Strategic Analysis of First Solar, Inc. (2024)

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Abstract: First Solar, founded in 1999, is a leading American solar technology company dedicated to developing sustainable energy solutions. First Solar focuses on producing environmentally efficient solar modules that address climate change, with a strong emphasis on sustainability and corporate social responsibility across the entire product lifecycle. Headquartered in the U.S., First Solar differentiates itself from other top solar manufacturers by not relying on China for its production. Its vertically integrated manufacturing process ensures control over every stage, from raw material sourcing to end-of-life recycling. This strategic analysis includes the use of the following: external/environmental analysis tools (PESTLE, Five Forces and Competitor Analyses) as well as internal analyses (VRIO, Value Chain and Functional). All of these analyses culminate in a SWOT analysis of the firm including recommendations for future actions.

Keywords: Case study, strategic analysis, solar technology.

INTRODUCTION

Figure 1 – National Headquarters First Solar Inc.
https://www.renewableenergyworld.com/solar/first-solar-buys-perovskite-firm-says-tandem-pv-will-define-the-future/

First Solar, founded in 1999, is a leading American solar technology company dedicated to developing sustainable energy solutions. First Solar focuses on producing environmentally efficient solar modules that address climate change, with a strong emphasis on sustainability and corporate social responsibility across the entire product lifecycle. Headquartered in the U.S., First Solar differentiates itself from other top solar manufacturers by not relying on China for its production. Its vertically integrated manufacturing process ensures control over every stage, from raw material sourcing to end-of-life recycling (First Solar, n.d.).

As one of the world's oldest and most experienced solar module manufacturers, First Solar has spent the past quarter-century establishing itself as the leading solar module technology and manufacturing company in the Western Hemisphere. Its global footprint includes facilities in the United States, Malaysia, Vietnam, and India, as well as regional offices worldwide (First Solar, 2024, p.6).

First Solar operates within the Semiconductor and Related Device Manufacturing sector, classified under NAICS code 334413 and SIC code 3674 (U.S. Census Bureau, 2022). More specifically, it falls under Solar Panel Manufacturing in the U.S. (NAICS code 334413C), where its primary activities involve manufacturing and supplying solar panels and solar cells to installers and downstream customers across residential, commercial, and utility sectors (IBISWorld, 2024).

The company stands out as one of the world's largest solar manufacturers, with a significant market share in the U.S. Solar Panel Manufacturing industry. According to IBISWorld (2024), First Solar holds an estimated 21.7% of the total market share, emphasizing its prominent position in the industry. A key factor in First Solar's success is its innovative technology, demonstrated by its advanced thin-film photovoltaic modules and flagship product lines, Series 6 and Series 7.
Developed in R&D labs in California and Ohio, these modules utilize Cadmium Telluride (CadTel) semiconductor technology, offering superior energy efficiency, lower degradation rates, and better performance in diverse environmental conditions compared to traditional crystalline silicon panels. Additionally, the CadTel semiconductor is derived from byproducts of copper and zinc mining, further advancing the company's sustainability goals. Together, these cutting-edge solar modules highlight First Solar's expertise and its continuous effort to enhance solar energy efficiency (First Solar, n.d.).

First Solar's Mission, Vision, and Objectives

First Solar is committed to leading the world's sustainable energy future by providing innovative, eco-efficient solar modules that contribute to the fight against climate change. They strive to exceed industry standards through cutting-edge technology, responsible manufacturing, and dedication to environmental stewardship. Their mission is to produce solar technology with the smallest environmental footprint, upholding ethical business standards, rigorous safety protocols, and operational excellence (First Solar, n.d.)

According to First Solar Sustainability Report (2024), their vision "is to lead the world's sustainable energy future." They emphasize their commitment to providing sustainable solar energy, through innovative technology, social and environmental responsibility. Also, First Solar has committed to powering 100% of its global manufacturing operations with renewable energy by 2028 and achieving Net Zero by 2050.

Another way First Solar shows their commitment to sustainability is by supporting a circular economy through an industry leading recycling program that recovers over 90% of materials, including semiconductors, for reuse in new modules. Their photovoltaic technology, developed from mining byproducts and high-value recycling process demonstrate this commitment to responsible product life cycle management and sustainability (First Solar, n.d.).

The objectives outlined in their 2023 Annual Report (First Solar, 2023, p. 10) are closely aligned with the company's vision and mission, focusing on three key priorities to strengthening its market position by the end of the decade:

1-*Market Expansion*: Serving all commercially addressable markets through an expanded product portfolio.
2-*Technological Leadership*: Investing in next-generation photovoltaic (PV) semiconductors and tandem thin-film technologies to stay at the forefront of solar innovation.
3-*Scaling Operations*: By leveraging scale as a key driver of value, their goal is to position the company to double its size by the end of the decade, capitalizing on the rapid expansion of the photovoltaic industry.

First Solar's Business Strategy

First Solar's business strategy is what has been characterized as a "best cost" strategy. (Virginia Tech, n.d.) This strategy emphasizes both low cost and differentiation, creating unique products or services tailored to the specific needs of a niche market (Parnell, 2021, p.197). Although Michael Porter (1980) originally argued that this strategy was difficult to achieve and that firms would be "caught in the middle", this strategy has worked out very well for certain organizations including Southwest Airlines, Target, Chipotle and Pabst Blue Ribbon. (Virginia Tech, n.d.)

First Solar's differentiation strategy includes:

- *Proprietary Thin-Film CadTel PV Technology*: Advanced modules that are cost-effective, energy-efficient, and environmentally friendly, outperforming c-Si modules with higher energy yield and better performance in hot and humid climates (First Solar, 2024, p. 18).
- *End-of-Life Recycling Program*: An industry-leading initiative that recovers over 90% of materials, supporting a circular economy and sustainable lifecycle management (First Solar, n.d.).
- *Research and Development*: First Solar's 2023 Annual Report highlights its R&D differentiation through vertical integration, encompassing "advanced research to product development, manufacturing, and applications" (First Solar, 2023, p.17). Ongoing investments in R&D drive innovation, ensure product durability through rigorous testing, and reinforce the company's leadership in thin-film solar technology.
- *Sustainability Commitments*: CadTel modules feature a 2.5x lower carbon footprint, 3x lower water footprint, and 2x faster energy payback compared to c-Si panels, supporting the company's goal of Net Zero by 2050 (First Solar, n.d.).
- *Financially Backed Warranties*: Comprehensive warranties enhance customer confidence and emphasize First Solar's commitment to quality (First Solar, 2023, p.18).

