



Tamagawa Holdings / 6838

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How to read a Shared Research report: This report begins with the trends and outlook section, which discusses the company's most recent earnings. First-time readers should start at the business section later in the report.

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Key financial data

Income statement (JPYmn)	FY03/10	FY03/11	FY03/12	FY03/13	FY03/14	FY03/15	FY03/16	FY03/17	FY03/18
	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Est.
Total sales	2,803	2,640	3,106	3,672	4,171	5,095	7,260	4,443	4,237
YoY	-34.8%	-5.8%	17.7%	18.2%	13.6%	22.1%	42.5%	-38.8%	-4.6%
Gross profit	392	326	590	1,049	1,198	1,479	1,550	1,292	
YoY	-58.8%	-16.8%	81.1%	77.8%	14.3%	23.4%	4.8%	-16.6%	
GPM	14.0%	12.3%	19.0%	28.6%	28.7%	29.0%	21.3%	29.1%	
Operating profit	-227	-286	-30	373	477	531	280	189	202
YoY	-	-	-	-	27.8%	11.3%	-47.4%	-32.3%	6.8%
OPM	-8.1%	-10.8%	-1.0%	10.2%	11.4%	10.4%	3.9%	4.3%	4.8%
Recurring profit	-224	-284	-24	375	478	514	211	107	107
YoY	-	-	-	-	27.6%	7.5%	-58.9%	-49.6%	0.9%
RPM	-8.0%	-10.8%	-0.8%	10.2%	11.5%	10.1%	2.9%	2.4%	2.5%
Net income	-570	-351	-37	340	436	427	165	45	57
YoY	-	-	-	-	28.5%	-2.2%	-61.3%	-73.0%	28.1%
Net margin	-20.3%	-13.3%	-1.2%	9.3%	10.5%	8.4%	2.3%	1.0%	1.3%
Per share data									
Shares issued (year end; '000)	6,774	6,774	6,774	10,753	41,259	42,031	42,598	42,598	
EPS	-35.1	-17.8	-1.9	15.7	11.7	10.4	4.0	1.1	1.4
EPS (fully diluted)	-	-	-	14.8	10.6	10.2	3.9	1.1	
Dividend per share	-	-	-	-	-	1.0	1.5	1.0	1.0-3.0
Book value per share	58.9	40.6	38.6	54.3	64.8	75.4	78.1	77.6	
Balance sheet (JPYmn)									
Cash and cash equivalents	665	493	56	390	1,764	1,524	2,737	2,155	
Total current assets	1,918	1,530	1,293	2,114	3,421	3,606	4,221	4,088	
Tangible fixed assets	295	205	133	564	718	2,410	2,464	2,584	
Investment and other assets	89	30	18	27	38	154	169	476	
Intangible fixed assets	39	-	-	1	31	194	309	279	
Total assets	2,341	1,766	1,445	2,709	4,210	6,376	7,164	7,446	
Accounts payable	443	430	364	386	474	620	321	524	
Short-term debt	433	203	30	40	323	300	1,395	986	
Total current liabilities	1,026	884	598	708	1,130	1,481	2,049	2,041	
Long-term debt	67	-	-	151	294	539	612	614	
Total fixed liabilities	153	83	85	251	442	1,733	1,820	2,144	
Total liabilities	1,179	967	683	959	1,572	3,215	3,869	4,185	
Net assets	1,162	799	761	1,751	2,638	3,161	3,295	3,261	
Total interest-bearing debt	500	203	30	192	618	839	2,007	1,600	
Cash flow statement (JPYmn)									
Cash flows from operating activities	-1	68	-332	36	764	387	1,614	102	
Cash flows from investing activities	12	93	77	-454	-265	-865	-392	-628	
Cash flows from financing activities	-82	-299	-168	783	875	238	-2	-57	
Financial ratios									
ROA (RP-based)	-8.4%	-13.8%	-1.5%	18.0%	13.8%	9.7%	3.1%	1.5%	
ROE	-43.4%	-35.8%	-4.7%	27.4%	20.1%	14.8%	5.2%	1.4%	
Equity ratio	49.6%	45.3%	52.7%	64.6%	62.7%	49.6%	46.0%	43.8%	

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

Recent updates

Highlights

On **November 14, 2017**, Tamagawa Holdings Co., Ltd. announced earnings results for 1H FY03/18; see the results section for details.

On **November 9, 2017**, the company announced that it has secured land for solar sharing via fixed asset leasing.

On the same day, the company's Board of Directors approved the signing of a sectional surface rights agreement pertaining to the land the company secured for its solar sharing business (total area: 4,626sqm; power output of about 406kW). The agreement will be between the company and the landowner. Solar sharing is the operation of solar power generation business utilizing agricultural land. In solar sharing, solar power systems are placed over the land where crops are grown, by propping up the solar panels to a certain height.

Construction of the solar power plant is scheduled to begin once the company officially receives approval necessary to develop the solar sharing business. According to the plan, completion of the plant is slated for late March 2018, and full-scale operation (electricity sales) will begin in FY03/19 or later.

On **the same day**, Shared Research updated the report following interviews with the company.

For corporate releases over three months old, see the News and topics section.

Trends and outlook

Quarterly trends and results

Cumulative (JPYmn)	FY03/17				FY03/18				FY03/18	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	% of FY	FY Est.
Sales	476	1,814	2,538	4,443	674	1,304			30.8%	4,237
YoY	-30.2%	63.7%	-24.0%	-38.8%	41.6%	-28.1%				-4.6%
Gross profit	132	526	744	1,292	208	416				
YoY	-41.1%	48.8%	-4.1%	-16.6%	57.3%	-20.9%				
GPM	27.8%	29.0%	29.3%	29.1%	30.9%	31.9%				
SG&A expenses	237	522	788	1,103	241	482				
YoY	-4.1%	1.6%	-9.1%	-13.2%	1.9%	-7.8%				
SG&A-to-sales ratio	49.7%	28.8%	31.0%	24.8%	35.8%	36.9%				
Operating profit	-104	3	-43	189	-33	-65			-	202
YoY	-	-	-	-32.3%	-	-				6.8%
OPM	-	0.2%	-	4.3%	-	-				4.8%
Recurring profit	-129	-43	-103	107	-61	-114			-	107
YoY	-	-	-	-49.6%	-	-				0.5%
RPM	-	-	-	2.4%	-	-				2.5%
Net income	-90	-4	-88	45	-72	-119			-	57
YoY	-	-	-	-73.0%	-	-				27.7%
Net margin	-	-	-	1.0%	-	-				1.3%

Quarterly (JPYmn)	FY03/17				FY03/18			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Sales	476	1,338	724	1,905	674	630		
YoY	-30.2%	214.0%	-67.6%	-51.4%	41.6%	-52.9%		
Gross profit	132	393	219	548	208	208		
YoY	-41.1%	206.1%	-48.3%	-29.2%	57.3%	-47.2%		
GPM	27.8%	29.4%	30.2%	28.7%	30.9%	33.0%		
SG&A expenses	237	285	265	315	241	240		
YoY	-4.1%	6.8%	-24.7%	-21.9%	1.9%	-15.9%		
SG&A-to-sales ratio	49.7%	21.3%	36.6%	16.5%	35.8%	38.1%		
Operating profit	-104	108	-47	233	-33	-33		
YoY	-	-	-	-	-	-		
OPM	-	8.1%	-	12.2%	-	-		
Recurring profit	-129	86	-60	209	-61	-53		
YoY	-	-	-	-	-	-		
RPM	-	6.4%	-	11.0%	-	-		
Net income	-90	86	-84	133	-72	-46		
YoY	-	-	-	-	-	-		
Net margin	-	6.5%	-	7.0%	-	-		

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

Note: Net income is net income attributable to the parent company shareholders.

Segment breakdown (cumulative) (JPYmn)	FY03/17				FY03/18			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Sales	476	1,814	2,538	4,443	674	1,304		
YoY	-30.2%	63.7%	-24.0%	-38.8%	41.6%	-28.1%		
Electronic and Communication Device	402	948	1,474	2,605	538	1,062		
YoY	-32.4%	0.2%	7.3%	24.6%	33.9%	12.1%		
Renewable Energy System Sales	8	735	891	1,610	27	37		
YoY	-56.4%	-	-50.1%	-67.4%	252.7%	-95.0%		
Solar Power Plant	67	131	173	228	109	203		
YoY	-5.0%	-2.8%	-4.1%	-1.1%	62.6%	54.1%		
Geothermal Power Plant	-	-	-	-	-	-		
Operating profit	-104	3	-43	189	-33	-65		
YoY	372.0%	-102.1%	-52.0%	-32.3%	-	-		
Electronic and Communication Device	-22	6	58	246	2	10		
YoY	-	-	-	-	-	60.8%		
Renewable Energy System Sales	-64	81	34	111	-47	-80		
YoY	-	-	-	-61.3%	-	-		
Solar Power Plant	29	55	56	73	53	91		
YoY	-1.9%	7.4%	-0.7%	28.7%	85.3%	66.3%		
Geothermal Power Plant	-	-	-0	-1	-1	-5		
Adjustments	-46	-139	-191	-240	-40	-82		
Segment breakdown (quarterly) (JPYmn)	FY03/17				FY03/18			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Sales	476	1,338	724	1,905	674	630		
YoY	-30.2%	214.0%	-67.6%	-51.4%	41.6%	-52.9%		
Electronic and Communication Device	402	546	527	1,131	538	524		
YoY	-32.4%	55.4%	22.9%	57.8%	33.9%	-4.0%		
Renewable Energy System Sales	8	727	156	719	27	10		
YoY	-56.4%	-	-91.1%	-77.2%	252.7%	-98.6%		
Solar Power Plant	67	64	41	55	109	93		
YoY	-5.0%	-0.5%	-7.9%	9.8%	62.6%	45.3%		
Geothermal Power Plant	-	-	-	-	-	-		
Operating profit	-104	108	-47	233	-33	-33		
YoY	-	-	-	-37.1%	-	-		
Electronic and Communication Device	-22	29	51	188	2	8		
YoY	-	-	-	107.3%	-	-		
Renewable Energy System Sales	-64	145	-47	77	-47	-33		
YoY	-	-	-	-75.6%	-	-		
Solar Power Plant	29	26	1	17	53	38		
YoY	-1.9%	19.9%	-78.5%	-	85.3%	45.3%		
Geothermal Power Plant	-	-	-0	-0	-1	-4		
Adjustments	-46	-93	-52	-49	-40	-42		

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

Note: The JPY240mn adjustment of the FY03/17 segment profit/loss comprises JPY44mn in adjustment of unrealized profit, JPY140mn in adjustment of dividends received from consolidated subsidiaries, JPY5mn elimination of inter-segment transactions, and JPY51mn profit/loss of unallocated group administration division.

1H FY03/18 results

- ▷ Sales: JPY1.3bn (-28.1% YoY)
- ▷ Operating loss: JPY65mn (operating profit of JPY3mn in 1H FY03/17)
- ▷ Recurring loss: JPY114mn (recurring loss of JPY43mn)
- ▷ Net loss*: JPY119mn (net loss of JPY4mn)

*Net loss refers to net loss attributable to parent company's shareholders.

Electronics and Telecoms Equipment

- Orders: JPY940mn (-29.8% YoY)
- Sales: JPY1.1bn (+12.1% YoY)
- Operating profit: JPY10mn (+60.8% YoY)

The company achieved higher sales and profits owing to growth in orders in the public and government sectors and shrinking costs from streamlining operations as plans were restarted for capital investment by telecom carriers on countermeasures against radio wave interference and orders gradually recovered.

Renewable Energy System Sales

Orders: JPY108mn (-86.1% YoY)
Sales: JPY37mn (-95.0% YoY)
Operating loss: JPY80mn (operating profit of JPY81mn in 1H FY03/17)

Major sales projects tend to be concentrated in 2H, more than before.

Solar Power Plant Operations

Sales: JPY203mn (+54.1% YoY)
Operating profit: JPY91mn (+66.3% YoY)

The solar power plants already activated in Shimonoseki, Tateyama, and Sodegaura have been steadily selling electricity and especially from April to June 2017 when the weather was favorable and there was plenty of sunlight, the amount of electricity sold increased YoY. In addition, the mega solar power plant in Kasumigaura commenced electricity sales on April 3, 2017. As a result, sales and profits both increased YoY.

Geothermal Power Plant Operations

No sales were booked. Operating loss was JPY5mn due to expenses (vs. no sales or expenses in 1H FY03/17).

For details on previous quarterly and annual results, see the Historical financial statements section.

Full-year company forecasts

(JPYmn)	FY03/17 FY Act.	FY03/18 FY Est.	YoY
Sales	4,443	4,237	-4.6%
Cost of sales	3,151		
Gross profit	1,292		
GPM	29.1%		
SG&A expenses	1,103		
SG&A ratio	24.8%		
Operating profit	189	202	6.8%
OPM	4.3%	4.8%	
Recurring profit	107	107	0.9%
RPM	2.4%	2.5%	
Net income	45	57	28.1%
Net margin	1.0%	1.3%	

Source: Shared Research based on company data
Note: Figures may differ from company materials due to differences in rounding methods.

Company forecasts by segment

Forecasts by Segment (JPYmn)	FY03/17 FY Act.	FY03/17 FY Est.	YoY
Sales	4,443	4,237	-4.6%
Electronic and Communication Device	2,605	2,700	3.6%
Renewable Energy Systems Sales	1,610	1,154	-28.3%
Solar Power Plant	228	379	66.4%
Geothermal Power Plant	-	-	-
Operating profit	189	202	6.8%
Electronic and Communication Device	246	210	-14.6%
Renewable Energy Systems Sales	111	13	-88.3%
Solar Power Plant	73	75	2.8%
Geothermal Power Plant	-1	-	-
Adjustments	-240	-96	-

Source: Shared Research based on company data
Note: Figures may differ from company materials due to differences in rounding methods.
Note: Adjustments in FY03/17 include adjustment of unrealized profit of JPY44mn.

FY03/18 forecasts

- ▷ Sales: JPY4.2bn (-4.6% YoY)
- ▷ Operating profit: JPY203mn (+7.2%)
- ▷ Recurring profit: JPY107mn (+0.9%)
- ▷ Net income*: JPY57mn (+28.1%)

*Net income refers to net income attributable to parent company shareholders.

Forecasts by segment are as follows.

Electronics and Telecoms Equipment

- ▷ Sales: JPY2.7bn (+3.7% YoY)
- ▷ Operating profit: JPY210mn (-14.6%)

Tamagawa forecasts a 24.0% YoY increase in mobile telecoms-related sales to JPY697mn. Although assuming little YoY change in mobile telecoms companies' capex (see Market and value change section), the company expects its market share to increase, because its price competitiveness has improved thanks to products with over 80% local content made by consolidated subsidiary Tamagawa Electronics Vietnam Co., Ltd. The subsidiary is not expected to book any overseas sales.

The company forecasts sales of JPY671mn (+4.4% YoY) in the public and government sector, where new project inquiries have been brisk, and aims for a recovery in sales to over JPY1.0bn (attained in FY03/15) in the medium term.

The company forecasts other sales (public sector/infrastructure and measuring instruments) of JPY1.3bn (-5.7% YoY). For public sector/infrastructure, the company targets repeat orders for commercial wireless optical transmission systems newly installed at airports, subways, and meteorological observation facilities in FY03/17, plus orders from new customers. For measuring instruments, Tamagawa plans to increase sales of power semiconductor testers and new applications. Testing equipment for electromagnetic noise in the automotive sector (automobile EMC test equipment), which is a new sector for the company, is also expected to contribute to results. Tamagawa has already delivered some EMC test equipment to major automakers and has received inquiries from Tier 1 automotive suppliers.

Tamagawa's development of a wireless optical transmission system for next-generation electro magnetic compatibility (EMC) testing was selected as a research project for accelerated commercialization among public entries in April–May 2017 by the Kanagawa Institute of Industrial Science and Technology, a Local Incorporated Administrative Agency. The theme of the research project is modification of RoF (radio over fiber) systems using Aoyama Gakuin University's technology for assessment of electromagnetic waves and the Kanagawa Institute's EMC testing technology to adapt it for use in next-generation EMC testing. Sophisticated electrical and electronic technologies are increasingly used in the automotive industry, such as connected cars, automated driving systems, and wireless charging, which means that high-precision EMC measurement will become more important than ever to ensure safety.

* EMC (electro magnetic compatibility) testing checks that electromagnetic waves emitted by electronic devices do not affect other devices, and that devices do not malfunction as a result of exposure to electromagnetic waves emitted by other devices.

* RoF (radio over fiber) is a technology that takes advantage of the low loss, wide bandwidth properties of optical fiber to achieve high-precision EMC measurement.

Tamagawa looks for lower segment profit despite the sales growth effect, because it plans to increase R&D spending from JPY83mn in FY03/17 to JPY120mn in FY03/18.

Renewable Energy System Sales

- ▷ Sales: JPY1.2bn (-28.3% YoY)
- ▷ Operating profit: JPY13mn (-88.3%)

Tamagawa plans to compensate for a sharp decline in revenue from the sale of solar power generation facilities with sales of small-scale wind power generation equipment. The company has not factored sales in the form of development contracting fees that it received for the Misawa Plant into its FY03/18 forecast.

The company forecasts sharply lower segment profit, due to sales decline and because it does not expect any development contracting fees, which made a large contribution in FY03/17.

Solar Power Plant Operations

- ▷ Sales: JPY379mn (+66.4% YoY)
- ▷ Operating profit: JPY75mn (+2.8%)

Tamagawa forecasts higher sales due to the contribution of Kasumigaura mega solar power plant in Ibaraki Prefecture (2.4MW capacity; electricity sales price: JPY36.0/kWh; estimated electricity sales revenue: JPY105mn) starting in Q1 and Noboribetsu power plant (1.9MW capacity; electricity sales price: 40.0/kWh; estimated electricity sales revenue: JPY94mn) from 2H.

The company expects higher segment profit as a result of sales growth.

The Misawa power plant, in which Tamagawa has a 30% stake, began selling electricity amounting to 1.5MW in output (portion allotted to the company) in Q4 FY03/17. Additional facilities that would increase the output by another 1.5MW (portion allotted) are set for launch in 2H FY09/18. The Misawa plant's earnings will contribute as equity-method profit/loss.

Medium-term outlook

Tamagawa seeks to grow earnings in the medium term in the Electronic and Communication Device, Renewable Energy System Sales, and Solar and Geothermal Power Plant businesses by implementing the following measures.

- ▷ Electronic and Communication Device: develop 5G products, expand the overseas business, and respond to 2020 Tokyo Olympics-related demand
- ▷ Renewable Energy System Sales: expand the scope of power plant development business; pioneer projects in used solar power plant market
- ▷ Solar and Geothermal Power Plant: increase power generation output (targets over 20MW in output capacity in FY03/19 versus 4.8MW in FY03/16)

Electronic and Communication Device Business

Since Masanori Kobayashi—CEO of Tamagawa Electronics—became a director at Tamagawa Holdings in June 2011, the plan has been to exit unprofitable projects, which resulted in earnings improvement.

In the medium term, Tamagawa aims to grow sales and profits by developing products for the next-generation mobile telecoms system (5G), expanding the overseas business, and responding to 2020 Tokyo Olympics-related demand. The company also plans to strengthen R&D to develop and launch new products to expand sales, while stepping up sales of more profitable Tamagawa-brand products.

Product development for 5G

For 5G (Fifth-Generation Mobile Communications System) services, which NTT Docomo (TSE:9437) aims to launch in 2020, technologies such as the SHF band, submillimeter and millimeter waves, carrier aggregation, massive-MIMO, beam forming, and NOMA are scheduled to be introduced in order to reach transmission speeds of up to 100 times those that are currently available. The company is moving forward with development to meet these technological needs.

