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ABALANCE CORP

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Executive summary

Abalance Corporation (TSE Standard: 3856) primarily manufactures and sells solar panels; the planning, development, sale, operation, and maintenance of solar power systems; and the sale of electricity generated by proprietary solar power plants. It takes on a holding company structure, with the parent holding company Abalance overseeing the group companies that handle the actual business operations. In FY06/22, consolidated revenue was JPY92.4bn and operating profit was JPY1.7bn. Businesses are managed under four reportable segments and Other businesses; the mainstay segments are the Solar Panel Manufacturing business (88.2% of FY06/22 consolidated revenue and 50.9% of operating profit before adjustments) and the Green Energy business (11.1% and 49.5%).

The company was established in April 2000 as a developer and administrator of Internet services. In November 2011, it converted WWB Corporation (unlisted; planned, sold, and installed solar power systems) into a wholly owned subsidiary through an exchange of shares, and the representative director and president of WWB at the time—Mr. Junsei Ryu—became the representative director of Abalance. Thereafter, Mr. Ryu expanded the company's solar power generation business, believing that solving energy-related issues was crucial for global environmental protection and the reduction of CO_2 emissions. In December 2020, Abalance acquired 84.85% of the voting rights in Vietnam Sunergy Joint Stock Company (VSUN; unlisted), a Vietnamese solar panel manufacturer that was generating revenue over three times that of Abalance at the time (FY06/21). With the addition of VSUN to the group, the company established an end-to-end business structure covering solar panel production to solar power plant-related solutions from planning to operation, maintenance, recycling, and trading of entire facilities.

Solar Panel Manufacturing business: VSUN, which operates this business, was established in June 2015. Headquartered in the Bac Giang Province of Northeast Vietnam, VSUN has four solar panel plants in Vietnam with an annual production capacity totaling 5GW. It sources raw materials from China and Southeast Asia, manufactures solar panels at its plants in Vietnam, and sells products chiefly to overseas customers directly or through its sales companies. About 60% of its revenue comes from the US, about 30% from Europe, and the remaining 10% from other regions. Industrial-use products account for roughly 80% of revenue; the rest is generated through home-use products.

Abalance says that amid prolonged US–China trade frictions, it made a foray into Vietnam to capture demand for solar panels that were free from US import restrictions and tariffs on China-made products. At the time of the acquisition, VSUN ranked second in production capacity within Vietnam, but since then, it worked to expand scale by making full use of its network to secure engineers from Chinese peer companies and elsewhere. At present, it tops the Vietnamese market in production capacity. With the acquisition of VSUN, Abalance's consolidated revenue climbed 13.8× from FY06/20 (pre-acquisition) to FY06/22, and operating profit was up 369.3% over the same period. Meanwhile, consolidated OPM fell from 5.4% to 1.8%, mainly due to an increase in raw material costs.

According to the company, VSUN has gained the recognition of third-party organizations for the reliable quality and performance of its products, as well as its procurement practices. The manufacturer has also cleared the strict quality standards of major purchasers. Abalance maintains that VSUN's manufacturing outside of China and its status as a Japanese-owned company generate a certain sense of quality assurance, which makes it easier for US companies and other customers to purchase its products even amid the US–China trade friction. In the current medium-term management plan ending in FY06/24, Abalance targets the achievement of 8GW in annual solar panel production capacity. The plan also includes a 6GW solar cell plant project. As the first phase of the project, a 3GW cell plant is currently under construction and slated for completion in October 2023. If demand continues to expand, the added panel production capacity can lead to revenue growth and margin improvements owing to economies of scale. Further, Shared Research understands that bringing the manufacture of solar cells in-house with the launch of the 3GW phase 1 plant will also contribute to revenue growth and better profit margins.

Green Energy business: Mainly operated by subsidiaries WWB and Valors Corporation, the Green Energy segment comprises a recurring revenue business (accounting for 25.9% of segment revenue in FY06/22) and a one-time revenue business (74.1%). The recurring revenue business is based on a model through which the company continues to own the solar power plants it either develops or acquires, earning income from selling the generated electricity to power utilities. In the one-time revenue business, the company engages in solar power plant trades with investors, sells products associated with power generation facilities, and uses agents to provide end-to-end services for solar projects (such as planning, engineering, development/construction, operation and maintenance, and recycling) to companies and consumers. Abalance plans to expand the portfolio of solar power plants under its ownership and further raise the revenue mix of its recurring revenue business to secure stable earnings.

The company's current portfolio includes over 50 solar power plants located in Japan and overseas, and the total output capacity of these facilities is 140MW. The Abalance group seeks to achieve 1GW in total output capacity by 2030. In the one-time revenue business, WWB has a track record of over 2,000 solar power plant trades, including the purchase and sale of pre-used facilities.

In the Solar Panel Manufacturing business, revenue is a function of the unit price of solar panels and sales volume. To calculate the unit price, we simply divided the FY06/22 revenue in this segment by 2.6GW, which was VSUN's production capacity during the same period, and arrived at approximately JPY31,000 per kW (Shared Research estimate). In the Green Energy segment, revenue from the operation of solar power plants (recurring revenue business) is a function of power generation income per kWh and the volume of electricity sold. A simple division of FY06/22 revenue in the recurring revenue business by 140MW (total output capacity of the company's facilities) yielded roughly JPY19,000 per kW (Shared Research estimate). In the one-time revenue business, sales equate to total sales of power plants and goods.

The cost of revenue ratio, which was 73.6% in FY06/20, increased following the acquisition of VSUN, reaching 89.5% in FY06/22. According to the company, the costs of solar cells and other raw materials account for a large portion of its cost of revenue. In contrast, the SG&A ratio, which was 21.0% in FY06/20, declined to 8.7% in FY06/22, chiefly due to a decrease in salaries, allowances, and bonuses, as well as lower container freight rates and other commission expenses. VSUN's solar panels are manufactured on a build-to-order basis, and advances are received at the time of order. The accounts receivable turnover period is about three months. Since transactions are mainly conducted in US dollars, foreign exchange impacts on purchases and sales offset each other. However, the company is subject to foreign exchange impact when it converts US dollar-based profits to Japanese yen.

Capital expenditures are affected by acquisitions of solar power plants and investments associated with solar panel manufacturing. Interest-bearing debt increased in tandem with bank borrowings obtained to finance investments, and at end-FY06/22, the debt-to-equity ratio rose to 6.6× while the equity ratio fell to 7.0%. VSUN independently obtains loans from multiple major financial institutions in Vietnam to fund its capital expenditures (the Abalance group does not offer debt guarantees). It plans to build solar cell plants with a total annual production capacity of 6GW by investing roughly USD300mn, which is about five times the amount it invested to build the existing four solar panel plants. As the first phase of the project, construction of a 3GW cell plant (investment of about USD180mn) is under way, funded by loans and cash on hand. To cover the cost of the second phase of this project and to secure funding for future business growth, the company plans to obtain new loans and also conduct VSUN's IPO via stock exchanges in Vietnam and elsewhere.

Shared Research understands that the solar panel industry is a highly competitive industry characterized by oversupply. It is also easily affected by changes in the government policies of China and other countries. VSUN's competitors are mostly major solar panel manufacturers in China. LONGi Green Energy Technology Co., Ltd. (SSE: 601012) tops the market with an annual production capacity of 60GW, followed by Trina Solar Co., Ltd. (SSE: 688599) at 50GW, and JinkoSolar Holding Co., Ltd. (NYSE: JKS) at 45GW. These companies also manufacture wafers and solar cells. In contrast, annual production capacity of VSUN's solar panel plants totals around 5GW, about 10% of the major companies' or even lower. Only a handful of manufacturers like VSUN make solar panels outside China, one being First Solar Inc. based in the US (NASDAQ: FSLR) with an annual production capacity of 9.8GW.

The International Energy Agency (IEA) predicts that global electricity demand will expand, with renewables such as solar and wind power becoming mainstream sources. IEA presents an outlook on installed capacity for each energy source based on three scenarios. In the most conservative scenario, it expects installed electricity capacity of solar power to grow from 892GW in 2021 to 3,020GW in 2030 and to 7,464GW in 2050. The less conservative scenarios project even greater capacity increases. Demand for solar panels will expand in tandem, and amid a push toward the reevaluation of supply chains due to US–China trade frictions and other factors, Shared Research understands that demand will be particularly strong for solar panels made outside China, such as those of VSUN.

Earnings trends

In FY06/22, consolidated revenue was JPY92.4bn (+243.6% YoY), operating profit was JPY1.7bn (+24.7% YoY), recurring profit was JPY1.5bn (+19.0% YoY), and net income attributable to owners of the parent was JPY867mn (+61.5% YoY). On the revenue front, orders for VSUN's solar panels in the US and European markets increased beyond initial expectations amid rising global demand for renewable energy. Operating profit also grew YoY despite sharp rises in raw material prices and container freight rates, as the company worked to negotiate purchase prices, improve production efficiency, and pass on part of the costs to customers. That said, operating profit growth fell short of the revenue growth mainly owing to hikes in raw material prices; OPM finished at 1.8% as a result, down from 5.1% in FY06/21.

In May 2023, Abalance announced an upward revision to its full-year FY06/23 earnings forecast for the third time. The revised forecast calls for consolidated revenue of JPY215.0bn (+132.6% YoY), operating profit of JPY14.0bn (+725.0% YoY), recurring profit of JPY13.5bn (+794.0% YoY), and net income attributable to owners of the parent of JPY5.7bn (+557.4% YoY). Compared to the previous forecast, these figures represent an upward revision of JPY40.0bn in consolidated revenue, JPY7.0bn in operating profit, JPY6.2bn in recurring profit, and JPY2.3bn in net income attributable to owners of the parent. According to the company, the majority of earnings contribution from VSUN's fourth solar panel plant, launched full-scale in January 2023 to address the larger-than-expected increase in US and European orders and sales of its solar panels, will be seen in Q4 or later. The profit projections also reflect improvements owing to successful pass-through of higher raw material costs and the decline in container freight rates.

The Abalance group has established a goal of becoming a core global company in the field of renewable energy by 2030. Central to its growth strategy is the achievement of 1GW in the output capacity of its own facilities in Japan and overseas, and 8GW in its annual production capacity of solar panels. To this end, it positions the Solar Panel Manufacturing business and the Green Energy business as growth drivers. The company considers the current medium-term management plan to be a preparation period for the accomplishment of these goals, and an important three years to pursue both sustainable growth and social value, and to maximize the group's corporate value.

Strengths and weaknesses

Abalance's strengths, according to Shared Research (See the "Strengths and weaknesses" section for details)

- Achieves differentiation by expanding solar panel production capacity in Vietnam, rather than in China where geopolitical risks are heightening
- Can provide end-to-end services in Japan that no other peers can match, thanks to the addition of VSUN's solar panel manufacturing capabilities
- VSUN is well recognized by third-party organizations and major purchasers for both its sustainable procurement practices and its solar panel quality, which bears comparison with major manufacturers

Weaknesses

- VSUN, which manufactures solar panels outside of China, carries a higher risk sourcing materials from China than Chinese companies manufacturing their panels domestically
- VSUN's manufacturing costs are higher than those of its main competitors because, being a latecomer in the solar panel industry, its production scale is relatively small, and the company does not manufacture upstream products
- Must maintain financial soundness to continue making large investments using bank loans; issues associated with financing could potentially limit investment

Key Financial Data

		FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22	FY06/23
Income statement(JPYmn)		**Cons.**	**Cons.**	**Cons.**	**Cons.**	**Cons.**	**Cons.**	**Cons.**	**Cons.**	**Cons.**	**Cons.**	**Company forecast**
Revenue		**2,303**	**3,347**	**4,396**	**4,540**	**6,495**	**7,301**	**5,985**	**6,678**	**26,901**	**92,435**	**215,000**
	YoY	72.4%	45.3%	31.4%	3.3%	43.1%	12.4%	-18.0%	11.6%	302.8%	243.6%	132.6%
Gross profit		**641**	**738**	**1,081**	**1,108**	**1,489**	**2,178**	**1,873**	**1,762**	**4,788**	**9,705**	
	YoY	95.5%	15.1%	46.5%	2.5%	34.4%	46.3%	-14.0%	-5.9%	171.7%	102.7%	
	Gross profit margin	27.8%	22.0%	24.6%	24.4%	22.9%	29.8%	31.3%	26.4%	17.8%	10.5%	
Operating profit		**205**	**264**	**420**	**397**	**115**	**927**	**608**	**362**	**1,361**	**1,697**	**14,000**
	YoY	123.0%	28.4%	59.5%	-5.5%	-71.0%	704.7%	-34.4%	-40.5%	276.4%	24.7%	725.0%
	Operating profit margin	8.9%	7.9%	9.6%	8.8%	1.8%	12.7%	10.2%	5.4%	5.1%	1.8%	6.5%
EBITDA		**229**	**296**	**468**	**431**	**169**	**1,050**	**882**	**627**	**2,081**	**3,309**	
	YoY	113.5%	28.9%	58.3%	-7.9%	-60.8%	521.0%	-16.0%	-29.0%	232.1%	59.0%	
	EBITDA margin	10.0%	8.8%	10.6%	9.5%	2.6%	14.4%	14.7%	9.4%	7.7%	3.6%	
Recurring profit		**115**	**241**	**339**	**427**	**49**	**874**	**566**	**306**	**1,269**	**1,510**	**13,500**
	YoY	120.3%	108.5%	40.9%	25.8%	-88.6%	1,700.1%	-35.2%	-46.0%	315.3%	19.0%	794.0%
	Recurring profit margin	5.0%	7.2%	7.7%	9.4%	0.7%	12.0%	9.5%	4.6%	4.7%	1.6%	6.3%
Net income		**117**	**234**	**200**	**231**	**-176**	**757**	**316**	**211**	**537**	**867**	**5,700**
	YoY	273.6%	100.6%	-14.6%	15.8%	-	-	-58.2%	-33.1%	154.2%	61.5%	557.4%
	Net margin	5.06%	6.99%	4.55%	5.10%	-2.7%	10.4%	5.3%	3.2%	2.0%	0.9%	2.7%
Per-share data(JPY, after stock split adjustment)												
Shares issued(year-end; '000)		10,543	15,123	15,123	15,123	15,569	15,569	15,569	15,587	16,002	16,702	
EPS		-28.7	20.9	13.2	15.3	0.0	48.6	20.4	13.6	34.2	52.8	334.5
Dividend per share		-	-	10.00	11.00	11.00	17.00	17.00	17.00	17.00	18.00	
Book value per share		9.05	57.13	68.68	80.65	68.51	113.54	127.15	134.99	251.62	356.95	
Balance sheet(JPYmn)												
Total current assets		**921**	**1,715**	**2,093**	**2,420**	**4,692**	**5,227**	**6,078**	**8,553**	**22,537**	**57,450**	
	Cash and deposits	295	494	407	496	672	601	799	1,209	4,722	3,966	
	Notes and accounts receivable	96	408	525	473	335	335	393	303	1,312	6,156	
	Merchandise and finished goods	378	499	263	385	423	327	172	246	6,480	26,740	
Tangible fixed assets		71	161	189	223	1,222	1,456	4,239	5,529	15,201	20,599	
Intangible assets		88	81	61	5	290	217	195	110	365	4,688	
Investments and other assets		90	115	188	142	195	289	459	554	1,268	2,432	
Total assets		**1,169**	**2,073**	**2,531**	**2,790**	**6,400**	**7,189**	**10,985**	**14,765**	**39,388**	**85,181**	
Total current liabilities		**587**	**821**	**1,127**	**1,368**	**3,545**	**3,873**	**4,641**	**6,745**	**26,212**	**57,721**	
Total fixed liabilities		**487**	**386**	**361**	**203**	**1,733**	**1,499**	**4,312**	**5,859**	**8,398**	**19,452**	
Total liabilities		**1,074**	**1,207**	**1,488**	**1,571**	**5,279**	**5,373**	**8,953**	**12,605**	**34,611**	**77,174**	
Total net assets		**506**	**866**	**1,043**	**1,219**	**1,121**	**1,816**	**2,032**	**2,159**	**4,777**	**8,007**	
Interest-bearing debt		613	497	631	611	3,230	3,233	5,323	8,982	17,984	39,273	
Net debt(after deducting cash and deposits)		318	3	225	115	2,558	2,632	4,524	7,773	13,262	35,307	
Net assets(excl. stock acquisition rights and and non-controlling interests)		506	864	1,038	1,219	1,077	1,767	1,969	2,093	4,006	5,933	
Cash flow statement(JPYmn)												
Cash flows from operating activities		121	-77	57	206	-984	405	-147	-861	-608	-6,348	
Cash flows from investing activities		-28	-116	-252	-75	-864	-559	-1,620	-472	-1,391	-13,321	
Cash flows from financing activities		48	393	104	-85	1,991	-62	1,913	1,465	5,290	17,752	
Financial ratios												
ROA (RP-based)		9.1%	14.8%	14.7%	16.0%	1.1%	12.9%	6.2%	2.4%	4.7%	2.4%	
Return on equity(ROE)		27.3%	34.2%	21.0%	20.5%	-15.3%	53.2%	16.9%	10.4%	17.6%	17.4%	
Interest-bearing debt/Net assets(times)		1.2	0.6	0.6	0.5	3.0	1.8	2.7	4.3	4.5	6.6	
Net debt/Net assets(times)		0.6	0.0	0.2	0.1	2.4	1.5	2.3	3.7	3.3	6.0	
Equity ratio		43.3%	41.7%	41.0%	43.7%	16.8%	24.6%	17.9%	14.2%	10.2%	7.0%	
Interest-bearing debt/EBITDA(times)		2.7	1.7	1.3	1.4	19.1	3.1	6.0	14.3	8.6	11.9	
Net debt/EBITDA(times)		1.4	0.0	0.5	0.3	15.1	2.5	5.1	12.4	6.4	10.7	

Source: Shared Research based on company data

Notes: The company conducted a 100-for-1 stock split in FY06/14, and a 3-for-1 stock split in September 2022. Other changes in the number of shares outstanding are due to capital increases via third-party allotment and/or the exercise of share subscription rights

Dividend per share (dividend per share) is on a parent-only basis; EBITDA is obtained by adding depreciation and goodwill amortization to operating profit

Trends and outlook

Quarterly trends and results

Earnings (quarterly)	FY06/22				FY06/23				FY03/23	
(cumulative) (JPYmn)	Q1	Q1-Q2	Q1-Q3	Q1-Q4	Q1	Q1-Q2	Q1-Q3	Q1-Q4	% of forecast	FY forecast
Revenue	9,805	26,655	55,652	92,435	55,729	112,071	164,824	-	76.7%	215,000
YoY	409.8%	130.3%	184.8%	243.6%	468.4%	320.5%	196.2%	-		132.6%
Cost of revenue	8,317	21,886	49,185	82,729	50,953	99,357	144,475	-		
YoY	569.3%	133.5%	215.9%	274.1%	512.6%	354.0%	193.7%	-		
Cost of revenue ratio	84.8%	82.1%	88.4%	89.5%	91.4%	88.7%	87.7%	-		
Gross profit	1,487	4,768	6,467	9,705	4,776	12,714	20,348	-		
YoY	118.4%	116.8%	62.7%	102.7%	221.2%	166.7%	214.6%	-		
Gross profit margin	15.2%	17.9%	11.6%	10.5%	8.6%	11.3%	12.3%	-		
SG&A expenses	1,133	4,236	5,743	8,007	3,147	7,546	10,366	-		
YoY	290.1%	212.7%	110.8%	133.6%	177.8%	78.1%	80.5%	-		
SG&A ratio	11.6%	15.9%	10.3%	8.7%	5.6%	6.7%	6.3%	-		
Operating profit	354	532	723	1,697	1,629	5,167	9,982	-	71.3%	14,000
YoY	-9.3%	-37.1%	-42.2%	24.7%	360.2%	871.2%	1,280.6%	-		725.0%
Operating profit margin	3.6%	2.0%	1.3%	1.8%	2.9%	4.6%	6.1%	-		6.5%
Recurring profit	271	340	486	1,510	1,444	5,860	11,133	-	82.5%	13,500
YoY	-19.2%	-61.4%	-60.0%	19.0%	432.8%	1,623.5%	2,190.7%	-		794.0%
Recurring profit margin	2.8%	1.3%	0.9%	1.6%	2.6%	5.2%	6.8%	-		6.3%
Net income attributable to owners of the parent	855	803	776	867	531	2,269	4,249	-	74.5%	5,700
YoY	344.6%	130.3%	33.3%	61.5%	-37.9%	182.6%	447.6%	-		557.4%
Net margin	8.7%	3.0%	1.4%	0.9%	1.0%	2.0%	2.6%	-		2.7%

Earnings (quarterly)	FY06/22				FY06/23			
(JPYmn)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Revenue	9,805	16,850	28,997	36,783	55,729	56,342	52,753	
YoY	409.8%	74.6%	263.8%	400.0%	468.4%	234.4%	81.9%	-
Cost of revenue	8,317	13,569	27,299	33,544	50,953	48,404	45,118	
YoY	569.3%	66.9%	340.6%	412.7%	512.6%	256.7%	65.3%	-
Cost of revenue ratio	84.8%	80.5%	94.1%	91.2%	91.4%	85.9%	85.5%	-
Gross profit	1,487	3,281	1,699	3,238	4,776	7,938	7,634	
YoY	118.4%	116.0%	-4.3%	298.3%	221.2%	141.9%	349.3%	-
Gross profit margin	15.2%	19.5%	5.9%	8.8%	8.6%	14.1%	14.5%	-
SG&A expenses	1,133	3,103	1,507	2,264	3,147	4,399	2,820	
YoY	290.1%	191.6%	10.0%	222.5%	177.8%	41.8%	87.1%	-
SG&A ratio	11.6%	18.4%	5.2%	6.2%	5.6%	7.8%	5.3%	-
Operating profit	354	178	191	974	1,629	3,538	4,815	
YoY	-9.3%	-60.9%	-52.8%	777.5%	360.2%	1,887.6%	2,420.9%	-
Operating profit margin	3.6%	1.1%	0.7%	2.6%	2.9%	6.3%	9.1%	-
Recurring profit	271	69	146	1,024	1,444	4,416	5,273	
YoY	-19.2%	-87.4%	-56.1%	1,761.8%	432.8%	6,300.0%	3,511.6%	-
Recurring profit margin	2.8%	0.4%	0.5%	2.8%	2.6%	7.8%	10.0%	-
Net income attributable to owners of the parent	855	-52	-27	91	531	1,738	1,980	
YoY	344.6%	-	-	-	-37.9%	-	-	-
Net margin	8.7%	-	-	0.2%	1.0%	3.1%	3.8%	-

Source: Shared Research based on company data

Revenue by segment

Revenue by segment(cumulative)	FY06/22				FY06/23			
(JPYmn)	Q1	Q1-Q2	Q1-Q3	Q1-Q4	Q1	Q1-Q2	Q1-Q3	Q1-Q4
Solar Panel Manufacturing business	7,398	22,723	49,369	81,501	53,250	107,304	155,945	
YoY	-	159.4%	228.7%	287.9%	619.8%	372.2%	215.9%	-
% of revenue	75.5%	85.2%	88.7%	88.2%	95.6%	95.7%	94.6%	-
Green Energy business	2,164	3,618	5,889	10,234	2,309	4,425	8,357	
YoY	26.3%	44.6%	44.1%	92.7%	6.7%	22.3%	41.9%	-
% of revenue	22.1%	13.6%	10.6%	11.1%	4.1%	3.9%	5.1%	-
IT business	9	14	40	292	154	301	444	
YoY	50.0%	27.3%	2.6%	484.0%	1,611.1%	2,050.0%	1,010.0%	-
% of revenue	0.1%	0.1%	0.1%	0.3%	0.3%	0.3%	0.3%	-
Photocatalyst business	24	55	71	80	10	18	29	
YoY	9.1%	1.9%	-25.3%	-52.9%	-58.3%	-67.3%	-59.2%	-
% of revenue	0.2%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	-
Reportable segments total	9,597	26,412	55,369	92,108	55,724	112,050	164,776	
YoY	450.6%	133.2%	187.8%	247.0%	480.6%	324.2%	197.6%	-
% of revenue	97.9%	99.1%	99.5%	99.6%	100.0%	100.0%	100.0%	-
Other	208	242	282	326	5	21	47	
YoY	15.6%	-0.8%	-6.3%	-8.2%	-97.6%	-91.3%	-83.3%	-
% of revenue	2.1%	0.9%	0.5%	0.4%	0.0%	0.0%	0.0%	-
Total	9,805	26,655	55,652	92,435	55,729	112,071	164,824	
YoY	409.8%	130.3%	184.8%	243.6%	468.4%	320.5%	196.2%	-
Revenue by segment(By quarter)	**FY06/22**				**FY06/23**			
(JPYmn)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Solar Panel Manufacturing business	7,398	15,325	26,646	32,132	53,250	54,054	48,641	
YoY	23.4%	107.2%	73.9%	20.6%	65.7%	1.5%	-10.0%	-
% of revenue	75.5%	90.9%	91.9%	87.4%	95.6%	95.9%	92.2%	-
Green Energy business	2,164	1,454	2,271	4,345	2,309	2,116	3,932	
YoY	26.3%	84.3%	43.3%	255.0%	6.7%	45.5%	73.1%	-
% of revenue	22.1%	8.6%	7.8%	11.8%	4.1%	3.8%	7.5%	-
IT business	9	5	26	252	154	147	143	
YoY	50.0%	0.0%	-7.1%	2,190.9%	1,611.1%	2,840.0%	450.0%	-
% of revenue	0.1%	0.0%	0.1%	0.7%	0.3%	0.3%	0.3%	-
Photocatalyst business	24	31	16	9	10	8	11	
YoY	9.1%	-3.1%	-61.0%	-88.0%	-58.3%	-74.2%	-31.3%	-
% of revenue	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	-
Reportable segments total	9,597	16,815	28,957	36,739	55,724	56,326	52,726	
YoY	450.6%	75.4%	265.9%	403.0%	480.6%	235.0%	82.1%	-
% of revenue	97.9%	99.8%	99.9%	99.9%	100.0%	100.0%	99.9%	-
Other	208	34	40	44	5	16	26	
YoY	15.6%	-46.9%	-29.8%	-18.5%	-97.6%	-52.9%	-35.0%	-
% of revenue	2.1%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	-
Total	9,805	16,850	28,997	36,783	55,729	56,342	52,753	
YoY	409.8%	74.6%	263.8%	400.0%	468.4%	234.4%	81.9%	-

Source: Shared Research based on company data

Operating profit by segment

Operating profit by segment(cumulative)	FY06/22				FY06/23			
(JPYmn)	Q1	Q1-Q2	Q1-Q3	Q1-Q4	Q1	Q1-Q2	Q1-Q3	Q1-Q4
Solar Panel Manufacturing business	-29	223	429	1,238	1,175	4,612	8,927	
YoY	-	-59.1%	-40.3%	69.4%	-	-	-	-
% of operating profit	-	41.9%	59.3%	73.0%	72.1%	89.3%	89.4%	-
Operating profit margin	-	1.0%	0.9%	1.5%	2.2%	4.3%	5.7%	-
Green Energy business	501	619	772	1,204	640	932	1,650	
YoY	-0.6%	23.6%	-4.7%	19.8%	27.7%	50.6%	113.7%	-
% of operating profit	141.5%	116.4%	106.8%	70.9%	39.3%	18.0%	16.5%	-
Operating profit margin	23.2%	17.1%	13.1%	11.8%	27.7%	21.1%	19.7%	-
IT business	0	0	5	7	1	11	17	
YoY	-	-	-66.7%	-56.3%	-	-	240.0%	-
% of operating profit	-	-	0.7%	0.4%	0.1%	0.2%	0.2%	-
Operating profit margin	-	-	12.5%	2.4%	0.6%	3.7%	3.8%	-
Photocatalyst business	5	9	-1	-17	-9	-23	-31	
YoY	-	-	-	-	-	-	-	-
% of operating profit	1.4%	1.7%	-	-	-	-	-	-
Operating profit margin	20.8%	16.4%	-	-	-	-	-	-
Reportable segments total	478	852	1,204	2,433	1,808	5,532	10,563	
YoY	-3.6%	-17.8%	-22.2%	36.2%	278.2%	549.3%	777.3%	-
% of operating profit	135.0%	160.2%	166.5%	143.4%	111.0%	107.1%	105.8%	-
Operating profit margin	5.0%	3.2%	2.2%	2.6%	3.2%	4.9%	6.4%	-
Other	0	-14	-35	-45	-36	-62	-91	
YoY	-	-	-	-	-	-	-	-
% of operating profit	-	-	-	-	-	-	-	-
Adjustments	-124	-305	-444	-689	-143	-302	-489	
YoY	-	-	-	-	-	-	-	-
% of operating profit	-	-	-	-	-	-	-	-
Total	354	532	723	1,697	1,629	5,167	9,982	
YoY	-9.3%	-37.1%	-42.2%	24.7%	360.2%	871.2%	-	-
Operating profit margin	3.6%	2.0%	1.3%	1.8%	2.9%	4.6%	6.1%	-
Operating profit by segment(By quarter)	**FY06/22**				**FY06/23**			
(JPYmn)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Solar Panel Manufacturing business	-29	252	206	1,238	1,175	3,437	4,315	
YoY	-	-53.8%	18.4%	69.4%	-	-	-	-
% of operating profit	-	141.6%	107.9%	127.1%	72.1%	97.1%	89.6%	-
Operating profit margin	-	1.6%	0.8%	3.9%	2.2%	6.4%	8.9%	-
Green Energy business	501	118	153	1,204	640	292	718	
YoY	-0.6%	-	-50.5%	19.8%	27.7%	147.5%	369.3%	-
% of operating profit	141.5%	66.3%	80.1%	123.6%	39.3%	8.3%	14.9%	-
Operating profit margin	23.2%	8.1%	6.7%	27.7%	27.7%	13.8%	18.3%	-
IT business	-	-	5	7	1	10	6	

	YoY	-	-	-77.3%	-56.3%	-	-	20.0%	-
	% of operating profit	-	-	2.6%	0.7%	0.1%	0.3%	0.1%	-
	Operating profit margin	-	-	19.2%	2.8%	0.6%	6.8%	4.2%	-
Photocatalyst business		5	4	-10	-17	-9	-14	-8	
	YoY	-	300.0%	-	-	-	-	-	-
	% of operating profit	1.4%	2.2%	-	-	-	-	-	-
	Operating profit margin	20.8%	12.9%	-	-	-	-	-	-
Reportable segments total		478	374	352	2,433	1,808	3,724	5,031	
	YoY	-3.6%	-30.9%	-31.1%	36.2%	278.2%	895.7%	-	-
	% of operating profit	135.0%	210.1%	184.3%	249.8%	111.0%	105.3%	104.5%	-
	Operating profit margin	5.0%	2.2%	1.2%	6.6%	3.2%	6.6%	9.5%	-
Other		-	-14	-21	-45	-36	-26	-29	
	YoY	-	-	-	-	-	-	-	-
	% of operating profit	-	-	-	-	-	-	-	-
Total		354	178	191	974	1,629	3,538	4,815	
YoY		-9.3%	-60.9%	-52.8%	777.5%	360.2%	-	-	-
Operating profit margin		3.6%	1.1%	0.7%	2.6%	2.9%	6.3%	9.1%	-

Source: Shared Research based on company data

Cumulative Q3 FY06/23 results

Revenue: JPY164.8bn (+196.2% YoY)
Operating profit: JPY10.0bn (13.8x YoY)
OPM: 6.1% (1.3% in cumulative Q3 FY06/22)
Recurring profit: JPY11.1bn (22.9x YoY)
Net income attributable to owners of the parent: JPY4.2bn (+447.6% YoY)

The Solar Panel Manufacturing business and the Green Energy business drove overall performance. At VSUN in charge of solar panel manufacture and sales, orders and sales surpassed expectations, lifted by high demand from the European and US markets seeking to advance decarbonization. Panel shipments also improved, thanks to the easing of port congestions caused by the import and export of raw materials and finished goods. As a result, consolidated revenue was up 196.2% YoY.