First Solar's Low-Cost Leadership Strategy includes:

- *Innovative Thin-Film Technology*: First Solar leverages its proprietary Cadmium Telluride (CadTel) thin-film technology to produce solar panels more economically than traditional silicon-based alternatives. The CadTel semiconductor layer, sourced from copper and zinc mining byproducts, offers superior cost-efficiency, scalability, and theoretical efficiency limits compared to conventional crystalline silicon (c-Si) panels (First Solar, n.d.).
- *R&D*: The company's research and development efforts are strategically aligned with its cost leadership goals. By concentrating on enhancing module longevity and streamlining manufacturing processes, First Solar aims to increase throughput, scale production volumes, and decrease material expenses (First Solar, 2023, p.17).
- *Vertical Integration*: First Solar's manufacturing model integrates all processes under one roof, significantly reducing production complexity and costs. This approach minimizes inter-factory logistics, cuts down on potential delays, and allows for rapid production cycles. The streamlined process enables the transformation of raw glass into finished solar panels in just four hours (First Solar, n.d.).
- *Incentives*: First Solar benefits from supportive government initiatives, such as the Inflation Reduction Act, which offers tax benefits for clean energy production and domestic manufacturing (First Solar, 2024, p. 20). These policies enable the company to expand its production capacity, further reduce manufacturing costs, and potentially offer more competitive pricing to customers, thereby strengthening its market position and profitability.

ENVIRONMENTAL/EXTERNAL ANALYSES (O/T)

The solar industry, like all business sectors, operates within the broader macroenvironment, external forces that influence all firms in an industry (Parnell, 2021). We start this external inquiry into the firm using PESTEL analysis This analytical tool examines the Political, Legal, Economic/Environmental, Social, and Technological factors shaping First Solar's operational field, offering insights into the company's *Opportunities* (potential for growth) and *Threats* (potential for retrenchment).

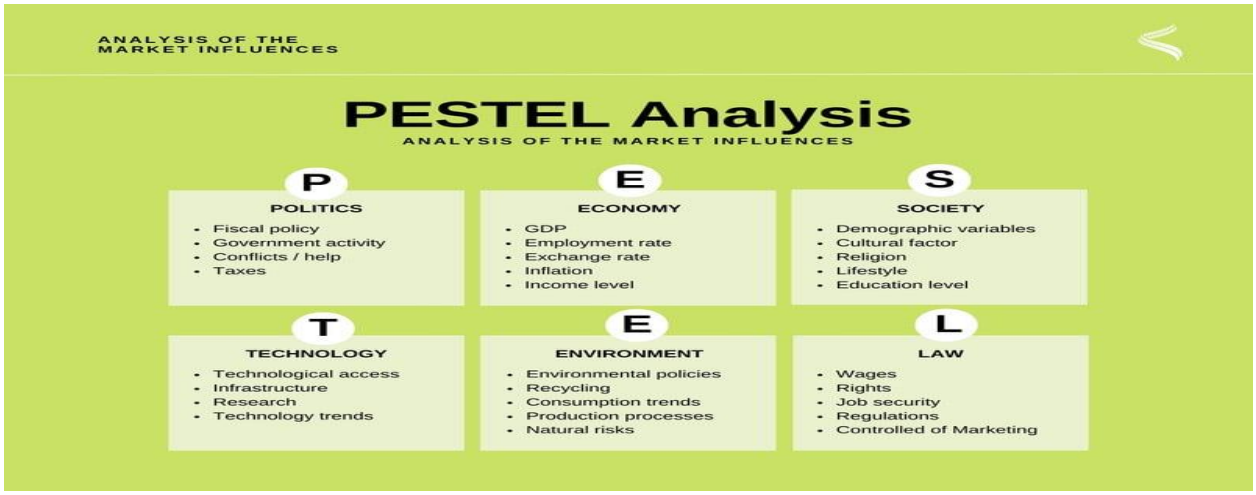

Figure 2 – PESTEL Analysis
https://krishnag.ceo/blog/pestel-analysis/

Political Factors: Political factors play an important role in shaping the economy, industries, and individual organizations, including the solar sector. First Solar has benefitted from recent policy developments and government incentives such as the Inflation Reduction Act, which provide substantial tax credits to support domestic clean energy production, creating a favorable environment for U.S. manufacturers. According to Kennedy & Weaver (2024), First Solar has successfully capitalized on the Inflation Reduction Act's incentives, securing $700 million through tax credit transfer sales, which demonstrate the impact of supportive government policies on its growth strategy. First Solar has significantly benefited from tariffs on Chinese solar cells and modules, which have increased the cost of imported panels and enhanced its competitiveness in the U.S. market. If these tariffs were removed, First Solar's competitive advantage would be reduced (Prochnow, 2024).

Legal Factors: For the legal factor, First Solar places great importance on protecting its intellectual property. According to Pickerel (2024), the company is investigating potential patent infringements related to its tunnel-oxide passivated contact (TOPCon) technology, acquired through the 2013 purchase of TetraSun. These patents, valid in multiple countries until 2030, are central to First Solar's innovation efforts. This legal action highlights the company's commitment to safeguarding its technological advancements and intellectual property.

Another example of a legal factor is the requirement for solar panel manufacturers to manage hazardous waste responsibly under environmental regulations. First Solar leads the industry with over 15 years of experience in global in-house PV recycling. In 2005, it launched the first industry-wide recycling program, highlighting its commitment to sustainability and ongoing innovation (First Solar, n.d.)

Economic Factors: An example of how the economic environment affects First Solar's cost structure is its $1.1 billion investment in a new manufacturing facility in Alabama. This expansion of vertically integrated production capabilities reduces First Solar's reliance on external suppliers and streamlines its manufacturing process, which can lower production costs. The new facility, which adds 3.5 gigawatts of capacity, allows the company to scale production domestically, potentially decreasing unit costs and improving efficiency. As a result, First Solar can offer more competitive pricing, aligning with its strategy to reduce solar technology costs while increasing profitability. Additionally, this expansion is expected to create over 800 new jobs in energy technology manufacturing (First Solar, 2024).

Social Factors: Regarding the social factor, First Solar's efforts yield substantial benefits for the community by promoting clean, affordable solar electricity and addressing critical issues such as water scarcity through reduced manufacturing water use. According to their website, the company has donated over $2.5 million since 2017 to support education, reduce inequalities, provide access to clean energy and water, and mitigate the impacts of COVID-19 (First Solar, n.d.). Additionally, according to CSRHub (n.d.), First Solar has a CSR score of 94,

reflecting its strong dedication to corporate social responsibility. This score aligns with my findings regarding the company's sustainable practices and positive community impact, suggesting that First Solar's commitment to social responsibility is accurately represented and responsive to the growing societal demand for ethical and sustainable business practices.

Technological Factors: Technological advances are transforming the solar energy sector, driving improvements in both efficiency and cost-effectiveness. First Solar has positioned itself at the forefront of this transformation through its two-decade-long investment in cadmium telluride (CdTe) technology. According to its sustainability report, the introduction of First Solar's Series 7 module represents a significant leap in solar technology, with a carbon footprint up to 22% lower than its Series 6 modules and as much as four times lower than crystalline silicon solar panels made from Chinese polysilicon (First Solar, 2024, p. 7). Additionally, the company's Ohio plant has become nearly fully automated, enabling it to produce solar panels more cost-effectively than its competitors do (Bloomberg, 2018).