* Beamforming refers to a technology to amplify wireless signals by concentrating radio waves into a selected direction

Source: Shared Research based on company data

Expansion of overseas businesses

In March 2015, Tamagawa established a second-tier subsidiary in Vietnam, Tamagawa Electronics Vietnam Co., Ltd. The subsidiary began operation in October 2015. Following its launch, the company began production of high-quality, high-frequency passive components for use in telecoms and broadcasting, as well as mobile base stations, geared toward the Japanese market. Reduced costs through increased local procurement are planned to lead to improvements in price competitiveness, yielding an increase in orders. Consequently, the company aims to expand business into Southeast Asia and the Middle East, focusing on capturing orders for overseas mobile infrastructure devices via low-cost proposals.

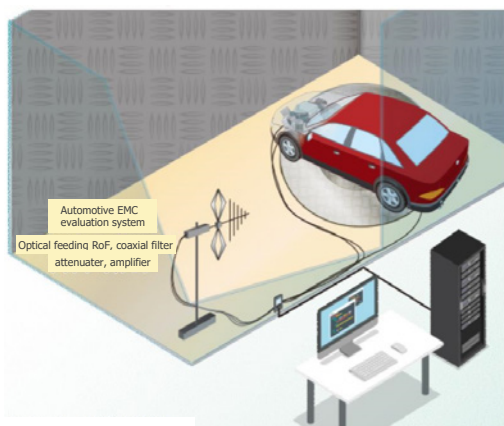
Responding to Olympics-related demand

In other areas, Tamagawa plans in the medium term to win orders via product proposals in the areas of AM/FM rebroadcasting equipment for dead zones and subsystems for next-generation digital terrestrial broadcasting equipment ahead of the Tokyo Olympics. Expansion of business via M&A in related areas is also a possibility.

Development of new and Tamagawa-brand products

- ▶ In terms of optical transmission equipment for trains, Tamagawa in FY03/16 has increased efforts to win contracts for telecoms and broadcasting-related public works projects to minimize the impact of restrained capex spending on the mobile-phone infrastructure market. As a result, the company has won an order. According to Tamagawa, the product is an analog optical transmission equipment that can convert wireless signals (similar to radio waves) directly to optical signals and transmit them. The system is simple and therefore cost effective. Further, compared to coaxial cables, optical fiber is suitable for transmitting wireless signals over long distances because of its high frequency characteristics, in addition to fewer signal losses. The wireless systems for trains that make use of this technology are expected to contribute to sales over the next three years.
- ▶ Since FY03/14, the company has increased investments in R&D for products of its own brand. It started sales of testing equipment for power semiconductors and a high-definition-image monitoring system in FY03/15. The Yano Research Institute's "Global Power Semiconductors Market: Key Research Findings" estimates that the global power semiconductor market will double to USD33.9bn in the ten years from 2015 to 2025.
- ▶ For the medium term, Tamagawa has been developing new products for electric noise resistance testing in the automotive sector as one of its own-brand products. Because previous noise resistance test equipment had all used electric cords, the resulting electromagnetic induction and attenuation made it difficult to measure very small signals. To solve this problem, the company applied to the noise resistance test equipment its technology for converting radio wave signals into optical signals through the use of fiber-optic cables, and was able to enhance the sensitivity of the test equipment and expand the range of signals that could be measured. This new noise resistance test equipment received an honorable mention in the 33rd Kanagawa High-Tech Grand-Prix in October 2016. Its project to develop a wireless optical transmission system for next-generation electro magnetic compatibility (EMC) testing was selected as a research project for accelerated commercialization among public entries in April–May 2017 by the Kanagawa Institute of Industrial Science and Technology.

Electromagnetic noise testing



Radio over fiber (RoF) unit



Source: Shared Research based on company data

Renewable Energy System Sales Business

In the medium term, Tamagawa will aim for earnings growth by expanding the scope of its power plant development and pioneer projects in used solar power plant market.

Selling solar power plant equipment

In FY03/15, Tamagawa acquired land for solar power plants and obtained rights to the Feed-in Tariff (FIT) scheme, and after the construction of solar power plants, also began sales of solar power plant equipment to external clients. In FY03/15, the company

reported sales of JPY1.1bn from selling 2.2MW equipment, and in FY03/16, sales of JPY5.0bn from selling 10.2MW equipment. In FY03/17, the company booked sales of JPY1.4bn for selling 2.3MW equipment.

When tax incentives for promoting investments in facilities to improve productivity, under which a solar power producer can immediately have related facilities fully depreciated, expired at the end of March 2016, the percentage of depreciation fell to 50% from April onward. There has been no depreciation incentive since April 2017.

While Tamagawa still believes that it will be able to promote the selling of solar power plant equipment as a lucrative business in FY03/18 and beyond, the company is anticipating a sales decline. Being proactive, however, it plans to offset the sales decline by adding the sale of small-scale wind power generation equipment (see below for details) to its portfolio and target development contracting fees from FY03/18 onward. Entering the market for secondhand solar power generation plants is also included in the medium-term plan. Specifically, the company is considering revenue generation through direct or indirect investment in facilities owned by struggling solar power generation companies or by functioning as a broker for such facilities. According to Teikoku Databank, Ltd., 50 solar power-related companies went bankrupt in 1H 2017, up 2.2x YoY.

Solar power-related companies include those whose main business is sales/installation of solar power generation systems, and consulting and other related services, and those that have a mainstay business as well as solar power-related operations.

Selling small-scale wind power generation equipment

Small-scale wind power generation refers to wind power generation equipment producing less than 20kW of electricity. As of May 2017, the purchase period for a wind power generation equipment of less than 20kW is 20 years, at the price of JPY55/kWh. Provided that wind speeds are sufficient, wind power generation can generate electricity during the night, differentiating it from solar power generation.

In order to demonstrate the reliability and functionality of this product, the company plans to construct and operate Small-scale Wind Power Generator Facility No. 1 (power output: 19.5kW) on grounds available at its Tateyama mega solar power plant (power output: approx. 2,000kW).

Tamagawa received approval to build small-scale wind power generation facilities in 21 locations in FY03/17. The company plans to begin sales of wind power generation systems in earnest in FY03/18.

Small-scale wind power generation equipment (Tateyama plant)



Source: Company data

The unit price of Tamagawa's small-scale wind power generation equipment is about JPY30mn.

Development contracting fees in mega solar power plant development

For large-scale solar power generation projects with capacity of about 10MW or more, the company has a policy of securing funding through joint development. During joint development of mega solar power generation facilities, in addition to generating revenue from selling power, the company also derives sales in the form of development contracting fees, which include fees received on disposal of land ownership rights and for the preparation of requisite legal documentation. The company received such fees from the Misawa plant (power output of 9.5MW), scheduled to begin operation in FY03/17.

As of May 2017, the company is engaged in due diligence for potential large-scale solar power generation projects like the Misawa plant, equivalent to 50MW of output. By being involved in development of latent projects over the medium term, Tamagawa aims to acquire development contracting fees in the medium term. In June 2016, with the intent of establishing a proprietary project financing system for the development of renewable energy power generation plants, the company newly established a dedicated project financing office.

Solar and Geothermal Power Plant Businesses

Tamagawa seeks earnings growth in the medium term by increasing the combined power output of solar, geothermal, and small-scale wind power generation (plans call for combined output to grow from 4.8MW in FY03/16 to 20.0MW in FY03/19). The company is also considering plans to move into small hydro, biomass, and hydrogen power generation businesses.

Power output under the medium-term plan

	FY03/16	FY03/19
Solar power plants	4.8MW	16.2MW
Geothermal power plants	-	850kW (equivalent to 6.8MW of solar power)
Small-scale wind power plants	-	351kW (equivalent to 2.8MW of solar power)

Source: Shared Research based on company data

Generating capacity of solar power plants

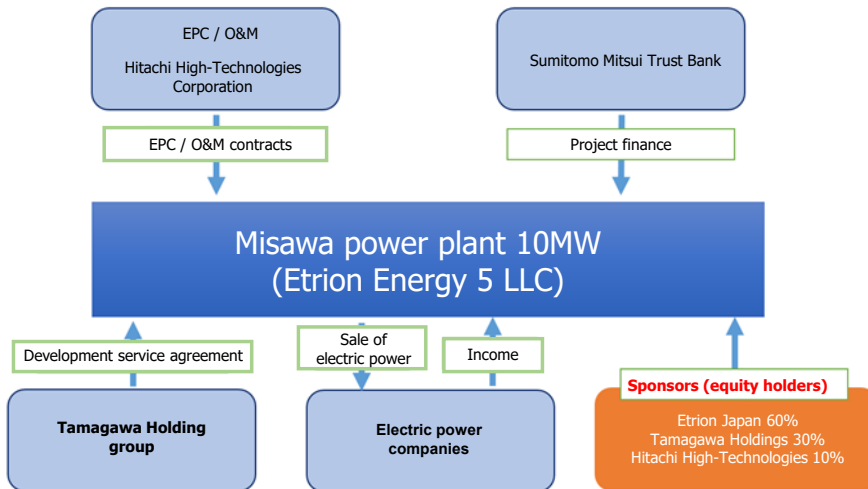
In addition to the total output of 8.7MW from solar power facilities already in operation, the company is expecting an additional capacity of 9.7MW (see “Solar power plant generation in the Business section”) from facilities in the planning stage as of May 2017. The company has also secured land and rights to develop solar power plants that can generate up to 18.4MW, exceeding the company’s medium-term goal of 16.2MW.

The company utilized its own funds to develop the solar power generation plant at Shimonoseki—its first venture—but from the Tateyama plant onward, Tamagawa has made use of leases and joint development initiatives to secure funding for facilities development. Solar power plant construction under a leasing arrangement improves the internal rate of return (IRR); compared with an IRR of 7.5% for the Shimonoseki plant, the Tateyama plant achieved an IRR of 16.5%.

For large-scale solar power generation plants with generating capacity of about 10.0MW or more, the company as a policy acquires funding via joint development. In June 2015, Tamagawa established an SPC (Etrion Energy 5 LLC) via joint investment with Etrion Japan for development of the Misawa plant (Aomori Prefecture), with Tamagawa holding a 30% stake. The Misawa plant began operation in Q4 FY03/17 with power generating capacity of about 10MW (Tamagawa is entitled to 3.0MW), and it is expected to generate approximately JPY390mn per year in revenue (Tamagawa’s share is JPY130mn). Earnings from the plant, booked as investment income from an equity-method subsidiary, began making contributions from Q4 FY03/17 onward.

According to the company, as of May 2017 due diligence was underway to build eight more large-scale solar power plants with combined generating capacity of 50MW.

Outline of Etrion Energy 5 LLC



Source: Shared Research based on company data
 *EPC refers to businesses comprehensively undertaking construction projects across the fields of engineering, procurement, and construction
 *O&M refers to businesses that undertake operation and maintenance of facilities after construction is complete

Geothermal power generation business

In the medium term, Tamagawa will aim for geothermal power generation of 850kW (equivalent to 6.8MW of solar power) in FY03/19. As of May 2017, the company was engaged in due diligence for two geothermal power generation plants with combined power generating capacity of 800kW (equivalent to 6.4MW of solar power). It announced in June 2017 that it would begin drilling work to release steam required for a geothermal binary power plant at a potential site in Ibusuki, Kagoshima Prefecture.

Geothermal power generation

Geothermal power generation involves using steam and hot water produced under the earth’s surface to drive steam turbines connected to electricity generators. This type of generation produces less carbon dioxide than thermal power stations. Another advantage is that geothermal generation is not affected by the depletion or rising prices of fuel, and it can be used in perpetuity. Geothermal generation also provides stable power; it is not affected by the weather, seasons, or day/night fluctuations like other major renewable energy sources such as solar and wind power.

According to the company, the Japanese government mulled over next-generation energy sources during the oil shocks in the 1970s and determined nuclear power as a core source of electricity in Japan. However, due to the New Energy and Industrial Technology Development Organization (NEDO)’s accumulation of data on geothermal power generation, it is now considered a source of energy with high potential in Japan.

The two main methods of geothermal power generation are steam and binary generation.

Steam generation: With this method, turbines are driven directly by natural steam at temperatures of 200–300C or more. Subterranean water at high temperatures and pressures is dominated by either steam or hot water. With the former, moisture can be easily removed and the dry steam routed to turbines to generate electricity. If the source is dominated by hot water, the fluid is first run through a flasher, which separates the steam from the hot water. In a double-flash cycle, turbines are driven by both high- and low-pressure steam.

Binary generation: This method is used when hot water and steam temperatures are 150C or less, and thus cannot drive turbines directly. Heat is exchanged from the geothermal fluid to a medium that has a lower boiling point than water (such as a water/ammonia mixture), and steam from that medium drives turbines to generate electricity.

Feed-in tariff system for geothermal power generation

Under the FY2016 feed-in tariff system, the price for electricity produced by solar power plants is JPY24/kWh and the purchase period is 20 years (for 10kW or more; excluding tax). In contrast, the price for electricity produced by geothermal power plants is JPY40/kWh and the purchase period is 15 years (for less than 15,000kW; excluding tax).

According to the company, a wholly owned 1MW solar power plant requiring an investment of JPY301mn (assuming the site is rented) would generate annual electricity sales of JPY29mn (on assumption of an average daily quantity of solar radiation of 3.7kWh/sqm), annual operating profit of JPY3mn, and an average yield of 6.3%, for a payout period of 15.7 years. In contrast, a 125kW geothermal plant (which generates electricity roughly equivalent to a 1MW solar power plant) needs capital spending worth JPY205mn (the site on rent) and generates annual sales of JPY41mn, annual operating profit of JPY18mn, and an average yield of 15.5% for an expected payout period of 6.4 years.

Sale of Beppu geothermal power plants

In January 2015, the company announced that it planned to build a total of seven geothermal power plants, and to this end acquired a total of seven separate plots of land. The company moved forward on construction at two of the seven sites but changed its plan in December 2015. The company sold the two plants currently under construction to a third-party and sold back the sites acquired for the five other geothermal power plants to their original owners.

Against risks of drilling springs, the company is apparently considering using its own drilling methods, which will have no direct effect on the company's business results but will enable the company to secure preferential rights to springs.

Other business

Hydrogen power

In January 2016, Tamagawa announced that it would establish an internal division to prepare for future developments in hydrogen power. Plans call for research and exploration of methods to store power generated via hydrogen.

In the renewable energy field, limitations imposed by the impact of weather conditions on systems such as solar power and wind power generation are an ongoing concern. Hydrogen power storage systems produce hydrogen from excess power generated by solar and wind power generation systems, and store this hydrogen for future use. The stored hydrogen is then combined with fuel cells, to release power as needed. Conventional batteries lose charge over time, but hydrogen—stored in tanks—can be stored for much greater lengths of time, allowing for efficient energy storage. This stored energy can then be provided to various areas on an as-needed basis.

Business

Business description

Tamagawa has four business segments: 1) Electronic and Communication Device business, which it has been involved in since the founding of consolidated subsidiary Tamagawa Electronics Co., Ltd. in 1968; 2) the Renewable Energy System Sales business, engaging in sales of equipment for solar and other power plants, and purchase and sales of solar power generation systems; 3) Solar Power Plant business; and 4) Geothermal Power Generation business.

Earnings by segment

Earnings by segment (JPYmn)	FY03/09	FY03/10	FY03/11	FY03/12	FY03/13	FY03/14	FY03/15	FY03/16	FY03/17
	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.
Sales	4,299	2,803	2,640	3,106	3,672	4,171	5,095	7,260	4,443
YoY	7.1%	-34.8%	-5.8%	17.7%	18.2%	13.6%	22.1%	42.5%	-38.8%
Electronic and Communication Device	3,248	2,709	2,390	2,406	3,156	3,230	3,401	2,091	2,605
YoY	-14.2%	-16.6%	-11.8%	0.7%	31.2%	2.3%	5.3%	-38.5%	24.6%
% of total	75.6%	96.6%	90.5%	77.5%	85.9%	77.4%	66.7%	28.8%	58.6%
Renewable Energy System Sales	-	-	-	19	441	890	1,606	4,938	1,610
YoY	-	-	-	-	-	101.8%	80.4%	207.5%	-67.4%
% of total	-	-	-	0.6%	12.0%	21.3%	31.5%	68.0%	36.2%
Solar Power Plant	-	-	-	-	-	52	88	230	228
YoY	-	-	-	-	-	-	70.7%	161.8%	-1.1%
% of total	-	-	-	-	-	1.2%	1.7%	3.2%	5.1%
Geothermal Power Plant	-	-	-	-	-	-	-	-	-
YoY	-	-	-	-	-	-	-	-	-
Operating profit	-68	-227	-286	-30	373	477	531	280	189
YoY	-	-	-	-	-	27.8%	11.3%	-47.4%	-32.3%
Electronic and Communication Device	-162	-292	-236	63	375	480	467	-12	246
YoY	-	-	-	-	497.4%	28.1%	-2.7%	-	-
% of total	-	-	-	-	99.8%	93.8%	77.7%	-	57.3%
Renewable Energy System Sales	-	-	-	-24	54	51	112	287	111
YoY	-	-	-	-	-	-5.5%	118.6%	155.9%	-61.3%
% of total	-	-	-	-	14.4%	10.0%	18.6%	92.3%	25.8%
Solar Power Plant	-	-	-	-	-12	-20	22	57	73
YoY	-	-	-	-	-	-	-	155.2%	28.7%
% of total	-	-	-	-	-	-	3.7%	18.2%	17.0%
Geothermal Power Plant	-	-	-	-	-	-	-0	-21	-1
YoY	-	-	-	-	-	-	-	-	-

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

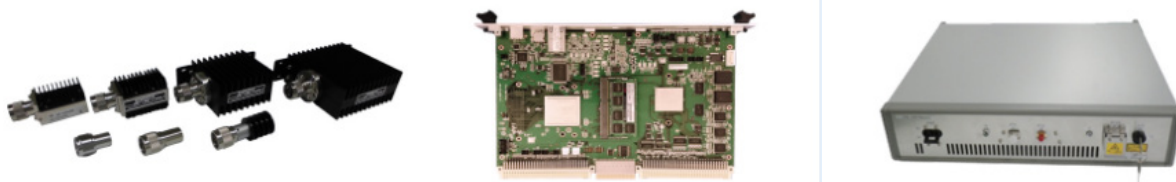
Note: In FY03/14, the company changed segments to include Solar System Sales and Solar Power Plant Business. Then in FY03/16, the Solar System Sales segment was changed to the Renewable Energy System Sales Business.

Electronic and Communication Device Business

(58.6% of FY03/17 sales; 57.3% of FY03/17 operating profit before adjustments)

Since the founding of consolidated subsidiary Tamagawa Electronics in 1968, Tamagawa has used its high-frequency wireless technology to develop, manufacture and sell high-frequency devices (amplifiers, attenuators, filters, distributors and frequency synthesizers). These products act as components in the wireless equipment used in mobile telecoms base stations, as well as in broadcasting, infrastructure, and firefighting systems. High-frequency devices (circuits and measuring instruments) support an antenna's radio wave transmissions by screening radio waves and adjusting signal intensity.

Tamagawa Electronics products: Components for LTE-Advanced mobile telecom base stations (left); Universal FPGA board with high-frequency frontend circuit (middle); and RoF system for optical power feeding (right)



Source: Company data

According to Tamagawa, high-frequency wireless is useful for data and video transmission as it uses wide-band radio waves, enabling fast transmission. In recent years, the usage of digital technology in telecoms and broadcasting equipment has been

rising. However, digital technology is still not suitable for use in parts intended to directly trade high-frequency signals with front-end parts, being unable to process these signals. As a result, these parts often make use of high-frequency analog technology, which Tamagawa holds as its specialization. While many vendors, including Tamagawa, are able to provide digital technology, few companies specialize in making high-frequency analog technology products. Tamagawa thus occupies a niche with high market share.