Operating profit grew 13.8x YoY. Factors affecting operating profit included the pass-through of component costs and finished goods transport costs that rose sharply due to global inflation, and a decline in container freight rates. OPM increased 1.3pp YoY to 6.1%. The company also recorded equity-method gains from investing in Meiji Machine, and non-operating gains such as foreign exchange gains associated with solar panel exports; recurring profit increased 22.9x YoY as a result.

Progress versus full-year forecast

In May 2023, the company announced a revision to its full-year FY06/23 earnings forecast for the third time. The progress rate versus the revised forecast was 76.7% for revenue, 71.3% for operating profit, 82.5% for recurring profit, and 74.5% for net income attributable to owners of the parent.

Investment plan

In line with the launch of VSUN's fourth solar panel plant, Abalance decided to manufacture solar cells (N-type TOPCon) in-house, rather than sourcing them from outside parties. To this end, it is currently constructing solar cell plants in Vietnam's Phu Tho Province. The company looks to achieve total annual production capacity of 6GW (total investment of about USD300mn), and the plant currently under construction is the first phase (3GW; investment of about USD180mn) of the project. The construction is slated for completion in October 2023. In addition to using the in-house manufactured cells in VSUN's solar panels, the company plans to sell surplus output to outside customers. In-house cell production will allow the company to lower cost and improve its profit margins, stabilize procurement, and enhance its ability to respond to import restrictions of various countries. As of the announcement of cumulative Q3 results, Abalance maintained that construction was progressing as planned. The company uses own capital and borrowings as funds for capital expenditures.

Entry into the storage battery business

In April 2023, the company entered the grid-scale storage battery business through WWB, with a view to further expanding the Green Energy business. With regard to the installation and operation of grid-scale batteries, WWB will join hands with major domestic utilities, construction companies, and heavy electric system manufacturers to cover engineering, procurement, construction, and trial adjustments, as well as control of power supply and demand via the electric power market transaction system. The introduction of grid-scale batteries grants users the adjustment capability against power supply and demand fluctuations. The business will not only contribute to the effective use of renewable energy and the spread of renewable energy in Japan, but also drive Abalance's business growth in the renewable energy business.

Financing activities

In January 2023, Abalance raised approximately JPY1.4bn through third-party allotment of newly issued shares. The proceeds have been earmarked for investment into solar power plants. The company intends to increase the output capacity of its proprietary solar plants to 1GW by 2030, and to this end, plans to expand its domestic solar plant portfolio by 50MW annually. It will use the raised funds to step up development and ownership mainly of high-voltage solar power plants. In September 2022, Abalance procured working capital of JPY400mn through a sustainability-linked loan agreement, which takes into consideration the company's decarbonization initiatives and performance in the Green Energy business. Under this arrangement, the loan's interest rate spread is adjusted depending on subsidiary WWB's level of contribution to decarbonization efforts.

Signing of a long-term partnership agreement with the Bank for Investment and Development of Vietnam
In May 2023, VSUN entered into a long-term partnership agreement with the Bank for Investment and Development of Vietnam (HOSE: BID), the country's largest state-owned bank. Under this agreement, the two parties will seek to accurately capture market opportunities, promote business diversification and growth, and enhance market competitiveness by leveraging and complementing their individual advantages. In doing so, they will work toward achieving a decarbonized society, which is their common goal. Specifically, VSUN plans to obtain financing for accelerating business activities, including plant construction.

VSUN's IPO

Since 2021, VSUN has been preparing for an IPO on the UPCoM OTC market in Vietnam to diversify its financing means and improve brand power. To complete the registration required for listing under the securities exchange law in Vietnam, VSUN has submitted necessary documents to the authorities and the papers are currently being reviewed. In addition, the company is considering IPOs on foreign securities markets outside Vietnam in preparation for greater funding needs.

Results in key reportable segments

Solar Panel Manufacturing business

Revenue: JPY155.9bn (+215.9% YoY)
Operating profit: JPY8.9bn (20.8x YoY)
OPM: 5.7% (0.9% in cumulative Q3 FY06/22)

Revenue and operating profit soared YoY in this business, fueled by robust demand for VSUN's solar panels in Europe and the US. In January 2023, the fourth solar panel plant began full-scale operation, and the company's annual production capacity expanded from the previous 2.6GW to 5.0GW. To maintain normal operations and shipments during the Chinese New Year and the Vietnamese Tet holidays, the company sought the cooperation of suppliers and adjusted production in advance to avoid a decline in capacity utilization. While VSUN has historically expanded its business by selling industrial and home-use solar panels for the European market, the sale of solar panels to the US market expanded rapidly in recent years. Shipments increased as port congestions eased. Operating profit was also up YoY, thanks to successful pass-through of raw material, goods transport, and other costs that sharply increased due to global inflation. Other contributing factors included the decline in container freight rates, and improvements in the company's production efficiency.

Green Energy business

Revenue: JPY8.4bn (+41.9% YoY)
Operating profit: JPY1.7bn (+113.7% YoY)
OPM: 19.7% (13.1% in cumulative Q3 F06/22)

Revenue and operating profit grew YoY in this business, primarily due to solid performance in solar power plant trades, sale of goods related to raw materials, sale of electricity, and income from operation and maintenance (O&M) services. Sale of power plants and goods related to components generated revenue of JPY5.9bn, sale of electricity and O&M services JPY2.4bn, and other operations JPY88mn. In the Green Energy business, the company promotes both the one-time revenue business and the recurring revenue business mainly through WWB and Valors. Operations in the one-time revenue business include sale of (low-voltage) solar power plants, as well as sale of solar panels, power conditioning systems, and other products for industrial use, as well as storage batteries for both industrial and home use. In the recurring revenue business, the company seeks to secure stable income from electricity sales through continued ownership of solar power plants after their construction. It actively pursues M&A activities to acquire companies owning solar power generation facilities, and also to strengthen property sourcing and construction management capabilities.

Full-year company forecast

Full-year company forecast

	FY06/22			FY06/23		
(JPYmn)	1H results	2H results	FY results	1H results	2H forecast	FY forecast
Revenue	26,655	65,780	92,435	112,071	102,929	215,000
YoY	130.3%	329.2%	243.6%	320.5%	56.5%	132.6%
Operating profit	532	1,165	1,697	5,167	8,833	14,000
YoY	-37.1%	125.9%	24.7%	871.2%	658.2%	725.0%
Operating profit margin	2.0%	1.8%	1.8%	4.6%	8.6%	6.5%
Recurring profit	340	1,170	1,510	5,860	7,640	13,500
YoY	-61.4%	201.9%	19.0%	1,623.5%	553.0%	794.0%
Recurring profit margin	1.3%	1.8%	1.6%	5.2%	7.4%	6.3%
Net income attributable to owners of the parent	803	64	867	2,269	3,431	5,700
YoY	130.3%	-66.0%	61.5%	182.6%	-	557.4%
Net margin	3.0%	0.1%	0.9%	2.0%	3.3%	2.7%

Source: Shared Research based on company data

In May 2023, Abalance announced an upward revision to its full-year FY06/23 earnings forecast for the third time. The revised forecast called for consolidated revenue of JPY215.0bn (+132.6% YoY), operating profit of JPY14.0bn (+725.0% YoY), recurring profit of JPY13.5bn (+794.0% YoY), and net income attributable to owners of the parent of JPY5.7bn (+557.4% YoY).

Compared to the previous forecast, these figures represented an upward revision of JPY40.0bn in consolidated revenue, JPY7.0bn in operating profit, JPY6.2bn in recurring profit, and JPY2.3bn in net income attributable to owners of the parent.

Amid continued strong demand in the US and European markets fueled by momentum for decarbonization, solar panel sales exceeded VSUN's previous projection (announced in February 2023). Profit margins improved as well, thanks to lower container freight rates and successful pass-through of the uptick in component purchase prices and transport expenses due to inflation. VSUN began operating its fourth solar panel plant (annual production capacity of 2.4GW) in January 2023. For the most part, however, shipments of the products manufactured there will only be reflected in the books in Q4 or later, because of the lead time between the start of production and the shipment, given that VSUN only manufactures on a build-to-order basis.

Medium-term management plan

Upward revision of quantitative targets

In February 2023, shortly after announcing a second upward revision to its FY06/23 earnings forecast, Abalance also revised upward its revenue and profit targets for FY06/24, the final year of the current medium-term management plan (FY06/22–FY06/24) unveiled in September 2022.

Strong performance of VSUN was the main driver behind the revision. The impact of profitability improvements from the new solar cell plant (slated for completion in October 2023) has not been reflected in the quantitative targets yet, as the company plans to reassess these figures once it becomes possible to rationally determine a future outlook. Earnings contribution associated with the full-scale operation of VSUN's fourth solar panel plant since January 2023 has not been taken into account as well. While there are no major changes to its growth strategy, the company updated certain parts of its priority measures, including production capacity expansion and construction plans for the new solar cell plants at VSUN.

Revised FY06/24 forecast
Revenue: JPY251.8bn (previous forecast of JPY150.0bn)
Operating profit: JPY15.8bn (JPY4.5bn)
Recurring profit: JPY15.8bn (JPY3.8bn)
Net income attributable to owners of the parent: JPY8.0bn (previously undisclosed)

Medium-term management plan (February 2023)

	FY06/22				FY06/23				FY06/24				CAGR
(JPYmn)	Results	YoY	YoY change	% of total	Budget	YoY	YoY change	% of total	Budget	YoY	YoY change	% of total	
Revenue	92,435	243.6%	65,534	100.0%	175,000	89.3%	82,565	100.0%	251,800	43.9%	76,800	100.0%	65.0%
Solar Panel Manufacturing business	81,775	289.2%	60,762	88.5%	165,000	101.8%	83,225	94.3%	239,000	44.8%	74,000	94.9%	71.0%
Green Energy business(one-time)	8,009	82.0%	3,608	8.7%	6,700	-16.3%	-1,309	3.8%	7,800	16.4%	1,100	3.1%	-1.3%
Green Energy business(recurring)	2,651	78.3%	1,164	2.9%	3,300	24.5%	649	1.9%	5,000	51.5%	1,700	2.0%	37.3%
Operating profit	1,697	24.7%	336	1.8%	7,000	312.5%	5,303	4.0%	15,800	125.7%	8,800	6.3%	205.1%
Recurring profit	1,510	19.0%	241	1.6%	7,300	383.4%	5,790	4.2%	15,800	116.4%	8,500	6.3%	223.5%
Net income attributable to owners of the parent	867	61.5%	330	0.9%	3,400	292.2%	2,533	1.9%	8,000	135.3%	4,600	3.2%	203.8%

Source: Shared Research based on company data

Key growth strategies

The Abalance group has set forth a goal of becoming a core global company in the field of renewable energy by 2030. Central to its growth strategy is the achievement of 1GW in output capacity using its own facilities in Japan and overseas, and 8GW in annual manufacturing capacity of solar panels. Accordingly, the Solar Panel Manufacturing business and the Green Energy business have been positioned as the growth drivers. Abalance considers the current medium-term management plan to be a preparation period for the accomplishment of these goals, and an important three years to pursue both sustainable growth and social value, and to maximize the group's corporate value.

In Green Energy, Abalance intends to advance both the one-time revenue business and the recurring revenue business. The one-time revenue business mainly comprises the sale of solar power plants (such as low-voltage plants), sale of industrial products including solar panels and power control systems, and the sale of industrial and home-use storage batteries. In the recurring-revenue business, Abalance seeks to obtain stable income from selling the electricity generated by the solar power plants it develops and owns on a long-term basis. The company plans to accelerate efforts toward achieving output capacity of 1GW, which is 1% of the total output capacity of 100GW targeted for 2030 under the Japanese government's Sixth Strategic Energy Plan.

In Solar Panel Manufacturing, Abalance will work to expand production capacity of solar panels, and also build plants to manufacture solar cells, which are the key components of solar panels. Total annual production capacity of solar panels has already reached 5GW with the operation of the fourth plant (annual production capacity of 2.4GW) starting in October 2022. The planned annual production capacity of the solar cell plants (total investment of USD300mn) is 6GW. The phase 1 construction work is already under way, and a plant with an annual production capacity of 3GW (total investment of about USD180mn) is slated for completion in October 2023. As a plan for the medium to long term, Abalance contemplates solar cell sales to outside parties, manufacture of wafers, and expansion of solar panel sales to South America and Africa.

The quantitative targets of the current medium-term management plan (shown in the table above) do not factor in the operation of the fourth solar panel plant and the phase 1 solar cell plant, as Abalance plans to reflect their effects on performance once it becomes possible to rationally determine the future outlook based on the situation post-launch. The addition of the fourth plant boosted the company's solar panel production capacity to 5GW. If demand continues to expand, the added capacity can lead to revenue growth and margin improvements from economies of scale. Further, Shared Research understands that bringing the manufacture of solar cells in-house with the launch of the 3GW phase 1 plant will lower the cost of raw materials and contribute to better profit margins.

Priority measures toward enhancement of corporate value

Green Energy business

- Promote solar self-consumption and solar sharing projects
- Acquire businesses (expedite business expansion) mainly in the renewable energy domain
- Develop hydrogen-based products; promote business centered on such products
- Form business alliances and strategic partnerships with major companies and general trading firms

Solar Panel Manufacturing business

- Full-scale operation of VSUN's fourth plant (increase annual production capacity from 2.6GW to 5GW)
- Complete construction of phase 1 solar cell plant and move on to phase 2

- Improve profit margins further
- VSUN's IPO in Vietnam and other overseas stock markets

Management and Finance

- Strengthen governance further in compliance with the corporate governance code
- Improve equity ratio (10% or higher); secure diverse financing options
- Change listing to the Prime Market

While specific quantitative targets have not been set, Abalance intends to achieve a high ROE, and also pay attention to return on invested capital (ROIC) as a management indicator in order to pursue sustainable growth of group corporate value.

Progress versus the medium-term management plan

The priority measures for the Green Energy business and the Solar Panel Manufacturing business are progressing as planned, although the spread of COVID-19 hampered sales activities at one point. VSUN's fourth solar panel plant has been in full operation since January 2023, and the 3GW phase 1 solar cell plant is due for completion in October 2023. Efforts toward other goals are also making progress as scheduled. In terms of business management and finance, the company conducted capital increases via third-party allotment to improve the equity ratio. (The equity ratio as of end-FY06/22 was 7.0%.)

Business

Business overview

The Abalance group comprises the parent company Abalance, consolidated subsidiaries, and affiliates. The parent is a pure holding company, and all business operations are handled by the group companies that fall under its umbrella. Key consolidated subsidiaries include WWB Corporation (unlisted) and Valors Corporation (unlisted) both in the Green Energy business, and Vietnam Sunergy Joint Stock Company (VSUN; unlisted) in the Solar Panel Manufacturing business.

Consolidated subsidiaries

	Name	Location	Paid-in capital/ capital contributions (JPYmn)	Primary business	% of voting rights/stake	Relationship with Abalance
1	WWB Corporation	Tokyo	100	Green Energy, Other businesses	100	Four concurrently serving officers
2	Tohoku Science Co., Ltd.	Tokyo	10	Green Energy	51	Financial support; one concurrently serving officer
3	Valors Corporation	Osaka	100	Green Energy	99.9	Two concurrently serving officers
4	Valors Engineering Corporation	Osaka	9	Green Energy	99.9	Two concurrently serving officers
5	Fuji Solar Corporation	Tokyo	1	Green Energy	51	One concurrently serving officer
6	Sanyo Power LLC	Tokyo	0	Green Energy	51	One concurrently serving officer
7	WWB Solar 1 LLC	Tokyo	0	Green Energy	100	
8	WWB Solar 2 LLC	Tokyo	0	Green Energy	100	One concurrently serving officer
9	Kakuda Electric Fuel Development LLC	Tokyo	0	Green Energy	100	
10	Kakuda Electric Fuel Development Silent Partnership	Miyagi Pref.	610	Green Energy	100	
11	WWB Wind Farm LLC	Tokyo	0	Green Energy	100	One concurrently serving officer
12	Bless Co., Ltd.	Osaka	7	Green Energy	100	One concurrently serving officer
13	Campanio Solar Co., Ltd.	Osaka	1	Green Energy	100	
14	Japan Solar Power Co., Ltd.	Tokyo	50	Green Energy	100	
15	Japan Solar Energy Co., Ltd.	Tokyo	5	Green Energy	100	
16	Japan Mirai Energy Co., Ltd.	Tokyo	30	Green Energy	100	
17	J. Mirai Co., Ltd.	Tokyo	3	Green Energy	100	
18	Vietnam Sunergy Joint Stock Company	Vietnam	1,793	Solar Panel Manufacturing	84.85	One concurrently serving officer
19	Abit Corporation	Tokyo	100	IT	100	Two concurrently serving officers
20	Digital Sign Co., Ltd.	Tokyo	100	IT	100	
21	Forthink Co., Ltd.	Hokkaido	10	IT	100	
22	Japan Photocatalyst Center Corporation	Saga Pref.	100	Photocatalyst	93.3	Financial support; one concurrently serving officer
23	Win Power Ltd.	Bangladesh	1	Other businesses	100	
	Seven other subsidiaries					

Source: Shared Research based on company data

Equity-method affiliates

	Name	Location	Paid-in capital/ capital contributions (JPYmn)	Primary business	% of voting rights/stake	Relationship with Abalance
1	Joyo Power Silent Partnership	Tokyo	20	Green Energy	30	
2	Toyo Power Co., Ltd.	Tokyo	8	Green Energy	39	Financial support; one concurrently serving officer
3	Yojo Power Co., Ltd.	Tokyo	1	Green Energy	39	Financial support; one concurrently serving officer
4	Japan Synergy Electric Power Silent Parnership	Tokyo	10	Green Energy	30	
5	Meiji Machine Co., Ltd.	Tokyo	100	Green Energy	39.99	Three concurrently serving officers

Source: Shared Research based on company data

The company's reportable segments are classified by business areas: namely Green Energy, Solar Panel Manufacturing, Photocatalyst, and IT. In addition, the company engages in businesses such as the purchase, sale, and rental of construction machinery under Other businesses.

- Green Energy business: Purchase/sale (trades) of solar power plants, sale of solar panels and related goods, power plant construction work, sale of electricity generated via solar and wind power systems
- Solar Panel Manufacturing business: Manufacture and sale of solar panels
- IT business: Introduction of company's mainstay products to new customers, sale of software licenses, systems development on contract, operation and maintenance work
- Photocatalyst business: Manufacture and sale of titanium coating agents and products utilizing such agents

Abalance's mainstay businesses are Solar Panel Manufacturing and Green Energy, each accounting for 88.2% and 11.1% of consolidated revenue in FY06/22, respectively. Solar Panel Manufacturing made up 50.9% of operating profit before adjustments and inclusion of Other businesses, while Green Energy accounted for 49.5% (there were some businesses that finished slightly in the red). Among the reportable segments, OPM was high in Green Energy at 11.8% whereas OPM trended at around 2.0% in other segments. By region, North America accounted for 73.8% of consolidated revenue, followed by Japan at 12.0%, Europe 4.0%, and Asia 1.7%. Other regions made up the remaining 8.5%.

Revenue and operating profit compositions by reportable segment

% of revenue(JPYmn)	FY06/22				
	Revenue		Operating profit		OPM
		% of total		% of total	
Reportable segment					
Green Energy business	10,234	11.1%	1,204	49.5%	11.8%
Solar Panel Manufacturing business	81,501	88.2%	1,238	50.9%	1.5%
IT business	292	0.3%	7	0.3%	2.4%
Photocatalyst business	80	0.1%	-17	-0.7%	-
Reportable segments total	92,107	99.6%	2,433	100.0%	2.6%
Other	326	0.4%	-45	-1.8%	-
Adjustments	0	0.0%	-689	-28.3%	-
Total	92,435	100.0%	1,697	69.7%	1.8%

Source: Shared Research based on company data

Revenue composition by region

Revenue composition by region(JPYmn)	FY06/21		FY06/22	
	Revenue		Revenue	
		% of total		% of total
Japan	5,533	20.6%	11,105	12.0%
Asia	16,781	62.4%	1,526	1.7%
North America	2,643	9.8%	68,185	73.8%
Europe	1,943	7.2%	3,719	4.0%
Other	0	0.0%	7,898	8.5%
Of which South America	0	0.0%	7,772	8.4%
Total	26,901	100.0%	92,435	100.0%

Source: Shared Research based on company data

Business overview by reportable segment

Solar Panel Manufacturing business (88.2% of consolidated revenue in FY06/22)

Vietnam Sunergy Joint Stock Company (VSUN), which the company acquired, is a holding company whose subsidiaries manufacture and sell solar panels (the holding company and its subsidiaries are collectively referred to as VSUN in this report). VSUN procures raw materials from Southeast Asia including China, manufactures solar panels at its plants in Vietnam, and sells them to the US, Europe, and Southeast Asia directly or through subsidiaries with sales branch functions.

According to Abalance, roughly 60% of VSUN's revenue comes from the US, about 30% from Europe, and about 10% from other regions including Africa, South America, and Asia. By customer, products for industrial use such as installation at mega solar plants and on factory rooftops account for approximately 80% of revenue; the remaining 20% of revenue comes from

products for home use. Abalance originally made entry into Vietnam to capitalize on the demand for solar panels that are free from US–China trade frictions as well as US import restrictions and tariffs, among other factors. While the top positions in the global solar panel manufacturer rankings are dominated by Chinese companies, VSUN maintains the largest production volume among the Japanese players, ranking around 15th among solar panel manufacturers globally by annual production capacity.

Overview of VSUN

VSUN, headquartered in the Bac Giang Province of Northeast Vietnam, is a solar panel manufacturing and sales company founded in June 2015. In December 2020, Abalance acquired additional shares in Fuji Solar Corporation (unlisted), which was an affiliate of WWB and a shareholder of VSUN, and made Fuji Solar a consolidated subsidiary. With this transaction, the company came to own 84.85% of VSUN's voting rights (direct and indirect ownership combined). The remaining shares in VSUN are owned by investment companies and multiple minority shareholders. Mr. Junsei Ryu (director of Abalance and representative director/chairman of WWB) and Mr. Jian Feng Cai are tasked with the management of VSUN, serving as director/chairman and general manager/CEO of the entity, respectively. Mr. Ryu has worked to expand the solar power business, recognizing that the energy problem needed to be resolved in order to protect the global environment and reduce CO_2 emissions. At the time of the acquisition, VSUN's revenue was more than three times that of the Abalance group in FY06/21.

Since VSUN is considered a high-tech company by the Vietnamese government, it enjoys a reduction in corporate income tax. VSUN's four plants are exempt from paying income taxes for four years from the first year of profit recognition, and the tax rates are reduced by half for the next nine years (the general corporate tax rate in Vietnam is 20%). According to Abalance, VSUN also receives other benefits such as lower-than-usual interest rates on borrowings from financial institutions. Abalance originally made entry into Vietnam to capture the demand for solar panels free from the US–China trade frictions as well as US import restrictions and tariffs, among other factors. Since the acquisition of VSUN, the company used its network to secure engineers from peer companies in China and elsewhere, and continued to expand production capacity.

Overview of VSUN

Vietnam Sunergy Joint Stock Company (VSUN)	
Headquarter location	Bac Giang Province, Vietnam
Capital stock (JPYmn)	1,793
Established	2015
Main business	VSUN, a holding company, manufactures and sells solar panels through its subsidiaries
Solar panel production capacity	5.0GW (total capacity of four plants in Vietnam)
Number of employees	Approximately 1,500
Major shareholder	Abalance either directly or indirectly owns an 84.85% stake in total
Management	Mr. Junsei Ryu, Director and chairman
	Mr. Jian Feng Cai , CEO
	Mr. Jing Juan Zhou
	Mr. Hiroyuki Tahara
	Mr. Dinh Tu Nguyen
Subsidiaries	Vietnam Sunergy Europe GmbH. (Solar panel sales company in Germany)
	VNREE Co., Ltd (Design, construction, and investment company pertaining to renewable energy in Vietnam)
	VSUN Solar USA Inc. (Solar panel sales company in the US)
	VSUN (Shanghai) New Energy Technology Company Limited (Solar panel sales company in China)
	Vietnam Sunergy (Bac Ninh) Company Limited (Manufactures and assembles solar panels in Vietnam)
	Vietnam Sunergy Cell Co., Ltd (Entity established in preparation for new business in Vietnam)

Source: Shared Research based on company data

Production capacity

At present, VSUN has four plants in Vietnam (in the Bac Giang and Bac Ninh Provinces) dedicated to the manufacture of solar panels (monocrystalline silicon and other panels; see box below for details). With the launch of the third plant (annual production capacity of 1GW; capital expenditure of USD12mn) in July 2021, and the fourth plant (2.4GW; approximately

USD30mn) in January 2023, VSUN's current production capacity has expanded to 5GW in total. VSUN is the largest solar panel manufacturer in Vietnam by production capacity, moving up from second place at the time it was acquired by Abalance. Under the medium-term management plan through FY06/24, the company looks to expand production capacity of its plants to 8GW in light of the current level of orders and sales. Construction of solar cell plants with an annual production capacity of 6GW (total investment of roughly USD300mn) is also under way as the company plans to make a shift from external procurement to in-house manufacture of solar cells—a key component in solar panel production. The first phase of the project, which is the construction of a cell plant with an annual production capacity of 3GW (total investment of roughly USD180mn), is scheduled for completion in October 2023.

Electrical power is measured in terms of watts: one gigawatt (GW) equals one thousand megawatts (MW), which equals one million kilowatts (kW), or one billion watts (W). A typical reactor at a nuclear power plant can produce around one gigawatt of electricity, enough to power roughly 300,000 homes. Kilowatt hour (kWh) refers to the measure of energy equivalent to the expenditure of one kilowatt (1kW=1,000W) for one hour.

VSUN plants

Source: Shared Research based on company data

Amid globally rising demand for renewable energy, solar panel orders to VSUN have been exceeding its initial projections significantly. Orders for industrial and home-use solar panels initially grew in Europe, followed by increases in the US and South America since around 2021. The growth of orders from the US is attributable to the push toward supply chain reconfiguration due to a shift in energy policies under the Biden administration and heightening geopolitical risks.

Meanwhile, the cost burden also increased due to combined effects of the COVID-19 outbreak in Vietnam, China's lockdowns, and the Ukrainian crisis, which led to a surge in raw material prices and container freight rates. VSUN sought to tackle these challenges by securing raw material supplies, negotiating raw material costs, and reevaluating suppliers to achieve further production efficiency and cost reductions while also pursuing cost pass-through.