Industry Analysis

The Solar Panel Manufacturing industry in the United States has shown remarkable growth in recent years, reflecting the nation's increasing focus on renewable energy sources. According to a report by IBISWorld (2024), the industry has experienced substantial financial expansion, with revenue climbing to $20.5 billion in 2024, representing a compound annual growth rate of 10.1%. This growth trajectory highlights the rising demand for solar energy solutions across the country.

Despite this positive trend, U.S. manufacturers face significant challenges in the global market. The industry continues to contend with fierce competition from international players, particularly those in Asia, who often offer more competitively priced products. This competitive landscape has been further complicated by the strengthening of the U.S. dollar, which has made American solar panel exports less attractive to international buyers (IBISWorld, 2024).

However, recent policy initiatives have provided a boost to domestic manufacturers. Notably, the Inflation Reduction Act has introduced measures to support the industry, including enhanced production and investment tax credits. These incentives aim to make U.S.-based solar panel manufacturing more economically viable, potentially helping domestic companies to better compete in both local and global markets (IBISWorld, 2024).

Building on this industry overview, we will now analyze its competitive environment using Porter's (1980) Five Forces model, a systematic approach for evaluating the profitability potential of firms within an industry (Danao, 2024). The stronger the forces in the industry, the more competitive the industry and therein less profitable.

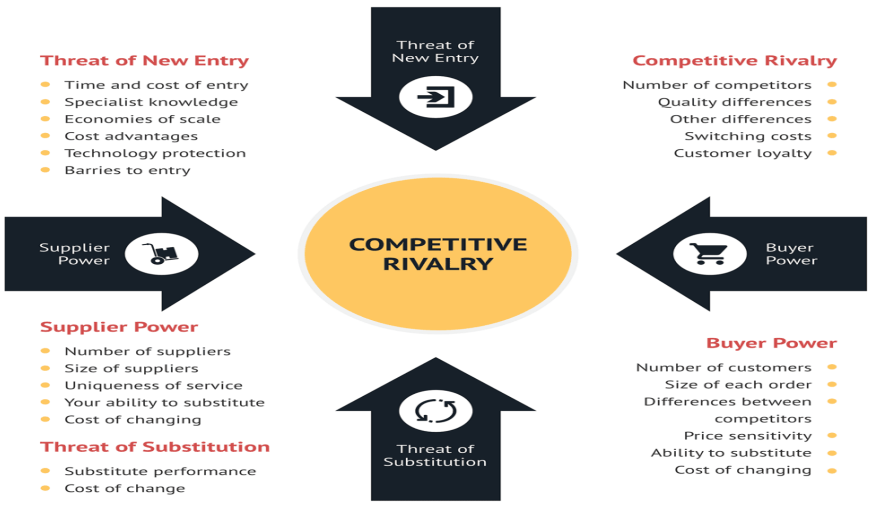

Figure 3 – Porter Five Forces Model
https://consulterce.com/five-forces-analysis/

Threat of New Entrants: Low

The threat of new entrants in the solar panel manufacturing industry is low due to the high startup costs involved. Starting a solar panel manufacturing business requires considerable upfront capital for setting up infrastructure, acquiring machinery, and meeting industry regulations. Sheykin (2024) highlights that the cost of the necessary manufacturing equipment can range between $15 million and $30 million, or more, depending on factors such as facility size and automation. Moreover, the capital needed for setting up a manufacturing facility can vary from $10 million to $50 million or higher.

Bargaining Power of Buyers: High

The bargaining power of buyers in the solar panel manufacturing industry is high, largely driven by the availability of cheaper solar panels from China. Robinson (2024) reports that Chinese solar panels are roughly 20% less expensive than those made in the U.S., creating a significant challenge for American manufacturers. Despite the government's efforts through subsidies and tariffs, this price gap remains a key factor.

Bargaining Power of Suppliers: Moderate

The bargaining power of suppliers in the solar panel manufacturing industry is influenced by several key factors. Critical raw materials like polysilicon, glass, aluminum, and copper are primarily sourced from a limited number of suppliers, with polysilicon production predominantly concentrated in China (EnergyTrend, 2024). Similarly, cadmium telluride (CdTe), a key material for thin-film solar panels, is sourced as a byproduct of copper and zinc mining, with major production centers in countries such as China, South Korea, Japan, and Canada (U.S. Geological Survey, 2022). This geographic concentration gives suppliers substantial advantage over pricing and availability.

However, while these raw materials are not scarce, the concentration of production and refining capabilities in specific regions can lead to supply chain vulnerabilities. To further mitigate supplier power, companies like First Solar have adopted vertically integrated models. This strategy enables them to source a significant portion of materials domestically, enhancing supply chain stability, reducing reliance on foreign suppliers, and improving transparency and traceability (First Solar, n.d.).

Threat of Substitutes: High

There are several alternatives available, including nonrenewable energy resources like coal, natural gas, and oil as well as other renewable sources such as wind, hydropower, biomass, geothermal energy, and nuclear power (U.S. Energy Information Administration, n.d.). As the costs associated with traditional (nonrenewable) energy sources continue to rise and concerns about environmental impact grow, consumers are increasingly exploring solar panels as an alternative.

Intensity of Competitive Rivalry: High

The level of competitive rivalry in the US solar panel manufacturing industry is high, largely due to intense competition from Chinese companies. As noted by Calabrese (2024), the competition between the US and China in the solar sector mirrors a broader tension between the pressing need for renewable energy and national security concerns. While US lawmakers acknowledge the crucial role of renewable energy, with solar expected to be the dominant power source by 2050, reliance on Chinese imports presents significant risks. The Biden administration has supported US manufacturers through initiatives like the Inflation Reduction Act (IRA), which promotes solar research and development, along with tax credits for manufacturing. These measures are making large-scale US solar panel production more feasible but have also drawn major Chinese manufacturers into the US market (Calabrese, 2024). See Figure 4 for a list of major competitors in the field.

In summary, the low threat of new entrants is offset by the high threat of substitutes, bargaining power of buyers and competitive rivalry leading us to conclude that the industry overall is competitive and therefore not overly profitable. However, "Overall, solar panel manufacturing revenue has swelled a CAGR (compound annual

growth rate) of 10.1% to $20.5 billion in 2024, including an 11.5% jump in 2024 alone." (IBIS World, n.d.) First Solar Inc.'s financials for 2024 were quite impressive – they reported 1,970.7 million in profits with a revenue base of 4,447.3 million = 44.3% profit margin (IBIS World, n.d.) Much of this growth has been sustained through government programs that have been strongly supported by the Biden administration. Whether this support will continue under the Trump Administration at this point is highly questionable.

