and prosecution of intellectual property suits, patent opposition proceedings, and related legal and administrative proceedings can be both costly and time consuming and may significantly divert the efforts and resources of our technical and management personnel. An adverse determination in any such litigation or proceedings to which we may become a party could subject us to significant liability to third parties, require us to seek licenses from third parties, which may not be available on reasonable terms, or at all, or pay ongoing royalties, require us to redesign our solar modules, or subject us to injunctions prohibiting the manufacture and sale of our solar modules or the use of our technologies. Protracted litigation could also result in our customers or potential customers deferring or limiting their purchase or use of our solar modules until the resolution of such litigation.

Currency translation and transaction risk may negatively affect our results of operations.

Although our reporting currency is the U.S. dollar, we conduct certain business and incur costs in the local currency of most countries in which we operate. As a result, we are subject to currency translation and transaction risk. For example, certain of our net sales in 2022 were denominated in foreign currencies, such as Japanese yen and Euro, and we expect to continue to have net sales denominated in foreign currencies in the future, such as Indian rupee. Certain business arrangements outside the United States have involved and may involve significant investments denominated in local currencies. Changes in exchange rates between foreign currencies and the U.S. dollar could affect our results of operations and result in exchange gains or losses. We cannot accurately predict the impact of future exchange rate fluctuations on our results of operations.

We could also expand our business into emerging markets, many of which have an uncertain regulatory environment relating to currency policy. Conducting business in such emerging markets could cause our exposure to changes in exchange rates to increase, due to the relatively high volatility associated with emerging market currencies and potentially longer payment terms for our proceeds.

Our ability to hedge foreign currency exposure is dependent on our credit profile with the banks that are willing and able to do business with us. Deterioration in our credit position or a significant tightening of the credit market conditions could limit our ability to hedge our foreign currency exposures; and therefore, result in exchange gains or losses.

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Unanticipated changes in our tax provision, the enactment of new tax legislation, or exposure to additional income tax liabilities could affect our profitability.

We are subject to income taxes in the various jurisdictions in which we operate. Accordingly, we are subject to a variety of tax laws and interpretations of such laws by local tax authorities. For example, in January 2022, the U.S. government published new regulations in the U.S. Federal Register to address various aspects of foreign tax credit regimes, including, among other things, guidance related to the disallowance of credits or deductions for foreign income taxes. These regulations, which became effective in March 2022, contain certain provisions that are applicable for periods prior to the effective date, and the final effects could result in material income tax expense in future periods. Furthermore, longstanding international tax laws that determine each country's jurisdictional tax rights in cross-border international trade continue to evolve as a result of the base erosion and profit shifting reporting requirements and the introduction of the global minimum tax recommended by the Organization for Economic Co-operation and Development. Additionally, in August 2022, the U.S. President signed into law the IRA, which revised U.S. tax law by, among other things, including a new corporate alternative minimum tax (the "CAMT") of 15% on certain large corporations, imposing a 1% excise tax on stock buybacks, and providing various incentives to address climate change, including the introduction of the advanced manufacturing production credit. The provisions of the IRA are generally effective for tax years beginning after 2022. Given the complexities of the IRA, which is pending technical guidance and regulations from the IRS and U.S. Treasury Department, we will continue to monitor these developments and evaluate the potential future impact to our results of operations. For further information, see the Risk Factor entitled, "We expect certain financial benefits as a result of tax incentives provided by the Inflation Reduction Act of 2022. If these expected financial benefits vary significantly from our assumptions, our business, financial condition, and results of operations could be adversely affected." Changes to these and other tax laws and regulations could have a material adverse impact on our business, financial condition, and results of operations.

We are subject to potential tax examinations in various jurisdictions, and taxing authorities may disagree with our interpretations of U.S. and foreign tax laws and may assess additional taxes. We regularly assess the likely outcomes of these examinations in order to determine the appropriateness of our tax provision; however, the outcome of tax examinations cannot be predicted with certainty. Therefore, the amounts ultimately paid upon resolution of such examinations could be materially different from the amounts previously included in our income tax provision, which could have a material adverse impact on our business, financial condition, and results of operations.

In addition, our future effective tax rate could be adversely affected by changes to our operating structure, losses of tax holidays, changes in the jurisdictional mix of earnings among countries with tax holidays or differing statutory tax rates, changes in the valuation of deferred tax assets and liabilities, changes in tax laws, and the discovery of new information in the course of our tax return preparation process. Any changes in our effective tax rate may have a material adverse impact on our business, financial conditions, and results of operations.

We have been and may be subject to or involved in litigation or threatened litigation, the outcome of which may be difficult to predict, and which may be costly to defend, divert management attention, require us to pay damages, or restrict the operation of our business.

From time to time, we have been and may be subject to disputes and litigation, with and without merit, that may be costly and which may divert the attention of our management and our resources in general, whether or not any dispute actually proceeds to litigation. The results of complex legal proceedings are difficult to predict. Moreover, complaints filed against us may not specify the amount of damages that plaintiffs seek, and we therefore may be unable to estimate the possible range of damages that might be incurred should these lawsuits be resolved against us. Even if we are able to estimate losses related to these actions, the ultimate amount of loss may be materially higher than our estimates. Any resolution of litigation, or threatened litigation, could involve the payment of damages or expenses by us, which may be significant or involve an agreement with terms that restrict the operation of our business. Even if any future lawsuits are not resolved against us, the costs of defending such lawsuits may be significant. These costs may exceed the dollar limits of our insurance policies or may not be covered at all by our

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insurance policies. Because the price of our common stock has been, and may continue to be, volatile, we can provide no assurance that additional securities or other litigation will not be filed against us in the future. See Note 12. "Commitments and Contingencies – Legal Proceedings" to our consolidated financial statements for more information on our legal proceedings.

Changes in, or any failure to comply with, privacy laws, regulations, and standards may adversely affect our business.

Personal privacy and data security have become significant issues in the United States, India, Europe, and in many other jurisdictions in which we operate. The regulatory framework for privacy and security issues worldwide is rapidly evolving and is likely to remain uncertain for the foreseeable future. Furthermore, federal, state, or foreign government bodies or agencies have in the past adopted, and may in the future adopt, laws and regulations affecting data privacy, all of which may be subject to invalidation by relevant foreign judicial bodies. Industry organizations also regularly adopt and advocate for new standards in this area.

In the United States, these include rules and regulations promulgated or pending under the authority of federal agencies, state attorneys general, legislatures, and consumer protection agencies. Internationally, many jurisdictions in which we operate have established their own data security and privacy legal framework with which we, relevant suppliers, and customers must comply. For example, the General Data Protection Regulation, a broad-based data privacy regime enacted by the European Parliament, which became effective in May 2018, imposed new requirements on how we collect, process, transfer, and store personal data, and also imposed additional obligations, potential penalties, and risk upon our business. Additionally, the California Consumer Privacy Act, which became effective in January 2020, imposed similar data privacy requirements. In many jurisdictions, enforcement actions and consequences for noncompliance are also rising. In addition to government regulation, privacy advocates and industry groups may propose new and different self-regulatory standards that either legally or contractually apply to us. Although we have implemented policies, procedures, and, in certain cases, contractual arrangements designed to facilitate compliance with applicable privacy and data security laws and standards, any inability or perceived inability to adequately address privacy and security concerns, even if unfounded, or comply with applicable privacy and data security laws, regulations, and policies, could result in additional fines, costs, and liabilities to us, damage our reputation, inhibit sales, and adversely affect our business.

Our Amended and Restated Bylaws designate a state or federal court located within the State of Delaware as the exclusive forum for substantially all disputes between us and our stockholders, and the federal district courts of the United States as the exclusive forum for the resolution of any complaint asserting a cause of action under the Securities Act of 1933, which could limit our stockholders' ability to choose the judicial forum for disputes with us or our directors, officers, employees, agents or stockholders.

Our Amended and Restated Bylaws ("Bylaws") provide that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware (or, if the Court of Chancery of the State of Delaware lacks subject matter jurisdiction, the federal district court for the District of Delaware) is the sole and exclusive forum for (i) any derivative action or proceeding brought on our behalf, (ii) any action or proceeding asserting a claim of breach of a fiduciary duty owed by any of our directors, officers, other employees, agents or stockholders to us or our stockholders, (iii) any action or proceeding against us or any of our directors, officers, other employees, agents or stockholders arising pursuant to any provision of the Delaware General Corporation Law ("DGCL"), our Amended and Restated Certificate of Incorporation or our Bylaws, (iv) any action or proceeding against us or any of our directors, officers or other employees asserting a claim that is governed by the internal affairs doctrine, or (v) any action or proceeding asserting an "internal corporate claim," as defined in the DGCL. Our Bylaws also provide that, unless we consent in writing to the selection of an alternative forum, the federal district courts of the United States are the exclusive forum for resolving any complaint asserting a cause of action under the Securities Act. Nothing in our Bylaws precludes stockholders that assert claims under the Exchange Act from bringing such claims in any court, subject to applicable law.

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Any person or entity holding, owning or otherwise acquiring any interest in any of our securities shall be deemed to have notice of and consented to these provisions. These exclusive forum provisions may limit a stockholder's ability to bring a claim in a judicial forum of its choosing for disputes with us or our directors, officers, other employees, agents or stockholders, which may discourage lawsuits against us and our directors, officers, other employees, agents or stockholders. The enforceability of similar choice of forum provisions in other companies' governing documents has been challenged in legal proceedings, and it is possible that a court could find these types of provisions to be inapplicable or unenforceable. For example, in December 2018, the Court of Chancery of the State of Delaware determined that a provision stating that federal district courts of the United States are the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act is not enforceable. Although this decision was reversed by the Delaware Supreme Court in March 2020, courts in other states may still find these provisions to be inapplicable or unenforceable. If a court were to find the exclusive forum provisions in our Bylaws to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving the dispute in other jurisdictions, which could adversely affect our results of operations.

Item 1B. ***Unresolved Staff Comments***

None.

Item 2. ***Properties***

As of December 31, 2022, our principal properties consisted of the following:

Nature	Primary Segment(s) Using Property	Location	Held
Corporate headquarters	Modules & Other	Tempe, Arizona, United States	Lease
Manufacturing plants, R&D facilities, and administrative offices	Modules	Perrysburg and Lake Township, Ohio, United States	Own
R&D facility	Modules	Santa Clara, California, United States	Lease
Manufacturing plant and administrative offices	Modules	Kulim, Kedah, Malaysia	Lease land, own buildings
Administrative offices	Modules & Other	Georgetown, Penang, Malaysia	Lease
Manufacturing plant	Modules	Ho Chi Minh City, Vietnam	Lease land, own buildings
Manufacturing plant (1)	Modules	Tamil Nadu, India	Lease land, own buildings
Manufacturing plant (2)	Modules	Frankfurt/Oder, Germany	Own
Manufacturing plant (3)	Modules	Trinity, Alabama, United States	Own

(1) Manufacturing plant currently under construction; operations are expected to commence in the second half of 2023.

(2) In December 2012, we ceased manufacturing at our German plant. Since its closure, we have, from time to time, marketed such property for sale.

(3) Manufacturing plant currently under construction; operations are expected to commence in late 2024.

Item 3. ***Legal Proceedings***

See Note 12. "Commitments and Contingencies – Legal Proceedings" to our consolidated financial statements for information regarding legal proceedings and related matters.

Item 4. ***Mine Safety Disclosures***

None.

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PART II

Item 5. ***Market for Registrant's Common Equity, Related Stockholder Matters, and Issuer Purchases of Equity Securities***

Market Information

Our common stock is listed on The Nasdaq Stock Market LLC under the symbol FSLR.

Holders

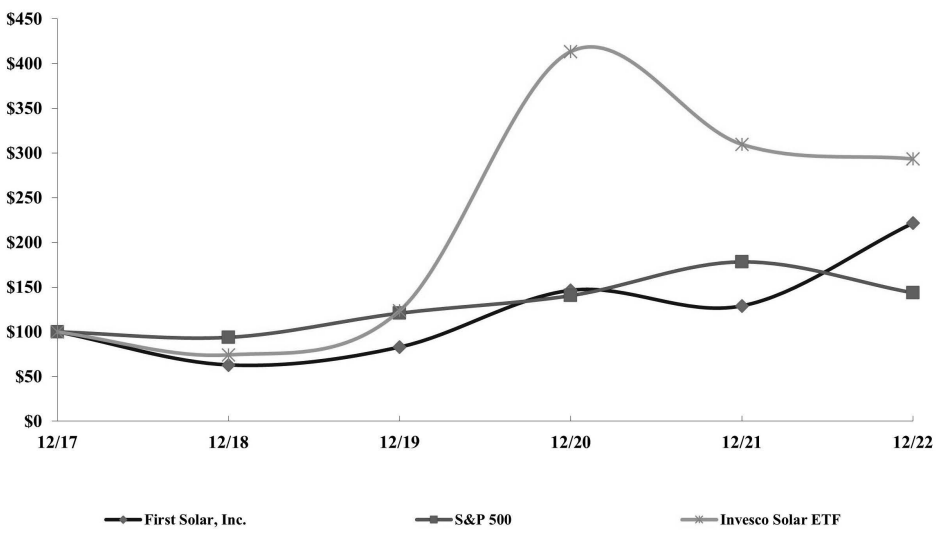
As of February 24, 2023, there were 44 record holders of our common stock, which does not reflect beneficial owners of our shares.

Dividend Policy

We have never paid and do not expect to pay dividends on our common stock for the foreseeable future. The declaration and payment of dividends is subject to the discretion of our board of directors and depends on various factors, including our net income, financial condition, cash requirements, future prospects, and other factors considered relevant by our board of directors. We expect to prioritize our working capital requirements, capacity expansion and other capital expenditure needs, R&D and technology investments, and merger and acquisition opportunities prior to returning capital to our shareholders.

Stock Price Performance Graph

The following graph compares the five-year cumulative total return on our common stock relative to the cumulative total returns of the S&P 500 Index and the Invesco Solar ETF, which represents a peer group of solar companies. For purposes of the graph, an investment of $100 (with reinvestment of all dividends) is assumed to have been made in our common stock, the S&P 500 Index, and the Invesco Solar ETF on December 31, 2017, and its relative performance is tracked through December 31, 2022. This graph is not "soliciting material," is not deemed filed with the SEC, and is not to be incorporated by reference in any filing by us under the Securities Act or the Exchange Act, whether made before or after the date hereof, and irrespective of any general incorporation language in any such filing. The stock price performance shown in the graph represents past performance and is not necessarily indicative of future stock price performance.



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Recent Sales of Unregistered Securities

None.

Purchases of Equity Securities by the Issuer and Affiliate Purchases

None.

Item 6. ***Reserved***

None.

Item 7. ***Management's Discussion and Analysis of Financial Condition and Results of Operations***

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our consolidated financial statements and the related notes thereto included in this Annual Report on Form 10-K. In addition to historical financial information, the following discussion and analysis contains forward-looking statements that involve risks, uncertainties, and assumptions as described under the "Note Regarding Forward-Looking Statements" that appears earlier in this Annual Report on Form 10-K. Our actual results could differ materially from those anticipated by these forward-looking statements as a result of many factors, including those discussed under Item 1A. "Risk Factors," and elsewhere in this Annual Report on Form 10-K. This discussion and analysis does not address certain items in respect of the year ended December 31, 2020. See Item 7. "Management's Discussion and Analysis of Financial Condition and Results of Operations" in our Annual Report on Form 10-K for the year ended December 31, 2021 for comparative discussions of our results of operations and liquidity and capital resources for the years ended December 31, 2021 and 2020.

Executive Overview

We are a leading American solar technology company and global provider of PV solar energy solutions. Developed at our R&D labs in California and Ohio, we manufacture and sell PV solar modules with an advanced thin film semiconductor technology that provide a high-performance, lower-carbon alternative to conventional crystalline silicon PV solar modules. From raw material sourcing through end-of-life module recycling, we are committed to reducing the environmental impacts and enhancing the social and economic benefits of our products across their life cycle. We are the world's largest thin film PV solar module manufacturer and the largest PV solar module manufacturer in the Western Hemisphere.

Certain of our financial results and other key operational developments for the year ended December 31, 2022 include the following:

- Net sales for 2022 decreased by 10% to $2.6 billion compared to $2.9 billion in 2021. The decrease in net sales was primarily attributable to sales of certain projects in the United States and Japan in the prior period, the prior period settlement of an outstanding indemnification arrangement associated with the sale of one of our projects, and a decrease in the average selling price per watt, partially offset by an increase in the volume of modules sold to third parties.

- Gross profit decreased 22.3 percentage points to 2.7% in 2022 from 25.0% in 2021 primarily due to a decrease in the average selling price per watt of our modules, the volume of higher gross profit projects sold during the prior period, an increase in sales freight, demurrage, and detention charges, an impairment loss for our Luz del Norte PV solar power plant, and the prior period settlement of the indemnification matter mentioned above. These decreases to gross profit were partially offset by the higher volume of modules sold and continued module cost reductions.

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- As of December 31, 2022, we had approximately 9.8 GW_{DC} of total installed nameplate module production capacity across all our facilities. We produced 9.1 GW_{DC} of solar modules during 2022, which represented a 15% increase in module production from 2021. The increase in production was primarily driven by higher throughput at our manufacturing facilities. We expect to produce between 11.5 GW_{DC} and 12.2 GW_{DC} of solar modules during 2023.

- During 2022, we announced plans to expand our manufacturing capacity by an additional 4.4 GW_{DC} by constructing our fourth manufacturing facility in the United States and increasing our manufacturing footprint at our existing facilities in Ohio. Such expansion plans, in combination with our previously announced expansion plans, are expected to increase our manufacturing capacity by approximately 11 GW_{DC} by 2025.

- In May 2022, we entered into various agreements with certain subsidiaries of PAG Real Assets ("PAG"), a private investment firm, for the sale of our Japan project development business. In June 2022, we completed the sale and, following certain customary post-closing adjustments, received total consideration of ¥66.4 billion ($490.8 million) and transferred cash and restricted cash of ¥8.4 billion ($61.9 million) to PAG. As a result of this transaction, we recognized a gain of $245.2 million, net of transaction costs, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations for the year ended December 31, 2022. In September 2022, we also completed the sale of our Japanese O&M operations to a subsidiary of PAG and, following certain customary post-closing adjustments, received total consideration of ¥692.7 million ($4.8 million). As a result of this transaction, we recognized a gain of $1.4 million, net of transaction costs and post-closing adjustments, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations for the year ended December 31, 2022.

Market Overview

Solar energy is one of the fastest growing forms of renewable energy with numerous economic and environmental benefits that make it an attractive complement to and/or substitute for traditional forms of energy generation. In recent years, the cost of producing electricity from PV solar power systems has decreased to levels that are competitive with or below the wholesale price of electricity in many markets. This price decline has opened new possibilities to develop systems in many locations with limited or no financial incentives, thereby promoting the widespread adoption of solar energy. Additionally, recently enacted government support programs, such as the IRA discussed above, have contributed to this momentum by providing solar module manufacturers, project developers, and project owners with various incentives to accelerate the ongoing transition to clean energy. For more information about these support programs, see Item 1. "Business - Support Programs."

Supply and demand. As a result of the market opportunities described above, we are in the process of expanding our manufacturing capacity by approximately 11 GW_{DC}, including the construction of our third manufacturing facility in the United States, which commenced commercial production of modules in early 2023; our first manufacturing facility in India, which is expected to commence operations in the second half of 2023; our fourth manufacturing facility in the United States, which is expected to commence operations in late 2024; and the expansion of our manufacturing footprint at our existing facilities in Ohio. In the aggregate, we believe manufacturers of solar cells and modules, particularly those in China, have significant installed production capacity, relative to global demand, and the ability for additional capacity expansion. Accordingly, we believe the solar industry may experience periods of structural imbalance between supply and demand, which could lead to periods of pricing volatility. In light of such market realities, we continue to focus on our strategies and points of differentiation, which include our advanced module technology, our manufacturing process, our R&D capabilities, the sustainability advantage of our modules, and our financial stability.

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Pricing competition. The solar industry has been characterized by intense pricing competition, both at the module and system levels. This competition may result in an environment in which pricing falls rapidly, thereby potentially increasing demand for solar energy solutions but constraining the ability for project developers and module manufacturers to sustain meaningful and consistent profitability. Our results of operations could be adversely affected if competitors reduce pricing to levels below their costs, bid aggressively low prices for module sale agreements, or are able to operate at minimal or negative operating margins for sustained periods of time. For certain of our competitors, including many in China, these practices may be enabled by their direct or indirect access to sovereign capital or other forms of state support. Although module average selling prices in many global markets have declined for several years, recent module spot pricing has increased, in part, due to trade measures and policies, government regulations, raw material availability, and supply chain disruptions. For example, module spot pricing in the United States has increased, in part, due to elevated commodity and logistics costs and, more recently, due to the rising demand for modules manufactured in the United States as a result of the IRA. The duration of this elevated period of pricing is uncertain.

Diverse offerings. We face intense competition from manufacturers of crystalline silicon solar modules and other emerging technologies. Solar module manufacturers compete with one another on sales price per watt, which may be influenced by several module value attributes, including wattage (through a larger form factor or an improved conversion efficiency), energy yield, degradation, sustainability, and reliability. Sales price per watt may also be influenced by warranty terms and customer payment terms. While conventional solar modules are monofacial, meaning their ability to produce energy is a function of direct and diffuse irradiance on their front side, most module manufacturers offer bifacial modules that also capture diffuse irradiance on the back side of a module. We currently produce monofacial solar modules and, based on recent R&D activities, expect to produce bifacial solar modules in the near term. Bifaciality compromises nameplate efficiency, but by converting both front and rear side irradiance, such technology may improve the overall energy production of a module relative to nameplate efficiency when applied in certain applications, which could potentially lower the overall LCOE of a system when compared to systems using conventional solar modules, including the modules we currently produce. Additionally, certain module manufacturers have introduced n-type mono-crystalline modules, such as TOPCon modules, which are expected to provide certain improvements to module efficiency, temperature coefficient, and bifacial performance, and claim to provide certain degradation advantages compared to other mono-crystalline modules.

Product efficiencies. We believe we are among the lowest cost module manufacturers in the solar industry on a module cost per watt basis, based on publicly available information. This cost competitiveness allows us to compete favorably in markets where pricing for modules and systems is highly competitive. Our cost competitiveness is based in large part on our advanced thin film semiconductor technology, module wattage (or conversion efficiency), proprietary manufacturing process (which enables us to produce a CdTe module in a matter of hours using a continuous and highly automated industrial manufacturing process, as opposed to a batch process), and our focus on operational excellence. In addition, our CdTe modules use approximately 2% to 3% of the amount of semiconductor material that is used to manufacture conventional crystalline silicon solar modules. The cost of polysilicon is a significant driver of the manufacturing cost of crystalline silicon solar modules, and the timing and rate of change in the cost of silicon feedstock and polysilicon could lead to changes in solar module pricing levels. In recent years, polysilicon consumption per cell has been reduced through various initiatives, which have contributed to declines in our relative manufacturing cost competitiveness over conventional crystalline silicon module manufacturers.

Energy performance. In many climates our solar modules provide certain energy production advantages relative to competing crystalline silicon solar modules. As a result, our solar modules can produce more annual energy in real world operating conditions than conventional crystalline silicon modules with the same nameplate capacity. For more information about these advantages, see Item 1. “Business – Business Strategy.” Additionally, we warrant that our solar modules will produce at least 98% of their labeled power output rating during the first year, with the warranty coverage reducing by a degradation factor between 0.3% and 0.5%, depending on the module series, every year thereafter throughout the limited power output warranty period of up to 30 years.

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While our modules are generally competitive in cost, reliability, and performance attributes, there can be no guarantee such competitiveness will continue to exist in the future to the same extent or at all. Any declines in the competitiveness of our products could result in further declines in the average selling prices of our modules and additional margin compression. We continue to focus on enhancing the competitiveness of our solar modules through our module technology and cost reduction roadmaps.

Certain Trends and Uncertainties

We believe that our business, financial condition, and results of operations may be favorably or unfavorably impacted by the following trends and uncertainties. See Item 1A. "Risk Factors" and elsewhere in this Annual Report on Form 10-K for discussions of other risks that may affect us.

Our business is evolving worldwide and is shaped by the varying ways in which our offerings can be compelling and economically viable solutions to energy needs in various markets. In addressing electricity demands, we are focused on providing utility-scale module offerings in key geographic markets that we believe have a significant need for mass-scale PV solar electricity, including markets throughout the United States, India, and Europe. We closely evaluate and monitor the appropriate level of resources required to support such markets and their associated sales opportunities. When deployed in utility-scale applications, our modules provide energy at a lower LCOE compared to traditional forms of energy generation, making them an attractive alternative to or replacement for aging fossil fuel-based generation resources. Accordingly, future retirements of aging energy generation resources represent a significant increase in the potential market for solar energy.

This focus on utility-scale module offerings exists within a current market environment that includes rooftop and distributed generation solar. We believe that utility-scale solar will continue to be a compelling offering for companies with technology and cost leadership and will continue to represent an increasing portion of the overall electricity generation mix. However, our module offerings in certain markets may be driven, in part, by future demand for rooftop and distributed generation solar solutions. For example, we continue to evaluate opportunities to develop and leverage other solar cell technologies in multi-junction applications that utilize our thin film PV technology. We believe such applications have the potential to enable our module conversion efficiency to reach 28% by 2030.

Demand for our PV solar module offerings depends, in part, on market factors outside our control. For example, many governments have proposed or enacted policies or support programs intended to encourage renewable energy investments to achieve decarbonization objectives and/or establish greater energy independence. While we compete in markets that do not require solar-specific government subsidies or support programs, our net sales and profits remain subject to variability based on the availability and size of government subsidies and economic incentives. Adverse changes in these factors could increase the cost of utility-scale systems, which could reduce demand for our solar modules. Recent developments to government support programs include the following:

- *United States.* In August 2022, the U.S. President signed the IRA into law, which is intended to accelerate the country's ongoing transition to clean energy. The provisions of the IRA are generally effective for tax years beginning after 2022. Among other things, the financial incentives provided by the IRA are expected to significantly increase demand for modules manufactured in the United States. Accordingly, the demand for these solar modules is expected to increase domestic manufacturing in the near term, which may result in localized supply chain constraints and periods of inflationary pricing for certain of our key raw materials, including substrate glass and cover glass. The financial incentives provided by the IRA are also expected to significantly increase demand for solar modules in general due to the incremental tax credit available for the qualified production of clean hydrogen that is powered by renewable resources. Given the complexities of the IRA, which is pending technical guidance and regulations from the IRS and U.S. Treasury Department, we continue to evaluate the extent of benefits available to us, which we expect will favorably impact our results of operations in future periods. For example, we currently expect to qualify for the advanced manufacturing production credit under Section 45X of the IRC, which provides certain specified

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benefits for solar modules and solar module components manufactured in the United States and sold to third parties. Such credit, which may be refundable to us or transferable to a third party, is available through 2032, subject to phase down beginning in 2030. For more information about certain risks associated with the benefits available to us under the IRA, see Item 1A. "Risk Factors – We expect certain financial benefits as a result of tax incentives provided by the Inflation Reduction Act of 2022. If these expected financial benefits vary significantly from our assumptions, our business, financial condition, and results of operations could be adversely affected."

- *India.* In September 2022, the government of India approved an expansion to its PLI scheme to INR 195 billion ($2.5 billion), which is intended to promote the manufacturing of high efficiency solar modules in India and to reduce India's dependency on foreign imports of solar modules. Under the PLI scheme, manufacturers are selected through a competitive bid process and receive certain cash incentives over a five-year period following the commissioning of their manufacturing facilities. Among other things, such incentives are based on the efficiency and temperature coefficient of the modules produced, the proportion of raw materials sourced from the domestic market, the extent to which the manufacturer's operations are fully integrated within India, and the quantity of modules sold from such manufacturing operations. At this time, it is uncertain whether and to what extent we may qualify for such incentives.

