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First Solar Strategic Audit

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Executive Summary

First Solar is a photovoltaic solar module producer with a focus on advanced thin film semiconductors. Like many solar module manufacturers, they are constantly aiming to increase the capacity of their modules and the sustainability of their operations. While operating in the solar panel manufacturing industry at large, First Solar faces many external factors that impact both the industry as well as their business. Most notably, climate change, shifting patent regulations, and a reliance on governmental subsidies are among the most important external issues that impact First Solar. The power of buyers and increasing competitive rivalry in the industry requires companies to develop and improve at a rapid speed, something that First Solar's capabilities allow them to capitalize on.

Internally, their recent move towards vertical disintegration has allowed them to focus more heavily on the manufacturing and technology sectors of their business. That being said, they still compete in many stages of the value chain allowing them to create value by reducing time of production and increasing quality.

First Solar uses a differentiation strategy to find its competitive advantage in its industry, using cadmium telluride (CdTe) technology to separate its product from those of its competitors. Their CdTe technology is both valuable and rare in the industry, providing First Solar with the key pieces of a sustainable competitive advantage in the utility-scale market.

The two main products that First Solar offers are designed to target different segments, with the Series 7 Module targeting large, utility-scale projects and the Series 6 more applicable to smaller, distributed generation projects. The company's emphasis on using technology to improve its manufacturing process is a strength that has allowed it to provide solutions for developers in both of these markets while maintaining an efficient production process.

In comparison with their competitor Canadian Solar, First Solar further demonstrates their dominance. Solar firms have experienced drops in their stock price industry-wide as a result of decreased demand in the residential and corporate market segments due to high interest rates. The utility-scale market, however, is less susceptible to these changes because of the market's long lead times. This delayed First Solar's stock price decrease relative to competitors such as Canadian Solar, JinkoSolar, and Enphase, allowing First Solar to be up six percent on the year.

Their research and development, manufacturing facilities, and intellectual property are among the most vital resources that allow First Solar to thrive in the industry. Its focus on R&D spurred First Solar's recent acquisition of Evolar, a highly-skilled research company based in Sweden that possesses the human capital necessary to continue the development and improvement of its cutting-edge CdTe technology. Evolar's know-how combined with First Solar's scale and resources will provide plenty of opportunity for First Solar's differentiation strategy.

Recently, First Solar made the decision to expand their manufacturing footprint in the U.S. This year, they broke ground on a facility in Louisiana; a decision that utilizes many aspects of their competitive advantage and further emphasizes their focus on manufacturing specifically. Overall, First Solar has set themselves up for continued growth in the coming years. Their competencies and decisions have allowed them to dominate in the industry thus far and, with the right strategic choices they will likely continue to thrive as the need for solar energy grows.

History

In 1984, inventor, scientist, and entrepreneur Harold McMaster started Glasstech Solar to develop cost-effective solar panels made of silicon. However, the endeavor was unsuccessful, and he decided to pay back the investors in Glasstech Solar and begin anew. So, in 1990, he raised $15 million to start Solar Cells, Inc. in Toledo, Ohio and shifted his focus to cadmium telluride (CdTe) because he viewed it as a better alternative to silicon. Within a few years, Solar Cells was the clear industry leader in thin-film photovoltaic technology (Welles, 1998). After nearly a decade of progressing the technology, True North Partners, a venture capital and private equity firm, purchased Solar Cells, Inc. in 1999 and rebranded it as First Solar, Inc.

Harold McMaster would leave the firm with the sale to focus on other projects, but the groundwork he laid would carry the new company into the twenty-first century. It continued to expand and began increasing production levels, and the company went public in 2006 at an IPO price of $24 per share. In 2009, the company hit the long-sought-after goal of getting manufacturing costs down to $1 per watt, becoming the first company in the world to do so. That same year, they surpassed an energy power production of 1 gigawatt (GW) and were the largest producer of PV cells in the world. At the end of 2011, it recognized its reliance on subsidies and incentives for solar, so it shifted its focus toward providing utility-scale PV systems in markets that could stand on their own. This decision moved it away from the rooftop market segment and into competition with conventional utility-scale power generators.

The company was forced to downsize in 2012 due to changing market dynamics, and they stopped operating in Germany for a time and cut significant production in their Malaysian factory as well. This led to a 30 percent reduction in First Solar's workforce, but they have steadily grown since in both workforce and capacity as they hit 9.1 GW in annual capacity in 2022 (Annual Report, 2022). Mark Widmar took over as CEO from James Hughes in 2016 and remains in that role today. He has made some key changes since taking over, arguably the most important of which has been simplifying the business model. Throughout the 2010s, First Solar expanded operations to include developing, constructing, financing, and operating solar power plants. However, over the last two years, Widmar has simplified the approach, and they are back to focusing on developing leading technology and manufacturing solar modules.

Industry

First Solar competes in the United States Solar Panel Manufacturing Industry. Their Industry Classification Code is NAICS 33441C.

Principle Business Model

First Solar is an American Solar Technology Company and a global provider of photovoltaic (PV) solar energy solutions. First Solar manufactures and sells PV solar modules with an advanced thin film semiconductor that allows for a higher performance, lower carbon alternative to traditional solar modules. First Solar is the world's largest thin film PV solar module manufacturer as well as the largest PV solar module manufacturer in the Western Hemisphere.

First Solar is largely focused on research and development (R&D) through their labs in California and Ohio. Throughout the entirety of their business model, First Solar puts an emphasis on economically sustainable practices.

Mission, Vision Statement, & Ethics

First Solar's Vision is to lead the world's sustainable energy future and their sustainability mission is to lead by example and empower the next generation. Along with their vision, First Solar has a Code of Business Conduct and Ethics. Within the Code of Business Conduct and Ethics, First Solar specifies a set of values, principles, and business practices that employees are expected to follow. Within this document, there are various subsections that range from rules and policies to behavior in and out of the workplace. First Solar's vision statement is consistent with their business model through their focus on research and development which will lead them to be an example in the sustainability field.

Top Management

First Solar's CEO is Mark Widmar who has previously served as CFO and CAO. Before joining First Solar, he worked for a carbon and graphite manufacturer and various tech manufacturing companies. His experience in the manufacturing and tech industries give him a knowledgeable background on First Solar's industry. Alex Bradley, the CFO, has previously served as VP of treasury and project finance. Before First Solar, he was an officer and board member of 8point3 and worked at HSBC. 8point3 is a partnership that owns, operates, and acquires solar energy projects. George Antoun, the CCO, was President US and a venture partner at TCV. TCV is a great previous experience for George due to their involvement in tech companies. Michael Kotalewski, the CMOO, has held various other roles at First Solar and previously worked at Dana Incorporated. Kuntal Kumar Verma, the CMO, was previously the CMEO and has held various other roles within First Solar. Prior to First Solar, he worked in engineering at Reliance Industries Limited India. Verma is a Master Black Belt in Six Sigma. Pat Buehler, the CPO, was previously the Chief Quality and Reliability Officer and also used to work at DuPont De Moneurs. Markus Goleckler, the CTO, used to be co-chief technology officer. Caroline Stockdale, the CPCO, served as CEO for First Perform and CHRO for Medtraunic and Warner Music Group. Jason Dymbort, the general counsel and secretary, was previously the general counsel and secretary for 8point3 as well as the corporate attorney for Chrvath, Swaine, & Moore LLP.

Overall, the top management team at First Solar has extensive background knowledge and prior experiences that make them qualified to lead First Solar in their future endeavors.

Major Goals

First Solar has several major goals they are working towards at this time. In 2023, First Solar's major production goal is to add 6.2 GW of global nameplate manufacturing capacity, which will

give them 16 GW of annual nameplate capacity by year end (Annual Report). Nameplate capacity is the theoretical full-load output registered with authorities for the purposes of classifying a unit. In regard to sustainability, First Solar's goal is to minimize the environmental impacts and enhance the social and economic benefits of products and projects across their life. Looking at long-term goals, the company hopes to further investments in manufacturing capacity, both greenfield expansion and optimization of output.

External Environment

The external environment segments that are most likely to impact our firm in the next five years are the physical and ecological environment and the political and legal environment. The physical/ecological environment provides a vast array of opportunities. As climate change progresses, the market for more sustainable energy alternatives will continue to grow. This includes factors such as global warming, increased extreme weather, the destruction of natural environments and water pollution. As these conditions get worse, First Solar will likely find itself in the position to capitalize on its sustainable business practices and mission to appeal to a higher number of consumers. On the other hand, the political and legal environment is full of threats to which First Solar needs to pay careful attention. Many of these factors are embedded in the employment sector of the market. There is a shift in classification of some workers to unionized laborers, which can lead to increased labor costs for companies. Also in this sector are threats from governmental changes. There are increasingly looser regulations on patents and intellectual property. First Solar has unique technology that puts them at the top of their industry in the U.S. If more companies are able to get ahold of their patents it may lead to serious issues for the company. First Solar views the general and industry environment as full of opportunities, while still recognizing the underlying threats. This is evident in a statement by their CEO, Mark Widmar, where he addresses the Inflation Reduction Act (IRA) of 2022, an important act for solar companies around the U.S. He states that this act "is a comprehensive foundation that enables the U.S. solar industry as a whole" and that the administration enacting the law "effectively entrusted our industry with the responsibility of enabling America's clean energy future", showing that he has an optimistic outlook on the environment of the solar industry as a whole (Widmar, 2022).

