RENEWABLE
ENERGY
INSTITUTE

Corporate PPA

Latest Trends in Japan (2023 Edition)

1. Contract Structures
   - On-site PPA
   - Physical PPA
   - Virtual PPA
2. Cost Comparisons
3. Latest Projects
4. Issues & Solutions

August 2023

■ Key Factors Expanding Corporate PPAs

1. Additional Renewables

Building (adding) new renewable facilities is effective for mitigating climate change to replace electricity generated by fossil fuels. Corporate energy users make PPAs, power purchase agreements, with new facilities to procure additional renewable electricity to consume in offices, stores and factories for the long term.

2. Solar Cost Reduction

Many of new renewable facilities in Japan are powered by solar. The generation cost declined in the last 10 years but increased in 2022 due to equipment shortages by the impact of COVID-19. It is still competitive against fossil fuels and nuclear power. Corporate PPAs by solar, particularly on-site, provide electricity at lower prices.

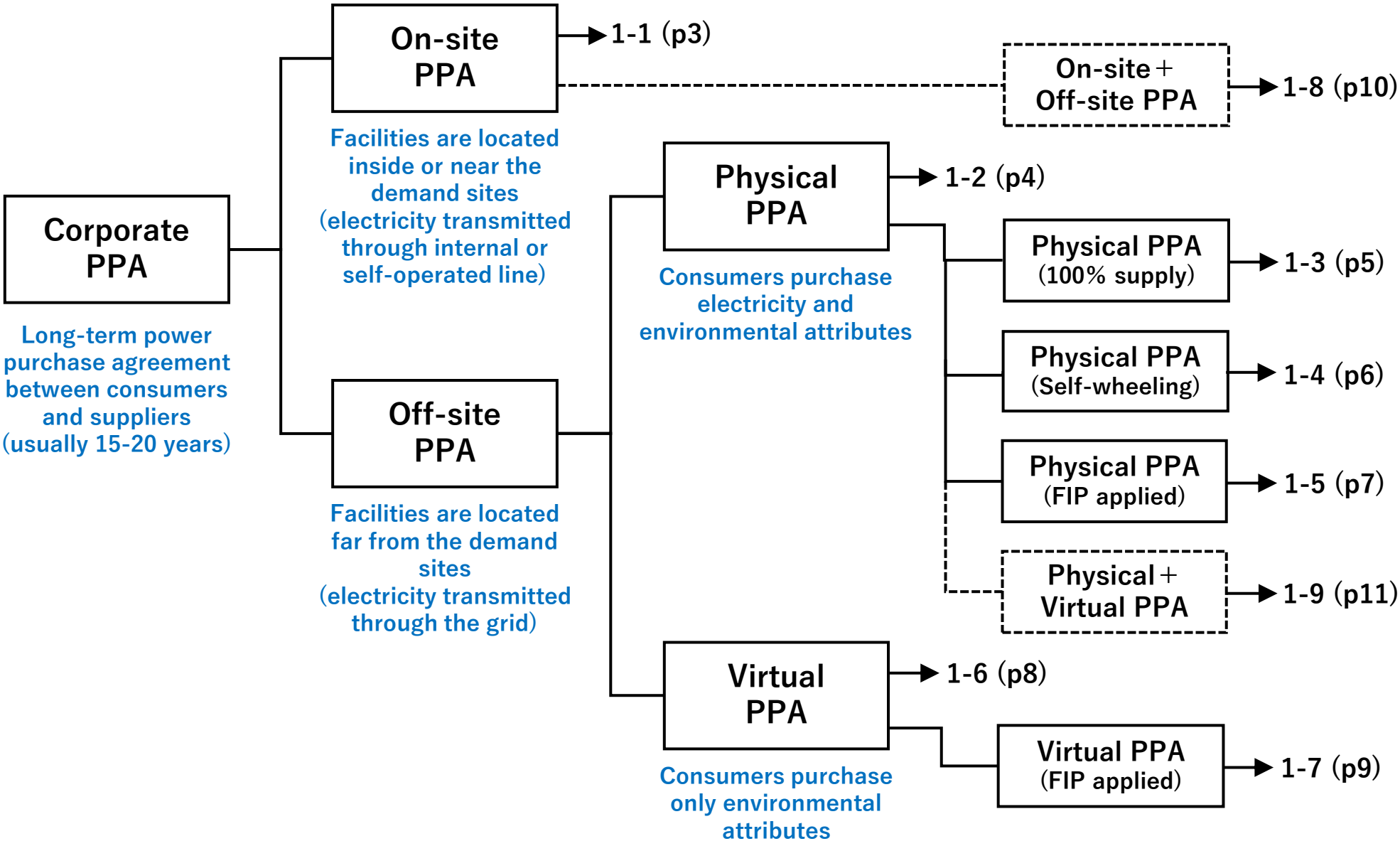
3. Electricity Price Increase

Prices of fossil fuels soared since late 2021 globally. Regular tariffs of electricity significantly increased in Japan due to the dependence on imported fossil fuels. Fuel surcharges increased nearly JPY10/kWh in 2022. Corporate energy users can reduce both CO_2 emissions and electricity costs by making corporate PPAs.