Demand for our solar energy solutions also depends on domestic or international trade policies and government regulations, which may be proposed, revised, and/or enacted across short- and long-term time horizons with varying degrees of impact to our net sales, profit, and manufacturing operations. Changes in these policies and regulations could adversely impact the competitive landscape of solar markets, which could reduce demand for our solar modules. Recent revisions or proposed changes to trade policy and government regulations include the following:

- *United States.* In June 2022, the U.S. President authorized the U.S. Secretary of Commerce to provide a 24-month antidumping and countervailing duty tariff exemption for imported solar panels from certain Southeast Asian countries. For more information about this development, see Item 1A. "Risk Factors – The reduction, elimination, or expiration of government subsidies, economic incentives, tax incentives, renewable energy targets, and other support for on-grid solar electricity applications, or the impact of other public policies, such as tariffs or other trade remedies imposed on solar cells and modules, could negatively impact demand and/or price levels for our solar modules and limit our growth or lead to a reduction in our net sales or increase our costs, thereby adversely impacting our operating results." Separately, the U.S. President also authorized the use of the Defense Production Act to expand domestic production of clean energy technologies. At this time, it is uncertain what impact, if any, these developments will have on future investments in solar module manufacturing in the United States.

- *United States.* In June 2022, the U.S. Supreme Court issued a ruling in West Virginia, et al. v. Environmental Protection Agency, et al., which limited the Environmental Protection Agency's ("EPA") ability to regulate greenhouse gas ("GHG") emissions under the Clean Air Act using a "generation shifting" approach from coal-fired power plants to renewable energy sources over time. At this time, it is unclear what effect this ruling will have on future EPA regulation of GHG emissions, the U.S. President's climate change initiatives, internationally agreed-upon climate goals, the extent and timing of future coal plant retirements in the United States, and/or future investments in renewable energy.

- *India*. The ALMM was introduced in 2021 as a non-tariff barrier to incentivize domestic manufacturing of PV modules by approving the list of models and manufacturers who can participate in certain solar development projects. The ALMM is approved by the MNRE, and any modifications to the ALMM and its application may affect future investments in solar module manufacturing in India. For more information about the ALMM, see Item 1A. "Risk Factors – The reduction, elimination, or expiration of government subsidies, economic incentives, tax incentives, renewable energy targets, and other support for on-grid solar electricity applications, or the impact of other public policies, such as tariffs or other trade remedies imposed on solar cells and modules, could negatively impact demand and/or price levels for our solar

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modules and limit our growth or lead to a reduction in our net sales or increase our costs, thereby adversely impacting our operating results."

Our ability to provide solar modules on economically attractive terms is also affected by the availability and cost of logistics services associated with the procurement of raw materials or equipment used in our manufacturing process and the shipping, handling, storage, and distribution of our modules. For example, although the cost of ocean freight throughout many parts of the world has recently decreased, such costs remain at elevated levels relative to pre-COVID-19 pandemic rates. Such factors may disrupt our supply chain and adversely impact our manufacturing operations as several of our key raw materials and components are either single-sourced or sourced from a limited number of international suppliers. We may also incur additional logistics costs, such as demurrage and detention, to the extent we are unable to retrieve or return our shipping containers in a timely manner. To mitigate such costs and better meet our customer commitments, we may adjust our shipping plans to include additional lead times for module deliveries and/or utilize our network of U.S. distribution centers. We are also employing module contract structures that provide additional consideration to us if the cost of logistics services, excluding demurrage and detention, exceeds a defined threshold. Additionally, our manufacturing capacity expansions in the U.S. and India are expected to bring manufacturing activities closer to customer demand, further mitigating our exposure to the cost of ocean freight. While it is currently unclear how long these issues will persist, they may be further exacerbated by the disruption of major shipping routes or other economic disruptions.

We generally price and sell our solar modules on a per watt basis. As of December 31, 2022, we had entered into contracts with customers for the future sale of 61.4 GW_{DC} of solar modules for an aggregate transaction price of $17.7 billion, which we expect to recognize as revenue through 2029 as we transfer control of the modules to the customers. Such volume includes contracts for the sale of 31.5 GW_{DC} of solar modules that include transaction price adjustments associated with future module technology improvements, including new product designs and enhancements to certain energy related attributes. Based on these potential technology improvements, the contracted module volumes as of December 31, 2022, the expected timing such technology improvements are incorporated into our manufacturing process, and the expected timing of module deliveries, such adjustments, if realized, could result in additional revenue of up to $0.5 billion, the majority of which would be recognized in 2025, 2026, and 2027. In addition to these price adjustments, certain of our contracts with customers may include favorable price adjustments associated with the extension of the ITC and/or sales freight in excess of a defined threshold. Certain of our contracts with customers may also include favorable or unfavorable price adjustments associated with changes to certain commodity prices and/or the module wattage committed for delivery. As a result, the revenue recognized from such contracts may increase or decrease in future periods relative to the original transaction price.

We continue to increase the nameplate production capacity of our existing manufacturing facilities by improving our production throughput, increasing module wattage (or conversion efficiency), and reducing manufacturing yield losses. Additionally, we are in the process of expanding our manufacturing capacity by approximately 11 GW_{DC}, including the construction of our third manufacturing facility in the United States, which commenced commercial production of modules in early 2023; our first manufacturing facility in India, which is expected to commence operations in the second half of 2023; our fourth manufacturing facility in the United States, which is expected to commence operations in late 2024; and the expansion of our manufacturing footprint at our existing facilities in Ohio. This additional capacity, and any other potential investments to add to or otherwise modify our existing manufacturing capacity in response to market demand and competition, may require significant internal and possibly external sources of capital, and may be subject to certain risks and uncertainties described in Item 1A. "Risk Factors," including those described under the headings "Our future success depends on our ability to effectively balance manufacturing production with market demand, effectively manage our cost per watt, and, when necessary, continue to build new manufacturing plants over time in response to market demand, all of which are subject to risks and uncertainties" and "If any future production lines are not built in line with committed schedules, it may adversely affect our future growth plans. If any future production lines do not achieve operating metrics similar to our existing production lines, our solar modules could perform below expectations and cause us to lose customers."

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Results of Operations

The following table sets forth our consolidated statements of operations as a percentage of net sales for the years ended December 31, 2022, 2021, and 2020:

	Years Ended December 31,		
	2022	2021	2020
Net sales	100.0 %	100.0 %	100.0 %
Cost of sales	97.3 %	75.0 %	74.9 %
Gross profit	2.7 %	25.0 %	25.1 %
Selling, general and administrative	6.3 %	5.8 %	8.2 %
Research and development	4.3 %	3.4 %	3.5 %
Production start-up	2.8 %	0.7 %	1.5 %
Litigation loss	— %	— %	0.2 %
Gain on sales of businesses, net	9.7 %	5.0 %	— %
Operating (loss) income	(1.0)%	20.1 %	11.7 %
Foreign currency loss, net	(0.6)%	(0.3)%	(0.2)%
Interest income	1.3 %	0.2 %	0.6 %
Interest expense, net	(0.5)%	(0.4)%	(0.9)%
Other income (expense), net	1.2 %	— %	(0.4)%
Income tax (expense) benefit	(2.0)%	(3.5)%	4.0 %
Net (loss) income	(1.7)%	16.0 %	14.7 %

Segment Overview

Our primary segment is our modules business, which involves the design, manufacture, and sale of CdTe solar modules, which convert sunlight into electricity. Third-party customers of our modules segment include developers and operators of systems, utilities, independent power producers, commercial and industrial companies, and other system owners. Our residual business operations include certain project development activities, O&M services, the results of operations from PV solar power systems we owned and operated in certain international regions, and the sale of such systems to third-party customers.

Net sales

We generally price and sell our solar modules on a per watt basis. During 2022, Intersect Power, Lightsource BP, and NextEra Energy each accounted for more than 10% of our modules business net sales, and the majority of our solar modules were sold to developers and operators of systems in the United States. Substantially all of our modules business net sales during 2022 were denominated in U.S. dollars. We recognize revenue for module sales at a point in time following the transfer of control of the modules to the customer, which typically occurs upon shipment or delivery depending on the terms of the underlying contracts. The revenue recognition policies for module sales are further described in Note 2. “Summary of Significant Accounting Policies” to our consolidated financial statements. Net sales from our residual business operations primarily consists of revenue recognized for sales of development projects or completed systems, including any modules installed in such systems and any revenue from energy generated by such systems. In certain prior periods, our residual business operations also included O&M services we provided to third parties.

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The following table shows net sales by reportable segment for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	2022	2021	2020	2022 over 2021		2021 over 2020	
Modules	$ 2,428,278	$ 2,331,380	$ 1,736,060	$ 96,898	4 %	$ 595,320	34 %
Other	191,041	591,997	975,272	(400,956)	(68)%	(383,275)	(39)%
Net sales	$ 2,619,319	$ 2,923,377	$ 2,711,332	$ (304,058)	(10)%	$ 212,045	8 %

Net sales from our modules segment increased by $96.9 million in 2022 primarily due to a 20% increase in the volume of watts sold, partially offset by a 13% decrease in the average selling price per watt. Net sales from our residual business operations decreased by $401.0 million in 2022 primarily due to sales of certain projects in the United States and Japan in the prior period and the settlement of an outstanding indemnification arrangement associated with the sale of one of our projects. Under the terms of the indemnification arrangement, we received $65.1 million for our portion of the settlement payment, which we recorded as revenue in the prior period. These decreases in net sales from our residual business operations were partially offset by the sale of our Luz del Norte PV solar power plant in the current period. See Note 12. "Commitments and Contingencies" to our consolidated financial statements for discussion of our indemnification arrangements.

Cost of sales

Our modules business cost of sales includes the cost of raw materials and components for manufacturing solar modules, such as glass, transparent conductive coatings, CdTe and other thin film semiconductors, laminate materials, connector assemblies, edge seal materials, and frames. In addition, our cost of sales includes direct labor for the manufacturing of solar modules and manufacturing overhead, such as engineering, equipment maintenance, quality and production control, and information technology. Our cost of sales also includes depreciation of manufacturing plant and equipment, facility-related expenses, environmental health and safety costs, and costs associated with shipping, warranties, and solar module collection and recycling (excluding accretion). Cost of sales for our residual business operations primarily consists of project-related costs, such as development costs (legal, consulting, transmission upgrade, interconnection, permitting, and other similar costs), engineering, procurement, and construction ("EPC") costs (consisting primarily of solar modules, inverters, electrical and mounting hardware, project management and engineering, and construction labor), and site specific costs.

The following table shows cost of sales by reportable segment for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	2022	2021	2020	2022 over 2021		2021 over 2020	
Modules	$ 2,312,881	$ 1,858,454	$ 1,306,929	$ 454,427	24 %	$ 551,525	42 %
Other	236,580	334,969	723,730	(98,389)	(29)%	(388,761)	(54)%
Cost of sales	$ 2,549,461	$ 2,193,423	$ 2,030,659	$ 356,038	16 %	$ 162,764	8 %
% of net sales	97.3 %	75.0 %	74.9 %				

Cost of sales increased $356.0 million, or 16%, and increased 22.3 percentage points as a percent of net sales when comparing 2022 with 2021. The increase in cost of sales was driven by a $454.4 million increase in our modules segment cost of sales primarily as a result of the following:

- higher costs of $350.9 million from an increase in the volume of modules sold;
- higher sales freight, demurrage, and detention charges of $167.2 million; and
- a reduction to our product warranty liability of $33.1 million in 2021 due to reductions to our projected module return rates; partially offset by
- continued module cost reductions, which decreased cost of sales by $60.9 million;
- manufacturing charges of $15.7 million in the prior period associated with the COVID-19 pandemic;

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- an increase to our module collection and recycling liability of $10.8 million in 2021 due to lower estimated by-product credits for certain semiconductor materials recovered during the recycling process and updates to certain valuation assumptions;
- a reduction to our product warranty liability of $10.2 million in 2022 due to reductions to our projected module return rates; and
- a reduction to our module collection and recycling liability of $7.5 million in 2022 due to lower estimated capital and chemical costs resulting from improvements to our module recycling technology.

Such increase in our modules segment cost of sales was partially offset by a $98.4 million decrease in our residual business operations cost of sales primarily due to the sales of certain projects in the United States and Japan in the prior period, partially offset by the impairment loss in the current period for our Luz del Norte PV solar power plant. See Note 7. "Consolidated Balance Sheet Details" to our consolidated financial statements for discussion of the impairment of our Luz del Norte project.

Gross profit

Gross profit may be affected by numerous factors, including the selling prices of our modules and the selling prices of projects and services included in our residual business operations, our manufacturing costs, the capacity utilization of our manufacturing facilities, and foreign exchange rates. Gross profit may also be affected by the mix of net sales from our modules business and residual business operations.

The following table shows gross profit for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	**2022**	**2021**	**2020**	**2022 over 2021**		**2021 over 2020**	
Gross profit	$ 69,858	$ 729,954	$ 680,673	$ (660,096)	(90)%	$ 49,281	7 %
% of net sales	2.7 %	25.0 %	25.1 %				

Gross profit decreased 22.3 percentage points to 2.7% in 2022 from 25.0% in 2021 primarily due to a decrease in the average selling price per watt of our modules, the volume of higher gross profit projects sold during the prior period, an increase in sales freight, demurrage, and detention charges, the impairment loss in the current period for our Luz del Norte PV solar power plant described above, and the prior period indemnification matter descried above. These decreases to gross profit were partially offset by the higher volume of modules sold and continued module cost reductions.

Selling, general and administrative

Selling, general and administrative expense consists primarily of salaries and other personnel-related costs, professional fees, insurance costs, and other business development and selling expenses.

The following table shows selling, general and administrative expense for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	**2022**	**2021**	**2020**	**2022 over 2021**		**2021 over 2020**	
Selling, general and administrative	$ 164,724	$ 170,320	$ 222,918	$ (5,596)	(3)%	$ (52,598)	(24)%
% of net sales	6.3 %	5.8 %	8.2 %				

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Selling, general and administrative expense in 2022 decreased compared to 2021 primarily due to higher charges for impairments of certain project assets in the prior period, a decrease in employee compensation expense primarily driven by reductions in headcount from the sales of our North American O&M operations and U.S. project development business in the prior period, and lower professional fees, partially offset by an increase in employee compensation expense driven by higher share-based compensation and employee bonus expenses.

Research and development

Research and development expense consists primarily of salaries and other personnel-related costs; the cost of products, materials, and outside services used in our R&D activities; and depreciation and amortization expense associated with R&D specific facilities and equipment. We maintain a number of programs and activities to improve our technology and processes in order to enhance the performance and reduce the costs of our solar modules.

The following table shows research and development expense for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	**2022**	**2021**	**2020**	**2022 over 2021**		**2021 over 2020**	
Research and development	$ 112,804	$ 99,115	$ 93,738	$ 13,689	14 %	$ 5,377	6 %
% of net sales	4.3 %	3.4 %	3.5 %				

Research and development expense in 2022 increased compared to 2021 primarily due to higher employee compensation expense resulting from an increase in headcount, lower share-based compensation expense in the prior period driven by the forfeiture of unvested shares by our former Chief Technology Officer, who retired in March 2021, increased freight costs, and increased material and module testing costs.

Production start-up

Production start-up expense consists of costs associated with operating a production line before it is qualified for commercial production, including the cost of raw materials for solar modules run through the production line during the qualification phase, employee compensation for individuals supporting production start-up activities, and applicable facility related costs. Production start-up expense also includes costs related to the selection of a new site and implementation costs for manufacturing process improvements to the extent we cannot capitalize these expenditures.

The following table shows production start-up expense for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	**2022**	**2021**	**2020**	**2022 over 2021**		**2021 over 2020**	
Production start-up	$ 73,077	$ 21,052	$ 40,528	$ 52,025	247 %	$ (19,476)	(48)%
% of net sales	2.8 %	0.7 %	1.5 %				

During 2022, we incurred production start-up expense primarily for our third manufacturing facility in the U.S. and for certain manufacturing upgrades at our Malaysian facilities. During 2021, we incurred production start-up expense primarily for the transition to Series 6 module manufacturing at our second facility in Kulim, Malaysia, which commenced commercial production in early 2021, and for certain manufacturing upgrades at our Malaysian facilities.

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Gain on sales of businesses, net

The following table shows gain on sales of businesses, net for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	**2022**	**2021**	**2020**	**2022 over 2021**		**2021 over 2020**	
Gain on sales of businesses, net	$ 253,511	$ 147,284	$ —	$ 106,227	72 %	$ 147,284	100 %
% of net sales	9.7 %	5.0 %	— %				

In 2022, we completed the sales of our Japan project development business and our Japan O&M operations to PAG and the sales of certain other international O&M operations to a subsidiary of Clairvest Group, Inc. ("Clairvest"). During 2021, we completed the sales of our North American O&M operations to a subsidiary of Clairvest and our U.S. project development business to Leeward Renewable Energy Development, LLC ("Leeward"). See Note 3. "Sales of Businesses" to our consolidated financial statements for further information related to these transactions.

Foreign currency loss, net

Foreign currency loss, net consists of the net effect of gains and losses resulting from holding assets and liabilities and conducting transactions denominated in currencies other than our subsidiaries' functional currencies.

The following table shows foreign currency loss, net for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	**2022**	**2021**	**2020**	**2022 over 2021**		**2021 over 2020**	
Foreign currency loss, net	$ (16,414)	$ (7,975)	$ (4,890)	$ (8,439)	106 %	$ (3,085)	63 %

Foreign currency loss increased in 2022 compared to 2021 primarily due to the differences between our economic hedge positions and the underlying exposures and higher costs associated with hedging activities related to our subsidiaries in India.

Interest income

Interest income is earned on our cash, cash equivalents, marketable securities, restricted cash, and restricted marketable securities. Interest income also includes interest earned from late customer payments.

The following table shows interest income for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	**2022**	**2021**	**2020**	**2022 over 2021**		**2021 over 2020**	
Interest income	$ 33,284	$ 6,179	$ 16,559	$ 27,105	439 %	$ (10,380)	(63)%

Interest income during 2022 increased compared to 2021 primarily due to higher interest rates on cash, marketable securities, and restricted marketable securities.

Interest expense, net

Interest expense, net is primarily comprised of interest incurred on long-term debt, settlements of interest rate swap contracts, and changes in the fair value of interest rate swap contracts that do not qualify for hedge accounting in accordance with Accounting Standards Codification ("ASC") 815. We may capitalize interest expense to our project assets or property, plant and equipment when such costs qualify for interest capitalization, which reduces the amount of net interest expense reported in any given period.

The following table shows interest expense, net for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	2022	2021	2020	2022 over 2021		2021 over 2020	
Interest expense, net	$ (12,225)	$ (13,107)	$ (24,036)	$ 882	(7)%	$ 10,929	(45)%

Interest expense, net in 2022 was consistent with 2021.

Other income (expense), net

Other income (expense), net is primarily comprised of miscellaneous items and realized gains and losses on the sale of marketable securities and restricted marketable securities.

The following table shows other income (expense), net for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	2022	2021	2020	2022 over 2021		2021 over 2020	
Other income (expense), net	$ 31,189	$ 314	$ (11,932)	$ 30,875	>100%	$ 12,246	103 %

Other income, net increased in 2022 compared to 2021 primarily due to the partial loan forgiveness of the Luz del Norte Credit Facilities in connection with the sale of our Luz del Norte PV solar power plant. See Note 11. "Debt" to our consolidated financial statements for further information related to this transaction.

Income tax (expense) benefit

Income tax expense or benefit, deferred tax assets and liabilities, and liabilities for unrecognized tax benefits reflect our best estimate of current and future taxes to be paid. We are subject to income taxes in both the United States and numerous foreign jurisdictions in which we operate, principally Singapore, Malaysia, and Vietnam. Significant judgments and estimates are required to determine our consolidated income tax expense. The statutory federal corporate income tax rate in the United States is 21%, and the tax rates in Singapore, Malaysia, and Vietnam are 17%, 24%, and 20%, respectively. In Malaysia, we have been granted a long-term tax holiday, scheduled to expire in 2027, pursuant to which substantially all of our income earned in Malaysia is exempt from income tax, conditional upon our continued compliance with certain employment and investment thresholds. In Vietnam, we have been granted a long-term tax incentive, scheduled to expire at the end of 2036, pursuant to which income earned in Vietnam is subject to reduced annual tax rates, conditional upon our continued compliance with certain revenue and R&D spending thresholds.

The following table shows income tax (expense) benefit for the years ended December 31, 2022, 2021, and 2020:

	Years Ended			Change			
(Dollars in thousands)	2022	2021	2020	2022 over 2021		2021 over 2020	
Income tax (expense) benefit	$ (52,764)	$ (103,469)	$ 107,294	$ 50,705	49 %	$ (210,763)	(196)%
Effective tax rate	613.7 %	18.1 %	(36.6)%				

Our tax rate is affected by recurring items, such as tax rates in foreign jurisdictions and the relative amounts of income we earn in those jurisdictions. The rate is also affected by discrete items that may occur in any given period, but are not consistent from period to period. Income tax expense decreased by $50.7 million during 2022 compared to 2021 primarily due to lower pretax income in the current year, partially offset by higher tax expense of $37.3 million associated with the sale of our Luz del Norte PV solar power plant during 2022.

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Liquidity and Capital Resources

As of December 31, 2022, we believe that our cash, cash equivalents, marketable securities, cash flows from operating activities, and contracts with customers for the future sale of solar modules will be sufficient to meet our working capital and capital expenditure needs for at least the next 12 months. As necessary, we also believe we will have adequate access to the capital markets. We monitor our working capital to ensure we have adequate liquidity, both domestically and internationally. We intend to maintain appropriate debt levels based upon cash flow expectations, our overall cost of capital, and expected cash requirements for operations, including near-term construction activities and purchases of manufacturing equipment for our newest manufacturing and R&D facilities in India and the United States. However, our ability to raise capital on terms commercially acceptable to us could be constrained if there is insufficient lender or investor interest due to company-specific, industry-wide, or broader market concerns. Any incremental debt financings could result in increased debt service expenses and/or restrictive covenants, which could limit our ability to pursue our strategic plans.

As of December 31, 2022, we had $2.6 billion in cash, cash equivalents, and marketable securities compared to $1.8 billion as of December 31, 2021. The increase in cash, cash equivalents, and marketable securities was primarily driven by cash receipts from module sales, including advance payments for future sales, proceeds from the sales of our Japan project development business and certain international O&M operations, and proceeds from borrowings, partially offset by purchases of property, plant and equipment, expenditures for the construction of certain projects in Japan, and other operating expenditures. As of December 31, 2022 and 2021, $1.2 billion and $0.8 billion, respectively, of our cash, cash equivalents, and marketable securities was held by our foreign subsidiaries and was primarily based in U.S. dollar, Japanese yen, Indian rupee, and Euro denominated holdings.

We utilize a variety of tax planning and financing strategies in an effort to ensure that our worldwide cash is available in the locations in which it is needed. If certain international funds were needed for our operations in the United States, we may be required to accrue and pay certain U.S. and foreign taxes to repatriate such funds. We maintain the intent and ability to permanently reinvest our accumulated earnings outside the United States, with the exception of our subsidiaries in Canada and Germany. In addition, changes to foreign government banking regulations may restrict our ability to move funds among various jurisdictions under certain circumstances, which could negatively impact our access to capital, resulting in an adverse effect on our liquidity and capital resources.

Although we compete in markets that do not require solar-specific government subsidies or support programs, such incentives continue to influence the demand for PV solar energy around the world. For example, the financial incentives provided by the IRA are expected to increase both the demand for and the domestic manufacturing of solar modules in the United States. We continue to evaluate the extent of benefits available to us by the IRA, which are expected to favorably impact our liquidity and capital resources in future periods. For example, we currently expect to qualify for the advanced manufacturing production credit under Section 45X of the IRC, which provides certain specified benefits for solar modules and solar module components manufactured in the United States and sold to third parties. Such credit may be refundable or transferable to a third party and is available from 2023 to 2032, subject to phase down beginning in 2030. Based on the current form factor of our modules, we expect to qualify for a credit of approximately 17 cents per watt for each module produced in the United States and sold to a third party. Accordingly, we expect the advanced manufacturing production credit will provide us with a significant source of funding throughout its 10-year period. For more information about certain risks associated with the benefits available to us under the IRA, see Item 1A. “Risk Factors – “We expect certain financial benefits as a result of tax incentives provided by the Inflation Reduction Act of 2022. If these expected financial benefits vary significantly from our assumptions, our business, financial condition, and results of operations could be adversely affected.”

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As a result of such market opportunities and increased demand for our products, we are in the process of expanding our capacity by approximately 11 GW_{DC}, including the construction of our third manufacturing facility in the United States, which commenced commercial production of modules in early 2023; our first manufacturing facility in India, which is expected to commence operations in the second half of 2023; our fourth manufacturing facility in the United States, which is expected to commence operations in late 2024; and the expansion of our manufacturing footprint at our existing facilities in Ohio. Our newest factory in the United States began producing and our newest factory in India is expected to produce our next generation Series 7 modules, which combine our thin film CdTe technology with a larger form factor and an innovative steel back rail mounting structure that reduces module installation time. In aggregate, we currently expect to invest approximately $2.7 billion for these facilities and upgrades. As we expand our manufacturing capacity, we expect to continue to receive advance payments from customers for the future sale of modules. Such advance payments are reflected as deferred revenue in our consolidated balance sheets. As of December 31, 2022, our deferred revenue was approximately $1.2 billion. Accordingly, the capital expenditures necessary to expand our capacity in the near term are expected to be financed, in part, by advance payments for module sales in future periods and by the advanced manufacturing production credit described above.

In addition to the expansion plans described above, we continue to increase the nameplate production capacity of our existing manufacturing facilities by improving our production throughput, increasing module wattage (or conversion efficiency), and reducing manufacturing yield losses. We have a demonstrated history of innovation, continuous improvement, and manufacturing success driven by our significant investments in various R&D initiatives. We continue to invest significant financial resources in such initiatives, including approximately $0.3 billion for a dedicated R&D facility in the United States to support the implementation of our technology roadmap. We expect such R&D facility to feature a high-tech pilot manufacturing line, allowing for the production of full-sized prototypes of thin film and tandem PV modules. Such R&D facility is expected to be completed in 2024. During 2023, we expect to spend $1.9 billion to $2.1 billion for capital expenditures, including the new facilities mentioned above and upgrades to machinery and equipment that we believe will further increase our module wattage and expand capacity and throughput at our manufacturing facilities.

We have also committed and expect to continue committing significant working capital to purchase various raw materials used in our module manufacturing process. Our failure to obtain raw materials and components that meet our quality, quantity, and cost requirements in a timely manner could interrupt or impair our ability to manufacture our solar modules, or increase our manufacturing costs. Accordingly, we may enter into long-term supply agreements to mitigate potential risks related to the procurement of key raw materials and components, and such agreements may be noncancelable or cancelable with a significant penalty. For example, we have entered into long-term supply agreements for the purchase of certain specified minimum volumes of substrate glass and cover glass for our PV solar modules. Our remaining purchases under these supply agreements are expected to be approximately $3.7 billion of substrate glass and approximately $301 million of cover glass. We have the right to terminate these agreements upon payment of specified termination penalties (which, in aggregate, are up to $251 million as of December 31, 2022 and decline over the remaining supply periods). Additionally, for certain strategic suppliers, we have made, and may in the future be required to make, certain advance payments to secure the raw materials necessary for our module manufacturing.