Total Value Potential

The US solar panel manufacturing industry grew 18.1 percent annually the last five years, 10.2 percent of which came in 2023 alone. This equates to an industry revenue of $9.3B in 2023. This was a result of protective trade policies placing tariffs on the imports of solar panels. Additionally, high energy prices in recent years have created a greater demand for alternative energy sources. However, that growth is expected to slow to 1.1 percent over the next five years, resulting in $10.2B in annual revenue. The slow in growth is mostly due to the expected decrease in price of natural gas and steamed coal. (IBIS World Report)

The Five Forces Model

Porter's Five Forces apply in various ways for the solar manufacturing industry, with some of the forces having a positive impact on the industry and others posing potential threats. One of the forces that provides a benefit to First Solar and the industry as a whole is the threat of new entry. Solar manufacturing is an industry that requires enormous up-front costs to run efficiently. There are incredible capital requirements to get a solar manufacturing company to be ready for market - including factories, equipment, materials, and labor. In addition to the startup costs, the market is already full of fully functioning solar manufacturing companies that will be able to produce far more efficiently than a startup ever could, likely undercutting their prices to maintain their market shares. Because of the extreme risks to a new solar manufacturing company, the threat of new entrants is not something that is putting stress on the solar manufacturing industry at the moment.

The threat of substitutes is mostly negative for solar, as there are many other widely used forms of energy in the US. The substitutes for solar are other forms of clean energy (e.g. wind, geothermal, and nuclear) and conventional energy that uses fossil fuels. The conventional energy sector is still a Goliath, and it is able to provide energy at competitive prices. It is still very widely used across the United States, with 79 percent of the nation's energy coming from conventional energy sources. Within the renewable energy sector, solar ranks third in usage, behind wind and biomass (University of Michigan, 2022). There are many substitutes to solar, and this is an issue that the industry must work to overcome.

The power of suppliers in the solar manufacturing industry is a tricky situation for most companies in the industry, as China is the main supplier for basically the entire industry, producing 75 to 90 percent of all the materials needed for solar manufacturing (IEA, 2022). For American solar manufacturing companies, this could potentially pose a threat, as US trade relations with China have been strained for years and do not look to be improving. Recently the US imposed a tariff on any solar materials coming from Southeast Asia to reduce the reliance on Chinese materials in the industry. Policies like these can make it difficult for these companies to consistently budget their costs and generate above-average returns for the long-term.

The power of buyers in the solar manufacturing industry is an area where the industry is getting some help from the US government, who is offering tax credits and subsidies to people who buy solar panels. This outside incentive that costs the manufacturing companies nothing offers another reason for businesses and households to consider buying solar panels. Since the residential home is rarely a direct customer of the manufacturers, the intermediate demand is driven by the final demand, so these incentives for households still drive demand for the manufacturers.

Finally, the intensity of competitive rivalry within the industry is high and getting higher, despite increasing barriers to entry. There are currently 20 firms in the solar manufacturing industry in the United States, and many of them are of similar size according to IBISWorld (2023). While the barriers to entry are high, there is support from the government for more solar production, and the industry is still growing fast. The incentives for buyers is strong enough to entice some new participants to join the market. There is not very high concentration in the industry, which means the competitive rivalry is high and companies are competing for each other's market shares at all times. In addition to these industry factors, incumbent firms are highly committed to

the business and fixed costs are high which leads to major exit barriers and increased competition among the existing firms.

Degree of Concentration

The degree of concentration in the solar manufacturing industry is low. The top four firms in the industry makeup 20.9 percent of the market share, according to IBISWorld. This is well below average in the renewable energy manufacturing sector. This low degree of concentration implies a high degree of competition and low risk of monopolistic practices within the industry. This could be a reason that we are still seeing high degrees of competition despite high barriers to entry. It is not an industry where firms have the ability to quickly squash any smaller companies, because they have to compete with all the other companies as well. This tends to be good for the consumer and drive high growth for extended periods.

Resources & Capabilities

Tangible Resources

Tangible resources are assets with physical substance that can be put to use within an organization to create value for a company. First Solar has done an excellent job of building up its resource base and using it to maintain market share in a fast-moving industry. These include physical, financial, and human resources.

1. Physical Resources

The firm's physical resources include the manufacturing plants, R&D facilities, and solar modules themselves. The company currently has two operational manufacturing plants, one R&D facility, and one location that does both manufacturing and R&D. On top of this, they have three manufacturing plants under development. Using these resources, they have the ability to vertically integrate from the research stage all the way to the application of the product.

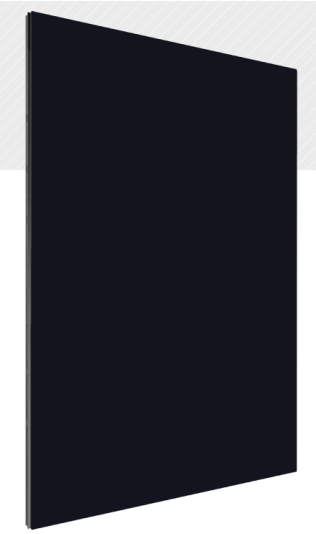
Table 1 - Facility Breakdown

Type	Location	Status
Manufacturing and R&D	Ohio, U.S.	Operational
R&D facility	California, U.S.	Operational
Manufacturing plant	Kedah, Malaysia	Operational
Manufacturing plant	Ho Chi Minh City, Vietnam	Operational
Manufacturing plant	Tamil, India	Under construction (late 2023)
Manufacturing plant	Alabama, U.S.	Under construction (late 2024)

Manufacturing plant	Louisiana, U.S.	Under construction (early 2026)

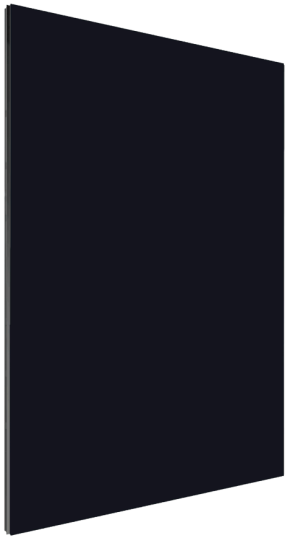
First Solar also has four current photovoltaic modules in inventory. These include the Series 6, Series 6 Plus, Series 7 TR1 (USA market), and Series 7 FT1 (India market) thin-film CdTe modules. The firm currently has over $56 million worth of accrued inventory.

Figure A - Series 6



430-460 watts, 18.6% eff.

Figure B - Series 6 Plus



455-480 watts, 19% eff.

Figure C - Series 7 TR1/FT1

505-540 watts, 19.3% eff.

(First Solar Datasheets, 2023)

2. Financial Resources

First Solar is in a good financial position and has had a strong balance sheet for years. This is showcased in multiple places throughout the financial statements, the first of which is their cash balance of $830 million in June of 2023 (Form 10-Q, 2023). They also have a current ratio of 3.35 and a quick ratio of 2.34, which shows they can easily cover their expenses even with short-term declines in revenue. Lastly, although they had a slight decline in 2022, the first six months of 2023 have seen a gross profit of $422.5 million, which is a 31 percent gross profit margin. These numbers all point to a healthy firm with strong financial resources to draw upon.

3. Human Resources

The human resources at First Solar is a vital resource that includes all of the employees, from factory line workers to the top executives. These executives can be seen in the Top Management section above. However, it goes far beyond the executive board, and in total, the company has 5,500 full and part-time employees. The vast majority of them are in the modules production business and work in the United States, Malaysia, and Vietnam (Annual Report, 2022). The company's success depends heavily on its ability to attract and retain top talent at all levels of its business, and so far, it has shown tremendous ability to do so.

Intangible Resources

By far, the most influential intangible resource for First Solar is their intellectual property, which they work hard to develop and protect. They rely on patents, trademarks, trade secrets, and confidentiality agreements to safeguard their intellectual property. The goal of this is to protect their proprietary technology and conduct business without infringing on the proprietary rights of others. To protect R&D activities they regularly file patents in the United States and other countries. In order to safeguard proprietary know-how that can't be patented they rely on trade secret protection and confidentiality agreements with third parties. First Solar's success relies heavily on its ability to develop and maintain proprietary technology and processes in the hopes of staying ahead of its competitors.

Capabilities

First Solar has a unique set of organizational capabilities that include project development, engineering procurement and construction services, and project finance. But as mentioned above, they have begun ignoring these fringe skills in order to focus on their main capability, which is developing and manufacturing solar modules. They are approaching the next chapter of the firm's journey with a "less is more" mentality. Nevertheless, these skill sets will continue to help them as other competitors don't have the same level of knowledge on their customers because they haven't been directly in the space. The manufacturing skill set begins with their ability to research and develop new technologies that allow them to continually design the next generation of solar PV modules. This includes their ability to manufacture and dispose of solar panels in a more sustainable way than their competitors. They have also built out the physical manufacturing capabilities themselves through highly skilled labor and their facilities. Finally, they have strong sales skills and have developed a reliable pipeline of bookings going out to 2029.

VRIO Framework

Many consumers in the industry place emphasis on the sustainability of their products. Many solar panel producers undercut the environmental benefits of solar energy by using large amounts of water, coal, and carbon to produce and transport their product. First Solar's cadmium telluride technology is more sustainable to produce than traditional crystalline silicon panels. Because of this, First Solar is able to create more value for the inherently environmentally conscious consumers in the solar panel industry.

First Solar's thin-film CdTe is rare in the industry. These panels provide a unique set of advantages that are not common with their competitors. In addition to a more environmentally sustainable manufacturing process, CdTe panels typically perform better in low-light environments. Also, First Solar has a higher degree of vertical integration than their competitors, which also provides unique advantages to their customers, including cost control and quality assurance. This comes from their heavy investment in their physical manufacturing plants. These advantages are not common in the industry.