4. Feed-in Premium

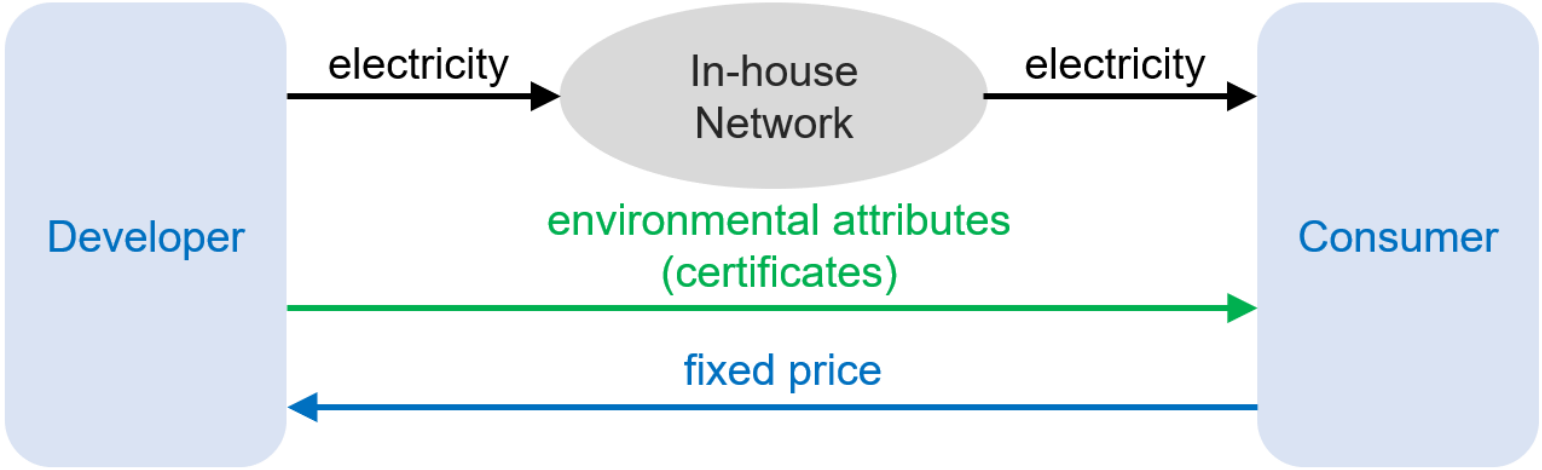
Feed-in Premium (FIP) program started in April 2022 replacing Feed-in Tariff (FIT) to support new development of renewable facilities. Under the FIP, developers need to sell electricity and environmental attributes at their own risk. Corporate PPAs provide opportunities and benefits for both developers and energy users.

■1 Options for Corporate PPAs



■1-1 Contract Structure of On-site PPA

On-site PPAs are made between consumers and developers. Consumers provide spaces to install facilities and purchase generated electricity and environmental values at fixed prices.

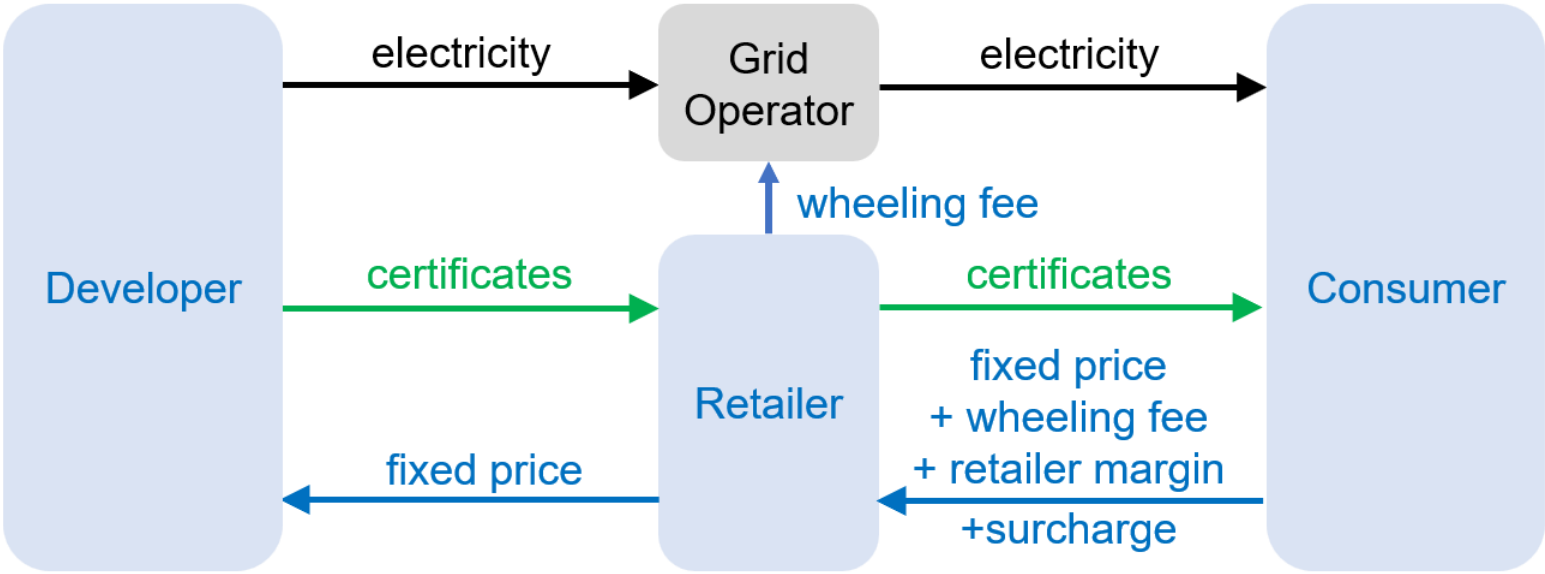


Refer to 2-1 (p12) on a cost comparison of on-site PPAs and regular tariffs.

Features	Benefits	Issues
●Consumers provide developers with spaces on the roof-top of buildings or lands in the demand sites (or adjacent sites connected with self-operated transmission lines) ●The installation, operation and maintenance of generation facilities are outsourced to developers.	●Consumers are not responsible for the installation and operation of the facilities (not like self-generation). ●Wheeling fees and renewable surcharges are not imposed. ●Consumers can take over the facilities without extra costs when the contract is completed.	●The scale of generation facilities is usually small due to limited spaces. ●It is usually difficult to utilize surplus electricity (necessary to install batteries or connect with the grid).

■1-2 Contract Structure of Physical PPA

In physical PPAs, generation facilities are constructed at distant places from the demand sites. Consumers purchase generated electricity and certificates (environmental values) at fixed prices through retailers.