In FY03/17, approximately 21% of Electronic and Communication Device sales came from devices for mobile telecoms base stations, about 25% from government and public sector-related sales, and 54% from devices for public sector/infrastructure. Tamagawa's main devices for mobile telecom base stations are high-frequency filters, distributors, synthesizers and attenuators, which identify radio waves of certain frequencies from among the diverse range of radio waves both transmitted and received by the antenna and amplify those specific radio waves. Other products (including public sector -related products) include wireless optical transmission systems for airports and subways and power semiconductor test systems.

Electronic and Communication Device sales by industry

	FY03/13	FY03/14	FY03/15	FY03/16	FY03/17
(JPYmn)	Act.	Act.	Act.	Act.	Act.
Total	3,155	3,233	3,400	2,091	2,605
YoY	-	2.5%	5.2%	-38.5%	24.6%
Mobile telecoms	1,924	1,422	1,404	486	549
YoY	-	-26.1%	-1.3%	-65.4%	13.0%
% of total	-	44.0%	41.3%	23.2%	21.1%
Defense	504	905	1,026	688	643
YoY	-	79.6%	13.4%	-32.9%	-6.5%
% of total	-	28.0%	30.2%	32.9%	24.7%
Others (public sector, etc.)	727	906	969	917	1,413
YoY	-	24.6%	7.0%	-5.4%	54.1%
% of total	-	28.0%	28.5%	43.9%	54.2%

Source: Shared Research based on company data

Renewable Energy System Sales Business

(36.2% of FY03/17 sales; 25.8% of FY03/17 operating profit before adjustments)

In this segment, consolidated subsidiary Tamagawa Energy sells solar power modules and solar power equipment. During FY03/16, the main contributor to this segment was sales of solar power equipment. In FY03/17, revenue from development contracting fees as well as sales of solar power equipment was booked in this segment.

Selling solar modules

In July 2011 Tamagawa entered an exclusive agreement to sell the solar modules of GPPV Solar Pte Ltd (GPPV below), and began selling GPPV solar systems (the exclusive selling agreement was changed to a selling agreement in February 2014 for further advancement of both companies' businesses).

Through sales agencies the company provides customers with photovoltaic (PV) modules and power conditioners. Where necessary the company also negotiates with electric utilities on behalf of customers and assists with loan applications to financial institutions.

In Japan contracts under the Feed-in Tariff (FIT, for details see later in report) scheme of the Ministry of Economy, Trade and Industry (METI) oblige electric utilities to buy electricity generated using 10-kilowatt or more solar power plants at a fixed price for 20 years. Prices and durations are revised every year. In 2014 (April 2013 – March 2014) the price of solar electricity was JPY36/kWh (excluding tax) for 20 years. Prices for 2015 (April 2014 – March 2015) have been lowered to JPY32/kWh (excluding tax). Prices for 2016 are JPY29/kWh (excluding tax) when contracts with utilities are done by June 2015 and JPY27/kWh (excluding tax) for contracts struck in July and later. The figure was later further reduced to JPY24 (excluding tax) for contracts made during FY2016 (April 2016 to March 2017). Generation facilities must obtain FIT certifications from METI. If a solar power producer applies for Green Investment Tax Incentives, related facilities can be fully depreciated immediately. The government also has similar regulations in place for wind, hydroelectric, geothermal, and biomass generation.

Selling solar power plant equipment

The company began selling solar power plant equipment from FY03/15. Under this business, the company obtains certain rights to sites for solar power plants and the FIT scheme from land and rights owners, then makes sales to outside customers. By selling 2.3MW equipment, it reported sales of JPY1.1bn in FY03/15. In FY03/16, sales were JPY5.0bn, the result of sales of 10.2MW in equipment. In FY03/17, the company reported sales of around JPY1.4bn for sales of 2.3MW of equipment.

The company sells equipment for solar systems for about JPY400,000 per kW of installed capacity. Sales are determined by multiplying installed generating capacity (kW) by the price per kWh of installed capacity. The solar system's gross profit margin is about 15%.

Development contracting fees in solar power plant development

For large-scale solar power generation projects with capacity of about 10.0MW or more, the company has a policy of securing funding through joint development. During joint development of mega solar power generation facilities, the company generates revenue not only from selling power, but by transferring ownership of the land to be used for the plant. Sales also come in the form of development contracting fees, which include fees received on disposal of land ownership rights and for the preparation of requisite legal documentation.

In FY03/17, Tamagawa received development contract fees of JPY150mn (booked as segment sales) from the Misawa plant (power output of 9.5MW), which was built in partnership with Etrion Japan K.K. and Hitachi High-Technologies Corporation.

Solar Power Plant Business

(5.1% of FY03/17 sales; 17.0% of FY03/17 operating profit before adjustments)

The company has recorded electricity sales revenue by owning and operating mega solar (power generation solar parks) from FY03/14.

What is mega solar?

Mega solar refers to solar power stations of 1MW-plus. Since the start of the FIT scheme for renewable energy in July 2012 it has been easier to secure profits, and a number of players from different sectors have joined the fray. There is also a trend for local governments and private-sector businesses to join forces and build mega solar businesses on vacant land.

While output varies with the location and amount of sunlight, a 1MW mega solar plant generates roughly 1,200MWh per year (assuming 14% utilization rate; depends on the amount of sunlight and the module's angle of inclination). A typical four-person household uses 4,430kWh per year; a 1MW mega solar plant can supply about 270 households. Mega solar plants need land: a 1MW plant covers about 15,000sqm (Tokyo Dome: 47,000sqm).

To take advantage of the FIT scheme first the operator needs METI approval to certify that the generation facilities comply with the law. The purchase price for power generated in the scheme depends on when the facilities were certified rather than when operations started. From April 2017 after the revised FIT Law took effect, the approval system has changed so that the business plan must be approved as well as the facility, and connection contracts with utilities became a prerequisite for certification.

Other than gaining licenses for the generating facilities and equipment, operators face no special requirements to qualify to sell all the renewable power they generate under FIT. While it is necessary to appoint a chief electrical engineer, company operators do not need to have electricity business experience.

Tamagawa's solar power plant operating business

In June 2012 Tamagawa set up a planning office and in September that year set up subsidiary GP Energy. Its first project—Shimonoseki power plant in Shimonoseki, Yamaguchi Prefecture—began operations in June 2013.

Tamagawa operates mega solar power plants in this subsegment, forming special-purpose companies (SPC). The SPC buys or leases land on which it builds and runs solar power plants of 1MW-plus capacity. The SPC scheme enables separate project financing, i.e., finance based on expected revenues for a particular project.

The company said upfront investment in mega solar plants—covering PV modules, supporting structures, electrical facilities and labor—runs to JPY260–320mn per MW.

Electricity is sold to electric utilities. Revenue is selling price per kWh multiplied by total amount of electricity sold. FIT defines electric utilities' purchase prices as JPY40.0 (excluding tax) per kWh for electricity generated at facilities that were FIT-certified in 2012, JPY36.0 (excluding tax) for those certified in 2013, and JPY32.0 (excluding tax) for those certified in 2014. In 2015, the purchase prices were JPY29 (excluding tax) per kWh for contracts between FIT-certified facilities and power utilities struck by June 2015 and JPY27 (excluding tax) per kWh for contracts done in July and later. The figure was later reduced again to JPY24 (excluding tax) for FY 2016 (April 2016 to March 2017), and to JPY21 (excluding tax) for FY 2017 (April 2017 to March 2018). Purchase duration is fixed at 20 years. The company's solar power generation plants were certified in FY 2014 or before, and its average sale price of electricity appears to be at least JPY36.0 (excluding tax) per kWh.

Shared Research understands that a 1MW mega solar plant generates roughly between 1.0 to 1.4GWh of electricity per year. Assuming the facility was FIT-certified in 2012, electric utilities will buy electricity for JPY40 (excluding tax) per kWh, which implies a revenue of JPY40mn per year. Weather and other factors impact the amount of power generated. Panel aging cuts output by 0.25-0.75% per year.

The main costs are depreciation, land rent, maintenance fees and insurance. Gross profit margins hover around 50% and the unlevered internal rate of return could be 9%.

Tamagawa's solar power plants

In addition to the total output of 8.7MW from solar power facilities already in operation, the company is expecting an additional capacity of 9.7MW (see "Solar power plant generation in the Business section") from facilities in the planning stage as of May 2017. The company has also secured land and rights to develop solar power plants that can generate up to 18.4MW, exceeding the company's goal of 16.2MW set forth for FY03/19 under the medium-term plan. The company commented that it has recorded profits on all facilities that have started electricity sales and does not have a single loss-making power plant.

In the development of solar power generation facilities, the company utilized its own funds in the development of the solar power generation plant at Shimonoseki—its first venture—but from the Tateyama plant onward, Tamagawa has made use of leases and joint development initiatives to secure funding for facilities development. If a solar power plant is constructed under a leasing arrangement, the internal rate of return (IRR) is improved; compared with an IRR of 7.5% for the Shimonoseki plant, the Tateyama plant achieved an IRR of 16.5%.

Shimonoseki Solar Power Plant



Source: Shared Research based on company data

Tamagawa Holdings solar power plants

Solar parks	Location	Feed-in-tariff (JPY/kWh)	Output (MW)	Operation start	Sales (JPYmn; Shared Research estimates)
Shimonoseki	Shimonoseki, Yamaguchi	40.0	1.6MW	Q1 FY03/13	76
Tateyama mega solar	Tateyama, Chiba	40.0	1.9MW	Q4 FY03/15	95
Sodegaura mega solar	Sodegaura, Chiba	36.0	1.3MW	Q4 FY03/15	60
Noboribetsu	Noboribetsu, Hokkaido	40.0	1.9MW	Q3 FY03/18	94
Kasumigaura mega solar	Kasumigaura, Ibaraki	36.0	2.4MW	Q1 FY03/18	105
Misawa	Misawa, Aomori	36.0	1.5MW	Q4 FY03/17	65
Misawa	Misawa, Aomori	36.0	1.5MW	Q2 FY03/18	65
Goto	Goto, Nagasaki	36.0	5.3MW	Q1 FY03/19	250
Minamishimabara	Minamishimabara, Nagasaki	40.0	1.0MW	Q2 FY03/19	40
Total	-	-	18.4MW	-	850

Source: Shared Research based on company data
Shared Research estimate for sales, based on annual electricity sales of 1,200MWh per 1MW solar power facility.

Joint development with Etrion Japan

For large-scale solar power generation plants with generating capacity of about 10.0MW or more, the company as a policy acquires funding via joint development. In June 2015, Tamagawa established an SPC via joint investment with Etrion Japan for development of the Misawa plant (Aomori Prefecture), with Tamagawa holding a 30% stake.

The Misawa plant has power generating capacity of about 9.5MW (Tamagawa entitled to 3.0MW), which translates to approximately JPY390mn per year in revenue. The company plans to begin operation of the plant in two stages (Q4 FY03/17 and Q3 FY03/18). In March 2017, electricity sales began on approximately 5MW capacity. Earnings from the plant, to be booked as equity-method investment income, began making contributions from Q4 FY03/17.

The Misawa plant is developed and operated by Etrion 5 LLC, owned 30% by Tamagawa, 60% by Etrion, and 10% by Hitachi High-Technologies Corporation. The EPC is operated by Hitachi High-Technologies, and capital expenditure of JPY3.4bn is covered by investments from the LLC and project financing from Sumitomo Mitsui Trust Bank Ltd.

According to the company, the alliance with Etrion Japan enables Tamagawa to expand business development options including fundraising and also advance its mega solar business. As of May 2017, the company was engaged in due diligence on latent solar power generation projects—much like the Misawa plant—equivalent to about 50MW of output. By being involved in development of latent projects over the medium term, Tamagawa aims to gain development contracting fees. In June 2016, with the intent of establishing a proprietary project financing system for the development of renewable energy power generation plants, the company newly established a project financing office.

Etrion Japan KK is part of the Etrion Group under parent company Etrion Corporation, which constructs, owns, and operates full-scale solar power plants. It is an independent power producer (IPP) with solar power plants totaling 139MW in output in Italy and Chile, and is listed on the Toronto and Stockholm stock exchanges. Etrion is also a part of the Lundin Group, an acclaimed resource group in the oil, gas, mining, and energy sectors. The Lundin Group is composed of 11 group companies and has operations in 25 countries worldwide. The top shareholder in Etrion is the Lundin Group, owning about 24%. Etrion has become the most significant renewable energy company within the group.

Misawa power plant details

Solar parks	Location	Feed-in-tariff (JPY /kWh)	Output (MW)	Area (sqm)	Operation start	Investment (JPYbn)	Sales (JPYmn; Shared Research estimates)
Misawa	Misawa, Aomori	36.0	9.5	163,000	FY03/17	3.4	390

Source: Shared Research based on company data

Strengths and weaknesses

Strengths

- ▶ **Benefiting from stable demand the electronics business has regained competitiveness:** The company said it has regained its competitive edge in high-frequency devices. Selling higher value-added products via original equipment manufacturer (OEM) channels, measures to cope with new product development, and government and public sector-related demand have borne fruit. In public demand a preference for Japanese suppliers lends Tamagawa an advantage over overseas rivals. Restarting R&D and selling under its own brand should enhance earnings.
- ▶ **Finished and pending projects in solar power:** Building up its solar power generation business from scratch, Tamagawa has acquired experience in everything from solar panel installation to project financing. As of May 2017, the company was engaged in due diligence on latent projects with a combined capacity of roughly 50MW that can be either developed into a mega solar or to which solar power generation equipment can be sold. Tamagawa has also conducted due diligence on potential geothermal power plants with combined capacity of 800W (which would generate about the same amount of electricity as a 6.4MW solar power plant). With the completion of these projects the company expects to see further growth in revenues and earnings.
- ▶ **Entrepreneurial management wants to rekindle investor trust:** Shared Research flags a resolve to get it right this time. It has entrepreneurial energy although is aware of investor skepticism. Liaising with investors and partners, Tamagawa wants to rebuild its image. According to the company, investors appreciate its full disclosure.

Weaknesses

- ▶ **Reputation:** Tamagawa has a history of business failures. CEO Toru Masuzawa is the subject of controversy. Masuzawa has been a defendant in a number of civil lawsuits relating to his time at J Bridge, but asserts that he was a victim of circumstance, and will rebuild his reputation and prove his management acumen. In addition to developing procedures to deal with reputational risk, in February 2014, the company established a compliance committee, and contracts with an outside legal firm for advisory services.
- ▶ **Shortage of manpower in Renewable energy-related business:** The renewable energy-related business only had 10 staff as of May 2017. The complexity of projects requires personnel with high entrepreneurship, strong motivation and expansive knowledge from fundraising to electrical engineering. However, efforts to hire appropriate personnel quickly may block sound corporate growth. Considering the downtrend in the feed-in-tariffs of renewable energy and limited business opportunities, this lack of human resources is concerning.
- ▶ **Potential rate cuts for fixed-rate feed-in tariffs:** The fixed FIT rate has been lowered each consecutive year, and it is likely that demand for solar power generation construction will decline in the medium term and that the expected profitability of new solar parks will decrease. According to the company, it will combat these issues by improving power conversion efficiency of its solar cells and other components in an effort to continue providing benefits to consumers. Tamagawa is also developing businesses using renewable energy sources other than solar power.

Group companies

As of end-March 2017, the group comprised Tamagawa Holdings Co., Ltd. and 14 consolidated subsidiaries.

- ▷ Tamagawa Electronics Co., Ltd. (100%): Electronic and Communication Device Business.
- ▷ Tamagawa Electronics Vietnam Co., Ltd. (100%): subsidiary of Tamagawa Electronics, manufacture and sale of components for communication devices.
- ▷ Tamagawa Energy Co., Ltd. (100%): Renewable Energy System Sales Business.
- ▷ GP Energy Co., Ltd., and other GP Energy companies (all 100%): Solar Power Plant Business, Geothermal Power Plant Business.

Market and value chain

Market overview

Wireless telecoms infrastructure

Smartphones and tablets are revolutionizing the wireless telecoms market. Smartphones generate 10-20x as much data traffic as traditional mobile phones. As bandwidth-hungry content mushrooms, data volumes swell. Dealing with the traffic surge is a pressing issue, creating demand for network infrastructure that can handle serious data volumes and speeds. Telecoms operators have rolled out high-speed mobile services like LTE and WiMAX. Spectrum reallocation is helping too. There is also a nationwide trend toward data offloading—using Wi-Fi and the like to funnel data through the fixed-line network.

Mobile data traffic in Japan is accelerating rapidly alongside the proliferation of smartphones. According to projections published in the Cisco Visual Networking Index, this trend is likely to continue, and mobile data traffic within Japan during 2019 is projected to reach 1.5 exabytes per month, an increase of 5.3x versus the 282 petabytes per month seen during 2014. It remains uncertain whether network infrastructure will keep up.

As a solution to the traffic increase, telecoms carriers are pushing and developing LTE-Advanced, as well as a new high-speed, large-capacity service using a new frequency band. Companies are developing technologies in anticipation of the rollout of 5G services. Currently LTE-Advanced (4G) services with features such as carrier aggregation (use of multiple frequencies) and Multiple Input Multiple Output (MIMO; use of multiple antennae for signal transmission) are becoming more common in mobile telecoms. R&D with a view to starting practical use of 5G (the next stage of evolution from LTE-Advanced) in 2020 is under way. 5G will enable a big increase in speeds to over 10Gbps by combining low and high frequency bands and aims to create a future where users can enjoy streaming high resolution (4k/8k) videos in crowded event venues and outdoors in major cities. The goal is a low-cost, low power consumption solution to the steep increase in traffic expected in the IoT age. NTT Docomo is trialing its 5G technology in Odaiba's Aomi district and Tokyo SkyTree from May 2017.

Capex trends at telecoms carriers

Actual investment trends at telecoms carriers are on an upward swing amid efforts to expand capacity and improve service, with focus on new technologies and new frequency bands. For example, in investment for LTE—the latest communications technology—the number of LTE base stations operated by NTT Docomo, Inc. (TSE1: 9437) was about 24,400 as of end-March 2013, but this number grew to 55,300 at end-March 2014, 97,400 at end-March 2015, 138,100 LTE at end-March 2016, and 161,900 at end-March 2017.

Capex by telecoms carriers declined overall in FY03/17. NTT Docomo maintained a similar level as the previous fiscal year, up 0.3% YoY to JPY597.1bn, but mobile telecom capex at KDDI was down 3.8% YoY to JPY325.0bn. However, capex ahead of the rollout of next-generation LTE Advanced technology is projected to increase going forward, because equipment must be updated to support new frequency bands.