The CdTe technology is rare in the industry; however, it is not impossible to imitate. Other companies could develop their own thin-film technology; however, it would be costly to do so. First Solar has hundreds of patents preventing competitors from replicating their intellectual

property. In order for firms to release a product that replicates the advantage of the CdTe models, they would have to invest extensively into their R&D to create a product without violating First Solar's patents.

First Solar has placed a huge emphasis on research and development. This gives them the capability to extract value in a rapidly developing solar industry. This can be seen in the development of their CdTe models. When first released, they were not as efficient as traditional models once in use, but that gap has closed thanks to their organization.

The rarity of First Solar's CdTe panels, manufacturing capabilities, and protected R&D provides First Solar with a competitive advantage. These are ways that they differentiate themselves from competitors and create value for consumers. This is how they have managed to gain significant market share in a growing industry.

Core Competencies

The first and most influential core competency that First Solar possesses is its manufacturing innovation. Innovation has been a staple of the company since its inception and is arguably the single greatest factor in the firm's success. This can be seen by their strong focus on R&D and ability to consistently develop new technologies and improve existing ones. Not only has the firm improved the products themselves, but they have also improved the manufacturing processes to increase scale and efficiency. By doing this, First Solar has reliably delivered superior modules to its customers and made a reasonable profit doing so. Evidence of this manufacturing innovation can be seen in 2009 when they became the first in the world to get production costs below $1 per watt and produced 1 GW worth of PV cells. Management has made it clear that they want to continue relying on this core competency to sustain competitive advantage as they move forward. The best example of this is the pivot away from multiple legacy business units to focus on manufacturing technologies and building the newest solar panel manufacturing plants across the globe.

The next core competency of First Solar is its focus on and ability to sustainably manufacture and recycle solar modules. They now call it "Responsible Solar" and it means they take pride in setting the bar for eco-efficiency and being socially responsible solar manufacturers. Although, this has been a focus of theirs for decades, beginning with a first of its kind recycling program in 2003, it has steadily developed into a core strength over the past few years. First Solar's management likely accelerated this as companies became more socially aware and focused more intently on sustainability goals. Not to mention, the connection of other Chinese manufacturers to forced labor and other poor practices in the sourcing and manufacturing of solar panels. Today First Solar markets this advantage over their competition very heavily and it has lead to high growth with developers and commercial users in the U.S. and other key countries.

The final and lesser (though still important) competency of the firm is its ability to sell long-term supply contracts for its solar modules. In an industry that moves very quickly and is by nature cyclical, having predictable revenue for years into the future is a significant advantage. At the end of 2022 the company had a backlog of bookings for 61.4 GW extending into 2029 and representing future revenue of $17.7 billion (Annual Report, 2022). This expected future revenue

allows them to make costly long-term investments that many competitors cannot without risking sinking the entire ship in a downturn. The certainty of demand, and strong customer base that results from this ability to sell long-term contracts results in high growth and consistency into the future.

SWOT Analysis

First Solar has many strengths as a company that have allowed them to gain a significant market share in their U.S. industry. The first and most prevalent strength is the ability for the company to incorporate technology improvements into their manufacturing process. When looking at this company, it is easy to see that technology and manufacturing are at the forefront of their business strategy. Within both of these sectors there are various strengths that propel the business. In the manufacturing sector, First Solar uses suppliers that can provide materials near their locations. This allows for cost and time reductions that can be vital when trying to continue to hold such a high market share. Additionally, First Solar has been working endlessly to improve the wattage of their solar modules. For technology, they have executed high level solar modules while focusing on cost reduction. First Solar has been using this technology to continue expanding their already prevalent global footprint. This, combined with their strength on executing long-term strategic plans, sets them up to continue separating themself in the industry.

First Solar's most obvious weakness comes in relation to their buyers. Intersect Power, Lightsource BP and NextEra Energy each accounted for more than 10 percent of the module's business net sales. With their top three customers taking up more than 30 percent of their sales, First Solar is extremely dependent on their customers. If one of these customers decides to jump ship and buy from one of their competitors, this puts First Solar in an extremely unfortunate situation. The company has similar issues on the other side of their supply chain as several of their materials, components and equipment are sourced from either one or a limited number of suppliers. This makes First Solar dependent on the decisions, prices, and timing of these suppliers. Finally, First Solar, being an energy company, works with many hazardous materials. With the use of these materials comes the potential for accidents which could lead to high clean up costs and public relations issues.

As a company operating in a growing industry, First Solar has many opportunities on which they can capitalize. The first opportunity is one that they have been working endlessly to capture which is that the public has an increasing focus on sustainability and environmental factors. Some studies have found that as many as 78 percent of US consumers care about a sustainable lifestyle, which has a lot to do with sustainable purchasing (Am, et al. 2023). Although First Solar targets companies more than individuals, the same holds true. They have many opportunities, including grants, for their sustainable ethical practices. This also comes with an increasing market for renewable energy, another important opportunity that greatly benefits First Solar. Looking at the government perspective, the U.S. government plans to place duties on certain solar products from China and four other countries in June 2024 (U.S. Department of Commerce, 2023). First Solar's biggest market is the U.S. so these duties will provide them more opportunity to expand throughout the country. Additionally, the passage of legislation intended to encourage renewable energy investments through tax credits, such as the Inflation Reduction Act, will be vital to First Solar competing with companies in other energy industries. Finally,

with an increase in utility-owned generation, there is an expanded number of potential buyers for First Solar's modules.

First Solar faces threats from the governmental sector including the potential reduction or elimination of government subsidies and incentives. Many of these incentives are providing them with great benefits right now and if taken away would require them to rethink many aspects of the business they are currently doing from a monetary standpoint. Additionally, in the global markets there are risks of structural imbalances between the supply and demand for photovoltaic solar modules as well as the threat of tariffs or other trade remedies which would restrict First Solar's ability to sell their modules internationally. First Solar also faces intense competition from manufacturers of crystalline silicon solar modules and global supply chain issues, as many other companies are.

SWOT Insight

First Solar has demonstrated an exceptional ability to effectively integrate new technology into their manufacturing process. As public focus on sustainable energy continues to increase, demand will grow. First Solar's technological capabilities will allow them to expand their manufacturing capacity to capture new market share.

First Solar currently benefits from U.S. trade policies that place tariffs on Chinese imports of solar panels, preventing "dumping" into US markets. However, the policies may not last forever. The possibility of the removal or revision of these policies could allow for more international firms to enter the market and threaten First Solar's market share. However, First Solar's use of CdTe lessens this threat. Many of the competing firms use traditional crystalline silicon models that are less sustainable to create. First Solar's ability to evolve their products to create differentiation in the market could allow the company to resist international pressure.

Due to the Inflation Reduction Act of 2022, there are opportunities for First Solar to obtain tax credits for investing in sustainable energy. Solar panel manufacturing is a capital intensive industry, so First Solar needs a large amount of liquidity in order to take advantage of this opportunity. However, First Solar's sales are highly concentrated with their top three customers. If First Solar were to lose one of these customers, they could almost immediately face liquidity issues, preventing them from being able to make investments worthy of obtaining the tax credit. First Solar could overcome this, though, by setting high internal working capital requirements to prevent any liquidity issues.

First Solar's inputs come from a relatively small number of suppliers. This may make First Solar especially susceptible to the ongoing global supply chain issues, limiting First Solar's production capacity. In order to limit this threat, First Solar could diversify their suppliers. That way, if one of their suppliers experiences a supply chain stoppage, First Solar would still be able to operate close to full capacity.

Performance

The firm was careful to be relatively broad and not set any strict expectations for 2023 in its annual report or any other statements to the public. However, they did mention multiple times in the 2022 Annual Report that they expected 2022 to be a year of transition in order to set the stage for growth and profitability in 2023 and beyond. It is safe to say that they are off to a good start in achieving this goal through the first half of 2023. To fully understand the climate of today, it is important to look at their performance last year, which they termed a "transition year" (Annual Report, 2022). Some key metrics to draw attention to are the net sales of $2.6 billion and gross profit of 2.7 percent, which was a 10 percent and 22.3 percent reduction from 2021, respectively. First Solar also produced 9.1 GW of solar modules throughout their various facilities in 2022.

Given their goals, we would like to see all of these metrics trending up through the first half of the year. To analyze this, we have chosen to primarily use the First Solar Form 10-Q published on July 21, 2023. The first metric, net sales, has seen a large jump in the first six months of 2023 compared to the same time period in 2022, going from $988 million to $1.35 billion. The increase in net sales was driven largely by a significant increase in the volume of modules sold to third parties, along with an increase in average selling price per watt. After a significant drop in gross profit last year, that number has rebounded to 38.3 percent over the last three months, which is 42 percentage points higher than the same period in 2022. They are also on track to produce a record 12 GW worth of solar modules this year, which is on the high end of their estimation from last year. The significant growth in net sales, gross profit, and manufacturing capacity show that the firm is performing incredibly well. The success has been fueled by a number of factors, arguably the most critical of which is the increase in government incentives and subsidies. These primarily include the 45X production credit added through the IRA in August of last year and the expansion of the PLI scheme in India, both of which promote domestic solar manufacturing. Other factors include the removal of residual business units, increases in manufacturing capacity and utilization, and increased demand from third parties. (Form 10-Q, 2023)

Firm Focus & Key Performance Indicators

First Solar is heavily focused on financial metrics in evaluating their performance in terms of growth and in comparison to their competition. In First Solar's most recent quarterly report, CEO Mark Widmar stated, "with half of 2023 behind us, we continue to see strengthened commercial, operational, and financial foundations, both in 2023 and in the coming years as we continue to grow" (First Solar, 2023). Financials are crucial to First Solar's ability to invest in research and development, technological innovations, and their expansion. To date, First Solar has invested over $1.5 billion in their research and development efforts, $370 million of which has been allocated to a new research and development center in Ohio (First Solar Breaks Ground, 2023). Along with that, First Solar has devoted $4.1 billion to manufacturing to in turn expand nameplate capacity from 6 GW of global nameplate capacity to 13 GW of global nameplate capacity between 2020 to 2023 (First Solar Inc.).