First Solar's Competitors' Comparison

	First Solar	JinkoSolar	SunPower	Canadian Solar	Trina Solar
Date Founded	1999	2006	1985	2001	1997
Country	USA	China	USA	Canada	China
Specialty	Thin-film CdTe solar modules	Crystalline silicon solar panels	High-efficiency monocrystalline solar panels	Polycrystalline and monocrystalline silicon solar panels	Crystalline silicon solar panels
Employees	6700	46,511	4,710	13,535	20,000
Revenue 2023 in US Million	$3,318.60	16,490.00	$1,690.00	$7,613.60	$15,320.00
CSR	94	81	73	96	84

Figure 4 – Major Competitors to First Solar
Information is derived from Gale Business Insights, Yahoo Finance, and CSRHub

We conducted a detailed comparison of several key factors among leading solar companies that compete with First Solar. Crystalline silicon manufacturers, primarily linked to China, are First Solar's main competitors (First Solar, 2023, p.11). This analysis includes their founding dates, operational locations, areas of specialization, revenue as of December 31, 2023, and Corporate Social Responsibility (CSR) scores. We believe comparing CSR is crucial, as it serves as a framework for companies to manage their economic, social, and environmental impacts responsibly. CSR emphasizes environmental sustainability, ethical practices, philanthropy, and financial accountability, all aimed at benefiting society while enhancing reputation and building stakeholder trust (Fernando, 2024).

First Solar and SunPower are based in the United States, while JinkoSolar and Trina Solar operate out of China, and Canadian Solar is headquartered in Canada. This geographic diversity reflects the global nature of the solar market. Notably, SunPower is the oldest company, founded in 1985, whereas JinkoSolar is the youngest, established in 2006. This difference highlights the varying levels of experience and market evolution among these companies (Gale Business Insights, n.d.; Yahoo Finance, n.d.).

In terms of specialization, First Solar distinguishes itself with its thin-film CdTe solar modules, which offer specific advantages applications. JinkoSolar, Canadian Solar, and Trina Solar focus on crystalline silicon technology. SunPower specializes in high-efficiency monocrystalline panels, with each company catering to

distinct market needs. Even though the companies specialize in different products, they operate in the same industry, targeting overlapping markets and customers (Gale Business Insights, n.d.; Yahoo Finance, n.d.).

JinkoSolar is the largest firm with 46,511 employees and revenue of $16.49 billion in 2023. First Solar follows with $3.32 billion in revenue, displaying the strength of its niche in thin-film technology. Despite its long history, SunPower ranks as the smallest company in terms of both revenue ($1.69 billion) and workforce (4,710 employees), reflecting its emphasis on specialized high-efficiency products (Gale Business Insights, n.d.; Yahoo Finance, n.d.).

When it comes to CSR scores, Canadian Solar excels with a score of 96, demonstrating a robust commitment to sustainability. First Solar closely follows with a score of 94, reflecting its focus on environmental innovation. JinkoSolar and SunPower have lower scores at 81 and 73 respectively, indicating areas where they can improve their sustainability efforts (CSRHub, n.d.).

While First Solar faces significant global competition, and industry challenges, requiring ongoing innovation and strategic agility, it demonstrates strong financial stability, technological advancement, and a commitment to sustainability. The company's unique focus on thin-film technology, coupled with its strong CSR initiatives, positions it favorably in a rapidly evolving market.

INTERNAL ANALYSES (S/W)

The internal environment encompasses elements within an organization's boundaries, including employees, management, and organizational culture. For the internal analyses, we are going to first start with VIRO (Value, Imitability, Rarity, and Organization) analysis which is a strategic analysis tool designed to evaluate a company's resources and capabilities to determine its potential for sustained competitive advantage and continuous improvement (Parnell, 2021).

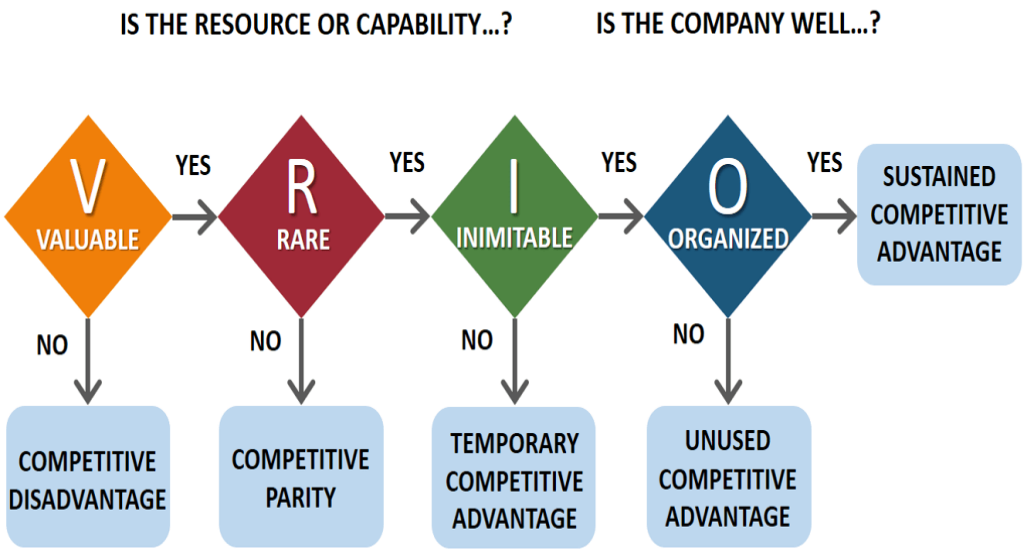

Figure 5 – VRIO Model
Https://biznewske.com/advantages-and-disadvantages-of-vrio-framework/

Levels of Competency	Core Competences	Distinctive Competencies	Competitive Advantage
Tangible Resources			
Proprietary Thin-Film CadTel Technology	*Value*: Enhances solar panel efficiency while reducing costs. CadTel technology is protected by *Rare*: Patented technology is rare in the market, and is integrated into *Organization*: Integrated into manufacturing and R&D processes for seamless production.	First Solar's distinctive competencies is in its unique proprietary material *Inimitable*: Protected by innovation that enhances patents, making it difficult for efficiency and reduces competitors to copy. Costs, is protected by exclusive to First Solar. integrated into manufacturing and R&D processes for continuous improvement (First Solar, 2023, p.18, 27)	First Solar's proprietary CadTel technology allows it to produce high-efficiency, cost-effective solar panels that competitors cannot easily imitate, providing a unique and a sustainable market edge.
Recycling and R&D Centers	*Value*: Reduces waste, enhances sustainability, and promotes innovation. *Inimitable*: Difficult for to replicate these without significant and technological *Rare*: Few competitors have integrated recycling centers in an advanced R&D facilities focused on sustainability. *Organization*: First Solar's perovskite and R&D to existing thin-film processes supports (First Solar, 2023, p.19).	These recycling centers achieve high reuse rates of materials, allowing the company to reclaim over processes 90% of the glass and investment recover semiconductors capabilities. from end-of-life solar panels. R&D centers focus on continuous innovation solar technology, advancements in technology and recycling improvements to its create a closed-loop supply chain and technological innovation.	First Solar's competitive advantage in recycling comes from its high-value processes that recover over 90% of module materials, making it the only solar manufacturer with global in-house recycling capabilities. In R&D, its investments in innovative technologies and the acquisition of Evolar enable the company to maintain leadership in solar technology and accelerate innovation cycles.