We have also committed certain financial resources to fulfill our solar module collection and recycling obligations and have established a trust under which these funds are put into custodial accounts with an established and reputable bank. As of December 31, 2022, such funds were comprised of restricted marketable securities of $182.1 million and restricted cash and cash equivalents balances of $6.7 million. As of December 31, 2022, our module collection and recycling liability was $128.1 million. Trust funds may be disbursed for qualified module collection and recycling costs (including capital and facility related recycling costs), payments to customers for assuming collection and recycling obligations, and reimbursements of any overfunded amounts. Investments in the trust must meet certain investment quality criteria comparable to highly rated government or agency bonds. As necessary, we adjust the funded amounts for our estimated collection and recycling obligations based on the

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estimated costs of collecting and recycling covered modules, estimated rates of return on our restricted marketable securities, and an estimated solar module life of 25 years, less amounts already funded in prior years.

As of December 31, 2022, we had no off-balance sheet debt or similar obligations, other than financial assurance related instruments, which are not classified as debt. We do not guarantee any third-party debt. See Note 12. "Commitments and Contingencies" to our consolidated financial statements for further information about our financial assurance related instruments.

Cash Flows

The following table summarizes key cash flow activity for the years ended December 31, 2022, 2021, and 2020 (in thousands):

	2022	2021	2020
Net cash provided by operating activities	$ 873,369	$ 237,559	$ 37,120
Net cash used in investing activities	(1,192,574)	(99,040)	(131,227)
Net cash provided by (used in) financing activities	309,392	40,550	(82,587)
Effect of exchange rate changes on cash, cash equivalents, restricted cash and restricted cash equivalents	47,438	3,174	3,778
Net increase (decrease) in cash, cash equivalents, restricted cash and restricted cash equivalents	$ 37,625	$ 182,243	$ (172,916)

Operating Activities

The increase in net cash provided by operating activities during 2022 was primarily driven by higher cash receipts from module sales, including advance payments for future sales, partially offset by higher expenditures for the construction of certain projects in Japan and certain advance payments for raw materials in the current year.

Investing Activities

The increase in net cash used in investing activities during 2022 was primarily due to higher net purchases of marketable securities, higher purchases of property, plant and equipment, and proceeds from the sales of our North American O&M operations and U.S. project development business in the prior year, partially offset by proceeds from the sales of our Japan project development business and certain international O&M operations in the current year.

Financing Activities

The increase in net cash provided by financing activities during 2022 was primarily due to higher net borrowings under project specific debt financings for the construction of certain projects in Japan. Such project specific debt financings were assumed by PAG when we completed the sale of our Japan project development business in June 2022. The increase is also due to borrowings under the India Credit Facility in the current year for the development and construction of our first manufacturing facility in India.

Recent Accounting Pronouncements

None.

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Critical Accounting Estimates

In preparing our consolidated financial statements in conformity with generally accepted accounting principles in the United States ("U.S. GAAP"), we make estimates and assumptions that affect the amounts of reported assets, liabilities, revenues, and expenses, as well as the disclosure of contingent liabilities. Some of our accounting policies require the application of significant judgment in the selection of the appropriate assumptions for making these estimates. By their nature, these judgments are subject to an inherent degree of uncertainty. We base our judgments and estimates on our historical experience, our forecasts, and other available information as appropriate. The actual results experienced by us may differ materially and adversely from our estimates. To the extent there are material differences between our estimates and the actual results, our future results of operations will be affected. Our significant accounting policies are described in Note 2. "Summary of Significant Accounting Policies" to our consolidated financial statements. The accounting policies that require the most significant judgment and estimates include the following:

Accrued Solar Module Collection and Recycling Liability. We previously established a module collection and recycling program, which has since been discontinued, to collect and recycle modules sold and covered under such program once the modules reach the end of their service lives. For legacy customer sales contracts that were covered under this program, we recognized expense at the time of sale for the estimated cost of our obligations to collect and recycle such modules. We estimate the cost of our collection and recycling obligations based on the present value of the expected future cost of collecting and recycling the solar modules, which includes estimates for the cost of packaging materials; the cost of freight from the solar module installation sites to a recycling center; material, labor, and capital costs; and by-product credits for certain materials recovered during the recycling process. We base these estimates on our experience collecting and recycling solar modules and certain assumptions regarding the estimated useful lives of modules covered by the program and the number of modules expected to be recycled. In the periods between the time of sale and the related settlement of the collection and recycling obligation, we accrete the carrying amount of the associated liability and classify the corresponding expense within "Selling, general and administrative" expense on our consolidated statements of operations.

We periodically review our estimates of expected future recycling costs and may adjust our liability accordingly. Such adjustments are presented within "Cost of Sales" on our consolidated statements of operations. During the year ended December 31, 2022, we completed our annual cost study of obligations under our module collection and recycling program and reduced the associated liability by $7.5 million primarily due to lower estimated capital and chemical costs resulting from improvements to our module recycling technology. As of December 31, 2022, a 10% increase in the expected future recycling costs would increase the liability by $13.7 million.

Product Warranties. We provide a limited PV solar module warranty covering defects in materials and workmanship under normal use and service conditions for up to 12.5 years. We also typically warrant that modules installed in accordance with agreed-upon specifications will produce at least 98% of their labeled power output rating during the first year, with the warranty coverage reducing by a degradation factor every year thereafter throughout the limited power output warranty period of up to 30 years. Among other things, our solar module warranty also covers the resulting power output loss from cell cracking.

As an alternative form of our standard limited module power output warranty, we have also offered an aggregated or system-level limited module performance warranty. This system-level limited module performance warranty is designed for utility-scale systems and provides 25-year system-level energy degradation protection. This warranty represents a practical expedient to address the challenge of identifying, from the potential millions of modules installed in a utility-scale system, individual modules that may be performing below warranty thresholds by focusing on the aggregate energy generated by the system rather than the power output of individual modules. The system-level limited module performance warranty is typically calculated as a percentage of a system's expected energy production, adjusted for certain actual site conditions, with the warranted level of performance declining each year in a linear fashion, but never falling below 80% during the term of the warranty.

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When we recognize revenue for sales of modules or projects, we accrue liabilities for the estimated future costs of meeting our limited warranty obligations. We make and revise these estimates based primarily on the number of solar modules under warranty installed at customer locations, our historical experience with and projections of warranty claims, and our estimated per-module replacement costs. We also monitor our expected future module performance through certain quality and reliability testing and actual performance in certain field installation sites. During the year ended December 31, 2022, we revised this estimate based on updated information regarding our warranty claims, which reduced our product warranty liability by $10.2 million. This updated information reflected lower-than-expected warranty claims for our older series of module technology as well as the evolving claims profile of our newest series of module technology, resulting in reductions to our projected module return rates. In general, we expect the return rates for our Series 6 modules to be lower than our older series, and we estimate that the return rate for such newer series of module technology will be less than 1%. As of December 31, 2022, a 1% increase in the return rate across all series of module technology would increase our product warranty liability by $147.0 million.

Income Taxes. We are subject to the income tax laws of the United States, its states and municipalities, and those of the foreign jurisdictions in which we have significant business operations. Such tax laws are complex and subject to different interpretations by the taxpayer and the relevant taxing authorities. We make judgments and interpretations regarding the application of these inherently complex tax laws when determining our provision for income taxes and also make estimates about when in the future certain items are expected to affect taxable income in the various tax jurisdictions. Disputes over interpretations of tax laws may be settled with the relevant taxing authority upon examination or audit. We regularly evaluate the likelihood of assessments in each of our taxing jurisdictions resulting from current and future examinations, and we record tax liabilities as appropriate.

In preparing our consolidated financial statements, we calculate our income tax provision based on our interpretation of the tax laws and regulations in the various jurisdictions where we conduct business. This requires us to estimate our current tax obligations, evaluate our ability and intent to permanently reinvest our accumulated earnings in jurisdictions outside the United States, assess uncertain tax positions, and assess temporary differences between the financial statement carrying amounts and the tax basis of assets and liabilities. These temporary differences result in deferred tax assets and liabilities. We must also assess the likelihood that each of our deferred tax assets will be realized. To the extent we believe that realization of any of our deferred tax assets is not more likely than not, we establish a valuation allowance. When we establish a valuation allowance or increase this allowance in a reporting period, we generally record a corresponding tax expense. Conversely, to the extent circumstances indicate that a valuation allowance is no longer necessary, that portion of the valuation allowance is reversed, which generally reduces our overall income tax expense.

We establish liabilities for potential additional taxes based on our assessment of the outcome of our tax positions. Once established, we adjust these liabilities when additional information becomes available or when an event occurs requiring an adjustment. Significant judgment is required in making these estimates and the actual cost of a tax assessment, fine, or penalty may ultimately be materially different from our recorded liabilities, if any.

We continually explore initiatives to better align our tax and legal entity structure with the footprint of our global operations and recognize the tax impact of these initiatives, including changes in the assessment of uncertain tax positions, indefinite reinvestment exception assertions, and the realizability of deferred tax assets, in the period when we believe all necessary internal and external approvals associated with such initiatives have been obtained, or when the initiatives are materially complete.

Asset Impairments. We assess long-lived assets classified as “held and used,” including our property, plant and equipment; operating lease assets; intangible assets; project assets; and PV solar power systems, for impairment whenever events or changes in circumstances arise, including consideration of technological obsolescence, that may indicate that the carrying amount of such assets may not be recoverable, and these assessments require significant judgment in determining whether such events or changes have occurred. These events or changes in circumstances may include a significant decrease in the market price of a long-lived asset; a significant adverse change in the

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extent or manner in which a long-lived asset is being used or in its physical condition; a significant adverse change in the business climate that could affect the value of a long-lived asset; an accumulation of costs significantly in excess of the amount originally expected for the acquisition or construction of a long-lived asset; a current-period operating or cash flow loss combined with a history of such losses or a projection of future losses associated with the use of a long-lived asset; or a current expectation that, more likely than not, a long-lived asset will be sold or otherwise disposed of significantly before the end of its previously estimated useful life. For purposes of recognition and measurement of an impairment loss, long-lived assets are grouped with other assets and liabilities at the lowest level for which identifiable cash flows are largely independent of the cash flows of other assets and liabilities, and we must also exercise judgment in assessing such groupings and levels.

When impairment indicators are present, we compare undiscounted future cash flows, including the eventual disposition of the asset group at market value, to the asset group's carrying value to determine if the asset group is recoverable. If the carrying value of the asset group exceeds the undiscounted future cash flows, we measure any impairment by comparing the fair value of the asset group to its carrying value. Fair value is generally determined by considering (i) internally developed discounted cash flows for the asset group, (ii) third-party valuations, and/or (iii) information available regarding the current market value for such assets. If the fair value of an asset group is determined to be less than its carrying value, an impairment in the amount of the difference is recorded in the period that the impairment indicator occurs. Estimating future cash flows requires significant judgment, and such projections may vary from the cash flows eventually realized.

Item 7A. ***Quantitative and Qualitative Disclosures about Market Risk***

Foreign Currency Exchange Risk

Cash Flow Exposure. We expect certain of our subsidiaries to have future cash flows that will be denominated in currencies other than the subsidiaries' functional currencies. Changes in the exchange rates between the functional currencies of our subsidiaries and the other currencies in which they transact will cause fluctuations in the cash flows we expect to receive or pay when these cash flows are realized or settled. Accordingly, we enter into foreign exchange forward contracts to hedge a portion of these forecasted cash flows. These foreign exchange forward contracts qualify for accounting as cash flow hedges in accordance with ASC 815 and we designated them as such. We initially report unrealized gains or losses for such contracts in "Accumulated other comprehensive loss" and subsequently reclassify amounts into earnings when the hedged transaction occurs and impacts earnings. For additional details on our derivative hedging instruments and activities, see Note 8. "Derivative Financial Instruments" to our consolidated financial statements.

Certain of our international operations, such as our manufacturing facilities in Malaysia and Vietnam, pay a portion of their operating expenses, including associate wages and utilities, in local currencies, which exposes us to foreign currency exchange risk for such expenses. Our manufacturing facilities are also exposed to foreign currency exchange risk for purchases of certain equipment and raw materials from international vendors. To the extent we expand into new markets, particularly emerging markets, our total foreign currency exchange risk, in terms of both size and exchange rate volatility, and the number of foreign currencies we are exposed to could increase significantly.

For the year ended December 31, 2022, 5% of our net sales were denominated in foreign currencies, including Japanese yen and Euro. As a result, we may, from time to time, have exposure to foreign currencies with respect to our net sales, which has historically represented one of our primary foreign currency exchange risks. A 10% change in the U.S. dollar to Japanese yen and Euro exchange rates would have had an aggregate impact on our net sales of $9.1 million, excluding the effect of our hedging activities.

Transaction Exposure. Many of our subsidiaries have assets and liabilities (primarily cash, receivables, deferred taxes, payables, accrued expenses, long-term debt, and solar module collection and recycling liabilities) that are denominated in currencies other than the subsidiaries' functional currencies. Changes in the exchange rates between

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the functional currencies of our subsidiaries and the other currencies in which these assets and liabilities are denominated will create fluctuations in our reported consolidated statements of operations and cash flows. We may enter into foreign exchange forward contracts or other financial instruments to economically hedge assets and liabilities against the effects of currency exchange rate fluctuations. The gains and losses on such foreign exchange forward contracts will economically offset all or part of the transaction gains and losses that we recognize in earnings on the related foreign currency denominated assets and liabilities. For additional details on our economic hedging instruments and activities, see Note 8. "Derivative Financial Instruments" to our consolidated financial statements.

As of December 31, 2022, a 10% change in the U.S. dollar relative to our primary foreign currency exposures would not have had a significant impact to our net foreign currency income or loss, including the effect of our hedging activities.

Interest Rate Risk

Customer Financing Exposure. We are also indirectly exposed to interest rate risk because many of our customers depend on debt financings to purchase modules. An increase in interest rates could make it challenging for our customers to obtain the capital necessary to make such purchases on favorable terms, or at all. Such factors could reduce demand or lower the price we can charge for our modules, thereby reducing our net sales and gross profit.

Marketable Securities and Restricted Marketable Securities Exposure. We invest in various debt securities, which exposes us to interest rate risk. The primary objectives of our investment activities are to preserve principal and provide liquidity, while at the same time maximizing the return on our investments. Many of the securities in which we invest may be subject to market risk. Accordingly, a change in prevailing interest rates may cause the market value of such investments to fluctuate. For example, if we hold a security that was issued with an interest rate fixed at the then-prevailing rate and the prevailing interest rate subsequently rises, the market value of our investment may decline.

For the year ended December 31, 2022, our marketable securities earned a return of 2%, including the impact of fluctuations in the price of the underlying securities, and had a weighted-average maturity of 6 months as of the end of the period. Based on our investment positions as of December 31, 2022, a hypothetical 100 basis point change in interest rates would have resulted in a $0.5 million change in the market value of our marketable securities investment portfolio. For the year ended December 31, 2022, our restricted marketable securities incurred a loss of 22%, including the impact of fluctuations in the price of the underlying securities, and had a weighted-average maturity of approximately 12 years as of the end of the period. Based on our restricted marketable securities positions as of December 31, 2022, a hypothetical 100 basis point change in interest rates would have resulted in a $17.6 million change in the market value of our restricted marketable securities portfolio.

Commodity and Component Risk

Some of our raw materials and components are sourced from a limited number of suppliers or a single supplier. Although we may enter into long-term supply contracts for certain raw materials and components, we may be exposed to price changes for certain raw materials and components used to manufacture our solar modules for which we are unable to secure long-term supply contracts or if our demand exceeds our committed supply. From time to time, we may utilize derivative hedging instruments to mitigate such raw material price changes. In addition, the failure of a key supplier could disrupt our supply chain, which could result in higher prices and/or a disruption in our manufacturing process. As a result, we may be in default of our delivery obligations if we experience a manufacturing disruption. In addition to price changes in the raw materials and components used in our manufacturing process, we are also exposed to price changes associated with the shipping, handling, storage, and distribution of our modules. To mitigate such price changes, we have used and expect to continue using module contract structures that provide additional consideration to us if the cost of certain raw materials or logistics services

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exceeds a defined threshold. However, we may be unable to pass along the full amount of cost increases we experience for such raw materials, components, and logistics services to our customers.

Credit Risk

We have certain financial and derivative instruments that subject us to credit risk. These consist primarily of cash, cash equivalents, marketable securities, accounts receivable, restricted cash, restricted cash equivalents, restricted marketable securities, foreign exchange forward contracts, and commodity swap contracts. We are exposed to credit losses in the event of nonperformance by the counterparties to our financial and derivative instruments. We place these instruments with various high-quality financial institutions and limit the amount of credit risk from any one counterparty. We monitor the credit standing of our counterparty financial institutions. Our net sales are primarily concentrated among a limited number of customers. We monitor the financial condition of our customers and perform credit evaluations whenever considered necessary. We typically require some form of payment security from our customers, including, but not limited to, advance payments, parent guarantees, letters of credit, bank guarantees, or surety bonds.

Item 8. ***Financial Statements and Supplementary Data***

Consolidated Financial Statements

Our consolidated financial statements as required by this item are included in Item 15. "Exhibits and Financial Statement Schedules." See Item 15(a) for a list of our consolidated financial statements.

Item 9. ***Changes in and Disagreements with Accountants on Accounting and Financial Disclosure***

None.

Item 9A. ***Controls and Procedures***

Evaluation of Disclosure Controls and Procedures

We carried out an evaluation, under the supervision and with the participation of management, including our Chief Executive Officer and Chief Financial Officer, of the effectiveness of our "disclosure controls and procedures" as defined in Exchange Act Rule 13a-15(e) and 15d-15(e). Based on that evaluation, our Chief Executive Officer and Chief Financial Officer concluded that as of December 31, 2022 our disclosure controls and procedures were effective to ensure that information required to be disclosed by us in reports that we file or submit under the Exchange Act is recorded, processed, summarized, and reported within the time periods specified in SEC rules and forms, and that such information is accumulated and communicated to our management, including our Chief Executive Officer and Chief Financial Officer, as appropriate, to allow timely decisions regarding required disclosure.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate "internal control over financial reporting," as defined in Exchange Act Rule 13a-15(f) and 15d-15(f). We also carried out an evaluation, under the supervision and with the participation of management, including our Chief Executive Officer and Chief Financial Officer, of the effectiveness of our internal control over financial reporting as of December 31, 2022 based on the criteria established in *Internal Control – Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"). Our internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with U.S. GAAP. Based on such evaluation, our management concluded that our internal control over financial reporting was effective as of December 31, 2022. The

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effectiveness of our internal control over financial reporting as of December 31, 2022 has also been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in its report which appears herein.

Changes in Internal Control over Financial Reporting

We also carried out an evaluation, under the supervision and with the participation of management, including our Chief Executive Officer and Chief Financial Officer, of our "internal control over financial reporting" to determine whether any changes in our internal control over financial reporting occurred during the quarter ended December 31, 2022 that materially affected, or are reasonably likely to materially affect, our internal control over financial reporting. Based on that evaluation, there were no such changes in our internal control over financial reporting that occurred during the quarter ended December 31, 2022.

Limitations on the Effectiveness of Controls

Control systems, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control systems' objectives are being met. Further, the design of any system of controls must reflect the fact that there are resource constraints, and the benefits of all controls must be considered relative to their costs. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, within our company have been detected. These inherent limitations include the realities that judgments in decision-making can be faulty and that breakdowns can occur because of error or mistake. Control systems can also be circumvented by the individual acts of some persons, by collusion of two or more people, or by management override of the controls. The design of any system of controls is also based in part upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions. Over time, controls may become inadequate because of changes in conditions or deterioration in the degree of compliance with policies or procedures.

Item 9B. ***Other Information***

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections

Not applicable.

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PART III

Item 10. ***Directors, Executive Officers, and Corporate Governance***

For information with respect to our executive officers, see Item 1. "Business – Information about Our Executive Officers." Information concerning our board of directors and audit committee of our board of directors will appear in our 2023 Proxy Statement, under the sections "Directors" and "Corporate Governance," and information concerning Section 16(a) beneficial ownership reporting compliance will appear in our 2023 Proxy Statement under the section "Section 16(a) Beneficial Ownership Reporting Compliance." We have adopted a code of business conduct and ethics that applies to all directors, officers, and associates of First Solar. Information concerning this code will appear in our 2023 Proxy Statement under the section "Corporate Governance." The information in such sections of the Proxy Statement is incorporated by reference into this Annual Report on Form 10-K.

Item 11. ***Executive Compensation***

Information concerning executive compensation and related information will appear in our 2023 Proxy Statement under the section "Executive Compensation," and information concerning the compensation committee of our board of directors (the "compensation committee") will appear under the sections "Corporate Governance" and "Compensation Committee Report." The information in such sections of the 2023 Proxy Statement is incorporated by reference into this Annual Report on Form 10-K.

Item 12. ***Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters***

Information concerning the security ownership of certain beneficial owners and management and related stockholder matters, including certain information regarding our equity compensation plans, will appear in our 2023 Proxy Statement under the section "Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters." The information in such section of the Proxy Statement is incorporated by reference into this Annual Report on Form 10-K.

Equity Compensation Plans

The following table sets forth certain information as of December 31, 2022 concerning securities authorized for issuance under our equity compensation plans:

Plan Category	Number of Securities to be Issued Upon Exercise of Outstanding Options and Rights (a)(1)	Weighted-Average Exercise Price of Outstanding Options and Rights (b)(2)	Number of Securities Remaining Available for Future Issuance Under Equity Compensation Plans (Excluding Securities Reflected in Column (a)) (c)
Equity compensation plans approved by stockholders	1,310,887	$ —	6,500,832
Equity compensation plans not approved by stockholders	—	—	—
Total	1,310,887	$ —	6,500,832

(1) Includes 1,310,887 shares issuable upon vesting of restricted stock units ("RSUs") granted under our 2020 Omnibus Incentive Compensation Plan ("2020 Omnibus Plan"). These RSUs include the maximum amount of performance units available for issuance under our long-term incentive program for key executive officers and associates.

(2) The weighted-average exercise price does not take into account the shares issuable upon vesting of outstanding RSUs, which have no exercise price.

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See Note 15. “Share-Based Compensation” to our consolidated financial statements for further discussion on our equity compensation plans.

Item 13. ***Certain Relationships and Related Transactions, and Director Independence***

Information concerning certain relationships and related party transactions will appear in our 2023 Proxy Statement under the section “Certain Relationships and Related Party Transactions,” and information concerning director independence will appear in our 2023 Proxy Statement under the section “Corporate Governance.” The information in such sections of the Proxy Statement is incorporated by reference into this Annual Report on Form 10-K.

Item 14. ***Principal Accountant Fees and Services***

Information concerning principal accounting fees and services and the audit committee of our board of directors’ pre-approval policies and procedures for these items will appear in our 2023 Proxy Statement under the section “Principal Accountant Fees and Services.” The information in such section of the Proxy Statement is incorporated by reference into this Annual Report on Form 10-K.

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PART IV

Item 15. ***Exhibits and Financial Statement Schedules***

(a) *Documents.* The following documents are filed as part of this Annual Report on Form 10-K:

Report of Independent Registered Public Accounting Firm (PCAOB ID No. 238)
Consolidated Balance Sheets
Consolidated Statements of Operations
Consolidated Statements of Comprehensive Income
Consolidated Statements of Stockholders' Equity
Consolidated Statements of Cash Flows
Notes to Consolidated Financial Statements

(b) *Exhibits.* Unless otherwise noted, the exhibits listed on the accompanying Index to Exhibits are filed with or incorporated by reference into this Annual Report on Form 10-K.

(c) *Financial Statement Schedules.* All financial statement schedules have been omitted as the required information is not applicable or is not material to require presentation of the schedule, or because the information required is included in the consolidated financial statements and notes thereto of this Annual Report on Form 10-K.

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Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of First Solar, Inc.

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of First Solar, Inc. and its subsidiaries ("the Company") as of December 31, 2022 and 2021, and the related consolidated statements of operations, comprehensive income, stockholders' equity and cash flows for each of the three years in the period ended December 31, 2022, including the related notes (collectively referred to as the "consolidated financial statements"). We also have audited the Company's internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control – Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO").

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control – Integrated Framework (2013)* issued by the COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in Management's Report on Internal Control over Financial Reporting appearing under Item 9A. Our responsibility is to express opinions on the Company's consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) ("PCAOB") and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission ("SEC") and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

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Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that (i) relates to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Product Warranty Liability

As described in Notes 2 and 12 to the consolidated financial statements, the Company provides a limited PV solar module warranty which covers defects in materials and workmanship for up to 12.5 years and warrants that modules will produce at least a specified minimum percentage of their labeled power output rating, on either an individual module or system-level basis, for up to 30 years. The Company's product warranty liability was $33.8 million as of December 31, 2022. Product warranty estimates are based primarily on the number of solar modules under warranty installed at customer locations, historical experience with and projections of warranty claims, and estimated per-module replacement costs.

The principal considerations for our determination that performing procedures relating to the product warranty liability is a critical audit matter are (i) the significant judgment by management in estimating the projections of warranty claims and (ii) a high degree of auditor judgment, subjectivity, and effort in performing procedures to evaluate the projections of warranty claims and related audit evidence.

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Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to valuation of the product warranty liability. These procedures also included, among others, testing the appropriateness of the methodology used and the reasonableness of the significant assumptions used by management in developing these estimates related to projections of warranty claims. Evaluating whether the significant assumptions relating to the product warranty liability were reasonable involved (i) testing historical warranty claims and settlements, (ii) evaluating the reasonableness and appropriateness of factors considered by management in estimating the final settlement of open customer claims, and (iii) evaluating the reasonableness and appropriateness of the methodology used by management to determine return rates used in the valuation of the product warranty liability.

/s/ PricewaterhouseCoopers LLP

Phoenix, Arizona
February 28, 2023

We have served as the Company's or its predecessor's auditor since 2000, which includes periods before the Company became subject to SEC reporting requirements.

FIRST SOLAR, INC. AND SUBSIDIARIES
CONSOLIDATED BALANCE SHEETS
(In thousands, except share data)

	December 31,	
	2022	2021
ASSETS		
Current assets:		
Cash and cash equivalents	$ 1,481,269	$ 1,450,654
Marketable securities	1,096,712	375,389
Accounts receivable trade, net	324,337	429,436
Accounts receivable unbilled, net	30,654	25,273
Inventories	621,376	666,299
Other current assets	237,073	244,192
Total current assets	3,791,421	3,191,243
Property, plant and equipment, net	3,536,902	2,649,587
PV solar power systems, net	6,242	217,293
Project assets	30,108	315,488
Deferred tax assets, net	78,680	59,162
Restricted marketable securities	182,070	244,726
Goodwill	14,462	14,462
Intangible assets, net	31,106	45,509
Inventories	260,395	237,512
Other assets	319,842	438,764
Total assets	$ 8,251,228	$ 7,413,746
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 341,409	$ 193,374
Income taxes payable	29,397	4,543
Accrued expenses	382,782	288,450
Current portion of long-term debt	—	3,896
Deferred revenue	263,215	201,868
Other current liabilities	21,245	34,747
Total current liabilities	1,038,048	726,878
Accrued solar module collection and recycling liability	128,114	139,145
Long-term debt	184,349	236,005
Deferred revenue	944,725	95,943
Other liabilities	119,937	256,224
Total liabilities	2,415,173	1,454,195
Commitments and contingencies		
Stockholders' equity:		
Common stock, $0.001 par value per share; 500,000,000 shares authorized; 106,609,094 and 106,332,315 shares issued and outstanding at December 31, 2022 and 2021, respectively	107	106
Additional paid-in capital	2,887,476	2,871,352
Accumulated earnings	3,140,289	3,184,455
Accumulated other comprehensive loss	(191,817)	(96,362)
Total stockholders' equity	5,836,055	5,959,551
Total liabilities and stockholders' equity	$ 8,251,228	$ 7,413,746

See accompanying notes to these consolidated financial statements.