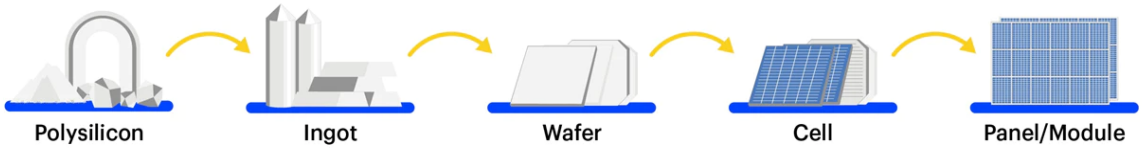
Inside view of a VSUN plant

Source: Shared Research based on company data

Solar panel manufacturing processes

The main manufacturing processes for solar panels begin with the creation of a silicon block called ingot. The ingot is then sliced to make silicon wafers, which are subsequently formed into solar cells. Multiple solar cells are then assembled to make solar panels (also referred to as solar modules). VSUN engages in the final step of the process, which is the production of solar panels.

Main processes of solar panel manufacturing (from crystalline silicon to panel)



Source: "Solar PV Global Supply Chains," International Energy Agency

Types of solar panels

Solar panels can be largely classified into those made of silicon, chemical compounds, or organic substances. Silicon solar panels are the most widely used in the world. Silicon is a substance that exists in abundance on the Earth. Silicon panels further break down into monocrystalline panels, polycrystalline panels, thin-film silicon panels, and heterojunction panels, among other types.

Monocrystalline panels have a long history and are the most widely used. Since they use solar cells made of high-purity, single-crystal silicon in which the silicon atoms maintain a regular arrangement, these panels offer high conversion efficiency. However, their manufacturing cost is also high. Polycrystalline panels use cells made from the leftovers and defective products resulting from monocrystalline silicon production. Because the material is lower in purity, polycrystalline panels offer lower conversion efficiency, but they are cheaper to manufacture. These panels are often used in large-scale installations such as industrial applications. Thin-film silicon panels use cells made by depositing a thin layer of non-crystalline silicon onto a substrate made of glass, metal, or other substances. The conversion efficiency is low, but the cells can be processed easily and are versatile; they are also heat resistant. Heterojunction panels use cells made from a combination of different types of silicon. They offer high conversion efficiency but are expensive to manufacture.

Types of monocrystalline solar cells include P-type monocrystalline passivated emitter and rear cell (PERC), N-type monocrystalline cells, and conventional monocrystalline cells. At present, the trend has shifted from the conventional monocrystalline cells to the P-type monocrystalline PERC, which is currently the most widely used. The technology and spread of the N-type, offering higher conversion efficiency, are still in progress. The N-type breaks down to heterojunction technology (HJT) solar cells, interdigitated back contact (IBC) cells, N-type PERC cells, N-type passivated emitter and rear totally diffused (PERT) cells, and tunnel oxide passivated contact (TOPCon) cells. In addition to conventional monocrystalline solar cells, the company has begun manufacturing solar panels made of cells that use TOPCon technology.

Solar panels that use non-silicon chemical compounds comprise CIS/CIGS and CdTe. CIS/CIGS panels contain semiconductors made of copper, iridium, selenium, and gallium compounds; these panels stand out for their absolutely low manufacturing cost. Semiconductors in CdTe panels are made of a cadmium and tellurium compound. These panels offer high conversion efficiency and can be manufactured at low cost, but manufacturers are limited because they use cadmium, which is toxic. Among other solar cells are the perovskite cells, which have been viewed with high expectations for being a next-generation material.

VSUN's solar panels

VSUN has R&D bases in both Tokyo and Vietnam, but the engineering work is mainly done in Tokyo. According to the company, the technology underpinning the quality and power generation efficiency of solar panels has been largely standardized, and among the major manufacturers, there is no one company that stands out technologically. Although VSUN's production scale is still small compared to major manufacturers, the company has gained recognition from third-party organizations not only for the quality, reliability, and functionality of its solar panels, but also in terms of its procurement standards. VSUN has also cleared the strict quality standards of major purchasers such as French petroleum company TotalEnergies SE (NYSE: TTE; Euronext: TTE) and French energy and gas company Engie SA (Euronext: ENGI).

In 2022, VSUN was recognized as a "Top Performer" in the PV Module Reliability Scorecard (released by US-based PV Evolution Labs [PVEL]) for the second consecutive year. Also, in an assessment conducted by EcoVadis—a global rating agency based in France that assesses companies' sustainable sourcing including their action toward human rights issues, VSUN was awarded a Bronze Medal for the second consecutive year since 2021, having ranked 64th percentile among over 75,000 participating companies worldwide. Further, VSUN has been certified as a Tier 1 solar panel manufacturer in the PV Market Outlook published by Bloomberg New Energy Finance (BNEF), which evaluates solar module makers in terms of their bankability. Most companies included in BNEF's Tier 1 list are Chinese, although some US and South Korean companies also make the list. VSUN is the only Japanese company marked as Tier 1.

The PV Module Reliability Scorecard is a report released since 2012 by a US-based independent organization PV Evolution Labs (PVEL) , which tests the reliability and performance of solar panels. The report outlines the results of tests conducted by PVEL annually under its product certification program based on which the brands producing solar panels of superior reliability and durability are certified as Top Performers. (https://modulescorecard.pvel.com/top-performers/). In 2022, PVEL certified 122 models manufactured by 25 companies as Top Performers, with VSUN being named for the second consecutive year. The 25 companies included Jinko, JA Solar, and other major solar panel manufacturers.

EcoVadis is a global third-party organization that makes comprehensive CSR and sustainability assessments mainly of global supply chain companies, focusing on the four areas of environment, labor and human rights, business ethics, and sustainable sourcing. Since its establishment in 2007, EcoVadis has conducted numerous assessments through its information-sharing platform on which over 75,000 companies spanning 200 industry categories and 160 countries around the world are registered. Since supply chains earning evaluations above a certain level are socially recognized as carrying no particular risks, the results of EcoVadis assessments are being referred to widely not only in the US and Europe but also in Japan in recent years.

BloombergNEF (BNEF) is a Bloomberg research service that supports business operators, market participants, and policymakers in the energy space and other fields by providing analysis, data, and commentary regarding the evolving energy-related economic environment. (https://about.bnef.com/) To do so, it stations some 250 research and analysis staff at its bases spanning the six continents of the world. BNEF releases a quarterly report called the PV Market Outlook in which it provides a list of Tier 1 solar panel manufacturers selected on the basis of their bankability and financial stability, among other assessment criteria. The list is widely used as an indicator of the ability of solar plant development projects to obtain non-recourse financing. VSUN has been included in the Tier 1 list since the third quarter of 2019.

According to the company, orders are increasing at VSUN as being a Japanese-owned company translates to quality assurance, making it easier for US and European companies to buy its products even amid prolonged trade frictions between the US and China. VSUN purchases the cells needed to manufacture solar panels and other raw materials in Asia, including China. It is difficult to exclude all sourcing from China and still complete the supply chain, but VSUN plans to reduce the weighting of China. The company explains that so far, the Chinese government has not imposed any supply bans or restrictions on VSUN's purchase of solar cells from Chinese manufacturers.

Abalance has been disclosing the key financial information on VSUN (a specified subsidiary) in its annual securities report since FY06/21. In FY06/22, VSUN's revenue accounted for 72.9% of Abalance's consolidated revenue and 86.6% of recurring profit. VSUN's revenue of JPY67.4bn in FY06/22 was up 220.9% YoY and recurring profit was up 66.5% YoY. RPM fell from 3.7% in FY06/21 to 1.9% in FY06/22.

VSUN: Key financials

Vietnam Sunergy Joint Stock Company	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Revenue									21,013	67,429
YoY	-	-	-	-	-	-	-	-	-	220.9%
% of consolidated revenue	-	-	-	-	-	-	-	-	78.1%	72.9%
Recurring profit									785	1,307
YoY	-	-	-	-	-	-	-	-	-	66.5%
Recurring profit margin	-	-	-	-	-	-	-	-	3.7%	1.9%
% of consolidated recurring revenue	-	-	-	-	-	-	-	-	61.9%	86.6%
Net income									718	1,213
YoY	-	-	-	-	-	-	-	-	-	68.9%
Net margin	-	-	-	-	-	-	-	-	3.4%	1.8%
% of consolidated net income	-	-	-	-	-	-	-	-	77.1%	75.0%
Net assets									2,762	5,222
YoY	-	-	-	-	-	-	-	-	-	89.1%
% of consolidated net assets	-	-	-	-	-	-	-	-	57.8%	65.2%
Total assets									16,894	44,967
YoY	-	-	-	-	-	-	-	-	-	166.2%
% of consolidated total assets	-	-	-	-	-	-	-	-	42.9%	52.8%
Equity ratio	-	-	-	-	-	-	-	-	16.3%	11.6%
ROE(Net income)	-	-	-	-	-	-	-	-	26.0%	23.2%
ROA (Net income)	-	-	-	-	-	-	-	-	4.3%	2.7%

Source: Shared Research based on company data

Green Energy business (11.1% of consolidated revenue in FY06/22)

In this business, the company trades solar power plants, sells solar panels and related products, owns power plants, and also engages in the development, construction, operation, and maintenance work associated with solar plants. WWB, Valors, and other consolidated subsidiaries and equity-method affiliates are charged with the actual business operations. The Green Energy segment further breaks down into the one-time revenue business and the recurring revenue business, each accounting for 74.1% and 25.9% of segment revenue in FY06/22, respectively.

Recurring revenue business

In this business, the company uses the solar power plants under its ownership to generate electricity, which it sells to power utilities. The company either develops these facilities on its own or acquires them from other parties through M&A. The electricity being sold mainly falls under the feed-in tariff (FIT) scheme (see below for details).

Development of solar power plants

To advance the recurring revenue business, the company has enhanced its ability to source properties and made acquisitions, thereby expanding the portfolio of solar power plants it owns. For instance, in recent years, Valors acquired all primarily Kyushu-based solar power plants owned by Campanio Solar Co., Ltd. (unlisted), and WWB obtained solar plants in the Ishikawa Prefecture and Shimane Prefecture by acquiring Japan Solar Power Co., Ltd. (unlisted). WWB also acquired the industrial solar power business from Japan Life Support Co., Ltd. (unlisted), thereby obtaining the latter's grid-connected low voltage plants, works in process, and the human resources associated with this business. Other transactions by WWB included the acquisitions of Japan Mirai Energy Co., Ltd. (unlisted) and J. Mirai Co., Ltd. (unlisted) engaging in renewable energy generation, management and operation of associated facilities, and the supply and sale of electricity. WWB obtained 14 solar power plants in the Miyagi Prefecture through this transaction.

The company says it has so far focused on power plants that utilized the FIT scheme, but has now entered a new phase where it can expect profitability from the feed-in premium (FIP) scheme, as well as self-consumption and other non-FIT projects.

Evolution of Japanese policies to promote the adoption of renewable energy

FIT Act

As a policy to promote the spread of renewable energy, the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electric Utilities (often abbreviated to "FIT Act") was implemented in July 2012. As a result, a feed-in tariff mechanism was put in place, whereby the Japanese government guarantees power utilities' purchase of electricity generated by five types of renewable sources, such as solar, wind, and geothermal power, at a fixed price for a fixed contract duration.

Under this scheme, a part of the cost born by power utilities is covered by the end users through the addition of a surcharge on their electricity bills. In this way, the government guarantees the purchase of renewable energy by power utilities at a fixed price and contract duration, thereby supporting the expansion of renewable energy in Japan. While the electricity purchase prices (tariffs) for large transactions are determined through competitive bidding, those of smaller transactions are based on the output capacity of the individual facilities. The feed-in tariffs have been lowered in phases through the years. In FY2012, tariffs per kWh stood at JPY40 for solar plants of 10kW or more and JPY42 for those less than 10kW. By FY2022, tariffs were down to JPY10 (for plants of 50kW or more), JPY11 (10kW or more to under 50kW), and JPY17 (less than 10kW). (New contracts subject to competitive bidding apply to plants of 250kW or more.)

Revised FIT Act

In April 2017, the Partial Revision of the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electric Utilities (the revised FIT Act) was implemented to address the growing financial burdens on the public and an increase in idle facilities. Areas of revision included changes in the certification system, placement of deadline on commencing operations, and mandatory maintenance of power generation facilities. As tariffs under the FIT scheme were not linked to market prices, renewable energy power producers could have electricity purchased at a fixed price regardless of when it was generated, and without having to consider the supply–demand balance. To address this, the revised FIT Act put in place an output control measure for supply adjustment when power supply temporarily exceeded demand significantly.

Act for Establishing Energy Supply Resilience

The Act for Establishing Energy Supply Resilience, which incorporated the Japanese government's strategic energy plan, as well as disaster risks, and revisions to the FIT Act, was implemented in April 2022. Among the policies concerning revisions to the FIT Act were the introduction of a Feed-in Premium (FIP) mechanism, enhancement of the transmission/distribution network to address the increase in renewable energy facilities, establishment of a system for disposal of renewable energy facilities, and the tightening of regulations on the timing of FIT certification expiry.

The FIP scheme is a system under which a fixed premium (subsidy) is added to the purchase price of electricity sold by renewable energy power producers in the wholesale market and other channels. The premium incentivized the power producers to invest in renewable energy and become more mindful of the market prices that fluctuate depending on the supply–demand balance, when generating electricity. The use of storage batteries also makes it possible for renewable energy power producers to sell electricity at market highs. Large solar power producers are required to shift to the FIP scheme, while medium-sized producers are eligible for both the FIT and the FIP schemes. Also, under the latest Act, FIT certification expires if the period from installation to facility operation takes more than one or three years.

Non-FIT

Non-FIT refers to renewable power generation that does not fall under the scope of the FIT scheme. Therefore, neither the Japanese government nor the power utilities are obligated to purchase non-FIT electricity. As the feed-in tariff rates continue to decline, the government is also promoting the non-FIT alternative, which does not burden taxpayers. Non-FIT enables power procurement at stable prices, unaffected by fluctuations in the electricity market. It also serves as a hedging tool against market price risks. Further, electricity generated by non-FIT solar power plants is credited with environmental value and is recognized as electricity 100% sourced from renewables. In contrast, electricity generated under the FIT scheme is not considered 100% renewable energy because taxpayers bear part of the cost by paying a surcharge.

Major companies in Japan and abroad have joined the global initiative "RE100" (renewable energy 100%), which aims to have all energy used in business activities sourced from renewables. These companies are actively pursuing the use of renewable energy, including in their supply chains. Shareholders, investors, and other corporate stakeholders are moving toward selective investment into companies that focus on ESG, and such momentum toward a decarbonized society is further encouraging the spread of non-FIT power generation.

Solar power plants in operation

The company's solar power plants currently in operation include those developed in-house and those acquired through M&A. With over 50 power plants, primarily in Japan, the total output capacity comes to 140MW. The Abalance group seeks to increase this capacity to 1GW by 2030, using proprietary power plants in Japan and overseas.

Main solar power plants in operation

Main power plants owned by the company		Business entity in charge	Output capacity (MW)	Start of operation
Miyanoura Solar Power Plant	Kagoshima Pref.	WWB Corporation	2.8	March 2020
Fukushima Onami Power Plant (Plant 2)	Fukushima Pref.	WWB Corporation	2.7	June 2021
Naka Solar Power Plant	Ibaraki Pref.	WWB Corporation	2.5	March 2022
Fukushima Onami Power Plant (Plant 1)	Fukushima Pref.	WWB Corporation	2.4	June 2021
Hanabatake Solar Power Plant (Compartments C, D, E)	Gunma Pref.	WWB Corporation	2.1	October 2020
Hanabatake Solar Power Plant (Compartments A, B)	Gunma Pref.	WWB Corporation	1.6	November 2020
Takahashi Solar Power Plant (Plant 1)	Okayama Pref.	WWB Corporation	1.5	March 2017
WWB Kawaguchiko Solar Power Plant	Yamanashi Pref.	WWB Corporation	1.4	July 2021
Kosai Ota Solar Power Plant	Shizuoka Pref.	WWB Corporation	1.2	June 2020
Kuranami Solar Power Plant	Chiba Pref.	WWB Corporation	1.1	March 2022
Takahashi Solar Power Plant (Plant 2)	Okayama Pref.	WWB Corporation	1.1	March 2020
Nagamine Solar Farm	Miyazaki Pref.	Valors Corporation	4.3	November 2021
Kunisaki Solar Power Plant	Oita Pref.	Valors Corporation	1.2	June 2015
Tsuno Solar Power Plant	Miyazaki Pref.	Valors Corporation	1.0	October 2015

Source: Shared Research based on company data

Main domestic solar power plants owned by the company

Miyanoura Solar Power Plant (Kagoshima Prefecture)

Hanabatake Solar Power Plant (Gunma Prefecture)

Source: Shared Research based on company data

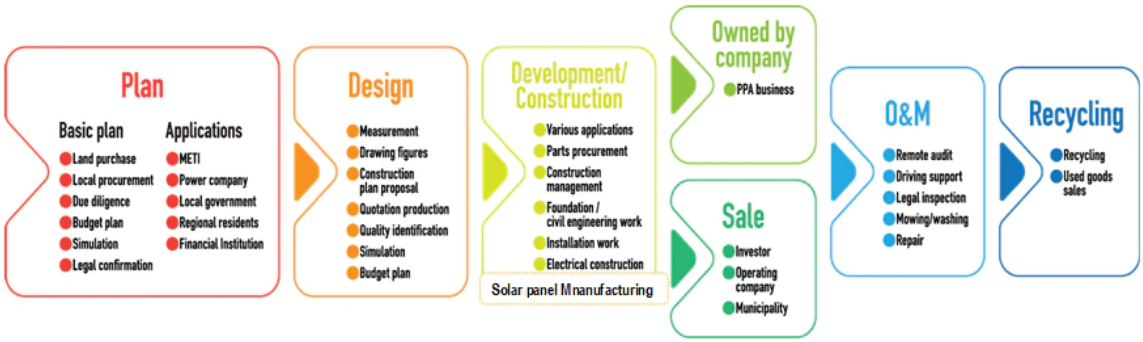
One-time revenue business

In this business, the company trades a wide range of power generation facilities (home-use, industrial, pre-used, and other) and sells goods associated with power generation equipment. It also offers end-to-end solar energy solutions to companies and households through agents and other channels.

The end-to-end solutions services cover the planning phase of solar power projects to engineering, development, and construction of the facility, operation and maintenance (O&M), and even recycling. Receiving an order that spans the entire lifecycle of a facility allows the company to provide seamless and efficient services. Contracts with power utilities, confirmation of laws and regulations with the local government, explanation to local residents, and support for obtaining loans from financial institutions are among the total support services offered by the company.

Abalance acquired VSUN in December 2020. Bringing a solar panel manufacturer into the group has allowed the company to provide a full range of services that no other company in Japan can offer. The construction of plants dedicated to the manufacture of solar cells used in the upstream process of solar panel production is also under way at VSUN, and the operation of these plants will further strengthen Abalance's end-to-end services.

End-to-end services



Source: Shared Research based on company data

Initiatives toward decarbonization

Decarbonization-minded management has gained momentum and companies are opting to disclose their management strategy and actions concerning climate change (Task Force on Climate-related Financial Disclosures [TCFD], see below). They are also setting decarbonization goals (Science-based Targets [SBT], see below; RE100). Against this backdrop, the company is working to bolster its ability to plan and propose solutions. Onsite and offsite power purchase agreements (PPA), solar-self consumption, self-wheeling, and solar sharing are some of the options it promotes.

Task Force on Climate-related Financial Disclosures (TCFD) was established by the Financial Stability Board (FSB) at the request of G20 to examine how climate-related information should be disclosed and how financial institutions should respond. TCFD encourages corporate and other entities to recognize climate change-related risks and opportunities and disclose information on specified items such as governance and strategies.

Science Based Targets (SBT) are reduction targets for greenhouse gas emissions in line with Paris Agreement goals. Under the SBT initiative, companies set temperature targets to be accomplished in five to 15 years and work on measures to limit warming by a predetermined year. While RE100 promotes the adoption of renewable energy, the SBT initiative seeks to reduce emissions among entire corporate value chains.

RE100 is a global initiative in which participating companies commit to using electricity from renewable sources for all their business activities. Member companies are required to report annually the status of their renewable power use and output.

Solution plans and proposals on decarbonization-minded business management

Onsite power purchase agreement (PPA): A model where an outside power producer installs a power generation facility within the premises of the end-user company. The end-user company uses the generated electricity, which it purchases from the outside power producer.

Offsite power purchase agreement (PPA): A model where an outside power producer installs a power generation facility outside the premises of the end-user company. The difference between onsite and offsite PPA is not limited to the location of the facility. Offsite PPA stands out for having an electricity retailer take part in the transaction. The Electricity Business Act stipulates that only those electricity retailers registered with the Japanese government can sell electricity delivered through the power grid network. As such, offsite PPA requires the involvement of an electricity retailer.

Solar self-consumption: In solar self-consumption, the end-user company uses electricity generated by a proprietary power generation facility placed within its own premises.

Self-wheeling: In self-wheeling, the end-user company uses self-generated electricity delivered from a proprietary power generation facility placed outside its own premises. This model also requires the involvement of an electricity retailer since the electricity is delivered through the power grid network.

Solar sharing system: A model where solar panels are installed on top of a farmland to simultaneously achieve both power generation and agriculture on a single piece of land. Mounted solar panels are installed at regular intervals so that the radiation necessary for crops is secured. Under this system, income is generated from the sale of generated electricity and the crops grown on the land.

In addition to developing solar power plants, the company takes part in the reuse and recycling of damaged or aged panels. It seeks to make efficient use of resources by, for instance, actively purchasing reusable panels from facilities that have suffered damage from natural disasters. To address concerns over panel disposal, in March 2021, WWB established PV Repower inc. (unlisted) to run a panel reuse and recycling business.

Other businesses

In June 2021, the company established Birdy Fuel Cells LLC to develop a hydrogen-based energy storage system, which is expected to play a key role in next-generation energy. The company has also entered the market for industrial and home-use storage batteries.

Financials of WWB and Valors

Abalance has been disclosing key financial information on WWB and Valors (specified subsidiaries) in its annual securities report. The financials available for WWB span FY06/17 to FY06/22 (see below) while those available for Valors are from FY06/17 to FY06/20. WWB's revenue in FY06/22 accounted for 8.8% of Abalance's consolidated revenue; Valors' revenue in FY06/20 made up 29.9% of consolidated revenue.

WWB: Key financials

WWB Corporation	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Revenue					4,781	5,516	4,018	5,153	5,344	8,137
YoY	-	-	-	-	-	15.4%	-27.2%	28.2%	3.7%	52.3%
% of consolidated revenue	-	-	-	-	73.6%	75.6%	67.1%	77.2%	19.9%	8.8%
Recurring profit					53	794	516	220	943	1,842
YoY	-	-	-	-	-	1,387.6%	-35.0%	-57.3%	327.8%	95.3%
Recurring profit margin	-	-	-	-	1.1%	14.4%	12.8%	4.3%	17.6%	22.6%
% of consolidated recurring revenue	-	-	-	-	109.9%	90.8%	91.2%	72.2%	74.3%	122.0%
Net income					-87	574	349	206	471	1,040
YoY	-	-	-	-	-	-	-39.1%	-41.0%	128.5%	120.8%
Net margin	-	-	-	-	-	10.4%	8.7%	4.0%	8.8%	12.8%
% of consolidated net income	-	-	-	-	-	75.4%	106.9%	95.2%	50.6%	64.3%
Net assets					320	694	973	1,179	1,701	2,561
YoY	-	-	-	-	-	116.6%	40.3%	21.2%	44.2%	50.6%
% of consolidated net assets	-	-	-	-	28.6%	38.2%	47.9%	54.6%	35.6%	32.0%
Total assets					3,713	4,732	8,328	9,810	12,581	17,413
YoY	-	-	-	-	-	27.4%	76.0%	17.8%	28.2%	38.4%
% of consolidated total assets	-	-	-	-	58.0%	65.8%	75.8%	66.4%	31.9%	20.4%
Equity ratio	-	-	-	-	8.6%	14.7%	11.7%	12.0%	13.5%	14.7%
ROE(Net income)	-	-	-	-	-	82.7%	35.9%	17.5%	27.7%	40.6%
ROA (Net income)	-	-	-	-	-	12.1%	4.2%	2.1%	3.7%	6.0%

Source: Shared Research based on company data

Valors: Key financials

Valors Corporation	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Revenue					1,494	1,813	2,075	1,999		
YoY	-	-	-	-	-	21.3%	14.5%	-3.7%	-	-
% of consolidated revenue	-	-	-	-	23.0%	24.8%	34.7%	29.9%	-	-
Recurring profit					476	302	421	153		
YoY	-	-	-	-	-	-36.6%	39.5%	-63.6%	-	-
Recurring profit margin	-	-	-	-	31.8%	16.6%	20.3%	7.7%	-	-
% of consolidated recurring revenue	-	-	-	-	979.1%	34.5%	74.3%	50.1%	-	-
Net income					328	215	279	106		
YoY	-	-	-	-	-	-34.4%	29.5%	-62.1%	-	-
Net margin	-	-	-	-	21.9%	11.9%	13.4%	5.3%	-	-
% of consolidated net income	-	-	-	-	-199.6%	28.3%	85.3%	48.9%	-	-
Net assets					349	565	844	949		
YoY	-	-	-	-	-	61.6%	49.4%	12.5%	-	-
% of consolidated net assets	-	-	-	-	31.2%	31.1%	41.5%	44.0%	-	-
Total assets					1,861	2,167	2,482	3,424		
YoY	-	-	-	-	-	16.5%	14.5%	38.0%	-	-
% of consolidated total assets	-	-	-	-	29.1%	30.2%	22.6%	23.2%	-	-
Equity ratio	-	-	-	-	18.8%	26.1%	34.0%	27.7%	-	-
ROE(Net income)	-	-	-	-	93.9%	38.1%	33.1%	11.1%	-	-
ROA (Net income)	-	-	-	-	17.6%	9.9%	11.2%	3.1%	-	-

Source: Shared Research based on company data

IT business (0.3% of consolidated revenue in FY06/22)

Consolidated subsidiaries Abit Corporation, Digital Sign Co., Ltd., and Forthink Co., Ltd. introduce mainstay product Knowledge Market to new customers, sell Microsoft-related licenses, and also engage in system integration, and operation and maintenance work.

Photocatalyst business (0.1% of consolidated revenue in FY06/22)

Consolidated subsidiary Japan Photocatalyst Center Corporation (unlisted) mainly manufactures and sells titanium coating agents (photocatalysts) and products utilizing such agents. Japan Photocatalyst Center has a proprietary photocatalyst manufacturing plant that has obtained ISO certification. Photocatalysts break down and remove bacterial and viral components, and can be used for deodorization and air purification. They are also effective on pollen, and can purify space near pollen-contaminated surfaces.

Other businesses (0.4% of consolidated revenue in FY06/22)

Consolidated subsidiaries WWB and Win Power Ltd. (based in Bangladesh, unlisted) sell construction machinery in Japan and overseas. WWB sells or leases a range of pre-used construction machinery, from basic construction equipment to specialized machines. Since WWB started off in the construction machinery business, it has developed a network not only in Japan but in a number of Asian countries through many years of business dealings. WWB also serves as the exclusive distributor in Japan of Sany Heavy Industry Co., Ltd. (SSE: 600031), a leading global construction machinery manufacturer.

At the time of the Fukushima nuclear disaster following the Great East Japan Earthquake in March 2011, WWB—with the cooperation of Sany Heavy Industry—donated to Tokyo Electric Power Company a concrete pump truck with a 62-meter boom (transport pipe) for water injection to the nuclear reactors.

Customers

Green Energy business

Customers in the recurring revenue business are the buyers of electricity generated by the company's power plants. For power plants operating under the FIT scheme, they are power utilities. In the one-time revenue business, investors are the primary counterparts in power plant trades. Companies and consumers are the customers for solar panel products, which the company sells through distributors.

Solar Panel Manufacturing business

VSUN sells industrial and home-use solar panels to customers in the US, Europe, and Southeast Asia. According to Abalance, roughly 60% of VSUN's revenue comes from the US, about 30% from Europe, and about 10% from other regions including Africa, South America, and Asia. Products for industrial use make up approximately 80% of revenue; here, customers are mostly power producers developing mega solar plants. Home-use products account for the remaining 20%.

IT, Photocatalyst, and Other businesses

Target customers are companies and general consumers.

Sales channels

Green Energy business

Sales in the recurring revenue business is mainly handled by WWB. In the one-time revenue business, the company engages in power plant trades, sells power generation facility-related products, and provides end-to-end solutions from power plant planning to operation and maintenance, mainly using the distributors/agents of WWB and Valors.

Solar Panel Manufacturing business

Industrial and home-use solar panels are sold to Europe, US, and Southeast Asia directly from VSUN or through its subsidiaries that function as sales branches. VSUN has sales companies in the US, Germany, Vietnam, and China, and does not use local trading firms. According to the company, over 70% of VSUN's revenue is derived from direct contracts, and the remaining 30% comes from sales through branches.

IT, Photocatalyst, and Other businesses

Consolidated subsidiaries Abit Corporation, Digital Sign Co., Ltd., and Forthink Co., Ltd. handle sales, operation, and maintenance in the IT business. Manufacturing and sales in the Photocatalyst business are conducted by Japan Photocatalyst Center Corporation. In other businesses, WWB and Win Power Ltd. sell or lease construction machinery to corporate customers in Japan and overseas. WWB also serves as the exclusive distributor in Japan of Sany Heavy Industry, a leading global construction machinery manufacturer.