Levels of Competency	Core Competences	Distinctive Competencies	Competitive Advantage
Intangible Resources			
Brand Reputation for Sustainability	*Value*: Enhances customer trust and loyalty. *Inimitable*: Reputation is hard to imitate. *Rare*: Few competitors possess a strong sustainability focused reputation. *Organization*: Capitalized through marketing and positioning.	As the largest thin-film PV solar module manufacturer globally in the Western Hemisphere, and the only U.S.- headquartered company among the top solar manufacturers (First Solar, 2023, p. 92), First Solar leads in environmental responsibility, bolstered by its strong reputation for sustainability, recycling initiatives, and innovative CadTel technology.	This positive brand reputation differentiates First Solar in the market, fostering customer loyalty and attracting investment. It enhances the company's ability to secure contracts and partnerships, positioning it favorably against competitors in the growing renewable energy sector.
Relationships with Key Suppliers	*Value*: Provides supply chain stability. *Inimitable*: Difficult to replicate without trust and history. *Rare*: Strong, long-term relationships are uncommon. *Organization*: Efficiently managed to ensure consistent production.	First Solar's strong relationships with key suppliers (Vitro, Omco Solar and Saint-Gobain) ensure a reliable and transparent supply chain, enabling efficient sourcing of high-quality materials essential for its advanced manufacturing processes. These long-term partnerships are difficult for competitors to replicate (First Solar, 2023, p.7)	First Solar's strong relationships with suppliers like Vitro, Omco Solar, and Saint-Gobain provide a reliable supply chain, ensuring access to high quality materials essential for advanced manufacturing. This stability fosters operational efficiency and enables rapid response to market demands, creating a competitive edge that is challenging for rivals to imitate.

Levels of Competency	Core Competences	Distinctive Competencies	Competitive Advantage
Employee Competences			
Skilled workers	Value: Skilled workers operate highly automated lines, improving efficiency and cutting costs compared to manual labor. Imitability: While automation is not new, First Solar's use of robotics and cad-tel tech is hard to replicate quickly. Rare: Robotics and proprietary cadmium telluride (cad-tel) tech are uncommon in large-scale solar manufacturing. Organization: First Solar's systems effectively leverage these skills to optimize production efficiency.	The company's success relies on attracting, training, and retaining skilled workers essential to its mission. First Solar's investment in advanced manufacturing techniques, such as automated operations and CadTel technology, enables cost-effective production of large utility-scale solar panels.	Skilled employees enhance efficiency and reduce costs, allowing rapid production scaling while maintaining high-quality standards. This combination of skilled labor and advanced technology provides a significant competitive advantage in the solar energy market (First Solar, n.d.; First Solar, 2023, p.14).
Expertise in solar energy technology	*Value*: Ensures high-quality product development and innovation. *Inimitable*: Their 25-year expertise in solar energy and proprietary CadTel technologies create significant barriers for competitors, making their market position difficult to replicate quickly. *Rare*: Few companies have such specialized expertise within the industry. *Organization*: First Solar's structure promotes collaboration and knowledge sharing among its experts.	First Solar's 25 years of experience in solar energy technology, combined with proprietary innovations like cadmium telluride solar cells, ensures high-quality product development and positions the company as a market leader. This specialized expertise is rare within the industry, and the organization fosters collaboration and knowledge sharing, further enhancing its competitive advantage.	Their extensive experience and proprietary technologies create a significant competitive advantage by enabling high-quality product development and innovation that are difficult for competitors to replicate, reinforcing their leadership position in the solar energy market. Also, advanced production processes reduce costs and enhance profitability compared to less advanced competitors (First Solar, 2024, p. 4)

Needed Resources, Assets, and Competences	First Solar's $1 billion revolving credit facility serves as a crucial financial resource, providing capital for expansion and operational flexibility (McColl, 2023). While the company has secured substantial financial resources, effective management of these funds is crucial to ensure they are allocated efficiently towards R&D and manufacturing expansions.	Developing strategies to counteract the impact of cheap imports, especially from China, is essential.	First Solar exhibits characteristics of a learning organization by continuously investing in R&D to enhance capabilities (First Solar, 2023, p.4).

Figure 6 – VIRO Analysis of First Solar
First Solar's 2023 Annual Report, First Solar's 2024 Sustainability Report and McColl (2023).

First Solar's VIRO analysis highlights its strategic strengths and competitive advantages in the solar energy market. Their proprietary Thin-Film CadTel technology is a key asset, enhancing efficiency and sustainability while being difficult for competitors to replicate. This technology, combined with a strong brand reputation for sustainability and robust supplier relationships, ensures operational stability and customer loyalty. Skilled employees and expertise in solar technology drive high-quality production and innovation. Also, First Solar's financial resources, including a $1 billion revolving credit facility, support expansion and strategic initiatives, reinforcing its leadership in the renewable energy sector (McColl, 2023).

First Solar's Value Chain

Next, we will analyze First Solar's Value Chain (see Value Chain table below). A value chain refers to the set of processes a business carries out to deliver value through its products or services. This includes everything from development and production to marketing, sales, and after-sales support. Analyzing the value chain helps identify ways to add value at each stage of the product/service lifecycle, enabling the company to strengthen its competitive position in the market
(Montevirgen, n.d.).

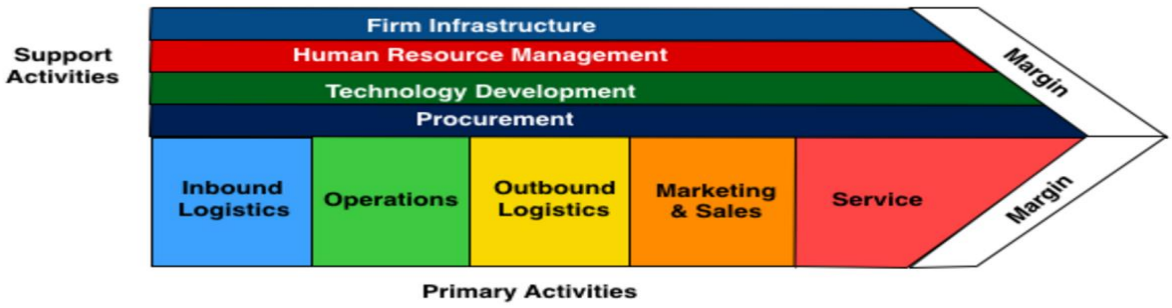

Figure 7 – Value Chain Model
https://jenvandermeer.org/2016/10/

Primary Functions	Inbound Logistics	Operations	Outbound Logistics	Marketing/Sales	Service
Secondary Functions					