FIRST SOLAR, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except per share amounts)

	Years Ended December 31,		
	2022	2021	2020
Net sales	$ 2,619,319	$ 2,923,377	$ 2,711,332
Cost of sales	2,549,461	2,193,423	2,030,659
Gross profit	69,858	729,954	680,673
Operating expenses:			
Selling, general and administrative	164,724	170,320	222,918
Research and development	112,804	99,115	93,738
Production start-up	73,077	21,052	40,528
Litigation loss	—	—	6,000
Total operating expenses	350,605	290,487	363,184
Gain on sales of businesses, net	253,511	147,284	—
Operating (loss) income	(27,236)	586,751	317,489
Foreign currency loss, net	(16,414)	(7,975)	(4,890)
Interest income	33,284	6,179	16,559
Interest expense, net	(12,225)	(13,107)	(24,036)
Other income (expense), net	31,189	314	(11,932)
Income before taxes and equity in earnings	8,598	572,162	293,190
Income tax (expense) benefit	(52,764)	(103,469)	107,294
Equity in earnings, net of tax	—	—	(2,129)
Net (loss) income	$ (44,166)	$ 468,693	$ 398,355
Net (loss) income per share:			
Basic	$ (0.41)	$ 4.41	$ 3.76
Diluted	$ (0.41)	$ 4.38	$ 3.73
Weighted-average number of shares used in per share calculations:			
Basic	106,551	106,263	105,867
Diluted	106,551	106,924	106,686

See accompanying notes to these consolidated financial statements.

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FIRST SOLAR, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME
(In thousands)

	Years Ended December 31,		
	2022	2021	2020
Net (loss) income	$ (44,166)	$ 468,693	$ 398,355
Other comprehensive (loss) income:			
Foreign currency translation adjustments	(32,021)	(13,213)	(2,810)
Unrealized (loss) gain on marketable securities and restricted marketable securities, net of tax of $2,639, $1,497, and $(1,231)	(56,744)	(24,666)	21,659
Unrealized (loss) gain on derivative instruments, net of tax of $1,678, $(55), and $(31)	(6,690)	3,243	(1,241)
Other comprehensive (loss) income	(95,455)	(34,636)	17,608
Comprehensive (loss) income	$ (139,621)	$ 434,057	$ 415,963

See accompanying notes to these consolidated financial statements.

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FIRST SOLAR, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(In thousands)

	Common Stock		Additional Paid-In Capital	Accumulated Earnings	Accumulated Other Comprehensive (Loss) Income	Total Stockholders' Equity
	Shares	Amount				
Balance at December 31, 2019	105,449	$ 105	$ 2,849,376	$ 2,326,620	$ (79,334)	$ 5,096,767
Cumulative-effect adjustment for the adoption of ASU 2016-13	—	—	—	(9,213)	—	(9,213)
Net income	—	—	—	398,355	—	398,355
Other comprehensive income	—	—	—	—	17,608	17,608
Common stock issued for share-based compensation	814	1	1,362	—	—	1,363
Tax withholding related to vesting of restricted stock	(283)	—	(13,118)	—	—	(13,118)
Share-based compensation expense	—	—	29,166	—	—	29,166
Balance at December 31, 2020	105,980	106	2,866,786	2,715,762	(61,726)	5,520,928
Net income	—	—	—	468,693	—	468,693
Other comprehensive loss	—	—	—	—	(34,636)	(34,636)
Common stock issued for share-based compensation	561	—	—	—	—	—
Tax withholding related to vesting of restricted stock	(209)	—	(15,989)	—	—	(15,989)
Share-based compensation expense	—	—	20,555	—	—	20,555
Balance at December 31, 2021	106,332	106	2,871,352	3,184,455	(96,362)	5,959,551
Net loss	—	—	—	(44,166)	—	(44,166)
Other comprehensive loss	—	—	—	—	(95,455)	(95,455)
Common stock issued for share-based compensation	444	1	—	—	—	1
Tax withholding related to vesting of restricted stock	(167)	—	(12,092)	—	—	(12,092)
Share-based compensation expense	—	—	28,216	—	—	28,216
Balance at December 31, 2022	106,609	$ 107	$ 2,887,476	$ 3,140,289	$ (191,817)	$ 5,836,055

See accompanying notes to these consolidated financial statements.

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FIRST SOLAR, INC. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF CASH FLOWS
(In thousands)

	Years Ended December 31,		
	2022	2021	2020
Cash flows from operating activities:			
Net (loss) income	$ (44,166)	$ 468,693	$ 398,355
Adjustments to reconcile net (loss) income to cash provided by operating activities:			
Depreciation, amortization and accretion	269,724	259,900	232,925
Impairments and net losses on disposal of long-lived assets	63,338	22,876	35,806
Share-based compensation	28,656	20,902	29,267
Deferred income taxes	(12,799)	49,847	36,013
Gain on sales of businesses, net	(253,511)	(147,284)	—
Gains on sales of marketable securities and restricted marketable securities	—	(11,696)	(15,346)
Liabilities assumed by customers for the sale of systems	(145,281)	(85,490)	(136,745)
Gain on debt forgiveness	(30,201)	—	—
Other, net	(1,029)	(3,484)	19,297
Changes in operating assets and liabilities:			
Accounts receivable, trade and unbilled	118,724	(96,951)	345,150
Inventories	16,693	(136,365)	(145,396)
Project assets and PV solar power systems	(14,336)	23,402	106,867
Other assets	(72,602)	(69,942)	(33,065)
Income tax receivable and payable	43,592	(13,062)	(177,431)
Accounts payable and accrued expenses	5,569	48,968	(109,583)
Deferred revenue	912,946	47,062	(157,284)
Other liabilities	(11,948)	(139,817)	(391,710)
Net cash provided by operating activities	873,369	237,559	37,120
Cash flows from investing activities:			
Purchases of property, plant and equipment	(903,605)	(540,291)	(416,635)
Purchases of marketable securities and restricted marketable securities	(3,375,008)	(2,147,136)	(901,924)
Proceeds from sales and maturities of marketable securities and restricted marketable securities	2,646,787	2,294,595	1,192,832
Proceeds from sales of businesses, net of cash and restricted cash sold	442,302	300,499	—
Other investing activities	(3,050)	(6,707)	(5,500)
Net cash used in investing activities	(1,192,574)	(99,040)	(131,227)
Cash flows from financing activities:			
Repayment of long-term debt	(75,896)	(72,676)	(225,344)
Proceeds from borrowings under long-term debt, net of discounts and issuance costs	397,380	129,215	156,679
Payments of tax withholdings for restricted shares	(12,092)	(15,989)	(13,118)
Other financing activities	—	—	(804)
Net cash provided by (used in) financing activities	309,392	40,550	(82,587)
Effect of exchange rate changes on cash, cash equivalents, restricted cash and restricted cash equivalents	47,438	3,174	3,778
Net increase (decrease) in cash, cash equivalents, restricted cash and restricted cash equivalents	37,625	182,243	(172,916)
Cash, cash equivalents, restricted cash and restricted cash equivalents, beginning of the period	1,455,837	1,273,594	1,446,510
Cash, cash equivalents, restricted cash and restricted cash equivalents, end of the period	$ 1,493,462	$ 1,455,837	$ 1,273,594
Supplemental disclosure of noncash investing and financing activities:			
Property, plant and equipment acquisitions funded by liabilities	$ 315,961	$ 61,598	$ 110,576

See accompanying notes to these consolidated financial statements.

1. First Solar and Its Business

We are a leading American solar technology company and global provider of PV solar energy solutions. Developed at our R&D labs in California and Ohio, we manufacture and sell PV solar modules with an advanced thin film semiconductor technology that provide a high-performance, lower-carbon alternative to conventional crystalline silicon PV solar modules. From raw material sourcing through end-of-life module recycling, we are committed to reducing the environmental impacts and enhancing the social and economic benefits of our products across their life cycle. We are the world's largest thin film PV solar module manufacturer and the largest PV solar module manufacturer in the Western Hemisphere.

2. Summary of Significant Accounting Policies

Basis of Presentation. These consolidated financial statements include the accounts of First Solar, Inc. and its subsidiaries and are prepared in accordance with U.S. GAAP. We eliminated all intercompany transactions and balances during consolidation. Certain prior year balances were reclassified to conform to the current year presentation.

Use of Estimates. The preparation of consolidated financial statements in conformity with U.S. GAAP requires us to make estimates and assumptions that affect the amounts reported in our consolidated financial statements and the accompanying notes. On an ongoing basis, we evaluate our estimates, including those related to accrued solar module collection and recycling liabilities, product warranties, accounting for income taxes, and long-lived asset impairments. Despite our intention to establish accurate estimates and reasonable assumptions, actual results could differ materially from such estimates and assumptions.

Fair Value Measurements. We measure certain assets and liabilities at fair value, which is defined as the price that would be received from the sale of an asset or paid to transfer a liability (i.e., an exit price) on the measurement date in an orderly transaction between market participants in the principal or most advantageous market for the asset or liability. Our fair value measurements use the following hierarchy, which prioritizes valuation inputs based on the extent to which the inputs are observable in the market.

- Level 1 – Valuation techniques in which all significant inputs are unadjusted quoted prices from active markets for assets or liabilities that are identical to the assets or liabilities being measured.

- Level 2 – Valuation techniques in which significant inputs include quoted prices from active markets for assets or liabilities that are similar to the assets or liabilities being measured and/or quoted prices for assets or liabilities that are identical or similar to the assets or liabilities being measured from markets that are not active. Also, model-derived valuations in which all significant inputs are observable in active markets are Level 2 valuation techniques.

- Level 3 – Valuation techniques in which one or more significant inputs are unobservable. Such inputs reflect our estimate of assumptions that market participants would use to price an asset or liability.

Cash and Cash Equivalents. We consider highly liquid investments with original maturities of three months or less at the time of purchase to be cash equivalents with the exception of time deposits, which are presented as marketable securities.

Restricted Cash and Restricted Cash Equivalents. Restricted cash and restricted cash equivalents consist of deposits held by various banks to secure certain of our letters of credit, as well as deposits held in custodial accounts to fund the estimated future costs of our solar module collection and recycling obligations. Restricted cash for our letters of credit is classified as current or noncurrent based on the maturity date of the corresponding letter of credit. Restricted cash and restricted cash equivalents held in custodial accounts are classified as noncurrent to align with the nature of the corresponding module collection and recycling liabilities.

Marketable Securities and Restricted Marketable Securities. We determine the classification of our marketable securities and restricted marketable securities at the time of purchase and reevaluate such designation at each balance sheet date. As of December 31, 2022 and 2021, all of our marketable securities and restricted marketable securities were classified as available-for-sale debt securities. Accordingly, we record them at fair value and account for the net unrealized gains and losses as part of "Accumulated other comprehensive loss" until realized. We record realized gains and losses on the sale of our marketable securities and restricted marketable securities in "Other income (expense), net" computed using the specific identification method.

We may sell marketable securities prior to their stated maturities after consideration of our liquidity requirements. We view unrestricted securities with maturities beyond 12 months as available to support our current operations and, accordingly, classify such securities as current assets under "Marketable securities" in our consolidated balance sheets. Restricted marketable securities consist of long-term duration marketable securities that we hold in custodial accounts to fund the estimated future costs of our solar module collection and recycling obligations. Accordingly, we classify restricted marketable securities as noncurrent assets under "Restricted marketable securities" in our consolidated balance sheets.

Accounts Receivable Trade. We record trade accounts receivable for our unconditional rights to consideration arising from our performance under contracts with customers. The carrying value of such receivables, net of the allowance for credit losses, represents their estimated net realizable value. Our module sales generally include up to 45-day payment terms following the transfer of control of the products to the customer. In addition, certain module sales agreements require a down payment for a portion of the transaction price upon or shortly after entering into the agreement or related purchase order. As a practical expedient, we do not adjust the promised amount of consideration for the effects of a significant financing component when we expect, at contract inception, that the period between our transfer of a promised product to a customer and when the customer pays for that product will be one year or less.

Accounts Receivable Unbilled. Accounts receivable unbilled represents a contract asset for revenue that has been recognized in advance of billing the customer, which was common for our project-related sales contracts. Revenue may be recognized in advance of billing the customer, resulting in an amount recorded to "Accounts receivable unbilled, net" or "Other assets" depending on the expected timing of payment for such unbilled receivables. Once we have an unconditional right to consideration, we typically bill our customer and reclassify the "Accounts receivable unbilled, net" to "Accounts receivable trade, net." Billing requirements vary by contract but are generally structured around the completion of certain development, construction, or other specified milestones.

Allowance for Credit Losses. The allowance for credit losses is a valuation account that is deducted from a financial asset's amortized cost to present the net amount we expect to collect from such asset. We estimate allowances for credit losses using relevant available information from both internal and external sources. We monitor the estimated credit losses associated with our trade accounts receivable and unbilled accounts receivable based primarily on our collection history, which we review annually, and the delinquency status of amounts owed to us, which we determine based on the aging of such receivables. We estimate credit losses associated with our marketable securities and restricted marketable securities based on the external credit ratings for such investments and the historical loss rates associated with such credit ratings, which we obtain from third parties. Such methods and estimates are adjusted, as appropriate, for relevant past events, current conditions, and reasonable and supportable forecasts. We recognize writeoffs within the allowance for credit losses when cash receipts associated with our financial assets are deemed uncollectible.

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Inventories – Current and Noncurrent. We report our inventories at the lower of cost or net realizable value. We determine cost on a first-in, first-out basis and include both the costs of acquisition and manufacturing in our inventory costs. These costs include direct materials, direct labor, and indirect manufacturing costs, including depreciation and amortization. Our capitalization of indirect costs is based on the normal utilization of our plants. If our plant utilization is abnormally low, the portion of our indirect manufacturing costs related to the abnormal utilization level is expensed as incurred. Other abnormal manufacturing costs, such as wasted materials or excess yield losses, are also expensed as incurred.

As needed, we may purchase critical raw materials that are used in our core production process in quantities that exceed anticipated consumption within our normal operating cycle, which is 12 months. We classify such raw materials that we do not expect to consume within our normal operating cycle as noncurrent.

We regularly review the cost of inventories, including noncurrent inventories, against their estimated net realizable value and record write-downs if any inventories have costs in excess of their net realizable values. We also regularly evaluate the quantities and values of our inventories, including noncurrent inventories, in light of current market conditions and trends, among other factors, and record write-downs for any quantities in excess of demand or for any obsolescence. This evaluation considers the use of modules in our product warranties, module selling prices, product obsolescence, strategic raw material requirements, and other factors.

Property, Plant and Equipment. We report our property, plant and equipment at cost, less accumulated depreciation. Cost includes the price paid to acquire or construct the assets, required installation costs, interest capitalized during the construction period, and any expenditures that substantially add to the value of or substantially extend the useful life of the assets. We capitalize costs related to computer software obtained or developed for internal use, which generally includes enterprise-level business and finance software that we customize to meet our specific operational requirements. We expense repair and maintenance costs at the time we incur them.

We begin depreciation for our property, plant and equipment when the assets are placed in service. We consider such assets to be placed in service when they are both in the location and condition for their intended use. We compute depreciation expense using the straight-line method over the estimated useful lives of assets, as presented in the table below. We depreciate leasehold improvements over the shorter of their estimated useful lives or the remaining term of the lease. The estimated useful life of an asset is reassessed whenever applicable facts and circumstances indicate a change in the estimated useful life of such asset has occurred.

	Useful Lives in Years
Buildings and building improvements	25 – 40
Manufacturing machinery and equipment	5 – 15
Furniture, fixtures, computer hardware, and computer software	3 – 7
Leasehold improvements	up to 15

PV Solar Power Systems. PV solar power systems represent project assets that we may temporarily own and operate after being placed in service. We report our PV solar power systems at cost, less accumulated depreciation. We begin depreciation for PV solar power systems when they are placed in service. We compute depreciation expense for the systems using the straight-line method over the shorter of the term of the related PPA or 25 years.

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Project Assets. Project assets primarily consist of costs related to solar power projects in various stages of development that are capitalized prior to the completion of the sale of the projects. These project related costs include costs for land, development, and construction of a PV solar power system. Development costs may include legal, consulting, permitting, transmission upgrade, interconnection, and other similar costs. We typically classify project assets as noncurrent due to the nature of solar power projects (as long-lived assets) and the time required to complete all activities to develop, construct, and sell projects, which is typically longer than 12 months. We present all expenditures related to the development and construction of project assets as a component of cash flows from operating activities.

Asset Impairments. We assess long-lived assets classified as "held and used," including our property, plant and equipment; PV solar power systems; project assets; operating lease assets; and intangible assets, for impairment whenever events or changes in circumstances arise, including consideration of technological obsolescence, that may indicate that the carrying amount of such assets may not be recoverable. These events and changes in circumstances may include a significant decrease in the market price of a long-lived asset; a significant adverse change in the extent or manner in which a long-lived asset is being used or in its physical condition; a significant adverse change in the business climate that could affect the value of a long-lived asset; an accumulation of costs significantly in excess of the amount originally expected for the acquisition or construction of a long-lived asset; a current-period operating or cash flow loss combined with a history of such losses or a projection of future losses associated with the use of a long-lived asset; or a current expectation that, more likely than not, a long-lived asset will be sold or otherwise disposed of significantly before the end of its previously estimated useful life. For purposes of recognition and measurement of an impairment loss, long-lived assets are grouped with other assets and liabilities at the lowest level for which identifiable cash flows are largely independent of the cash flows of other assets and liabilities.

When impairment indicators are present, we compare undiscounted future cash flows, including the eventual disposition of the asset group at market value, to the asset group's carrying value to determine if the asset group is recoverable. If the carrying value of the asset group exceeds the undiscounted future cash flows, we measure any impairment by comparing the fair value of the asset group to its carrying value. Fair value is generally determined by considering (i) internally developed discounted cash flows for the asset group, (ii) third-party valuations, and/or (iii) information available regarding the current market value for such assets. If the fair value of an asset group is determined to be less than its carrying value, an impairment in the amount of the difference is recorded in the period that the impairment indicator occurs. Estimating future cash flows requires significant judgment, and such projections may vary from the cash flows eventually realized.

We consider a long-lived asset to be abandoned after we have ceased use of the asset and we have no intent to use or repurpose it in the future. Abandoned long-lived assets are recorded at their salvage value, if any.

We classify long-lived assets or asset groups we plan to sell, excluding project assets and PV solar power systems to be sold as part of our ongoing operations, as held for sale on our consolidated balance sheets only after certain criteria have been met, including: (i) management has the authority and commits to a plan to sell the asset, (ii) the asset is available for immediate sale in its present condition, (iii) an active program to locate a buyer and the plan to sell the asset have been initiated, (iv) the sale of the asset is probable within 12 months, (v) the asset is being actively marketed at a reasonable sales price relative to its current fair value, and (vi) it is unlikely that the plan to sell will be withdrawn or that significant changes to the plan will be made. We record assets or asset groups held for sale at the lower of their carrying value or fair value less costs to sell. If, due to unanticipated circumstances, such assets or asset groups are not sold in the 12 months after being classified as held for sale, then held for sale classification would continue as long as the above criteria are still met.

Goodwill. Goodwill represents the excess of the purchase price of acquired businesses over the estimated fair value assigned to the individual assets acquired and liabilities assumed. We do not amortize goodwill, but instead test goodwill for impairment at least annually. We perform impairment tests between the scheduled annual test in the fourth quarter if facts and circumstances indicate that it is more likely than not that the fair value of a reporting unit that has goodwill is less than its carrying value.

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We may first make a qualitative assessment of whether it is more likely than not that a reporting unit's fair value is less than its carrying value to determine whether it is necessary to perform a quantitative goodwill impairment test. Such qualitative impairment test considers various factors, including macroeconomic conditions, industry and market considerations, cost factors, the overall financial performance of a reporting unit, and any other relevant events affecting our company or a reporting unit. If we determine through the qualitative assessment that a reporting unit's fair value is more likely than not greater than its carrying value, the quantitative impairment test is not required. If the qualitative assessment indicates it is more likely than not that a reporting unit's fair value is less than its carrying value, we perform a quantitative impairment test. We may also elect to proceed directly to the quantitative impairment test without considering qualitative factors.

The quantitative impairment test is the comparison of the fair value of a reporting unit with its carrying amount, including goodwill. Our modules business represents our only reporting unit. We define the fair value of a reporting unit as the price that would be received to sell the unit as a whole in an orderly transaction between market participants at the measurement date. We primarily use an income approach to estimate the fair value of our reporting unit. Significant judgment is required when estimating the fair value of a reporting unit, including the forecasting of future operating results and the selection of discount and expected future growth rates used to determine projected cash flows. If the estimated fair value of a reporting unit exceeds its carrying value, goodwill is not impaired, and no further analysis is required. Conversely, if the carrying value of a reporting unit exceeds its estimated fair value, we record an impairment loss equal to the excess, not to exceed the total amount of goodwill allocated to the reporting unit.

Intangible Assets. Intangible assets primarily include developed technologies and our internally-generated intangible assets, substantially all of which are patents on technologies related to our products and production processes. We record an asset for patents after the patent has been issued based on the legal, filing, and other costs incurred to secure it. We amortize intangible assets on a straight-line basis over their estimated useful lives, which generally range from 5 to 20 years.

Leases. Upon commencement of a lease, we recognize a lease liability for the present value of the lease payments not yet paid, discounted using an interest rate that represents our ability to borrow on a collateralized basis over a period that approximates the lease term. We also recognize a lease asset, which represents our right to control the use of the underlying property, plant or equipment, at an amount equal to the lease liability, adjusted for prepayments and initial direct costs.

We subsequently recognize the cost of operating leases on a straight-line basis over the lease term, and any variable lease costs, which represent amounts owed to the lessor that are not fixed per the terms of the contract, are recognized in the period in which they are incurred. Any costs included in our lease arrangements that are not directly related to the leased assets, such as maintenance charges, are included as part of the lease costs. Leases with an initial term of one year or less are considered short-term leases and are not recognized as lease assets and liabilities. We also recognize the cost of such short-term leases on a straight-line basis over the term of the underlying agreement.

Many of our leases contain renewal or termination options that are exercisable at our discretion. At the commencement date of a lease, we include in the lease term any periods covered by a renewal option, and exclude from the lease term any periods covered by a termination option, to the extent we are reasonably certain to exercise such options. In making this determination, we seek to align the lease term with the expected economic life of the underlying asset.

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Deferred Revenue. When we receive consideration, or such consideration is unconditionally due, from a customer prior to transferring goods to the customer under the terms of a sales contract, we record deferred revenue, which represents a contract liability. Such deferred revenue results from advance payments received on sales of solar modules. Deferred revenue is classified as current or noncurrent based on the expected date that module shipments commence for each sales contract. As a practical expedient, we do not adjust the consideration in a contract for the effects of a significant financing component when we expect, at contract inception, that the period between a customer's advance payment and our transfer of a promised product or service to the customer will be one year or less. Additionally, we do not adjust the consideration in a contract for the effects of a significant financing component when the consideration is received as a form of performance security.

Product Warranties. We provide a limited PV solar module warranty covering defects in materials and workmanship under normal use and service conditions for up to 12.5 years. We also typically warrant that modules installed in accordance with agreed-upon specifications will produce at least 98% of their labeled power output rating during the first year, with the warranty coverage reducing by a degradation factor every year thereafter throughout the limited power output warranty period of up to 30 years. Among other things, our solar module warranty also covers the resulting power output loss from cell cracking. In resolving claims under both the limited defect and power output warranties, we typically have the option of either repairing or replacing the covered modules or, under the limited power output warranty, providing additional modules to remedy the power shortfall. Our limited module warranties also include an option for us to remedy claims under such warranties, generally exercisable only after the second year of the warranty period, by making certain cash payments. Under the limited workmanship warranty, the optional cash payment will be equal to the prevailing market price of the module, reduced by a degradation factor, and under the limited power output warranty, the cash payment will be equal to the shortfall in power output. Such limited module warranties are standard for module sales and may be transferred from the original purchasers of the solar modules to subsequent purchasers upon resale.

As an alternative form of our standard limited module power output warranty, we have also offered an aggregated or system-level limited module performance warranty. This system-level limited module performance warranty is designed for utility-scale systems and provides 25-year system-level energy degradation protection. This warranty represents a practical expedient to address the challenge of identifying, from the potential millions of modules installed in a utility-scale system, individual modules that may be performing below warranty thresholds by focusing on the aggregate energy generated by the system rather than the power output of individual modules. The system-level limited module performance warranty is typically calculated as a percentage of a system's expected energy production, adjusted for certain actual site conditions, with the warranted level of performance declining each year in a linear fashion, but never falling below 80% during the term of the warranty. In resolving claims under the system-level limited module performance warranty to restore the system to warranted performance levels, we first must validate that the root cause of the issue is due to module performance; we then have the option of either repairing or replacing the covered modules, providing supplemental modules, or making a cash payment. Consistent with our limited module power output warranty, when we elect to satisfy a warranty claim by providing replacement or supplemental modules under the system-level module performance warranty, we do not have any obligation to pay for the labor to remove or install modules.

In addition to our limited solar module warranties described above, for PV solar power systems we have constructed, we have provided limited warranties for defects in engineering design, installation, and BoS part workmanship for a period of one to two years following the substantial completion of a system. In resolving claims under such BoS warranties, we have the option of remedying the defect through repair or replacement.

When we recognize revenue for sales of modules or projects, we accrue liabilities for the estimated future costs of meeting our limited warranty obligations. We make and revise these estimates based primarily on the number of solar modules under warranty installed at customer locations, our historical experience with and projections of warranty claims, and our estimated per-module replacement costs. We also monitor our expected future module performance through certain quality and reliability testing and actual performance in certain field installation sites.

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Accrued Solar Module Collection and Recycling Liability. Historically, we recognized expense at the time of sale for the estimated cost of our future obligations for collecting and recycling solar modules covered by our solar module collection and recycling program. See Note 12. "Commitments and Contingencies" to our consolidated financial statements for further information.

Derivative Instruments. We recognize derivative instruments on our consolidated balance sheets at fair value. On the date that we enter into a derivative contract, we designate the derivative instrument as a fair value hedge, a cash flow hedge, a hedge of a net investment in a foreign operation, or a derivative instrument that will not be accounted for using hedge accounting methods. As of December 31, 2022 and 2021, all of our derivative instruments were designated either as cash flow hedges or as derivative instruments not accounted for using hedge accounting methods.

We record changes in the fair value of a derivative instrument that is highly effective and that is designated and qualifies as a cash flow hedge in "Accumulated other comprehensive loss" until our earnings are affected by the variability of the cash flows from the underlying hedged item. We record any amounts excluded from effectiveness testing in current period earnings in the same income statement line item in which the earnings effect of the hedged item is reported. We report changes in the fair value of derivative instruments that are not designated or do not qualify for hedge accounting in current period earnings. We classify cash flows from derivative instruments on the consolidated statements of cash flows in the same category as the item being hedged or on a basis consistent with the nature of the instrument.