Capex by company (JPYbn)	FY03/09 Act.	FY03/10 Act.	FY03/11 Act.	FY03/12 Act.	FY03/13 Act.	FY03/14 Act.	FY03/15 Act.	FY03/16 Act.	FY03/17 Act.	FY03/18 Planned
NTT Docomo	737.6	686.5	668.5	726.8	753.7	703.1	661.8	595.2	597.1	570.0
YoY	-2.8%	-6.9%	-2.6%	8.7%	3.7%	-6.7%	-5.9%	-10.1%	0.3%	-4.5%
LTE	-	-	26.0	92.3	218.9	331.1	406.7	365.4	-	-
YoY	-	-	-	255.0%	137.2%	51.3%	22.8%	-10.2%	-	-
KDDI	575.1	518.0	441.8	421.6	467.0	571.8	667.7	531.4	519.4	530.0
YoY	14.7%	-9.9%	-14.7%	-4.6%	10.8%	22.4%	-	-20.4%	-2.3%	2.0%
Mobile	432.1	376.8	338.7	304.2	338.2	374.0	479.1	338.0	325.0	330.0
YoY	10.3%	-12.8%	-10.1%	-10.2%	11.2%	10.6%	-	-29.5%	-3.8%	1.5%
Others	140.6	138.7	103.1	115.6	128.8	197.8	188.6	193.4	194.3	200.0
YoY	28.3%	-1.4%	-25.7%	12.1%	11.4%	53.6%	-	2.5%	0.5%	2.9%
SoftBank	259.1	222.9	392.6	474.1	631.6	712.5	583.7	412.6	320.6	-
YoY	-11.8%	-14.0%	76.1%	20.8%	33.2%	12.8%	-18.1%	-29.3%	-22.3%	-

Source: Shared Research based on data from respective companies
 Note: Capex at KDDI from FY03/15 onward includes portions consolidated from UQ Communications.
 Note: SoftBank figures only include group telecoms companies within Japan

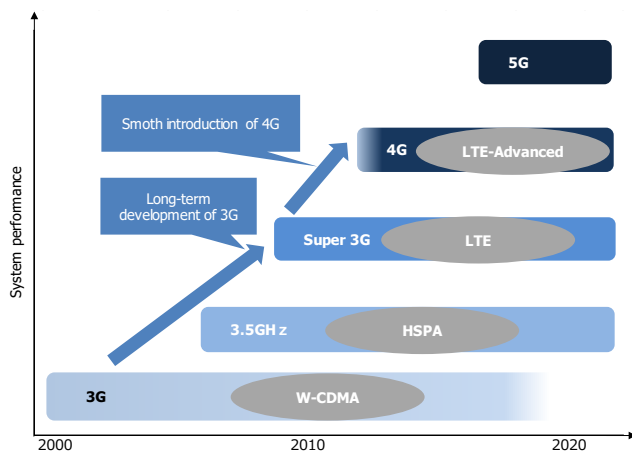
LTE Advanced

NTT Docomo, Inc. (TSE1: 9437) launched a new telecoms service in March 2015 using LTE-Advanced, the next-generation mobile telecoms standard following LTE, paving the way for speedier data transmission. NTT Docomo began with urban areas in 22 prefectures and expanded the service to major cities nationwide during FY2015. KDDI also began providing its LTE-Advanced service during FY2015.

LTE Advanced is a fourth generation mobile telecoms standard recognized by the International Telecommunication Union (ITU)*, offering higher speeds than LTE which has spread globally. Under development, it aims at providing speeds of up to 1Gbps when the user is stationary and up to 100Mbps when moving at high speed.

* In mobile and electronic telecoms the ITU aims to establish standards and regulations between countries. Main activities: standardization, allocation of mobile spectrum, and coordinating connections between countries to enable international telephone calls.

Evolution of Telecommunications Technology



Source: Shared Research based on various data

Faster speeds under LTE Advanced will be attained by adding technical elements to existing LTE technology. Two elements are key: upgrading the multiple-input and multiple-output (MIMO) technology used in spatial multiplexing, and carrier aggregation to enable bandwidth expansion.

It is Shared Research’s understanding that NTT Docomo’s current LTE network is composed mostly of 3G base stations that have been updated with LTE components. In contrast, new frequency allocations are planned for the introduction of LTE Advanced, and this will require changes to base stations, including the antennas.

New frequency allocation for LTE-Advanced

In December 2014, the Ministry of Internal Affairs and Communications announced the allocation of 3.5GHz band for LTE-Advanced (4G) to NTT Docomo, KDDI, and Softbank. Specific frequency bands allocated were 3,480 to 3,520MHz for NTT Docomo, 3,520 to 3,560MHz for KDDI, and 3,560 to 3,600MHz for Softbank.

Renewable Energy System Sales

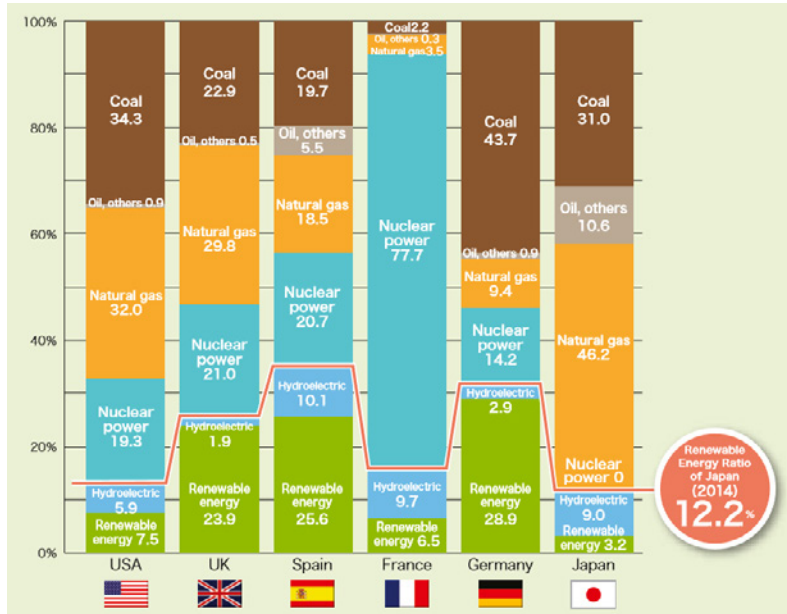
The increase in power output of renewable energy systems is essential to improving energy self-sufficiency and tackling global warming.

Japan’s energy self-sufficiency rate is 6%; renewable energy accounts for only 12% of power generation output

Japan’s energy self-sufficiency rate remains low at 6%, second-lowest in the 34 OECD countries as of 2012. Japan continues to depend on imported fossil fuels for power generation. Dependence on imported fossil fuels for power generation was 76% at the time of the first oil shock (FY1973) and was down to 62% (FY2010) before the Great East Japan Earthquake in March 2011. However, due to the subsequent stoppage of nuclear power stations, dependence on imported fossil fuels surged to 88% in FY2014. Imported fossil fuels carry an implied risk of supply and price instability.

Introducing more renewable energy sources is critical for Japan to raise its energy self-sufficiency rate and reduce its dependence on imported fossil fuels for power generation. Renewable energy accounted for only 12.2% of power generation output in 2014, which is lower than other developed countries.

Renewable energy's share of total power generation output



Source: *Energy in Japan FY2016*, Agency for Natural Resources and Energy

Spread of renewable energy essential to combat global warming

The IPCC's Fifth Assessment Report (AR5) discusses the progress of global warming and how renewable energy is effective in counteracting it. The Paris Agreement requires all parties that ratified the Framework Convention on Climate Change to reduce greenhouse gas emissions to below FY2013 levels by FY2030.

Fifth Assessment Report points out need to increase supply of renewable energy to counteract global warming risk

The Intergovernmental Panel on Climate Change (IPCC) is under the auspices of the United Nations. Its Fifth Assessment Report published in September 2013 forecasts a global average temperature increase of 0.3–4.8°C by the end of the 21st century.

The effects of global warming are apparent in many areas, such as abnormal weather patterns and loss of ecosystems. Even a 1°C rise in global average temperature raises the risk of abnormal weather events such as heatwaves, heavy rain, and flooding. A 2°C increase means a higher risk of severe impact on Arctic ice and coral reefs as well as lower agricultural crop yields. A 3°C rise brings the threat of rising sea levels as a result of melting ice sheets in Greenland and elsewhere. A 4°C rise implies a sharp decline in grain production and fish catch, putting the world's food security at risk.

The report also shows how much less damage would be caused by global warming in the +2°C scenario versus the +4°C scenario. It clearly states that there is a high risk of flooding, heatwaves, and water and food shortages in Asia in the +4°C scenario, but the risk is reduced in the +2°C scenario.

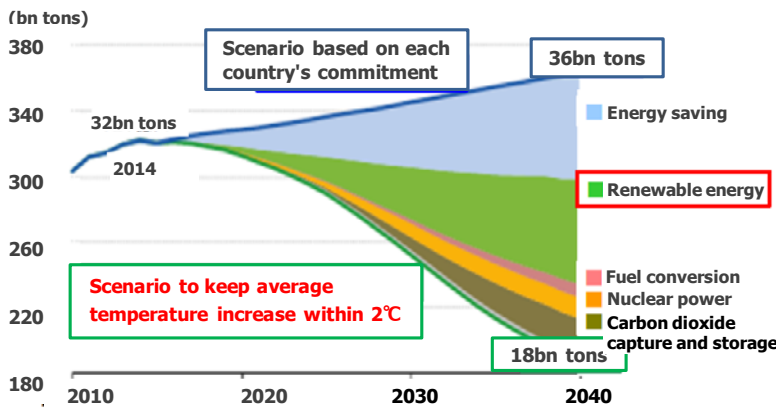
According to the report, greenhouse gas (GHG) concentration must be no greater than 450 parts per million (ppm) in 2100 to keep the global average temperature increase below 2°C compared with before the Industrial Revolution (1861–1880). To this end, global GH emissions must be reduced by 40–70% by 2050 versus 2010. This requires fast improvement of energy efficiency and tripling or quadrupling the supply of low-carbon energy such as renewable energy, nuclear power, and carbon capture and storage (CCS).

Paris Agreement also targets less than 2°C global average temperature increase

The Paris Agreement is a set of internationally agreed rules governing GH gas emissions by each country from 2020 onward. It was agreed and ratified by more than 190 countries attending the 2015 Paris Climate Conference (COP21) in Paris, France, and took effect in November 2016. The US announced that it would withdraw from the Paris Agreement in June 2017.

The main purpose of the Paris Agreement is to keep the rise in global average temperature to less than 2°C compared with before the Industrial Revolution and attempt to keep it below 1.5°C. All countries must prepare voluntary CO2 reduction targets for submission to the United Nations, as well as implement domestic measures to reduce CO2. Japan’s target is to cut GH emissions by 26% from 2013 levels in FY 2030.

Breakdown of CO2 cuts under the +2°C scenario



Source: Shared Research, based on International Energy Agency data

Promote introduction of renewable energy so that it accounts for 22–24% of total power generation output in FY 2030

According to METI’s *Long-term Energy Supply and Demand Outlook* (July 2015), the government plans to maximize the uptake of renewable energy over three years or so from FY 2013 and continue these efforts thereafter to improve energy self-sufficiency and combat global warming. As a result, renewable energy will increase its share of total power generation output to around 22–24% in 2030 versus 14.6% in FY 2015.

Capacity of renewable energy facilities and estimated new capacity in 2030 ('000 kW)

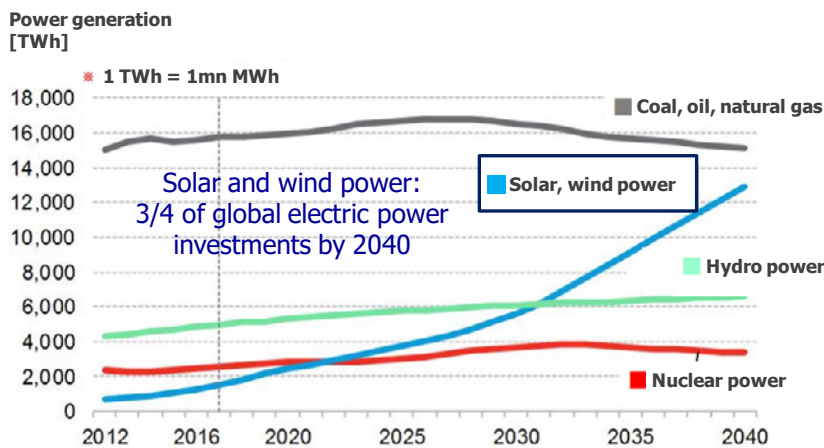
	Solar power	Wind power	Small/medium hydro	Geothermal	Biomass
Before introduction of FIT	5,600	2,560	9,600	500	2,300
December 2016 (A)	37,610	3,240	9,830	510	3,070
FY2030 target (B)	64,000	10,000	10,840~11,550	1,400~1,550	6,020~7,280
B/A (approx.)	1.7x	3.1x	1.1x	2.9x	2.2x

Source: Shared Research based on various materials

Brisk investment in renewable energy

According to *New Energy Outlook 2017* published by Bloomberg New Energy Finance (BNEF), new investment in renewable energy is estimated to reach USD7.4tn by 2040, accounting for 72% of USD10.2tn total investment in new power generation facilities. Of this figure, solar power is forecast to increase capacity by 14x at an investment of USD2.8tn, while wind power will increase capacity by over 4x at an investment of USD3.3tn. Thus the total for solar and wind power, which currently accounts for 12% of world capacity and 5% of total power generation output, is forecast to increase its share sharply to 48% of capacity and 34% of output, respectively.

Projected world electric power mix in 2040



Source: Shared Research, based on Bloomberg New Energy Finance (BNEF) data

Solar power market

A discussion follows of projections for Japan's solar power market, government measures and incentives to increase solar power generation, and the feed-in tariff (FIT) system, which all impact Tamagawa's earnings.

Government policy and incentives to increase solar power generation

Renewable Energy Special Measures Act takes effect and FIT system introduced for renewable energy in July 2012

The Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities (Renewable Energy Special Measures Act) was passed into law in August 2011 and took effect in July 2012. The act introduced the feed-in tariff (FIT) system that provides a government guarantee that power companies will buy electricity generated using five renewable energy sources including solar, wind, and geothermal power generation at a set price for a set period of time. The cost of purchasing electricity is added to electricity prices as a levy.

The spread of solar power in Germany and Spain is attributed to similar FIT systems. Renewable energy is more likely to gain popularity if purchase prices of electricity generated using renewable energy sources are high.

Revised FIT Law takes effect in April 2017

The FIT system was introduced in July 2012. The Agency for Natural Resources and Energy estimates that total output of power generation facilities using renewable energy sources increased around 2.5x from about 21mn kW at end-June 2012 to 53.3mn kW at end-October 2016. The cost of purchasing renewable energy increased from JPY300bn in FY 2012 to JPY2.3tn in FY 2016, of which JPY1.8tn was paid for by levies of around JPY675 per month for an average household. The Agency for Natural Resources and Energy estimates the cost of increasing power generated using renewable energy sources at JPY3.7tn – JPY4.0tn in 2030.

The revised Renewable Energy Special Measures Act (Revised FIT Law) took effect in April 2017 to address the increased financial burden on consumers and the increase in renewable energy facilities that were not in operation. The revised law sets medium- to long-term electricity purchase price (FIT) targets and introduces an auction system (see below). Before the revision, connection contracts with utilities were concluded after facilities were certified by METI, but under the new system, connection contracts with utilities also became a prerequisite for certification so that only facilities with a high probability for operating as a business would be certified by METI.

Surplus power buyback for solar power generation facilities with under 10kW capacity

Surplus power buyback was introduced for solar power generation facilities with less than 10kW capacity, which means a household with solar power generation equipment can sell power surplus to power companies. When this system started in 2009, the purchase price was set high at JPY48 per kW (including consumption tax) to serve as an incentive, and was fixed for a period of ten years beginning solar power equipment installation. For newer installations, the purchase price has been lowered year by year. Purchase prices since FY2016 (March 2017) are shown below.

Under the revised FIT Law, the target purchase price of power generated by household solar power generation equipment was about the same as household electricity prices (JPY24/kWh) and the electricity sales price will be lowered to JPY11/kWh (in line with electricity market prices) as soon as possible after 2020.

Solar power purchase price for power generation facilities with less than 10kW capacity

Purchase category		Purchase price per kWh (JPY)				Purchase period
		FY2016	FY2017	FY2018	FY2019	
Under 10kW	Installation of output regulator is not compulsory	31	28	26	24	10 years
	Installation of output regulator is compulsory	33	30	26	26	
Under 10kW (Combination of solar power and other energy source)	Installation of output regulator is not compulsory	25	25		24	
	Installation of output regulator is compulsory	27	27		26	

Source: Shared Research, based on Agency for Natural Resources and Energy data
Installation of output regulators is compulsory in the supply areas of Hokkaido Electric Power, Tohoku Electric Power, Chugoku Electric Power, Shikoku Electric Power, Kyushu Electric Power, and Okinawa Electric Power.

Buyback of full output of solar power facilities with capacity of 10kW plus

The purchase of full output of solar power generation facilities with capacity of 10kW or more began in July 2012 under the FIT system. Utilities will buy the full output of solar facilities regardless of the generator's own consumption. The purchase price in FY2012 was set at JPY40/kWh (exclusive of tax) fixed for 20 years beginning equipment installation. The purchase price fell to JPY36/kWh in FY2013, JPY32/kWh in FY2014, JPY29/kWh in FY2015 (for connection contracts concluded by June; JPY27/kWh for contracts concluded in or after July), and as shown below for FY2016 onward (all prices exclusive of tax).

Purchase price of solar power generation facilities with output of 10kW or more

Purchase category	Purchase price per kWh (JPY)				Purchase period
	FY2016	FY2017	FY2018	FY2019	
10kW to less than 2,000kW	24	21	-	-	20 years
2,000kW or more	24	Determined by auction			

Source: Shared Research, based on Agency for Natural Resources and Energy data

Purchase prices under the FIT system have fallen, because the three-year buyback period at a higher (incentive) price when the system was first introduced has ended, and solar power generation system prices have dropped. The total cost of installing a solar power generation system with 10kW plus capacity declined 23.9% (by an average of 6.6% per year) from 2012 to 2016 (see below).

Solar power generation system expenses (capacity of 10kW or more)

	2012	2013	2014	2015	2016
System expenses (JPY/kWh)	426,000	377,000	343,000	323,000	324,000
YoY change	-	-11.5%	-9.0%	-5.8%	0.3%

Source: Shared Research, based on Agency for Natural Resources and Energy data

Under the revised FIT Law, which sets target prices for solar power generation, the target cost for non-residential solar power generation is JPY14/kWh (system cost: JPY200,000/kWh) in 2020 and JPY7/kWh (JPY100,000/kWh) in 2030. Companies are working to lower installation and equipment costs of solar power generation systems and improve the conversion efficiency of solar power modules to achieve these targets.

A research group at Kobe University's Graduate School of Engineering has developed technology to raise the conversion efficiency of solar cells to over 50% by using a new solar cell structure that absorbs long-wave spectral components of sunlight

that passes through (and are thus not captured by) conventional solar cells. Raising the conversion efficiency of solar cells to over 50% sharply reduces power generation costs and will make power generation cost of JPY7/kWh possible.

Change from approving the facility to approving the business plan

Before the Revised FIT Law took effect, connection contracts with utilities were concluded after facilities were certified by METI, but under the new system, connection contracts with utilities also became a prerequisite for certification so that only facilities with a high probability for operating as a business would be certified by METI. METI does not only approve the facility, but the business plan for the power generation business as well. Thus, approval depends on whether the applicant planning to run a business using a new solar power facility has a framework in place for appropriate management and operation. The approval process entails an inspection before starting operation, and sets out compliance requirements for facility inspection and management during operation and dismantling of facilities after the business closes down. METI will issue an improvement order or cancel certification of a facility if a business fails to comply with these rules.

These changes are designed to eliminate solar power projects that are certified, but take a long time to begin operation due to delays in concluding connection contracts with utilities, and ensure the appropriate operation and management of solar power generation businesses.

Historical performance

Q1 FY03/18 results

- ▷ Sales: JPY674mn (+41.6% YoY)
- ▷ Operating loss: JPY33mn (operating loss of JPY104mn in Q1 FY03/17)
- ▷ Recurring loss: JPY61mn (recurring loss of JPY129mn)
- ▷ Net loss*: JPY72mn (net loss of JPY90mn)

*Net loss refers to net loss attributable to parent company shareholders.

All segments posted sales and profit growth except Geothermal Power Plant Operations.