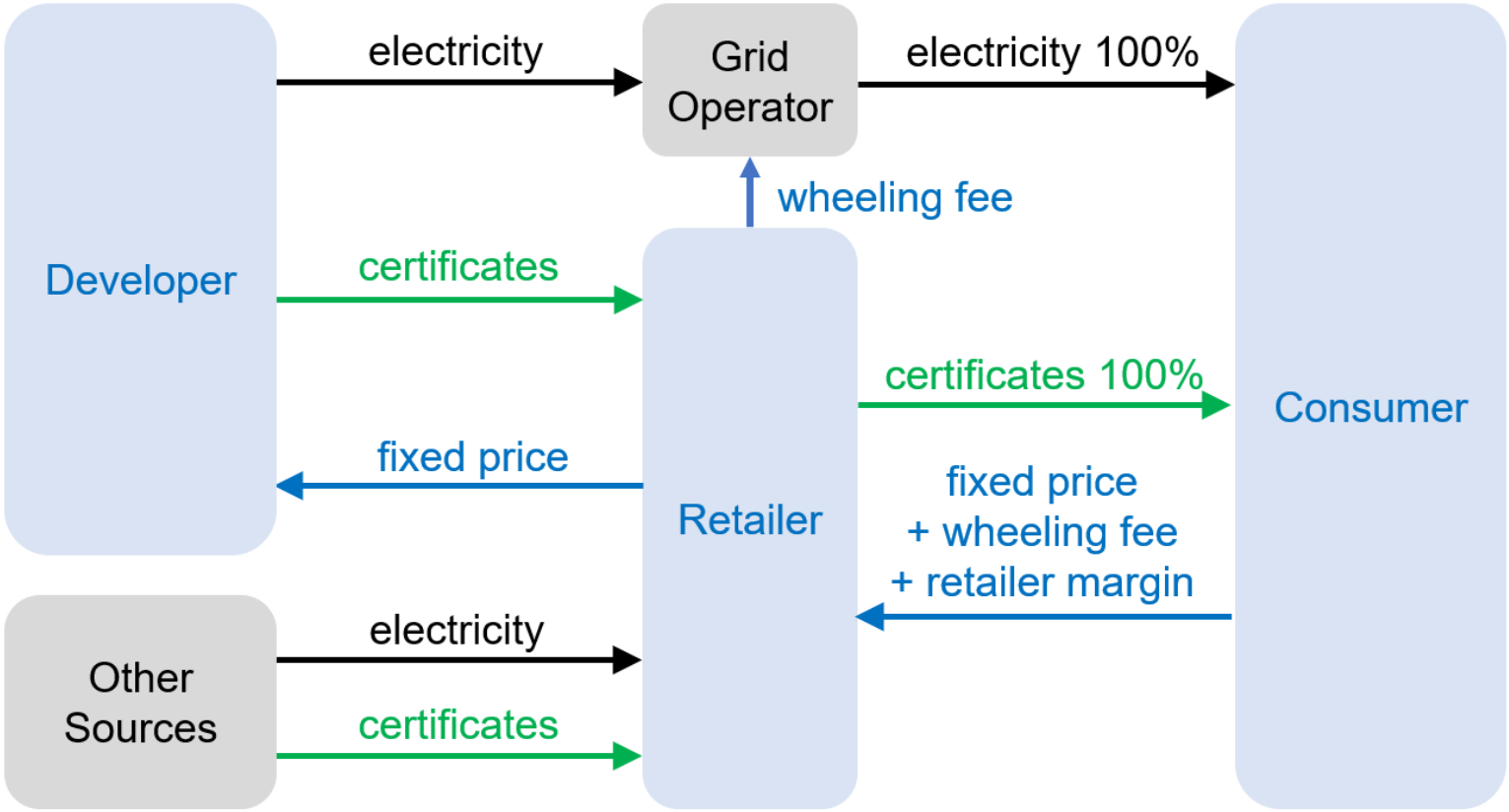


Refer to 2-2 and 2-3 (p13, p14) on a cost comparison of physical PPAs and regular tariffs.

Features	Benefits	Issues
●Developers construct generation facilities for consumers to provide electricity and certificates through retailers. ●Direct contracts without involving retailers are allowed in case consumers apply the self-wheeling program and are responsible for balancing supply and demand.	●Consumers make contracts with specific facilities and can confirm environmental impacts of electricity generation. ●Consumers can fix costs of purchasing electricity and certificates for the long term.	●Consumers need to make another contract for filling the gap between the entire demand of the sites and the supply by PPAs. ●Consumers need to fix the demand sites.

■1-3 Contract Structure of Physical PPA
(100% supply)

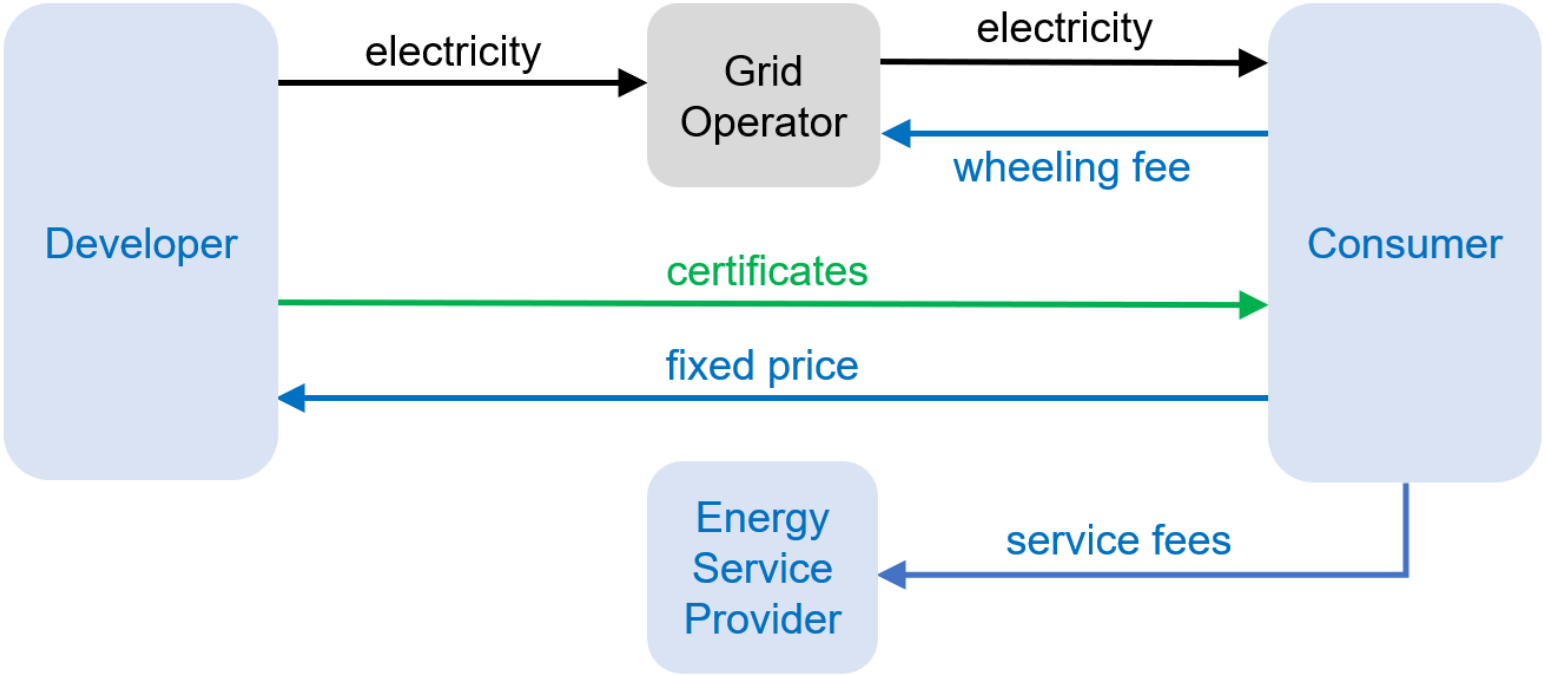
In case the entire demand of the sites is not provided by physical PPAs, retailers procure electricity and certificates from other sources to provide 100% renewable electricity to consumers.