Earnings structure

Revenue

Green Energy business

In the recurring revenue business, the company generates revenue from its solar power plants operating under the FIT scheme. Here, revenue is a function of power generation income per kWh and the volume of electricity sold. The company

does not disclose the amount of electricity it sells. In the one-time revenue business, revenue from sale of goods equates to total product sales. A simple division of FY06/22 revenue in the recurring revenue business by 140MW (total output capacity of the company's power plants) yielded roughly JPY19,000 per kW (Shared Research estimate).

Solar Panel Manufacturing business

Revenue in this business is a function of the unit price of solar panels and the sales volume, but the company does not disclose figures such as its solar panel shipment volume. Abalance says it makes revenue projections for this business using both a top-down and bottom-up approach, factoring in the annual production capacity and assumptions for demand and unit price trends. To calculate a unit price for the company's solar panel, we simply divided the FY06/22 revenue in this segment by 2.6GW, which was VSUN's production capacity in the same period, and arrived at approximately JPY31,000 per kW (Shared Research estimate).

Revenue trends

Total revenue has changed dramatically over the past decade. In FY06/18, revenue exceeded the JPY7.0bn mark, reaching a record high at the time. Revenue in the two fiscal years that followed undershot this mark. However, with the acquisition of VSUN, the top line surged to JPY26.9bn in FY06/21 and JPY92.4bn in FY06/22. Note that because of the timing of the acquisition, VSUN's contribution to consolidated revenue was limited to nine months in FY06/21. (Consolidated revenue from FY06/22 onward reflects VSUN's full-year contribution.)

By reportable segment, in FY06/13, Construction Machinery Sales accounted for 31.9% of revenue, IT business 15.5%, and Solar Power Generation business (renamed Green Energy business in FY06/18) 52.7%. With the expansion of the Solar Power Generation business from FY06/13, the revenue mix of this business grew to 86.8% of the total by FY06/17. This business had originally centered on the sale of solar power systems and related products, and business expanded as the company entered the solar power generation business targeting enterprises (for instance, sale of solar power facilities with land, and solar IT). In FY06/21, the company acquired VSUN, adding the Solar Panel Manufacturing business as a new reportable segment. It also reclassified the Photocatalyst business—formerly under Other businesses—as an independent reportable segment, thereby arriving at the current four reportable segments. The Construction Machinery Sales business was reclassified to Other businesses in FY06/21.

Revenue by segment

Revenue by segment	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Solar Panel Manufacturing business									21,013	81,501
YoY	-	-	-	-	-	-	-	-	-	287.9%
% of revenue	-	-	-	-	-	-	-	-	78.1%	88.2%
Green Energy business	1,213	2,349	3,455	3,940	5,636	6,513	5,178	6,249	5,311	10,234
YoY	462.1%	93.7%	47.1%	14.0%	43.0%	15.6%	-20.5%	20.7%	-15.0%	92.7%
% of revenue	52.7%	70.2%	78.6%	86.8%	86.8%	89.2%	86.5%	93.6%	19.7%	11.1%
IT business	356	259	153	90	101	81	172	59	50	292
YoY	-	-27.2%	-40.9%	-41.3%	12.3%	-19.5%	111.7%	-66.0%	-14.6%	484.0%
% of revenue	15.5%	7.7%	3.5%	2.0%	1.6%	1.1%	2.9%	0.9%	0.2%	0.3%
Photocatalyst business									170	80
YoY	-	-	-	-	-	-	-	-	-	-52.9%
% of revenue	-	-	-	-	-	-	-	-	0.6%	0.1%
Construction Machinery Sales business	734	738	788	510	758	706	596	258		
YoY	-	0.5%	6.8%	-35.3%	48.7%	-6.9%	-15.6%	-56.7%	-	-
% of revenue	31.9%	22.1%	17.9%	11.2%	11.7%	9.7%	10.0%	3.9%	-	-
Reportable segments total	2,303	3,347	4,396	4,540	6,495	7,301	5,946	6,565	26,546	92,108
YoY	-	45.3%	31.4%	3.3%	43.1%	12.4%	-18.6%	10.4%	304.3%	247.0%
% of revenue	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.4%	98.3%	98.7%	99.6%
Other	0	0	0	0	0	0	39	113	355	326
YoY	-	-	-	-	-	-	-	190.3%	214.6%	-8.2%
% of revenue	-	-	-	-	-	-	0.6%	1.7%	1.3%	0.4%
Total	2,303	3,347	4,396	4,540	6,495	7,301	5,985	6,678	26,901	92,435
YoY	72.4%	45.3%	31.4%	3.3%	43.1%	12.4%	-18.0%	11.6%	302.8%	243.6%

Source: Shared Research based on company data
Note: The Green Energy business was referred to as the Solar Power Generation business through FY06/17; same hereinafter

The company began disclosing a revenue breakdown by region from FY06/21. In FY06/22, sales to North America made up the largest share of revenue at 73.8%, followed by those to Japan at 12.0%, Europe at 4.0%, and Asia at 1.7%. Versus FY06/21, revenue from sales to Asia fell 90.9% in FY06/22 whereas those to North America, Japan, and Europe were up 25.8x, 100.7%, and 91.4% YoY, respectively.

Abalance says that it barely had any market share in the US before the Biden administration, but orders from the US have grown dramatically since around the time of the inauguration in January 2021. The company attributes this to the shift in US

energy policies under the Biden administration and a strong move toward reevaluation of supply chains due to heightened geopolitical risks.

Revenue by geographical region

Revenue composition by region	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Japan									5,533	11,105
YoY									-	100.7%
% of revenue									20.6%	12.0%
Asia									16,781	1,526
YoY									-	-90.9%
% of revenue									62.4%	1.7%
North America									2,643	68,185
YoY									-	2,479.8%
% of revenue									9.8%	73.8%
Europe									1,943	3,719
YoY									-	91.4%
% of revenue									7.2%	4.0%
Other									0	7,898
YoY									-	-
% of revenue									-	8.5%
South America									0	7,772
YoY									-	-
% of revenue									-	8.4%
Total									26,901	92,435
YoY									-	243.6%

Source: Shared Research based on company data

US tariff exemptions for solar power-related imports from Southeast Asia

In June 2022, President Biden declared a state of emergency regarding the shortage of solar cells and panels, and issued a presidential proclamation instructing the Secretary of Commerce to take appropriate measures. These included tariff exemptions for imports of solar power-related products from Cambodia, Malaysia, Thailand, and Vietnam for a maximum period of 24 months ("Declaration of Emergency and Authorization for Temporary Extensions of Time and Duty-Free Importation of Solar Cells and Modules from Southeast Asia").

The proclamation spoke of the solar panel bottleneck emerging in the US. The majority of solar modules installed in the US are imported, and in 2020, three-quarters of these imports came from Southeast Asia. That said, due to increasing demand for solar power generation driven by the climate change, carbon neutrality efforts, and rising energy prices, the current level of panel imports no longer satisfies the growing demand in the US. Because of the shortage, about half of the expected domestic solar installations slated for the year following the proclamation have been at risk and a significant number of solar projects are being postponed or cancelled across the US.

Cost of revenue

The company had maintained a cost ratio of 80% or lower through FY06/20, prior to the acquisition of VSUN. However, this figure rose to 82.2% in FY06/21 and 89.5% in FY06/22. Although there has been no disclosure of a cost breakdown, the higher cost ratio was chiefly attributable to raw materials and other manufacturing costs resulting from the VSUN acquisition, according to the company. The cost of materials, including solar cells (a key component of solar panels) constituted a large portion of the manufacturing costs, while labor costs were relatively low as VSUN employed local workers. Other costs included depreciation and other expenses. In the Green Energy business, construction costs, which included expenditure on solar panels for the power plants being developed, accounted for a large portion of overall costs. The company sources many of the materials from China, but looks to stabilize procurement by purchasing from other Asian countries as well. It expects the cost of revenue to decline once the manufacture of solar cells is brought in-house with the launch of proprietary solar cell plants.

Income statement	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Revenue	2,303	3,347	4,396	4,540	6,495	7,301	5,985	6,678	26,901	92,435
YoY	72.4%	45.3%	31.4%	3.3%	43.1%	12.4%	-18.0%	11.6%	302.8%	243.6%
Cost of revenue	1,663	2,609	3,315	3,432	5,006	5,123	4,112	4,916	22,112	82,729
YoY	64.8%	56.9%	27.1%	3.5%	45.9%	2.3%	-19.7%	19.6%	349.8%	274.1%
Cost ratio	72.2%	78.0%	75.4%	75.6%	77.1%	70.2%	68.7%	73.6%	82.2%	89.5%
Gross profit	641	738	1,081	1,108	1,489	2,178	1,873	1,762	4,788	9,705
YoY	95.5%	15.1%	46.5%	2.5%	34.4%	46.3%	-14.0%	-5.9%	171.7%	102.7%
Gross profit margin	27.8%	22.0%	24.6%	24.4%	22.9%	29.8%	31.3%	26.4%	17.8%	10.5%

Source: Shared Research based on company data

SG&A expenses

The SG&A ratio, which trended around 20% from FY06/17 to FY06/20, fell to 12.7% in FY06/21 after the acquisition of VSUN, and declined further to 8.7% in FY06/22. Although commission expenses and taxes and dues increased, substantial revenue growth more than absorbed these increases. Of the SG&A expenses in FY06/22, commission expenses made up the largest share at 1.8% of the total, followed by salaries, allowances, and bonuses at 0.9%, and depreciation at 0.4%. Entry under "other expenses" constituted a large portion of total SG&A expenses at 5.2%, of which taxes and dues were the main expenditure.

According to Abalance, commission expenses are chiefly container freight and operator commissions associated with shipments. Taxes and dues are mostly the tariffs borne by VSUN for its exports, and will increase in tandem with production growth going forward. The R&D expenses are the expenses of Birdy Fuel Cells LLC operating the hydrogen business. The company also has subsidiaries dedicated to R&D, but their expenditures are negligible. The company says it has been able to maintain a small inventory and keep write-downs of trade receivables at a minimum. The risk of unsold orders is low because contracts are concluded separately per each project. The company also receives advances on trade receivables depending on potential credit risks.

SG&A expenses	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
SG&A expenses	435	474	660	710	1,374	1,251	1,265	1,400	3,427	8,007
YoY	84.8%	8.9%	39.3%	7.6%	93.3%	-8.9%	1.1%	10.7%	144.7%	133.6%
SG&A ratio	18.9%	14.2%	15.0%	15.6%	21.1%	17.1%	21.1%	21.0%	12.7%	8.7%
Commission expenses	69	72	103	129	327	221	256	229	492	1,640
YoY	161.7%	3.7%	43.2%	25.5%	153.7%	-32.4%	15.7%	-10.5%	114.7%	233.3%
% of revenue	3.0%	2.1%	2.3%	2.8%	5.0%	3.0%	4.3%	3.4%	1.8%	1.8%
Salaries, allowances and bonuses	94	153	210	221	303	367	361	400	678	865
YoY	103.2%	62.5%	36.9%	5.4%	37.3%	21.2%	-1.8%	10.8%	69.6%	27.6%
% of revenue	4.1%	4.6%	4.8%	4.9%	4.7%	5.0%	6.0%	6.0%	2.5%	0.9%
Depreciation	8	6	5	4	21	26	32	25	28	350
YoY	-44.3%	-24.6%	-14.6%	-26.9%	474.6%	20.4%	24.8%	-20.8%	11.0%	1,150.0%
% of revenue	0.3%	0.2%	0.1%	0.1%	0.3%	0.3%	0.5%	0.4%	0.1%	0.4%
Amortization of goodwill	32	17	17	17	34	101	107	77	12	147
YoY	71.4%	-46.0%	0.0%	0.0%	94.4%	200.0%	5.7%	-27.9%	-84.5%	1,125.0%
% of revenue	1.4%	0.5%	0.4%	0.4%	0.5%	1.4%	1.8%	1.2%	0.0%	0.2%
Directors' compensations	60	58	84	91	96	113	118	133	109	115
YoY	44.6%	-2.6%	43.9%	8.0%	6.1%	17.9%	4.2%	12.9%	-18.3%	5.5%
% of revenue	2.6%	1.7%	1.9%	2.0%	1.5%	1.6%	2.0%	2.0%	0.4%	0.1%
R&D expenses	3	-	30	-	12	0	-	-	-	74
YoY	700.7%	-	-	-	-	-98.0%	-	-	-	-
% of revenue	0.1%	-	0.7%	-	0.2%	0.0%	-	-	-	0.1%
Provision for doubtful accounts	3	2	0	12	182	13	-54	12	18	8
YoY	1,766.7%	-27.6%	-	-	1,422.5%	-93.1%	-	-	44.3%	-55.6%
% of revenue	0.1%	0.1%	-	0.3%	2.8%	0.2%	-	0.2%	0.1%	0.0%
Other	166	165	212	237	398	410	446	523	2,090	4,808
YoY	88.6%	-0.3%	28.0%	11.9%	67.9%	3.0%	8.8%	17.4%	299.4%	130.0%
% of revenue	7.2%	4.9%	4.8%	5.2%	6.1%	5.6%	7.4%	7.8%	7.8%	5.2%

Source: Shared Research based on company data

Operating profit

Much like consolidated revenue, operating profit has shifted dramatically over the past decade. In FY06/18, operating profit stood at JPY927mn, which was a record high at the time. However, with the acquisition of VSUN, operating profit soared to JPY1.4bn in FY06/21 (reflecting nine-months' contribution of VSUN). In FY06/22, the figure grew further to JPY1.7bn, up 368.8% from the pre-acquisition FY06/20. Looking at the combined operating profits of the company's reportable segments (before addition of Other business and adjustments), in FY06/12, the IT business and the Solar Power Generation business accounted for 70.7% and 29.9% of the total, respectively, with the Construction Machinery business logging a slight loss. Operating profit in the Solar Power Generation business continued to grow from FY06/13, effectively accounting for almost the entire operating profit by FY06/17. The operating profit mix of the Green Energy business (previously the Solar Power Generation business up to FY06/17) declined in FY06/21, with the acquisition of VSUN and the addition of Solar Panel Manufacturing business as a new reportable segment.

The company maintains that although raw material prices jumped in 2022, it has been able to pass on some of these costs to customers. Cost pass-through has only been in place for one year, so cost pass-through and other countermeasures were not sufficiently reflected in prior contracts, according to Abalance. Prior contracts did not include flexible clauses that would allow the company to pass on the cost increases caused by inflation, sharp increases in container freight rates, COVID-19, and Russia's invasion of Ukraine, among other factors. The company has been negotiating to add such clauses at the time of contract renewal with customers. It also believes that the launch of proprietary plants to manufacture solar cells—a key component of solar panels—will stabilize parts procurement, strengthen the supply chain, and improve profit margins. The company also plans the sale of excess solar cells to outside parties.

Operating profit by segment	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Solar Panel Manufacturing business									731	1,238
YoY	-	-	-	-	-	-	-	-	-	69.4%
% of total	-	-	-	-	-	-	-	-	40.9%	50.9%
Green Energy business	208	271	539	625	529	1,297	932	817	1,005	1,204
YoY	528.2%	30.4%	98.7%	16.0%	-15.5%	145.4%	-28.2%	-12.3%	23.0%	19.8%
% of total	87.6%	63.0%	89.2%	99.7%	100.9%	105.5%	93.4%	112.4%	56.3%	49.5%
IT business	34	85	29	4	26	8	63	-41	16	7
YoY	-	147.3%	-66.0%	-85.7%	538.0%	-68.6%	658.5%	-	-	-56.3%
% of total	14.4%	19.7%	4.8%	0.7%	5.0%	0.7%	6.3%	-5.6%	0.9%	0.3%
Photocatalyst business									32	-17
YoY	-	-	-	-	-	-	-	-	-	-
% of total	-	-	-	-	-	-	-	-	1.8%	-0.7%
Construction Machinery Sales business	-5	74	37	-2	-31	-76	3	-50		
YoY	-	-	-50.5%	-	-	-	-	-	-	-
% of total	-2.1%	17.3%	6.1%	-0.3%	-5.9%	-6.1%	0.3%	-6.8%	-	-
Reportable segments total	**237**	**430**	**605**	**627**	**524**	**1,230**	**997**	**727**	**1,786**	**2,433**
YoY	-	81.3%	40.5%	3.7%	-16.5%	134.7%	-18.9%	-27.1%	145.7%	36.2%
% of total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Other	0	0	0	0	0	0	-20	-6	-54	-45
YoY	-	-	-	-	-	-	-	-	-	-
Adjustments	-32	-167	-184	-230	-409	-303	-369	-359	-370	-689
YoY	-	-	-	-	-	-	-	-	-	-
Total	205	264	420	397	115	927	608	362	1,361	1,697
YoY	123.0%	28.4%	59.5%	-5.5%	-71.0%	704.7%	-34.4%	-40.5%	276.4%	24.7%

Source: Shared Research based on company data

OPM

Much like consolidated revenue and operating profit, OPM reached a record 12.7% in FY06/18, but has been underperforming this mark since. By reportable segment, the Solar Power Generation business maintained an OPM of around 15% through FY06/18. OPM in the IT business remained relatively high as well, although it fluctuated from year to year. The acquisition of VSUN led to an OPM decline to 5.1% in FY06/21. The margin dropped further to 1.8% in FY06/22, as higher cost of revenue due to raw material price hikes overshadowed the revenue growth from significant order increases in Europe and other markets.

OPM by segment	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Solar Panel Manufacturing business	-	-	-	-	-	-	-	-	3.5%	1.5%
Green Energy business	17.2%	11.6%	15.6%	15.9%	9.4%	19.9%	18.0%	13.1%	18.9%	11.8%
IT business	9.6%	32.7%	18.8%	4.6%	26.0%	10.2%	36.4%	-	32.0%	2.4%
Photocatalyst business	-	-	-	-	-	-	-	-	18.8%	-
Construction Machinery Sales business	-	10.1%	4.7%	-	-	-	0.4%	-	-	-
Reportable segments total	10.3%	12.9%	13.8%	13.8%	8.1%	16.8%	16.8%	11.1%	6.7%	2.6%
Total	8.9%	7.9%	9.6%	8.8%	1.8%	12.7%	10.2%	5.4%	5.1%	1.8%

Source: Shared Research based on company data

Capital expenditures

Purchases of solar power plants and equipment for solar panel manufacturing have been the main reasons behind changes in capital expenditures. In FY06/21, capital expenditures accounted for 23.4% of consolidated revenue because of such purchases, but the percentage dropped to 4.8% in FY06/22. VSUN has completed its fourth solar panel plant, but plans to build new solar cell plants with total annual production capacity of 6GW (total investment of roughly USD300mn). As the first phase of the project, a 3GW plant (investment of roughly USD180mn) is under construction, aiming for an October 2023 completion. The latest medium-term management plan spanning FY06/22 through FY06/24 focuses on a growth strategy based on the achievement of 1GW in output capacity (domestic and overseas power plants combined), 8GW in annual solar panel production capacity, and 6GW in solar cell production capacity. Accordingly, Abalance plans to continue making large investments.

Capital expenditures	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Total capital expenditures	17	102	151	60	434	408	2,096	1,408	6,290	4,406
% of revenue	0.8%	3.0%	3.4%	1.3%	6.7%	5.6%	35.0%	21.1%	23.4%	4.8%

Source: Shared Research based on company data

Earnings

Operating profit and net income attributable to owners of the parent have increased YoY since FY06/21, after posting YoY declines for two consecutive years from FY06/19. In FY06/22, both ROE and ROA declined YoY to 17.4% and 2.4%, respectively. The average period in inventory fell from nine months in FY06/20 to four months in FY06/22. The average accounts receivable turnover period was one month or less for all fiscal years, while the average accounts payable turnover

period declined from 2.3 months in FY06/21 to 1.9 months in FY06/22. As a result, the cash conversion cycle also declined from 3.2 months to 2.9 months.

According to the company, sales contracts are signed on a project by project basis, and manufacturing is done on a build-to-order basis. Generally, the average period from receiving orders to booking revenue is three to four months. The accounts receivable collection period is relatively short because the company receives a certain amount as advance payment whose conditions vary depending on the creditworthiness of the customer. Since transactions are mainly conducted in US dollars, foreign exchange impacts on purchases and sales offset each other. However, the company is subject to foreign exchange impact when it converts US dollar-based profits to Japanese yen. Abalance conservatively estimates the exchanges rates used internally, and maintains that the foreign exchange impact is small, provided there is no sharp appreciation of the yen.

If robust demand continues, the enhancement of solar panel production capacity will result in substantial revenue growth with the economies of scale also improving the profit margins. Shared Research understands that once the phase 1 solar cell plant (3GW) begins operation, the in-house manufacture of solar cells will contribute to margin improvements.

Profit margins	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Revenue	2,303	3,347	4,396	4,540	6,495	7,301	5,985	6,678	26,901	92,435
Cost of revenue	1,663	2,609	3,315	3,432	5,006	5,123	4,112	4,916	22,112	82,729
Gross profit	641	738	1,081	1,108	1,489	2,178	1,873	1,762	4,788	9,705
Operating profit	205	264	420	397	115	927	608	362	1,361	1,697
YoY	123.0%	28.4%	59.5%	-5.5%	-71.0%	704.7%	-34.4%	-40.5%	276.4%	24.7%
Operating profit margin	8.9%	7.9%	9.6%	8.8%	1.8%	12.7%	10.2%	5.4%	5.1%	1.8%
Net income attributable to owners of the parent	117	234	200	231	-176	757	316	211	537	867
YoY	273.6%	100.6%	-14.6%	15.8%	-	-	-58.2%	-33.1%	154.2%	61.5%
Net margin	5.1%	7.0%	4.5%	5.1%	-	10.4%	5.3%	3.2%	2.0%	0.9%
Inventory(Merchandise and finished goods, Work in process, Raw materials and supplies)	379	613	600	1,051	3,061	3,987	3,804	5,000	10,947	30,552
YoY	16.2%	62.0%	-2.2%	75.3%	191.3%	30.2%	-4.6%	31.4%	118.9%	179.1%
% of total assets	32.4%	29.6%	23.7%	37.7%	47.8%	55.5%	34.6%	33.9%	27.8%	35.9%
Accounts receivable	96	408	525	473	335	335	393	303	1,312	6,156
YoY	-17.7%	327.1%	28.5%	-9.9%	-29.2%	0.2%	17.2%	-22.8%	332.5%	369.2%
% of total assets	8.2%	19.7%	20.7%	16.9%	5.2%	4.7%	3.6%	2.1%	3.3%	7.2%
Accounts payable	165	514	436	529	331	411	533	991	5,058	14,595
YoY	25.0%	211.7%	-15.2%	21.3%	-37.3%	23.9%	29.8%	86.0%	410.4%	188.6%
% of total assets	14.1%	24.8%	17.2%	18.9%	5.2%	5.7%	4.8%	6.7%	12.8%	17.1%
Net assets(excl. stock acquisition rights and and non-controlling interests)	506	864	1,038	1,219	1,077	1,767	1,969	2,093	4,006	5,933
YoY	45.6%	70.8%	20.2%	17.4%	-11.6%	64.0%	11.4%	6.3%	91.4%	48.1%
% of total assets	43.3%	41.7%	41.0%	43.7%	16.8%	24.6%	17.9%	14.2%	10.2%	7.0%
Total assets	1,169	2,073	2,531	2,790	6,400	7,189	10,985	14,765	39,388	85,181
YoY	-13.9%	77.3%	22.1%	10.2%	129.4%	12.3%	52.8%	34.4%	166.8%	116.3%
% of total assets	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
ROA (RP-based)	9.1%	14.8%	14.7%	16.0%	1.1%	12.9%	6.2%	2.4%	4.7%	2.4%
Return on equity(ROE)	27.3%	34.2%	21.0%	20.5%	-15.3%	53.2%	16.9%	10.4%	17.6%	17.4%
Tangible fixed asset turnover(excl. construction in progress)	32.5	20.8	23.2	20.4	5.3	5.0	2.1	2.0	1.9	4.9
Total asset turnover	2.0	1.6	1.7	1.6	1.0	1.0	0.5	0.5	0.7	1.1
Inventory turnover	6.5	6.7	7.2	5.5	3.2	2.1	1.5	1.5	3.4	4.5
Average period in inventory(months)	2.0	2.2	1.6	2.8	5.7	6.6	7.6	9.0	4.9	4.0
Accounts receivable turnover period(months)	0.5	1.5	1.4	1.2	0.6	0.6	0.8	0.5	0.6	0.8
Accounts payable turnover period(months)	0.9	1.8	1.2	1.4	0.6	0.7	1.1	1.8	2.3	1.9
Cash conversion cycle(months)	1.6	1.8	1.9	2.6	5.7	6.4	7.3	7.7	3.2	2.9

Source: Shared Research based on company data

Financial standing

The group's interest-bearing debt has increased due to the need to finance capital expenditures. The company expanded investments while logging a net operating cash outflow since FY06/19. Free cash flow has been negative since FY06/14, and as a result, interest-bearing debt reached JPY39.3bn on a gross basis in FY06/22, while net interest-bearing debt after deducting cash and cash equivalents stood at JPY35.3bn. Short-term interest-bearing debt accounted for 51.3% of the total. Pledged assets in FY06/22 included machinery, equipment, and vehicles, as well as merchandise and finished goods, amounting to JPY25.2bn in total value.

In terms of shareholders' equity, in December 2021, the company conducted a capital increase, raising a total of JPY775mn intended for the expansion of renewable energy-related business base, acquisition of solar power plants in the secondary market, and R&D activities. In January 2023, the company conducted another capital increase via third-party allotment, raising approximately JPY1.4bn to be invested in the solar power generation business.

At end-FY06/22, the debt-to-equity ratio rose to 6.6x and the equity ratio fell to 7.0%. The interest coverage ratio declined to 2.4x. According to the company, VSUN's capital expenditures have been financed by loans from several major financial institutions in Vietnam. VSUN manages its finances on a stand-alone basis and conducts its own financing activities; it secures loans from financial institutions at lower interest rates than usual. Also, Abalance does not provide individual guarantees to

VSUN. However, as a way of showing support not only through management and supervision but also on the financing front, Abalance offers assistance by, for instance, introducing Japanese banks to VSUN for green financing.

Initiatives toward green finance

In September 2022, WWB entered into a sustainability-linked loan agreement (a JPY400mn loan) with The Hiroshima Bank, Ltd. (unlisted; the banking subsidiary of Hirogin Holdings, Inc. [TSE Prime: 7337]). Under this arrangement, the loan's interest rate spread becomes adjusted depending on the borrower's level of contribution to decarbonization efforts. In March 2023, VSUN obtained a green loan of USD10mn from The Chiba Bank, Ltd. (TSE Prime: 8331). The borrowing is based on a green loan framework, limiting its use as fresh funds for the new solar panel plant.

Financial ratios	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Cash flows from operating activities	121	-77	57	206	-984	405	-147	-861	-608	-6,348
Cash flows from investing activities	-28	-116	-252	-75	-864	-559	-1,620	-472	-1,391	-13,321
FCF	93	-194	-195	131	-1,848	-155	-1,766	-1,333	-1,999	-19,669
Cash flows from financing activities	48	393	104	-85	1,991	-62	1,913	1,465	5,290	17,752
Cash and cash equivalents	295	494	407	496	672	601	799	1,209	4,722	3,966
Interest-bearing debt	613	497	631	611	3,230	3,233	5,323	8,982	17,984	39,273
short-term	166	163	349	487	1,738	2,080	2,194	3,386	9,856	20,153
Pledged assets	-	-	89	497	1,114	1,303	2,275	4,881	19,995	25,200
Net debt(after deducting cash and cash equivalents)	318	3	225	115	2,558	2,632	4,524	7,773	13,262	35,307
Net assets(excl. stock acquisition rights and and non-controlling interests)	506	864	1,038	1,219	1,077	1,767	1,969	2,093	4,006	5,933
Operating profit	205	264	420	397	115	927	608	362	1,361	1,697
Interest and dividend income	0	0	1	2	0	0	6	2	3	111
Business profit(operating profit + interest and dividend income)	205	264	421	399	116	927	614	364	1,364	1,808
EBITDA(operating profit + depreciation and goodwill amortization)	229	296	468	431	169	1,050	882	627	2,081	3,309
Interest expenses	18	15	14	11	18	44	85	111	317	740
Interest coverage ratio(times)	11.1	17.4	29.3	34.9	6.4	21.0	7.2	3.3	4.3	2.4
Interest-bearing debt/EBITDA(times)	2.7	1.7	1.3	1.4	19.1	3.1	6.0	14.3	8.6	11.9
Net debt/EBITDA(times)					15.1	2.5	5.1	12.4	6.4	10.7
Interest-bearing debt/Net assets(times)	1.2	0.6	0.6	0.5	3.0	1.8	2.7	4.3	4.5	6.6
Net debt/Net assets(times)	0.6	0.0	0.2	0.1	2.4	1.5	2.3	3.7	3.3	6.0
Short-term debt/Interest-bearing debt	27.1%	32.9%	55.3%	79.7%	53.8%	64.3%	41.2%	37.7%	54.8%	51.3%
Equity ratio	43.3%	41.7%	41.0%	43.7%	16.8%	24.6%	17.9%	14.2%	10.2%	7.0%

Source: Shared Research based on company data

Order backlogs and orders received

The company discloses data on order backlogs and orders received, which are leading indicators of revenue (quarterly figures are not released). At end-FY06/22, order backlogs were JPY131.3bn (23x YoY), with the Solar Panel Manufacturing business accounting for 97% of the total. Orders received as of end-FY06/22 grew 670.2% YoY to JPY217.8bn, with the Solar Panel Manufacturing business accounting for 94.8% of the total.