Important Key Performance Indicators (KPIs) in the solar manufacturing industry include interest coverage, percentage change in sales, cash after operations as a percentage of sales (IBIS World Report), and Manufacturing Capacity Utilization (PVTech):

Table 2 - Key Performance Indicators

Key Performance Indicators		
KPI	**First Solar**	**Industry**
Interest Coverage	44.7	262.7
Change in Sales Percentage	(10.1)%	(3)%
Cash After Operations as a Percentage of Sales	8.1%	22.7
Manufacturing Capacity Utilization	97%	40%

Based on these typical KPIs, First Solar is underperforming despite having a large market share. It is important to note however, that these KPIs are being negatively influenced by the 2022 year of transition and will likely revert by the end of 2023.

Competitive Advantage

One of the best and most encompassing measures of competitive advantage is profit margin. A firm with a better profit margin than its competitors has often figured out how to get the most return for their investments and run the most efficiently. Out of six of the largest solar manufacturing firms in the world, First Solar scored in the top half in profit margin three out of four times since 2020 (up to 2023 year-to-date), but scored last in 2022. As previously stated, 2022 was a transition year for First Solar (profit margin: 2.67 percent compared to the average of 14.7 percent), so this drop in margin was in line with their vision. 2023 has appeared to be a bounce-back year so far for the firm, with a profit margin of nearly 17 percent to this point.

First Solar invests heavily into R&D, as stated earlier. This heavy emphasis is a driver of its competitive advantage and is a key piece to the valuable and rare CdTe product that First Solar produces. As a result, even in years of lower profit margin, First Solar is investing in its competitive advantage and expects to continue to see their differentiated product capture more market share in the future. For example, it broke ground on a new $1.1B manufacturing facility in Louisiana in late September of this year. According to Yahoo Finance, this facility will have a manufacturing capacity of 3.5 gigawatts when it is completed. Increasing capacity at this speed will give First Solar more flexibility to keep up with its competitors in the future. Relying on its core competencies will allow First Solar to increase profit margin and sustain its competitive advantage.

Compensation

First Solar's compensation plan is heavily performance-based. It is made up of three components (base salary, cash incentive compensation, and equity-based compensation), two of which are performance-based metrics. Cash incentive compensation is used to incentivize activities that are in alignment with the firm's strategic plan in the short-term. It is made up primarily from their Annual Bonus Program which encourages short-term objectives to help the firm achieve its mission. The firm's compensation committee selects performance metrics that will be tracked to determine cash incentive compensation. The metrics in the 2022 bonus plan included a minimum adjusted EBITDA of $200 million (which had to be achieved for any bonus payout), gender representation and safety metrics (35 percent of the plan), various wattage requirements (40 percent of the plan), and net bookings (25 percent of the plan).

The target bonus percentages for this area of compensation vary based on job responsibilities, internal pay equity, and peer group data, and are different for each person on the executive team. Equity-based compensation is used to align the interests of the executive team with the firm's other stockholders. First Solar grants a combination of 60 percent Restricted Stock Units (RSU) and 40 percent Performance Units (PU) to address retention concerns and give varying vesting schedules. These amounts also vary per executive.

For example, in 2022 Mark Widmar (CEO) had a base salary of $922,222, 125 percent target bonus percentage, $4,549,997 in grant date fair value for RSUs and PUs combined, and $12,200 in all other compensation for a total of $7,207,833. With his base salary in 2021 being $900,309, this means that only 12.49 percent of his compensation from the prior year was guaranteed. Caroline Stockdale (CPCO) had a base salary of $430,001, 80 percent target bonus percentage, $750,050 in grant date fair value for RSUs and PUs combined, and $12,200 in all other compensation for a total of $1,673,851. Her base salary in 2021 was $430,001, meaning that 25.69 percent of her prior year compensation was guaranteed. The compensation system design for First Solar does seem to be consistent with their overall firm-level performance expectations. With such a high percentage of the executive team's compensation being dependent on specific performance objectives, the company is likely to incentivize the right behaviors and align their employees' objectives with the overall company objectives and strategic goals. (DEF 14A, 2023)

Table 3 - Compensation Breakdown

Compensation Breakdown		
Employee	**Mark Widmar**	**Caroline Stockdale**
Base Salary	$922,222	$430,001
RSUs & PUs	$4,549,997	$750,050
Other Compensation	$12,200	$12,200
Total:	$7,207,833	$1,673,851

Comparison to Competitor - Canadian Solar

Mission & Vision

Canadian Solar's vision is to power the world with solar energy and create a better and cleaner Earth for future generations. Their mission is to lead the energy revolution and create a brighter future together. Their slogan is to "make a difference" and they base these goals on values of customer success, innovation, grit, and excellence. Canadian Solar is heavily focused on sustainability through their three pillars of environmental (emissions, waste, renewable energy), government (policies, due diligence, and risk management), and social (human rights and health and safety) (ESG Report, 2022).

Physical Resources

Canadian Solar has over 23 manufacturing facilities across Asia and the Americas. Along with that, they have a presence in all continents besides Australia. Canadian Solar directs large efforts towards their research and development. The R&D department focuses on cells, modules, and solar systems.

Financial Resources

Canadian Solar is in a good place with their financials. The trend of their financial status has been generally upward. Their gross profit in Q4 of 2022 was $349 million, which is up 16 percent from the previous year. Additionally, net revenues were up 29 percent year-over-year (Investor Relations, 2022).

Human Resources

Human resources are a vital source for Canadian Solar. Canadian Solar employs over 20,000 people with nearly 600 of these individuals working in research and development (About Us, 2023). Canadian Solar prides themselves on the diversity in their workplace. Ethnic minority groups represent 45 percent of employees in the United States, middle management positions are 26 percent female, and 0.7 percent of staff have disabilities (ESG Report, 2022). Their focus on treating employees fairly and adopting inclusive leadership practices help them gather and retain valuable individuals.

Intangible Resources

One of Canadian Solar's most valuable resources is their intellectual property. Within their organization, they spend significant amounts of time and money to develop and innovate new ideas. Because of this, it is important that their hard work is protected. These efforts have led them to obtaining 2,134 patents worldwide (About Us, 2023).

Overall, Canadian Solar and First Solar are relatively similar in the resources and capabilities that they possess. They are both focused on R&D as well as innovation to sustain a competitive advantage in the industry.

Product Markets

First Solar and Canadian Solar both operate in the broader solar energy industry. However, First Solar's PV technology prevents the modules from degrading at the same rate as normal crystalline silicon modules (First Solar, 2023). Because of this, First Solar has the largest presence in the utility-scale submarket. Canadian Solar manufactures modules and develops solar projects in the utility-scale market as well as the residential and commercial segments (About Us, 2023). They do compete in the same geographic markets. Both firm's primary markets are in North America and have expanded into Asia and Europe. Although First Solar has a larger presence in the utility-scale market currently, it is still a major business segment for Canadian Solar. Canadian Solar is investing more into that market segment by developing a complementary product: utility-scale battery storage (About Us, 2023). This investment signifies that Canadian Solar is aiming to be a major player in the utility-scale market across their current geographic regions. This makes Canadian Solar a direct competitor for First Solar.

Canadian Solar Compared to Industry Standards

Canadian Solar is a major player in the residential solar industry, with a 9 percent global market share (Ksir, 2023). With a market capitalization of $2.16 billion, it is on the smaller end of the global residential solar distributors, but still competes worldwide with a high level of integration. It brought in $7.03 billion in revenue in 2022, ranking second in solar companies behind JinkoSolar (Reiff, 2023). In addition to its high revenue, it retained $188.1 million in net income, which ranked second in the industry as well behind Enphase Energy. Its high levels of vertical integration help keep sourcing costs low, which provided it with a competitive advantage during the supply chain crises that followed the pandemic. More control over its supply helped keep costs down.

Factors for Outperformance

First Solar outperforms Canadian Solar in the solar panel manufacturing industry due to a variety of factors. First Solar has recently taken many steps to decrease its vertical integration and focus specifically on the manufacturing aspect of its value chain. It is clear that they realized where their competencies were and made the strategic decision to focus on the areas where they could maximize the value created from exploiting these competencies. This also led to a focus on one specific product, PV solar modules. Canadian Solar sells modules and inverters which requires them to focus energy, time, and money on both products. Additionally, First Solar aims to focus specifically on utility purchasers rather than businesses or homeowners. Because they are focused on a niche segment of the market, they are better able to design their product to fit the needs of these consumers. All of their research and development goes into creating the best possible product for utility consumers at the lowest price.

Canadian Solar manufactures their solar modules and inverters outside of the United States despite the U.S. being their most profitable market. This puts First Solar at an advantage as they manufacture and sell primarily in the United States. First Solar is subject to subsidies by the U.S. government and does not deal with as many regulations as a foreign firm such as Canadian Solar.

Solar panel manufacturing firms have seen a drastic decrease in stock price industry-wide, which is consistent with the 30 percent decline of Invesco Solar, a solar-based ETF. High interest rates have slashed demand in the residential and commercial market segments (Maguire, 2023). Canadian Solar has not been immune to this phenomenon, creating another disadvantage. While First Solar has been partially affected by interest rates, the utility-scale market has a much longer lead time, making the market less volatile and putting First Solar at an advantage.