Consumers may make contracts with retailers at fixed costs for the entire demand. The fixed costs may be higher than the case of simple physical PPAs.

■1-4 Contract Structure of Physical PPA
(Self-wheeling)

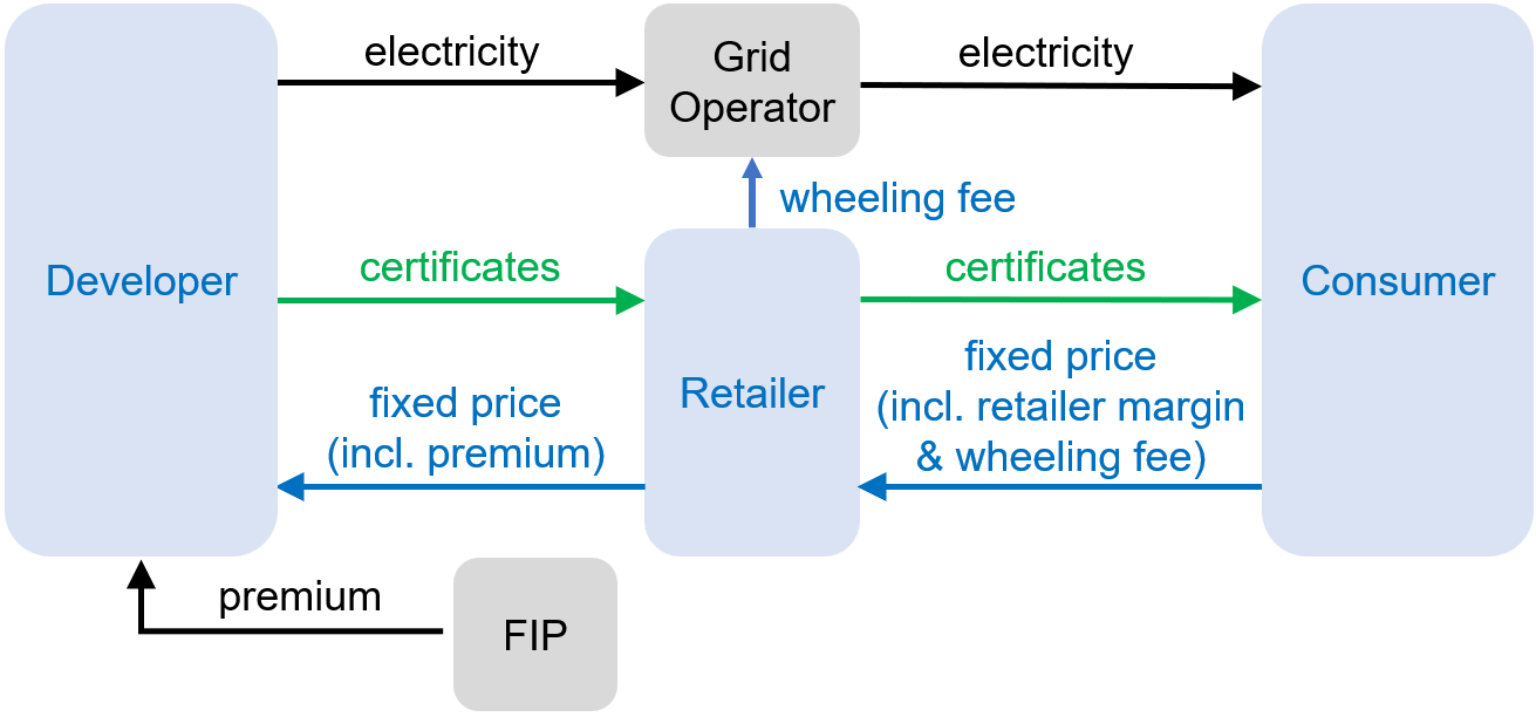
With applying the self-wheeling program, consumers can make physical PPAs directly with developers. Consumers do not have to pay renewable surcharges under the self-wheeling program but usually need to outsource tasks of balancing supply and demand to energy service providers.



For applying the self-wheeling program for physical PPAs, consumers and developers need to comply with the guidelines by Ministry of Economy, Trade and Industry, effective as of November 18, 2021.