Production/Market	US raw materials such as glass, steel, tellurium (First Solar, 2023, p.18)	Advanced manufacturing process (CuRe technology, bifacial thin film panels).	Production and distribution of advanced thin film CadTel PV modules (Series 6 & Series 7).	Sales to commercial and residential markets.	Post-sales support and recycling services
Firm Infrastructure	Agreements with key US suppliers for materials (First Solar, 2023, p.8),	Expanding global operations (new factories in Ohio, R&D in Europe and India).	Streamlined manufacturing and distribution networks.	US investments and global manufacturing expansion strategies.	Ethical practices (Responsible Business Alliance certification)
Technology Development	Procurement of innovative materials (thin film tech).	CuRe technology (22.6% conversion efficiency) and bifacial panel production (First Solar, 2023, p.7).	Leveraging technology advancements for product improvement.	Promote tech advantages in marketing efforts.	Continuous innovation to maintain tech leadership.
Human Resource Management	Expanding highly skilled workforce for new tech development (First Solar, 2023, p.28)	Hiring and training for advanced solar panel manufacturing.	Development of logistics and distribution workforce.	Focus on tech expertise in sales and support teams.	Safety and ethical treatment standards as per audits.
Procurement	Supplier agreements with Vitro, Omco Solar, etc. (First Solar, 2023, p.8)	Procurement of R&D materials for perovskite tech and CuRe program.	Coordination with suppliers for efficient module production.	Acquisition of marketing services, including digital platforms	Supplier vetting and adherence to RBA standards.

Figure 8 – Value Chain First Solar
Information for Value Chain Chart derived from First Solar's 2023 Annual Report and First Solar's 2024 Sustainability Report.

The analysis of First Solar's value chain reveals its strengths in vertical integration and strategic procurement, facilitating efficient manufacturing. By sourcing materials domestically and leveraging advanced technologies, the company enhances product quality and operational efficiency (First Solar, n.d.). Its dedication to sustainability and responsible practices further strengthens its market position, appealing to environmentally conscious consumers and stakeholders. We contend this holistic approach ensures First Solar's competitive advantage in the renewable energy sector, positioning it for ongoing growth and success in innovation.

Functional Strategies

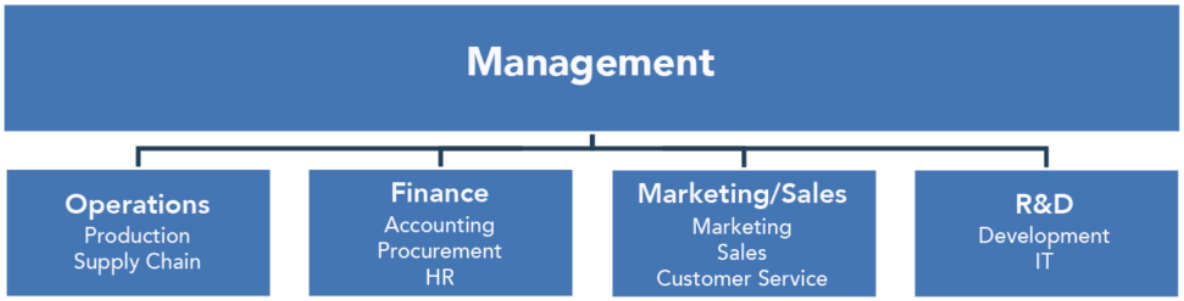

Figure 9 – Functional Analysis
https://www.coursesidekick.com/business/study-guides/wmopen-introductiontobusiness/functional-areas-2

For this last part of the internal analysis, we will review First Solar's functional strategy (See First Solar's Function Strategy table). A functional strategy is a detailed plan developed by each department within an organization, such as marketing, production, finance, human resources, or IT. These strategies are designed to align with and support the company's main business goals, ensuring that all areas work together to achieve the organization's objectives (MBA Skool Team, 2023). In First Solar's case, this analysis will focus on how key functional areas contribute to the company's competitive advantage in the solar energy market.

Descriptions	Strengths	Weaknesses
Finance		
Cost in manufacturing	producing thin-film solar panels that are more cost-effective	Capital expenditure for manufacturing capacity expansion
Revenue from sales	3.3186 billion dollars in revenue for FY 2023 an increase of 26.7% (MacroTrends, 2024)	Political instability and trade policy changes, including tariffs and the elimination of government subsidies, can disrupt production, raise costs, and decrease demand (First Solar, 2023, p.24)
Cash Flow	2023's gross cash balance of $2.1 billion (First Solar, 2023, p.59)	Capital expenditures between $1.7 billion and $1.9 billion for 2024 (First Solar, 2023, p.74)
Marketing		
Brand and Uniqueness	First Solar's strong branding as US-based, eco-friendly, and socially responsible solar module producer	Absence from China limits its cost competitiveness and market reach in key regions
Committed to 100% renewable energy by 2028, showcasing its leadership in sustainability	Renewable energy commitment strengthens its sustainability image, attracting eco-conscious customers and investors (First Solar, n.d.).	Achieving 100% renewable energy by 2028 may raise costs, affecting short-term profitability (First Solar, n.d.).
Government incentives and tax credits	By promoting tax credits and subsidies, First Solar enhances its appeal in cost sensitive markets	Reliance on government incentives risks reduced demand and competitive pricing if policies change.
Information Technology		

Innovative technology	First Solar achieved 22.6% CadTel efficiency, launched the first bifacial thin film solar panel, and plans CuRe module production in 2024 (First Solar, 2023, p.7)	The high costs and potential delays in scaling new technologies may affect short-term profitability.
Advanced technology and automation	First Solar is leveraging robotic technology to improve their solar panel production efficiency (Bloomberg, 2018)	High costs of maintaining cutting-edge systems
Quality	First Solar's thin film CdTe PV technology, chosen for its cost, scalability, and efficiency, offers unique quality advantages	CdTe solar cells require a complex multilayer structure, increasing manufacturing complexity and costs.
Human Resources		
Employees' well-being	First Solar prioritizes employee well-being and engagement	employee well-being often requires substantial financial investment in programs, benefits, and resources
Attracting and retaining employees	Attracting and retaining skilled employees enhances First Solar's innovation and productivity, leading to competitive advantage (First Solar, 2023, p.14).	High competition for talent
Training or developing employees	Improves their skills and abilities, resulting in higher productivity, greater job satisfaction, and leads to competitive advantage	Continuously developing and upskilling employees requires ongoing financial investment
Production/ Operations		
Differentiation	The 475-watt output from Series 6 and 545-watt output from Series 7 shows commitment to innovation and product differentiation (First Solar, n.d.)	Production cost
Cost	Producing thin-film solar panels that are more cost-effective to manufacture than traditional silicon-based panels	Dependence on certain materials for thin film panels may lead to supply chain risks and cost fluctuations
Expanding production capacity	In 2023, First Solar achieved record production of 12.1 GW, a 33% increase from 2022 (First Solar, 2024, p.34)	Record production increases may lead to inefficiencies if demand does not remain consistent.
R&D		
Advanced technology investment	Investment in new facilities and technologies accelerates innovation, positioning First Solar as a leader in the thin-film solar market	Significant financial resources are required for R&D investments, which may strain budgets and limit short-term profitability
Acquisition	The acquisition of Evolar enhances First Solar's capabilities, leveraging European expertise in perovskite technology for advanced product development (First Solar, 2023, p.19).	The focus on developing perovskite technology involves risks associated with market adoption and potential technological hurdles
Dedication to Eco-friendly Solar Innovations	Investing in eco-friendly solar innovations strengthens First Solar's R&D, advancing sustainable and high-performance technologies	Higher R&D costs for eco-friendly innovations may strain production budgets and reduce product cost-

	(First Solar, 2023, p.19)	effectiveness

Figure 10 – Functional Analysis of First Solar

Information for Functional Strategy Chart derived from First Solar 2023 Annual Report, First Solar 2024 Sustainability Report, First Solar's website and Bloomberg 2018.