Order backlogs by segment	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Solar Panel Manufacturing business									2,356	127,382
YoY	-	-	-	-	-	-	-	-	-	5,306.7%
% of total	-	-	-	-		-	-	-	41.4%	97.0%
Green Energy business (Solar Power Generation business until FY06/17)	445	1,532	541	1,470	3,390	3,200	2,812	3,969	3,258	3,916
YoY	-	243.9%	-64.7%	171.7%	130.6%	-5.6%	-12.1%	41.2%	-17.9%	20.2%
% of total	72.7%	90.7%	88.9%	93.3%	96.1%	96.8%	98.4%	99.4%	57.3%	3.0%
IT business	154	112	52	49	39	34	38	17	72	37
YoY	-	-27.7%	-53.3%	-6.5%	-20.4%	-11.7%	11.6%	-55.8%	326.4%	-48.6%
% of total	25.2%	6.6%	8.6%	3.1%	1.1%	1.0%	1.3%	0.4%	1.3%	0.0%
Photocatalyst business										
YoY	-	-	-	-	-	-	-	-	-	-
% of total	-	-	-	-	-	-	-	-	-	-
Construction Machinery Sales business	13	46	15	57	98	72	8	7		
YoY	-	252.0%	-66.6%	270.4%	70.9%	-25.7%	-88.4%	-13.6%	-	-
% of total	2.1%	2.7%	2.5%	3.6%	2.8%	2.2%	0.3%	0.2%	-	-
Total	613	1,690	609	1,575	3,527	3,307	2,858	3,994	5,687	131,336
YoY	-	175.7%	-64.0%	158.8%	123.9%	-6.2%	-13.6%	39.7%	42.4%	2,209.4%

Source: Shared Research based on company data

Orders received by segment	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Solar Panel Manufacturing business									23,369	206,526
YoY									-	783.8%
% of total						-	-	-	82.7%	94.8%
Green Energy business(Solar Power Generation business until FY06/17)	1,646	3,436	2,139	4,869	7,556	6,308	5,153	7,328	4,623	10,892
YoY	-	108.7%	-37.7%	127.6%	55.2%	#REF!	-18.3%	42.2%	-36.9%	135.6%
% of total	60.5%	77.7%	70.5%	88.4%	89.5%	89.3%	87.9%	96.1%	16.4%	5.0%
IT business	332	217	104	87	91	77	176	37	106	258
YoY	-	-34.8%	-51.9%	-16.9%	5.2%	-15.7%	129.4%	-78.9%	184.7%	143.4%
% of total	12.2%	4.9%	3.4%	1.6%	1.1%	1.1%	3.0%	0.5%	0.4%	0.1%
Photocatalyst business									170	80
YoY									-	-52.9%
% of total	-	-	-	-	-	-	-	-	0.6%	0.0%
Construction Machinery Sales business	745	771	793	552	799	681	532	257		
YoY	-	3.5%	2.8%	-30.4%	44.8%	-14.7%	-21.9%	-51.7%		
% of total	27.4%	17.4%	26.1%	10.0%	9.5%	9.6%	9.1%	3.4%	-	-
Total	2,723	4,424	3,037	5,507	8,446	7,065	5,861	7,622	28,271	217,757
YoY	-	62.5%	-31.4%	81.4%	53.3%	-16.3%	-17.0%	30.0%	270.9%	670.2%

Source: Shared Research based on company data

Market and value chain

Here, we will primarily focus on the solar panel market, where the mainstay businesses of the Abalance group belong. While there are no official statistics indicating the global market size for solar panels alone, the International Energy Agency (IEA) gives an estimate of the overall solar power generation market in its "Trends in Photovoltaic Application" report. IEA also releases historical data and outlook on global electricity supply and demand as well as power output capacity by energy source, in its "World Energy Outlook" (WEO) report. In addition, other research institutions and market research companies provide information on current market size and outlook. In Japan, Fuji Keizai Co., Ltd. provides market size data for solar cells in its "2021 Current Status and Future Outlook on Solar Cell-related Technologies and Market" report released in December 2021.

Solar power generation market

According to IEA, total revenue generated in the global solar power sector, including revenue from silicon, wafers, cells, and panels, reached USD190bn in 2021 (approximately JPY21tn based on average exchange rate of JPY109.8/dollar in 2021), up 18.8% YoY. This figure was calculated, taking into account the solar panel (PV) annual installations, cumulative installations, and average cost of installation (note: the figure excludes USD5.4bn in revenue linked to O&M). Neither the base figures of the calculations, such as volume and per-unit value, nor data on future outlook are disclosed in the IEA report.

Total revenue generated in the global solar power sector grew at a CAGR of 11.6% over the five years from 2017 to 2021, with growth rates in 2020 and 2021 finishing higher than the average. Since IEA does not disclose the details of its calculations, we attempted to estimate the value of PV per GW by simply dividing the total revenue by the PV annual installations data (in GW) in the IEA report. The Shared Research estimate (referred to as "reference value" in the table below) showed that from 2019, total revenue in the solar power sector grew due to an increase in the amount of PV installations, which more than compensated for the decline in unit value per GW.

Total revenue generated by the global solar power generation market

Solar power generation market	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	CAGR over the five years from 2017 to 2021	CAGR over the five years from 2012 to 2021
Total revenue(USDmn)	75,000	86,000	82,000	80,000	110,000	110,000	132,000	135,000	160,000	190,000		
YoY	-31.8%	14.7%	-4.7%	-2.4%	37.5%	0.0%	20.0%	2.3%	18.5%	18.8%	11.6%	5.6%
(Reference value)												
PV annual installations(GW)	30	38	40	51	77	103	105	113	146	174		
YoY	-4.2%	26.8%	6.1%	25.9%	52.1%	34.0%	1.7%	7.9%	28.9%	19.2%	17.7%	18.8%
Unit value(per GW, USDmn)	2,517	2,275	2,045	1,584	1,432	1,069	1,262	1,196	1,100	1,095		
YoY	-28.8%	-9.6%	-10.1%	-22.5%	-9.6%	-25.4%	18.0%	-5.2%	-8.0%	-0.4%	-5.2%	-11.1%

Source: Shared Research based on data from the respective years' "Trends in Photovoltaic Applications" report published by the International Energy Agency

Other research institutions and market research companies also provide estimates on the size of the solar power generation market or the solar panel market. They consistently expect the markets to expand, fueled by the support measures extended by governments and a drive toward carbon neutrality.

Solar power generation market: Size and outlook

(USDmn)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	CAGR
Solar power generation market											
Precedence Research(Canada)	197,230	211,310	226,440	242,670	260,100	278,820	298,920	320,520	343,710	368,630	(2021- 2030)
YoY	-	7.1%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.3%	7.2%
Solar panel market											(2021- 2028)
Global Market Insights(US)	61,000	-	-	-	-	-	-	85,000	-	-	4.9%
											(2021- 2030)
Custom Market Insights (US)	151,000	-	-	-	-	-	-	-	-	292,320	7.6%

Source: Shared Research based on information provided by Precedence Research, Global Market Insights, and Custom Market Insights

In Japan, Fuji Keizai provided data on the global solar cell market in its report, "2021 Current Status and Future Outlook on Solar Cell-related Technologies and Market" (released December 2021). According to the report, in 2021, the global solar cell market (including panels, ingot, and wafers) was valued at JPY10.3tn, which is about half of IEA's estimate. Fuji Keizai also gave a projection for 2035, stating that the solar cell market will likely remain largely flat from 2021, at JPY10.2tn in 2035. It expects output capacity to increase from 260.8GW in FY2021 to 487.3GW in FY2035 (+86.8%), but the total value will be minimized due to a decline in per-unit value. Fuji Keizai maintains that many companies will be unable to sufficiently pass on the soaring raw material prices, transport expenses, and other production cost hikes to their selling prices at shipment. As a result, their profits will be squeezed, and the industry will likely be prompted to restructure at an accelerated pace.

Fuji Keizai expects the total value of the solar cell market in Japan (including panels and power generation systems) to decline 46.5% from JPY281.9bn in 2021 (estimate) to JPY150.9bn in 2035. Meanwhile, it projects output to increase from 6.7GW in 2021 to 7.26GW in 2035. According to Fuji Keizai, the market is expected to stop shrinking around 2030 and shift to expansion thereafter, against the backdrop of lower prices accompanying bolstered global production, rising electricity prices, and increasing demand for carbon-neutral solutions.

Global electricity demand and supply; output capacity

Outlook on global electricity demand and supply

The WEO 2022 report predicts the global electricity demand to expand, with renewables such as solar and wind power becoming mainstream sources. According to the report, electricity demand is expected to grow 24.0% from 2021 to 2030 in the stated policies scenario (STEPS), 28.6% in the announced pledges scenario (APS), and 36.6% in the net zero emissions by 2050 scenario (NZE). In developed countries, demand for transportation-use electricity will increase with the spread of electric vehicles, and in developing countries, electricity demand will rise in tandem with population growth and increased demand for air conditioning. The report projects further increase in electricity demand in the scenarios through 2050.

WEO presents outlook in three scenarios

The WEO 2022 report presents three scenarios, providing a framework to explore the effects of various policy choices, investment trends, and technological developments on the projections. Assumptions for each of the scenarios are as follows.

* **Stated policies scenario (STEPS)** shows the trajectory implied by current policy settings
* **Announced pledges scenario (APS)** assumes all aspirational targets announced by countries—including their long-term net zero and energy access goals—are met in full and as scheduled
* **Net zero emissions by 2050 scenario (NZE)** proposes a way to limit global warming to 1.5°C and to achieve universal access to modern energy by 2030

(See "https://www.iea.org/reports/world-energy-outlook-2022" for details on the WEO report)

On the supply front, all scenarios expect electricity sourced from fossil fuels to decline while renewables expand. Among the clean energy sources, electricity supplies from nuclear and hydroelectric power will likely remain flat or decline, whereas those from solar and wind power are expected to increase. WEO projects the share of renewable energy in the total energy mix to increase from 38.2% in 2021 to 52.9% in the STEPS, 58.9% in the APS, and 71.5% in the NZE. Further, it expects solar power to account for 11.5% of the energy mix in 2030 (versus 3.5% in 2021) in the STEPS, 13.5% in the APS, and 20.0% in the NZE. The report expects this trend to continue into 2050.

Outlook on global electricity demand and supply

Outlook on global electricity demand and supply	Results		Results		Stated policies scenario(STEPS)				Announced pledges scenario(APS)				Net zero emissions by 2050 scenario, (NZE)			
(TWh)	2010	% of total	2021	% of total	2030	% of total	2050	% of total	2030	% of total	2050	% of total	2030	% of total	2050	% of total
Electricity demand	18,548	100.0%	24,700	100.0%	30,621	100.0%	43,672	100.0%	31,752	100.0%	53,810	####	33,733	100.0%	62,159	100.0%
Change from 2021			33.2%		24.0%		76.8%		28.6%		117.9%		36.6%		151.7%	
Electricity supply	21,539	100.0%	28,334	100.0%	34,834	100.0%	49,845	100.0%	35,878	100.0%	61,268	####	37,723	100.0%	73,232	100.0%
Change from 2021			31.5%		22.9%		75.9%		26.6%		116.2%		33.1%		158.5%	
Fossil fuels			17,435	61.5%	16,324	46.9%	12,862	25.8%	14,539	40.5%	5,332	8.7%	9,823	26.0%	85	0.1%
Change from 2021					-6.4%		-26.2%		-16.6%		-69.4%		-43.7%		-99.5%	
Renewable energy	6,990	32.5%	10,835	38.2%	18,424	52.9%	36,711	73.7%	21,121	58.9%	53,976	88.1%	26,960	71.5%	70,315	96.0%
Change from 2021					70.0%		238.8%		94.9%		398.2%		148.8%		549.0%	
Nuclear	2,756	12.8%	2,776	9.8%	3,351	9.6%	4,260	8.5%	3,547	9.9%	5,103	8.3%	3,896	10.3%	5,810	7.9%
Hydroelectric	3,449	16.0%	4,327	15.3%	5,078	14.6%	6,809	13.7%	5,213	14.5%	7,543	12.3%	5,725	15.2%	8,251	11.3%
Wind	342	1.6%	1,870	6.6%	4,604	13.2%	10,691	21.4%	5,816	16.2%	17,416	28.4%	7,840	20.8%	23,486	32.1%
Change from 2021					146.2%		471.7%		211.0%		831.3%		319.3%		1,155.9%	
Solar	32	0.1%	1,003	3.5%	4,011	11.5%	12,118	24.3%	4,838	13.5%	18,761	30.6%	7,551	20.0%	27,006	36.9%
Change from 2021					299.9%		1,108.2%		382.4%		1,770.5%		652.8%		2,592.5%	
Other	411	1.9%	859	3.0%	1,380	4.0%	2,833	5.7%	1,707	4.8%	5,153	8.4%	1,948	5.2%	5,762	7.9%

Source: "World Energy Outlook 2022" report released by the International Energy Agency

By region, WEO projects electricity demand to increase, especially in Asia Pacific. In all scenarios, demand is expected to fall in North America, Europe, and Japan, while rising in Asia Pacific including China, India, and Southeast Asia, as well as in Africa and the Middle East in the period between 2021 and 2030.

Outlook on global electricity demand by region

Outlook on global electricity demand(TWh)	Results		Stated policies scenario(STEPS)				Announced pledges scenario(APS)			
	2021	% of total	2030	% of total	2050	% of total	2030	% of total	2050	% of total
Total	24,700	100.0%	30,621	100.0%	43,672	100.0%	31,752	100.0%	53,810	100.0%
North America	4,852	19.6%	5,266	17.2%	6,830	15.6%	5,544	17.5%	8,786	16.3%
US	4,004	16.2%	4,281	14.0%	5,482	12.6%	4,529	14.3%	7,187	13.4%
Central and South America	1,097	4.4%	1,308	4.3%	2,168	5.0%	1,447	4.6%	2,940	5.5%
Brazil	541	2.2%	622	2.0%	985	2.3%	637	2.0%	1,138	2.1%
Europe	3,645	14.8%	4,182	13.7%	5,060	11.6%	4,639	14.6%	6,561	12.2%
EU	2,608	10.6%	2,922	9.5%	3,327	7.6%	3,271	10.3%	4,348	8.1%
Africa	707	2.9%	994	3.2%	2,041	4.7%	1,128	3.6%	3,355	6.2%
South Africa	194	0.8%	229	0.7%	365	0.8%	248	0.8%	494	0.9%
Middle East	1,064	4.3%	1,372	4.5%	2,430	5.6%	1,343	4.2%	2,878	5.3%
Eurasia	1,181	4.8%	1,291	4.2%	1,669	3.8%	1,280	4.0%	1,652	3.1%
Asia Pacific	12,161	49.2%	16,208	52.9%	23,475	53.8%	16,371	51.6%	27,638	51.4%
China	7,556	30.6%	9,969	32.6%	12,868	29.5%	9,940	31.3%	14,504	27.0%
India	1,273	5.2%	2,117	6.9%	4,293	9.8%	2,107	6.6%	5,314	9.9%
Japan	934	3.8%	893	2.9%	922	2.1%	952	3.0%	1,153	2.1%
Southeast Asia	1,037	4.2%	1,537	5.0%	2,848	6.5%	1,580	5.0%	3,214	6.0%

Source: The "World Energy Outlook 2021" and "World Energy Outlook 2022" reports released by the International Energy Agency

Outlook on installed electricity capacity

Based on its forecast on electricity demand trends, WEO also provides an outlook on installed electricity capacity by source. According to the outlook, installed capacity of solar power is expected to grow from 892GW in 2021 to 3,020GW in 2030, 5,573GW in 2040, and 7,464GW in 2050 for STEPS. This represents a 3.4x increase from the 2021 level by 2030, a 6.2x increase by 2040, and an 8.4x increase by 2050. APS and NZE call for an even larger growth in installed capacity. These figures have been upwardly revised from the 2021 WEO projections.

Outlook on global installed capacity by power source

Outlook on global installed capacity by power source	Results		Stated policies scenario(STEPS)			Announced pledges scenario(APS)			Net zero emissions by 2050 scenario, (NZE)		
(GW)	2010	2021	2030	2040	2050	2030	2040	2050	2030	2040	2050
Total	5,198	8,185	11,954	16,468	19,792	12,932	20,258	26,541	15,306	26,870	33,878
(WEO2021)			11,143	14,719	17,844	11,996	17,867	22,795	14,933	26,384	33,415
Renewable energy	1,343	3,278	6,707	10,666	13,653	7,744	14,510	20,290	10,349	21,398	27,304
Solar	39	892	3,020	5,573	7,464	3,498	7,471	11,065	5,052	11,620	15,468
(WEO2021)			2,550	4,516	6,163	3,063	6,232	9,095	4,956	10,980	14,458
Wind	181	832	1,830	2,853	3,564	2,251	4,246	5,727	3,072	6,435	7,795
Hydroelectric	1,027	1,358	1,563	1,795	2,027	1,609	1,988	2,325	1,782	2,349	2,685
Nuclear	403	413	471	545	590	487	622	716	535	777	871
Hydrogen and Ammonia			3	13	13	30	180	228	189	640	573
Fossil fuels	3,448	4,462	4,496	4,467	4,229	4,241	3,698	3,017	3,451	1,742	1,267
Storage battery	1	27	270	768	1,296	425	1,246	2,286	778	2,311	3,860

Source: "World Energy Outlook 2022" report released by the International Energy Agency

A Shared Research estimate on the required additions in installed capacity per year, based on the projections for solar power and wind power output capacities, showed that in the STEPS, the required addition per year came to 236GW through 2030, 246GW through 2040, and 227GW through 2050. Since output capacity increased by 78GW per year from 2010 to 2021,

the required addition of 236GW per year from 2021 through 2030 based on STEPS (the most conservative scenario) represents a roughly threefold increase.

Outlook on installed capacity for solar and wind power

Outlook on installed capacity for solar and wind power	Results		Stated policies scenario(STEPS)			Announced pledges scenario(APS)			Net zero emissions by 2050 scenario, (NZES)		
(GW)	2010	2021	2030	2040	2050	2030	2040	2050	2030	2040	2050
Solar	39	892	3,020	5,573	7,464	3,498	7,471	11,065	5,052	11,620	15,468
Projected annual growth of installed capacity		78	236	246	227	290	346	351	462	565	503
Wind	181	832	1,830	2,853	3,564	2,251	4,246	5,727	3,072	6,435	7,795
Projected annual growth of installed capacity		59	111	106	94	158	180	169	249	295	240

Source: "World Energy Outlook 2022" report released by the International Energy Agency

The "Renewables 2022" report also published by IEA provides historical data on solar power output capacity by country and region, along with an outlook through 2027. In 2021, the overall installed capacity for solar power stood at 891GW globally, of which China accounted for 308GW, Europe 195GW, the US 119GW, and Japan 78GW. The CAGR over the five years from 2017 to 2021 was 24.1% overall, with the CAGR in Brazil, Netherlands, ASEAN, MENA, and India exceeding 40% for the same period.

The outlook from 2022 to 2027 indicated a fall in the overall growth rate to a CAGR of 16.5%. Still, the growth rates in MENA, Spain, and Brazil are expected to surpass 20%. A comparison of the actual growth in solar power output capacity from 2017 to 2021 and the projected growth from 2022 to 2027 shows that, excluding a few countries like Japan, output capacity will more than double in many countries and regions. According to the "Renewables 2022" report, concerns over energy security due to Russia's invasion of Ukraine are driving countries to reduce their dependence on imported fossil fuels whose prices are soaring, and switch to renewables such as solar and wind power at an accelerated pace.

Installed capacity by country and region

Global solar power generation installed capacity(GW)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	CAGR over the five years from 2017 to 2021
Total	100	137	177	227	302	399	496	606	740	891	24.1%
China	7	18	28	43	78	131	175	205	253	308	31.8%
(Europe)	72	82	89	98	105	113	124	146	167	195	13.2%
US	8	13	19	26	41	52	63	76	95	119	23.4%
Japan	7	14	23	34	42	50	56	63	72	78	13.1%
India	1	1	3	5	10	18	28	38	42	52	40.0%
Germany	34	37	38	39	41	42	45	49	54	59	7.7%
Australia	2	3	4	5	6	7	11	16	20	25	34.3%
(ASEAN)	1	1	2	2	4	4	5	11	23	26	46.6%
South Korea	1	2	3	4	5	6	9	13	17	22	34.7%
Italy	17	18	19	19	19	20	20	21	22	23	3.2%
Brazil	0	0	0	0	0	1	2	5	8	13	165.1%
Spain	5	5	5	5	5	5	5	9	10	15	26.1%
Netherlands	0	1	1	2	2	3	5	7	11	14	46.8%
France	4	5	6	7	8	9	10	11	12	15	13.8%
(Middle East and North Africa)	0	1	1	1	2	3	4	9	10	12	44.1%
UK	2	3	6	10	12	13	13	13	14	14	3.0%
Other	2	3	6	8	11	14	19	26	33	42	32.0%

Source: "Renewables 2022" report released by the International Energy Agency

Outlook on installed capacity by country and region

Global solar power generation installed capacity(GW)	2021	2022 est.	2023 est.	2024 est.	2025 est.	2026 est.	2027 est.	CAGR over the five years from 2017 to 2021	CAGR over the five years from 2022 to 2027	Growth from 2017 to 2021	Growth from 2022 to 2027
Total	891	1,101	1,321	1,553	1,803	2,065	2,359	24.1%	16.5%	589	1,259
China	308	400	497	596	700	799	915	31.8%	18.0%	231	515
(Europe)	195	233	273	314	360	410	464	13.2%	14.8%	90	231
US	119	138	162	192	227	269	316	23.4%	18.1%	77	179
Japan	78	84	91	98	103	107	111	13.1%	5.9%	36	28
India	52	68	83	99	117	138	161	40.0%	18.8%	43	93
Germany	59	66	75	84	96	110	127	7.7%	13.9%	18	61
Australia	25	30	34	39	43	47	53	34.3%	12.1%	20	23
(ASEAN)	26	29	33	38	43	49	55	46.6%	13.4%	22	26
South Korea	22	25	30	34	38	41	45	34.7%	12.1%	17	20
Italy	23	25	27	30	33	37	42	3.2%	10.8%	3	17
Brazil	13	25	34	41	49	58	66	165.1%	21.4%	13	41
Spain	15	21	29	37	45	53	61	26.1%	23.3%	10	40
Netherlands	14	19	23	27	31	34	36	46.8%	14.5%	12	18
France	15	18	21	23	27	29	32	13.8%	12.2%	7	14
(Middle East and North Africa)	12	15	19	24	31	38	46	44.1%	25.3%	10	31
UK	14	15	16	17	20	23	26	3.0%	12.6%	2	12
Other	42	55	66	78	92	109	127	32.0%	18.4%	32	73

Source: "Renewables 2022" report released by the International Energy Agency
Note: Estimates are based on the main scenario

Solar panel production capacity, production, and prices

While IEA and other projections point to an increase in installed capacity for solar power, solar panels manufactured in 2021 stood at 242GW versus an overall production capacity of 482GW. In other words, the capacity utilization rate (production/production capacity) was as low as 50.2%. A comparison of the CAGR of the past five years showed that production capacity has increased at a faster pace than production growth, causing the capacity utilization rate to trend downward.

The rise and fall of the solar panel industry

The solar panel industry is a highly competitive industry characterized by habitual oversupply and price declines. Up to the early 1990s, Japanese companies had dominated the upper ranks of the global market share, but China began mass production in the 2000s and has since commanded the global market with its absolute cost competitiveness. In the early 2010s, amid governments of various countries working to reduce their feed-in tariff rates, the solar panel demand in Europe—then the largest market—declined rapidly due to the European debt crisis. As a result, major solar panel manufacturers including those in China suffered business failures. By 2015, however, China came to lead the world by cumulative solar power installations while Japanese and German companies retreated due to intensified price competition. Chinese companies exported large quantities of inexpensive solar panels to countries like the US. This has inflicted substantial damage on the domestic solar panel industry in the US, causing trade friction between the US and China.

Solar panel production and production capacity

Solar panel production and production capacity(MW)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	CAGR over the five years from 2017 to 2021	CAGR over the 10 years from 2012 to 2021
Production capacity	58,000	60,949	67,259	93,674	104,860	154,893	183,844	219,187	326,676	482,727		
YoY	11.5%	5.1%	10.4%	39.3%	11.9%	47.7%	18.7%	19.2%	49.0%	47.8%	35.7%	25.0%
Production	36,487	39,869	45,965	62,664	78,060	105,142	115,973	140,297	179,474	242,378		
YoY	1.4%	9.3%	15.3%	36.3%	24.6%	34.7%	10.3%	21.0%	27.9%	35.0%	25.4%	21.0%
Capacity utilization rate(%)	62.9%	65.4%	68.3%	66.9%	74.4%	67.9%	63.1%	64.0%	54.9%	50.2%		

Source: Shared Research based on data from the "Trends in Photovoltaic Applications" report by the International Energy Agency

In a global solar panel price index that sets 2015 as the base year (100), the index number was 30 in 2021. According to the index, prices declined 32% YoY in 2018, but the margin of decline narrowed since, and turned to a 16% YoY increase in 2021. The "Trends in Photovoltaic Applications 2022" report by IEA explained that although oversupply cast a downward pressure, prices rose in 2021 because of an increase in demand for polycrystalline silicon, which is a key raw material for solar panels.

Solar panel prices

Solar panel prices	2015	2016	2017	2018	2019	2020	2021
Price index(2015=100)	100	92	66	45	32	26	30
YoY	-9%	-8%	-28%	-32%	-29%	-19%	15%

Source: "Technology cost trends for solar PV module, 2015-2021" released by the International Renewable Energy Agency

Government policy trends

The Intergovernmental Panel on Climate Change (IPCC), an intergovernmental body of the United Nations, advocates that in order to limit post-industrial revolution global warming to 1.5°C or less, carbon neutrality must be achieved by around 2050. In response, governments around the world have stepped up their efforts to achieve carbon neutrality, with major countries seeking to achieve this goal by 2050, and developing countries, by 2060 or 2070. Meanwhile, many countries are also moving toward import restrictions on solar panels made in China. The US has already imposed import restrictions, claiming that the import of solar products from China has inflicted serious impact on the domestic solar power industry.

Initiatives in major countries and regions

US

In 2021, the Obama administration imposed anti-dumping and countervailing duties on China-made solar products. This was a measure against Chinese companies' unfair sales practices for solar products and the improper subsidies granted by the Chinese government, which posed a serious impact on the US solar power industry. In 2018, the Trump administration

imposed emergency import restrictions on solar products (including those from countries other than China) based on section 201 of the Trade Act of 1974, citing that the domestic industry was being adversely affected. In the same year, the Trump administration imposed additional tariffs on solar products made in China, based on section 301 of the Trade Act of 1974.

Following the inauguration of the Biden administration in January 2021, the US returned to the Paris Agreement. It currently seeks to achieve zero greenhouse gas emissions in the power generation space by 2035 and carbon neutrality by 2050. In 2022, the government extended the anti-dumping and countervailing duties, as well as the emergency import restrictions, but some solar panels were excluded from being subject to these measures, and import-quantity restrictions on solar cells were also relaxed. In June 2022, the Uyghur Forced Labor Prevention Act was put in effect. Polycrystalline silicon, a raw material for solar panels, became subject to the act, and its importation became prohibited in principle if the production process involved the Xinjiang Uyghur Autonomous Region.

In November 2021, President Biden signed a USD1tn infrastructure investment bill, which included funding to establish electric vehicle charging stations at 500,000 locations nationwide and achieve widespread adoption of solar and wind power. In June 2022, the Biden administration declared a state of emergency regarding the supply shortage of solar cells and panels. A presidential proclamation was released, instructing the Secretary of Commerce to provide tariff exemptions and other measures for imports of solar products from Cambodia, Malaysia, Thailand, and Vietnam for up to 24 months.

In August 2022, the Inflation Reduction Act was passed. Within its provisions on energy security and climate change, the Inflation Reduction Act appropriated 40% of the USD369.0bn budget to supporting green electricity, promoting its adoption by granting tax breaks to operators of renewables-based power generation facilities.

EU

In 2013, the European Commission imposed import restrictions on solar panels made in China as measures against dumping and subsidies. These restrictions were extended in 2017, but were abolished in 2018. In 2022, the European Commission announced a bill to ban products made through forced labor; the bill is currently under review. Products manufactured inside and outside the EU are subject to the ban, reflecting concerns over human rights violations in China's Xinjiang Uyghur Autonomous Region and other locations.

In 2019, the European Commission proposed the Green Deal, and has stepped up its efforts toward greenhouse gas reduction and carbon neutrality in EU by 2050. In January 2020, the European Commission announced the European Green Deal Investment Plan, pledging investment of EUR1tn over the next decade.

China

In September 2020, President Xi Jinping announced that China will shift toward reducing greenhouse gas emissions by 2030 and achieve carbon neutrality by 2060. In October 2021, China disclosed an action plan, outlining its policy to push forward adoption of renewable energy.

In 2022, China proposed to add manufacturing equipment for solar cell silicon wafers to its list of export-restricted items. Shared Research understands this to be a retaliatory measure against the import restrictions and other trade barriers placed by the US and EU on foreign-made solar panels, and against the policies of the US and other countries to foster their domestic solar power industries by granting preferential treatment.