■1-5 Contract Structure of Physical PPA
(FIP applied)

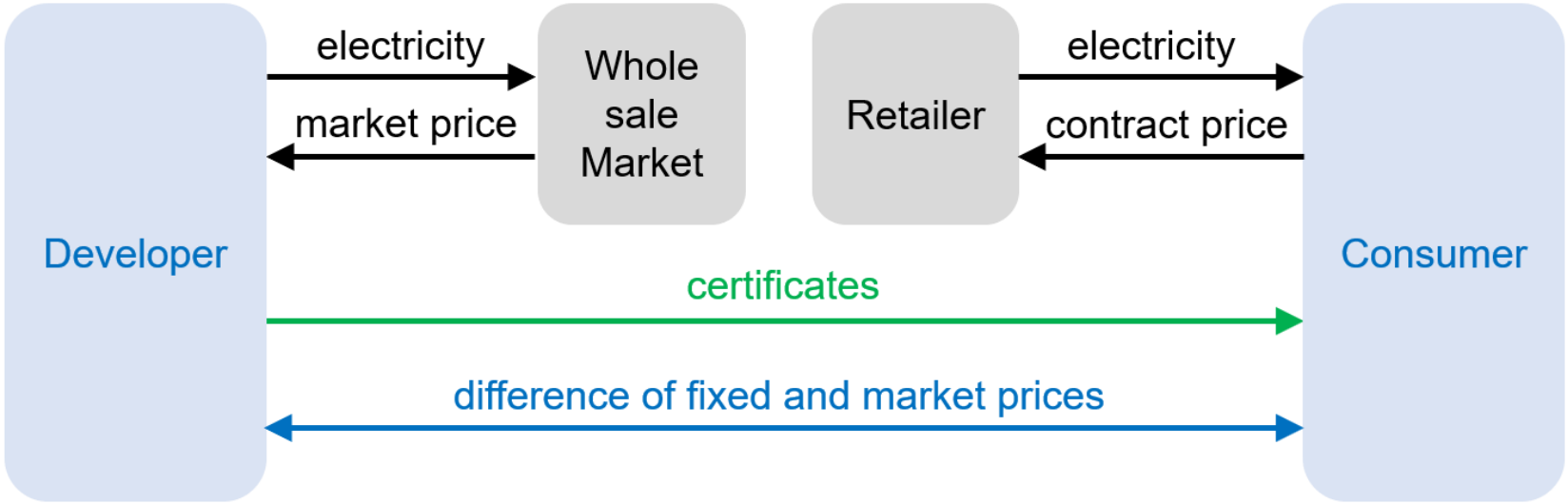
With applying the Feed-in Premium (FIP) program, developers can receive premiums based on the difference between FIP-certified fixed prices and the average wholesale market prices. Physical PPAs with generation facilities other than solar can be made at the same level of market prices.



In the FIP program, a fixed price is certified for each generation facility. Premiums are paid to developers based on the difference between the fixed price and the average wholesale market price. Developers can get market-based premiums in addition to the fixed revenue from Physical PPAs.

■1-6 Contract Structure of Virtual PPA

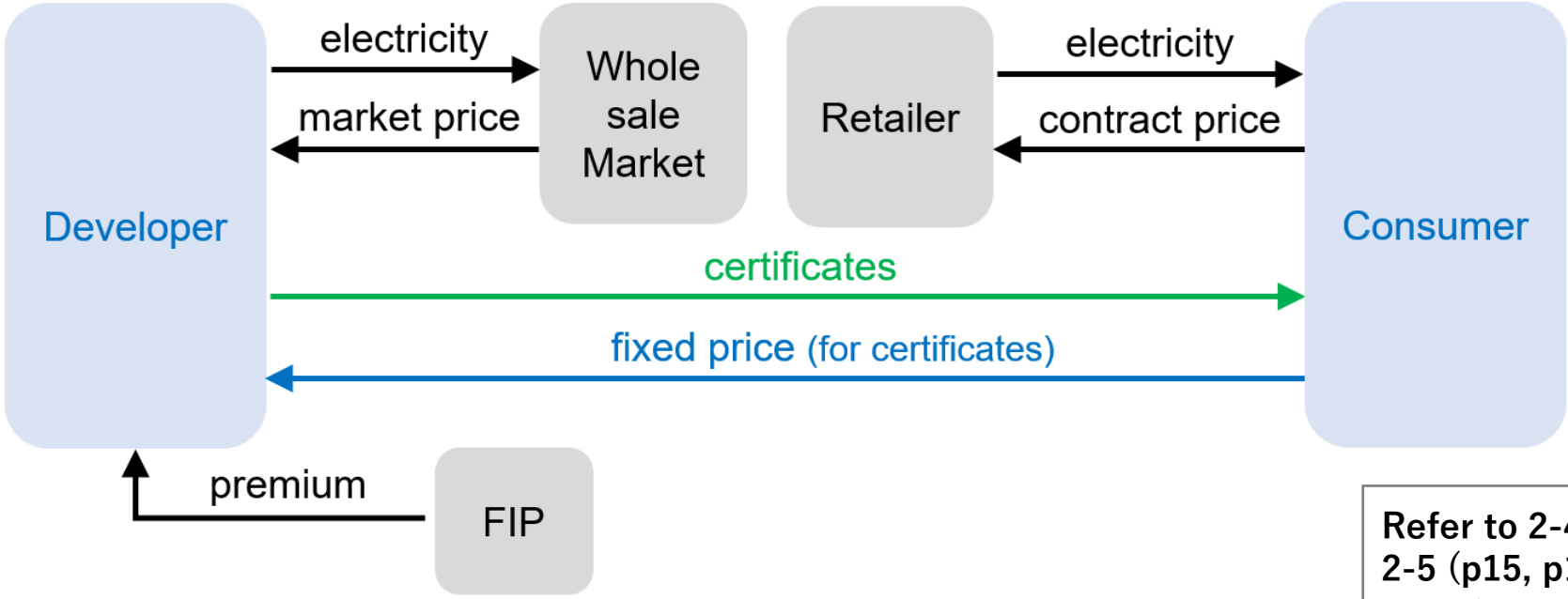
In virtual PPAs, consumers purchase certificates from developers, and electricity from retailers through another contract. Developers sell generated electricity to the wholesale market and receive or pay the difference of the fixed price and the market price.