Finally, as the power of buyers continues to increase in the solar module industry, First Solar has emerged with an advantage due to the "industry's best environmental profile with the lowest carbon and water footprint, and fastest energy payback" they boast (*Series 7*). Consumers who are concerned with renewable energy sources are likely to search for those that best meet their desires. First Solar's ability to prove that they are highly sustainable in an already sustainable industry sets them apart from competitors.

Strategic Actions in the Industry

Due to recent economic and political factors, First Solar's competitors have been looking to make aggressive strategic moves into the U.S. solar production market. In January of 2023, Hanwha Q Cells announced a strategic investment of $2.5 billion into the U.S. solar industry (Groom, 2023). This is the largest investment of its kind to date from any firm in the U.S. market. The goal of the investment is to expand its solar business in a multitude of ways. The investment will establish production lines for their core solar value chain in North America with the goal of an entirely domestic supply chain. It would begin with the production of raw poly-silicon, then turn ingots into wafers, wafers into cells, and finally cells into modules all within the U.S. If it can achieve this, it will be the first of its kind and likely something First Solar and others will try to replicate to maximize production and federal incentives.

In March of this year, LONGi Solar announced a joint venture with Invenergy to construct a 5 GW solar panel factory in Pataskala, Ohio, under a new company, Illuminate USA. LONGi is a Chinese-based panel manufacturer and is currently the world's top producer of PV by volume. Invenergy, on the other hand, is a U.S.-based solar and wind project developer. Prior to the announcement, LONGi had no manufacturing facilities outside of Asia, but the strategic partnership allows LONGi to enter the U.S. market in a strong position. The joint venture has invested $220 million to acquire and build out the 1.1 million-square-foot building in Pataskala, Ohio. They began construction of the buildout in April of this year and plan to commence initial operations in December 2023. Once fully operational, the 5 GW facility will be the largest solar plant in the U.S. (Crowell, 2023).

Both of the above strategic actions took place in 2023, and it will take years for their full effects to be felt, but regardless, they will likely be impactful on the rest of the industry. The critical influencing factors of these decisions are the passing of the IRA, including the 45X domestic production tax credit, and the sanctions put on solar modules from China. First Solar also influenced these decisions by increasing its U.S. manufacturing footprint with the announced Alabama and Louisiana plants set to come online in 2024 and 2026, respectively. This influence can be seen in LONGi's decision as they are building their facility in Ohio where First Solar has already established a strong labor pool. As of April 2023, First Solar was the largest U.S.

producer with 2.7 GW of manufacturing capacity, and Q Cells was second with 1.7 GW of capacity, not including each of their planned additions (Zientara, 2023). Although market share has not been impacted by these actions yet, it will as LONGi goes from no U.S. manufacturing capacity to competing and potentially leading the market. The next few years will be key in determining winners and losers of the U.S. solar panel manufacturing market as firms compete for resources and market share.

Differentiation

First Solar has differentiated its product from its competitors, which is a major contributor to its competitive advantage. The firm has done this in four critical ways. The first and most important source of differentiation is in the firm's advanced module technology. The vast majority of their competitors use crystalline silicon modules, but First Solar is one of the only firms using their thin-film PV modules with a cadmium telluride absorption layer. This product provides a unique set of advantages that project developers value, such as a slower degradation rate and better results in low-light environments. The next source of differentiation from the competition is First Solar's vertically integrated research and development process, from advanced technology research to manufacturing and applications. The firm devotes more resources to R&D than nearly all of its competitors and continually makes product and process innovations in an attempt to stay ahead of the competition. Finally, as mentioned earlier, First Solar uses its focus on sustainability to differentiate itself. The source of their sustainability runs from the integrated manufacturing process which reduces energy and material usage, to their commitment to end-of-life recycling.

First Solar chooses not to pursue a cost-leadership position in the market but still uses processes to reduce costs and keep profit high. The main factor preventing them from leading the market in cost is the expensive price of cadmium telluride relative to silicon. The price difference and the more expensive labor costs compared to manufacturers in China make it nearly impossible for the firm to pursue a cost leadership position. However, the firm's unique manufacturing process is a key advantage in reducing costs compared to competitors. The modules are manufactured in an automated environment that integrates the manufacturing steps into a high-throughput, continuous process. This method eliminates the resource-intensive batch processing that is used to produce competitors' crystalline silicon modules, which typically takes several days and multiple factories compared to the few hours it takes First Solar to complete a module. Using this method reduces costs, improves quality control, and helps meet stringent internal standards. First Solar also has the advantage of using only 2 to 3 percent of the amount of semiconductor material as crystalline silicon modules, leading to one of the lowest module costs per watt (Annual Report, 2022).

Approach to the Market

First Solar competes in the broad solar market, but uses differentiated products to target different segments. Its Series 7 Module is a highly differentiated, cutting-edge product available only to the utility-scale market. It further differentiates within this product by offering the Series 7 TR1

exclusively to U.S. companies, as well as the Series 7 FT1, which targets the India market. First Solar appeals to these customers by offering quick installation and crack warranty, as well as boasting the "industry's best 0.3% warranted annual degradation rate" (Investor Relations, 2022). This product is meant for large projects and developers who value maximum efficiency and performance above all.

The Series 6 Module targets an entirely different market - the distributed generation market, which refers to energy projects that generate from sources near the project as opposed to a power plant or an off-site source (SCEP, 2023). First Solar accesses this market through three main distributors - Graybar, Kinect Solar, and WESCO Distribution. The Series 6 is a less costly option designed to provide solar energy to a broader range of customers, including "community solar projects, C&I solutions, schools, and municipal/military applications" (Investor Relations, 2022). First Solar's appeal to these markets is still mostly focused on its differentiated product that provides superior performance over its lifetime, but it also does so at a more competitive price. Its decision to target two completely separate markets with two differentiated products underscores First Solar's product differentiation strategy that contributes to its competitive advantage.

Generic Business-Level Strategy

First Solar's generic business-level strategy is differentiation. First Solar focuses heavily on research and development to create high-quality, reliable, unique products for consumers. Being highly innovative allows them to create products that consumers place a high-value on. Due to the efforts placed on innovation, research, and development, First Solar is not a cost leader, but these efforts allow them to create a unique, differentiated product from other competitors. First Solar pursues differentiation by creating two unique products that target different segments of the market but still provide consumers with a high-quality product to meet the needs of these different consumers.

In their current competitive situation, differentiation is an appropriate strategy for First Solar because they are leading the utility sector of the industry in market share. This allows them to create value for their consumers by focusing resources on additional R&D and innovation. Since First Solar has to develop and innovate to keep their products from becoming obsolete, a strategy that capitalizes on that and allows them to charge a higher price is critical. Additionally, differentiation strategies in general create a "premium feel" around the product. This is important for First Solar as their consumers are looking for quality in selecting panels they are going to purchase in bulk. As First Solar continues to decrease their vertical integration and focus more exclusively on manufacturing, their differentiation strategy will allow them to create the best product and most value for their consumers.

Although differentiation is the most effective strategy for First Solar, it does leave them vulnerable in some capacities. Since many utility consumers are buying in bulk, they may be seeking products that come at a lower cost. If First Solar is not meticulous about providing features that create clear value, they are at risk of losing customers to cost-leadership firms. This is particularly alarming due to the power held by First Solar's buyers. If one company chooses to switch suppliers, First Solar will lose out on a massive amount of sales. Also, there is an industry

wide threat regarding the reduction or elimination of government subsidies and incentives. If this happens, companies may not have the resources to spend money on high quality products leaving them to opt for lower cost options, which First Solar does not provide. In order for their position as a differentiator to be secure, First Solar needs to have a strategy for maintaining customers and their competitive positioning if these subsidies are eliminated.

Industry Value Chain & Vertical Integration

The solar panel manufacturing industry has a value chain very similar to that of a traditional manufacturing industry with only slight adjustments to account for demand for firm intervention during and after the solar module's useful life. The value chain is as follows:

Stage 1 is the extraction of raw materials. According to the U.S. Department of Energy's Office of Energy Efficiency & Renewable Energy, this stage has two distinct branches for traditional silicon and CdTe models. For silicon modules, the most integral material is high-purity polysilicon. For CdTe module producers, like First Solar, the key materials include cadmium and tellurium.

Stage 2 is the production of components and intermediate goods. In this stage, firms producing traditional silicon modules produce ingots, which are solid pieces of silicon melted together, and silicon wafers to eventually make up their finished product. CdTe firms deposit thin layers of cadmium telluride onto glass (*Solar Value Chain*, 2016).

Stage 3 is final assembly manufacturing. In this phase, firms assemble the final solar module by combining all the individual components mentioned in stage 2 prior to distributing the finished modules to consumers.

Stage 4 is marketing and sales. Once the solar panels are manufactured, they are marketed and sold to various customers, including solar project developers, residential customers, and commercial entities. This stage involves distribution channels, branding, and customer outreach.

Stage 5 is project development and installation. For large-scale solar projects, this stage involves the development of solar farms or installations. Project developers plan, design, and install solar panel systems, connecting them to the electrical grid (*Solar Value Chain*, 2016).

Stage 6 is operation and maintenance. After installation, solar panel systems require ongoing operation and maintenance. This stage involves monitoring system performance, conducting repairs, and ensuring optimal efficiency over the system's lifecycle (*Solar Value Chain*, 2016).

Stage 7 is end-of-life management. Solar modules typically have a life expectancy of around 30 years. After this, solar panels need to either be transported to a landfill or, ideally, recycled. Recycling these units has become increasingly popular (*The Opportunities of Solar Panel Recycling*, 2019).