At the inception of a hedge, we formally document all relationships between hedging instruments and the underlying hedged items as well as our risk-management objective and strategy for undertaking the hedge transaction. We also formally assess (both at inception and on an ongoing basis) whether our derivative instruments are highly effective in offsetting changes in the fair value or cash flows of the underlying hedged items and whether those derivatives are expected to remain highly effective in future periods. When we determine that a derivative instrument is not highly effective as a hedge, we discontinue hedge accounting prospectively. In all situations in which we discontinue hedge accounting and the derivative instrument remains outstanding, we carry the derivative instrument at its fair value on our consolidated balance sheets and recognize subsequent changes in its fair value in current period earnings.

Accumulated Other Comprehensive Income or Loss. Our accumulated other comprehensive income or loss includes foreign currency translation adjustments, unrealized gains and losses on available-for-sale debt securities, and unrealized gains and losses on derivative instruments designated and qualifying as cash flow hedges. We record these components of accumulated other comprehensive income or loss net of tax and release such tax effects when the underlying components affect earnings.

Revenue Recognition – Module Sales. We recognize revenue for module sales at a point in time following the transfer of control of the modules to the customer, which typically occurs upon shipment or delivery depending on the terms of the underlying contracts. Such contracts may contain provisions that require us to make liquidated damage payments to the customer if we fail to ship or deliver modules by scheduled dates. We recognize these liquidated damages as a reduction of revenue in the period we transfer control of the modules to the customer.

Revenue Recognition – Solar Power Project Sales. We recognize revenue for the sale of a development project or for the sale of a completed system when we enter into the associated sales contract with the customer. Such revenue recognition is dependent, in part, on our customers' commitment to perform their obligations under the contract, which is typically measured through the receipt of cash deposits or other forms of financial security issued by creditworthy financial institutions or parent entities.

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As part of certain prior project sales, we conduct performance testing of a system to confirm it meets the operational and capacity expectations noted in its EPC agreement. In addition, we may provide an energy performance test during the first or second year of a system's operation to demonstrate that the actual energy generation for the applicable period meets or exceeds the modeled energy expectation, after certain adjustments. In certain instances, a bonus payment may be received at the end of the applicable test period if the system performs above a specified level. Conversely, if there is an underperformance event with regard to these tests, we may incur liquidated damages as specified in the applicable EPC agreement. Such performance guarantees represent a form of variable consideration and are estimated at contract inception at their most likely amount and updated at the end of each reporting period as additional performance data becomes available and only to the extent that it is probable that a significant reversal of any incremental revenue will not occur.

Revenue Recognition – Operations and Maintenance. We recognize revenue for standard, recurring O&M services over time as customers receive and consume the benefits of such services, which typically include 24/7 system monitoring, certain PPA and other agreement compliance, large generator interconnection agreement compliance, performance engineering analysis, regular performance reporting, turn-key maintenance services including spare parts and corrective maintenance repair, warranty management, and environmental services. Costs of O&M services are expensed in the period in which they are incurred.

Revenue Recognition – Energy Generation. We sell energy generated by PV solar power systems under PPAs or on an open contract basis. For energy sold under PPAs, we recognize revenue each period based on the volume of energy delivered to the customer (i.e., the PPA off-taker) and the price stated in the PPA. For energy sold on an open contract basis, we recognize revenue at the point in time the energy is delivered to the grid based on the prevailing spot market prices.

Shipping and Handling Costs. We account for shipping and handling activities related to contracts with customers as costs to fulfill our promise to transfer the associated products. Accordingly, we record amounts billed for shipping and handling costs as a component of net sales, and classify such costs as a component of cost of sales.

Taxes Collected from Customers and Remitted to Governmental Authorities. We exclude from our measurement of transaction prices all taxes assessed by governmental authorities that are both (i) imposed on and concurrent with a specific revenue-producing transaction and (ii) collected from customers. Accordingly, such tax amounts are not included as a component of net sales or cost of sales.

Research and Development. We incur research and development costs during the process of researching and developing new products and enhancing our existing products, technologies, and manufacturing processes. Our research and development costs consist primarily of employee compensation, materials, outside services, and depreciation. We expense these costs as incurred until the resulting product has been completed, tested, and made ready for commercial manufacturing.

Production Start-Up. Production start-up expense consists of costs associated with operating a production line before it is qualified for commercial production, including the cost of raw materials for solar modules run through the production line during the qualification phase, employee compensation for individuals supporting production start-up activities, and applicable facility related costs. Production start-up expense also includes costs related to the selection of a new site and implementation costs for manufacturing process improvements to the extent we cannot capitalize these expenditures.

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Share-Based Compensation. We recognize share-based compensation expense for the estimated grant-date fair value of equity awards issued as compensation to employees over the requisite service period, which is generally four or five years. For awards with performance conditions, we recognize share-based compensation expense if it is probable that the performance conditions will be achieved. We account for forfeitures of share-based awards as such forfeitures occur. Accordingly, when an associate's employment is terminated, all previously unvested awards granted to such associate are forfeited, which results in a benefit to share-based compensation expense in the period of such associate's termination equal to the cumulative expense recorded through the termination date for the unvested awards. We recognize share-based compensation expense for awards with graded vesting schedules on a straight-line basis over the requisite service periods for each separately vesting portion of the award as if each award was in substance multiple awards.

Foreign Currency Translation. The functional currencies of certain of our foreign subsidiaries are their local currencies. Accordingly, we apply period-end exchange rates to translate their assets and liabilities and daily transaction exchange rates to translate their revenues, expenses, gains, and losses into U.S. dollars. We include the associated translation adjustments as a separate component of "Accumulated other comprehensive loss" within stockholders' equity. The functional currency of our subsidiaries in Canada, Chile, Malaysia, Singapore, and Vietnam is the U.S. dollar; therefore, we do not translate their financial statements. Gains and losses arising from the remeasurement of monetary assets and liabilities denominated in currencies other than a subsidiary's functional currency are included in "Foreign currency loss, net" in the period in which they occur.

Income Taxes. We use the asset and liability method to account for income taxes whereby we calculate deferred tax assets or liabilities using the enacted tax rates and tax law applicable to when any temporary differences are expected to reverse. We establish valuation allowances, when necessary, to reduce deferred tax assets to the extent it is more likely than not that such deferred tax assets will not be realized. We do not provide deferred taxes related to the U.S. GAAP basis in excess of the outside tax basis in the investment in our foreign subsidiaries to the extent such amounts relate to indefinitely reinvested earnings and profits of such foreign subsidiaries.

Income tax expense includes (i) deferred tax expense, which generally represents the net change in deferred tax assets or liabilities during the year plus any change in valuation allowances, and (ii) current tax expense, which represents the amount of tax currently payable to or receivable from taxing authorities. We only recognize tax benefits related to uncertain tax positions that are more likely than not of being sustained upon examination. For those positions that satisfy such recognition criteria, the amount of tax benefit that we recognize is the largest amount of tax benefit that is more likely than not of being sustained on ultimate settlement of the uncertain tax position.

Per Share Data. Basic net income or loss per share is computed by dividing net income or loss by the weighted-average number of common shares outstanding for the period. Diluted net income per share is computed giving effect to all potentially dilutive common shares, including restricted stock and performance units, unless there is a net loss for the period. In computing diluted net income per share, we utilize the treasury stock method.

Government Grants. We account for government assistance that is not subject to the scope of ASC 740 using a grant accounting model, by analogy to International Accounting Standards 20, *Accounting for Government Grants and Disclosure of Government Assistance*, and recognize such grants when we have reasonable assurance that we will comply with the grant's conditions and that the grant will be received. Government grants whose primary condition is the purchase, construction, or acquisition of a long-lived asset are considered asset-based grants and are recognized as a reduction to such asset's cost basis, which reduces future depreciation. Other government grants not related to long-lived assets are considered income-based grants, which are initially recognized as "Government grants receivable" and are also recognized as a reduction to the related cost of activities that generated the benefit. Proceeds received from asset-based grants are presented as cash inflows from investing activities on the consolidated statements of cash flows, whereas proceeds received from income-based grants are presented as cash inflows from operating activities.

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3. Sales of Businesses

Sale of Japan Project Development Business

In May 2022, we entered into various agreements with certain subsidiaries of PAG, a private investment firm, for the sale of our Japan project development business. The transaction included our approximately 293 MW_{DC} utility-scale solar project development platform, which comprised the business of developing, contracting for the construction of, and selling utility-scale PV solar power systems. Additionally, PAG agreed to certain module purchase commitments.

In June 2022, we completed the sale of our Japan project development business and, following certain customary post-closing adjustments, received total consideration of ¥66.4 billion ($490.8 million) and transferred cash and restricted cash of ¥8.4 billion ($61.9 million) to PAG. As a result of this transaction, we recognized a gain of $245.2 million, net of transaction costs, during the year ended December 31, 2022, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations.

Sales of North American and International O&M Operations

In August 2020, we entered into an agreement with a subsidiary of Clairvest for the sale of our North American O&M operations. In March 2021, we completed the transaction and, following certain customary post-closing adjustments, received total consideration of $149.1 million. As a result of this transaction, we recognized a gain of $115.8 million, net of transaction costs and post-closing adjustments, during the year ended December 31, 2021, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations.

In January 2022, we completed the sale of our Chilean O&M operations to a separate subsidiary of Clairvest and, following certain customary post-closing adjustments, received total consideration of $1.9 million. As a result of this transaction, we recognized a gain of $1.6 million, net of transaction costs and post-closing adjustments, during the year ended December 31, 2022, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations.

In September 2022, we completed the sale of our Australian O&M operations to a separate subsidiary of Clairvest and, following certain customary post-closing adjustments, received total consideration of $6.0 million. As a result of this transaction, we recognized a gain of $4.4 million, net of transaction costs and post-closing adjustments, during the year ended December 31, 2022, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations.

In September 2022, we also completed the sale of our Japanese O&M operations to a subsidiary of PAG and, following certain customary post-closing adjustments, received total consideration of ¥692.7 million ($4.8 million). As a result of this transaction, we recognized a gain of $1.4 million, net of transaction costs and post-closing adjustments, during the year ended December 31, 2022, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations.

Sale of U.S. Project Development Business

In January 2021, we entered into an agreement with Leeward, a subsidiary of the Ontario Municipal Employees Retirement System, for the sale of our U.S. project development business. In March 2021, we completed the transaction and received consideration of $151.4 million for the sale of such business. As a result of this transaction, we recognized a gain of $31.5 million, net of transaction costs and post-closing adjustments, during the year ended December 31, 2021, which was included in "Gain on sales of businesses, net" in our consolidated statements of operations.

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4. Goodwill and Intangible Assets

Goodwill

Goodwill for the modules business consisted of the following at December 31, 2022 and 2021 (in thousands):

	December 31, 2021	Acquisitions (Impairments)	December 31, 2022
Gross amount	$ 407,827	$ —	$ 407,827
Accumulated impairment losses	(393,365)	—	(393,365)
Total	$ 14,462	$ —	$ 14,462

	December 31, 2020	Acquisitions (Impairments)	December 31, 2021
Gross amount	$ 407,827	$ —	$ 407,827
Accumulated impairment losses	(393,365)	—	(393,365)
Total	$ 14,462	$ —	$ 14,462

We performed our annual impairment analysis in the fourth quarters of 2022, 2021, and 2020. ASC 350-20 allows companies to perform a qualitative assessment of whether it is more likely than not that a reporting unit's fair value is less than its carrying value to determine whether it is necessary to perform a quantitative goodwill impairment test. Such qualitative assessment considers various factors, including macroeconomic conditions, industry and market considerations, cost factors, the overall financial performance of a reporting unit, and any other relevant events affecting our company or a reporting unit.

We performed a qualitative assessment for our modules business in each respective period and concluded that it was not more likely than not that the fair value of the modules business was less than its carrying amount. Accordingly, a quantitative goodwill impairment test for the modules business was not required in any period presented.

Intangible assets, net

The following tables summarize our intangible assets at December 31, 2022 and 2021 (in thousands):

	December 31, 2022		
	Gross Amount	Accumulated Amortization	Net Amount
Developed technology	$ 97,347	$ (68,650)	$ 28,697
Patents	8,970	(6,561)	2,409
Total	$ 106,317	$ (75,211)	$ 31,106

	December 31, 2021		
	Gross Amount	Accumulated Amortization	Net Amount
Developed technology	$ 99,964	$ (61,985)	$ 37,979
Power purchase agreements	6,486	(1,621)	4,865
Patents	8,480	(5,815)	2,665
Total	$ 114,930	$ (69,421)	$ 45,509

Amortization of intangible assets was $10.9 million, $10.9 million, and $10.8 million for the years ended December 31, 2022, 2021, and 2020, respectively.

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Estimated future amortization expense for our definite-lived intangible assets was as follows at December 31, 2022 (in thousands):

	Amortization Expense
2023	$ 10,510
2024	10,380
2025	3,910
2026	2,526
2027	2,426
Thereafter	1,354
Total amortization expense	$ 31,106

5. Cash, Cash Equivalents, and Marketable Securities

Cash, cash equivalents, and marketable securities consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Cash and cash equivalents:		
Cash	$ 1,476,945	$ 1,450,654
Money market funds	4,324	—
Total cash and cash equivalents	1,481,269	1,450,654
Marketable securities:		
Foreign debt	59,777	103,317
U.S. debt	56,463	18,627
Time deposits	980,472	253,445
Total marketable securities	1,096,712	375,389
Total cash, cash equivalents, and marketable securities	$ 2,577,981	$ 1,826,043

The following table provides a reconciliation of cash, cash equivalents, restricted cash and restricted cash equivalents reported within our consolidated balance sheets as of December 31, 2022 and 2021 to the total of such amounts as presented in the consolidated statements of cash flows (in thousands):

	Balance Sheet Line Item	2022	2021
Cash and cash equivalents	Cash and cash equivalents	$ 1,481,269	$ 1,450,654
Restricted cash – current	Other current assets	3,175	1,532
Restricted cash – noncurrent	Other assets	2,734	3,651
Restricted cash equivalents – noncurrent	Other assets	6,284	—
Total cash, cash equivalents, restricted cash, and restricted cash equivalents		$ 1,493,462	$ 1,455,837

During the years ended December 31, 2021 and 2020, we sold marketable securities for proceeds of $5.5 million and $188.1 million, respectively, and realized gains of less than $0.1 million and $0.2 million, respectively, on such sales. See Note 10. “Fair Value Measurements” to our consolidated financial statements for information about the fair value of our marketable securities.

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The following tables summarize the unrealized gains and losses related to our available-for-sale marketable securities, by major security type, as of December 31, 2022 and 2021 (in thousands):

	As of December 31, 2022				
	Amortized Cost	Unrealized Gains	Unrealized Losses	Allowance for Credit Losses	Fair Value
Foreign debt	$ 59,940	$ —	$ 140	$ 23	$ 59,777
U.S. debt	58,308	—	1,823	22	56,463
Time deposits	980,810	—	—	338	980,472
Total	$ 1,099,058	$ —	$ 1,963	$ 383	$ 1,096,712

	As of December 31, 2021				
	Amortized Cost	Unrealized Gains	Unrealized Losses	Allowance for Credit Losses	Fair Value
Foreign debt	$ 103,263	$ 81	$ 18	$ 9	$ 103,317
U.S. debt	19,003	10	384	2	18,627
Time deposits	253,531	—	—	86	253,445
Total	$ 375,797	$ 91	$ 402	$ 97	$ 375,389

The following table presents the change in the allowance for credit losses related to our available-for-sale marketable securities for the years ended December 31, 2022 and 2021 (in thousands):

	2022	2021
Allowance for credit losses, beginning of period	$ 97	$ 121
Provision for credit losses, net	667	423
Sales and maturities of marketable securities	(381)	(447)
Allowance for credit losses, end of period	$ 383	$ 97

The contractual maturities of our marketable securities as of December 31, 2022 were as follows (in thousands):

	Fair Value
One year or less	$ 983,472
One year to two years	73,086
Two years to three years	31,841
Three years to four years	4,427
Four years to five years	—
More than five years	3,886
Total	$ 1,096,712

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6. Restricted Marketable Securities

Restricted marketable securities consisted of the following as of December 31, 2022 and 2021 (in thousands):

	2022	2021
Foreign government obligations	$ 46,886	$ 64,855
Supranational debt	8,661	10,997
U.S. debt	109,328	145,326
U.S. government obligations	17,195	23,548
Total restricted marketable securities	$ 182,070	$ 244,726

Our restricted marketable securities represent long-term investments to fund the estimated future cost of collecting and recycling modules covered under our solar module collection and recycling program. We have established a trust under which estimated funds are put into custodial accounts with an established and reputable bank, for which First Solar, Inc.; First Solar Malaysia Sdn. Bhd.; and First Solar Manufacturing GmbH are grantors. As of December 31, 2022 and 2021, such custodial accounts also included noncurrent restricted cash and cash equivalents balances of $6.7 million and $0.9 million, respectively, which were reported within "Other assets." Trust funds may be disbursed for qualified module collection and recycling costs (including capital and facility related recycling costs), payments to customers for assuming collection and recycling obligations, and reimbursements of any overfunded amounts. Investments in the trust must meet certain investment quality criteria comparable to highly rated government or agency bonds. As necessary, we fund any incremental amounts for our estimated collection and recycling obligations on an annual basis based on the estimated costs of collecting and recycling covered modules, estimated rates of return on our restricted marketable securities, and an estimated solar module life of 25 years, less amounts already funded in prior years.

During the year ended December 31, 2021, we sold all our restricted marketable securities for proceeds of $258.9 million and realized gains of $11.7 million on such sales, and repurchased $255.6 million of restricted marketable securities as part of our ongoing management of the custodial accounts. During the year ended December 31, 2020, we sold certain restricted marketable securities for proceeds of $115.2 million and realized gains of $15.1 million on such sales, and repurchased $114.5 million of restricted marketable securities as part of our ongoing management of the custodial accounts. See Note 10. "Fair Value Measurements" to our consolidated financial statements for information about the fair value of our restricted marketable securities.

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The following tables summarize the unrealized gains and losses related to our restricted marketable securities, by major security type, as of December 31, 2022 and 2021 (in thousands):

	As of December 31, 2022				
	Amortized Cost	Unrealized Gains	Unrealized Losses	Allowance for Credit Losses	Fair Value
Foreign government obligations	$ 64,008	$ —	$ 17,112	$ 10	$ 46,886
Supranational debt	11,146	—	2,485	—	8,661
U.S. debt	148,288	—	38,932	28	109,328
U.S. government obligations	24,551	—	7,352	4	17,195
Total	$ 247,993	$ —	$ 65,881	$ 42	$ 182,070

	As of December 31, 2021				
	Amortized Cost	Unrealized Gains	Unrealized Losses	Allowance for Credit Losses	Fair Value
Foreign government obligations	$ 66,867	$ —	$ 2,002	$ 10	$ 64,855
Supranational debt	11,362	—	365	—	10,997
U.S. debt	150,060	—	4,697	37	145,326
U.S. government obligations	24,640	—	1,086	6	23,548
Total	$ 252,929	$ —	$ 8,150	$ 53	$ 244,726

The following table presents the change in the allowance for credit losses related to our restricted marketable securities for the years ended December 31, 2022 and 2021 (in thousands):

	2022	2021
Allowance for credit losses, beginning of period	$ 53	$ 13
Provision for credit losses, net	(11)	69
Sales of restricted marketable securities	—	(29)
Allowance for credit losses, end of period	$ 42	$ 53

As of December 31, 2022, the contractual maturities of our restricted marketable securities were between 8 years and 17 years.

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7. Consolidated Balance Sheet Details

Accounts receivable trade, net

Accounts receivable trade, net consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Accounts receivable trade, gross	$ 325,379	$ 430,100
Allowance for credit losses	(1,042)	(664)
Accounts receivable trade, net	$ 324,337	$ 429,436

Accounts receivable unbilled, net

Accounts receivable unbilled, net consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Accounts receivable unbilled, gross	$ 30,654	$ 25,336
Allowance for credit losses	—	(63)
Accounts receivable unbilled, net	$ 30,654	$ 25,273

Allowance for credit losses

The following tables present the change in the allowances for credit losses related to our accounts receivable for the years ended December 31, 2022 and 2021 (in thousands):

Accounts receivable trade	2022	2021
Allowance for credit losses, beginning of period	$ 664	$ 3,009
Provision for credit losses, net	553	(2,224)
Writeoffs	(175)	(121)
Allowance for credit losses, end of period	$ 1,042	$ 664

Accounts receivable unbilled	2022	2021
Allowance for credit losses, beginning of period	$ 63	$ 303
Provision for credit losses, net	(63)	(240)
Allowance for credit losses, end of period	$ —	$ 63

Inventories

Inventories consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Raw materials	$ 397,912	$ 404,727
Work in process	66,641	65,573
Finished goods	417,218	433,511
Inventories	$ 881,771	$ 903,811
Inventories – current	$ 621,376	$ 666,299
Inventories – noncurrent	$ 260,395	$ 237,512

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Other current assets

Other current assets consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Spare maintenance materials and parts	$ 114,428	$ 112,070
Operating supplies	47,492	41,034
Prepaid expenses	43,262	28,232
Prepaid income taxes	8,314	41,379
Restricted cash	3,175	1,532
Derivative instruments (1)	2,018	5,816
Other	18,384	14,129
Other current assets	$ 237,073	$ 244,192

(1) See Note 8. "Derivative Financial Instruments" to our consolidated financial statements for discussion of our derivative instruments.

Property, plant and equipment, net

Property, plant and equipment, net consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Land	$ 35,259	$ 18,359
Buildings and improvements	893,049	693,289
Machinery and equipment	2,762,801	2,527,627
Office equipment and furniture	146,467	139,611
Leasehold improvements	40,160	40,517
Construction in progress	1,121,938	461,708
Property, plant and equipment, gross	4,999,674	3,881,111
Accumulated depreciation	(1,462,772)	(1,231,524)
Property, plant and equipment, net	$ 3,536,902	$ 2,649,587

We assess our property, plant and equipment for impairment whenever events or changes in circumstances arise that may indicate that the carrying amount of such assets may not be recoverable. We consider a long-lived asset to be abandoned after we have ceased use of the asset and we have no intent to use or repurpose it in the future, and such abandoned assets are recorded at their salvage value, if any. During 2020, we recorded an impairment loss of $17.4 million in "Cost of sales" for certain abandoned module manufacturing equipment, including framing and assembly tools, as such equipment was no longer compatible with our long-term module technology roadmap.

Depreciation of property, plant and equipment was $244.9 million, $233.2 million, and $198.9 million for the years ended December 31, 2022, 2021, and 2020, respectively.

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PV solar power systems, net

PV solar power systems, net consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
PV solar power systems, gross	$ 11,593	$ 281,660
Accumulated depreciation	(5,351)	(64,367)
PV solar power systems, net	$ 6,242	$ 217,293

Depreciation of PV solar power systems was $9.2 million, $11.8 million, and $19.6 million for the years ended December 31, 2022, 2021, and 2020, respectively.

We evaluate our PV solar power systems for impairment under a held and used impairment model whenever events or changes in circumstances arise that may indicate that the carrying amount of a particular system may not be recoverable. Such events or changes may include a significant decrease in the market price of the asset, current-period operating or cash flow losses combined with a history of such losses or a projection of future losses associated with the use of the asset, and changes in expectations regarding our intent to hold the asset on a long-term basis or the timing of a potential asset disposition.

In November 2021, the off-taker for our 4 MW_{AC} PV solar power plant located in Samoa notified us of its intention to terminate the PPA. Given the limited availability of alternative off-take opportunities, including both contracted and uncontracted sales of electricity produced by the project, we determined it was more likely than not that the carrying amount of the project was not recoverable due to our expectation that the project would be disposed of significantly before the end of its previously estimated useful life. As a result, we measured the fair value of the plant using an income approach valuation technique and recorded an impairment loss of $10.2 million in "Cost of sales" for the difference between the estimated fair value and carrying value of the plant.

During 2022, we received multiple non-binding offers to purchase our Luz del Norte PV solar power plant and elected to pursue such opportunities in coordination with the project's lenders. As a result of the expected sale, we compared the undiscounted future cash flows for the project to its carrying value and determined that the project was not recoverable. Accordingly, we measured the fair value of the project using a market approach valuation technique and recorded an impairment loss of $57.8 million in "Cost of sales" in our consolidated statements of operations. Such impairment loss was comprised of $55.6 million for PV solar power systems, $1.3 million for intangible assets, and $0.9 million for operating lease assets. In December 2022, we completed the sale of the project to a subsidiary of Toesca Asset Management ("Toesca"). In connection with the sale, the project's lenders agreed to forgive a portion of the loan balance. See Note 11. "Debt" to our consolidated financial statements for further information related to this transaction.

Project assets

Project assets consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Project assets – development costs, including project acquisition and land costs	$ 30,108	$ 117,407
Project assets – construction costs	—	198,081
Project assets	$ 30,108	$ 315,488

In June 2022, we completed the sale of the majority of our project assets to PAG in connection with the sale of our Japan project development business. See Note 3. "Sales of Businesses" to our consolidated financial statements for further information about this transaction.

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Other assets

Other assets consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Operating lease assets (1)	$ 93,185	$ 207,544
Advance payments for raw materials	91,260	86,962
Income tax receivables	56,993	39,862
Accounts receivable unbilled, net	11,498	20,840
Restricted cash equivalents	6,284	—
Restricted cash	2,734	3,651
Accounts receivable trade, net	1,500	21,293
Indirect tax receivables	123	21,873
Other	56,265	36,739
Other assets	$ 319,842	$ 438,764

(1) See Note 9. "Leases" to our consolidated financial statements for discussion of our lease arrangements.

Accrued expenses

Accrued expenses consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Accrued property, plant and equipment	$ 148,777	$ 42,031
Accrued freight	77,136	61,429
Accrued compensation and benefits	47,939	34,606
Accrued inventory	44,679	42,170
Accrued other taxes	19,765	23,103
Product warranty liability (1)	10,660	13,598
Accrued project costs	4,601	48,836
Other	29,225	22,677
Accrued expenses	$ 382,782	$ 288,450

(1) See Note 12. “Commitments and Contingencies” to our consolidated financial statements for discussion of our “Product Warranties.”

Other current liabilities

Other current liabilities consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Operating lease liabilities (1)	$ 9,193	$ 12,781
Derivative instruments (2)	6,668	3,550
Other taxes payable	1,185	8,123
Other	4,199	10,293
Other current liabilities	$ 21,245	$ 34,747

(1) See Note 9. "Leases" to our consolidated financial statements for discussion of our lease arrangements.

(2) See Note 8. “Derivative Financial Instruments” to our consolidated financial statements for discussion of our derivative instruments.

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Other liabilities

Other liabilities consisted of the following at December 31, 2022 and 2021 (in thousands):

	2022	2021
Operating lease liabilities (1)	$ 40,589	$ 145,912
Deferred tax liabilities, net (2)	28,929	27,699
Product warranty liability (3)	23,127	38,955
Other	27,292	43,658
Other liabilities	$ 119,937	$ 256,224

(1) See Note 9. "Leases" to our consolidated financial statements for discussion of our lease arrangements.

(2) See Note 16. “Income Taxes” to our consolidated financial statements for discussion of our net deferred tax liabilities.

(3) See Note 12. “Commitments and Contingencies” to our consolidated financial statements for discussion of our “Product Warranties.”

8. Derivative Financial Instruments

As a global company, we are exposed in the normal course of business to interest rate, foreign currency, and commodity price risks that could affect our financial position, results of operations, and cash flows. We use derivative instruments to hedge against these risks and only hold such instruments for hedging purposes, not for speculative or trading purposes.