Electronics and Telecoms Equipment

- ▷ Orders: JPY321mn (+33.3% YoY)
- ▷ Sales: JPY538mn (+33.9%)
- ▷ Operating profit: JPY2mn (operating loss of JPY22mn in Q1 FY03/17)

The company achieved higher sales owing to growth in orders in the public and government sectors despite a temporary drop in order receipts due to delayed plans for capital investment by telecom carriers on countermeasures against radio wave interference. Sales breakdown by sector was as follows: mobile telecoms-related JPY96mn (-7.1% YoY), public and government sectors JPY151mn (+12.4%), and other (public sector/infrastructure, measuring instruments, etc.) JPY289mn (+77.5%). Sales of the Tamagawa-brand products, which have higher profit margins, totaled JPY142mn (+23.2% YoY) and the sales mix of these products was 26.4% of the total versus 28.6% in Q1 FY03/17. Sales of products for transport infrastructure increased due to repeat orders for its commercial wireless optical transmission system.

Profits were up due to the sales growth effect and improved profit margins. The company focused on cutting costs by streamlining operations. Cost reduction progressed as a result of increasing local procurement to 80% at Vietnamese subsidiary Tamagawa Electronics Vietnam Co., Ltd.

Renewable Energy System Sales

- ▷ Orders: JPY10mn (-91.7% YoY)
- ▷ Sales: JPY27mn (+252.7%)
- ▷ Operating loss: JPY47mn (operating loss of JPY64mn in Q1 FY03/17)

The company booked revenues from operation and maintenance of solar power plants and sales of small-scale wind power generation equipment. Major sales projects will be concentrated in 2H, in line with the initial company plan.

Solar Power Plant Operations

- ▷ Sales: JPY109mn (+62.6% YoY)
- ▷ Operating profit: JPY53mn (+85.3%)

The segment booked electricity sales from mega solar power plants in Shimonoseki, Tateyama, Sodegaura, as well as Kasumigaura, which started electricity sales in April 2017 (total capacity: approximately 2.4MW; power generation volume: 2,900MWh; electricity sales price: JPY36/kWh; and annual revenue from electricity sales: JPY105mn).

Geothermal Power Plant Operations

No sales were booked. Operating loss was JPY1mn due to expenses (vs. no sales or expenses in Q1 FY03/17).

Full-year FY03/17 results

- ▷ Sales: JPY4.4bn (-38.8% YoY)
- ▷ Operating profit: JPY189mn (-32.3%)
- ▷ Recurring profit: JPY107mn (-49.6%)
- ▷ Net profit*: JPY45mn (-73.0%)

*Net loss refers to net loss attributable to parent company shareholders.

Compared with the company's initial forecast, FY03/17 sales were down 33%, operating profit 46.5%, recurring profit 59.0%, and net income 76.8%. This is mainly attributed to lower-than-expected earnings of Renewable Energy System Sales for the following two reasons.

- The original plan for solar power facility in Kasumigaura, Ibaraki Prefecture was for consolidated subsidiary Tamagawa Energy to sell the plant to an outside customer and book earnings accordingly. However, the company later decided to operate the facility as its own, instead of making a profit in the short term from selling the facility outright.
- Competition intensified for projects that can be connected to the grid in FY03/17 because of changes in the tax and project approval systems due to take effect in April 2017. As a result, purchase and sales volumes of Renewable Energy System Sales projects declined. The company was also unable to undertake as much purchasing and sales as originally planned to win purchasing projects, because the deadline for the Notification of Minor Change (which must be submitted to METI to purchase and sell solar power generation facilities before March 2017) was changed to January 20, 2017, affected by the transition to the new approval system as notified by the Agency for Natural Resources and Energy in November 2016.

Earnings by segment were as follows. All segments except Geothermal Power Plant Operations posted segment profit.

Electronics and Telecoms Equipment

- ▷ Orders: JPY2.7bn (+26.9% YoY)
- ▷ Sales: JPY2.6bn (+24.6%)
- ▷ Operating profit: JPY246mn (operating loss of JPY12mn in FY03/16)

Sales broke down by sector into mobile telecoms JPY549mn (+13.0% YoY), government and public sector JPY643mn (-6.5%), and other (public sector/infrastructure and measuring instruments) JPY1.4bn (+54.1%). Segment profit increased due to the sales growth effect and improved profit margins. In addition to efforts to improve business efficiency and trim expenses, sales of relatively profitable Tamagawa-brand products grew 27.6% YoY. In addition, cost reduction progressed as a result of Vietnamese subsidiary Tamagawa Electronics Vietnam Co., Ltd. increasing local content to 80%.

The company achieved higher sales and profits owing to gradual recovery from 2H of capital investment on countermeasures against radio wave interference, growth in orders in the public and government sectors, as well as shrinking costs from streamlining operations, as summarized below.

- ▷ Although demand from mobile telecoms-related industries slumped, the company improved its price competitiveness by increasing local content at Tamagawa Electronics Vietnam, which led to an uptick in orders and sales of 4G base station-related products.
- ▷ Tamagawa is developing equipment and devices for pilot tests of 5G-related products with a view to trademarking them in 2020. The company is developing a sensor for antenna performance testing and equipment to test the reliability of semiconductors for next-generation mobile base stations. It is also developing devices such as front-end analog modules to handle millimeter and sub-millimeter waves (a part connected directly below the antenna to transmit signals), multi-wave duplexers capable of handling signals on multiple wavelengths, and next-generation high-efficiency power amplifiers.

- ▷ Sales declined YoY in the government and public sector business, but Tamagawa is targeting a recovery in sales to over JPY1bn (attained in FY03/15) in the medium term, because new project inquiries have been brisk.
- ▷ In other businesses (public sector/infrastructure and measuring instruments), the company won orders for its commercial wireless optical transmission system for use in airports (Narita Airport) and in next-generation weather forecasting equipment. The order for the subsystem for next-generation weather forecasting equipment was received from Toshiba Corporation. The next-generation weather forecasting equipment is one of the R&D themes (heavy rain and tornado forecasting technology) in the “Enhancement of Societal Resiliency against Natural Disasters” category of the Strategic Innovation Promotion Program (SIP), a national project. In the longer term, the company aims to develop a next-generation weather forecasting radar system that forecasts sudden weather events like guerilla rainstorms and tornados quickly and accurately, and promptly notifies major cities and local governments.
- ▷ In the automotive business, the company developed a new electromagnetic noise tester using fiber-optics technology to convert radio waves to light signals, thereby improving sensitivity and measuring a wider bandwidth. The new system was delivered to a major automaker and the company has received inquiries from a Tier 1 automotive supplier.
- ▷ Tamagawa recorded a sharp increase in sales and orders for its power semiconductor testing equipment, with sales up 1.6x YoY to JPY495mn.

Renewable Energy System Sales

- ▷ Orders: JPY1.6bn (-67.1% YoY)
- ▷ Sales: JPY1.6bn (-67.4%)
- ▷ Operating profit: JPY111mn (-61.3%)

Lower sales and profit were prompted by a YoY decline in sales of solar power generation facilities. The company made a change of plan, and decided to operate a solar power plant within the group rather than selling it to another operator. Further, sales activities for winning purchasing projects were less successful than expected.

The company was unable to undertake as much purchasing and sales as originally planned to win purchasing projects eligible for tax incentives, because the deadline for the Notification of Minor Change (which must be submitted to METI to purchase and sell solar power generation facilities before March 2017) was changed to January 20, 2017, affected by the transition to the new approval system as notified by the Agency for Natural Resources and Energy in November 2016. As for the solar power plant in Kasumigaura, Ibaraki Prefecture, scheduled for connection in late March 2017, the company had initially planned to sell the plant to an outside customer for a profit through consolidated subsidiary Tamagawa Energy. However, the company later decided to operate the plant within the group instead of selling it for short-term profit, thinking that owning and operating the plant would generate steady cash flow for 20 years and help strengthen the earnings structure and finances of the company for the medium to long term.

The company also received development contract fees in connection with the development of Misawa plant (power generating capacity of roughly 10MW), which contributed to sales and profits.

Solar Power Plant Operations

- ▷ Sales: JPY228mn (-1.1% YoY)
- ▷ Operating profit: JPY73mn (+28.7%)

The segment booked electricity sales from mega solar power plants in Shimonoseki, Tateyama, and Sodegaura. Reviewing SG&A expenses and working to increase profitability resulted in higher OP.

In FY03/17, Tamagawa began construction of Noboribetsu power plant (1.9MW output; plans to begin electricity sales in Q2 FY03/18) in October 2016 and Goto power plant (5.3MW; Q1 FY03/19) in January 2017, and acquired the Kasumigaura power plant (2.4MW, began sales in Q1 FY03/18) in March 2017.

In Q4 FY03/17, electricity sales began for two of the four zones of the Misawa power plant (total output: 10MW; 30% owned by Tamagawa) with output of around 5MW.

Geothermal Power Plant Operations

No sales were booked. Operating loss was zero due to expenses (vs. operating loss of JPY20mn in FY03/16).

Q3 FY03/17 results

- ▷ Sales: JPY2.5bn (-24.0% YoY)
- ▷ Operating loss: JPY43mn (operating loss of JPY90mn in Q3 FY03/16)
- ▷ Recurring loss: JPY103mn (recurring loss of JPY138mn in Q3 FY03/16)
- ▷ Net loss*: JPY88mn (net loss of JPY180mn in Q3 FY03/16)

*Net loss refers to net loss attributable to parent company's shareholders.

All segments posted profits, except for the Geothermal Power Plant business, in which the company is preparing to begin operation.





Electronic and Communication Device

- ▷ Orders: JPY2.0bn (+32.7% YoY)
- ▷ Sales: JPY1.5bn (+6.1% YoY)
- ▷ Operating profit: JPY58mn (operating loss of JPY102mn in Q3 FY03/16)




Mobile telecom providers restrained capital investment on base stations, leading to a drop in demand; the company focused on increasing order flows from the public and government sectors. Sales in the mobile-telecom sector were JPY371mn (+12.2% YoY), while government sector sales were JPY358mn (-25.1% YoY). Other sales (public, infrastructure, and measuring instruments) were JPY745mn (-28.4% YoY). Profits rose in tandem with an increase in overall sales and improved profit margins. The company made efforts to raise operational efficiency and reduce costs. Sales of the company's own products, which are relatively more profitable, also increased, accounting for 38.0% of the segment's sales (23.4% in Q3 FY03/16). Local procurement ratio at subsidiary Tamagawa Electronics Vietnam Co., Ltd. rose to 80% and contributed to reduction in CoGS.

Major initiatives undertaken in cumulative Q3 FY03/17 were as follows:

- ▶ While demand fell in the mobile-telecom sector, improvements made in price competitiveness, thanks to increased local procurement at Tamagawa Electronics Vietnam and lowered CoGS, led to a rise in orders and sales of products related to 4G base stations.
- ▶ In the area of 5G mobile telecoms equipment, the company pushed ahead with development work on 5G devices and equipment for field testing with the aim of a full-scale commercial rollout in 2020. The company is in the process of developing equipment to field test the reliability of next-generation mobile telecoms-use semiconductors and sensors for gauging the performance of antennas. The company is developing front-end analog modules to handle millimeter and sub-millimeter waves (a part connected directly below the antenna to transmit signals, multi-wave duplexers capable of handling signals on multiple wavelengths, and next-generation high-efficiency power amplifiers).
- ▶ In the government sector, sales declined YoY during the cumulative Q3 period. However, the company said that sales were expected to recover in FY03/18 since demand was on the mend and that it has seen a growing number of inquiries about possible orders related to new projects.



-  In the public sector, infrastructure, and measuring instruments areas, the company won orders for its commercial wireless optical transmission system for use in airports (Narita Airport) and in next-generation weather forecasting equipment. The company also began to approach airports other than Narita Airport to drum up sales.
-  The company won an order from Toshiba for a subsystem used in next-generation weather forecasting equipment. The new weather forecasting equipment is being developed under Japan's Strategy Innovation Promotion Program as part of an initiative to promote "Enhancement of Societal Resiliency against Natural Disasters" that would improve forecasting of heavy rains and tornados and thereby help the government better prepare for natural disasters. The project team is now working on a next-generation weather radar that will allow forecasters to make quick and accurate predictions of meteorological conditions, such as heavy cloudbursts and tornados, and create a system to quickly convey the information to local governments and other interested parties.
-  In the area of electric noise resistance testing equipment in the automotive sector, the company developed a new product that converts the signals from the noise resistance test equipment into optical signals that could be sent via fiber-optic cables, thereby enhancing the sensitivity of the test equipment and expanding the range of signals that could be measured. The company delivered the product to a major automaker during cumulative Q3 FY03/17. The company also said that it had received inquiries about this product from a certain Tier 1 automotive supplier.
-  Testing equipment for power semiconductors saw an expansion in orders as the company targets FY03/17 sales of JPY495mn (1.6x YoY).

Renewable Energy System Sales

-  Orders: JPY983mn (-73.7% YoY)
-  Sales: JPY891mn (-51.1% YoY)
-  Operating profit: JPY34mn (operating loss of JPY28mn in Q3 FY03/16)

Sales in this segment during cumulative Q3 FY03/16 only reflected equipment sales. Meanwhile, in the latest cumulative Q3 period, sales reflected revenues from installation work at three different solar power facilities (with combined power generating capacity of roughly 1.2MW), that included a profitable contract for operation and maintenance, which significantly contributed to earnings. The company also received development contract fees in connection with the development of Misawa plant (power generating capacity of roughly 9.5MW).

Major initiatives undertaken in cumulative Q3 FY03/17 were as follows:

-  The company plans to pursue joint projects to secure the financing needed for development of solar power plants with output capacity of at least 10.0MW. As of February 2017, the company was considering a project following the Misawa power plant project (joint development with Etrion Japan), that would allow it to continue earning development contract fees in FY03/18.
-  In the area of small-scale wind power facilities, in March 2016 the company erected its own small-scale wind turbine (capacity 19.5kW) on some extra land at its Tateyama solar park. For small-scale wind turbines with power generating capacity of 20kW or less, the feed-in tariff is fixed at JPY55 per kWh during the 20-year purchase period (compared with JPY24 per kWh for solar systems capable of generating 10kW or more). Wind turbines also have an advantage over solar power arrays of being able to generate power more hours every day because, unlike solar panels, they can generate electricity at night. The company, as of February 2017, obtained seven permits to build small-scale wind power facilities.

The Agency of Natural Resources and Energy sent out a cautionary notice in November 2016 about the transition to a new feed-in-tariff system. The notice set the deadline for submitting a notice of minor changes to the Bureau of Economy, Trade and Industry—necessary for acquisition or sale of a power plant by March 2017—at January 20, 2017. This deadline made it difficult for the company to carry out related acquisition and sales activities as originally planned.

As for the solar power plant in Kasumigaura, Ibaraki Prefecture, scheduled for connection in late March 2017, the company had initially planned to sell the plant to an outside customer for a profit through consolidated subsidiary Tamagawa Energy. However, the company later decided to operate the plant within the group instead of selling it for short-term profit, thinking that owning and operating the plant would generate steady cash flow for 20 years and help strengthen the earnings structure and finances of the company for the medium to long term.

Solar Power Plant Operations

- ▷ Sales: JPY173mn (-4.1% YoY)
- ▷ Operating profit: JPY56mn (-0.7% YoY)

The segment booked electricity sales from mega solar power plants in Shimonoseki, Tateyama, and Sodegaura.

Tamagawa is considering raising output capacity at solar power plants in Shimonoseki, Tateyama, and Sodegaura by building additional power generation facilities. According to the company, in cases where the output capacity of a solar power plant is increased through such additions, a feed-in-tariff rate equivalent to that of the preexisting facilities will also be applied to the added facilities. The company said that it was making steady progress toward the medium-term goal of achieving total capacity of 20.0MW in FY03/20.

Geothermal Power Plant Operations

No sales or expenses were booked, as the company prepares to start operations of geothermal power plants.

FY03/16 results

- ▷ Sales: JPY7.3bn (+42.5% YoY)
- ▷ Operating profit: JPY280mn (-47.4% YoY)
- ▷ Recurring profit: JPY211mn (-58.9% YoY)
- ▷ Net income: JPY165mn (-61.3% YoY)

(*Net income refers to net income attributable to parent company shareholders.)

Electronic and Communication Device Business

- ▷ Orders: JPY2.2bn (-33.1% YoY)
- ▷ Sales: JPY2.1bn (-38.1% YoY)
- ▷ Operating loss: JPY12mn (operating profit of JPY467 in FY03/15)

Mobile telecom providers changed their construction plans for base stations and restrained capital investment, leading to a drop in both segment earnings and profits. In other areas (public sector, infrastructure, measurement, etc.), orders were acquired in the wireless transport (railway and airports) sector for fiber-optic products for use in airport facilities, and in Tamagawa-manufactured products, orders were favorable for testing equipment for power semiconductors.

A breakdown of sales is as follows:

- ▷ Mobile telecoms: JPY486mn (-65.4% YoY)
- ▷ Government: JPY688mn (-32.9%)
- ▷ Other (public sector, infrastructure, measurement, etc.): JPY934mn (-3.6%)

Renewable Energy System Sales Business

- ▷ Orders: JPY4.9bn (+187.9% YoY)

- ▷ Sales: JPY5.0bn (+176.4% YoY)
- ▷ Operating profit: JPY287mn (+155.9% YoY)

The sale of equipment for solar power plants resulted in both sales and profits rising YoY.

Solar Power Plant Business

- ▷ Sales: JPY230mn (+161.8% YoY)
- ▷ Operating profit: JPY57mn (+155.2% YoY)

Mega solar power plants in Shimonoseki, Tateyama, and Sodegaura sold electricity in line with forecasts.

Geothermal Power Plant Business

No sales were recorded, and operating loss was JPY20mn due to various expenses.

FY03/15 results

- ▷ Sales: JPY5.1bn (+22.1% YoY)
- ▷ Operating profit: JPY531mn (+11.3%)
- ▷ Recurring profit: JPY514mn (+7.5%)
- ▷ Net income: JPY427mn (-2.2%)

Electronic and Communication Device Business

- ▷ Orders: JPY3.2bn (-7.8% YoY)
- ▷ Sales: JPY3.4bn (+5.3%)
- ▷ Operating profit: JPY467mn (-2.7%)

Mobile telecom providers increased their investments in wireless facilities at the beginning of 2H. However, they changed construction plans during Q4.

The company sought to win new orders in the area of 3.9-generation mobile facilities, government facilities, and public sector/infrastructure. As a new business area, the company began to sell testing equipment for power semiconductors in June 2014. Since Tamagawa has secured orders in the new business, it expects to report sales in FY03/16. The company also installed a new high-definition monitoring system essential for the safe and smooth management of its group solar-power plants. Sales of the company's own products totaled JPY1.4bn (+22.5% YoY), accounting for 40.4% in the segment.

Operating profit declined due to spending on research and development worth JPY239mn (JPY124mn in the previous year).

Segment profit after allocation of corporate costs and others was JPY420mn (-7.3% YoY), surpassing the initial target of JPY370mn. The company attributed the more profit than planned to a rise in sales of its own products, efficient procurement of materials due to the introduction of a core system, and disappearance of the cost to cope with defects.

Solar System Sales Business

- ▷ Orders: JPY1.7bn (+102.8% YoY)
- ▷ Sales: JPY1.8bn (+101.8%)
- ▷ Operating profit: JPY112mn (+118.6%)

The company streamlined its operations and expanded sales reach to all parts of the country.

The company started sales of solar power plant equipment. By selling 2.3MW equipment, it reported sales of JPY1.1bn.

Solar Power Plant Business

- ▷ Sales: JPY87mn (+70.7% YoY)
- ▷ Operating profit: JPY22mn (operating loss of JPY19mn a year earlier)

The Shimonoseki solar park, which operated for nine months in the previous year, was in full-year operation in FY03/15. Plants in Tateyama (1.9MW) and Sodegaura (1.3MW), both in Chiba Prefecture, began operations in February and March, respectively, of 2015.

Geothermal Power Plant Business

This segment was created during FY03/15. The company is preparing to start operations of geothermal power plants during FY03/16. No sales were recorded, and operating loss was zero.