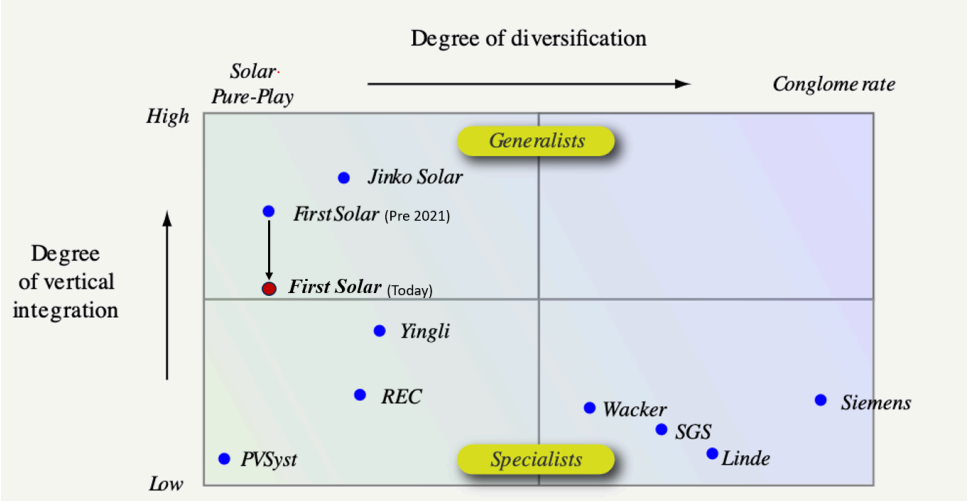
First Solar is a vertically integrated firm, but over the last two years, they have become less integrated in an attempt to refocus their efforts on developing and manufacturing modules. First Solar today competes in multiple stages of the value chain, including the production of

intermediate goods, assembly of final goods, sales, and end-of-life recycling. However, First Solar's focus is split far from evenly between each stage, with most going to the production of components and final assembly. In each manufacturing facility, the firm starts with raw materials and a sheet of glass to produce the necessary components, and within hours, they have combined the individual components and completed the final assembly of the module. By controlling both steps in the manufacturing process instead of just the final module assembly, like some of their competitors, they are able to create value by reducing the time required to complete a module and increasing the quality of the product. Next, the firm markets and sells the modules primarily to utility-scale project developers, often through long-term supply contracts. In line with their focus on sustainability, the last area of the value chain the firm focuses on is end-of-life management. Their recycling process recovers roughly 90 percent of the glass and semiconductor material for reuse in new glass container products and new modules (Annual Report, 2022). Many customers in the renewable energy space value sustainable practices and are willing to pay a premium for these end-of-life guarantees.

On top of this, First Solar dedicates an immense amount of time and resources to the supporting activity of research and development at each level of the value chain they participate in. This vertically integrated R&D model has helped First Solar improve every part of its value chain and stay ahead of the competition in terms of product and process. In the past, the firm also operated in project development and installation and in operations and maintenance. However, the firm's management felt this amount of vertical integration was destroying value instead of creating it due to decreasing solar project returns (Annual Report, 2022). The firm completes its manufacturing activities in every major market it operates in, including the U.S., Malaysia, Vietnam, and soon India. Going forward, they are making a noticeable effort to develop their U.S. manufacturing capabilities with two of the three planned manufacturing facilities under construction in the U.S. Having reduced their level of vertical integration, it is likely First Solar will continue to explore ways to increase value in the stages they already compete in.

The below figure demonstrates how First Solar's vertical integration has changed and how they now compare to some major competitors in the industry.

Figure D - Solar Players Degree of Integration



(*Solar Value Chain*, 2016)

Diversification

First Solar is a U.S.-based company that serves mostly U.S.-based developers, but it is attaining some level of geographic diversification. According to Statista, in 2022, 83.8 percent of First Solar's net sales were in the United States, with Chile, France, and Japan the next biggest buyers (Statista, 2022). The value of exposure to foreign markets is that it diversifies demand and can act as a hedge when one target market is exposed to tougher economic conditions, lowering aggregate demand. A firm is more likely to survive a recession in its home country when it has considerable business elsewhere. A 14.2 percent exposure to foreign markets is not negligible by any means and is likely to continue to grow as First Solar expands its operations and continues to scale its PV and CdTe technologies. However, for right now, the level of geographic diversification for First Solar is somewhat low as the firm continues to rely on the U.S. market for the majority of its business.

Mergers & Acquisitions

In May of 2023, First Solar announced that it was acquiring Evolar AB, a Swedish R&D firm specializing in PV technology. This acquisition was a clear effort by First Solar to accelerate its strategy of using PV solar panels with a CdTe layer to produce a highly differentiated product. Evolar was a leader in PV technology, providing expertise in the form of 30 R&D staff members who now work for First Solar from their facility in Sweden. By combining Evolar's knowledge and efficiency with First Solar's scale and resources, the acquisition will allow First Solar to scale its PV/CdTe products more efficiently and effectively.

The main goal of the acquisition was to bolster First Solar's R&D department, but the firm also accomplished a bit of geographic diversification on the supply side in the process, as it now has a European presence for the first time. Mark Widmar, CEO of First Solar, highlighted this aspect of the acquisition, saying, "In addition to significantly expanding our capacity for advanced research, we are pleased to extend our R&D footprint to Europe. By connecting our advanced research lab in California with Europe and building the Western Hemisphere's largest PV R&D innovation center in Ohio, we are effectively establishing and leading a uniquely transatlantic effort to develop and commercialize the next generation of photovoltaics" (First Solar). The effort is one piece of a long-term plan to establish First Solar as among the world's leaders in the future of solar energy through a deliberate and substantial investment in research and development of the most cutting-edge technology in the industry.

Stock Market Reaction to Acquisition of Evolar

When the news about the acquisition was announced on May 12, 2023, First Solar (ticker: FSLR) was one of the hottest stocks of the day, gaining nearly 26.5 percent by market close. Investors saw the move as a clear effort by the firm to continue its business-level strategy to beat competitors by offering the best, most valuable product on the market. Acquiring a world leader in PV research and development underscored this sentiment, and investors were impressed. However, the market has since walked back its enthusiasm about the project, as FSLR is down 42 percent since that day. Market volatility, especially as it pertains to the NASDAQ, on which FSLR is traded, may be partially to blame for the downturn, but it is clear that excitement over

the acquisition was short-lived. First Solar paid $38 million for 100 percent of Evolar, with another $42 million potentially to be paid if certain milestones are met. In First Solar's 10Q filed for the quarter ended September 30, 2023, it wrote that the fair value of this acquisition at the time was determined to be $18.5 million, but that a large portion of the deal would be accounted as an "in-process research and development…intangible asset." It accounted for $15 million of goodwill, a strong premium for a small company such as Evolar.

Results of Acquisition

It is too early to fully determine the success of this acquisition, as it was an R&D expansion that took place only seven months ago. The success of acquiring Evolar will be measured in the future by the success of First Solar's PV technology in tandem with CdTe. With the resources and expertise of Evolar under its umbrella, First Solar now has more capacity than ever before to continue to lead the globe in solar energy research and provide a highly differentiated product to its customers.

Board of Directors

First Solar's Board of Directors is made up of 12 members: the Chair of the Board, CEO, and 10 independent members. There is no CEO duality as Mark Widmar does not serve as the Board Chair, but he does serve as a director. Additionally, Molly E. Joseph serves as the Lead Independent Chair. She has held multiple roles at various companies and led many acquisitions and strategic transitions. Overall, First Solar's board is very diverse with experience ranging from directing a zoo to global investment groups to U.S. immigration. Across the board, there are members passionate about various topics including healthcare, agriculture, global policy, and much more. Some directors have served on the board for over 10 years, while others are new additions. By bringing together a group of individuals with unique experiences, interests, and insights, they have been able to create a highly diversified board to serve First Solar (Leadership, 2023).

Committees

Table 4 - Board of Director Committees

Director	**Audit**	**Compensation**	**Nominating & Governance**	**Technology**
Michael J Ahearn				X
Richard Chapman	X	X		
Anita George				X
George Hambro				Chair
Molly Joseph	X		X	

Craig Kennedy	X			
Lisa Kro	Chair			
William J. Post		X	X	X
Paul H. Stebbins	X	X	Chair	
Michael Sweeney		Chair	X	
Norman Wright		X	X	

The audit committee for First Solar consists of chair Lisa Kro, and members Richard Chapman, Molly Joseph, Craig Kennedy, and Paul Stebbins. Lisa was likely chosen as the chair of the audit committee due to having her CPA (inactive) as well as her previous experiences in accounting, finance, and leadership positions. Richard has previous experience as a CFO and is also a CPA (inactive). Molly provides value with her previous experience as an investment banker, in compensation and finance committee roles, and with a JD. Craig has previously been an audit committee chair and has an MBA. Lastly, Paul has founded and served on many committees that provide him with relevant experience.

The compensation committee consists of Chair, Michael Sweeney, and Members Richard Chapman, William Post, Paul Stebbins, and Norman Wright. Michael has previous experience in management and operating functions in several companies that make him qualified to be chair of the committee. Richard also currently serves on the board of directors for a diversified financial services company. William has served many director roles and has received many honors and awards, including an Honorary Doctorate.