Despite impressive revenue growth driven by technological investments and government incentives, First Solar faces financial risks from potential trade policy changes and shifts in government support. The company is committed to innovation, with advancements like 22.6% CadTel efficiency and upcoming CuRe modules, though scaling these technologies might influence short-term profitability. In addition, First Solar's focus on employee well-being and training enhances productivity but requires ongoing investments. The acquisition of Evolar increases expertise in perovskite technology but introduces certain market risks. While First Solar's emphasis on innovative technology solidifies its leadership position, it must address potential cost-related challenges to ensure sustainable growth.

First Solar's strategic focus on advanced thin-film technology, competitive pricing, and eco-friendly branding establishes it as a leader in the renewable energy sector. Its significant growth and innovations emphasize a commitment to sustainability, yet addressing issues like rising debt and market limitations will be crucial for continued success. By leveraging its strengths and investing in future technologies, First Solar can enhance its market presence and solidify its role as a key player in the solar energy industry.

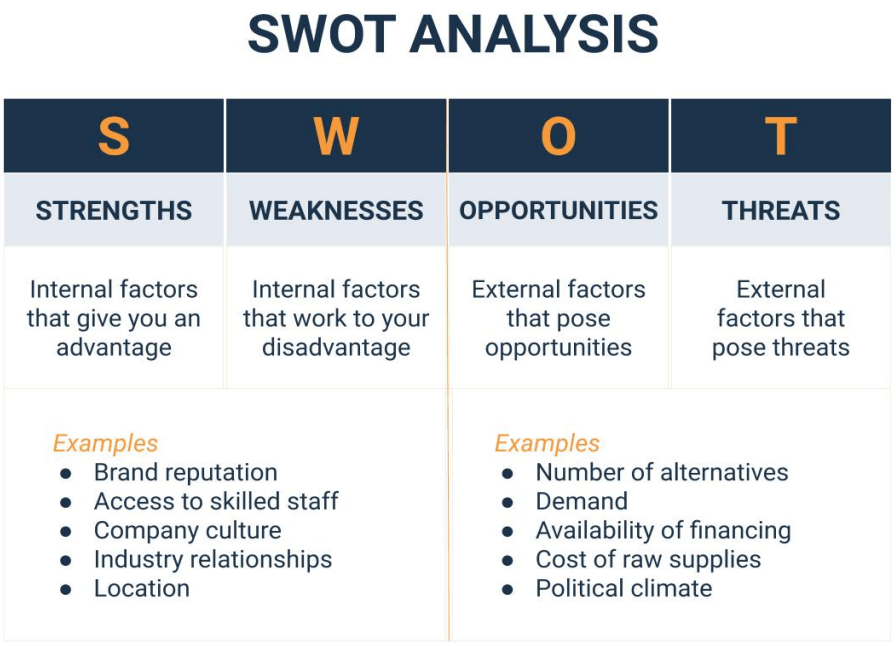

Figure 11 – SWOT Analysis
https://seekingalpha.com/article/4427284-tesco-a-swot-analysis

SWOT analysis focuses on aligning a firm's internal strengths and weaknesses with the external opportunities and threats it faces (Parnell, 2021). The SWOT analysis for First Solar indicates that their strengths outweighs its weaknesses, and its opportunities exceed its threats. This conclusion was derived by first estimating the Strengths and Weaknesses scores given the above analyses. As indicated in the Internal Analysis table below, the average score is 8.4 on a 10-point scale. There were consistently high scores across functional areas, resources/capabilities, and Value Chain, highlighting First Solar's strong internal operations. Key strengths include First Solar's proprietary Thin-Film CadTel Technology, global manufacturing network, and strong sustainability reputation.

INTERNAL ANALYSIS			
Value Chain	**Strengths (+)**	**Weaknesses (-)**	**Result (S+W)**
Primary Activities			
Production linkages	9	1	8
Marketing linkages	9	1	8
Secondary Activities Linkages	8	1	7
o Inbound Logistics	10	0	10
o Operations	9	1	8
o Outbound Logistics	10	0	10
o Marketing & Sales	9	1	8
o Service	10	0	10
Average			**8.6**
Functions			
Finance	9	1	8
Marketing	9	1	8
Technology	10	0	10
Human Resources	10	0	10
Production & Operations	9	1	8
Average			**8.8**
	163	11	152
TOTAL AVERAGE			**8.4**

Figure 12 – Calculated Strengths/Weakness Score First Solar

The external environment analysis shows a high opportunity score of 9.8, suggesting strong potential growth despite some challenges. (See Figure 13 below.) Favorable factors include tax incentives, patents/intellectual property protection, environmental consciousness, and technological advances. However, First Solar must remain vigilant against threats such as potential changes in permits and tariff removal, recycling, and disposal regulations, and rising material costs.

External Environment/	**Opportunities (+)**	**Threats (-)**	**Result (O+T)**
Sub Areas			
Political			**-7**
Tax Incentives/Grants	10		
Permits		8	
Tariff Removal		9	
Legal			**8**
Patents/IP	9		
Health & Safety	7		
Recycling & Disposal		8	
Economic			**-6**
Cost of Material		9	

New Facility	10		
Expansion Costs		7	
Social			**27**
Environmental Concerns	10		
Demographics	9		
Social Values	8		
Technological			
Tech Advances	10		**27**
Robotics	9		
Emerging Technologies	8		
Totals	90	41	49
AVERAGE PLEST SCORE			**9.8**

Figure 13 – Calculated Opportunities/Threats Score First Solar

In summary, First Solar appears to be in a strong position in that its strengths outweigh its weaknesses and its opportunities outweigh its threats. See Figure 14 below. Its positive score of (9.8, 8.4) [S/W, O/T] places the firm in Q1 growth quadrant suggesting that the firm should expand through either concentrated growth (same customers, same market), vertical/horizontal integration (buy competitors and/or suppliers), or related diversification (enter related businesses – i.e. other alternative energy sources such as wind power).