Income statement

Income statement (JPYmm)	FY03/08	FY03/09	FY03/10	FY03/11	FY03/12	FY03/13	FY03/14	FY03/15	FY03/16	FY03/17
	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Total sales	4,012	4,299	2,803	2,640	3,106	3,672	4,171	5,095	7,260	4,443
YoY	28.8%	7.1%	-34.8%	-5.8%	17.7%	18.2%	13.6%	22.1%	42.5%	-38.8%
CoGS	3274	3,348	2,412	2,314	2,516	2,623	2,973	3,616	5,710	3,151
Gross profit	738	951	392	326	590	1,049	1,198	1,479	1,550	1,292
GPM	18.4%	22.1%	14.0%	12.3%	19.0%	28.6%	28.7%	29.0%	21.3%	29.1%
SG&A expenses	620	1,020	619	612	619	675	721	947	1,270	1,103
SG&A-to-sales ratio	15.5%	23.7%	22.1%	23.2%	19.9%	18.4%	17.3%	18.6%	17.5%	24.8%
Operating profit	118	-68	-227	-286	-30	373	477	531	280	189
YoY	71.0%	-	-	-	-	-	27.8%	11.3%	-47.4%	-32.3%
OPM	2.9%	-1.6%	-8.1%	-10.8%	-1.0%	10.2%	11.4%	10.4%	3.9%	4.3%
Non-operating income	49	45	16	18	14	19	9	8	16	16
Non-operating expenses	58	105	14	16	8	17	8	25	84	99
Recurring profit	109	-128	-224	-284	-24	375	478	514	211	107
YoY	9.9%	-	-	-	-	-	27.6%	7.5%	-58.9%	-49.6%
RPM	2.7%	-3.0%	-8.0%	-10.8%	-0.8%	10.2%	11.5%	10.1%	2.9%	2.4%
Extraordinary gains	16	52	0	45	-	1	2	5	61	18
Extraordinary losses	492	341	346	109	7	0	0	0	3	14
Tax charges	39	-7	-1	3	6	36	44	92	104	66
Implied tax rate	-11%	1.6%	0.1%	-0.8%	-20.9%	9.6%	9.1%	17.7%	38.6%	59.5%
Net income	-408	-408	-570	-351	-37	340	436	427	165	45
YoY	-	-	-	-	-	-	28.5%	-2.2%	-61.3%	-73.0%
Net margin	-10.2%	-9.5%	-20.3%	-13.3%	-1.2%	9.3%	10.5%	8.4%	2.3%	1.0%

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

Historical forecast accuracy

Results vs. Initial Est. (JPYmm)	FY03/08	FY03/09	FY03/10	FY03/11	FY03/12	FY03/13	FY03/14	FY03/15	FY03/16	FY03/17
	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.	Cons.
Sales (Initial Est.)	3,000	3,870	3,389	3,110	2,980	3,378	4,504	4,534	5,600-7,300	6,633
Sales (Results)	4,012	4,299	2,803	2,640	3,106	3,672	4,171	5,095	7,260	4,443
Results vs. Initial Est.	33.7%	11.1%	-17.3%	-15.1%	4.2%	8.7%	-7.4%	12.4%	-	-33.0%
Operating profit (Initial Est.)	40	129	139	191	22	69	493	506	590-850	354
Operating profit (Results)	118	-68	-227	-286	-30	373	477	531	280	189
Results vs. Initial Est.	195.2%	-	-	-	-	441.1%	-3.2%	5.0%	-	-46.5%
Recurring profit (Initial Est.)	52	71	133	179	18	65	488	489	520-790	260
Recurring profit (Results)	109	-128	-224	-284	-24	375	478	514	211	107
Results vs. Initial Est.	109.5%	-	-	-	-	476.5%	-2.0%	5.1%	-	-59.0%
Net income (Initial Est.)	50	63	133	179	13	60	449	450	400-570	192
Net income (Results)	-408	-408	-570	-351	-37	340	436	427	165	45
Results vs. Initial Est.	-	-	-	-	-	466.3%	-2.8%	-5.1%	-	-76.8%

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

Balance sheet

Balance sheet (JPYmn)	FY03/08 Cons.	FY03/09 Cons.	FY03/10 Cons.	FY03/11 Cons.	FY03/12 Cons.	FY03/13 Cons.	FY03/14 Cons.	FY03/15 Cons.	FY03/16 Cons.	FY03/17 Cons.
ASSETS										
Cash and deposits	706	820	665	493	56	390	1,764	1,524	2,737	2,155
Marketable securities	256	-	-	-	-	-	-	-	-	-
Accounts receivable	2,046	1,033	915	663	864	1,345	1,112	1,377	985	1,456
Inventories	580	345	275	328	299	328	347	447	318	343
Other current assets	134	47	63	45	74	52	197	258	181	133
Total current assets	3,722	2,245	1,918	1,530	1,293	2,114	3,421	3,606	4,221	4,088
Buildings	174	162	132	94	80	87	114	130	157	144
Tools, furniture and fixtures	458	88	36	5	1	58	87	126	88	74
Machinery and equipment	20	2	1	1	0	22	430	1,458	1,407	1,321
Land	198	198	126	106	52	52	52	540	652	406
Construction in progress	-	-	-	-	-	346	35	156	159	639
Accumulated depreciation	1,142	1,151	997	959	899	884	908	966	966	1,187
Total tangible fixed assets	855	451	295	205	133	564	718	2,410	2,464	2,584
Investment securities	90	251	69	23	8	14	19	23	17	23
Other	7	16	20	7	9	13	19	131	152	453
Investment and other assets	97	267	89	30	18	27	38	154	169	476
Software	301	25	25	-	-	1	19	88	77	67
Other	22	22	14	-	-	-	12	106	232	212
Total intangible assets	323	47	39	-	-	1	31	194	309	279
Total fixed assets	1,275	765	423	235	150	593	788	2,759	2,942	3,339
Total assets	4,997	3,010	2,341	1,766	1,445	2,709	4,210	6,376	7,164	7,446
LIABILITIES										
Accounts payable	1,301	511	443	430	364	386	474	620	321	524
Short-term interest-bearing debt	404	507	433	203	30	40	323	300	1,395	986
Accounts payable	253	108	39	31	48	108	86	169	101	165
Other current liabilities	336	99	111	220	156	173	247	392	232	366
Total current liabilities	2,293	1,226	1,026	884	598	708	1,130	1,481	2,049	2,041
Long-term interest-bearing debt	441	216	67	-	-	151	294	539	612	614
Lease obligations	-	-	-	-	-	-	-	947	925	1,246
Other fixed liabilities	208	101	86	83	85	100	148	247	283	284
Total fixed liabilities	649	318	153	83	85	251	442	1,733	1,820	2,144
Total interest-bearing debt	844	724	500	203	30	192	618	839	2,007	1,600
Total Liabilities	2,942	1,544	1,179	967	683	959	1,572	3,215	3,869	4,185
NET ASSETS										
Capital stock	1,029	1,029	1,102	1,102	1,102	1,387	1,625	1,656	1,677	1,677
Capital surplus	1,196	1,024	1,096	1,096	1,096	1,381	1,620	1,077	1,057	994
Retained earnings	-119	-619	-983	-1,335	-1,372	-991	-555	445	611	655
Total net assets	2,055	1,466	1,162	799	761	1,751	2,638	3,161	3,295	3,261
Working capital	1,325	867	747	562	800	1,287	986	1,204	982	1,276
Total interest-bearing debt	844	724	500	203	30	192	618	839	2,007	1,600
Net debt	138	-96	-165	-290	-26	-198	-1,146	-685	-730	-555

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

Assets

During FY03/17, current assets accounted for 54.9% of total assets. The ratio of fixed assets has increased since FY03/13.

Primary factors of current assets were cash and deposits (52.7% of current assets in FY03/17) and accounts receivable (35.6%).

Operating cash flows stemming from improved profitability, stock issuances, and financing activity were factors in cash and deposits increasing from JPY390mn in FY03/13 to JPY2.2bn in FY03/17.

Tangible fixed assets shrank to JPY133mn in FY03/12 owing to a string of impairment losses amid slumping profits. In FY03/13 and onward, tangible fixed assets have been on an uptrend due to construction of solar parks and capex in the Electronic and Communication Device business.

Liabilities

In FY03/17, a majority of liabilities is comprised of accounts payable, interest-bearing debts, and lease obligations.

Interest-bearing debts shrank from JPY844mn in FY03/08 to JPY30mn in FY03/12. Shared Research estimates that borrowing was difficult due to the profit slump, so Tamagawa repaid short- and long-term borrowings, corporate bond redemptions continued, and there was no debt refinancing. In FY03/13 interest-bearing debts increased for the first time in five years, and in FY03/17 the figure was JPY1.6bn.

In FY03/17 net debt (interest-bearing debts minus cash and deposits) was positive, amounting to positive JPY555mn.

The company newly reported lease obligations in FY03/15 because it built the solar parks in Tateyama and Sodegaura, both in Chiba Prefecture, on leases.

Net assets

Due to the extended profit slump and net losses, net assets declined from JPY4.2bn in FY03/07 to JPY761mn in FY03/12. Retained earnings were minus JPY1.3bn in FY03/12. Net assets totaled JPY3.3bn in FY03/17 as a result of financing and building up net income over subsequent years.

In FY03/13, capital increased due to the exercise of share subscription rights issued via third party allotment in January 2013. In FY03/15 and FY03/16, capital also increased slightly due to the exercise of share subscription rights. Factors that increased capital similarly increased capital reserve. That said, capital reserve decreased in FY03/15 to cover negative retained earnings, and due to distribution of retained earnings as dividends in FY03/16 and FY03/17. Since FY03/13, retained earnings have increased as a result of posting net income and covering negative retained earnings in FY03/15.

Cash flows

Cash flow statement (JPYmn)	FY03/08 Cons.	FY03/09 Cons.	FY03/10 Cons.	FY03/11 Cons.	FY03/12 Cons.	FY03/13 Cons.	FY03/14 Cons.	FY03/15 Cons.	FY03/16 Cons.	FY03/17 Cons.
Cash flows from operating activities (1)	-136	259	-1	68	-332	36	764	387	1,614	102
Cash flows from investing activities (2)	-111	-17	12	93	77	-454	-265	-865	-392	-628
Free cash flow (1+2)	-247	242	11	162	-255	-418	499	-478	1,222	-526
Cash flows from financing activities	-121	-194	-82	-299	-168	783	875	238	-2	-57
Depreciation and amortization (A)	58	217	76	20	14	22	84	106	187	177
Capital expenditures (B)	-134	-82	-22	-7	-12	-446	-254	-866	-662	-569
Working capital changes (C)	-179	-459	-120	-186	238	488	-301	219	-222	294
Simple FCF (NI + A + B - C)	-305	186	-397	-152	-272	-572	568	-552	-87	-641

Source: Shared Research based on company data

Note: Figures may differ from company materials due to differences in rounding methods.

Cash flows from operating activities

Cash flows from operating activities hinge on net income, depreciation, goodwill amortization and changes in working capital. The reason that operating cash flow topped net losses plus depreciation and goodwill amortization from FY03/09 through FY03/11 was impairment losses, valuation losses on investment securities and a drop in working capital. In FY03/12 operating cash flow fell despite a narrower net loss due to an increase in accounts receivable. In FY03/13 and later operating cash flow stayed in the black as the company continued to report annual net income.

Cash flows from operating activities were significantly higher than net income during FY03/16 due to equipment sales in the Renewable Energy System Sales business, which caused cash inflows from the increase and decrease in inventories.

Cash flows from investing activities

Through FY03/12 Tamagawa was restrained in its investments with capex below JPY100mn, so cash flows from investing activities were minus JPY17mn in FY03/09 but positive from FY03/10 through FY03/12. Tamagawa's investment cash flow remained in negative territory in FY03/13 and the subsequent years due to capital investments in the Electronic and Communication Device Business and capex in the solar parks.

Cash flows from financing activities

Interest-bearing debt declined from FY03/09 through FY03/12, so cash flows from financing activities remained negative. In January 2013 Tamagawa made a placement of 2.1mn shares and issued options (if exercised would prompt the issuance of 4.8mn additional shares) to fund solar park construction. There were 1.8m shares issued in FY03/13 on the exercising of options. In FY03/13 Tamagawa saw JPY783mn in financing cash flows: JPY554mn from the issuance of shares; JPY47mn from option issuance; JPY170mn from long-term borrowing; and JPY100mn from corporate bond issuance.

During FY03/14, inflows included JPY450mn from the issuance of shares, and inflows from borrowings, leading to JPY875mn in financing cash flows.

In FY03/15, cash flows from financing activities came to JPY238mn, due to JPY58mn in revenue from issuing new shares, JPY26mn in revenue from issuing share purchase warrants, and borrowings.

Other information

History

Founded in 1968, the company was a leader in analog high-frequency wireless technology. By the mid-2000s the business was derailed by Korean competitors. After several missteps and ownership changes Tamagawa found itself with the current leadership in 2012.

J Bridge Corp became a shareholder in 2007. In 2007 J Bridge Corp (now Asia Development Capital Co Ltd; TSE2: 9318) became a shareholder. J Bridge in turn installed an executive from a company in which it held an equity stake (J Capital Management Co Ltd, 14.7% stake) to Tamagawa's board in 2007. The new board member was then made CEO and proceeded to make a number of failed acquisitions, speculative investments and unwise decisions, leading to further deterioration.

Raised capital for biomass energy in 2010. After the J Bridge-appointed CEO stepped down in 2009, the company liquidated some money-losing subsidiaries in a bid to regain profitability. But amid declining sales its core electronics and telecommunications equipment business continued to lose money in FY03/09-FY03/11. In 2010 the company raised JPY144mn in new capital to launch a biomass energy business. It was liquidated in March 2012 after posting operating losses in FY03/11 through Q2 FY03/13.

Masanori Kobayashi joins core business in June 2011. In June 2011, Masanori Kobayashi, a veteran of the company, was appointed a director of Tamagawa Electronics Co Ltd, a subsidiary that is the core business. Kobayashi was subsequently appointed CEO of Tamagawa Electronics in April 2012 and he took charge of rebuilding the electronics and telecommunications equipment business. The reform included exiting unprofitable projects, something Tamagawa was routinely doing while battling overseas rivals. The segment returned to operating profitability in FY03/12.

The company is actively engaged in renewable energy-related businesses, setting up an internal division to prepare for entering the solar energy business in October 2010. It began selling electricity at a mega solar power plant in Shimonoseki, Yamaguchi Prefecture in June 2013. It also launched the geothermal power plant business in December 2014 and began electricity sales at a small-scale wind power facility in Tateyama, Chiba Prefecture in March 2016.

Focusing on profits. In April 2012, following a request from a major Tamagawa HD shareholder, Toru Masuzawa became executive director of Tamagawa Holdings, and CEO in June 2012. In June 2014, Tamagawa shifted to a joint leadership system of two representative directors to cope with difficult market conditions. In addition to the incumbent Representative Director Toru Masuzawa, the company promoted Masanori Kobayashi to new representative director with the aim to establish a fair and transparent management base by maintaining and improving its compliance system and ensuring strong corporate governance. In June 2016, Akihiro Ushiroda became Executive Vice President to form a management team of three representative directors.

Year	Month	Remarks
1968	Nov.	Tamagawa Electronics founded in Ota-ku, Tokyo (capital: JPY1mn)
1999	Aug.	Shares registered on Japan Securities Dealers' Association registry of OTC-traded shares
2007	Oct.	Trade name changed to Tamagawa Holdings Co., Ltd. after company split; new company Tamagawa Electronics Co., Ltd. founded
2010	Oct.	Established internal division to prepare for entry into solar energy business
2011	Oct.	Internal division above changes name to solar power department
2013	Jan.	Capital increase by third party allotment
2013	Feb.	Founded wholly-owned subsidiary Tamagawa Solar Systems
2013	Jun.	Began electricity sales at mega solar power plant in Shimonoseki, Yamaguchi Prefecture
2014	Dec.	Began geothermal power generation business
2015	Feb.	Began electricity sales at mega solar power plant in Tateyama, Chiba Prefecture
2015	Mar.	Began electricity sales at mega solar power plant in Sodegaura, Chiba Prefecture
2015	Mar.	Announces memorandum of understanding regarding business alliance with Etrion Japan

2015	May	Tamagawa Solar Systems changes name to Tamagawa Energy
2015	Jun.	Subsidiary Tamagawa Electronics established Vietnamese subsidiary Tamagawa Electronics Vietnam Co, Ltd.
2016	Jan.	Established internal division to prepare for hydrogen power business
2016	Jun.	Acquired equity interest in Etrion Energy 5 LLC (becomes equity-method affiliate)
2017	Mar.	Began electricity sales at solar power plant in Misawa, Aomori Prefecture
2017	Apr.	Began electricity sales at solar power plant in Kasumigaura

News and topics

July 2017

On **July 24, 2017**, the company announced that the construction of its solar power plant in Misawa (Aomori Prefecture) has been completed.

The construction work of the solar power plant in Misawa (Aomori Prefecture), which the company developed jointly with Etrion Japan K.K. and Hitachi High-Technologies Corporation as announced in June 2016, has been completed. The new plant constitutes of four separate plots and has a generating capacity of about 10.0MW in total.

Overview

- ▷ Location: Misawa, Aomori Prefecture
- ▷ Operator: Etrion Energy 5 LLC
- ▷ Total area: Approx. 163,000m²
- ▷ Capacity: Approx. 9.5MW
- ▷ Feed-in tariff: JPY36/kWh before tax (fixed for 20 years)
- ▷ First year generation volume: Approx. 10,740,000kWh (planned)

Solar power plant in Misawa, Aomori Prefecture



Source: Company data.

June 2017

On **June 19, 2017**, the company announced that it will begin drilling work at a plot in Ibusuki (Kagoshima prefecture) where it plans to build a geothermal power plant.

The company's consolidated subsidiary Tamagawa Energy resolved on the same day to begin drilling work at the plot in Ibusuki (Kagoshima prefecture) chosen for its geothermal power plant. The drilling is to allow the discharge of steam required in geothermal binary power generation.

As part of efforts to develop a new base for renewable energy, the group has been independently pushing forward power development initiatives targeting the launch of a geothermal power plant business in Ibusuki. The company will begin drilling work at this time, since it has received drilling approval and completed examination of the geothermal reservoir.

Geothermal binary power generation

Geothermal binary power generation uses the technology where heat is exchanged from subterranean hot water or steam to a medium with a lower boiling point than water, and steam from that medium is in turn used to drive turbines for power generation. Since the majority of discharged steam can be reinjected to its underground reservoir through a reinjection well, the technology makes it possible to generate renewable energy with almost no negative effect on the environment.

Benefits of the geothermal power business

- ▷ Unlike solar power, geothermal power allows for stable 24-hour power generation, as it is not affected by the weather, seasons, or day/night fluctuations
- ▷ Due to the above reasons, a geothermal power plant with capacity of around 125Kw can generate the same amount of electricity as a 1.0MW solar power plant. The space required is also relatively small, and therefore enables efficient power generation

- ▷ The feed-in tariff for electricity produced by geothermal power plant is fixed at JPY40/kWh (for less than 15,000Kw; excluding tax) for FY2017
- ▷ An analysis of investment versus projected revenues shows that the geothermal power business is highly cost effective; the company can aim to maximize its return on investments

Schedule

The drilling work is expected to continue for about six months, and the company expects a power generation capacity of about 500Kw. Actual production capacity will become evident once steam is actually discharged and a discharge test is completed, and the company plans to make a separate announcement once details become clear.

Drilling work for geothermal power plant



Source: Company data.

April 2017

On **April 3, 2017**, the company announced that its Kasumigaura solar power plant (Ibaraki Prefecture) has begun operation to sell electricity.