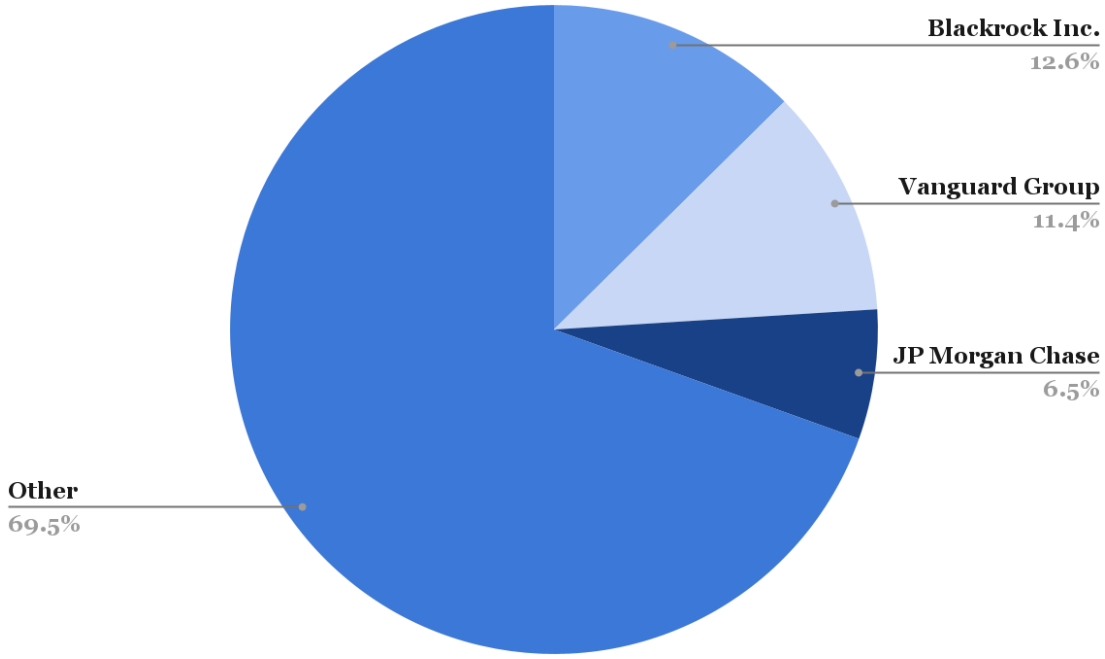
The nominating and governance committee consists of Chair, Paul Stebbins, and Members Molly Joseph, William Post, Michael Sweeney, and Norman Wright. Paul serves on many boards and in leadership positions throughout various companies. Molly, William, Michael, and Norman have also all held director, leadership, and executive roles that make them qualified to serve on the nominating and governance committee to set First Solar up for future success.

The technology committee consists of Chair George Hambro, and Members Michael Ahearn, Anita George, and William Post. George has previously served as COO for First Solar. Prior to First Solar, he has also held vice presidencies of Engineering & Development and Operations for IT Industries. These prior experiences make him qualified for his role as chair of the technology committee. Michael Ahearn holds a B.A. in Finance as well as a J.D. from Arizona State University. He is the Chair and Managing Partner of True North Venture Partners, a venture capital firm that he launched. Anita serves on several nonprofit advisory boards and councils, including one at the Indian Institute of Technology. She also holds a masters degree in economic policy. William provides extensive leadership insight for this committee because of his corporate and community involvement.

Stockholders & Employee Ownership

Currently, First Solar's largest stockholders are the institutional holders of Blackrock Inc., Vanguard Group Inc., and JP Morgan Chase & Company. Together, these three stockholders hold 31,436,556 shares (29.99 percent). The total shares outstanding are 104,840,000 and 85.46 percent of them are held by institutions (First Solar, Inc. (FSLR), 2023). According to the Annual Report, First Solar has 1,310,887 securities to be issued upon exercise of outstanding options and rights and 6,500,832 securities remaining available for future issuance under equity compensation plans. These shares come from the Omnibus Plan adopted in 2020. The compensation committee is in charge of utilizing this plan to award common stock to directors, officers, employees, and consultants of First Solar (Annual Report). There does not seem to be a high degree of employee ownership of the stock at First Solar excluding the executives, but there is a plan with committee oversight to award the common stock that is available. Executives receive a combination of RSUs and PUs as outlined in the Compensation section.

Figure E - Stock Ownership Breakdown



Recent Issues for Shareholder Vote

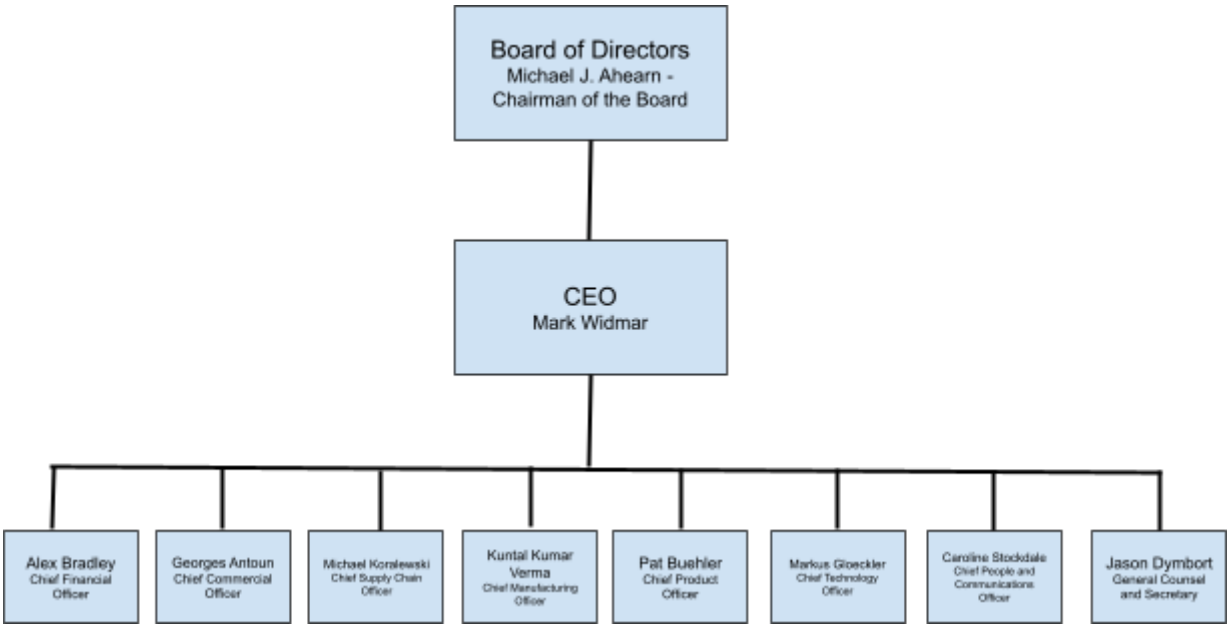
The most recent Proxy Statement listed four issues for shareholders to vote on at the annual meeting held on May 9th, 2023. The first proposal was to elect the twelve members of the board of directors to hold office until the next annual meeting of stockholders or until their respective successors have been elected and qualified. The next issue up for vote was the ratification of the appointment of PricewaterhouseCoopers LLP as the firm's independent registered public accounting firm for the year ending December 31, 2023. Proposal number three was the approval, on an advisory basis, of the compensation of the firm's named executive officers. Finally, proposal number four was the approval, on an advisory basis, of the frequency of

advisory votes on the compensation of the firm's named executive officers (Schedule 14A, 2023). None of these issues were of concern for the governance of First Solar because they were routine and had been approved easily in prior annual meetings.

Organizational Structure

First Solar utilizes a traditional organizational structure, with a series of executives reporting to the CEO, who reports to the board of directors. The structure of First Solar is appropriate because it allows executives to specialize in areas that give First Solar competitive advantage, like technology, product, and manufacturing, while keeping a level of accountability and unity through the CEO. It would not make sense for First Solar to have a matrix structure, as it does not operate subsidiaries as separate strategic business units. Through this structure, First Solar is able to maintain continuity in its differentiation business strategy. In addition, the wide executive team allows for proper communication and surveillance of all three of First Solar's manufacturing locations in Ohio, Malaysia, and Vietnam, as well as their offices in Arizona, Mexico, Brazil, Brussels, Frankfurt, Singapore, and New Delhi.

Figure F - Organizational Structure



Control Systems

First Solar is subject to Sarbanes-Oxley Act section 404(a) and 404(b). This requires both management's assessment of their internal controls over financial reporting (ICFR) and a registered public accounting firm's attestation to management's assessment. PricewaterhouseCoopers LLP attested to the fact that First Solar's ICFR meets the standards of the COSO framework, the gold standard for internal controls, in fiscal year 2022.

Additionally, in their most recent earnings call, CEO Mark Widmar shared some of the controls they use to monitor performance. Average selling price, or ASP gives insights into market demand and revenue/profitability. CFO Alex Bradley later explains their increase in profit margin in Q3, acknowledging that this was primarily due to increasing ASP. The earnings call also takes the time to go through all their plants' and regions' capacities. They use the increase in nameplate capacity to show evidence of growth as a company.

Recent Strategic Decision

Recently, First Solar has made the strategic decision to build its fifth American manufacturing facility in Iberia Parish, Louisiana. This is a large financial investment for the company, costing them $1.1 billion overall. Today, the firm has a U.S. manufacturing capacity of 2.7 GW and the Louisiana plant will give the firm another 3.5 GW of capacity in the hopes of reaching 14 GW in total U.S. production by 2026. These aggressive goals show First Solar's strategic commitment to U.S. manufacturing (First Solar Breaks Ground, 2023).

In addition to the production increases, the Louisiana facility will generate 700 new direct manufacturing jobs. Today, they have 2,500 direct employees and the new manufacturing plant will bring the U.S. total to 4,000 direct employees. They are already the largest employer in America's solar manufacturing sector and this new facility will further solidify this. Louisiana was a key target for the firm's next facility because of the state's talented labor pool and existing workforce development programs. With the need for roughly 700 skilled workers these were important characteristics for the firm to consider.

As mentioned above, First Solar has made the strategic shift to focus on its core manufacturing capabilities. The Louisiana facility will help the firm accomplish this vision and will be one of the most advanced production facilities in the world. Using their integrated manufacturing approach, they will turn a sheet of glass into a fully-functioning module in 4.5 hours, producing 12 new solar panels every minute.

