Final Report for Activity 2

-Means for the local production of power for local consumption in a post-FIT-

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1. Introduction

1.1 Background and purposes

- Japan's feed-in-tariff program for electricity generated by residential photovoltaic systems has been phased out since November 2019. It is now an urgent task to arrange "local production for local consumption (LPLC)" for electricity generated by such photovoltaic systems (hereinafter "ex-FIT") as part of the drive to promote LPLC for electricty generated by renewable energy facilities.
- The City of Yokohama finds it essential to promote LPLC of renewable energies (hereinafter "renewables") to achieve decarbonization. This project is aimed at "exploring methods of promoting LPLC for ex-FIT and formulating specific projects based on the considered methods."

1.2 This document's structure and positioning

- Main document
  Yokohama_【Report】ex-FIT LPLC consideration project.doc《This document》
- Appendices
  Yokohama_【Appendix｜Figures and Tables】ex-FIT LPLC consideration project.pptx
  Yokohama_【Appendix｜Tasks and Distribution of Roles】ex-FIT LPLC consideration project.xlsx
  Yokohama_【Appendix｜Current Status Investigation back data】ex-FIT LPLC consideration project.xlsx

2. Investigation into the current status of ex-FIT

2.1. Overview (overall)

- An investigation was conducted on six items that are required in considering the methods for promoting LPLC of ex-FIT.
- The "premise / definitions," "research method" and "result summary" were compiled for each of the investigation items (Items ①～⑥).

Table 1 | Premise, definition and research method

① Research into the number of ex-FIT cases in Yokohama (* | Estimate)		
	Premise and definitions	• Investigating the "number of ex-FIT cases," their "system capacity*" and "surplus energy*" in Yokohama • Research period: "2019 – 2023" and "forecast for 2024 onwards"
	Research method	• Aggregating TEPCO Energy Partner (hereinafter TEPCO EP)in-house data • Estimation - Calculating based on TEPCO EP in-house data and various organizations' official figures
	Result summary	• The number of ex-FIT cases in Yokohama peaked in FY2019 at 7,500 and is expected to fluctuate at around 3,000 – 5,000 per annum from FY2020 onwards.
② Research into trends in ex-FIT market share		
	Premise and definitions	• Investigating "ex-FIT buyback market share" in terms of the number of cases in the TEPCO territory • Estimating the "number of ex-FIT buyback cases," "system capacity*" and "surplus energy*" of TEPCO EP, which has the largest market share
	Research method	• Examining an industry newspaper - Gas Energy News • Estimation - Calculating based on TEPCO EP in-house data and various organizations' official figures
	Result summary	• TEPCO EP has approx. 90% market share in ex-FIT buyback, while the rest has approx. 10% market share combined (including PPSs and housing manufacturers).
③ Research into options offered by retail electricity suppliers that buy back ex-FIT nationwide		
	Premise and definitions	• Investigating "options offered by retail electricity suppliers that buy back ex-FIT" • Identifying cases that may be useful as references in considering LPLC options for renewable energies from the following perspectives: i. Options other than plain buyback ii. Options in partnership with local governments iii. Options incorporating sale within the respective local communities
	Research method	• Online research

		- The "list of electricity suppliers" posted on the website of the Agency for Natural Resources and Energy, as well as the websites of applicable electricity suppliers
	Result summary	• The list posted by the Agency for Natural Resources and Energy includes 54 companies that buy back ex-FIT, offering 105 options. • This includes 8 LPLC options, offered by five companies.

*Estimation

④	Research into the uptake of batteries by households that own photovoltaic systems	
	Premise and definitions	• Investigating the "uptake of batteries nationwide and in similar cities among households that own photovoltaic systems • Estimating the uptake of batteries in Yokohama
	Research method	• Online research - Conducting a survey on the uptake of batteries nationwide and in similar cities • Estimation - Using the results of the above survey to estimate the status of battery uptake in Yokohama
	Result summary	• About 12-14% of households with photovoltaic systems have installed batteries nationwide and in a similar city (Kawasaki) • Yokohama is estimated to have a similar or slightly lower level of battery uptake.
⑤	Household responses to ex-FIT	
	Premise and definitions	• Defining household intentions and responses to the phase-out of FIT and investigating the intentions of households nationwide concerning the end of FIT
	Research method	• Online research - Conducting a survey on intentions after the end of FIT
	Result summary	• 20%+ of respondents want to consume all the electricity they generate at home, while over 50% want to acquire a battery and other facilities. • Over 40% are focusing on buyback pricing in choosing who to sell their surplus electricity to.
⑥	Response to ex-FIT in other cities	
	Premise and definitions	• Investigating local governments' LPLC initiatives and home consumption support (subsidization, etc.) concerning ex-FIT
	Research method	• Online research - Website of the Agency for Natural Resources and Energy - Websites of industry newspapers
	Result summary	• The cities of Shizuoka and Hamamatsu have built a mechanism of consuming ex-FIT electricity generated locally within the respective cities. • The City of Kawasaki and the Tokyo Metropolitan Government subsidize household purchase of batteries and residential fuel cells.