The company began electricity sales for its Kasumigaura (Ibaraki Prefecture) solar power plant with a generating capacity of about 2.4MW, upon completion of grid connection with Tokyo Electric Power Company.

Overview of the Kasumigaura solar power plant

- ▷ Location: Kasumigaura, Ibaraki Prefecture
- ▷ Operator: GP Energy B LLC
(a subsidiary of Tamagawa's wholly-owned subsidiary)
- ▷ Total area: Approx. 40,354m²
- ▷ Capacity: Approx. 2.4MW
- ▷ Feed-in tariff: JPY36/kWh before tax (fixed for 20 years)
- ▷ Generation revenue: JPY105mn/year (planned)
- ▷ First year generation volume: Approx. 2,900,000kWh (planned)

Kasumigaura solar power plant in Ibaraki Prefecture



Source: Company data.

Tamagawa Holdings solar power plants

Solar parks	Location	Feed-in-tariff (JPY/kWh)	Output (MW)	Operation start	Sales (JPYmn; Shared Research estimates)
Shimonoseki	Shimonoseki, Yamaguchi	40.0	1.6MW	Q1 FY03/13	76
Tateyama mega solar	Tateyama, Chiba	40.0	1.9MW	Q4 FY03/15	95
Sodegaura mega solar	Sodegaura, Chiba	36.0	1.3MW	Q4 FY03/15	60
Noboribetsu	Noboribetsu, Hokkaido	40.0	1.9MW	Q3 FY03/18	94
Kasumigaura mega solar	Kasumigaura, Ibaraki	36.0	2.4MW	Q1 FY03/18	105
Misawa	Misawa, Aomori	36.0	1.5MW	Q4 FY03/17	65
Misawa	Misawa, Aomori	36.0	1.5MW	Q2 FY03/18	65
Goto	Goto, Nagasaki	36.0	5.3MW	Q1 FY03/19	250
Minamishimabara	Minamishimabara, Nagasaki	40.0	1.0MW	Q2 FY03/19	40
Total	-	-	18.4MW	-	850

Source: Shared Research based on company data
Shared Research estimate for sales, based on annual electricity sales of 1,200MWh per 1MW solar power facility.

March 2017

On **March 13, 2017**, the company announced that its Misawa solar power plant (Aomori Prefecture) has begun selling electricity through partial operation of the plant.

The Misawa plant, which the company constructed jointly with Etrion Japan K.K. and Hitachi High-Technologies Corporation, constitutes of four separate plots and has a generating capacity of about 10.0MW. The plant began electricity sales upon completion of grid connection with Tohoku Electric Power on two of the four plots, allowing total output of about 5.0MW.

Overview of the Misawa solar power plant

- ▷ Location: Misawa City, Aomori Prefecture
- ▷ Operator: Etrion 5 LLC (30% owned by Tamagawa)
- ▷ Total area: Approx. 163,000m²
- ▷ Capacity: Approx. 9.5MW
- ▷ Feed-in tariff: JPY36/kWh (fixed for 20 years)
- ▷ First year generation volume: Approx. 10,740,000kWh (planned)

Misawa solar power plant in Aomori Prefecture



Source: Company data.

On **March 1, 2017**, the company announced the acquisition of a mega solar power plant in Kasumigaura, Ibaraki Prefecture, and revisions to its full-year FY03/17 earnings forecasts.

Acquisition of mega solar power plant in Kasumigaura, Ibaraki Prefecture

Tamagawa's consolidated subsidiary GP Energy B G.K. passed a resolution on an installment sales agreement with Ricoh Leasing Company, Ltd., for the purchase of a 2.4MW solar power plant in Kasumigaura, Ibaraki Prefecture, scheduled for connection in late March 2017.

The plant is ready to start selling electricity from late March 2017. Originally Tamagawa was considering the plant for resale to an outside customer through consolidated subsidiary Tamagawa Energy, which conducts the Renewable Energy System Sales business, but decided to operate it as its own project.

Overview of mega solar power plant in Kasumigaura, Ibaraki Prefecture

▷ Acquisition cost equivalent:	JPY1.0bn
▷ Total cost paid in installments:	JPY1.3bn
▷ First installment:	Late March 2017 (planned)
▷ Capacity:	Approx. 2.4MW
▷ Feed-in tariff:	JPY36/kWh (fixed for 20 years)
▷ Generation revenue:	Approx. JPY105mn/year (planned)
▷ First-year generation volume:	Approx. 2,900MWh (planned)
▷ Start of the sale of electricity:	Late March 2017 (planned)

Revisions to full-year FY03/17 earnings forecasts

Full-year FY03/17 earnings forecasts

▷ Sales:	JPY4.4bn (previous forecast JPY6.6bn)
▷ Operating profit:	JPY133mn (JPY354mn)
▷ Recurring profit:	JPY51mn (JPY260mn)
▷ Net income:	JPY12mn (JPY192mn)

Reasons for the revisions

There are two reasons for the revisions:

- ▀ The power plant GP Energy B will acquire in Kasumigaura, Ibaraki Prefecture, was originally slated for resale by Tamagawa Energy to an outside customer, with the proceeds to be booked as earnings. However, the company decided to operate the plant as its own project instead of selling it for a one-time profit.
- ▀ Because of revisions in tax and application systems scheduled to take effect in April 2017, there has been intense competition for plants that can be connected before the end of March 2017. As a result, the amounts spent for acquisition, and received in sales, of plants in the Renewable Energy System Sales business have stayed below original plans. Further, the Agency of Natural Resources and Energy sent out a cautionary notice in November 2016 about the transition to the new system. The notice set the deadline for submitting a notice of minor changes to the Bureau of Economy, Trade and Industry—necessary for acquisition or sale of a power plant by March 2017—at January 20, 2017. This deadline made it difficult to carry out acquisition and sales activities as originally planned.

January 2017

On **January 16, 2017**, the company announced that GP Energy 2 Co., Ltd., a consolidated subsidiary, will acquire a solar power plant through a leasing agreement. The company has been planning to construct the plant in Goto City, Nagasaki Prefecture.

The plant is a large-scale, mega solar power plant with an approximately 5.3MW output, connecting to an extra-high voltage grid, the company’s first of its kind. The power plant will be able to sell electricity at a feed-in tariff of JPY36 per kWh (excluding consumption tax) for twenty years, with expected yearly generation revenue (planned) of approximately JPY250mn.

Details of lease

- ▷ Description of lease assets: Solar power generation systems, for a total lease fee of JPY2.9bn
- ▷ Lessor: Ricoh Leasing Company, Ltd.
- ▷ Conclusion of the agreement: January 15, 2017
- ▷ Lease start date: March or April 2018 (planned)

November 2016

On **November 1, 2016**, the company announced that it received an order for a subsystem that will be used in a next generation weather instrument.

The company received an order from Toshiba Corporation for a subsystem that will be used in a next-generation weather instrument. This device is part of the “research and development of technology to predict heavy rains and tornadoes,” one item of the national project “Enhancement of Societal Resiliency against Natural Disasters” under the Strategic Innovation Promotion Program (SIP). The results of this project are expected to be used in the 2020 Tokyo Olympics and Paralympics.

Resiliency is used in this case to refer to the ability of a society to recover and withstand natural disasters that result from climate change.

October 2016

On **October 31, 2016**, the company made an announcement regarding the acquisition of fixed assets (mega solar electricity generation facilities) through a lease.

GP Energy 6 Co., Ltd., a subsidiary of Tamagawa Holdings’ consolidated subsidiary GP Energy Co., Ltd., has passed a resolution to acquire the mega solar power plant in Noboribetsu city, a facility with an output of approximately 2MW that the company has been planning for construction in Hokkaido’s Noboribetsu city. GP Energy 6 intends to acquire the power generation plant by entering into a contract with Ricoh Leasing Company, Ltd., with the lease planned to begin in August 2017.

The mega solar electricity generation facility in Noboribetsu city, Hokkaido occupies a favorable site approximately 72,000sqm in area, and will be able to sell electricity at a fixed feed-in tariff of JPY40 per kWh (excluding consumption tax) for twenty years, with an expected yearly generation revenue (planned) of approximately JPY94mn. Further, twelve units of tracking systems that can be

anticipated to improve the efficiency of solar energy power generation are planned for installation within the same site, and are expected to contribute to earnings of the company. KCCS Mobile Engineering Co., Ltd., the company responsible for construction of this power generation facility, is a Kyocera group company that has worked on installation and construction of public and industrial solar power generation system facilities throughout Japan. Shared Research believes that the construction of this facility to proceed in a rapid, reliable manner.

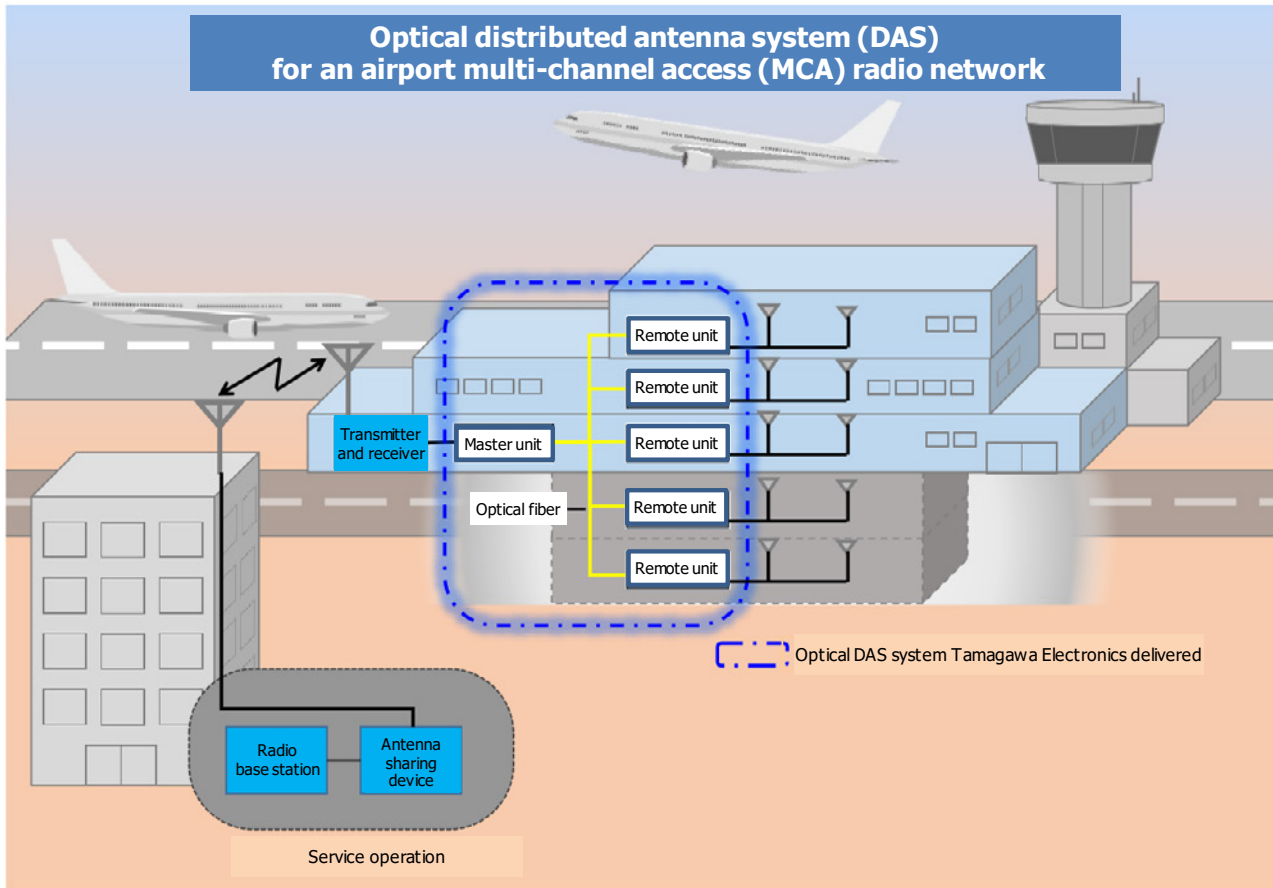
Description of assets to be leased (mega solar power generation facility in Noboribetsu city, Hokkaido)

- ▷ Operator: GP Energy 6 Co., Ltd.
- ▷ EPC operator: KCCS Mobile Engineering Co., Ltd.
- ▷ Capacity: Approximately 2MW
- ▷ First year output (planned): About 2,350,000kWh
- ▷ Outline of leased assets and total lease fee: Solar power generation systems for JPY711mn
- ▷ Acquisition cost equivalent: JPY490mn

On **October 6, 2016**, the company announced the operational launch of a system for which the company had earlier won a consignment contract in the public and social infrastructure field.

The company's Tamagawa Electronics Co., Ltd. unit (Tamagawa Electronics), sought to win more contracts in the public and social infrastructure field to expand its business territory. As a result, the company received an order from Nippon Airport Radio Service Co., Ltd. for development and production of an optical distributed antenna system (DAS) for an airport multi-channel access (MCA) radio network. The system has begun operation at Narita International Airport.

Tamagawa Electronics supplied the DAS system, an optical transmission device for dead zones aimed at increasing the number of communications lines and enhancing the overall network functionality. One of the major features of this system is that it can be expanded with the addition of more units, allowing the user to easily enlarge the wireless communications area. The system can also be used with a surveillance application using the ethernet to monitor various devices in operation.



Source: Shared Research based on company data

September 2016

On **September 12, 2016**, the company announced the status of its mega solar power plant in Noboribetsu, Hokkaido Prefecture.

Status of the mega solar power plant in Noboribetsu

The company already received certification for the land and power sales business at the mega solar power plant in Noboribetsu, Hokkaido Prefecture. It had been applying for development permits and preparing for construction. It received permission from Hokkaido Prefecture to develop forested area necessary to build a large solar power plant.

The price has been approved under METI's feed-in tariff scheme for renewable energy, at JPY40 per kWh (excl. tax; fixed for 20 years).

Overview of the plant

- ▷ Capacity: About 2MW
- ▷ Feed-in tariff (fixed for 20 years): JPY40/kWh (excl. tax)
- ▷ Generating revenue (planned): About JPY94mn/year
- ▷ First-year output: About 2,350,000kWh

June 2016

On **June 29, 2016**, the company announced a new medium-term management plan, covering from FY03/17 to FY03/20.

The new plan calls for FY03/20 sales of JPY10.1bn and operating profit of JPY1.1bn. Detailed targets for each segment are outlined below:

Medium-term management plan: Segment sales and profit targets

Long-term outlook (JPYmn)	FY03/16	FY03/17	vs. FY03/16	FY03/20	vs. FY03/16
	Act.	Plan	Changes	Plan	Changes
Sales	7,259	6,633	-8.6%	10,140	39.7%
Electronic and Communication Device	2,091	2,600	24.3%	3,500	67.4%
Renewable Energy System Sales	4,938	3,787	-23.3%	5,100	3.3%
Solar Power Plant	230	246	7.0%	1,190	417.4%
New businesses	-	-	-	350	-
Operating Profit	279	354	26.9%	1,090	290.7%
Electronic and Communication Device	-11	214	-	350	-
Renewable Energy System Sales	286	223	-22.0%	370	29.4%
Solar Power Plant	56	61	8.9%	335	498.2%
New businesses	-	-	-	35	-

Source: Shared Research based on company data

Note: Figures may differ from company documents due to differences in rounding methods.

- ▀ **Electronic and Communication Device Business:** Generate stronger earnings by capturing orders for power amplifiers (used in next generation mobile phones), increasing overseas market share, and M&A targeting related businesses.
- ▀ **Renewable Energy System Sales Business:** Expand sales of small-scale wind power generation equipment, commercialize geothermal power generation, biomass power generation and small-scale wind power generation equipment, and launch initiatives to win orders in the second-hand solar power plant market, expand the sales network, and strengthen its organizational structure by expanding the sales network and hiring more personnel.
- ▀ **Solar Power Plant and Geothermal Power Plant Businesses:** Expand capacity at the company's power stations from the present 5MW to 20MW, generate stronger earnings by acquiring customers for its upcoming geothermal power plant operations and evaluate the possibility of setting up renewable energy plants in the overseas Asian market.
- ▀ **New businesses:** Undertake initiatives related to hydrogen power storage and business investment, and explore ways to realize synergies with existing businesses and to directly/indirectly tap opportunities at related businesses.

On **June 22, 2016**, the company announced that it had obtained an equity interest in Etrion Energy 5 LLC (to become an equity-method affiliate).

As it announced on March 30 and June 11, 2015, Tamagawa was in talks with Etrion Japan KK (Etrion) as to how to proceed on a joint solar power generation venture in Misawa City, Aomori Prefecture. At a board of directors meeting held on June 22, 2016, a resolution was passed on obtaining an equity interest in Etrion Energy 5 LLC (Etrion 5GK). The effective date of the equity purchase is June 22, at a price of JPY300,000, and this will give Tamagawa a 30% stake in Etrion 5GK, making it an equity-method affiliate.

With the equity interest Tamagawa is obtaining from Etrion in Etrion 5GK, the operation will proceed as a joint venture, and construction will begin as early as possible so that the sale of electricity can begin in the near future. According to a term sheet agreed with Etrion, Tamagawa will hold a 30% stake in the special purpose company that will oversee the project, and the equity purchase is based on this agreement.

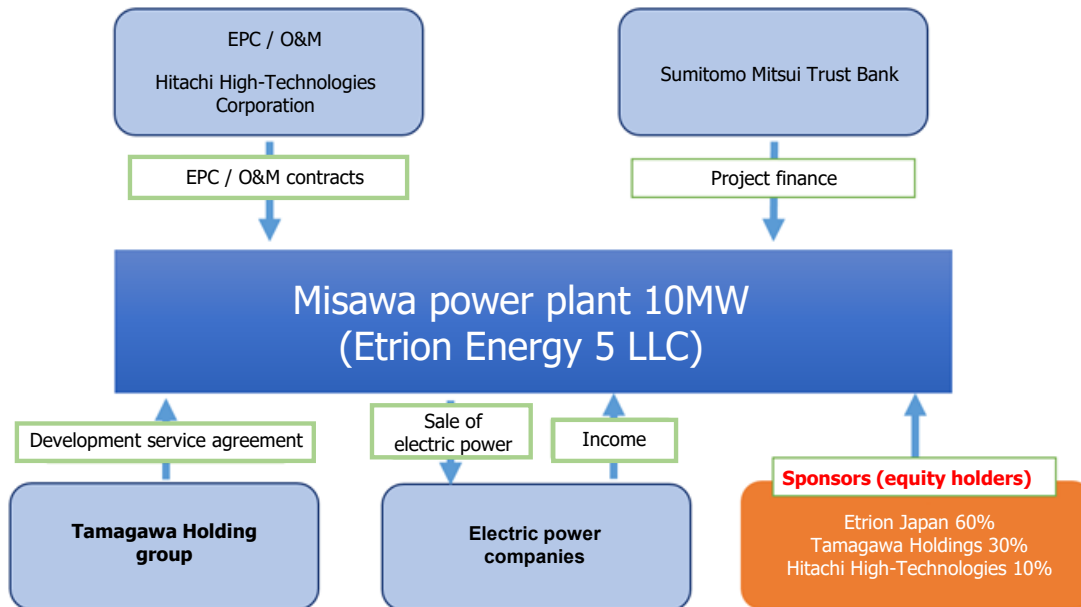
Tamagawa will also make an additional investment of JPY53mn in Etrion 5GK effective the same date as the aforementioned equity purchase (June 24, 2016). The other investors in the project will make additional investments in proportion to their stakes, so that even after this additional round of investments, the equity interest ratio will remain unchanged. Furthermore, on the same date as the aforementioned equity purchase and in keeping with their respective stakes, the various investors in Etrion 5GK will provide subordinated loans in accordance with subordinated loan agreements they have with Etrion 5GK. Tamagawa's planned loan is JPY106mn.