India

In 2018, India imposed a two-year safeguard on solar cells and panels imported from China and Malaysia. In 2022, it adopted a new climate change measure that aims to reduce carbon dioxide emissions by 45% by 2030, and to have 50% of its total energy supply sourced from renewables. Through such initiatives, India intends to achieve carbon neutrality by 2070.

Japan

In October 2020, the Japanese government expressed its intent to achieve a decarbonized society, and accordingly set out to accomplish carbon neutrality by 2050. The government also disclosed an ambitious goal of reducing greenhouse gas emissions by 46% from 2013 levels in FY2030, and further reducing emissions up to 50% thereafter. In October 2021, the government finalized its 6th Strategic Energy Plan, which prioritized the adoption of renewables as a primary power source. Under the Clean Energy Strategy, the Japanese government plans to continue investments into the adoption of renewables, such as funding for technological innovation and R&D for green transformation, establishment of next-generation transmission networks on the infrastructure front, and introduction of carbon pricing. By doing so, it will seek to achieve a carbon-neutral society.

The 6th Strategic Energy Plan calls for an increase in installed capacity of solar power from 55.8GW in FY2019 to 103.5–117.6GW by FY2030. The government plans to source 18GW from already certified facilities that have yet to be operational, and another 26.2GW through new certifications based on strengthened policies, which would bring up the total to around 100GW. It intends to step up efforts to achieve this target. The 6th Strategic Energy Plan also aims to raise the ratio of solar energy from 8.3% of total power generation in FY2021 to 14–16% by FY2030.

Outlook on Japan's renewables-based output capacity

(GW)	FY2019(Results)	5th Strategic Energy Plan(July 2018)	6th Strategic Energy Plan(October 2021)
Solar	55.8	64.0	103.5-117.6
Onshore wind	4.2	9.2	17.9
Offshore wind	-	0.8	5.7
Geothermal	0.6	1.4-1.6	1.5
Hydroelectric	50.0	48.5-49.3	50.7
Biomass	4.5	6-7	8
Output capacity(billion kWh)	185	236.6-251.5	336.0-353.0

Source: Shared Research based on the "6th Strategic Energy Plan" announced by the Ministry of Economy, Trade and Industry

(GW)	FY2019(a) (Results)	FIT certified facilities that have yet to be operational	New FIT certifications(c)		Total(a)+(b)+(c)	
		(b)	Continued effort	Strengthened policies	Continued effort	Strengthened policies
Ground	41.3	17.2	4.8	26.2	63.3	100
Roof	14.5	0.8	9.0		24.3	
Total	55.8	18.0	13.8	26.2	87.6	100

Source: Shared Research based on the "6th Strategic Energy Plan" announced by the Ministry of Economy, Trade and Industry

Installed capacity in Japan by power source

Installed capacity by power source	2,012	2,013	2,014	2,015	2,016	2,017	2,018	2,019	2,020	2,021	6th Strategic Energy Plan 2,030
Fossil fuels	88.6%	88.3%	87.5%	84.8%	83.7%	80.9%	76.9%	75.6%	76.3%	72.9%	41%
Coal	31.0%	32.9%	33.5%	34.2%	32.8%	32.8%	31.6%	32.0%	31.0%	31.0%	19%
Natural gas	40.1%	40.9%	43.0%	40.9%	41.4%	39.7%	38.4%	37.3%	39.0%	34.4%	20%
Oil, etc.	17.5%	14.4%	11.0%	9.7%	9.5%	8.4%	6.9%	6.3%	6.4%	7.4%	2%
Nuclear	1.5%	0.9%	0.0%	0.9%	1.7%	3.1%	6.2%	6.2%	3.9%	6.9%	20 - 23%
Renewable energy	10.0%	10.9%	12.5%	14.3%	14.6%	16.0%	16.9%	18.2%	19.8%	20.3%	36 - 38%
Hydroelectric	7.1%	7.3%	7.9%	8.4%	7.6%	7.9%	7.7%	7.8%	7.8%	7.5%	11%
Solar	0.6%	1.2%	2.2%	3.3%	4.4%	5.2%	6.0%	6.8%	7.9%	8.3%	14 - 16%
Wind	0.4%	0.5%	0.5%	0.5%	0.6%	0.6%	0.7%	0.7%	0.9%	0.9%	5%
Geothermal	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	1%
Biomass	1.6%	1.6%	1.7%	1.8%	1.9%	2.1%	2.3%	2.6%	2.9%	3.2%	5%

Source: Shared Research based on the "6th Strategic Energy Plan" announced by the Ministry of Economy, Trade and Industry

Costs of power generation facilities

The International Renewable Energy Agency (IREA) provides data on installed costs of renewables-based power generation facilities across the world. According to the data, total installed costs and levelised cost of electricity (USD/kWh) declined the most for solar power facilities in the period from 2010 to 2021, indicating heightened cost advantage of solar power systems. Total installed costs of solar power projects fell 82%, and levelised cost of electricity for solar fell 88%. The facility utilization rate was a low 17% in 2021, although up from 14% in 2010.

International Renewable Energy Agency (IRENA) is an international organization established in 2011 to promote renewable energy (solar, wind, biomass, geothermal, hydropower, marine energy, etc.) and its sustainable use. IRENA's secretariat is based in Abu Dhabi, the capital of the UAE.

	Total installed costs(USD/kW)			Facility utilization rate(%)			Levelised cost of electricity(USD/kWh)		
	2010	2021	Rate of change	2010	2021	Rate of change	2010	2021	Rate of change
Biomass	2,714	2,353	-13%	72	68	-6%	0.078	0.067	-14%
Geothermal	2,714	3,991	47%	87	77	-11%	0.05	0.068	34%
Hydroelectric	1,315	2,135	62%	44	45	2%	0.039	0.048	24%
Solar	4,808	857	-82%	14	17	25%	0.417	0.048	-88%
Onshore wind	2,042	1,325	-35%	27	39	44%	0.102	0.033	-68%
Offshore wind	4,876	2,858	-41%	38	39	3%	0.188	0.075	-60%

Source: Shared Research based on the "Renewable Power Generation Costs in 2021" report issued by the International Renewable Energy Agency
Note: The weighted average is applied to both total installed costs and levelized cost of electricity

Trends over the past five years and the past decade both indicate a decline in total installed costs and levelised cost of electricity, year on year.

Global solar power generation costs	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	CAGR over the five years from 2017 to 2021	CAGR over the 10 years from 2012 to 2021
Total installed costs(USD/kW)	3,124	2,742	2,478	1,887	1,717	1,483	1,267	1,046	916	857	-13.0%	-14.5%
Facility utilization rate(%)	15.1%	16.4%	16.6%	16.5%	16.7%	17.5%	17.9%	17.5%	16.1%	17.2%		
Levelised cost of electricity(USD/kWh)	0.233	0.179	0.161	0.121	0.106	0.084	0.071	0.062	0.055	0.048	-14.7%	-17.0%

Source: Shared Research based on the "Renewable Power Generation Costs in 2021" report issued by the International Renewable Energy Agency

Japan's Agency for Natural Resources and Energy has published data on domestic power generation costs in 2020 and an outlook for 2030. According to the data, the cost of generating solar power in general was JPY12.9 per kWh, while the cost of generating solar power for home use was JPY17.7 per kWh. These figures are still relatively high compared to the cost of generating electricity from coal and LNG, but projections indicate that generation costs of solar power will become lower than those of coal and LNG-sourced electricity by 2030. A closer look at the cost structure shows that while fuel or social costs are not required for wind and solar power, capital costs were higher compared to coal and thermal power in 2020. The capital costs of solar and wind power are expected to decline by 2030, leading to lower overall power generation costs.

Japan's power generation costs by power source

Power generation costs by power source in 2020										
Power source	Coal thermal	LNG thermal	Nuclear	Oil thermal	Onshore Wind	Offshore Wind	Solar (industrial use)	Solar (home use)	Small hydro	Medium hydro
Power generation cost(JPY/kWh)	12.5	10.7	11.5 -	26.7	19.8	30	12.9	17.7	25.3	10.9
Capital cost	2.0	1.3	4.2	4.9	10.0	12.5	8.8	14.6	8.6	5.7
Fuel cost	4.3	6.4	1.7	14.8	0.0	0.0	0.0	0.0	0.0	0.0
Operating and maintenance costs	2.3	1.2	3.7	3.3	4.7	8.6	3.2	2.5	13.4	3.0
Social cost	3.9	1.7	0.6	3.5	0.0	0.0	0.0	0.0	0.0	0.0
Policy cost	0.0	0.1	1.3	0.2	5.2	9.0	0.9	0.6	3.2	2.3
Facility utilization rate	70.0%	70.0%	70.0%	30.0%	25.4%	30.0%	17.2%	13.8%	60.0%	60.0%
Expected lifetime	40 years	40 years	40 years	40 years	25 years	25 years	25 years	25 years	40 years	40 years
Power generation costs by power source in 2030										
Power source	Coal thermal	LNG thermal	Nuclear	Oil thermal	Onshore Wind	Offshore Wind	Solar (industrial use)	Solar (home use)	Small hydro	Medium hydro
Power generation cost(JPY/kWh)	13.6 - 22.4	10.7 - 14.3	11.7 -	24.9 - 27.6	9.8 - 17.2	25.9	8.2 - 11.8	8.7 - 14.9	25.2	10.9
Capital cost	2.0	1.3	4.2	4.9	7.1	11.9	7.3	11.4	8.6	5.7
Fuel cost	4.3	6.0	1.7	12.9	0.0	0.0	0.0	0.0	0.0	0.0
Operating and maintenance costs	2.3	1.2	3.7	3.3	4.7	6.3	3.2	2.5	13.4	3.0
Social cost	4.9	2.1	0.6	3.7	0.0	0.0	0.0	0.0	0.0	0.0
Policy cost	0.1	0.1	1.5	0.1	2.9	7.7	0.7	0.3	3.2	2.3
Facility utilization rate	70.0%	70.0%	70.0%	30.0%	25.4%	33.2%	17.2%	13.8%	60.0%	60.0%
Expected lifetime	40 years	40 years	40 years	40 years	25 years	25 years	25 years	25 years	40 years	40 years

Source: Shared Research based on "2021 Working Group for Verification of Power Generation Costs," Advisory Committee for Natural Resources and Energy, Agency for Natural Resources and Energy

Note: Costs include capital costs such as construction cost and property tax, O&M costs such as expenses on personnel and repair, fuel costs such as expenses associated with fossil fuels and the nuclear fuel cycle, social costs including expenditure on carbon dioxide countermeasures and measures against disaster risks, and policy costs including subsidies to areas where nuclear power plants are located.

Solar panel supply chain

The manufacturing processes of a solar panel constitute the production of polycrystalline silicon, ingots, wafers, solar cells, and panels. By country, China leads in production capacity for each of these materials. According to IEA, China produced 79.4% of polycrystalline silicon (Xinjiang Uyghur Autonomous Region being the main place of production), 96.8% of silicon wafers, 85.1% of solar cells, and 74.7% of solar modules manufactured in 2021. A comparison with 2010 shows that China's market share has risen for each of these items. Chinese manufacturers have bolstered their supply capability, thanks in part to its government's support measures, and the supply chain's dependence on China has increased as a result. In 2021, China dominated in the manufacture of solar panels/modules, accounting for 74.7% of global production, followed by Vietnam at 6.8%, and Malaysia at 3.7%. Shared Research understands that the share increases of Vietnam and Malaysia are partly owed to Chinese manufacturers exporting via these countries in an effort to bypass US's import restrictions on China-made solar products.

Solar panel production capacity by country and region

Solar panel production capacity	Demand		Module		Solar cell		Wafer		Polycrystalline silicon	
	2010	2021	2010	2021	2010	2021	2010	2021	2010	2021
China	3.5%	36.4%	55.7%	74.7%	57.9%	85.1%	78.3%	96.8%	79.4%	79.4%
North America	6.2%	17.6%	7.6%	2.4%	4.6%	0.6%	0.3%	0.0%	5.6%	5.6%
Europe	80.4%	16.8%	12.8%	2.8%	7.3%	0.6%	3.2%	0.5%	8.0%	8.0%
Asia Pacific	8.6%	13.2%	18.7%	15.4%	28.4%	12.4%	18.3%	2.5%	6.0%	6.0%
India	0.0%	6.9%	3.6%	2.8%	1.8%	1.1%	0.0%	0.0%	0.0%	0.0%
Other	1.1%	9.1%	1.6%	1.9%	0.0%	0.2%	0.0%	0.2%	1.0%	1.0%

Source: Shared Research based on "Solar PV Manufacturing Capacity by Country and Region, 2021" data released by the International Energy Agency

Breakdown of the solar panel manufacturing market by country

Solar panel manufacturing market by country	China	Vietnam	Malaysia	South Korea	US	India	Thailand
	74.7%	6.8%	3.7%	3.3%	2.7%	2.1%	1.2%

Source: Shared Research based on "Solar PV Manufacturing Capacity by Country and Region, 2021" data released by the International Energy Agency

Solar power generation market in Japan

In December 2021, Fuji Keizai published the results of its survey on the Japanese solar power generation market. According to the survey, the lease market for the onsite power purchase agreement model (onsite PPA; arrangement where the power plant is owned by a third party) was estimated at JPY27.7bn (+172% YoY) in FY2021. Further, the survey expected the market to reach JPY255.3bn in FY2035, 15.9x the market size in FY2020. Meanwhile, the solar self-consumption market, estimated at JPY281.6bn in FY2021 (+114.1% YoY), was expected to reach JPY585.7bn in FY2035 (2.4x the market size in FY2020), based on the survey.

Under the onsite PPA model, a service provider installs solar systems at the site of a customer-owned property, such as on the rooftop of a customer's building, and supplies electricity to the customer based on a power purchase agreement. The customer does not have to make an initial investment as the solar system can be leased. Once the contract period ends or the amount of electricity purchased reaches a certain level, ownership of the solar system is transferred to the customer free of charge. The lease market for the onsite PPA model gained traction since 2017, when the difference between the price of electricity sold under the FIT scheme and the purchase price of electricity from power grids became smaller. The survey also projected the solar self-consumption market to expand as players make a shift away from investment-driven projects based on the FIT scheme.

Competition

Solar panel manufacturers

According to BloombergNEF's 2021 Tier 1 list, there are over 50 solar panel manufacturers globally. A Shared Research calculation on production capacity by company, assuming total global annual production capacity of 482GW in 2021 (IEA data), showed that LONGi Green Energy Technology Co., Ltd. (SSE: 601012) accounted for 12.4% of the total, followed by Trina Solar Co. Ltd. (SSE: 688599) at 10.4%, and JinkoSolar Holding Co., Ltd. (NYSE: JKS) at 9.3%. The top 15 companies made up 63.2% of the overall market, and Chinese companies, 54.0%. Canadian Solar Inc. (NASDAQ: CSIQ), headquartered in Canada, has key plants in China. The South Korean Hanwha Qcells Co., Ltd. (NASDAQ: HQCL), primarily based in Germany, also has plants in China.

Of the top 15 companies, ten are listed on stock exchanges such as the Shanghai, Beijing, and Shenzhen stock exchanges, and NYSE and NASDAQ in the US. There are four to five solar panel manufacturers in Vietnam, the largest being VSUN.

VSUN ranks around 15th globally by annual production capacity, which has expanded to 5GW or 1.0% of the global total. Competition centers on the top 15, but here, we consider JinkoSolar (China), Canadian Solar (Canada), and First Solar, Inc. (US; NASDAQ: FSLR) as VSUN's peer companies, since they are comparable in terms of accounting standards, among other factors.

Ranking by annual solar panel production capacity

Company	Established	Head office	Annual production capacity (2021; GW)	% of total	Listing		Market capitalization (USDbn)
1 LONGi Green Energy Technology Co., Ltd.	2000	China	60.0	12.4%	Shanghai	601012	47.0
2 Trina Solar Co., Ltd.	1997	China	50.0	10.4%	Shanghai	688599	17.2
3 JinkoSolar Holding Co., Ltd.	2006	China	45.0	9.3%	NYSE	JKS	2.6
4 JA Solar Holdings Co., Ltd	2005	China	40.0	8.3%	Unlisted	-	-
5 Canadian solar Inc.	2001	Canada	23.9	5.0%	NASDAQ	CSIQ	2.5
6 Talesun Solar Co., Ltd.	2010	China	13.0	2.7%	Unlisted	-	-
7 Hanwha Q CELLS Co., Ltd.	1999	South Korea	12.4	2.6%	NASDAQ	HQCL	0.8
8 Suntech Power Holdings Co., Ltd.	2001	China	10.0	2.1%	Unlisted	-	-
9 First Solar, Inc.	1999	US	8.4	1.7%	NASDAQ	FSLR	23.0
10 Risen Energy Co., Ltd.	1986	China	8.1	1.7%	Shenzhen	30018	4.7
11 Astronergy Co., Ltd. (CHINT SOLAR)	2006	China	8.0	1.7%	Unlisted	-	-
12 Haitai New Energy Technology Co., Ltd.	2006	China	8.0	1.7%	Beijing	835985	-
13 Znshine PV-Tech Co., Ltd	1988	China	6.0	1.2%	Unlisted	-	-
14 HT-SAAE	1998	China	6.0	1.2%	Shanghai	600151	2.1
15 EGing Photovoltaic Technology Co., Ltd	2003	China	6.0	1.2%	Shanghai	600537	1.3

Source: Shared Research based on data from the websites of individual companies, and BloombergNEF's Tier 1 List
Note: Market capitalization figures are as of end-March 2023

JinkoSolar Holding Co., Ltd. (NYSE: JKS)

JinkoSolar, established in 2006 and headquartered in the Shangrao economic development zone (Jiangxi, China), is a solar product manufacturer ranking third globally by annual production capacity for solar panels. JinkoSolar initially focused on the production of wafers, but eventually began manufacturing panels. Since 2016, it has ranked among the top global panel manufacturers by cumulative shipment volume. JinkoSolar manufactures wafers, solar cells, and panels. At end-2022, its annual production capacity stood at 65GW for wafers, 55GW for solar cells, and 70GW for panels. JinkoSolar has 12 production bases in China, Vietnam, Malaysia, and a global sales network. It listed on NYSE in 2010, and market capitalization as of end-March 2023 was roughly USD2.6bn. In FY12/22, consolidated revenue was USD12.1bn, EBITDA was USD67mn, and net income attributable to owners of the parent was USD90mn. The employee count was 45,500.

Canadian Solar Inc. (NASDAQ: CSIQ)

Canadian Solar, established in 2001 and headquartered in British Columbia (Canada), ranks among the world's largest solar power project operators/solar product manufacturers. In addition to having a vertically integrated manufacturing system for solar cells, it also engineers, develops, and manufactures other products for solar power generation and energy storage. Canadian Solar operates globally, with particular focus on North America, South America, and Europe. At end-2022, its annual production capacity stood at 20GW for ingots, 20GW for wafers, 20GW for solar cells, and 32GW for solar modules. Production bases are located in China and Southeast Asia. Having listed on NASDAQ in 2006, market capitalization as of end-March 2023 was roughly USD2.5bn. In FY12/22, consolidated revenue was USD7.5bn, EBITDA was USD641mn, and net income attributable to owners of the parent was USD240mn. The employee count stood at 18,400.

First Solar, Inc. (NASDAQ: FSLR)

First Solar, established in 1999 and headquartered in Arizona, is a solar technology company. It manufactures and sells high-performance and low-carbon products. These include solar panels made of cadmium telluride-coated glass, which were developed in First Solar's US-based R&D lab applying its thin-film technology. The company seeks to manage the entire product lifecycle from procurement of raw materials to the recycling of used panels. At end-2022, its annual solar panel production capacity stood at 9.8GW. By creating production bases in the US, Malaysia, Vietnam, and India, First Solar has built a production system that does not rely on China's silicon supply chain. Having listed on NASDAQ in 2006, its market capitalization as of end-March 2023 was roughly USD23.0bn. In FY12/22, consolidated revenue was USD2.6bn, EBITDA was USD242mn. First Solar logged a USD44mn net loss attributable to owners of the parent in FY12/22. The employee count was 5,500.

Production system and sales by region

Among the four companies, JinkoSolar boasts the largest total annual production capacity at 190GW. Canadian Solar's production capacity is about half this figure, at 92GW, while First Solar's and VSUN's both fall short at less than 10GW. JinkoSolar and Canadian Solar have built a vertically integrated production system from the upstream to downstream processes of manufacturing, whereas VSUN only handles the downstream panel production (VSUN's solar cell plant is slated

for completion in October 2023). As another difference, most of the plants of JinkoSolar and Canadian Solar are located in China, but VSUN's solar panel plants are in Vietnam, although the company still relies on China for raw materials. Meanwhile, First Solar manufactures cadmium telluride (CdTe) solar panels, building a supply chain outside of China (mainly in the US).

The three companies, excluding VSUN, disclose their solar panel shipment volumes and sales. Based on this data, the price of panels per MW was roughly USD330,000 for Canadian Solar, USD260,000 for JinkoSolar, and USD250,000 for First Solar. Since VSUN does not disclose shipment volumes, we estimated the price per MW based on VSUN's annual production capacity assuming full plant utilization (note: the company's third plant began operation in July 2021). Our calculation yielded USD490,000 per MW for FY12/22, the highest among the four companies. For revenue mix by region, both Canadian Solar and JinkoSolar generate revenue globally, while 84% of First Solar's revenue comes from the US alone. VSUN generates about 60% of its revenue from the US and 30% from Europe.

Annual production capacity of the four companies

	VSUN		Canadian Solar		First Solar		JinkoSolar	
Head office	**Vietnam**		**Canada**		**US**		**China**	
Established	**2015**		**2001**		**1999**		**2001**	
Fiscal year	**FY12/21**	**FY12/22**	**FY12/21**	**FY12/22**	**FY12/21**	**FY12/22**	**FY12/21**	**FY12/22**
Annual production capacity(GW)								
Ingot	0.0	0.0	5.4	20.4	0.0	0.0	0.0	0.0
Wafer	0.0	0.0	11.5	20.0	0.0	0.0	32.5	65.0
Solar cell	0.0	0.0	13.9	19.8	0.0	0.0	24.0	55.0
Panel/Module	2.6	2.6	23.9	32.2	7.9	9.8	45.0	70.0
Total	2.6	2.6	54.7	92.4	7.9	9.8	101.5	190.0
Number of employees	803	867	13,535	18,423	4,800	5,500	31,030	46,511
Shipment volume(MW)								
Wafer	-	-	-	-	-		2,153	1,063
Solar cell	-	-	-	-	-		856	997
Panel	2,600	2,600	14,300	21,100	7,900	9,800	22,233	44,500
Revenue(USDmn)								
Wafer	-	-	-	-	-		181	68
Solar cell	-	-	-	-	-		95	148
Panel	321	1,276	3,547	6,976	2,331	2,428	5,922	11,631
Price per MW(USD)								
Wafer	-	-	-	-	-		83,952	63,658
Solar cell	-	-	-	-	-		111,147	148,929
Panel	123,325	490,908	248,028	330,597	295,111	247,783	266,356	261,381
Revenue composition by region								
North America	-	-	43.2%	37.4%	n.a.	n.a.	16.2%	4.5%
US	-	Approx. 60%	30.1%	26.3%	84.0%	83.7%	n.a.	n.a.
Europe	-	Approx. 30%	16.3%	25.9%	n.a.	n.a.	18.3%	23.6%
France	-	-	0.5%	0.4%	4.2%	2.6%	n.a.	n.a.
China	-	-	22.9%	25.5%	n.a.	n.a.	24.8%	41.9%
Asia(excl. China)	-	-	17.7%	11.2%	n.a.	n.a.	25.1%	13.6%
Japan	-	-	9.6%	4.4%	7.1%	1.8%	n.a.	n.a.
India	-	-	2.7%	2.6%	1.3%	1.4%	n.a.	n.a.

Source: Shared Research based on company data
Notes: Numbers of employees for VSUN are taken from Abalance's FY06/21 and FY06/22 data.
VSUN's revenue per region is based on a hearing with Abalance.
VSUN's price per MW was calculated using annual production capacity, since shipment volumes are undisclosed.

Profits and financial standing

Profits

VSUN has a larger presence among the four in terms of revenue, compared to its positioning based on annual production capacity. We understand this is attributable to the higher unit price of VSUN's solar panels, as mentioned above. VSUN's cost ratio exceeds 90%, while the cost ratios of the other three trend in the 70% and 80% range. According to the company, material costs—particularly, the cost of solar cells, which are a key component—constitute a large portion of VSUN's cost of revenue. In FY12/22, First Solar's cost ratio temporarily exceeded 90%, but its cost ratio over the five years through FY12/21 averaged below 80%. Because of the high cost ratio, VSUN's GPM remains below 10%, whereas the GPMs of the other three are in the upper 10% and 20% range.

Although VSUN's profitability is relatively low, since the company uses financial leverage, its ROE is the highest among the four, at 60.9% (FY06/22). As the first phase of the 6GW solar cell plant project, a 3GW plant is slated for completion in October 2023. Shared Research believes that VSUN's cost ratio will fall once this plant begins operation.

(USDmn)	VSUN		Canadian Solar		First Solar		JinkoSolar	
Fiscal year	FY12/21	FY12/22	FY12/21	FY12/22	FY12/21	FY12/22	FY12/21	FY12/22
Accounting standard	IFRS	IFRS	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP
Revenue	319	1,256	5,277	7,469	2,923	2,619	6,407	12,052
YoY	-	293.9%	51.8%	41.5%	7.8%	-10.4%	19.0%	88.1%
Revenue/Solar panel annual production capacity(USD/MW)	122,624	483,031	96,475	80,829	370,048	267,277	63,119	63,433
Cost of revenue	291	1,152	4,368	6,205	2,193	2,549	5,362	10,272
YoY	-	296.0%	56.7%	42.1%	8.0%	16.2%	20.8%	91.6%
Cost of revenue ratio	91.2%	91.7%	82.8%	83.1%	75.0%	97.3%	83.7%	85.2%
Gross profit	28	104	909	1,263	730	70	1,045	1,780
YoY	-	271.7%	31.8%	38.9%	7.2%	-90.4%	10.5%	70.4%
GPM	8.8%	8.3%	17.2%	16.9%	25.0%	2.7%	16.3%	14.8%
SG&A expenses	24	62	719	907	290	351	872	1,718
YoY	-	157.1%	53.1%	26.2%	-20.0%	20.7%	29.7%	97.1%
SG&A ratio	7.6%	4.9%	13.6%	12.1%	9.9%	13.4%	13.6%	14.3%
Selling expenses	19	50	399	559	-	-	448	1,050
YoY	-	159.4%	77.8%	40.2%	-	-	18.2%	134.2%
% of revenue	6.1%	4.0%	7.6%	7.5%	-	-	7.0%	8.7%
Administrative expenses	5	12	309	342	-	-	308	509
YoY	-	147.8%	36.9%	10.7%	-	-	42.7%	65.1%
% of revenue	1.5%	1.0%	5.9%	4.6%	-	-	4.8%	4.2%
Net income	4	42	95	240	469	-44	113	90
YoY	-	1,071.0%	-35.1%	151.9%	17.7%	-	220.4%	-20.5%
Net margin	1.1%	3.4%	1.8%	3.2%	16.0%	-	1.8%	0.7%
EBITDA	8	47	474	641	847	242	458	67
YoY	-	479.8%	14.2%	35.2%	53.8%	-71.4%	-5.3%	-85.4%
EBITDA margin	2.5%	3.7%	9.0%	8.6%	29.0%	9.3%	7.1%	0.6%
ROE(Net income)	13.1%	60.9%	5.3%	12.4%	7.9%	-	6.5%	3.8%
ROA (Net income)	1.5%	6.8%	1.3%	2.7%	6.3%	-	1.0%	0.6%

Source: Shared Research based on company data

Note: For VSUN, the exchange rate used to convert Vietnamese dong (VND) to USD was VND0.0004375/USD for FY12/21 and VND0.00004231/USD in FY12/22

The USD amounts presented for Canadian Solar, First Solar, and JinkoSolar are USD figures disclosed by each company.

Financial standing

Similarly to Canadian Solar, VSUN's ratio of interest-bearing debt to net assets was high at 2.2x in FY12/22. Also, much like JinkoSolar, VSUN's equity ratio was a low 11.2%.

For the size of its revenue, VSUN does not own a lot of tangible fixed assets. As such, the tangible fixed assets turnover ratio is high. We understand that since VSUN is only involved in the downstream process of panel manufacture, it has been able to rein in expenditures on manufacturing equipment. VSUN's cash conversion cycle has also been reduced to about two months, which is shorter than the others. A relatively short accounts receivable turnover period plays a part in this because the period in inventory and the average accounts payable turnover period are largely the same for the four companies. According to Abalance, production begins only when orders are confirmed, and VSUN also receives advance payments at the time the orders are placed. On average, the period from receiving orders to booking revenue is three to four months.