Depending on the terms of the specific derivative instruments and market conditions, some of our derivative instruments may be assets and others liabilities at any particular balance sheet date. We report all of our derivative instruments at fair value and account for changes in the fair value of derivative instruments within “Accumulated other comprehensive loss” if the derivative instruments qualify for hedge accounting. For those derivative instruments that do not qualify for hedge accounting (i.e., “economic hedges”), we record the changes in fair value directly to earnings. See Note 10. “Fair Value Measurements” to our consolidated financial statements for information about the techniques we use to measure the fair value of our derivative instruments.

The following tables present the fair values of derivative instruments included in our consolidated balance sheets as of December 31, 2022 and 2021 (in thousands):

	December 31, 2022			
	Other Current Assets	Other Assets	Other Current Liabilities	Other Liabilities
Derivatives designated as hedging instruments:				
Commodity swap contracts	$ —	$ 17	$ 4,447	$ 144
Total derivatives designated as hedging instruments	$ —	$ 17	$ 4,447	$ 144
Derivatives not designated as hedging instruments:				
Foreign exchange forward contracts	$ 2,018	$ —	$ 2,221	$ —
Total derivatives not designated as hedging instruments	$ 2,018	$ —	$ 2,221	$ —
Total derivative instruments	$ 2,018	$ 17	$ 6,668	$ 144

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	December 31, 2021	
	Other Current Assets	Other Current Liabilities
Derivatives designated as hedging instruments:		
Foreign exchange forward contracts	$ 1,336	$ 139
Total derivatives designated as hedging instruments	$ 1,336	$ 139
Derivatives not designated as hedging instruments:		
Foreign exchange forward contracts	$ 4,480	$ 3,411
Total derivatives not designated as hedging instruments	$ 4,480	$ 3,411
Total derivative instruments	$ 5,816	$ 3,550

The following table presents the pretax amounts related to derivative instruments designated as cash flow hedges affecting accumulated other comprehensive income (loss) and our consolidated statements of operations for the years ended December 31, 2022, 2021, and 2020 (in thousands):

	Foreign Exchange Forward Contracts	Commodity Swap Contracts	Total
Balance as of December 31, 2019	$ (962)	$ —	$ (962)
Amounts recognized in other comprehensive income (loss)	(3,881)	1,472	(2,409)
Amounts reclassified to earnings impacting:			
Cost of sales	1,199	—	1,199
Balance as of December 31, 2020	(3,644)	1,472	(2,172)
Amounts recognized in other comprehensive income (loss)	2,864	1,531	4,395
Amounts reclassified to earnings impacting:			
Cost of sales	1,906	(3,003)	(1,097)
Balance as of December 31, 2021	1,126	—	1,126
Amounts recognized in other comprehensive income (loss)	545	(8,101)	(7,556)
Amounts reclassified to earnings impacting:			
Cost of sales	(1,671)	859	(812)
Balance as of December 31, 2022	$ —	$ (7,242)	$ (7,242)

During the years ended December 31, 2022 and 2021, we recognized unrealized losses of less than $0.1 million within “Cost of sales” for amounts excluded from effectiveness testing for our foreign exchange forward contracts designated as cash flow hedges. During the year ended December 31, 2020, we recognized unrealized gains of $1.2 million within “Cost of sales” for amounts excluded from effectiveness testing for our foreign exchange forward contracts designated as cash flow hedges.

The following table presents the pretax amounts related to derivative instruments designated as net investment hedges affecting accumulated other comprehensive income (loss) and our consolidated statements of operations for the year ended December 31, 2022 (in thousands):

	Foreign Exchange Forward Contracts
Balance as of December 31, 2021	$ —
Amounts recognized in other comprehensive income (loss)	(667)
Balance as of December 31, 2022	$ (667)

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During the year ended December 31, 2022, we recognized unrealized gains of $0.9 million within "Other income (expense), net" for amounts excluded from effectiveness testing for our derivative instruments designated as net investment hedges.

The following table presents gains and losses related to derivative instruments not designated as hedges affecting our consolidated statements of operations for the years ended December 31, 2022, 2021, and 2020 (in thousands):

		Amount of Gain (Loss) Recognized in Income		
	Income Statement Line Item	2022	2021	2020
Foreign exchange forward contracts	Cost of sales	$ 583	$ 57	$ (462)
Foreign exchange forward contracts	Foreign currency loss, net	75,421	15,053	(6,317)
Interest rate swap contracts	Interest expense, net	—	(315)	(7,259)

Interest Rate Risk

From time to time, we may use interest rate swap contracts to mitigate our exposure to interest rate fluctuations associated with certain of our debt instruments. We do not use such swap contracts for speculative or trading purposes. During the years ended December 31, 2021 and 2020, all of our interest rate swap contracts related to project specific debt facilities. Such swap contracts did not qualify for accounting as cash flow hedges in accordance with ASC 815 due to our expectation to sell the associated projects before the maturity of their project specific debt financings and corresponding swap contracts. Accordingly, changes in the fair values of these swap contracts were recorded directly to "Interest expense, net."

Foreign Currency Risk

Cash Flow Exposure

We expect certain of our subsidiaries to have future cash flows that will be denominated in currencies other than the subsidiaries' functional currencies. Changes in the exchange rates between the functional currencies of our subsidiaries and the other currencies in which they transact will cause fluctuations in the cash flows we expect to receive or pay when these cash flows are realized or settled. Accordingly, we enter into foreign exchange forward contracts to hedge a portion of these forecasted cash flows. As of December 31, 2021, these foreign exchange forward contracts hedged our forecasted cash flows for periods up to 11 months. These foreign exchange forward contracts qualify for accounting as cash flow hedges in accordance with ASC 815, and we designated them as such. We report unrealized gains or losses on such contracts in "Accumulated other comprehensive loss" and subsequently reclassify applicable amounts into earnings when the hedged transaction occurs and impacts earnings. We determined that these derivative financial instruments were highly effective as cash flow hedges as of December 31, 2021.

As of December 31, 2021, the notional values associated with our foreign exchange forward contracts qualifying as cash flow hedges were as follows (notional amounts and U.S. dollar equivalents in millions):

	December 31, 2021	
Currency	Notional Amount	USD Equivalent
U.S. dollar (1)	$38.4	$38.4
British pound	GBP 10.6	$14.4

(1) These derivative instruments represent hedges of outstanding payables denominated in U.S. dollars at certain of our foreign subsidiaries whose functional currencies are other than the U.S. dollar.

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Net Investment Exposure

The functional currencies of certain of our foreign subsidiaries are their local currencies. Accordingly, we apply period-end exchange rates to translate their assets and liabilities and daily transaction exchange rates to translate their revenues, expenses, gains, and losses into U.S. dollars. We include the associated translation adjustments as a separate component of "Accumulated other comprehensive loss" within stockholders' equity. From time to time, we may seek to mitigate the impact of such translation adjustments by entering into foreign exchange forward contracts that are designated as hedges of net investments in certain foreign subsidiaries. In June 2022, we entered into a foreign exchange forward contract with a notional value of ¥8.0 billion ($60.6 million), which matured in December 2022. Such foreign exchange forward contract qualified for and was designated as a hedge of our net investment in a certain foreign subsidiary in Japan. We report unrealized gains or losses on this contract, which are based on spot exchange rates, as a component of our foreign currency translation adjustments within "Accumulated other comprehensive loss" and subsequently reclassify applicable amounts into earnings when the net investments are sold or substantially liquidated.

Transaction Exposure and Economic Hedging

Many of our subsidiaries have assets and liabilities (primarily cash, receivables, deferred taxes, payables, accrued expenses, operating lease liabilities, and solar module collection and recycling liabilities) that are denominated in currencies other than the subsidiaries' functional currencies. Changes in the exchange rates between the functional currencies of our subsidiaries and the other currencies in which these assets and liabilities are denominated will create fluctuations in our reported consolidated statements of operations and cash flows. We may enter into foreign exchange forward contracts or other financial instruments to economically hedge assets and liabilities against the effects of currency exchange rate fluctuations. The gains and losses on such foreign exchange forward contracts will economically offset all or part of the transaction gains and losses that we recognize in earnings on the related foreign currency denominated assets and liabilities.

We also enter into foreign exchange forward contracts to economically hedge balance sheet and other exposures related to transactions between certain of our subsidiaries and transactions with third parties. Such contracts are considered economic hedges and do not qualify for hedge accounting. Accordingly, we recognize gains or losses from the fluctuations in foreign exchange rates and the fair value of these derivative contracts in "Foreign currency loss, net" on our consolidated statements of operations.

As of December 31, 2022 and 2021, the notional values of our foreign exchange forward contracts that do not qualify for hedge accounting were as follows (notional amounts and U.S. dollar equivalents in millions):

		December 31, 2022	
Transaction	**Currency**	**Notional Amount**	**USD Equivalent**
Sell	Canadian dollar	CAD 4.2	$3.1
Sell	Chilean peso	CLP 5,996.5	$7.0
Purchase	Euro	€160.2	$170.5
Sell	Euro	€38.4	$40.9
Sell	Indian rupee	INR 27,119.5	$327.4
Purchase	Japanese yen	¥2,982.7	$22.4
Sell	Japanese yen	¥8,950.3	$67.1
Purchase	Malaysian ringgit	MYR 99.8	$22.6
Sell	Malaysian ringgit	MYR 13.7	$3.1
Sell	Mexican peso	MXN 34.6	$1.8
Purchase	Singapore dollar	SGD 1.4	$1.0

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	December 31, 2021		
Transaction	**Currency**	**Notional Amount**	**USD Equivalent**
Purchase	Australian dollar	AUD 3.2	$2.3
Purchase	Brazilian real	BRL 2.6	$0.5
Sell	Brazilian real	BRL 2.6	$0.5
Purchase	British pound	GBP 2.5	$3.4
Sell	Chilean peso	CLP 4,058.6	$4.8
Purchase	Euro	€77.6	$88.0
Sell	Euro	€38.6	$43.8
Sell	Indian rupee	INR 10,943.0	$147.1
Purchase	Japanese yen	¥667.5	$5.8
Sell	Japanese yen	¥31,524.6	$273.9
Purchase	Malaysian ringgit	MYR 17.0	$4.1
Sell	Malaysian ringgit	MYR 24.5	$5.9
Sell	Mexican peso	MXN 34.6	$1.7
Purchase	Singapore dollar	SGD 5.5	$4.1

Commodity Price Risk

We use commodity swap contracts to mitigate our exposure to commodity price fluctuations for certain raw materials used in the production of our modules. During the year ended December 31, 2022, we entered into various commodity swap contracts to hedge a portion of our forecasted cash flows for purchases of aluminum frames between July 2022 and December 2023. Such swaps had an aggregate initial notional value based on metric tons of forecasted aluminum purchases, equivalent to $70.5 million, and entitle us to receive a three-month average London Metals Exchange price for aluminum while requiring us to pay certain fixed prices. The notional amount of the commodity swap contracts proportionately adjusts with forecasted purchases of aluminum frames. As of December 31, 2022, the notional value associated with these contracts were $30.5 million.

These commodity swap contracts qualify for accounting as cash flow hedges in accordance with ASC 815, and we designated them as such. We report unrealized gains or losses on such contracts in “Accumulated other comprehensive loss” and subsequently reclassify applicable amounts into earnings when the hedged transactions occur and impact earnings. We determined that these derivative financial instruments were highly effective as cash flow hedges as of December 31, 2022. In the following 12 months, we expect to reclassify into earnings $6.6 million of net unrealized losses related to these commodity swap contracts that are included in “Accumulated other comprehensive loss” at December 31, 2022 as we realize the earnings effects of the related forecasted transactions. The amount we ultimately record to earnings will depend on the actual commodity pricing when we realize the related forecasted transactions.

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9. Leases

Our lease arrangements include land associated with our corporate and administrative offices, land for our international manufacturing facilities, and certain of our manufacturing equipment. Such leases primarily relate to assets located in the United States, Malaysia, India, and Vietnam.

The following table presents certain quantitative information related to our lease arrangements for the years ended December 31, 2022 and 2021, and as of December 31, 2022 and 2021 (in thousands):

	2022	2021
Operating lease cost	$ 14,634	$ 17,681
Variable lease cost	2,517	2,041
Short-term lease cost	339	817
Total lease cost	$ 17,490	$ 20,539
Payments of amounts included in the measurement of operating lease liabilities	$ 15,359	$ 19,405
Lease assets obtained in exchange for operating lease liabilities	$ 4,394	$ 21,187

	December 31, 2022	December 31, 2021
Operating lease assets	$ 93,185	$ 207,544
Operating lease liabilities – current	9,193	12,781
Operating lease liabilities – noncurrent	40,589	145,912
Weighted-average remaining lease term	6 years	19 years
Weighted-average discount rate	5.1 %	2.8 %

In June 2022, we completed the sale of our Japan project development business to PAG, which included the transfer of various land leases associated with the business. As a result, we derecognized lease assets of $87.7 million, current lease liabilities of $3.0 million, and noncurrent lease liabilities of $77.9 million. See Note 3. “Sales of Businesses” to our consolidated financial statements for further information about this transaction.

As of December 31, 2022, the future payments associated with our lease liabilities were as follows (in thousands):

	Total Lease Liabilities
2023	$ 11,319
2024	10,895
2025	9,814
2026	8,343
2027	5,768
Thereafter	11,384
Total future payments	57,523
Less: interest	(7,741)
Total lease liabilities	$ 49,782

10. Fair Value Measurements

The following is a description of the valuation techniques that we use to measure the fair value of assets and liabilities that we measure and report at fair value on a recurring basis:

- *Cash Equivalents and Restricted Cash Equivalents.* At December 31, 2022, our cash equivalents and restricted cash equivalents consisted of money market funds. We value our cash equivalents and restricted cash equivalents using observable inputs that reflect quoted prices for securities with identical characteristics and classify the valuation techniques that use these inputs as Level 1.

- *Marketable Securities and Restricted Marketable Securities.* At December 31, 2022 and 2021, our marketable securities consisted of foreign debt, U.S. debt, and time deposits, and our restricted marketable securities consisted of foreign and U.S. government obligations, supranational debt, and U.S. debt. We value our marketable securities and restricted marketable securities using observable inputs that reflect quoted prices for securities with identical characteristics or quoted prices for securities with similar characteristics and other observable inputs (such as interest rates that are observable at commonly quoted intervals). Accordingly, we classify the valuation techniques that use these inputs as either Level 1 or Level 2 depending on the inputs used. We also consider the effect of our counterparties' credit standing in these fair value measurements.

- *Derivative Assets and Liabilities*. At December 31, 2022 and 2021, our derivative assets and liabilities consisted of foreign exchange forward contracts involving major currencies. At December 31, 2022, our derivative assets and liabilities also consisted of commodity swap contracts involving major commodity prices. Since our derivative assets and liabilities are not traded on an exchange, we value them using standard industry valuation models. As applicable, these models project future cash flows and discount the amounts to a present value using market-based observable inputs, including credit risk, foreign exchange rates, forward and spot prices for currencies, and forward prices for commodities. These inputs are observable in active markets over the contract term of the derivative instruments we hold, and accordingly, we classify the valuation techniques as Level 2. In evaluating credit risk, we consider the effect of our counterparties' and our own credit standing in the fair value measurements of our derivative assets and liabilities, respectively.

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At December 31, 2022 and 2021, the fair value measurements of our assets and liabilities measured on a recurring basis were as follows (in thousands):

		Fair Value Measurements at Reporting Date Using		
	December 31, 2022	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Cash equivalents:				
Money market funds	$ 4,324	$ 4,324	$ —	$ —
Restricted cash equivalents:				
Money market funds	6,284	6,284	—	—
Marketable securities:				
Foreign debt	59,777	—	59,777	—
U.S. debt	56,463	—	56,463	—
Time deposits	980,472	980,472	—	—
Restricted marketable securities	182,070	—	182,070	—
Derivative assets	2,035	—	2,035	—
Total assets	$ 1,291,425	$ 991,080	$ 300,345	$ —
Liabilities:				
Derivative liabilities	$ 6,812	$ —	$ 6,812	$ —

		Fair Value Measurements at Reporting Date Using		
	December 31, 2021	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Marketable securities:				
Foreign debt	$ 103,317	$ —	$ 103,317	$ —
U.S. debt	18,627	—	18,627	—
Time deposits	253,445	253,445	—	—
Restricted marketable securities	244,726	—	244,726	—
Derivative assets	5,816	—	5,816	—
Total assets	$ 625,931	$ 253,445	$ 372,486	$ —
Liabilities:				
Derivative liabilities	$ 3,550	$ —	$ 3,550	$ —

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Fair Value of Financial Instruments

At December 31, 2022 and 2021, the carrying values and fair values of our financial instruments not measured at fair value were as follows (in thousands):

	December 31, 2022		December 31, 2021	
	Carrying Value	Fair Value	Carrying Value	Fair Value
Assets:				
Accounts receivable unbilled, net - noncurrent	$ 11,498	$ 10,304	$ 20,840	$ 18,846
Accounts receivable trade, net - noncurrent	1,500	1,339	21,293	18,605
Liabilities:				
Long-term debt, including current maturities (1)	$ 185,000	$ 160,986	$ 246,737	$ 243,865

(1) Excludes unamortized discounts and issuance costs.

The carrying values in our consolidated balance sheets of our current trade accounts receivable, current unbilled accounts receivable, restricted cash, accounts payable, and accrued expenses approximated their fair values due to their nature and relatively short maturities; therefore, we excluded them from the foregoing table. The fair value measurements for our noncurrent unbilled accounts receivable, noncurrent trade accounts receivable, and long-term debt are considered Level 2 measurements under the fair value hierarchy.

Credit Risk

We have certain financial and derivative instruments that subject us to credit risk. These consist primarily of cash, cash equivalents, marketable securities, accounts receivable, restricted cash, restricted cash equivalents, restricted marketable securities, foreign exchange forward contracts, and commodity swap contracts. We are exposed to credit losses in the event of nonperformance by the counterparties to our financial and derivative instruments. We place these instruments with various high-quality financial institutions and limit the amount of credit risk from any one counterparty. We monitor the credit standing of our counterparty financial institutions. Our net sales are primarily concentrated among a limited number of customers. We monitor the financial condition of our customers and perform credit evaluations whenever considered necessary. We typically require some form of payment security from our customers, including, but not limited to, advance payments, parent guarantees, letters of credit, bank guarantees, or surety bonds.

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11. Debt

Our long-term debt consisted of the following at December 31, 2022 and 2021 (in thousands):

Loan Agreement	Currency	Balance (USD) 2022	2021
India Credit Facility	USD	$ 185,000	$ —
Luz del Norte Credit Facilities	USD	—	183,829
Kyoto Credit Facility	JPY	—	62,908
Long-term debt principal		185,000	246,737
Less: unamortized discounts and issuance costs		(651)	(6,836)
Total long-term debt		184,349	239,901
Less: current portion		—	(3,896)
Noncurrent portion		$ 184,349	$ 236,005

India Credit Facility

In July 2022, FS India Solar Ventures Private Limited, our indirect wholly-owned subsidiary, entered into a finance agreement (the "India Credit Facility") with the U.S. International Development Finance Corporation ("DFC") for aggregate borrowings up to $500.0 million for the development and construction of an approximately 3.3 GW_{DC} solar module manufacturing facility located in Tamil Nadu, India. Principal on the India Credit Facility is payable in scheduled semi-annual installments through the facility's expected maturity in August 2029. The India Credit Facility is guaranteed by First Solar, Inc.

Luz del Norte Credit Facilities

In August 2014, Parque Solar Fotovoltaico Luz del Norte SpA ("Luz del Norte"), our indirect wholly-owned subsidiary and project company, entered into credit facilities (the "Luz del Norte Credit Facilities") with DFC and the International Finance Corporation ("IFC") to provide limited-recourse senior secured debt financing for the design, development, financing, construction, testing, commissioning, operation, and maintenance of a 141 MW_{AC} PV solar power plant located near Copiapó, Chile. In December 2022, we completed the sale of the project to a subsidiary of Toesca. In connection with the sale, DFC and IFC agreed to forgive a portion of the outstanding loan balance, resulting in a gain of $30.2 million recorded within "Other income, net" in our consolidated statements of operations. The remaining outstanding balance of $145.3 million was assumed by Toesca.

Kyoto Credit Facility

In July 2020, First Solar Japan GK, our wholly-owned subsidiary, entered into a construction loan facility with Mizuho Bank, Ltd. for borrowings up to ¥15.0 billion ($142.8 million), which are intended to be used for the construction of a 38 MW_{AC} PV solar power plant located in Kyoto, Japan. In May 2022, we repaid the remaining $73.2 million principal balance on the credit facility.

Momura Credit Facility

In May 2022, FS Japan Project 25 GK ("Momura"), our indirect wholly-owned subsidiary and project company, entered into a credit agreement with Nomura Capital Investment Co., Ltd. and Aozora Bank, Ltd. for aggregate borrowings up to ¥21.5 billion ($168.1 million) for the development and construction of a 53 MW_{AC} PV solar power plant located in Tochigi, Japan. The credit facility consisted of an ¥18.8 billion ($146.6 million) term loan facility, a ¥1.9 billion ($15.1 million) consumption tax facility, and a ¥0.8 billion ($6.4 million) debt service reserve facility. In June 2022, we completed the sale of our Japan project development business, and the credit facility's outstanding balance of $107.2 million was assumed by PAG. See Note 3. "Sales of Businesses" to our consolidated financial statements for further information about this transaction.

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Yatsubo Credit Facility

In May 2022, FS Japan Project 24 GK ("Yatsubo"), our indirect wholly-owned subsidiary and project company, entered into a credit agreement with Nomura Capital Investment Co., Ltd. and Aozora Bank, Ltd. for aggregate borrowings up to ¥10.9 billion ($85.0 million) for the development and construction of a 26 MW_{AC} PV solar power plant located in Tochigi, Japan. The credit agreement consisted of a ¥9.5 billion ($74.2 million) term loan facility, a ¥1.0 billion ($7.6 million) consumption tax facility, and a ¥0.4 billion ($3.2 million) debt service reserve facility. In June 2022, we completed the sale of our Japan project development business, and the credit facility's outstanding balance of $70.0 million was assumed by PAG. See Note 3. "Sales of Businesses" to our consolidated financial statements for further information about this transaction.

Orido Credit Facility

In May 2022, FS Japan Project B5 GK ("Orido"), our indirect wholly-owned subsidiary and project company, entered into a credit agreement with Nomura Capital Investment Co., Ltd. and Aozora Bank, Ltd. for aggregate borrowings up to ¥5.3 billion ($41.3 million) for the development and construction of a 14 MW_{AC} PV solar power plant located in Tochigi, Japan. The credit agreement consisted of a ¥4.6 billion ($36.0 million) term loan facility, a ¥0.5 billion ($3.6 million) consumption tax facility, and a ¥0.2 billion ($1.7 million) debt service reserve facility. In June 2022, we completed the sale of our Japan project development business, and the credit facility's outstanding balance of $18.0 million was assumed by PAG. See Note 3. "Sales of Businesses" to our consolidated financial statements for further information about this transaction.

Interest Rate Risk

As of December 31, 2022, our long-term debt borrowing rates were as follows:

Loan Agreement	Interest Rate	Effective Interest Rate
India Credit Facility	U.S. Treasury Constant Maturity Yield plus 1.75%	4.96%

During the years ended December 31, 2022, 2021, and 2020, we paid $11.6 million, $12.7 million, and $14.9 million, respectively, of interest related to our long-term debt arrangements.

Future Principal Payments

At December 31, 2022, the future principal payments on our long-term debt were due as follows (in thousands):

	Total Debt
2023	$ —
2024	13,117
2025	33,633
2026	33,633
2027	33,652
Thereafter	70,965
Total long-term debt future principal payments	$ 185,000

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12. Commitments and Contingencies

Commercial Commitments

During the normal course of business, we enter into commercial commitments in the form of letters of credit and surety bonds to provide financial and performance assurance to third parties. As of December 31, 2022, the majority of these commercial commitments supported our modules business.

As of December 31, 2022, the issued and outstanding amounts and available capacities under these commitments were as follows (in millions):

	Issued and Outstanding	Available Capacity
Bilateral facilities (1)	$ 117.4	$ 98.8
Surety bonds	9.1	232.8

(1) Of the total letters of credit issued under the bilateral facilities, $5.5 million was secured with cash.

Product Warranties

When we recognize revenue for sales of modules or projects, we accrue liabilities for the estimated future costs of meeting our limited warranty obligations for both modules and the balance of the systems. We estimate our limited product warranty liability for power output and defects in materials and workmanship under normal use and service conditions based on return rates for each series of module technology. We make and revise these estimates based primarily on the number of solar modules under warranty installed at customer locations, our historical experience with and projections of warranty claims, and our estimated per-module replacement costs. We also monitor our expected future module performance through certain quality and reliability testing and actual performance in certain field installation sites. From time to time, we have taken remediation actions with respect to affected modules beyond our limited warranties and may elect to do so in the future, in which case we would incur additional expenses. Such potential voluntary future remediation actions beyond our limited warranty obligations may be material to our consolidated statements of operations if we commit to any such remediation actions.

Product warranty activities during the years ended December 31, 2022, 2021, and 2020 were as follows (in thousands):

	2022	2021	2020
Product warranty liability, beginning of period	$ 52,553	$ 95,096	$ 129,797
Accruals for new warranties issued	4,727	9,266	9,424
Settlements	(12,690)	(12,337)	(22,464)
Changes in estimate of product warranty liability	(10,803)	(39,472)	(21,661)
Product warranty liability, end of period	$ 33,787	$ 52,553	$ 95,096
Current portion of warranty liability	$ 10,660	$ 13,598	$ 22,278
Noncurrent portion of warranty liability	$ 23,127	$ 38,955	$ 72,818

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During the year ended December 31, 2022 and 2021, we revised our limited product warranty liability estimate based on updated information regarding our warranty claims, which reduced our product warranty liability by $10.2 million and $33.1 million, respectively. This updated information reflected lower-than-expected warranty claims for our older series of module technology as well as the evolving claims profile of our newest series of module technology, resulting in reductions to our projected module return rates. During the year ended December 31, 2020, we revised this estimate based on updated information regarding our warranty claims, which reduced our product warranty liability by $19.7 million. This updated information reflected lower-than-expected settlements for our older series of module technology and revisions to projected settlements, resulting in a lower projected return rate.

Indemnifications

In certain limited circumstances, we have provided indemnifications to customers or other parties under which we are contractually obligated to compensate such parties for losses they suffer resulting from a breach of a representation, warranty, or covenant; the resolution of specific matters associated with a project's development or construction; or guarantees of a third party's payment or performance obligations. For contracts that have such indemnification provisions, we initially recognize a liability under ASC 460 for the estimated premium that would be required by a guarantor to issue the same indemnity in a standalone arm's-length transaction with an unrelated party. We may base these estimates on the cost of insurance or other instruments that cover the underlying risks being indemnified and may purchase such instruments to mitigate our exposure to potential indemnification payments. We subsequently measure such liabilities at the greater of the initially estimated premium or the contingent liability required to be recognized under ASC 450. We recognize any indemnification liabilities as a reduction of earnings associated with the related transaction.

After an indemnification liability is recorded, we derecognize such amount pursuant to ASC 460 depending on the nature of the indemnity, which derecognition typically occurs upon expiration or settlement of the arrangement, and any contingent aspects of the indemnity are accounted for in accordance with ASC 450. As of December 31, 2022 and 2021, we accrued $2.5 million and $3.8 million of current indemnification liabilities, respectively. As of December 31, 2022, the maximum potential amount of future payments under our indemnifications was $97.1 million, and we held insurance and other instruments allowing us to recover up to $28.0 million of potential amounts paid under the indemnifications.