By conducting development operations jointly with a major corporation and a major EPC contractor, Tamagawa believes it can effectively operate this large solar power generation facility. This will also be the first project to receive financing through a project finance scheme with a major financial institution, so this is an important project in terms of the company's business strategy. Once Etrion 5GK receives the initial loan from the financial institution, Tamagawa plans to transfer land for the project to Etrion 5GK at a price of JPY274mn (book value).

Power plant overview

- ▷ Location: Misawa City, Aomori Prefecture
- ▷ Operator: Etrion Energy 5 LLC
- ▷ EPC: Hitachi High-Technologies Corporation
- ▷ Capacity: approximately 9.5MW (total)
- ▷ Feed-in tariff: JPY36/kWh (before tax; fixed for 20 years)
- ▷ First-year output: 10,740,000kWh (estimate)
- ▷ Construction to start: July 2016
- ▷ Commercial operation to start: February 2017

Outline of Etrion Energy 5 LLC



Source: Shared Research based on company data

*EPC refers to businesses comprehensively undertaking construction projects across the fields of engineering, procurement, and construction.

*O&M refers to businesses that undertake operation and maintenance of facilities after construction is complete.

March 2016

On **March 28, 2016**, the company announced successfully completed grid connections for its small-scale wind power generation facility.

As announced on February 1, 2016, the company has decided to begin power sales from small-scale wind power generation equipment. Following the construction of Small-scale Wind Power Generator Facility No. 1 (power output: 19.5kW) on grounds available at its Tateyama mega solar power plant (power output: approx. 2,000kW), connections with Tokyo Electric Power Company's grid were completed and sales of electrical power started on March 25, 2016.

On **March 14, 2016**, the company announced upward revisions to its FY03/16 earnings forecasts.

Revisions to full-year earnings forecast

- ▷ Sales: JPY7.1bn (previous forecast JPY5.4bn)
- ▷ Operating profit: JPY258mn (JPY159mn)
- ▷ Recurring profit: JPY187mn (JPY105mn)
- ▷ Net income: JPY176mn (JPY106mn)

Reasons for the revision

At the Renewable Energy System Sales segment, the company was able to win more new orders for its solar power plant equipment than projected in its previous forecast (December 10, 2015), and based on these favorable sales expects both sales and profits to outstrip the previous forecast.

On **March 1, 2016**, the company announced the development of optical transmission equipment for trains.

Subsidiary Tamagawa Electronics Co. Ltd. (Tamagawa Electronics) has increased efforts to win contracts for telecoms and broadcasting-related public works projects to minimize the impact of restrained capex spending in the mobile-phone infrastructure market. As a result, Tamagawa Electronics has won an order for optical transmission equipment for use in trains, and has decided to start developing these products.

According to the company's press release, one benefit of Tamagawa Electronics' analog optical transmission equipment is the cost effectiveness due to system simplification. They enable wireless signals that are the same as radio waves to be directly converted to optical signals and transmitted. Further, compared to coaxial cables, optical fiber is suitable for transmitting wireless signals over long distances because of its high frequency characteristics, in addition to fewer signal losses.

The company expects the development of these products to boost earnings from FY03/17–FY03/19, and plans to have a separate release regarding the earnings impact of this product when announcing its FY03/17 earnings forecast.

February 2016

On **February 22, 2016**, the company announced the establishment of a new subsidiary.

The company plans to expand its renewable energy business overseas, starting with Vietnam. In order to carry out accurate and precise assessments of the business environment, it has established a subsidiary to increase its understanding of the joint crediting mechanism (JCM) and the local electric power system in Vietnam, as well as to facilitate joint research with educational institutions as it seeks to develop businesses overseas in the future.

Subsidiary details

- ▷ Name: THD Research Institute Co., Ltd.
- ▷ Date of establishment: March 7, 2016 (planned)
- ▷ Capital: JPY1.0mn
- ▷ Owner: Tamagawa Holdings Co., Ltd. (100%)
- ▷ Business: Investigation, promotion of research, and the holding of seminars relating to the company's overseas renewable energy business, starting with Vietnam

On **February 1, 2016**, the company announced new products (small-scale wind power generation equipment) in its Renewable Energy System Sales segment. The new product will be sold by Tamagawa Energy, a subsidiary of the company.

Summary of small-scale wind power generation equipment

Small-scale wind power generation refers to wind power generation equipment producing less than 20kW of electricity, with a purchase period of 20 years. Provided that wind speeds are sufficient, wind power generation can generate electricity during the night, differentiating it from solar power generation. The company thinks that demand for such power generation will increase in the future.

In order to demonstrate the reliability and functionality of this product, the company plans to construct and operate Small-scale Wind Power Generator Facility No. 1 (power output: 19.5kW) on grounds available at its Tateyama plant (power output: approx. 2,000kW). The wind turbines are to be supplied by C&F Green Energy, the manufacturer of models the company plans to sell. The Tateyama plant has already received approval from the Ministry of Economy, Trade and Industry, and approval from Tokyo Electric Power (TSE: 9501) to provide power through its grid. Tamagawa aims to complete construction and began sales of power in March 2016.

Summary of turbine manufacturer

C&F Green Energy—a C&F Group member company based in Ireland—is set to provide wind turbines to Tamagawa. C&F Green Energy began development, production, and installation of small and medium scale wind power generation facilities in 2006. It has installed over 1,000 wind turbines across Europe, including in Ireland, the United Kingdom, Italy, France, and Switzerland. The C&F Group began design, manufacturing, and supply of metal and chrome parts for automotive applications in 1989, and provides its products to companies across the globe.

The current wind turbine units—manufactured by C&F Green Energy—to be provided to Tamagawa have received ClassNK approval from Nippon Kaiji Kyokai, a necessity for facilities to receive approval under the feed-in tariff system.

Sales plans

From an efficiency standpoint, the small-scale wind power generation equipment should ideally be placed in regions where the wind speed is at least 5m/s. In FY03/16, Tamagawa plans to perform final checks on the functionality of wind power generation equipment it owns, prior to beginning sales of the same models in FY03/17. By actively acquiring and developing areas that meet the aforesaid standard, the company aims to sell about 100 units during FY03/17.

January 2016

On **January 25, 2016**, the company announced plans to install a solar power tracking system at its solar park in Sodegaura.

As announced on March 24, 2015, the company launched electricity sales at its solar park in Sodegaura, Chiba (hereafter, Sodegaura solar park) last year. In order to explore new possibilities for its Solar Power Plant Business, it has decided to establish a solar power plant at this park which makes use of an automatic tracking system—the company’s first usage of this technology.

About the tracking system

The tracking system the company plans to use is known as a universal-axis solar tracker. It automatically adjusts the solar panel to the optimal angle in relation to the sun’s position, allowing it to gather more sunlight than a fixed panel and as such make full use of the available solar energy. This in turn greatly increases its energy output. The company expects that the total amount of energy generated will be 20-30% more than that generated by the fixed solar panels it has been using until now, and anticipates an increase in its power generating efficiency.

About the tracking system’s installation

- ▷ Location: Sodegaura City, Chiba Prefecture
- ▷ Capacity: Approx. 12kW
- ▷ Feed-in tariff: JPY32/kWh (excluding tax, fixed for 20 years)
- ▷ Maker: TopperSun (Taiwan)

On **January 12, 2016**, Tamagawa Holdings Co., Ltd. announced an update on the status of its plans to construct a solar park in Goto City, Nagasaki Prefecture.

As announced on November 18, 2014, the company is planning to construct and operate a solar park in Goto City, Nagasaki Prefecture. Tamagawa has now selected a contractor to carry out the construction work for the solar park.

The solar park plans to utilize a 5.3MW extra high voltage system—the first of its type for Tamagawa. The company has been preparing to start the sale of electricity there as soon as possible.

Nangoku Corporation, which is scheduled to perform construction work for the solar park, is a general trading company based in Kagoshima that operates businesses such as construction materials, machinery and equipment, telecommunications, and energy throughout the Kyushu region and has more than 40 subsidiaries and affiliates. Nangoku plans to build 30 solar energy power plants on its own in Kyushu for a total generating capacity of around 200MW and has constructed more solar power facilities.

About the Goto City solar park

- ▷ Location: Yoshikugi-cho, Goto City, Nagasaki Prefecture
- ▷ Operator: GP Energy 2 Co., Ltd. (wholly owned subsidiary)
- ▷ Area: 10 hectares
- ▷ Capacity: Approx. 5.3MW
- ▷ Feed-in tariff: JPY36/kWh (fixed for 20 years)
- ▷ Generation revenue: JPY250mn/year (tentative)
- ▷ First-year generation volume: Approx. 6,790,566kWh
- ▷ Start of the sale of electricity: April 2017 (planned)

On **January 4, 2016**, the company provided an update on the status of its plans to launch a power plant business in Misawa, Aomori Prefecture.

As indicated in its December 26, 2014 announcement, the firm plans to construct and operate solar energy power plant facilities with a total capacity of approximately ten megawatts in Misawa, Aomori Prefecture (hereafter “power plant business”). It is in the process of performing the necessary procedures and hopes to start electricity sales at an early stage. Tohoku Electric Power Co. has now officially approved a request for grid connections to Tamagawa’s power plant facilities (procedure for connecting to a power company’s grid, which is a precondition for selling power).

As the firm indicated on June 11, 2015, it reached a basic agreement with Etrion Japan KK (hereafter “Etrion”) to jointly operate these power plant facilities. The official approval of the grid connection request should encourage quicker and more concrete discussions with Etrion as the company looks to start operations.

Tamagawa Holdings expects this power plant business to begin selling power from FY03/17 and plans to promptly report any concrete developments regarding this joint project with Etrion.

Power plant overview

- ▷ Location: Misawa, Aomori
- ▷ Operator: GP Energy A, GP Energy B, GP Energy C, GP Energy D (wholly owned units)
- ▷ Premises: Approx. 153,000sqm
- ▷ Capacity: Approx. 10MW

- ▷ Feed-in tariff: JPY36/kWh (before tax; fixed for 20 years)
- ▷ Revenue: JPY390mn a year (estimate)
- ▷ First year output: Approx. 10,852,814kWh (estimate)

December 2015

On December 10, 2015, the company revised its sales and earnings forecast for FY3/16, and also provided an updated status report on its Geothermal Power Plant Business.

Revised FY 3/16 forecast

- ▷ Sales: JPY5.41bn (previously JPY5.6–7.3bn)
- ▷ Operating profit: JPY159mn (previously JPY590–850mn)
- ▷ Recurring profit: JPY105mn (previously JPY520–790mn)
- ▷ Net income: JPY106mn (previously JPY400–570mn)

Reasons for the revision

Moves by telecommunications carriers to restrain abrupt spending on mobile phone infrastructure and a lull (due to seasonality) in work on large government projects hurt sales at the Electronic and Communication Device segment. As this left 1H sales short of the company's initial forecast and put the Electronic and Communication Device segment below its breakeven point, the company revised its full-year earnings forecast.

Tamagawa Holdings had previously given its full-year forecast as a range estimate, owing to its Renewable Energy System Sales segment, where sales and earnings vary depending on changes in the operating environment caused by external factors. As indicated in the Geothermal Power Plant Business status report released the same day, the upper end of the forecast range was based on the assumption that upon the completion of construction of the two geothermal power plants that are currently under construction, the company would sell electrical power from the geothermal power plant and the geothermal power plants themselves, and would also sell the sites previously acquired for two other geothermal power plants where construction has not yet begun. However, the company has sold the two plants that were under construction to a third party, resold the land acquired to build the two other geothermal power plants, and halted the sale of geothermal power plants. In addition to lowering the expected sales amount at the Electronic and Communication Device segment, these moves caused the company to revise down earnings figures at both the upper and lower end of the expected range.

The sharp drop in expected profits relative to the company's full-year revised sales forecast is due to the fact that the decline in sales was at the high-margin Electronic and Communication Device segment.

Given the current operating environment, company plans for restoring orders and sales at the Electronic and Communication Device segment call for focusing on expanding sales to the government market and the public sector/ infrastructure--related market, and also on acquiring new customers. These efforts have brought in new large scale orders and improved the segment's order flow but, since most of the deliveries under these orders will not be until April 2016 or later, the contributions to earnings from will not appear until next fiscal year.

Current status of previously planned geothermal power plants

On January 29, 2015, the company announced that it planned to build a total of seven geothermal power plants, and to this end acquired a total of seven separate plots of land. The company moved forward on construction at two of the seven sites but changed its plan. Under the new plan, the company will sell the two plants currently under construction to a third-party and sell back the sites acquired for the five other geothermal power plants to their original owners.

At the geothermal power plant located in Beppu City, Oita Prefecture, a reexamination of data acquired after work had begun showed that Tamagawa Holdings was unlikely to get the return on the project it originally envisioned. After a series of talks with

the outside party that originally proposed the project, Tamagawa Holdings reached an agreement to sell the two power plants currently under construction to a company owned by the party that originally proposed the project at a price that would be greater than the total amount Tamagawa Holdings had invested in the two projects. The transaction and payment under this agreement are to be completed by the end of January 2016.

As for the remaining five sites at which construction of geothermal power plants has not yet begun, Tamagawa Holdings chose to exercise its right under the original purchase contract to sell the land back to the original owner at the same price for which it was purchased. Two of the five sites have already been sold back to their original owners and the sales of remaining three sites are expected to be completed by the end of December 2015.

The company had expected to use some of the capital that was raised by a warrant issue for its geothermal power plant operations. However, after only 10 of the warrants issued were exercised, adverse changes in the operating environment and the stock market pushed the company's share price down to a level where it made sense for the company to buy back and cancel all of the remaining 9,990 warrants and finance construction at the first geothermal power plant site with cash on hand.

Corporate governance and environment/CSR-related information (as of June 2017)

Organizational form and capital structure	Organization	Company with Audit & Supervisory Board	
	Controlling shareholders	None	
Directors	Number of directors (per Articles of Incorporation)	8	
	Directors' term of office (per Articles of Incorporation)	1 years	
	Number of directors	6	
	Outside directors	2	
	Independent outside officers	0	
Audit & Supervisory Board	Existence of Audit & Supervisory Board	Y	
	Number of Audit & Supervisory Board members (per Articles of Incorporation)	5	
	Number of Audit & Supervisory Board members	3	
	Outside members of Audit & Supervisory Board	2	
	Independent outside officers	2	
Other	Independent officers	2	
	Implementation of measures regarding director incentives	Performance-linked remuneration and stock option	
	Eligible for stock option	Directors, others	
Other	Preparation of convening notices in English	Y	Online disclosure
	Disclosure of individual director's compensation	None	
	Policy to determine amount and calculation method of remuneration	Y	
	Corporate takeover defenses	None	
Environmental conservation activities, CSR activities	Obtained ISO14001 certification		
	Contribution to society through product development of high frequency microwave technologies, required in the age of 5G/IoT Contribution to society through economic effects sand natural environment improvements by expanding renewable energy business		

Major shareholders

Top shareholders	Voting rights ratio
Marilyn Tang	14.88%
Pershing Division of Donaldson, Lufkin & Jenrette Sec. Corporation	5.05%
Hiromasu Shimanuki	4.74%
HS Securities Co., Ltd.	3.97%
Toru Masuzawa	3.25%
Rakuten Securities, Inc.	2.51%
Sada Kubota	2.38%
Japan Securities Finance Co., Ltd.	2.27%
Yuichi Sunaga	1.37%
Hideto Komai	0.98%

Source: Shared Research based on company data
As of end-March 2017

Top management

President & CEO: Toru Masuzawa

Masuzawa joined Wako Securities Co., Ltd. (now Mizuho Securities Co., Ltd.) in April 1985. He gained experience at Commerzbank Southeast Asia from 1994, HSBC Securities from 1998, Barclays Private Bank from 1999, and Time Square Venture from 2004. Later in 2004, he became an executive officer at J Bridge Corp (now Asia Development Capital Co. Ltd) and then president in 2005. In April 2012, he became an executive officer at Tamagawa and, in June 2012, became the company president (current position).

Executive Vice President: Akihiro Ushiroda

Ushiroda joined U-EN Corporation in July 2005 and then KDA Audit Corporation in 2007. He joined Tamagawa in January 2012 as manager of the business administration department, was promoted to director of the corporate planning department and finance and accounting department in 2015, and was then promoted to executive vice president in June 2016 (current position).

Executive Vice President: Masanori Kobayashi

Kobayashi joined Fuji Keiki Co., Ltd. in April 1977, then moved to Tamagawa in December 1981. He became manager of the measuring instruments department in 1999 and was put in charge of director information in 2005. He became an auditor in 2006, an executive officer at Tamagawa Electronics Co., Ltd., in 2011, president of Tamagawa Electronics in 2012 (current position), and executive vice president of Tamagawa Holdings in 2014 (current position).

Company profile

Company	Head office
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Phone	Listed on
+81-3-6435-6933	JASDAQ
Established	Exchange listing
May 7, 1970	August 31, 1999
Website	Fiscal year-end
http://www.tmex.co.jp/english/index.html	March
IR Web	
http://www.tmex.co.jp/english/ir-info.html	

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AS ONE CORPORATION	Hearts United Group Co., Ltd.	SANIX INCORPORATED
Ateam Inc.	IDOM Inc.	Sanrio Company, Ltd.
Aucfan Co., Ltd.	IGNIS LTD.	SATO HOLDINGS CORPORATION
Axell Corporation	Inabata & Co., Ltd.	SBS Holdings, Inc.
Azbil Corporation	Infomart Corporation	Seria Co.,Ltd.
Bell-Park Co., Ltd.	Intelligent Wave, Inc.	SHIP HEALTHCARE HOLDINGS, INC.
Benefit One Inc.	istyle Inc.	SMS Co., Ltd.
Canon Marketing Japan Inc.	Itochu Enex Co., Ltd.	Snow Peak, Inc.
Cama Biosciences, Inc.	J Trust Co., Ltd	Solasia Pharma
CERES INC.	Japan Best Rescue System Co., Ltd.	SOURCENEXT Corporation
Chiyoda Co., Ltd.	JINS Inc.	Star Mica Co., Ltd.
Chugoku Marine Paints, Ltd.	KAMEDA SEIKA CO., LTD.	SymBio Pharmaceuticals Limited
cocokara fine Inc.	Kenedix, Inc.	Takashimaya Company, Limited
COMSYS Holdings Corporation	KFC Holdings Japan, Ltd.	Takihyo Co., Ltd.
CRE, Inc.	LAC Co., Ltd.	TAMAGAWA HOLDINGS CO., LTD.
CREEK & RIVER Co., Ltd.	Lasertec Corporation	TEAR Corporation
Daiseki Co., Ltd.	MATSUI SECURITIES CO., LTD.	3-D Matrix, Ltd.
DIC Corporation	MEDINET Co., Ltd.	TKC Corporation
Digital Arts Inc.	Milbon Co., Ltd.	TOKAI Holdings Corporation
Digital Garage Inc.	MIRAIT Holdings Corporation	Tri-Stage Inc.
Don Quijote Holdings Co., Ltd.	NAGASE & CO., LTD	VISION INC.
Dream Incubator Inc.	NAIGAI TRANS LINE LTD.	VISIONARY HOLDINGS CO., LTD.
EARTH CHEMICAL CO., LTD.	NanoCarrier Co., Ltd.	VOYAGE GROUP, INC.
Elecom Co., Ltd.	Net One Systems Co.,Ltd.	WirelessGate, Inc.
Emergency Assistance Japan Co., Ltd.	Nichi-Iko Pharmaceutical Co., Ltd.	YELLOW HAT LTD.
en-Japan Inc.	NIPPON PARKING DEVELOPMENT Co., Ltd.	YUMESHIN HOLDINGS CO., LTD.
euglena Co., Ltd.	Nisshinbo Holdings Inc.	Yushiro Chemical Industry Co., Ltd.
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