(USDmn)	VSUN		Canadian Solar		First Solar		JinkoSolar	
Fiscal year	FY12/21	FY12/22	FY12/21	FY12/22	FY12/21	FY12/22	FY12/21	FY12/22
Accounting standard	IFRS	IFRS	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP	USGAAP
Cash and deposits	21	134	870	981	1,451	1,481	1,306	1,485
YoY	-	541.2%	-26.2%	12.8%	18.2%	2.1%	13.9%	13.7%
% of total assets	8.6%	21.8%	11.8%	10.9%	19.6%	18.0%	11.4%	9.4%
Inventory	111	296	1,192	1,524	666	621	2,080	2,530
YoY	-	167.5%	71.3%	27.8%	17.4%	-6.7%	62.0%	21.7%
% of total assets	45.7%	48.1%	16.1%	16.9%	9.0%	7.5%	18.2%	16.1%
Accounts receivable	40	6	651	971	429	324	1,191	2,418
YoY	-	-85.9%	19.4%	49.1%	46.8%	-24.5%	50.9%	102.9%
% of total assets	16.6%	0.9%	8.8%	10.7%	5.8%	3.9%	10.4%	15.3%
Tangible fixed assets	23	33	1,402	1,827	2,650	3,537	3,134	4,682
YoY	-	44.4%	21.1%	30.3%	10.3%	33.5%	64.2%	49.4%
% of total assets	9.4%	5.4%	19.0%	20.2%	35.7%	42.9%	27.4%	29.7%
Total assets	242	616	7,388	9,037	7,414	8,251	11,453	15,755
YoY	-	154.4%	13.0%	22.3%	4.3%	11.3%	40.4%	37.6%
% of total assets	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Interest-bearing debt	83	150	3,258	4,012	240	184	3,908	3,937
YoY	-	81.1%	12.7%	23.2%	-14.1%	-23.2%	39.5%	0.8%
% of total assets	34.3%	24.4%	44.1%	44.4%	3.2%	2.2%	34.1%	25.0%
Net assets(excl. stock acquisition rights and and non-controlling interests)	27	69	1,801	1,942	5,960	5,836	1,734	2,369
YoY	-	152.4%	14.7%	7.8%	7.9%	-2.1%	13.3%	36.6%
% of total assets	11.3%	11.2%	24.4%	21.5%	80.4%	70.7%	15.1%	15.0%
Operating cash flows	-46	88	-408	917	238	873	68	-841
Investing cash flows	-13	-43	-430	-630	-99	-1,193	-1,775	-1,779
Financing cash flows	44	68	614	429	-99	-1,193	1,886	2,902
R&D	n.a.	n.a.	58	70	99.1	112.8	72	105
% of revenue	-	-	1.1%	0.9%	3.4%	4.3%	1.1%	0.9%
Purchase of tangible fixed assets	13	24	429	627	540	904	1,355	1,776
% of revenue	4.2%	1.9%	8.1%	8.4%	18.5%	34.5%	21.1%	14.7%
Tangible fixed asset turnover	13.9	38.1	3.8	4.1	1.1	0.7	2.0	2.6
Total asset turnover	1.3	2.0	0.7	0.8	0.4	0.3	0.6	0.8
Inventory turnover	2.6	3.9	3.7	4.1	3.3	4.1	2.6	4.1
Average period in inventory(months)	4.2	2.8	2.7	2.4	2.7	2.8	3.9	2.5
Accounts receivable turnover period(months)	1.5	0.1	1.5	1.6	1.8	1.5	2.2	2.4
Accounts payable turnover period(months)	2.1	0.8	1.1	1.3	0.8	1.6	2.0	1.5
Cash conversion cycle(months)	3.6	2.1	3.0	2.7	3.7	2.8	4.1	3.4
Equity ratio	11.3%	11.2%	24.4%	21.5%	80.4%	70.7%	15.1%	15.0%
Interest-bearing debt/EBITDA	10.2	3.2	6.9	6.3	0.3	0.8	8.5	58.9
Net debt/EBITDA	7.7	0.3	5.0	4.7	-1.4	-5.3	5.7	36.7
Interest-bearing debt/Net assets	3.0	2.2	1.8	2.1	0.0	0.0	2.3	1.7
Net debt/Net assets	2.3	0.2	1.3	1.6	-0.2	-0.2	1.5	1.0

Source: Shared Research based on company data

Solar power producers in Japan

Abalance maintains that it has no specific competitor among the domestic solar power producers. With a capacity of over 1GW, Pacifico Energy K.K. (unlisted; unaffiliated with major conglomerates) is the largest among the Japanese companies with proprietary solar power facilities. Tokyu Fudosan Holdings Corporation (TSE Prime: 3289) is the second largest, followed by Orix Corporation (TSE Prime: 8591). WWB, which handles Abalance's power generation business, ranks around 30th with a capacity of 140MW.

	Company	Established	Capital stock	Listing	Country	Facilities in Japan	No. of power plants owned	FY2021	
			(JPYmn)			(MW)		Revenue	Operating profit
1	Pacifico Energy K.K.	2012	100	Unlisted	Japan	1,096	13	-	-
2	Tokyu Fudosan Holdings Corporation	1918	77,562	TSE Prime: 3289	Japan	737	61	989,049	83,800
3	Orix Corporation	1964	3,344,812	TSE Prime: 8591	Japan	701	105	2,520,365	302,083
4	SB Energy Corp.	2011	4,770	Unlisted	Japan	668	44	-	-
5	Yamasa Corporation	1967	15	Unlisted	Japan	563	97	-	-
6	Vena Energy Holdings Ltd.	2012	475,608	Unlisted	Singapore	535	26	51,232	15,415
7	Renewable Japan Co., Ltd.	2012	4,627	TSE Growth: 9522	Japan	526	48	17,718	1,289
8	Sonnedix Power Holdings Ltd.	2009	-	Unlisted	UK	420	24	-	-
9	Tokyo Century Corporation	1969	81,129	TSE Prime: 8439	Japan	400	88	1,277,976	82,675
10	X-ELIO Energy	2007	-	Unlisted	Spain	363	10	-	-
30	WWB Corporation	2006	100	Unlisted	Japan	144	38	8,137	1,842

Source: Shared Research based on "Top 50 Japanese Solar Portfolios 2022" released by Solar Plaza, and data disclosed by individual companies
Note: In February 2023, SB Energy Corp. has agreed to a transaction in which Toyota Tsusho Corporation was to acquire 85% of its shares. The transaction was completed in April 2023.

Strengths and weaknesses

Strengths

Achieves differentiation by expanding solar panel production capacity in Vietnam, rather than in China where geopolitical risks are heightening

Abalance explains that it made a foray into Vietnam to capture demand for solar panels that are free from US import restrictions and tariffs amid prolonged US–China trade frictions. At the time of its acquisition, VSUN ranked second in solar panel production capacity within Vietnam, but since then, Abalance worked to expand VSUN by making full use of its HR network to secure engineers from peer companies in China. At present, VSUN tops the Vietnamese market in production capacity. Mr. Junsei Ryu, who manages VSUN, was naturalized in Japan after graduating from a Japanese university. He believed that solving energy-related issues was key to protecting the global environment and reducing CO_2 emissions and has played an instrumental role in expanding the company's solar power generation business, including the acquisition of VSUN.

According to the International Energy Agency (IEA), China dominated in the manufacture of solar panels in 2021, accounting for 74.7% of global production, followed by Vietnam (6.8%), Malaysia (3.7%), South Korea (3.3%), and the US (2.7%). VSUN's main competitors are major solar panel manufacturers operating globally, many of them being Chinese companies. Only a handful of companies of a certain production scale like VSUN manufacture solar panels outside of China, one being the US-based First Solar Inc.

VSUN sources raw materials from China and Southeast Asia and manufactures solar panels in Vietnam. About 60% of VSUN's revenue comes from the US, about 30% from Europe, and the remaining 10% from other regions. Abalance maintains that demand for VSUN's solar panels has been on the rise in the US, among other countries, as more customers are reassessing their supply chain amid prolonged US–China trade friction and Russia's war in Ukraine. Being a Japanese-owned company generates a certain sense of quality assurance, which also makes it easier for US companies to buy VSUN's products, says the company. In addition to further expanding production capacity of its solar panel and cell plants in Vietnam, VSUN has plans to manufacture in the US and elsewhere.

Can provide end-to-end services in Japan that no other peers can match, thanks to the addition of VSUN's solar panel manufacturing capabilities

The Abalance group conducts solar power plant trades, sells goods associated with solar power generation, and offers a full range of services from the planning phase of solar power projects to engineering, development, and construction of the facility, operation and maintenance, and even recycling. Receiving a contract that spans the entire lifecycle of a facility allows the company to provide seamless, speedy, and efficient services. The company also offers customers support in areas such as contracts with power utilities, confirmation of laws and regulations with the local government, explanation to local residents, and paperwork necessary to obtain loans from financial institutions.

Abalance acquired VSUN in December 2020, bringing the manufacture of solar panels in-house. This move has enabled the company to provide end-to-end services that no other domestic companies can match. VSUN is currently building a plant to manufacture solar cells needed in the upstream processes of solar panel production. The operation of this plant will further strengthen Abalance's overarching services.

VSUN is well recognized by third-party organizations and major purchasers for its sustainable procurement practices and its solar panel quality, which bears comparison with major manufacturers

Chinese companies dominate the top positions in the global solar panel manufacturer rankings by annual production volume. Meanwhile, VSUN ranks around 15th with an annual production capacity of 5GW. According to a Shared Research estimate, roughly 60% of world's production capacity is shared by some 15 companies, while numerous small and medium-sized manufacturers make up the remaining 40%.

VSUN's R&D bases are located in Tokyo and Vietnam, and the company has gained the recognition of third-party organizations and major buyers not only for the reliable quality and performance of its products, but also for its procurement practices. Such recognition plays a significant role in VSUN's competition with majors companies. For instance, in 2022,

VSUN was recognized as a "Top Performer" in the PV Module Reliability Scorecard (released by US-based PV Evolution Labs [PVEL]) for the second consecutive year, becoming one of the few manufacturers to receive this accolade aside from major solar panel manufacturers. Further, in an assessment conducted by EcoVadis, a global rating agency based in France that assesses companies' sustainable procurement practices (including their responses to human rights violations in China), VSUN was awarded a Bronze Medal in 2022 for the second consecutive year, having ranked 64th percentile among over 75,000 participating companies worldwide. VSUN has also cleared the strict quality standards of major purchasers such as French petroleum company TotalEnergies and French energy and gas company Engie. In product development, in addition to the production of conventional monocrystalline panels, VSUN began manufacturing solar panels that use the TOPCon technology, which is still on its way to wide adoption.

Weaknesses

VSUN, which manufactures solar panels outside of China, carries a higher risk sourcing materials from China compared to Chinese companies manufacturing their panels domestically

Solar panel production begins with the upstream process of manufacturing polycrystalline silicon, followed by the manufacture of ingots, wafers, solar cells, and finally solar panels. By country, China leads in production capacity for each of these materials/products. According to IEA, China produced 79.4% of polycrystalline silicon (Xinjiang Uyghur Autonomous Region being the main place of production), 96.8% of wafers, 85.1% of solar cells, and 74.7% of solar modules manufactured globally in 2021. A comparison with 2010 shows that China's market share has risen for each of these items, as production capacity expanded in the country on the back of Chinese government's industrial policies and the relatively small outlays necessary to manufacture products. The supply chain's dependence on China has increased as a result.

In 2021, China dominated the global solar panel market, accounting for 74.7% of all panels manufactured globally. Vietnam followed at 6.8%, and Malaysia at 3.7%. That said, Shared Research understands that the share increases of Vietnam and Malaysia are partly owed to Chinese manufacturers exporting via these countries or companies like VSUN opting to establish production bases outside of China, seeking to be free from import restrictions on China-made solar products by US and Europe.

Although VSUN does not manufacture solar panels in China, it sources solar cells (key components of solar panels) from China and Southeast Asia. Therefore, it carries a larger procurement risk compared to major Chinese companies manufacturing solar panels in China. For instance, if China were to impose export restrictions on solar cells and other raw materials, VSUN's production may be jeopardized. To minimize the procurement risk and also reduce costs, VSUN plans to build its own solar cell plants with a total annual production capacity of 6GW. As the first phase of this project, a 3GW cell plant is slated for completion in October 2023. The operation of this plant will lower the risk of cell procurement from China. Still, Shared Research understands that the risk associated with procurement of wafers and other materials from China will persist.

VSUN's manufacturing costs are higher than those of its main competitors because, being a latecomer in the solar panel industry, its production scale is still relatively small, and the company does not manufacture upstream products

VSUN's main competitors are major solar panel manufacturers, particularly those in China. LONGi Green Energy Technology tops the market with an annual production capacity of 60GW. Trina Solar ranks second at 50GW, and JinkoSolar is third at 45GW. In contrast, annual production capacity of VSUN's solar panel plants is around 5GW, only about 10% compared to the major companies'. Large manufacturers are involved in the upstream processes as well, manufacturing wafers and solar cells alongside solar panels. The addition of such materials to the calculation yields an annual production capacity of over 100GW for some companies. Much like VSUN, First Solar also manufactures panels outside China; its annual production capacity is 9.8GW.

Shared Research understands that VSUN's manufacturing costs are higher than those of major competitors. It would be best to compare the cost per unit by dividing each company's cost of revenue by total volume, but since some companies do not disclose their figures for total volume, we calculated the cost of revenue per MW (total revenue/production capacity) for the purpose of comparison. According to our calculations, as of end-FY12/22, cost of revenue per MW was USD4.5mn for VSUN, USD1.2mn for JinkoSolar, USD2.8mn for First Solar, and USD1.8mn for Canadian Solar. VSUN's high cost is mainly attributable to its relatively small business scale and lack of involvement in the upstream processes of solar panel manufacture, such as the production of wafers and solar cells.

Must maintain financial soundness to continue making large investments using bank loans; issues associated with financing could potentially limit investment

VSUN plans to invest roughly USD300mn on a project to build solar cell plants with a total annual production capacity of 6GW. This is roughly five times the total investment made to build its four solar panel plants. Abalance explains that the construction of a 3GW cell plant (investment of about USD180mn) is in progress as the first phase of this project, and that it has already secured loans and cash on hand to finance this phase. Under its current medium-term management plan, Abalance places the achievement of 1GW in power generation capacity using its own facilities, and 8GW in annual manufacturing capacity of solar panels as the centerpiece of its growth strategy. To this end, it will continue to make large investments. According to Abalance, VSUN secures its own funds for investment (without guarantees from the Abalance group) by obtaining loans from Vietnamese financial institutions at low interest rates. The Abalance group as a whole will need to borrow from banks while maintaining a certain level of financial soundness. Depending on how the fundraising from VSUN's IPO proceeds, the company may also need to rein in investments.

Abalance has a history of continuing large investments despite negative operating cashflows. Major outlays have been attributable to the development and acquisition of solar power plants (total output capacity of 140MW), and investments into solar panel plants (annual production capacity of 5GW) since acquiring VSUN. The company has conducted capital increases, but investments have been mostly funded by bank borrowings. As a result, interest-bearing debt expanded and the debt-to-equity ratio (interest-bearing debt/shareholders' equity) had risen to 6.6× at end-FY06/22, while the equity ratio dropped to 7.0%. The current portion of the interest-bearing debt accounted for 51.3% of the total. The interest coverage ratio declined to 2.4×. The company will be exposed to a heavy burden of repayment if its performance were to deteriorate due to a decline in solar panel demand.

Financial statements

Income statement

Income statement	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Revenue	2,303	3,347	4,396	4,540	6,495	7,301	5,985	6,678	26,901	92,435
YoY	72.4%	45.3%	31.4%	3.3%	43.1%	12.4%	-18.0%	11.6%	302.8%	243.6%
Cost of revenue	1,663	2,609	3,315	3,432	5,006	5,123	4,112	4,916	22,112	82,729
YoY	64.8%	56.9%	27.1%	3.5%	45.9%	2.3%	-19.7%	19.6%	349.8%	274.1%
Cost ratio	72.2%	78.0%	75.4%	75.6%	77.1%	70.2%	68.7%	73.6%	82.2%	89.5%
Gross profit	641	738	1,081	1,108	1,489	2,178	1,873	1,762	4,788	9,705
YoY	95.5%	15.1%	46.5%	2.5%	34.4%	46.3%	-14.0%	-5.9%	171.7%	102.7%
Gross profit margin	27.8%	22.0%	24.6%	24.4%	22.9%	29.8%	31.3%	26.4%	17.8%	10.5%
SG&A expenses	435	474	660	710	1,374	1,251	1,265	1,400	3,427	8,007
YoY	84.8%	8.9%	39.3%	7.6%	93.3%	-8.9%	1.1%	10.7%	144.7%	133.6%
SG&A ratio	18.9%	14.2%	15.0%	15.6%	21.1%	17.1%	21.1%	21.0%	12.7%	8.7%
Operating profit	205	264	420	397	115	927	608	362	1,361	1,697
YoY	123.0%	28.4%	59.5%	-5.5%	-71.0%	704.7%	-34.4%	-40.5%	276.4%	24.7%
Operating profit margin	8.9%	7.9%	9.6%	8.8%	1.8%	12.7%	10.2%	5.4%	5.1%	1.8%
EBITDA	229	296	468	431	169	1,050	882	627	2,081	3,309
YoY	113.5%	28.9%	58.3%	-7.9%	-60.8%	521.0%	-16.0%	-29.0%	232.1%	59.0%
EBITDA margin	10.0%	8.8%	10.6%	9.5%	2.6%	14.4%	14.7%	9.4%	7.7%	3.6%
Non-operating income/expenses	-90	-23	-81	29	-67	-52	-42	-56	-92	-187
Non-operating income	0	11	1	47	39	34	64	112	376	769
Non-operating expenses	90	34	82	17	106	86	106	169	468	956
Recurring profit	115	241	339	427	49	874	566	306	1,269	1,510
YoY	120.3%	108.5%	40.9%	25.8%	-88.6%	1,700.1%	-35.2%	-46.0%	315.3%	19.0%
Recurring profit margin	5.0%	7.2%	7.7%	9.4%	0.7%	12.0%	9.5%	4.6%	4.7%	1.6%
Extraordinary gains/losses	-108	1	28	-39	1	42	15	-1	-15	750
Extraordinary gains		3	28	3	1	74	15	12	1	1,022
Extraordinary losses	108	2		41		32	0	12	16	272
Pre-tax profit	13	241	367	388	50	917	581	305	1,255	2,260
YoY	-68.7%	1,743.4%	52.3%	5.6%	-87.2%	1,741.7%	-36.6%	-47.5%	311.5%	80.1%
Pre-tax profit margin	0.6%	7.2%	8.4%	8.6%	0.8%	12.6%	9.7%	4.6%	4.7%	2.4%
Income taxes	-104	13	25	160	214	156	254	88	323	642
Implied tax rate	-1,388.7%	5.2%	6.9%	41.2%	430.2%	17.0%	43.7%	29.0%	25.8%	28.4%
Net income	117	234	200	228	-164	761	327	217	931	1,618
YoY	273.6%	101.0%	-14.8%	14.3%	-	-	-57.0%	-33.7%	330.0%	73.8%
Net margin	5.1%	7.0%	4.5%	5.0%	-	10.4%	5.5%	3.2%	3.5%	1.8%
Net income attributable to owners of the parent	117	234	200	231	-176	757	316	211	537	867
YoY	273.6%	100.6%	-14.6%	15.8%	-	-	-58.2%	-33.1%	154.2%	61.5%
Net margin	5.1%	7.0%	4.5%	5.1%	-	10.4%	5.3%	3.2%	2.0%	0.9%

Source: Shared Research based on company data
Note: EBITDA equals operating profit plus depreciation and goodwill amortization.

- The company adopted the Accounting Standard for Revenue Recognition from the beginning of FY06/22. Accordingly, it recognizes revenue at the transfer of promised goods and services to its customers, in an amount reflecting the consideration to which it expects to be entitled in exchange for those goods or services. In the IT business and the Photocatalyst business, the company previously recognized revenue based on the completed-contract method. However, for contracts that require fulfillment of obligations over a certain period, the company shifted to recognizing revenue as obligations become fulfilled over that period. In accordance with the rules on transitional treatment, Abalance applied the new revenue recognition standard after adjusting its retained earnings as of the beginning of FY6/22 to reflect the cumulative effect of retroactively applying the standard to preceding periods. The company says the impact of this adjustment on retained earnings is negligible.

- The company adopted the Accounting Standard for Fair Value Measurement from the beginning of FY06/22. It says there is no impact of this change on its financial statements.

- Following the acquisition of VSUN in December 2020, Abalance's income statement and balance sheet have undergone a dramatic change as did its business composition. In FY06/20, the Green Energy business accounted for 93.6% of consolidated revenue. Due to the acquisition, however, the Solar Panel Manufacturing business run by VSUN came to account for 78.2% of FY06/21 consolidated revenue, while the revenue mix of Green Energy fell to 19.7%.

Revenue

Abalance's consolidated revenue was up 302.8% YoY in FY06/21 and 243.6% YoY in FY06/22, owing to the acquisition of VSUN. The Solar Panel Manufacturing business made up 61.8% of consolidated revenue in FY06/22 and the Green Energy business, 35.5%, together accounting for 97.3% of the total.

Cost of revenue

Although the company does not disclose a breakdown, it maintains that solar cell and other raw material costs have made up the bulk of its cost of revenue following the acquisition of VSUN. Labor costs are relatively small since VSUN hires local

people. The cost ratio, which trended around 70% up to FY06/20, rose to 89.5% in FY06/22.

SG&A expenses

The breakdown of SG&A expenses includes taxes and dues; commission expenses; salaries, allowances, and bonuses; and depreciation, in descending order of amount. The SG&A ratio was around 20% through FY06/20. With the acquisition of VSUN, however, the ratio of expenses such as commission expenses and salaries, allowances, and bonuses to revenue declined, and the overall SG&A ratio fell to 12.8% in FY06/21 and 8.7% in FY06/22. Taxes and dues are mostly the tariffs borne by VSUN for its solar panel exports, and will increase in tandem with production growth going forward. Commission expenses are chiefly container freight and operator commissions associated with shipments.

Balance sheet

Balance sheet	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Assets										
Current assets										
Cash and deposits	295	494	407	496	672	601	799	1,209	4,722	3,966
Notes and accounts receivable	96	408	525	473	335	335	393	303	1,312	6,156
Merchandise and finished goods	378	499	263	385	423	327	172	246	6,480	26,740
Real estate for sale			333	118	73	44	414	1,536	365	768
Work in process		115	336	666	2,637	3,659	3,631	4,751	4,462	3,804
Raw materials and supplies	0	0	0	0	1		1	3	5	8
Other	156	210	239	304	758	479	668	505	5,189	16,114
Allowance for doubtful accounts	-3	-11	-10	-22	-204	-219	-1	0	-1	-109
Total current assets	**921**	**1,715**	**2,093**	**2,420**	**4,692**	**5,227**	**6,078**	**8,553**	**22,537**	**57,450**
YoY	38.8%	86.2%	22.0%	15.6%	93.9%	11.4%	16.3%	40.7%	163.5%	154.9%
% of assets	78.8%	82.8%	82.7%	86.7%	73.3%	72.7%	55.3%	57.9%	57.2%	67.4%
Fixed assets										
Tangible fixed assets										
Buildings and structures	18	11	11	11	29	39	116	116	427	569
Accumulated depreciation	-7	-5	-6	-8	-14	-20	-53	-59	-120	-191
Buildings and structures (net)	10	6	5	4	15	19	62	58	306	378
Machinery, equipment, and vehicles	11	52	52	51	848	970	2,172	2,649	13,626	19,532
Accumulated depreciation	-11	-12	-23	-31	-154	-250	-369	-528	-1,492	-3,088
Machinery, equipment, and vehicles(net)	0	39	29	19	694	720	1,803	2,122	12,133	16,443
Land		64	114	148	472	707	1,033	1,133	1,332	1,791
Construction in progress							1,330	2,211	1,331	1,757
Other							53	53	197	415
Total tangible fixed assets	**71**	**161**	**189**	**223**	**1,222**	**1,456**	**4,239**	**5,529**	**15,201**	**20,599**
YoY	132.3%	127.5%	17.5%	17.7%	448.6%	19.1%	191.0%	30.4%	174.9%	35.5%
% of assets	6.1%	7.8%	7.5%	8.0%	19.1%	20.3%	38.6%	37.4%	38.6%	24.2%
Intangible assets										
Goodwill	87	69	52		270	169	152	78	332	4,631
Other	1	12	9	5	20	48	43	33	32	56
Total intangible assets	**88**	**81**	**61**	**5**	**290**	**217**	**195**	**110**	**365**	**4,688**
YoY	-86.0%	-7.3%	-24.5%	-91.3%	5,361.3%	-25.3%	-9.9%	-43.7%	231.8%	1,184.4%
% of assets	7.5%	3.9%	2.4%	0.2%	4.5%	3.0%	1.8%	0.7%	0.9%	5.5%
Investments and other assets										
Investment securities		2	48	48	48	51	13	89	206	1,165
Long-term loans receivable	282	290	395	339	370	32	160	172	41	42
Deferred tax assets	78	97	45	0		100	111	60	434	540
Other	43	49	90	83	145	119	354	291	662	901
Allowance for doubtful accounts	-313	-322	-390	-327	-368	-13	-178	-59	-76	-216
Investments and other assets	**90**	**115**	**188**	**142**	**195**	**289**	**459**	**554**	**1,268**	**2,432**
YoY	133.7%	28.1%	62.9%	-24.0%	36.6%	48.4%	59.1%	20.6%	128.9%	91.8%
% of assets	7.7%	5.6%	7.4%	5.1%	3.0%	4.0%	4.2%	3.8%	3.2%	2.9%
Total fixed assets	**646**	**358**	**438**	**371**	**1,437**	**1,962**	**4,893**	**6,193**	**16,835**	**27,719**
YoY	-7.1%	-44.6%	22.6%	-15.4%	287.8%	36.5%	149.4%	26.6%	171.8%	64.7%
% of assets	55.2%	17.2%	17.3%	13.3%	22.5%	27.3%	44.5%	41.9%	42.7%	32.5%
Deferred assets										
Total deferred assets							14	17	16	10
Total assets	**1,169**	**2,073**	**2,531**	**2,790**	**6,400**	**7,189**	**10,985**	**14,765**	**39,388**	**85,181**
YoY	-13.9%	77.3%	22.1%	10.2%	129.4%	12.3%	52.8%	34.4%	166.8%	116.3%
Liabilities										
Current liabilities										
Accounts payable	165	514	436	529	331	411	533	991	5,058	14,595
Short-term borrowings	40	38	194	410	1,027	1,270	1,147	699	6,499	18,356
Current portion of long-term borrowings	103	97	122	51	697	800	967	1,071	869	1,266
Current portion of bonds payable								32	102	66
Lease obligations	23	29	33	26	13	11	6	2	2	1
Income taxes payable	43	26	45	54	162	237	94	38	588	180
Contract liabilities										16,255
Advances received	163	90	161	223	850	834	1,522	1,607	4,672	
Current portion of long-term accounts payable							75	1,582	2,384	464
Provision for bonuses					24	20	17	17	30	44
Other	51	28	137	76	440	292	281	703	6,002	6,488
Total current liabilities	**587**	**821**	**1,127**	**1,368**	**3,545**	**3,873**	**4,641**	**6,745**	**26,212**	**57,721**
YoY	-31.1%	39.8%	37.3%	21.4%	159.1%	9.3%	19.8%	45.3%	288.6%	120.2%
% of assets	50.2%	39.6%	44.5%	49.0%	55.4%	53.9%	42.2%	45.7%	66.5%	67.8%
Fixed liabilities										
Bonds							100	36	116	50
Long-term borrowings	396	297	269	92	1,467	1,139	1,679	3,594	6,105	12,032
Lease obligations	51	36	14	32	25	13	8	0	79	10
Deferred tax liabilities		1		0	122	231	167	139	128	95
Long-term accounts payable							1,342	1,966	1,828	7,028
Long-term accounts payable–other							896	2	2	2
Other	40	51	78	78	120	115	114	120	136	232

Total fixed liabilities	**487**	**386**	**361**	**203**	**1,733**	**1,499**	**4,312**	**5,859**	**8,398**	**19,452**
YoY	231.4%	-20.8%	-6.4%	-43.8%	755.6%	-13.5%	187.6%	35.9%	43.3%	131.6%
% of assets	41.6%	18.6%	14.3%	7.3%	27.1%	20.9%	39.3%	39.7%	21.3%	22.8%
Total liabilities	**1,074**	**1,207**	**1,488**	**1,571**	**5,279**	**5,373**	**8,953**	**12,605**	**34,611**	**77,174**
YoY	7.4%	12.4%	23.3%	5.6%	236.0%	1.8%	66.6%	40.8%	174.6%	123.0%
% of assets	91.8%	58.2%	58.8%	56.3%	82.5%	74.7%	81.5%	85.4%	87.9%	90.6%
Net assets										
Shareholders' equity										
Capital stock	802	1,069	656	656	701	701	701	702	825	1,243
Capital surplus	35	302			45	45	45	47	229	647
Retained earnings	-331	-507	383	564	333	1,022	1,245	1,368	2,919	3,689
Treasury stock	0	0	0	0	-1	-1	-21	-21	-21	-22
Total shareholders' equity	**506**	**864**	**1,038**	**1,219**	**1,077**	**1,767**	**1,969**	**2,096**	**3,953**	**5,557**
YoY	45.6%	70.8%	20.2%	17.4%	-11.6%	64.0%	11.4%	6.4%	88.6%	40.6%
% of assets	43.3%	41.7%	41.0%	43.7%	16.8%	24.6%	17.9%	14.2%	10.0%	6.5%
Accumulated other comprehensive income										
Accumulated other comprehensive income								**-3**	**52**	**374**
Share subscription rights		2	1			2	5	3	13	135
Non-controlling interests			3		43	47	58	63	758	1,939
Total net assets	**506**	**866**	**1,043**	**1,219**	**1,121**	**1,816**	**2,032**	**2,159**	**4,777**	**8,007**
YoY	40.8%	71.2%	20.4%	16.9%	-8.1%	62.0%	11.9%	6.2%	121.3%	67.6%
% of assets	43.3%	41.8%	41.2%	43.7%	17.5%	25.3%	18.5%	14.6%	12.1%	9.4%

Source: Shared Research based on company data

Assets

The acquisition of VSUN led to a 166.8% YoY increase in total assets as of end-FY06/21; total assets were up another 116.3% YoY at end-FY06/22. The increases were centered on current assets. At end-FY06/22, current assets and fixed assets accounted for 67.4% and 32.4% of total assets, respectively.