In September 2017, we made an indemnification payment in connection with the sale of one of our projects following the underpayment of anticipated cash grants by the United States government. In February 2018, the associated project entity commenced legal action against the United States government seeking full payment of the cash grants. In May 2021, the parties reached an agreement, pursuant to which the United States government made a settlement payment to the project entity. Under the terms of the indemnification arrangement, we received $65.1 million for our portion of the settlement payment, which we recorded as revenue during the year ended December 31, 2021.

Solar Module Collection and Recycling Liability

We previously established a module collection and recycling program, which has since been discontinued, to collect and recycle modules sold and covered under such program once the modules reach the end of their service lives. For legacy customer sales contracts that are covered under this program, we agreed to pay the costs for the collection and recycling of qualifying solar modules, and the end-users agreed to notify us, disassemble their solar power systems, package the solar modules for shipment, and revert ownership rights over the modules back to us at the end of the modules' service lives. Accordingly, we recorded any collection and recycling obligations within "Cost of sales" at the time of sale based on the estimated cost to collect and recycle the covered solar modules.

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We estimate the cost of our collection and recycling obligations based on the present value of the expected future cost of collecting and recycling the solar modules, which includes estimates for the cost of packaging materials; the cost of freight from the solar module installation sites to a recycling center; material, labor, and capital costs; and by-product credits for certain materials recovered during the recycling process. We base these estimates on our experience collecting and recycling solar modules and certain assumptions regarding costs at the time the solar modules will be collected and recycled. In the periods between the time of sale and the related settlement of the collection and recycling obligation, we accrete the carrying amount of the associated liability and classify the corresponding expense within "Selling, general and administrative" expense on our consolidated statements of operations.

We periodically review our estimates of expected future recycling costs and may adjust our liability accordingly. Such adjustments are presented within "Cost of sales" on our consolidated statements of operations. During the year ended December 31, 2022, we completed our annual cost study of obligations under our module collection and recycling program and reduced the associated liability by $7.5 million primarily due to lower estimated capital and chemical costs resulting from improvements to our module recycling technology. During the year ended December 31, 2021, we completed our annual cost study of obligations under our module collection and recycling program and increased the associated liability by $10.8 million primarily due to lower estimated by-product credits for certain semiconductor materials recovered during the recycling process and updates to certain valuation assumptions. During the year ended December 31, 2020, we completed our annual cost study of obligations under our module collection and recycling program and reduced the associated liability by $18.9 million primarily due to changes to the estimated timing of cash flows associated with capital, labor, and maintenance costs and updates to certain valuation assumptions.

Our module collection and recycling liability was $128.1 million and $139.1 million as of December 31, 2022 and 2021, respectively. During the years ended December 31, 2022, 2021, and 2020, we recognized accretion expense of $5.5 million, $5.4 million and $5.2 million, respectively, associated with this liability. See Note 6. "Restricted Marketable Securities" to our consolidated financial statements for more information about our arrangements for funding this liability.

Legal Proceedings

Class Action

On January 7, 2022, a putative class action lawsuit titled City of Pontiac General Employees' Retirement System v. First Solar, Inc., et al., Case No. 2:22-cv-00036-MTL, was filed in the United States District Court for the District of Arizona (hereafter "Arizona District Court") against the Company and certain of our current officers (collectively, "Putative Class Action Defendants"). The complaint was filed on behalf of a purported class consisting of all purchasers of First Solar common stock between February 22, 2019 and February 20, 2020, inclusive. The complaint asserts violations of Sections 10(b) and 20(a) of the Securities Exchange Act of 1934 and Rule 10b-5 based on allegedly false and misleading statements related to the Company's Series 6 solar modules and its project development business. It seeks unspecified damages and an award of costs and expenses. On April 25, 2022, the Arizona District Court issued an order appointing the Palm Harbor Special Fire Control & Rescue District Firefighters' Pension Plan and the Greater Pennsylvania Carpenters' Pension Fund as Lead Plaintiffs. On June 23, 2022, Lead Plaintiffs filed an Amended Complaint that brings the same claims and seeks the same relief as the original complaint. Putative Class Action Defendants filed a motion to dismiss on August 22, 2022. Lead Plaintiffs filed their opposition to the motion to dismiss on October 21, 2022. Putative Class Action Defendants filed a reply in support of their motion to dismiss on November 21, 2022. On January 10, 2023, the Court granted the Putative Class Action Defendants' motion to dismiss in full, with leave to amend by February 10, 2023. On February 10, 2023, Lead Plaintiffs filed a Second Amended Complaint. Putative Class Action Defendants filed a motion to dismiss the Second Amended Complaint on February 24, 2023. Given the early stage of the litigation, at this time we are not in a position to assess the likelihood of any potential loss or adverse effect on our financial condition or to estimate the amount or range of possible loss, if any, from this action.

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Derivative Action

On September 13, 2022, a derivative action titled Federman v. Widmar, et al., Case No. 2:22-cv-01541-JAT, was filed by a putative stockholder purportedly on behalf of the Company in the Arizona District Court against our current directors and certain officers of the Company (collectively, "Derivative Action Defendants"), alleging violations of Section 14(a) of the Securities Exchange Act of 1934, breach of fiduciary duties, contribution and indemnification, aiding and abetting, and gross mismanagement. The complaint generally alleges that the Derivative Action Defendants caused or allowed false and misleading statements to be made concerning the Company's Series 6 modules and project development business. The action includes claims for, among other things, damages in favor of the Company and an award of costs and expenses to the putative plaintiff stockholder, including attorneys' fees. The Company believes that the plaintiff in the derivative action lacks standing to pursue litigation on behalf of First Solar. On February 17, 2023, the case was transferred to Judge Liburdi, who is also presiding over the related putative class action. The plaintiff in the derivative action intends to file an amended derivative complaint, which the parties have jointly stipulated will be due by March 10, 2023. Given the early stage of the litigation, at this time we are not in a position to assess the likelihood of any potential loss or adverse effect on our financial condition or to estimate the amount or range of possible loss, if any, from this action.

Opt Out Action

First Solar was party to a suit titled Maverick Fund, L.D.C. v. First Solar, Inc., et al., Case No. 2:15-cv-01156-ROS, filed in 2015 in the Arizona District Court by putative stockholders that opted out of our previously settled class action lawsuit.

In July 2020, the parties executed a definitive settlement agreement pursuant to which First Solar agreed to pay a total of $19 million in exchange for mutual releases and a dismissal with prejudice of the Opt-Out Action. The agreement contains no admission of liability, wrongdoing, or responsibility by any of the defendants. On July 30, 2020, First Solar funded the settlement, and on July 31, 2020, the parties filed a joint stipulation of dismissal. On September 10, 2020, the Arizona District Court entered an order dismissing the case with prejudice. As of December 31, 2019, we accrued $13 million of estimated losses for this action. As a result of the settlement, we accrued an incremental $6 million litigation loss during the year ended December 31, 2020.

Other Matters and Claims

On July 12, 2021, Southern Power Company and certain of its affiliates ("Southern") filed an arbitration demand with the American Arbitration Association against two subsidiaries of the Company, alleging breach of the EPC agreements for five projects in the United States, for which the Company's subsidiaries served as EPC contractor. The arbitration demand asserts breach of obligations to design and engineer the projects in accordance with the EPC agreements, particularly as such obligations relate to the procurement of tracker systems and inverters. The Company and its subsidiaries deny the claims, and defended the claims in arbitration hearings, which concluded in late February 2023. At this time, the Company believes that Southern is seeking damages of approximately $60 million. The parties are in the process of submitting post-hearing briefs and proposals, which are due in early May 2023. The arbitration panel will choose from the parties' proposals by issuing an award later this year. At this time, given the inherent risks and uncertainties involved in arbitration, we believe the likelihood of a potential loss is reasonably possible, but we are unable to estimate the amount or range of potential loss, if any, from this arbitration.

During the year ended December 31, 2022, we received several indemnification demands from certain customers, for whom we provided EPC services, regarding claims that such customers' PV tracker systems infringe, in part, on patents owned by Sade, the owner of a company called Trabant Solar, Inc. In January 2023, we were notified by two of our customers that Sade served them with patent infringement complaints, and we have assumed the defense of these claims. We have conducted due diligence on the patents and claims and believe that we will prevail in the actions. Additionally, we anticipate the commencement of an Inter Partes Review before the United States Patent and Trademark Office seeking to invalidate such claims. Given the early stage of the litigation, at this time we are not in a position to assess the likelihood of any potential loss or adverse effect on our financial condition or to estimate the amount or range of possible loss, if any, from these actions.

We are party to other legal matters and claims in the normal course of our operations. While we believe the ultimate outcome of these matters and claims will not have a material adverse effect on our financial position, results of operations, or cash flows, the outcome of such matters and claims is not determinable with certainty, and negative outcomes may adversely affect us.

13. Revenue from Contracts with Customers

The following table presents the disaggregation of revenue from contracts with customers for the years ended December 31, 2022, 2021, and 2020 along with the reportable segment for each category (in thousands):

Category	Segment	2022	2021	2020
Solar modules	Modules	$ 2,428,278	$ 2,331,380	$ 1,736,060
Solar power systems	Other	153,290	513,362	794,797
Energy generation (1)	Other	25,756	37,614	61,948
O&M services	Other	11,995	43,060	115,590
EPC services (2)	Other	—	(2,039)	2,937
Net sales		$ 2,619,319	$ 2,923,377	$ 2,711,332

(1) During the year ended December 31, 2020, the majority of energy generated and sold by our PV solar power systems was accounted for under ASC 840 consistent with the classification of the associated PPAs.

(2) For certain of our EPC agreements, we provide an energy performance test during the first or second year of a system's operation to demonstrate that the actual energy generation for the applicable period meets or exceeds the modeled energy expectation, after certain adjustments. If there is an underperformance event with regard to these tests, we may incur liquidated damages as specified in the applicable EPC agreement. During the year ended December 31, 2021, we accrued liquidated damages for certain of these agreements, which we recognized as a reduction to revenue.

We recognize revenue for module sales at a point in time following the transfer of control of the modules to the customer, which typically occurs upon shipment or delivery depending on the terms of the underlying contracts. Such contracts may contain provisions that require us to make liquidated damage payments to the customer if we fail to ship or deliver modules by scheduled dates. We recognize these liquidated damages as a reduction of revenue in the period we transfer control of the modules to the customer.

We recognize revenue for sales of development projects or completed systems when we enter into the associated sales contract. For certain prior project sales, including sales of solar power systems with EPC services, such revenue included estimated amounts of variable consideration. These estimates may require significant judgment to determine the most likely amount of net contract revenues. The cumulative effect of revisions to estimates is recorded in the period in which the revisions are identified and the amounts can be reasonably estimated. During the years ended December 31, 2022 and 2021, we recorded revenue of $1.5 million and $71.3 million, respectively, due to net changes in transaction prices for certain projects we previously sold, which represented 0.9% and 2.1% of the aggregate revenue for such projects, respectively. Changes for the year ended December 31, 2021 were primarily due to a $65.1 million settlement of an outstanding indemnification arrangement associated with the prior sale of a project. See Note 12. "Commitments and Contingencies" to our consolidated financial statements for discussion of

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our indemnification arrangements. During the year ended December 31, 2020, revenue decreased $17.0 million due to net changes in transaction prices for certain projects we previously sold, partially offset by a $7.5 million increase in revenue due to net changes in input cost estimates for such projects, which represented 0.5% of the aggregate revenue for such projects.

The following table reflects the changes in our contract assets, which we classify as "Accounts receivable unbilled, net" and our contract liabilities, which we classify as "Deferred revenue," for the year ended December 31, 2022 (in thousands):

	2022	2021	Change	
Accounts receivable unbilled, net (1)	$ 42,152	$ 46,113	$ (3,961)	(9)%
Deferred revenue	$ 1,207,940	$ 297,811	$ 910,129	306 %

(1) Includes $11.5 million and $20.8 million of noncurrent accounts receivable unbilled, net classified as "Other assets" on our consolidated balance sheets as of December 31, 2022 and 2021, respectively.

During the year ended December 31, 2022, our contract assets decreased by $4.0 million primarily due to billings for certain prior project sales. During the year ended December 31, 2022, our contract liabilities increased by $910.1 million primarily due to advance payments received for sales of solar modules in the current year, partially offset by the recognition of revenue for sales of solar modules for which payment was received in prior years. During the years ended December 31, 2022 and 2021, we recognized revenue of $279.1 million and $182.0 million, respectively, that was included in the corresponding contract liability balance at the beginning of the periods.

As of December 31, 2022, we had entered into contracts with customers for the future sale of 61.4 GW_{DC} of solar modules for an aggregate transaction price of $17.7 billion, which we expect to recognize as revenue through 2029 as we transfer control of the modules to the customers. Such aggregate transaction price excludes estimates of variable consideration associated with (i) future module technology improvements, including new product designs and enhancements to certain energy related attributes, (ii) the extension of the ITC, (iii) sales freight in excess of a defined threshold, (iv) changes to certain commodity prices, and (v) the module wattage committed for delivery, among other things. As a result, the revenue recognized from such contracts may increase or decrease in future periods relative to the original transaction price. These contracts may also be subject to amendments made by us or requested by our customers. These amendments may increase or decrease the volume of modules to be sold under the contract, change delivery schedules, or otherwise adjust the expected revenue under these contracts.

14. Stockholders' Equity

Preferred Stock

As of December 31, 2022 and 2021, we had authorized 30,000,000 shares of undesignated preferred stock, $0.001 par value, none of which was issued and outstanding. Our board of directors is authorized to determine the rights, preferences, and restrictions on any series of preferred stock that we may issue.

Common Stock

As of December 31, 2022 and 2021, we had authorized 500,000,000 shares of common stock, $0.001 par value, of which 106,609,094 and 106,332,315 shares, respectively, were issued and outstanding. Each share of common stock is entitled to a single vote. We have not declared or paid any dividends through December 31, 2022.

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15. Share-Based Compensation

The following table presents share-based compensation expense recognized in our consolidated statements of operations for the years ended December 31, 2022, 2021, and 2020 (in thousands):

	2022	2021	2020
Cost of sales (1)	$ 3,174	$ 892	$ 3,183
Selling, general and administrative (1)	22,367	19,578	22,093
Research and development (2)	3,080	432	3,991
Production start-up	35	—	—
Total share-based compensation expense	$ 28,656	$ 20,902	$ 29,267

(1) On March 31, 2021, we completed the sales of our North American O&M operations and U.S. project development business, which resulted in the forfeiture of unvested shares for associates departing the Company as part of the transactions. See Note 3. "Sales of Businesses" to our consolidated financial statements for further information related to these transactions.

(2) Effective March 15, 2021, our former Chief Technology Officer retired from the Company, which resulted in the forfeiture of his unvested shares during the year ended December 31, 2021.

Share-based compensation expense capitalized in inventory and PV solar power systems was $0.3 million and $0.7 million as of December 31, 2022 and 2021, respectively. As of December 31, 2022, we had $36.5 million of unrecognized share-based compensation expense related to unvested restricted stock and performance units, which we expect to recognize over a weighted-average period of approximately 1.6 years. During the years ended December 31, 2022, 2021, and 2020, we recognized an income tax benefit in our statement of operations of $7.3 million, $7.5 million, and $7.3 million, respectively, related to share-based compensation expense, including excess tax benefits. We authorize our transfer agent to issue new shares, net of shares withheld for taxes as appropriate, for the vesting of restricted stock and performance units or grants of unrestricted stock.

Share-Based Compensation Plans

During the year ended December 31, 2020, we adopted our 2020 Omnibus Plan, under which directors, officers, employees, and consultants of First Solar, Inc. (including any of its affiliates) are eligible to participate in various forms of share-based compensation. The 2020 Omnibus Plan is administered by the compensation committee(or any other committee designated by our board of directors), which is authorized to, among other things, determine the recipients of grants, the exercise price, and the vesting schedule of any awards made under the 2020 Omnibus Plan. Our board of directors may amend, modify, or terminate the 2020 Omnibus Plan without the approval of our stockholders, except for amendments that would increase the maximum number of shares of our common stock available for awards under the 2020 Omnibus Plan, increase the maximum number of shares of our common stock that may be delivered by incentive stock options, or modify the requirements for participation in the 2020 Omnibus Plan.

The 2020 Omnibus Plan provides for the grant of incentive stock options, non-qualified stock options, stock appreciation rights, restricted shares, restricted stock units, performance units, cash incentive awards, performance compensation awards, and other equity-based and equity-related awards. In addition, the shares underlying any forfeited, expired, terminated, or canceled awards, or shares surrendered as payment for taxes required to be withheld, become available for new award grants. We may not grant awards under the 2020 Omnibus Plan after 2030, which is the tenth anniversary of the 2020 Omnibus Plan's approval by our stockholders. As of December 31, 2022, we had 6,500,832 shares available for future issuance under the 2020 Omnibus Plan.

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Restricted Stock and Performance Units

We issue shares to the holders of restricted stock units on the date the restricted units vest. The majority of shares issued are net of applicable withholding taxes, which we pay on behalf of our associates. As a result, the actual number of shares issued will be less than the number of restricted stock units granted. Prior to vesting, restricted stock units do not have dividend equivalent rights or voting rights, and the shares underlying the restricted stock units are not considered issued and outstanding.

In April 2018, the compensation committee approved grants of performance units for key executive officers and associates to be earned over an approximately three-year performance period, which ended in December 2020. Vesting of the 2018 grants of performance units was contingent upon the relative attainment of target gross margin, operating expense, and contracted revenue metrics. In February 2021, the compensation committee certified the achievement of the vesting conditions applicable to the grants, which approximated the target level of performance. Accordingly, each participant received one share of common stock for each vested performance unit, net of any tax withholdings.

In July 2019, the compensation committee approved additional grants of performance units for key executive officers to be earned over a multi-year performance period, which ended in December 2021. Vesting of the 2019 grants of performance units was contingent upon the relative attainment of target cost per watt, module wattage, gross profit, and operating income metrics. In March 2022, the compensation committee certified the achievement of the vesting conditions applicable to the grants, which approximated the maximum level of performance. Accordingly, each participant received one share of common stock for each vested performance unit granted, net of any tax withholdings.

In March 2020, the compensation committee approved additional grants of performance units for key executive officers to be earned over a multi-year performance period, which ended in December 2022. Vesting of the 2020 grants of performance units is contingent upon the relative attainment of target contracted revenue, module wattage, and return on capital metrics, to be certified by the compensation committee in 2023.

In May 2021, the compensation committee approved additional grants of performance units for key executive officers. Such grants are expected to be earned over a multi-year performance period ending in December 2023. Vesting of the 2021 grants of performance units is contingent upon the relative attainment of target contracted revenue, cost per watt, incremental average selling price, and operating income metrics.

In March 2022, the compensation committee approved additional grants of performance units for key executive officers. Such grants are expected to be earned over a multi-year performance period ending in December 2024. Vesting of the 2022 grants of performance units is contingent upon the relative attainment of target contracted revenue, cost per watt, and return on capital metrics.

Vesting of performance units is also contingent upon the employment of program participants through the applicable vesting dates, with limited exceptions in case of death, disability, a qualifying retirement, or a change-in-control of First Solar. Outstanding performance units are included in the computation of diluted net income per share based on the number of shares that would be issuable if the end of the reporting period were the end of the contingency period.

In February 2022, First Solar adopted a Clawback Policy ("the Policy") that applies to the Company's current and former Section 16 officers. The Policy applies to all incentive compensation, including any performance-based annual incentive awards and performance-based equity compensation. The Policy was adopted to ensure that incentive compensation is paid or awarded based on accurate financial results and the correct calculation of performance against incentive targets.

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The following is a summary of our restricted stock unit activity, including performance unit activity, for the year ended December 31, 2022:

	Number of Shares	Weighted-Average Grant-Date Fair Value
Unvested restricted stock units at December 31, 2021	1,316,860	$ 60.09
Restricted stock units granted (1)	462,234	89.21
Restricted stock units vested	(425,019)	62.20
Restricted stock units forfeited	(43,188)	64.86
Unvested restricted stock units at December 31, 2022	1,310,887	$ 69.51

(1) Restricted stock units granted include the maximum amount of performance units available for issuance under our long-term incentive program for key executive officers and associates. The actual number of shares to be issued will depend on the relative attainment of the performance metrics described above.

We estimate the fair value of our restricted stock unit awards based on our stock price on the grant date. For the years ended December 31, 2021 and 2020, the weighted-average grant-date fair value for restricted stock units granted in such years was $78.86 and $45.01, respectively. The total fair value of restricted stock units vested during 2022, 2021, and 2020 was $26.4 million, $27.8 million, and $32.9 million, respectively.

Unrestricted Stock

During the years ended December 31, 2022, 2021, and 2020, we awarded 19,868; 19,513; and 27,731, respectively, of fully vested, unrestricted shares of our common stock, excluding amounts withheld for taxes, to the chairman and independent members of our board of directors. Accordingly, we recognized $1.9 million, $1.8 million, and $1.5 million of share-based compensation expense for these awards during the years ended December 31, 2022, 2021, and 2020, respectively.

16. Income Taxes

In August 2022, the U.S. President signed into law the IRA, which revised U.S. tax law by, among other things, including a new CAMT of 15% on certain large corporations, imposing a 1% excise tax on stock buybacks, and providing various incentives to address climate change, including the introduction of the advanced manufacturing production credit. The provisions of the IRA are generally effective for tax years beginning after 2022. Given the complexities of the IRA, which is pending technical guidance and regulations from the IRS and U.S. Treasury Department, we will continue to monitor these developments and evaluate the potential future impact to our results of operations.

In November 2022, the U.S. Treasury Department released proposed foreign tax credit ("FTC") regulations addressing various aspects of the U.S. FTC regime. Among other items, these proposed regulations provide certain exceptions for determining creditable foreign withholding taxes. Taxpayers may rely on these proposed regulations, which apply to tax years beginning on or after December 28, 2021. As a result of these proposed regulations, foreign withholding taxes will continue to be creditable.

In March 2020, the Coronavirus Aid, Relief, and Economic Security Act (the "CARES Act") was signed into law. The CARES Act includes a number of federal corporate tax relief provisions that are intended to support the ongoing liquidity of U.S. corporations. Among other provisions, the CARES Act allows net operating losses incurred in 2018, 2019, and 2020 to be carried back to each of the five preceding taxable years. As a result of the CARES Act, we expect to carry back our 2019 and 2020 net operating losses to our 2016 U.S. corporate income tax return, which restores certain foreign tax credits we expect to utilize by amending our 2017 and 2018 U.S. corporate income tax returns. Such amended returns restore other general business credits we expect to utilize in future tax years before the credits expire and eliminate the transition tax liability for accumulated earnings of foreign subsidiaries resulting from the Tax Cuts and Jobs Act. As a result, we recorded a tax benefit of $89.7 million for the year ended December 31, 2020, which represents the one-time income tax benefit for the difference between the statutory federal corporate income tax rate of 35% applicable to our 2016 U.S. corporate income tax return and the current federal corporate income tax rate of 21%. Any changes to the estimate will be recorded in the period the carry back claims are filed.

Although we continue to evaluate our plans for the reinvestment or repatriation of unremitted foreign earnings, we expect to indefinitely reinvest the earnings of our foreign subsidiaries to fund our international operations, with the exception of certain subsidiaries for which applicable taxes have been recorded as of December 31, 2022. Accordingly, we have not recorded any provision for additional U.S. or foreign withholding taxes related to the outside basis differences of our foreign subsidiaries in which we expect to indefinitely reinvest their earnings. However, our future plans for repatriation of unremitted foreign earnings could be affected by our current and future expansion activities and the timing of the IRA credits, the majority of which are expected to be refunded in cash.

The U.S. and non-U.S. components of our income or loss before income taxes for the years ended December 31, 2022, 2021, and 2020 were as follows (in thousands):

	2022	2021	2020
U.S. (loss) income	$ (17,652)	$ 315,297	$ 22,475
Non-U.S. income	26,250	256,865	270,715
Income before taxes and equity in earnings	$ 8,598	$ 572,162	$ 293,190

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The components of our income tax expense or benefit for the years ended December 31, 2022, 2021, and 2020 were as follows (in thousands):

	2022	2021	2020
Current expense (benefit):			
Federal	$ 8,434	$ 9,531	$ (149,162)
State	399	3,469	4,027
Foreign	49,984	10,109	26,303
Total current expense (benefit)	58,817	23,109	(118,832)
Deferred (benefit) expense:			
Federal	(13,928)	58,510	12,681
State	(700)	3,775	7,591
Foreign	8,575	18,075	(8,734)
Total deferred (benefit) expense	(6,053)	80,360	11,538
Total income tax expense (benefit)	$ 52,764	$ 103,469	$ (107,294)

Our Malaysian subsidiary has been granted a long-term tax holiday that expires in 2027. The tax holiday, which generally provides for a full exemption from Malaysian income tax, is conditional upon our continued compliance with meeting certain employment and investment thresholds, which we are currently in compliance with and expect to continue to comply with through the expiration of the tax holiday in 2027.

Our Vietnamese subsidiary had previously been granted a tax incentive that provided a two-year tax exemption, which began in 2020, and reduced annual tax rates through the end of 2025. In May 2022, our Vietnamese subsidiary was granted a new long-term tax incentive that provides an additional two-year tax exemption and reduced annual tax rates through 2036, conditional upon our continued compliance with certain revenue and R&D spending thresholds, which we are currently in compliance with and expect to continue to comply with through the expiration of the tax holiday.

Our income tax results differed from the amount computed by applying the relevant U.S. statutory federal corporate income tax rate to our income or loss before income taxes for the following reasons for the years ended December 31, 2022, 2021, and 2020 (in thousands):

	2022		2021		2020	
	Tax	Percent	Tax	Percent	Tax	Percent
Statutory income tax expense	$ 1,806	21.0 %	$ 120,154	21.0 %	$ 61,570	21.0 %
Effect of tax holiday	27,424	318.9 %	(32,339)	(5.7)%	(11,500)	(3.9)%
Changes in valuation allowance	22,239	258.6 %	2,603	0.5 %	(31,671)	(10.8)%
Non-deductible expenses	10,776	125.3 %	3,955	0.7 %	3,834	1.3 %
Change in tax contingency	4,326	50.3 %	2,198	0.4 %	(59,010)	(20.1)%
Foreign dividend income	2,857	33.2 %	2,611	0.5 %	3,004	1.0 %
Effect of CARES Act	1,127	13.1 %	1,880	0.3 %	(89,699)	(30.6)%
State tax, net of federal benefit	700	8.1 %	4,757	0.8 %	11,059	3.8 %
Share-based compensation	(1,017)	(11.8)%	(2,991)	(0.5)%	(720)	(0.2)%
Return to provision adjustments	(1,767)	(20.5)%	(4,932)	(0.9)%	2,414	0.8 %
Foreign tax rate differential	(4,227)	(49.1)%	4,632	0.8 %	6,135	2.1 %
Tax credits	(12,654)	(147.2)%	(3,395)	(0.6)%	(8,091)	(2.8)%
Other	1,174	13.8 %	4,336	0.8 %	5,381	1.8 %
Reported income tax expense (benefit)	$ 52,764	613.7 %	$ 103,469	18.1 %	$ (107,294)	(36.6)%

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During the year ended December 31, 2022, we received net tax refunds of $3.9 million. During the years ended December 31, 2021 and 2020, we made net tax payments of $38.2 million and $22.2 million, respectively.