From a wide strategic perspective, First Solar is highly focused on developing American manufacturing capacity. Their CEO firmly believes in this endeavor, calling First Solar "America's Solar Company." Since 2020, the firm has invested $4.1 billion in expanding their manufacturing capacity, the majority of which has gone to U.S. production. In addition to recently breaking ground on the Louisiana facility, First Solar commissioned a third factory in Ohio this year. In 2024, they are expected to complete their new Alabama facility and the expansion of their existing Ohio facility. First Solar's focus on increased manufacturing capacity also reinforces the importance of research and development. First Solar is planning to invest $370 million dedicated to a R&D innovation center in Perrysburg, Ohio, which is expected to be complete in 2024 (News Details, 2023).

Building out its U.S. manufacturing capabilities, especially in Louisiana, is an intelligent strategic decision for First Solar. With a focus on differentiation, increased capacity and production efficiency are essential to continuing the growth of their competitive advantage. Additionally, a vital aspect of the company's key resources is their network of facilities throughout both the U.S. and internationally. This decision will further strengthen this resource

creating the ability for First Solar to expand its U.S. manufacturing lead. As we mentioned with the acquisition of Evolar, an expansion of First Solar's scale and resources combined with the added human capital they gained with this acquisition allows them the potential to continue to improve upon their highly differentiated product line.

On top of the factors discussed above, the recent 45X incentive implemented through the IRA and the sanctions placed on imported solar modules make this a sound decision for the firm. We support the firm's recent strategic decision because we expect the U.S. to remain a key market for the solar industry, and firms with large domestic manufacturing footprints will have a significant advantage in the future.

References

About Us. Canadian Solar – Global. (n.d.). https://www.canadiansolar.com/aboutus/

Am, J. B., Doshi, V., Noble, S., & Malik, A. (2023, February 6). *Consumers care about sustainability-and back it up with their wallets*. McKinsey & Company. https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/consumers-care-about-sustainability-and-back-it-up-with-their-wallets.

Canadian Solar Emea Green Financing Framework. (n.d.). https://csisolarweb.s3.ap-east-1.amazonaws.com/wp-content/uploads/2020/01/02150623/Canadian-Solar-EMEA-Green-Financing-Framework-Second-Party-Opinion.pdf

Canadian solar reports fourth quarter and full year 2022 results. Canadian Solar Inc. (2023, March 21). https://investors.canadiansolar.com/news-releases/news-release-details/canadian-solar-reports-fourth-quarter-and-full-year-2022-results

Center for Sustainable Systems, University of Michigan. 2022. "U.S. Renewable Energy Factsheet." Pub. No. CSS03-12. https://css.umich.edu/sites/default/files/2022-09/Renewable%20Energy_CSS03-12.pdf.

Crowell, C. (2023, March 13). *Longi solar panel manufacturing coming to Ohio via Invenergy Joint Venture*. Solar Builder Magazine. https://solarbuildermag.com/news/longi-solar-panel-manufacturing-coming-to-ohio-via-invenergy-joint-venture/

Department of Commerce Issues Final Determination of circumvention inquiries of solar cells and modules from China. U.S. Department of Commerce. (2023, August 18). https://www.commerce.gov/news/press-releases/2023/08/department-commerce-issues-final-determination-circumvention-inquiries#:~:text=Pursuant%20to%20the%20Presidential%20Proclamation,termination%20of%20the%20President's%20Proclamation.

First Solar. (2022). Annual Report 2022. https://www.annualreports.com/HostedData/AnnualReports/PDF/NASDAQ_FSLR_2022.pdf.

First Solar. (2023). DEF 14A. https://d18rn0p25nwr6d.cloudfront.net/CIK-0001274494/f36205d0-656d-4978-994d-d05537ae8d49.pdf.

First Solar. (2023). Form 10-Q. https://s202.q4cdn.com/499595574/files/doc_financials/2023/q2/d4e12d45-baba-423d-b95c-691614d1e14c.pdf.

First Solar breaks ground on $1.1 billion, 3.5 GW Louisiana Manufacturing Facility. First Solar, Inc., First Solar Breaks Ground on $1.1 Billion, 3.5 GW Louisiana Manufacturing Facility. (2023, September 21).

https://investor.firstsolar.com/news/news-details/2023/First-Solar-Breaks-Ground-on-1.1-Billion-3.5-GW-Louisiana-Manufacturing-Facility/default.aspx.

First Solar Inc. Announces Second Quarter 2023 Financial Results. (2023, July 27). https://investor.firstsolar.com/news/news-details/2023/First-Solar-Inc.-Announces-Second-Quarter-2023-Financial-Results/default.aspx.

First Solar, Inc., investor relations. (n.d.). https://investor.firstsolar.com/overview/default.aspx.

First Solar. (2023, May 12). *News details*. First Solar, Inc., First Solar Strengthens Global Technology Position in PV with Acquisition of Evolar, a Leading European Thin Film Company. https://investor.firstsolar.com/news/news-details/2023/First-Solar-Strengthens-Global-Technology-Position-in-PV-with-Acquisition-of-Evolar-a-Leading-European-Thin-Film-Company/default.aspx

"First Solar, Inc. (FSLR) Stock Major Holders." *Yahoo! Finance*, Yahoo!, 12 Nov. 2023, finance.yahoo.com/quote/FSLR/holders/.

Groom, N. (2023, January 11). *S. Korea's Hanwha Qcells to invest $2.5 bln in U.S. Solar Supply Chain*. Reuters. https://www.reuters.com/business/energy/koreas-hanwha-qcells-invest-25-bln-us-solar-supply-chain-2023-01-11/

IEA (2022), Solar PV Global Supply Chains, IEA, Paris https://www.iea.org/reports/solar-pv-global-supply-chains, License: CC BY 4.0.

Ksir, D. (2023, February 26). *Canadian solar: Buy but only at $31 per share (NASDAQ:CSIQ)*. Seeking Alpha. https://seekingalpha.com/article/4581983-canadian-solar-buy-at-31-per-share

"Leadership." *First Solar*, www.firstsolar.com/about-us/leadership. Accessed 12 Nov. 2023.

Maguire, G. (2023, September 27). *Beaten down US solar sector may be primed for a rebound: Maguire*. Reuters. https://www.reuters.com/business/energy/beaten-down-us-solar-sector-may-be-primed-rebound-maguire-2023-09-27/#:~:text=High%20interest%20rates%20that%20caused,of%202023%2C%20hammering%20sector%20sentiment.

News details. First Solar, Inc., First Solar Selects Louisiana for Fifth American Manufacturing Facility. (n.d.). https://investor.firstsolar.com/news/news-details/2023/First-Solar-Selects-Louisiana-for-Fifth-American-Manufacturing-Facility/default.aspx

News details. First Solar, Inc., First Solar Strengthens Global Technology Position in PV with Acquisition of Evolar, a Leading European Thin Film Company. (n.d.). https://investor.firstsolar.com/news/news-details/2023/First-Solar-Strengthens-Global-Tec

hnology-Position-in-PV-with-Acquisition-of-Evolar-a-Leading-European-Thin-Film-Company/default.aspx

Petridis, Alex (2023), Solar Panel Manufacturing in the US, IBISWorld. https://my-ibisworld-com.libproxy.unl.edu/us/en/industry/33441c/products-and-markets.

Reiff, N. (2023, May 8). *10 biggest solar companies*. Investopedia. https://www.investopedia.com/10-biggest-solar-companies-5077655

Renewable energy: Distributed generation policies and programs. Energy.gov. (n.d.). https://www.energy.gov/scep/slsc/renewable-energy-distributed-generation-policies-and-programs#:~:text=Distributed%20generation%20is%20the%20term,generation%20sources%20from%20power%20plants.

Series 7 - Made in America, for America. Made in America, for America | First Solar. (n.d.). https://www.firstsolar.com/en/Products/Series-7

Solar Photovoltaics Supply Chain Review Report. (2023). Energy.gov. https://www.energy.gov/eere/solar/solar-photovoltaics-supply-chain-review-report

Solar Value Chain. (2016). Green Rhino Energy. https://www.greenrhinoenergy.com/solar/industry/ind_valuechain.php

Statista (2022). Net sales of First Solar, Inc. in financial year 2022, by region. https://www.statista.com/statistics/330708/net-sales-by-region-of-first-solar/

The Opportunities of Solar Panel Recycling. (2019, January 19). Northeast Recycling Council. https://nerc.org/news-and-updates/blog/nerc-blog/2019/01/29/the-opportunities-of-solar-panel-recycling?gclid=Cj0KCQiAjMKqBhCgARIsAPDgWlwMUy1iwpMt9h5UhHkx2TImdDYQTf2xhIsK5prHVrJ3NSH7zo2zH5saAoShEALw_wcB

Welles, E. (1998). *Going for BROKE*, vol. *20* no. 8, pp. 66–78, June 1998.

Widmar, Mark. *We're investing in America's future*. We're investing in America's future | First Solar. (n.d.). https://www.firstsolar.com/Resources/Blogs/Investing-in-Americas-future

Yuen, S. (2023, May 24). Global solar PV manufacturing capacity could meet deployment needs in 2030 - IEA. https://www.pv-tech.org/global-solar-pv-manufacturing-capacity-could-meet-deployment-needs-in-2030-iea/global-manufacturing-capacity-utilisation-rate-of-about-2040-25.

Zientara, B. (2019, May 10). *Top 5 American solar panel manufacturers in 2023*. Solar Reviews. https://www.solarreviews.com/blog/best-american-solar-panel-manufacturers