Features	Benefits	Issues
●Developers construct new generation facilities and provide only certificates to consumers while selling electricity to the wholesale market. ●The price including electricity and certificates is fixed and the difference from the wholesale market price is paid between developers and consumers.	●Consumers do not have to change the existing electricity contracts. ●Certificates can be applied to any demand sites. ●Regardless of the demand every hour, certificates can be used for electricity consumed during the month or the year.	●Consumers need to manage with variable costs including electricity and certificates. ●Mark-to-market accounting may be applied for every monthly transactions.

■1-7 Contract Structure of Virtual PPA
(FIP applied)

Developers can receive premiums based on the difference between FIP-certified fixed prices and the average wholesale market prices. Difference for virtual PPAs becomes smaller. With the premiums, developers may make virtual PPAs with consumers at fixed prices.

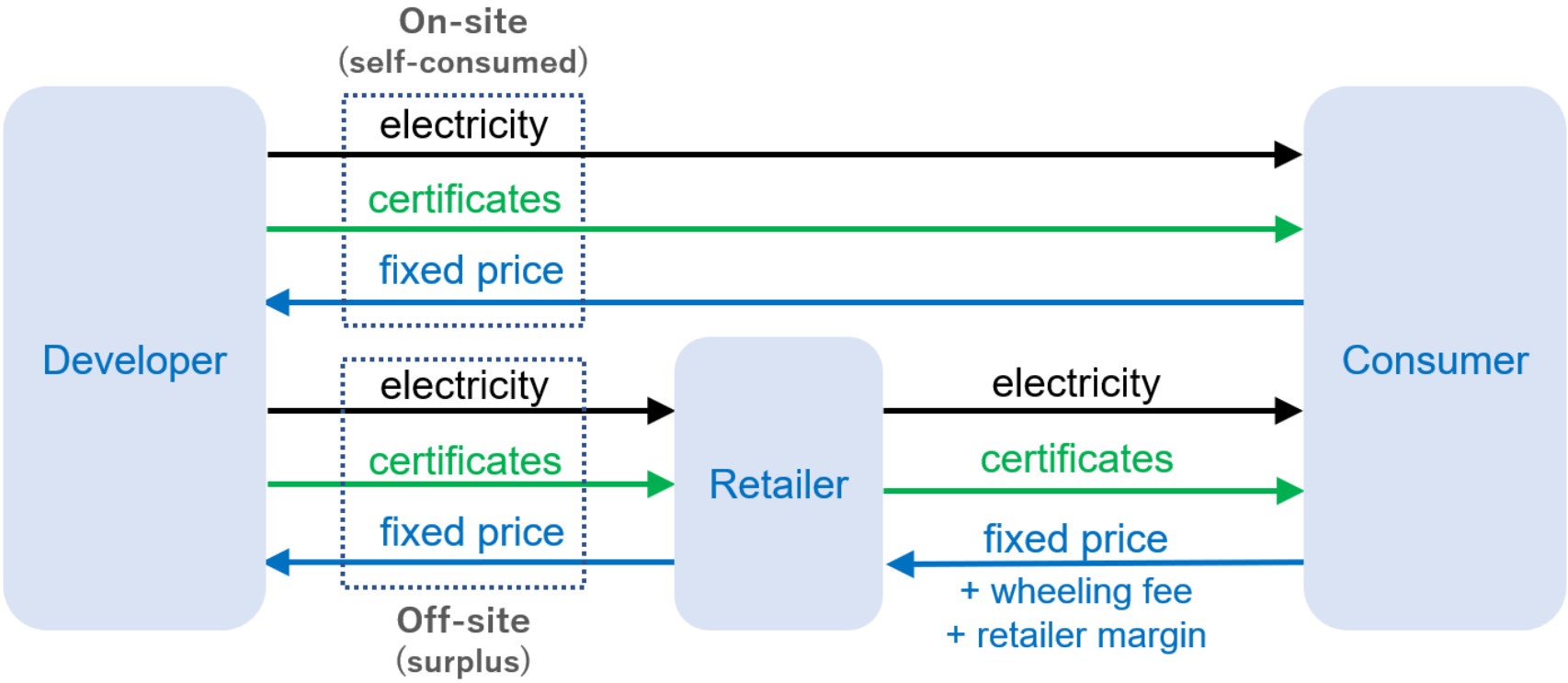


Direct virtual PPAs between developers and consumers are allowed only in case generation facilities applying the FIP program start the operation in April 2022 and beyond. Facilities without the FIT program are also allowed for direct virtual PPAs. In other cases, retailers should be involved between developers and consumers.

Refer to 2-4 and 2-5 (p15, p16) on a cost comparison of virtual PPAs and regular tariffs.