2.2. Investigation results for each reseach item

① Research into the number of ex-FIT cases in Yokohama

【Premise and definitions】

- Investigating the “number of ex-FIT cases,” their “system capacity*” and “surplus energy*” in Yokohama　*Estimation
- Research period: “2019 – 2023” and “forecast for 2024 onwards”

【Research method and data sources】

- Aggregating TEPCO data
  - Number of ex-FIT cases
- Estimating based on the following conefficients
  - System capacity　4.6kW

    Average system capacity per household[*1]
  - Surplus electricity generated　3,220kWh

    Average electricity generated per household per annum (4,600kWh)[*2]× Ratio of surplus electricity (70%)[*3]

*1 | ”Current status of photovoltaic power generation” by the Japan Photovoltaic Energy Association
https://www.meti.go.jp/shingikai/santeii/pdf/039_01_00.pdf

*2 | Official figures released by the Japan Photovoltaic Energy Association and figures calculated in *1
https://taiyoko-ch.com/investment/electric-generating-capacity.html#:~:text=%E5%A4%AA%E9%99%BD%E5%85%89%E7%99%BA%E9%9B%BB%E3%81%AB%E9%96%A2%E3%81%99%E3%82%8B%E8%AA%BF%E6%9F%BB,%E7%B4%842.7kWh%E3%81%A8%E3%81%AA%E3%82%8A%E3%81%BE%E3%81%99%E3%80%82

*3 | ”Committee Chairman’s proposal on buyback price and period for 2020” by METI
https://www.meti.go.jp/shingikai/santeii/pdf/055_01_02.pdf

【Results】

- The number of ex-FIT cases in Yokohama peaked in FY2019 at 7,500, is expected to fluctuate at around 3,000 – 5,000 per annum in FY2020 – 2023, and reach around 6,800 in cumulative total from FY2024 onwards.
- The increase of remote work could reduce the amount of surplus electricity.

Figure 1 | Number of ex-FIT households in Yokohama and estimation in the amount of surplus electricity

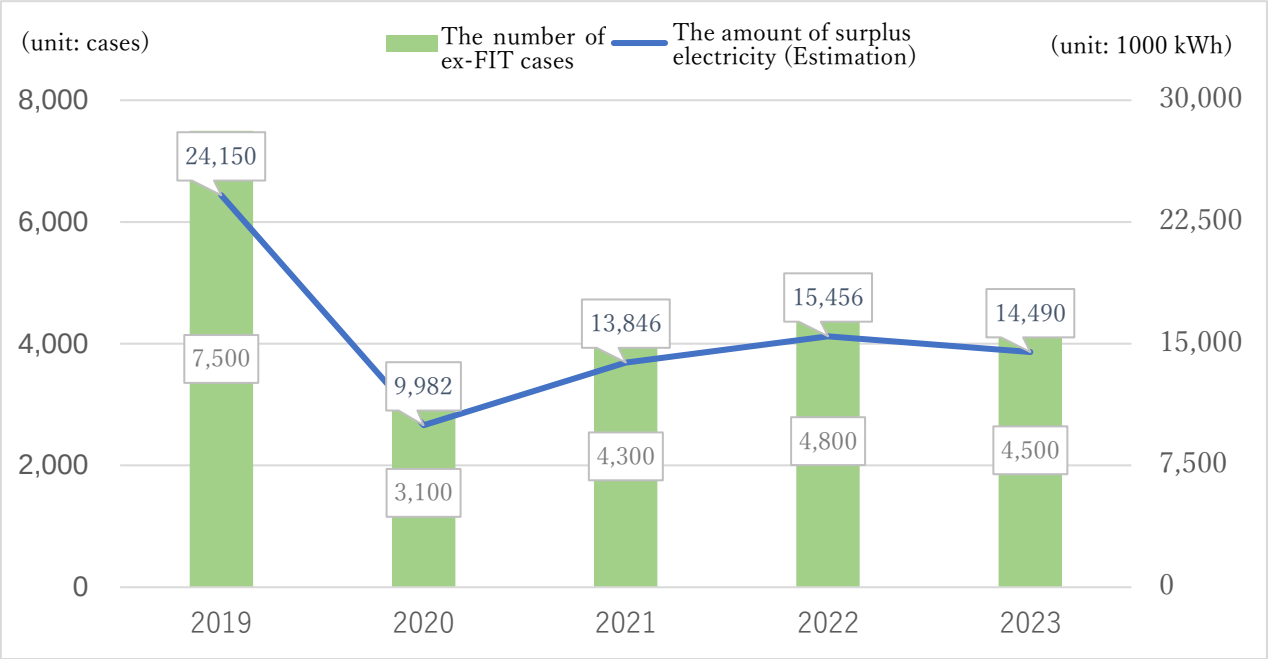


Table 2 | The number of ex-FIT cases, estimated surplus electricity and estimated system capacity in Yokohama

	2019	2020	2021	2022	2023
Number of ex-FIT cases [cases]	7,500	3,100	4,300	4,800	4,500
System capacity [kW]	34,500	14,260	19,780	22,080	20,700
Surplus electricity [thousand kWh]	24,150	9,982	13,846	15,456	14,490

※Surplus electricity may decline due to the increase of remote work. (The impact of remote work is not reflected to Figure 1 and Table 2.)