Current assets

The company's current assets mainly include merchandise and finished goods, accounts receivable, cash and deposits, and work in process. As of end-FY06/22, merchandise, finished goods, and work in process accounted for 81.2% of current assets.

Tangible fixed assets

The company's tangible fixed assets mainly include machinery, equipment, and vehicles; land; construction in progress; and buildings and structures. At end-FY06/22, tangible fixed assets made up 24.2% of total assets. Roughly 80% of tangible fixed assets are machinery, equipment, and vehicles. Land and construction in progress follow. Except for leased assets, tangible fixed assets are mostly depreciated using the declining-balance method. However, the company uses the straight-line method for depreciation of machinery and equipment in the Green Energy business.

Intangible assets

The main components of intangible assets are goodwill and software. At end-FY06/22, intangible assets reached 5.5% of total assets, chiefly due to the recording of goodwill. The bulk of the goodwill was associated with WWB's acquisition of shares in Japan Mirai Energy Co., Ltd. and J. Mirai Co., Ltd., and Valors' acquisition of shares in Campanio Solar Co., Ltd.

Liabilities

Liabilities chiefly include current liabilities such as short-term borrowings, contract liabilities, accounts payable, and current portion of long-term borrowings. Fixed liabilities comprise long-term borrowings and long-term accounts payable—installment purchase. At end-FY06/22, the ratio of liabilities to total assets was 90.6%, with current liabilities accounting for 67.8% and fixed liabilities, 22.8%.

Interest-bearing debt

At end-FY06/22, the ratio of interest-bearing debt to total assets was 46.1%. Short-term debt accounted for 51.3% of the interest-bearing debt, and the remaining 48.7% was long-term debt. 77.4% of total interest-bearing debt was secured.

Net assets

Within net assets, retained earnings and capital stock have increased in particular. The ratio of net assets to total assets has tracked a downward trajectory, reaching 7.0% at end-FY06/22.

Cash flow statement

Cash flow statement	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Cash flows from operating activities										

Pre-tax profit	13	241	367	388	84	917	581	304	1,255	2,260
Depreciation	24	32	47	34	54	123	167	188	708	1,465
Amortization of goodwill	32	17	17	17		101	107	77	12	147
Impairment losses	108			35		28				
Software amortization	1									
Change in provision for doubtful accounts	81	16	67	-50	223	13	-54	-119	18	248
Change in provision for bonuses					19	-4	-3	0	13	6
Interest income	-0	0	-1	-2	0	0	-6	-2	-10	-129
Interest expenses	18	15	14	11	18	44	85	111	317	740
Equity in earnings of affiliates	0	0	18	0	13	8	-2	-27	-19	-26
Foreign exchange gains and losses	-1	0	-4	1	0	-5	0	2	-139	49
Change in trade receivables	21	-313	-117	52	138	-1	-214	113	-2,419	-11,424
Change in inventories	-66	-257	14	-451	221	-927	-956	-1,270	-3,399	-16,745
Change in real estate for sale			-269	215	45	29	-370	-1,126	226	-272
Loss on liquidation of project										125
Change in trade payables	33	349	-78	93	-732	79	120	378	3,569	19,793
Change in advances received	25	-73	71	62	-583	-16	671	63	-197	-1,238
Other						320	283	664	-174	292
Subtotal	164	7	139	323	-837	641	391	-647	-240	-4,710
Interest and dividends income received	0	0	0	1	1	0	1	0	29	117
Interests paid	-19	-15	-14	-12	-17	-44	-85	-114	-298	-754
Income taxes paid	-24	-70	-68	-106	-131	-265	-453	-101	-160	-1,002
Cash flows from operating activities (1)	**121**	**-77**	**57**	**206**	**-984**	**405**	**-147**	**-861**	**-608**	**-6,348**
Cash flows from investing activities										
Payments into time deposits				-119	-26	-141	-92	-401	-114	-331
Proceeds from withdrawal of time deposits				75	23		41	140	113	96
Purchase of tangible fixed assets	-17	-90	-141	-55	-428	-377	-1,473	-117	-2,732	-6,137
Purchase of intangible assets		-11	-10	-5	-14	-31	-7	-11	-10	-12
Deposits paid										-787
Purchase of shares of subsidiaries and associates	-3	-2	-3			-1	-13	-67	-27	-944
Purchase of subsidiaries' shares affecting scope of consolidation	-4				-405		-21			-3,992
Proceeds from purchase of subsidiaries' shares affecting scope of consolidation						0			1,825	
Payments for transfer of business										-169
Loan advances	-17	-12	-92	-105	-12	-44	-154		-431	-980
Proceeds from collection of loans receivable	0		8	131	12	43	38		10	27
Other				-1			-7	-9	-3	-63
Cash flows from investing activities (2)	**-28**	**-116**	**-252**	**-75**	**-864**	**-559**	**-1,620**	**-472**	**-1,391**	**-13,321**
Free cash flow (1+2)	**93**	**-194**	**-195**	**131**	**-1,848**	**-155**	**-1,766**	**-1,333**	**-1,999**	**-19,669**
Cash flows from financing activities				-32	1,983	17	510	1,996	5,176	14,000
Repayments of installment payables							-62	-403	-189	-328
Proceeds from sale and leaseback transaction	82	15		17			1,478			3,473
Proceeds from short-term borrowings	16	106	816	1,244	1,508	1,713	2,033	1,979	13,812	46,519
Repayments of short-term borrowings	-39	-121	-659	-1,028	-891	-1,471	-1,792	-2,130	-10,823	-36,222
Proceeds from long-term borrowings			110	70	1,600	671	1,289	3,546	3,625	7,623
Repayments of long-term borrowings	-25	-104	-114	-317	-235	-896	-1,019	-1,399	-1,438	-3,920
Proceeds from issuance of bonds							100		200	
Redemption of bonds								-32	-48	-102
Repayments of lease obligations	-15	-26	-29	-21	-27	-14	-11	-10	-1	-25
Proceeds from issuance of shares					90				224	775
Proceeds from share issuance exercising share subscription rights								4	21	59
Dividends paid			-25	-50	-55	-67	-86	-87	-89	-98
Cash flows from financing activities	**48**	**393**	**104**	**-85**	**1,991**	**-62**	**1,913**	**1,465**	**5,290**	**17,752**
Depreciation and amortization (A)	24	32	47	34	54	123	274	265	720	1,612
Purchase of tangible fixed assets and intangible assets(B)	-17	-102	-151	-60	-442	-408	-1,480	-128	-2,742	-6,149
Change in working capital (C)	-1	198	181	307	2,069	847	-246	648	2,889	14,912
Simple FCF (NI + A + B - C)	124	-34	-85	-101	-2,633	-374	-644	-300	-4,374	-18,582
Effect of exchange rate changes on cash and cash equivalents	1	0	4	-1	0	5	0	-3	221	852
Change in cash and cash equivalents	142	200	-88	45	143	-212	147	127	3,512	-1,065
Cash and cash equivalents (beginning of year)	153	295	494	407	452	595	383	530	679	4,191
Cash and cash equivalents (year-end)	295	494	407	452	595	383	530	679	4,191	3,125

Source: Shared Research based on company data

The Abalance group has been logging a net cash outflow from operating activities since FY06/19, as increases in trade receivables and inventories have more than offset the inflow. Cash flows from investing activities have also been negative due to outlays associated with production capacity enhancements at VSUN's solar panel plants and the acquisition of solar power plants in Japan. Against this backdrop, cash flows from financing activities have maintained a net cash inflow due to bank borrowings and leaseback contracts with leasing companies.

Cash flows from operating activities

Cash flows from operating activities are affected by changes in trade receivables and inventories. Operating cash flows have finished at a net outflow since FY06/19 due to these factors.

Cash flows from investing activities

Cash flows from investing activities are mainly affected by purchases of tangible fixed assets, purchase/sale of subsidiary shares, and provision of loans. The net cash outflow since FY06/21 is chiefly attributable to purchases of tangible fixed assets and subsidiary shares.

Cash flows from financing activities

Cash flows from financing activities are mainly affected by borrowings made or repaid. The increase in borrowings has exceeded repayments, and cash flows from financing activities have been positive since FY06/17.

Historical earnings

1H FY06/23 results

Revenue: JPY112.1bn (+320.5% YoY)
Operating profit: JPY5.2bn (+871.2% YoY)
Recurring profit: JPY5.9bn (17.2x YoY)
Net income attributable to owners of the parent: JPY2.3bn (+182.6% YoY)

The Solar Panel Manufacturing business and the Green Energy business continued to drive overall performance. At VSUN in charge of solar panel manufacture and sales, orders and sales surpassed expectations, lifted by high demand from the European and US markets that seek to advance decarbonization. Panel shipments also improved, thanks to the easing of port congestions caused by the import and export of raw materials and finished goods. As a result, consolidated revenue was up 320.5% YoY.

The YoY growth of operating profit surpassed that of revenue, thanks to the successful pass-through of raw material, transport, and other costs that sharply increased due to global inflation. Other contributing factors included the decline in container freight rates, and improvements in the company's production efficiency. Gains from equity-method investment into Meiji Machine Co., Ltd. (TSE Standard: 6334) also led to a YoY increase in non-operating income. OPM was up 2.0pp YoY to 4.6%.

Progress versus full-year forecast

In February 2023, Abalance revised its full-year earnings forecast upward in consideration of the business environment and its earnings status. 1H progress versus the revised forecast was 64.0% for revenue, 73.8% for operating profit, 80.3% for recurring profit, and 66.7% for net income attributable to owners of the parent.

Investment plan

In line with the launch of VSUN's fourth solar panel plant, Abalance decided to manufacture solar cells (N-type TOPCon) in-house, rather than sourcing them from outside parties. To this end, it is currently constructing solar cell plants in Vietnam's Phu Tho Province. The company looks to achieve total annual production capacity of 6GW (total investment of about USD300mn) with the plant currently under construction being the first phase (3GW; investment of about USD180mn) of the project. The construction is slated for completion in October 2023. In addition to using the in-house manufactured cells in VSUN's solar panels, the company plans to sell surplus output to outside customers. In-house cell production will allow the company to lower cost and improve its profit margins, stabilize procurement, and enhance its ability to respond to import restrictions of various countries.

Capital and business alliance with Meiji Machine

In February 2022, Abalance acquired a stake in Meiji Machine Co., Ltd. through a tender offer, and the two parties also entered into a capital and business alliance agreement. Meiji Machine chiefly manufactures and sells flour and feed manufacturing equipment. Through the alliance, Abalance looks to achieve synergies such as expanded sales of solar sharing systems, expanded sales of machinery and equipment to all regions of Southeast Asia, and the operation of safe and clean pig and chicken farms utilizing photocatalysts.

Financing activities

In January 2023, Abalance raised approximately JPY1.4bn through third-party allotment of newly issued shares. The proceeds have been earmarked for investment into solar power plants. The Abalance group plans to increase the output capacity of its proprietary solar plants to 1GW by 2030, and to this end, intends to expand its domestic solar plant portfolio by 50MW annually. The company plans to use the raised funds mainly to step up development and ownership of high-voltage solar power plants. In September 2022, Abalance procured working capital of JPY400mn through a sustainability-linked loan agreement, which takes into consideration the company's decarbonization initiatives and performance in the Green Energy business. Under this arrangement, the loan's interest rate spread is adjusted depending on subsidiary WWB's level of contribution to decarbonization efforts.

VSUN's IPO

Since 2021, VSUN has been preparing for an IPO on the UPCoM OTC market in Vietnam to diversify its financing means and improve brand power. To complete the registration required for listing under the securities exchange law in Vietnam,

VSUN has submitted necessary documents to the authorities and the papers are currently being reviewed. In addition, the company is considering IPOs on foreign securities markets outside Vietnam in preparation for greater funding needs.

Results in key reportable segments

Solar Panel Manufacturing business

Revenue: JPY107.3bn (+372.2% YoY)
Operating profit: JPY4.6bn (20.7x YoY)

Revenue and operating profit climbed YoY in this business, fueled by robust demand for VSUN's solar panels in Europe and the US. While VSUN has historically expanded its business by selling industrial and home-use solar panels for the European market, the sale of solar panels to the US market expanded rapidly during 1H. Shipments increased as port congestions eased. Operating profit was also up YoY, thanks to successful pass-through of raw material, goods transport, and other costs that sharply increased due to global inflation. Other contributing factors included the decline in container freight rates, and improvements in the company's production efficiency. To maintain normal operations and shipments during the Chinese New Year and the Vietnamese Tet holidays, the company sought the cooperation of suppliers and adjusted production in advance to avoid a decline in capacity utilization.

Green Energy business

Revenue: JPY4.4bn (+22.3% YoY)
Operating profit: JPY932mn (+50.6% YoY)

Revenue and operating profit grew YoY in this business, primarily due to solid performance in solar power plant trades, sale of goods associated with raw materials, sale of electricity, and income from O&M services. In the Green Energy business, the company promotes both one-time revenue and recurring revenue businesses mainly through subsidiaries WWB and Valors. Operations in the one-time revenue business include sale of (low-voltage) solar power plants, as well as sale of solar panels, power conditioning systems, and other products for industrial use, as well as storage batteries for both industrial and home use. In the recurring revenue business, the company seeks to secure stable income from electricity sales through continued ownership of solar power plants after their construction. It actively pursues M&A activities to acquire companies owning solar power generation facilities, as well as to strengthen property sourcing and construction management capabilities.

Full-year FY06/22 results

Revenue: JPY92.4bn (+243.6% YoY)
Operating profit: JPY1.7bn (+24.7% YoY)
Recurring profit: JPY1.5bn (+19.0% YoY)
Net income attributable to owners of the parent: JPY867mn (+61.5% YoY)

Revenue
The company had left its full-year projections unchanged for all items in consideration of the impact of COVID-19 and the crisis in Ukraine. However, consolidated revenue for the full year finished up 243.6% YoY due to a larger-than-expected increase in solar panel orders from Europe, US, and other markets.

Operating profit
In the Solar Panel Manufacturing business, the company posted an operating loss in Q1 FY06/22 due to a sharp increase in marine transport costs owing to raw material price hikes and global container shortages. The company made a turnaround into the black from Q2, however, as it negotiated raw material prices, reassessed suppliers, and made cost improvements by further enhancing production efficiency, while successfully negotiating cost pass-through. As a result, full-year operating profit rose 24.7% YoY. Meanwhile, OPM declined from 5.1% in FY06/21 to 1.8%, mainly due to higher raw material prices.

Recurring profit and net income attributable to owners of the parent
Recurring profit only grew 19.0% YoY due to an increase in non-operating losses from higher interest expenses, among other factors. Net income attributable to owners of the parent was up 61.5% YoY as the company recorded extraordinary gains. RPM was 1.6% (versus 4.7% in FY06/21) and net income margin was 0.9% (2.0%).

Capital expenditures
Capital expenditures increased 30.0% YoY to JPY4.4bn. Main uses included acquisitions of solar power plants for the power

generation business (JPY1.3bn) in Green Energy, and equipment purchases in the Solar Panel Manufacturing business (JPY1.2bn).

Cash flows

Operating cash flows finished at a net outflow of JPY6.3bn as a result of an increase in trade receivables and inventories. Investing cash flows also finished at a net outflow of JPY13.3bn as the company purchased tangible fixed assets and shares in subsidiaries. As a result, free cash flows were a negative JPY19.7bn. Meanwhile, cash flows from financing activities finished at a net inflow of JPY17.8bn as the increase in borrowings more than absorbed repayments. Cash and cash equivalents as of end-FY06/22 stood at JPY3.1bn, down from JPY4.2bn in FY06/21.

Transition to a recurring revenue model

While the company continues to sell solar power plants and solar power-related products in the Green Energy business, to ensure stable earnings, it has been working to expand its own portfolio of solar power generation facilities by acquiring companies that own solar power plants. Abalance has positioned FY06/22 as a preparatory period for accomplishing the Group's 2030 Vision (proprietary output capacity of 1GW). To this end, it has been gradually transitioning to a recurring-revenue model over the previous three years. In FY06/22, Abalance recorded a total of JPY2.7bn from electricity sales and O&M services, which are both sources of stable income.

Financing and capital increase

In December 2021, the company conducted a capital increase, raising a total of JPY775mn intended for the expansion of renewable energy-related business base, acquisition of solar power plants in the secondary market, and R&D of next-generation energy at group company Birdy Fuel Cells LLC. The R&D work envisions commercialization of an option to store enough solar power to supply electricity for seven consecutive days. The service, which is to be offered at the same price as solar panels, is earmarked for a launch in 2024.

Acquisition of Meiji Machine Co., Ltd.

In February 2022, Abalance acquired a stake in Meiji Machine (maker of flour and feed manufacturing equipment) via a tender offer in compliance with the Financial Instruments and Exchange Act, and the two parties also entered into a capital and business alliance agreement. According to Abalance, Meiji Machine has established its own sales base through the manufacture and sale of flour and feed manufacturing equipment. The alliance enables the two parties to join hands and develop businesses using both of their sales bases. Since Meiji Machine also has knowledge and experience in the solar power business (and the pursuit of a decarbonized society), Abalance looks to achieve synergies such as expanded sales of solar sharing systems, expanded sales of machinery and equipment to all regions of Southeast Asia, and the operation of safe and clean pig and chicken farms utilizing photocatalysts.

Results in key reportable segments

Solar Panel Manufacturing business

Revenue: JPY81.5bn (+287.9% YoY)
Operating profit: JPY1.2bn (+69.4% YoY)

Against the backdrop of robust growth in global demand for renewable energy, consolidated revenue jumped YoY as orders for industrial and home-use solar panels for the European and US markets increased beyond initial expectations. That said, costs at VSUN also rose due to sharp increases in raw material prices and container freight rates, stemming from multiple factors such as the spread of COVID-19 in Vietnam, lockdowns in China, and the crisis in Ukraine. Still, operating profit was up YoY, as the company worked to secure raw materials, negotiated raw material prices, reassessed suppliers, and made cost improvements by further enhancing production efficiency, while successfully negotiating cost pass-through.

Green Energy business

Revenue: JPY10.2bn (+92.7% YoY)
Operating profit: JPY1.2bn (+19.8% YoY)

In the Green Energy segment, the Abalance group sells (low-voltage) solar power plants, solar panels, power conditioning systems, industrial and home-use storage batteries, and other solar power-related products under the one-time revenue business. It also actively pursues a recurring-revenue business model so that it can generate stable income from electricity sales through the continued ownership of solar power plants after their construction. The company actively engages in M&A

activities to acquire solar power plants for long-term holding and to strengthen its ability to source properties. It also develops its own solar power plants. Thanks to the larger portfolio of such facilities, revenue from electricity sales has been expanding. With companies clearly moving toward decarbonization-minded management, Abalance also sought to bolster its ability to plan and propose related solutions while aggressively pursuing non-FIT registration and solar sharing projects as well.

Other information

History

History	
2000 Apr	Established Real Communications Co., Ltd.
2000 Aug	Moved head office to Chiyoda-ku, Tokyo
2001 Feb	Changed company name to Realcom Co., Ltd.
2005 Feb	Moved head office to Taito-ku, Tokyo
2006 Feb	Established US subsidiary Realcom Technology, Inc. for sales and support services in the US and planning and development of next-generation products
2007 Sep	Listed on the Mothers Market of the Tokyo Stock Exchange (TSE)
2008 Mar	Established US subsidiary Realcom U.S., Inc.
2011 Nov	Made WWB Corporation a wholly owned subsidiary via stock exchange
2012 Sep	Moved head office to Shinagawa-ku, Tokyo
2017 Mar	WWB Corporation established an SPC (VW LLC) and made Valors Corporation a subsidiary
2017 Mar	Changed company name to Abalance Corporation
2018 Feb	WWB Corporation established Fuji Solar Corporation
2018 Nov	Switched listing from the Mothers Market to the Second Section of TSE
2019 Oct	Established Abit Corporation through an incorporation-type split of the IT division
2020 Dec	Made Vietnam Sunergy Joint Stock Company (VSUN) a subsidiary
2021 Jun	WWB Corporation established Birdy Fuel Cells LLC
2021 Oct	WWB Corporation made Campanio Solar Co., Ltd. a subsidiary via second-tier subsidiary, Valors Corporation
2021 Oct	WWB Corporation made Japan Solar Power Co., Ltd. a subsidiary
2021 Nov	WWB Corporation succeeded the industrial-use solar power generation business from Japan Life Support Co., Ltd.
2022 Mar	Abit Corporation made Digital Sign Co., Ltd. a subsidiary
2022 Mar	WWB Corporation made Japan Mirai Energy Co., Ltd. and J. Mirai Co., Ltd. subsidiaries via second-tier subsidiary, WWB Solar 03 LLC
2022 Mar	Made Meiji Machine Co., Ltd. an equity-method affiliate

Source: Shared Research based on company data

Major shareholders

Mr. Junsei Ryu has been Abalance's major shareholder since the company made WWB Corporation a wholly owned subsidiary through a share exchange conducted in November 2011. The company has no business ties with the other individual and corporate shareholders shown below.

Major shareholders	Shares held (000 shares)	Shareholding ratio
Junsei Ryu	1,860	33.58%
Ryuhei Tanaka	269	4.85%
Iizuka Future Design Co., Ltd.	215	3.88%
Yutaka Hino	161	2.91%
BNYM SA/NV FOR BNYM ROR BNYM GCM CLIENT ACCTS M ILM FE (Standing proxy: MUFG Bank)	144	2.60%
Heishiro Gen	126	2.27%
Jingukan	115	2.08%
Hiroshi Yamashita	105	1.89%
AN Promotion Co., Ltd.	95	1.71%
Custody Bank of Japan, Ltd. (trust account)	79	1.42%
Total	3,168	57.19%

Source: Shared Research based on company data

Dividend policy

Abalance's basic policy is to accomplish stable dividend payments and actively return profits to shareholders in accordance with the state of its finances, while maintaining the necessary internal reserves to develop future businesses and strengthen the company's financial position. Abalance pays dividends twice a year as an interim dividend and year-end dividend.

Top management

Mr. Yasuaki Mitsuyuki became a representative director and president of Abalance as well as a director of WWB in September 2018.

Mr. Junsei Ryu became a representative director of Abalance when the company made WWB a wholly owned subsidiary through a stock exchange in November 2011. He then became a director in September 2016. Mr. Ryu concurrently serves as the representative director of key group subsidiary WWB, and director and chairman of VSUN.

Title	Representative director and president
Name	Yasuaki Mitsuyuki
Date of birth	January 4, 1951
1974 Apr	Joined The Industrial Bank of Japan, Limited
2000 Jun	General manager of inspection, The Industrial Bank of Japan, Limited.
2003 Apr	General manager of sales, Drake Beam Morin–Japan Inc.
2005 Jan	Director and senior managing director, Daishinto Inc.
2009 Jun	Director, Shidax Corporation
2010 Jul	Special advisor, Shidax Corporation
2011 Jan	Director, SFP Dining Co., Ltd.
2011 Oct	Managing director, SFP Dining Co., Ltd.
2013 Jan	Director and executive vice president, SFP Dining Co., Ltd.
2016 Jun	Outside director, Edoichi Co., Ltd.
2017 Sep	Outside audit & supervisory board member, Novarese Co., Ltd.
2018 Sep	Representative director and president of the company (current position)
2018 Sep	Director, WWB Corporation (current position)
2018 Sep	Director, Valors Corporation (current position)
2018 Sep	Director, Valors Engineering Corporation (current position)

Source: Shared Research based on company data

Title	Director
Name	Junsei Ryu
Date of birth	October 21, 1971
2003 Feb	Founding representative director, J-TEC YK
2006 Jun	Founding representative director, WWB Corporation (current position)
2011 Nov	Representative director of the company
2016 Sep	Director of the company (current position)
2017 Mar	Representative director, Valors Corporation (current position)
2017 Mar	Representative director, Valors Engineering Corporation (current position)
2018 Apr	Chairman of the board, Vietnam Sunergy Company Limited (current position)
2019 Jan	Representative director, Japan Photocatalyst Center Corporation (current position)

Source: Shared Research based on company data

Company philosophy

The Abalance group envisions becoming an "excellent creative company" by providing value. It aspires to contribute to the sustainable progress of society on an ongoing basis by improving social lifestyles through value creation, focusing on the provision of advanced products, businesses, and services.

Management indicators

The Abalance group places importance on ROE as a management indicator that guides toward sustainable growth of group corporate value. Further, as the company makes greater progress shifting from the conventional sale of solar power plants to a recurring-revenue model of operating the solar plants it owns, Abalance will be looking to incorporate KPIs that are more indicative of its performance versus the returns demanded by stakeholders. These include indicators based on return on invested capital (ROIC) and weighted average cost of capital (WACC). In preparation for the full-scale introduction of the KPIs, the company currently manages its businesses paying attention to these figures.

Corporate governance

At its ordinary general meeting of shareholders held in September 2020, Abalance made a proposal to revise its articles of incorporation and shift to a company with an audit and supervisory committee, with an aim to further enhancing corporate governance and raising its corporate value. With the passing of this resolution, the company transitioned from a company with an audit and supervisory board to one with an audit and supervisory committee.

Form of organization and capital structure	
Form of organization	Company with Audit & Supervisory Committee
Controlling shareholder(excluding parent company)	-
Parent company	None
Directors and Audit & Supervisory Committee	
Number of directors under Articles of Incorporation	8
Number of directors	5
Directors' term of office under Articles of Incorporation	1 year
Chairperson of the Board of Directors	President
Number of outside directors	3
Number of independent outside directors	3
Number of auditors under Articles of Incorporation	-
Number of members of Audit & Supervisory Committee	3
Number of outside directors(Audit & Supervisory Committee)	3
Number of independent outside members of Audit & Supervisory Committee	-
Other	Other
Participation in electronic voting platform	Y
Providing convocation notice in English	None
Implementation of measures regarding director incentives	Stock option
Eligible for stock option	Inside directors, Outside directors, Employees, Directors of subsidiaries, Employees of subsidiaries, Other
Disclosure of directors' compensation	None
Policy to determine amount and calculation method of remuneration	Y
Corporate takeover defenses	None

Source: Shared Research based on company data

Basic policy on sustainability

The Abalance group understands that addressing sustainability related to climate change and other global environmental issues is a highly important theme. In terms of the UN sustainable development goals (SDGs), the company is chiefly committed to goals 7, 11, and 13, which it plans to contribute to by providing safe and secure clean energy. The company also actively works toward goal 3 (Good Health and Well-being) through its photocatalyst and other healthcare-related businesses.

Number of employees

Number of employees	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
(JPYmn)	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Total	36	34	41	48	66	74	76	67	878	1,008
Number of temporary employees(not included in the above)	6	5	5		5	11	23	16	8	17
Solar Panel Manufacturing business									803	867
Number of temporary employees(not included in the above)										
Green Energy business(Solar Power Generatiion business until FY06/17)	12	17	25	28	45	50	44	45	51	63
Number of temporary employees(not included in the above)	3	4	5		3	7	14	12	5	10
IT business	20	13	11	14	14	20	7	2	2	46
Number of temporary employees(not included in the above)	3	1			2	2	6			
Photocatalyst business									7	9
Number of temporary employees(not included in the above)										3
Construction Machinery Sales business	4	4	5	6	7	4	2	2		
Number of temporary employees(not included in the above)						2	2	2		
Other							10	4		
Number of temporary employees(not included in the above)										
Companywide(shared)							13	14	15	23
Number of temporary employees(not included in the above)							1	2	2	4

Source: Shared Research based on company data

Number of employees, Average annual salary(Parent)	FY06/13	FY06/14	FY06/15	FY06/16	FY06/17	FY06/18	FY06/19	FY06/20	FY06/21	FY06/22
	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent
Number of employees	20	13	11	14	14	20	20	14	15	23
Average number of part-time employees(not included in the above)	3	1			2	2	7	2	2	4
Average age	38.6	39.1	40.4	40.6	40.1	41.0	41.4	47.4	48.7	47.4
Average years of service	5.6	6.5	6.0	5.2	4.8	4.0	4.6	3.7	4.3	3.0
Average annual salary (JPY'000)	5,688	5,559	5,784	6,069	5,974	5,117	6,090	7,283	7,921	5,734

Source: Shared Research based on company data

Profile

Company Name

Abalance Corporation

Phone

81-03-6864-4001

Established

2000-04-17

Head Office

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Listed On

Tokyo Stock Exchange, Standard Market

Exchange Listing

2007-09-19

Fiscal Year-End

Jun

About Shared Research Inc.

We offer corporate clients comprehensive report coverage, a service that allows them to better inform investors and other stakeholders by presenting a continuously updated third-party view of business fundamentals, independent of investment biases. Shared Research can be found on the web at https://sharedresearch.jp.

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