■1-8 On-site + Off-site Hybrid PPA

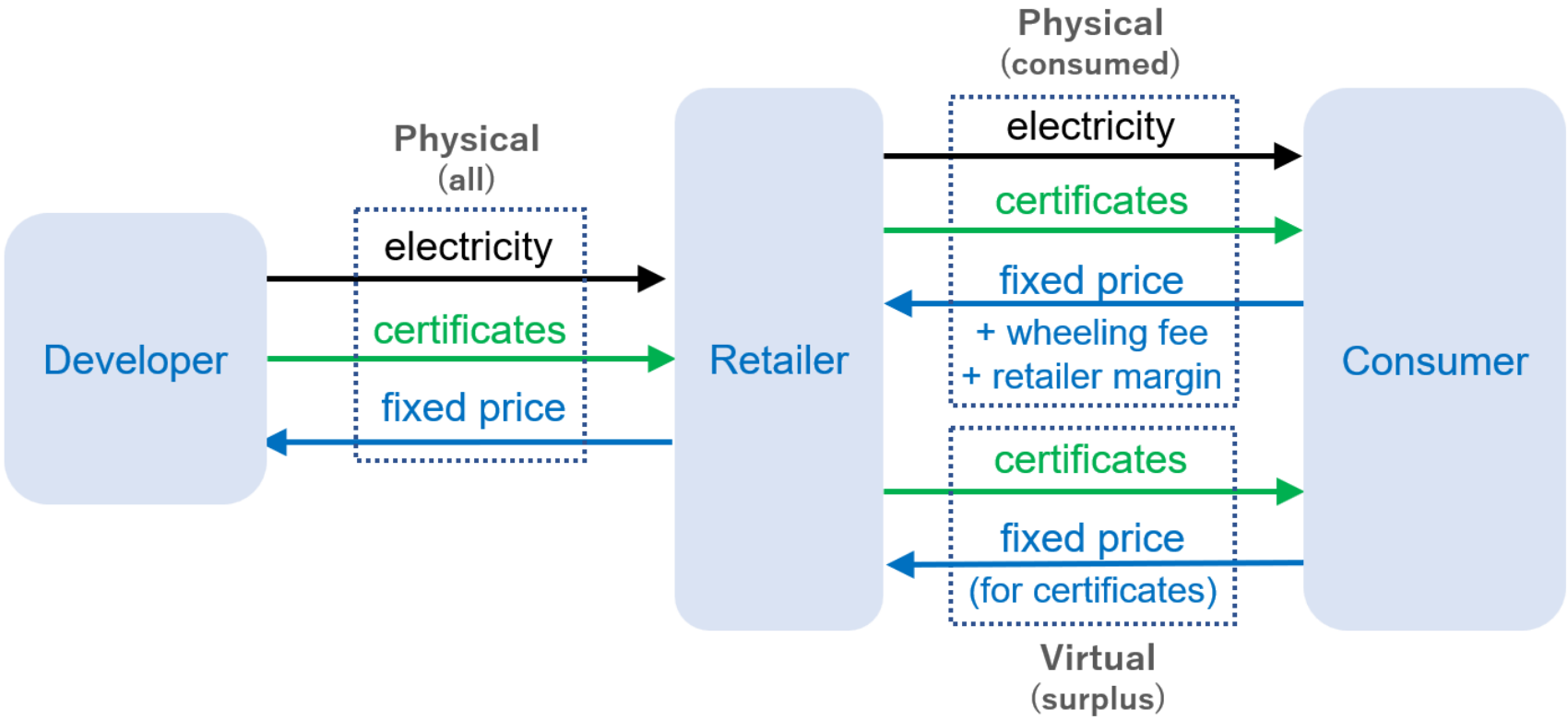
Surplus electricity and certificates from on-site PPAs can be provided to other demand sites of consumers through off-site PPAs.



Both physical and virtual PPAs can be applied for surplus electricity and/or certificates.

■1-9 Physical + Virtual Hybrid PPA

Surplus certificates from physical PPAs can be provided to consumers through virtual PPAs.



Surplus electricity is sold to other consumers by retailers without certificates.

■2-1 Costs of On-site PPA

Consumers do not have to pay wheeling fees and renewable surcharges for on-site PPAs and can use renewable electricity with less costs.

JPY/kWh	On-site PPA (solar)	Regular Tariffs (industry use, national average)		
		FY2012-2021 (average)	FY2021	FY2022
Generation	14.82	16.86	15.92	approx. 23.5
Retail	—			
Wheeling	—			
Renewable Surcharges	—	1.71	3.36	3.45
Total Consumer Costs	14.82	18.57	19.28	approx. 27

* All the costs include tax.
Costs for on-site PPA are estimated based on the FIT/FIP prices for 20-year contracts.
Regular tariffs are published by the government except for FY2022 estimated by REI (Renewable Energy Institute).

■2-2 Costs of Physical PPA

Consumer costs for physical PPAs were higher than regular tariffs in FY2021 but became competitive in FY2022.

JPY/kWh	Physical PPA (solar)		Regular Tariffs (industry use, national average)		
	High Voltage	Special High Voltage	FY2012-2021 (average)	FY2021	FY2022
Generation	13		16.86	15.92	approx. 23.5
Retail	3	1.5			
Wheeling	4	2			
Renewable Surcharges	3		1.71	3.36	3.45
Total Consumer Costs	23	19.5	18.57	19.28	approx. 27
	25.30 (w/tax)	21.45 (w/tax)			

* Costs for physical PPA excluding tax are estimated by REI for 20-year contracts.
Regular tariffs including tax are published by the government except for FY2022 estimated by REI.

■2-3 Costs of Physical PPA (with carbon price)

Consumer costs for physical PPAs can be considered reflecting carbon price to be applied in Japan in the near future.

JPY/kWh	Physical PPA (solar)		Regular Tariffs (industry use, national average)		
	High Voltage	Special High Voltage	FY2012-2021 (average)	FY2021	FY2022
Total Consumer Costs	25.30	21.45	18.57	19.28	approx. 27
Carbon Price	—		2.50 (JPY10K/ton)		
Adjusted Consumer Costs	25.30	21.45	21.07	21.78	approx. 29.5

* All the costs include tax except carbon price.
Carbon price (JPY10k/ton) is based on the average level of internal carbon pricing by major Japanese companies as of 2023.
Price impact (JPY2.50/kWh) is calculated by the national target of carbon emissions intensity of electricity for FY2030 at 0.250kg/kWh.

■2-4 Costs of Virtual PPA

Consumer costs for virtual PPAs depend on the wholesale market prices which are relatively low in the daytime.

<table>
<tr><th rowspan="2">JPY/kWh</th><th colspan="2">Virtual PPA
(solar)</th><th colspan="3">Regular Tariffs
(industry use, national average)</th></tr>
<tr><th>High Voltage</th><th>Special High Voltage</th><th>FY2012-2021
(average)</th><th>FY2021</th><th>FY2022</th></tr>
<tr><td>Generation</td><td colspan="2">14.3－Market Prices
(for certificates)</td><td rowspan="3">16.8</td><td rowspan="3">15.92</td><td rowspan="3">approx.
23.5</td></tr>
<tr><td>Retail</td><td colspan="2" rowspan="3">Regular Tariffs</td></tr>
<tr><td>Wheeling</td></tr>
<tr><td>Renewable Surcharges</td><td>1.71</td><td>3.36</td><td>3.45</td></tr>
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＋Regular Tariffs</td><td>18.57</td><td>19.28</td><td>approx.
27</td></tr>
</table>

* All the costs include tax.
Generation cost is estimated by REI for 20-year contracts.
Regular tariffs including tax are published by the government except for FY2022 estimated by REI.