Deferred income taxes reflect the net tax effects of temporary differences between the carrying amounts of assets and liabilities calculated under U.S. GAAP and the amounts calculated for preparing our income tax returns. The items that gave rise to our deferred taxes as of December 31, 2022 and 2021 were as follows (in thousands):

	2022	2021
Deferred tax assets:		
Net operating losses	$ 122,950	$ 110,979
Tax credits	103,260	86,885
Capitalized research and development	32,932	—
Accrued expenses	28,226	35,193
Long-term contracts	23,531	9,065
Compensation	13,167	10,551
Equity in earnings	4,172	4,174
Deferred expenses	1,735	1,786
Inventory	1,490	10,057
Restricted marketable securities and derivatives	357	—
Goodwill and intangible assets	221	1,784
Other	23,249	24,244
Deferred tax assets, gross	355,290	294,718
Valuation allowance	(135,763)	(123,917)
Deferred tax assets, net of valuation allowance	219,527	170,801
Deferred tax liabilities:		
Property, plant and equipment	(150,477)	(106,361)
Investment in foreign subsidiaries	(5,689)	(15,583)
Acquisition accounting / basis difference	(4,065)	(4,065)
Capitalized interest	(1,331)	(1,338)
Restricted marketable securities and derivatives	—	(4,337)
Other	(8,214)	(7,654)
Deferred tax liabilities	(169,776)	(139,338)
Net deferred tax assets	$ 49,751	$ 31,463

We use the deferral method of accounting for investment tax credits under which the credits are recognized as reductions in the carrying value of the related assets. The use of the deferral method also results in a basis difference from the recognition of a deferred tax asset and an immediate income tax benefit for the future tax depreciation of the related assets. Such basis differences are accounted for pursuant to the income statement method.

The following table shows changes in the valuation allowance against our deferred tax assets during the years ended December 31, 2022, 2021, and 2020 (in thousands):

	2022	2021	2020
Valuation allowance, beginning of year	$ 123,917	$ 127,711	$ 151,705
Additions	58,922	8,976	23,884
Reversals	(47,076)	(12,770)	(47,878)
Valuation allowance, end of year	$ 135,763	$ 123,917	$ 127,711

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We maintained a valuation allowance of $135.8 million and $123.9 million as of December 31, 2022 and 2021, respectively, against certain of our deferred tax assets, as it is more likely than not that such amounts will not be fully realized. During the year ended December 31, 2022, the valuation allowance increased by $11.8 million primarily due to current year operating losses in certain jurisdictions, partially offset by the partial release of the valuation allowance in jurisdictions with current year operating income.

As of December 31, 2022, we had federal and aggregate state net operating loss carryforwards of $9.0 million and $423.3 million, respectively. As of December 31, 2021, we had federal and aggregate state net operating loss carryforwards of $10.4 million and $428.5 million, respectively. If not used, the federal net operating loss carryforwards incurred prior to 2018 will begin to expire in 2030, and the state net operating loss carryforwards will begin to expire in 2029. Federal net operating losses arising in tax years beginning in 2018 may be carried forward indefinitely, and the associated deduction is limited to 80% of taxable income. The utilization of our net operating loss carryforwards is also subject to an annual limitation under Section 382 of the IRC due to changes in ownership. Based on our analysis, we do not believe such limitation will impact our realization of the net operating loss carryforwards as we anticipate utilizing them prior to expiration.

As of December 31, 2022, we had U.S. foreign tax credit carryforwards of $9.3 million, federal and state research and development credit carryforwards of $63.8 million, and investment tax credits of $55.4 million available to reduce future federal and state income tax liabilities. If not used, these credits will begin to expire in 2028, 2029, and 2029, respectively.

The following table shows a reconciliation of the beginning and ending amount of liabilities associated with uncertain tax positions for the years ended December 31, 2022, 2021, and 2020 (in thousands):

	2022	2021	2020
Unrecognized tax benefits, beginning of year	$ 7,811	$ 5,370	$ 72,169
Increases related to prior year tax positions	4,569	—	169
Decreases related to prior year tax positions	—	(44)	(256)
Decreases from lapse in statute of limitations	(361)	(492)	(67,396)
Increases related to current tax positions	2,474	2,977	684
Unrecognized tax benefits, end of year	$ 14,493	$ 7,811	$ 5,370

If recognized, $14.5 million of unrecognized tax benefits, excluding interest and penalties, would reduce our annual effective tax rate. Due to the uncertain and complex application of tax laws and regulations, it is possible that the ultimate resolution of uncertain tax positions may result in liabilities that could be materially different from these estimates. In such an event, we will record additional tax expense or benefit in the period in which such resolution occurs. Our policy is to recognize any interest and penalties that we may incur related to our tax positions as a component of income tax expense or benefit. During the years ended December 31, 2022, 2021, and 2020, we recognized interest and penalties of $0.3 million, $0.3 million, and $5.3 million, respectively, related to unrecognized tax benefits.

We are subject to audit by federal, state, local, and foreign tax authorities. We are currently under examination in India, Japan, Chile, Singapore, and the state of California. We believe that adequate provisions have been made for any adjustments that may result from tax examinations. However, the outcome of tax examinations cannot be predicted with certainty. If any issues addressed by our tax examinations are not resolved in a manner consistent with our expectations, we could be required to adjust our provision for income taxes in the period such resolution occurs.

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The following table summarizes the tax years that are either currently under audit or remain open and subject to examination by the tax authorities in the most significant jurisdictions in which we operate:

	Tax Years
Vietnam	2012 - 2021
Singapore	2017 - 2021
United States	2018 - 2021
Malaysia	2019 - 2021

In certain of the jurisdictions noted above, we operate through more than one legal entity, each of which has different open years subject to examination. The table above presents the open years subject to examination for the most material of the legal entities in each jurisdiction. Additionally, tax years are not closed until the statute of limitations in each jurisdiction expires. In the jurisdictions noted above, the statute of limitations can extend beyond the open years subject to examination.

17. Net (Loss) Income per Share

The calculation of basic and diluted net (loss) income per share for the years ended December 31, 2022, 2021, and 2020 was as follows (in thousands, except per share amounts):

	2022	2021	2020
Basic net (loss) income per share			
Numerator:			
Net (loss) income	$ (44,166)	$ 468,693	$ 398,355
Denominator:			
Weighted-average common shares outstanding	106,551	106,263	105,867
Diluted net (loss) income per share			
Denominator:			
Weighted-average common shares outstanding	106,551	106,263	105,867
Effect of restricted stock and performance units	—	661	819
Weighted-average shares used in computing diluted net (loss) income per share	106,551	106,924	106,686
Net (loss) income per share:			
Basic	$ (0.41)	$ 4.41	$ 3.76
Diluted	$ (0.41)	$ 4.38	$ 3.73

The following table summarizes the potential shares of common stock that were excluded from the computation of diluted net (loss) income per share for the years ended December 31, 2022, 2021, and 2020 as such shares would have had an anti-dilutive effect (in thousands):

	2022	2021	2020
Anti-dilutive shares	576	14	—

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18. Accumulated Other Comprehensive Loss

The following table presents the changes in accumulated other comprehensive loss, net of tax, for the year ended December 31, 2022 (in thousands):

	Foreign Currency Translation Adjustment	Unrealized (Loss) Gain on Marketable Securities and Restricted Marketable Securities	Unrealized Gain (Loss) on Derivative Instruments	Total
Balance as of December 31, 2021	$ (89,452)	$ (8,036)	$ 1,126	$ (96,362)
Other comprehensive loss before reclassifications	(27,306)	(59,383)	(7,556)	(94,245)
Amounts reclassified from accumulated other comprehensive loss	(4,715)	—	(812)	(5,527)
Net tax effect	—	2,639	1,678	4,317
Net other comprehensive loss	(32,021)	(56,744)	(6,690)	(95,455)
Balance as of December 31, 2022	$ (121,473)	$ (64,780)	$ (5,564)	$ (191,817)

The following table presents the pretax amounts reclassified from accumulated other comprehensive loss into our consolidated statements of operations for the years ended December 31, 2022, 2021, and 2020 (in thousands):

Comprehensive Income Components	Income Statement Line Item	2022	2021	2020
Foreign currency translation adjustment:				
Foreign currency translation adjustment	Cost of sales	$ —	$ 269	$ 370
Foreign currency translation adjustment	Gain on sales of businesses, net	3,756	—	—
Foreign currency translation adjustment	Other income (expense), net	959	(1,203)	2,560
Total foreign currency translation adjustment		4,715	(934)	2,930
Unrealized gain on marketable securities and restricted marketable securities	Other income (expense), net	—	11,696	15,346
Unrealized gain (loss) on derivative instruments:				
Foreign exchange forward contracts	Cost of sales	1,671	(1,906)	(1,199)
Commodity swap contracts	Cost of sales	(859)	3,003	—
Total unrealized gain (loss) on derivative instruments		812	1,097	(1,199)
Total gain reclassified		$ 5,527	$ 11,859	$ 17,077

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19. Segment and Geographical Information

Our primary segment is our modules business, which involves the design, manufacture, and sale of CdTe solar modules, which convert sunlight into electricity. Third-party customers of our modules segment include developers and operators of systems, utilities, independent power producers, commercial and industrial companies, and other system owners. Our residual business operations include certain project development activities, O&M services, the results of operations from PV solar power systems we owned and operated in certain international regions, and the sale of such systems to third-party customers.

Our business is managed by our Chief Executive Officer, who is also considered our chief operating decision maker ("CODM"). Our CODM views sales of solar modules as the primary driver of our consolidated operating results. Our modules segment contributes to our operating results by providing the fundamental technologies and solar modules that drive our business and sales opportunities. Accordingly, our CODM generally makes decisions about allocating resources and assessing performance of the company based on the gross profit of our modules segment. However, information about our modules segment assets is not reported to the CODM for purposes of making such decisions. Accordingly, we exclude such asset information from our reportable segment financial disclosures.

The following tables provide a reconciliation of certain financial information for our reportable segment to information presented in our consolidated financial statements for the years ended December 31, 2022, 2021, and 2020 (in thousands):

	Year Ended December 31, 2022		
	Modules	Other	Total
Net sales	$ 2,428,278	$ 191,041	$ 2,619,319
Gross profit (loss)	115,397	(45,539)	69,858
Depreciation and amortization expense	230,827	9,361	240,188
Goodwill	14,462	—	14,462

	Year Ended December 31, 2021		
	Modules	Other	Total
Net sales	$ 2,331,380	$ 591,997	$ 2,923,377
Gross profit	472,926	257,028	729,954
Depreciation and amortization expense	219,712	12,189	231,901
Goodwill	14,462	—	14,462

	Year Ended December 31, 2020		
	Modules	Other	Total
Net sales	$ 1,736,060	$ 975,272	$ 2,711,332
Gross profit	429,131	251,542	680,673
Depreciation and amortization expense	181,402	20,813	202,215
Goodwill	14,462	—	14,462

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The following table presents net sales for the years ended December 31, 2022, 2021, and 2020 by geographic region, based on the customer country of invoicing (in thousands):

	2022	2021	2020
United States	$ 2,193,619	$ 2,456,597	$ 1,843,433
Chile	173,279	32,050	21,870
France	67,656	121,537	127,097
Japan	46,426	207,609	469,657
India	37,215	37,650	33,848
Canada	82	5,288	118,865
All other foreign countries	101,042	62,646	96,562
Net sales	$ 2,619,319	$ 2,923,377	$ 2,711,332

The following table presents long-lived assets, which include property, plant and equipment, operating lease assets, project assets, and PV solar power systems as of December 31, 2022 and 2021 by geographic region, based on the physical location of the assets (in thousands):

	2022	2021
United States	$ 1,876,218	$ 1,112,369
Malaysia	791,750	862,156
Vietnam	611,031	652,639
India	341,616	106,966
Japan	30,454	420,071
Chile	—	213,846
All other foreign countries	15,368	21,865
Long-lived assets	$ 3,666,437	$ 3,389,912

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20. Concentrations of Risks

Customer Concentration Risk. The following customers each comprised 10% or more of our total net sales for the years ended December 31, 2022, 2021, and 2020:

	2022	2021	2020
	% of Net Sales	% of Net Sales	% of Net Sales
Customer #1	14 %	*	*
Customer #2	10 %	*	*
Customer #3	10 %	*	*
Customer #4	*	12 %	*
Customer #5	*	10 %	11 %
Customer #6	*	*	10 %

* Net sales for these customers were less than 10% of our total net sales for the period.

Supplier Risk. Several of our key raw materials and components, in particular CdTe and substrate glass, and manufacturing equipment are either single-sourced or sourced from a limited number of suppliers. Failure of any of our key suppliers to perform could disrupt our supply chain and adversely impact our operations by impairing our ability to deliver solar modules to customers in the required quality and quantities and at a price that is profitable to us.

Production Risk. Shortages of essential components and equipment could occur due to increases in demand or interruptions of supply, which may be exacerbated by the availability of logistics services, thereby adversely affecting our ability to meet customer demand for our products. Our solar modules are currently produced at our facilities in Perrysburg, Ohio; Lake Township, Ohio; Kulim, Malaysia; and Ho Chi Minh City, Vietnam. Damage to or disruption of these facilities could interrupt our business and adversely affect our ability to generate net sales.

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INDEX TO EXHIBITS

The following exhibits are filed with or incorporated by reference into this Annual Report on Form 10-K:

Exhibit Number	Exhibit Description	Incorporated by Reference			
		Form	File No.	Date of First Filing	Exhibit Number
3.1	Amended and Restated Certificate of Incorporation of First Solar, Inc.	S-1/A	333-135574	10/25/06	3.1
3.2	Amended and Restated Bylaws of First Solar, Inc.	8-K	001-33156	7/23/21	3.1
4.1	Description of the Registrant's Securities	10-K	001-33156	2/21/20	4.1
10.1+	Form of Change in Control Severance Agreement	S-1/A	333-135574	10/25/06	10.15
10.2	Form of Director and Officer Indemnification Agreement	10-K	001-33156	2/27/13	10.20
10.3+	Employment Agreement, dated March 15, 2011, and Change in Control Severance Agreement, dated April 4, 2011 between First Solar, Inc. and Mark Widmar	10-Q	001-33156	5/5/11	10.3
10.4+	Employment Agreement, effective July 1, 2012, and Change in Control Severance Agreement, effective July 1, 2012 between First Solar, Inc. and Georges Antoun	10-Q	001-33156	8/3/12	10.1
10.5+	Non-Competition and Non-Solicitation Agreement, effective as of March 15, 2011, between First Solar, Inc. and Mark Widmar	10-Q	001-33156	5/7/13	10.2
10.6+	Change in Control Severance Agreement, effective as of July 1, 2012, between First Solar, Inc. and Georges Antoun	10-Q	001-33156	5/7/13	10.3
10.7+	Amendment to Change in Control Severance Agreement	10-Q	001-33156	8/7/13	10.1
10.8	Restricted Cash Assignment of Deposits	10-Q	001-33156	8/6/14	10.2
10.9+	First Solar, Inc. 2015 Omnibus Incentive Compensation Plan	DEF 14A	001-33156	4/8/15	App. A
10.10+	Amendment to Employment Agreement, effective as of July 1, 2016, between First Solar, Inc. and Mark Widmar, and Amendment to Non-Competition and Non-Solicitation Agreement, effective as of July 1, 2016, between First Solar, Inc. and Mark Widmar, and Second Amendment to Change-in-Control Severance Agreement, effective as of July 1, 2016, between First Solar, Inc. and Mark Widmar	10-Q	001-33156	4/28/16	10.1
10.11+	Employment Agreement, effective as of October 24, 2016, and Change-in-Control Severance Agreement, effective as of October 24, 2016, between First Solar, Inc. and Alexander Bradley	10-Q	001-33156	11/3/16	10.1
10.12+	Employment Agreement, Change In Control Severance Agreement, Confidentiality and Intellectual Property Agreement, and Non-Competition and Non-Solicitation Agreement, effective as of October 7, 2019 between First Solar, Inc. and Caroline Stockdale	10-K	001-33156	2/21/20	10.34
10.13+	Form of Performance Unit Award Agreement - Form Perf Unit-010	10-K	001-33156	2/21/20	10.46
10.14+	First Solar, Inc. 2020 Omnibus Incentive Compensation Plan	DEF 14A	001-33156	4/1/20	App. A
10.15+	Form of Grant Notice for 2020-2022 Executive Performance Equity Plan	10-Q	001-33156	5/8/20	10.1
10.16+	Employment Agreement, First Amendment to Employment Agreement, Change In Control Severance Agreement, Confidentiality and Intellectual Property Agreement, and Non-Competition and Non-Solicitation Agreement, effective as of August 10, 2020 between First Solar, Inc. and Patrick Buehler	10-Q	001-33156	10/28/20	10.1
10.17+	Employment Agreement, Change In Control Severance Agreement, Confidentiality and Intellectual Property Agreement, and Non-Competition and Non-Solicitation Agreement, effective as of August 10, 2020 between First Solar, Inc. and Jason Dymbort	10-Q	001-33156	10/28/20	10.2

Exhibit Number	Exhibit Description	Incorporated by Reference			
		Form	File No.	Date of First Filing	Exhibit Number
10.18+	Employment Agreement, Change In Control Severance Agreement, Confidentiality and Intellectual Property Agreement, and Non-Competition and Non-Solicitation Agreement, effective as of August 10, 2020 between First Solar, Inc. and Markus Gloeckler	10-Q	001-33156	10/28/20	10.3
10.19+	Employment Agreement, First Amendment to Employment Agreement, Change In Control Severance Agreement, Confidentiality and Intellectual Property Agreement, and Non-Competition and Non-Solicitation Agreement, effective as of August 10, 2020 between First Solar, Inc. and Michael Koralewski	10-Q	001-33156	10/28/20	10.4
10.20+	First Amendment to Employment Agreement, effective as of October 8, 2020 between First Solar, Inc. and Caroline Stockdale	10-Q	001-33156	10/28/20	10.5
10.21+	Employment Agreement, First Amendment to Employment Agreement, Change In Control Severance Agreement, Confidentiality and Intellectual Property Agreement, and Non-Competition and Non-Solicitation Agreement, effective as of August 10, 2020 between First Solar, Inc. and Kuntal Kumar Verma	10-Q	001-33156	10/28/20	10.6
10.22+	First Amendment to Employment Agreement, effective as of January 8, 2021 between First Solar, Inc. and Markus Gloeckler	10-K	001-33156	2/26/21	10.46
10.23+	Form of Performance Unit Award Agreement - Form Perf Unit-011	10-K	001-33156	2/26/21	10.47
10.24+	Form of Performance Unit Award Agreement - Form Perf Unit-012	10-K	001-33156	2/26/21	10.48
10.25+	Form of Grant Notice for 2021-2023 Executive Performance Equity Plan	10-Q	001-33156	7/30/21	10.1
10.26+	Form of Performance Unit Award Agreement - Form Perf Unit-013	10-K	001-33156	3/1/22	10.31
10.27+	Form of Performance Unit Award Agreement - Form Perf Unit-014	10-Q	001-33156	4/28/22	10.1
10.28+	Form of Grant Notice for 2022-2024 Executive Performance Equity Plan	10-Q	001-33156	4/28/22	10.6
10.29‡§	Business Purchase and Sale Agreement, dated May 12, 2022, among First Solar Japan GK, PAG Renewables Holding Pte. Ltd. and PAG Renewables FM Holding Pte. Ltd.	10-Q	001-33156	7/28/22	10.1
10.30‡§	First Amendment to Business Purchase and Sale Agreement, dated June 24, 2022, among First Solar Japan GK, PAG Renewables Holding Pte. Ltd. and PAG Renewables FM Holding Pte. Ltd.	10-Q	001-33156	7/28/22	10.2
10.31‡§	Membership Interests Purchase and Sale Agreement, dated May 12, 2022, among First Solar Japan GK, Kyoto Solar Plant L.P., Yatsubo Solar Plant L.P., Momura Solar Plant L.P., Iwaki Solar Plant L.P., Hita Solar Plant L.P., Shimo Onuki Solar Plant L.P., Orido Solar Plant L.P., Handa Solar Plant L.P. and Tochigi Solar Plant L.P.	10-Q	001-33156	7/28/22	10.3
10.32‡§	First Amendment to Membership Interests Purchase and Sale Agreement, dated June 24, 2022, among First Solar Japan GK, Kyoto Solar Plant L.P., Yatsubo Solar Plant L.P., Momura Solar Plant L.P., Iwaki Solar Plant L.P., Hita Solar Plant L.P., Shimo Onuki Solar Plant L.P., Orido Solar Plant L.P., Handa Solar Plant L.P. and Tochigi Solar Plant L.P.	10-Q	001-33156	7/28/22	10.4
10.33‡§	TK Interests Purchase and Sale Agreement, dated May 12, 2022, among TK Investco 7 Pte. Ltd., TK Investco 8 Pte. Ltd., TK Investco 10 Pte. Ltd., TK Investco 11 Pte. Ltd. and Gioia Investment Pte. Ltd.	10-Q	001-33156	7/28/22	10.5

Exhibit Number	Exhibit Description	Incorporated by Reference			
		Form	File No.	Date of First Filing	Exhibit Number
10.34‡§	First Amendment to TK Interests Purchase and Sale Agreement, dated June 24, 2022, among TK Investco 7 Pte. Ltd., TK Investco 8 Pte. Ltd., TK Investco 10 Pte. Ltd., TK Investco 11 Pte. Ltd. and Gioia Investment Pte. Ltd.	10-Q	001-33156	7/28/22	10.6
10.35‡§	Finance Agreement between FS India Solar Ventures Private Limited and United States International Development Finance Corporation dated July 27, 2022	10-Q	001-33156	7/28/22	10.7
10.36‡§	Guaranty Agreement, dated August 4, 2022, between First Solar, Inc. and United States International Development Finance Corporation	10-Q	001-33156	10/27/22	10.1
10.37+*	Form of Performance Unit Award Agreement - Form Perf Unit-015	—	—	—	—
10.38+*	Form of RSU Award Agreement	—	—	—	—
10.39+*	Form of Grant Notice for RSU Award Agreement	—	—	—	—
10.40+*	Form of Option Award Agreement	—	—	—	—
10.41+*	Form of Share Award Agreement	—	—	—	—
10.42+*	Form of Cash Incentive Award Agreement	—	—	—	—
10.43+*	Form of Performance Cash Incentive Award Agreement	—	—	—	—
21.1*	List of Subsidiaries of First Solar, Inc.	—	—	—	—
23.1*	Consent of Independent Registered Public Accounting Firm	—	—	—	—
31.1*	Certification of Chief Executive Officer pursuant to Rule 13a-14(a) and 15d-14(a), as amended	—	—	—	—
31.2*	Certification of Chief Financial Officer pursuant to Rule 13a-14(a) and 15d-14(a), as amended	—	—	—	—
32.1†	Certification of Chief Executive Officer and Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	—	—	—	—
101.INS*	XBRL Instance Document – the instance document does not appear in the Interactive Data file because its XBRL tags are embedded within the Inline XBRL document	—	—	—	—
101.SCH*	XBRL Taxonomy Extension Schema Document	—	—	—	—
101.CAL*	XBRL Taxonomy Extension Calculation Linkbase Document	—	—	—	—
101.DEF*	XBRL Taxonomy Extension Definition Linkbase Document	—	—	—	—
101.LAB*	XBRL Taxonomy Label Linkbase Document	—	—	—	—
101.PRE*	XBRL Taxonomy Extension Presentation Document	—	—	—	—
104*	Cover page formatted as Inline XBRL and contained in Exhibit 101	—	—	—	—

+ Management contract, compensatory plan, or arrangement.

‡ Portions of this exhibit have been redacted in compliance with Item 601(b)(10) of Regulation S-K.

§ Exhibits and schedules have been omitted pursuant to Item 601(a)(5) of Regulation S-K.

* Filed herewith.

† Furnished herewith. This exhibit shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934 or otherwise subject to the liabilities of that section, nor shall it be deemed incorporated by reference in any filing under the Securities Act of 1933 or the Securities Exchange Act of 1934, whether made before or after the date hereof and irrespective of any general incorporation language in any filings.

Item 16. ***Form 10-K Summary***

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

FIRST SOLAR, INC.

Date: February 28, 2023	By:	/s/ BYRON JEFFERS
	Name:	Byron Jeffers
	Title:	Chief Accounting Officer

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

Signature	Title	Date
/s/ MARK R. WIDMAR Mark R. Widmar	Chief Executive Officer and Director	February 28, 2023
/s/ ALEXANDER R. BRADLEY Alexander R. Bradley	Chief Financial Officer	February 28, 2023
/s/ MICHAEL J. AHEARN Michael J. Ahearn	Chairman of the Board of Directors	February 28, 2023
/s/ RICHARD D. CHAPMAN Richard D. Chapman	Director	February 28, 2023
/s/ ANITA MARANGOLY GEORGE Anita Marangoly George	Director	February 28, 2023
/s/ GEORGE A. HAMBRO George A. Hambro	Director	February 28, 2023
/s/ MOLLY E. JOSEPH Molly E. Joseph	Director	February 28, 2023
/s/ CRAIG KENNEDY Craig Kennedy	Director	February 28, 2023
/s/ LISA A. KRO Lisa A. Kro	Director	February 28, 2023
/s/ WILLIAM J. POST William J. Post	Director	February 28, 2023
/s/ PAUL H. STEBBINS Paul H. Stebbins	Director	February 28, 2023
/s/ MICHAEL SWEENEY Michael Sweeney	Director	February 28, 2023
/s/ NORMAN L. WRIGHT Norman L. Wright	Director	February 28, 2023

Corporate Information.

EXECUTIVE MANAGEMENT

Mark Widmar, Chief Executive Officer
Alex Bradley, Chief Financial Officer
Georges Antoun, Chief Commercial Officer
Michael Koralewski, Chief Supply Chain Officer
Kuntal Kumar Verma, Chief Manufacturing Officer
Pat Buehler, Chief Product Officer
Markus Gloeckler, Chief Technology Officer
Caroline Stockdale, Chief People and Communications Officer
Jason Dymbort, General Counsel & Secretary

BOARD OF DIRECTORS

Michael J. Ahearn, Chairman of the Board
Richard D. Chapman, Independent Director
Anita Marangoly George, Independent Director
George A. Hambro, Independent Director
Molly E. Joseph, Lead Independent Director
Craig Kennedy, Independent Director
Lisa A. Kro, Independent Director
William J. Post, Independent Director
Paul H. Stebbins, Independent Director
Michael Sweeney, Independent Director
Mark R. Widmar, Director and Chief Executive Officer
Norman L. Wright, Independent Director

CORPORATE HEADQUARTERS

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Tempe, AZ 85288
Telephone +1 602 414 9300
Facsimile +1 602 414 9400
info@firstsolar.com
www.firstsolar.com

INVESTOR RELATIONS

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Tempe, AZ 85288
investor@firstsolar.com

TRANSFER AGENT

Computershare Trust Company, N.A.
P.O. Box 505000
Louisville, KY 40233-5002
Stockholder Services:
+1 800 962 4284
www.computershare.com

STOCK LISTING

First Solar, Inc. common stock is traded on the Nasdaq Global Select Market, listed under FSLR.

INDEPENDENT AUDITORS

PricewaterhouseCoopers LLP

First Solar, the First Solar logo, and Leading the World's Sustainable Energy Future are trademarks of First Solar, Inc., registered in the U.S. and other countries. Series 7, Series 6, Series 6 *Plus*, CuRe, Series 6 CuRe, and the Series 6 CuRe logo are trademarks of First Solar, Inc.

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LEADING THE WORLD'S
SUSTAINABLE ENERGY FUTURE

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All financial numbers in this report are based on U.S. Generally Accepted Accounting Principles.

This letter contains statements other than statements of historical fact, which are subject to risks, uncertainties and other factors as described in the company's filings with the Securities and Exchange Commission. These forward-looking statements are qualified in their entirety by the cautionary statements and risk factors contained in the company's Annual Report on Form 10-K for the fiscal year ended December 31, 2022.