	Strengths (+)	**Weaknesses (-)**
OPPORTUNITIES (+)	**GROWTH (Q1)**	**HARVEST (Q2)**
	Concentrated Growth Horizontal Integration Vertical Integration Related Diversification	Rethink Concentrated Growth Horizontal Integration Divestiture* Liquidation*
THREATS (-)	**MAINTENANCE (Q3)**	**CORRECTIVE (Q4)**
	Related Diversification Conglomerate Diversification Cooperative Strategies	Turnaround/Retrenchment Related Diversification Conglomerate Diversification Divestiture/Liquidation*

Figure 14 - Corporate Level Strategy Selection Matrix

However, First Solar must closely monitor potential public policy an alternative energy industry changes under the new Trump administration including permits and tariffs, recycling, and disposal regulations, rising material costs and changing competition from low-cost imports, especially from Asian markets. By leveraging its technological expertise and sustainability focus, First Solar is well positioned to capitalize on what currently appears to be an expanding solar energy market that may change under a Trump administration.

CONCLUSION: THE BOTTOM LINE

Does the First Solar's strategy seem to work? Why or why not?

First Solar's generic strategy of best cost appears effective. Its proprietary Thin-Film CadTel Technology produces cost-effective, energy-efficient, and environmentally friendly solar panels. Together with a strong recycling program and R&D investments, these initiatives enhance product quality, sustainability, and technological leadership in thin-film solar technology (First Solar, 2023).

They currently employ the corporate grand strategy of Vertical Integration (Q1) that allows First Solar to control multiple stages of its production and distribution process. This strategy is clear as the company designs, manufactures, and deploys solar panels and at the same time offers related services such as operations and maintenance (First Solar, Inc., n.d.). Vertical integration enables First Solar to reduce costs, improve product differentiation, and maintain quality control. According to Parnell (2021), vertical integration refers to merging various stages of activities within the distribution channel, which is exactly what First Solar achieves through its integrated approach.

Are there any misalignments between the firm's mission, strategy, environment, or internal operations? If so, what are they?

There appears that there are no misalignments between First Solar's mission, strategy, environment, or internal operations. The company's mission is to produce solar technology with the smallest environmental footprint while upholding ethical business standards, rigorous safety protocols, and operational excellence (First Solar, n.d.). This mission aligns seamlessly with its strategies and actions. First Solar has consistently demonstrated its commitment to sustainability through initiatives like its low-carbon manufacturing processes, recycling programs, and ambitious Net Zero by 2050 goals (First Solar, 2024). These efforts prove that the company operates in alignment with its mission, ensuring its practices reflect its stated values.

First Solar's Best-Cost Strategy and Vertical Integration align with its capabilities and external environment. The Thin-Film CadTel Technology supports cost-effective, energy-efficient solar panels that align with its sustainability mission. Vertical integration allows First Solar to control production and distribution, reducing costs, improving differentiation, and ensuring quality control (First Solar, n.d.).

Internally, First Solar's global manufacturing facilities optimize production and logistics, supporting its strategies. It's R&D and recycling centers advance sustainability by minimizing waste and reclaiming over 90% of materials, reflecting its commitment to environmental responsibility and innovation (First Solar, n.d.).

How can the firm use its strengths to overcome weaknesses and threats as well as leverage opportunities? Immediate and longer-term actions that need to be taken?

There are ways First Solar can overcome their weaknesses and threats. For example, First Solar can leverage its strong branding as a U.S.-based, ecofriendly, and socially responsible solar module producer (strength) to address its absence from China (weakness), which limits cost competitiveness and market expansion. Targeted marketing campaigns should emphasize its U.S. operations, sustainable practices, and ethical brand values. Additionally, the company should continue innovating its proprietary Thin-Film CadTel Technology and optimizing its supply chain to enhance efficiency and competitiveness.

The acquisition of Evolar strengthens First Solar's capabilities by leveraging European expertise in perovskite technology to advance product development and innovation. This acquisition is expected to accelerate the development of high-efficiency multi-junction devices by integrating Evolar's expertise with First Solar's existing R&D capabilities (First Solar, 2023, p.19, 63). This strategic move not only enhances R&D efficiency but also establishes a stronger presence in the European market (opportunity), where demand for advanced solar technologies is high. Access to this market provides new opportunities and partnerships, helping to justify and offset expansion costs (threat).
First Solar should take immediate and longer-term actions to strengthen its position in the solar energy market. In the short term, the company should focus on optimizing production processes across its global manufacturing facilities in Ohio, India, Malaysia, and Vietnam. This will help improve operational efficiency and reduce costs. Additionally, First Solar should strategically utilize its $1 billion revolving credit facility to advance research

(McColl, 2023) and development initiatives, particularly in perovskite technology, an area enhanced by the recent acquisition of Evolar. By integrating Evolar's expertise with its own R&D capabilities, First Solar can accelerate innovation in high-efficiency solar modules. Strengthening relationships with key suppliers like Vitro, Omco Solar, and Saint-Gobain will also be crucial to ensuring a stable and high-quality supply chain (First Solar, n.d.).

In the longer term, First Solar should continue to invest in its R&D centers and integrated recycling facilities. These investments will drive innovation, enhance sustainability, and align with the company's mission. Developing new products to address evolving market demands will be another essential focus, allowing First Solar to maintain its competitive edge in a rapidly advancing industry. In addition, the company should explore expansion into new countries, which will open up opportunities for revenue growth and strengthen its global presence.

What is the most important action that needs to be taken by First Solar and why?

The most important action First Solar needs to take is to prioritize continued investment in research and development (R&D) and technological advancements, while simultaneously enhancing its sustainability practices. This aligns directly with their mission to produce solar technology with the smallest environmental footprint while upholding ethical business standards, safety protocols, and operational excellence (First Solar, n.d.). Additionally, as stated in their Sustainability Report (2024), First Solar's vision is to "lead the world's sustainable energy future." By focusing on R&D and sustainability, First Solar reinforces its commitment to providing innovative, sustainable solar energy solutions that align with both its mission and long-term vision for global environmental and social responsibility.

Final Comments

As they describe themselves, First Solar represents "Uniquely American Solar Technology" (First Solar, n.d.), standing out as the only U.S.-headquartered company among the world's ten largest solar manufacturers. With a global footprint that includes facilities in the United States, Malaysia, Vietnam, and India, First Solar differentiates itself from other top solar manufacturers. By creating eco-efficient solar modules, First Solar plays a key role in the global fight against climate change and is making significant strides toward leading the world's sustainable energy future.

While First Solar faces significant global competition and industry challenges, it demonstrates strong stability, technological advancement, and a commitment to sustainability. The company's unique focus on thin-film technology, coupled with its robust corporate social responsibility initiatives, positions it favorably in a rapidly evolving market. As First Solar continues to leverage government support and expand its manufacturing capabilities, it remains well equipped to navigate the competitive landscape and contribute positively to the global transition to renewable energy. First Solar's strengths, along with its commitment to innovation and sustainability, position it for ongoing growth and success in the renewable energy sector.

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