■2-5 Costs of Virtual PPA (FIP applied)

Virtual PPAs may be made at fixed costs for certificates in case the generation facilities are certified by Feed-in Premium (FIP) and the developers can receive premiums based on the wholesale market prices.

JPY/kWh	Virtual PPA (solar)		Regular Tariffs (industry use, national average)		
	High Voltage	Special High Voltage	FY2012-2021 (average)	FY2021	FY2022
Generation	1.1 (for certificates)		16.8	15.92	approx. 23.5
Retail	Regular Tariffs				
Wheeling					
Renewable Surcharges			1.71	3.36	3.45
Total Consumer Costs	Regular Tariffs +1.1		18.57	19.28	approx. 27

* All the costs include tax.
Costs for Certificates (JPY1.1/kWh) is based on the average level of the latest transactions.

■3 Latest Projects
(Off-site PPAs, 1MW＋, Aug 2022 - Jul 2023)

Consumer	Retailer	Developer	Capacity	Supply	Term
Sony Group	*(Virtual PPA)*	OTS	2MW	Nov 2022	20 years
Nippon Life Insurance	Kansai Electric Power	KPRE	2MW	Apr 2023	20 years
Tokyu	Tokyu Power Supply	GDsPJ	9MW	*UD*	*UD*
Ebara	Ebara Environmental Plant	Hanwha Q Cells Japan etc.	8MW	Mar 2023	8 years
Shizuoka Bank	Chubu Electric Power Miraiz	Chubu Electric Power	2MW	Sep 2023	*UD*
Hokuriku Bank	Hokuriku Electric Power	Hokuriku Electric Power Biz Energy Solution	3.1MW	Summer 2023	*UD*
Mizuho Bank	TEPCO Energy Partner	Advance	7.5MW	*UD*	*UD*
Tokai RIka	Chubu Electric Power Miraiz	Chubu Electric Power Miraiz	2.2MW	Dec 2022	*UD*
Ricoh	*(Virtual PPA)*	Kamisato Construction	1.3MW	Aug 2023	*UD*
OSG	Chubu Electric Power Miraiz	Agri-Gascom	4.5MW	Spring 2023	20 years
Tokyu Construction	*(Virtual PPA)*	Clean Energy Connect	4MW	Mar 2023	20 years
NTT Group	NTT Anode Energy	Clean Energy Connect	70MW	by April 2024	30 years
Amazon	*UD*	Clean Energy Connect	70MW	by Mar 2025	*UD*
Hakuhoukai Group	Updater	Smart Blue etc.	7MW	Apr 2023	20 years
Mazda, Toyo Sheet	Chugoku Elecric Power	Choshu Industry	4.9MW	Apr 2023	*UD*
Takashimaya	Digital Grid	Tokyu Land	4MW	Apr 2023	2 years
Kao	*(Virtual PPA)*	Mizuho Leasing	15.6MW	Jul 2023	*UD*
Murata Manufacturing	*(Virtual PPA)*	Renova	115MW	by Mar 2024	*UD*
Amazon	*UD*	KR Energy #1	31MW	Apr 2023	*UD*
JR West	Kansai Electric Power	Kansai Electric Power	5.5MW	by Mar 2024	*UD*
Yasuda Real Estate	Renewable Japan	Renewable Japan	2.7MW	*UD*	*UD*
Tokyo Gas	Tokyo Gas	Tokyo Gas Engineering Solutions	1.7MW	by Mar 2024	*UD*
Hokkaido Coca-Cola Bottling	Hokkaido Electric Power	HARE Hare	1MW	*UD*	*UD*

UD: Undisclosed

*** Information from the official announcement.**

■4 Issues and Solutions

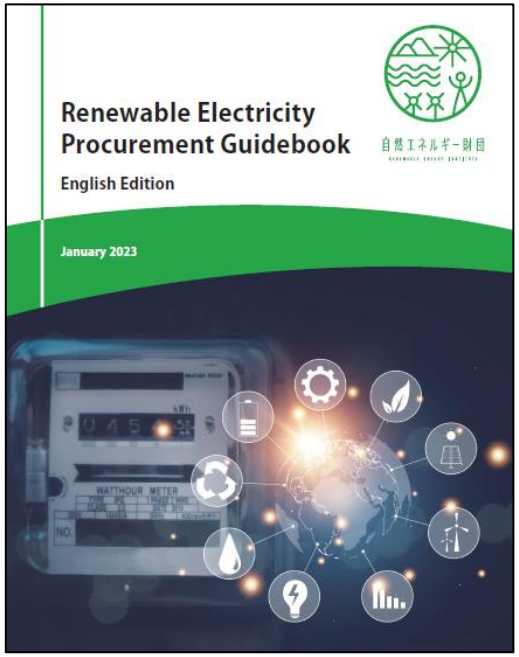
There are several typical issues for accelerating corporate PPAs in Japan. Political support for promoting renewable energy nationwide is required.

Issue		Key Solutions
Construction Sites	● Construction sites for new generation facilities are limited.	[Policy] Deregulations of land usage [Developer] Aggregation of small spaces [Consumer] Usage of owned spaces
Grid Connection	● Connecting new generation facilities to the grid is difficult, and the connecting costs may be very high.	[Policy] Enhancement of the grid [Grid Operator] Improvement of operation [Developer] Construction of distributed low-voltage generation facilities
Curtailment	● Temporary shutdown are required in case of grid congestion or oversupply.	[Policy] Revision of the dispatching rule [Grid Operator] Improvement of forecast [Consumer] Option of hydro and geothermal
Long-term Contract	● Risks of facility troubles and other unpredictable events may occur during the contract term.	[Developer] Purchase of damage insurance [Consumer] Addition of midterm cancellation [Financial Inst.] Insurance for corporate PPA

[Reference]

Renewable Electricity Procurement Guidebook

January 2023



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