② Research into trends in ex-FIT market share

【Premise and definitions】

- Investigating “ex-FIT buyback market share” in terms of the number of cases in the TEPCO territory (as of September 2020)
- Compiling the “number of ex-FIT buyback cases,” “system capacity*” and “surplus energy*” of TEPCO EP, which has the largest market share
  * Estimation
- Examining buyback offers of major electric utilities other than TEPCO EP

【Research method and data sources】

- Examinig an industry newspaper
  - Calculating ex-FIT buyback market share based on an article of Gas Energy News (September 7, 2020)
- Estimating based on the following conefficients
  - System capacity 4.6kW
    Average system capacity per household[*1]
  - Surplus electricity generated 3,220kWh
    Average electricity generated per household per annum (4,600kWh)[*2]× Ratio of surplus electricity (70%)[*3]

*1 | ”Current status of photovoltaic power generation” by the Japan Photovoltaic Energy Association
https://www.meti.go.jp/shingikai/santeii/pdf/039_01_00.pdf

*2 | Official figures released by the Japan Photovoltaic Energy Association and figures calculated in *1
https://taiyoko-ch.com/investment/electric-generating-capacity.html#:~:text=%E5%A4%AA%E9%99%BD%E5%85%89%E7%99%BA%E9%9B%BB%E3%81%AB%E9%96%A2%E3%81%99%E3%82%8B%E8%AA%BF%E6%9F%BB,%E7%B4%842.7kWh%E3%81%A8%E3%81%AA%E3%82%8A%E3%81%BE%E3%81%99%E3%80%82

*3 | ”Committee Chairman’s proposal on buyback price and period for 2020” by METI
https://www.meti.go.jp/shingikai/santeii/pdf/055_01_02.pdf

【Results】

- Gas Energy News quoted (on September 7, 2020) TEPCO EP's renewable energy promotion manager, Nobuyoshi Katsuoka, as saying that TEPCO EP currently buys back approx. 400 million – 500 million Wh of electricity, that the Tokyo metropolitan area will have around 1.9 billion Wh of ex-FIT by 2025, and that TEPCO EP plans to secure around 90% of it. TEPCO EP's market share in ex-FIT buyback in the TEPCO territory is estimated to be around 90%, while the rest has approx. 10% market share combined.

Figure 2 | Market share for ex-FIT buyback in the TEPCO territory

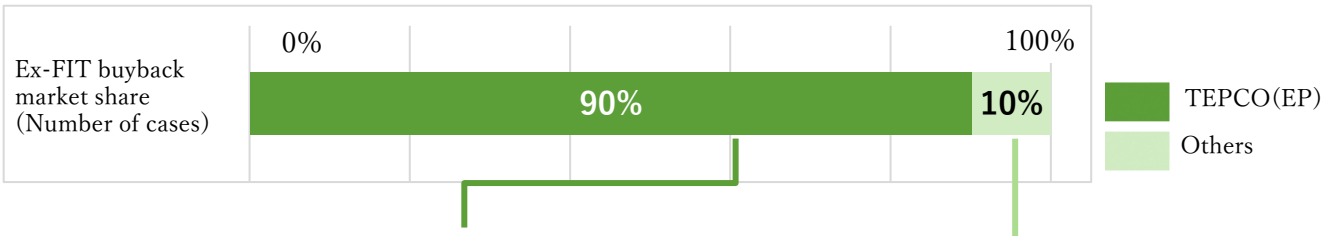


Table 3 | TEPCO (EP) capturing ex-FIT

Number of cases [cases]	180,000
System capacity (estimate) [kW]	828,000
Buyback electricity (estimate) [thousand kWh]	579,600

Table 4 | Other main PPSs, housing manufacturers and their buyback offers

Main businesses		Buyback offers	Buyback unit price [incl. tax] (TEPCO territory)
Category	Name	Name and overview	
PPS	Smart Tech	Smart FIT	¥11.5/kWh
	ENEOS	ENEOS PV buyback service	¥11.0/kWh
	Tokyo Gas	PV buyback plan	¥9.5/kWh
	Osaka Gas	Buyback plan	¥9.5/kWh
		Electricity set plan	¥10.0/kWh
		Electricity set plan + Style E option	¥10.5/kWh
Housing manufacturer	Toyota Home	PV buyback service (In collaboration with Global Engineering)	¥9.5/kWh
	Sumitomo Forestry	SFC Denki (In collaboration with Family Net Japan)	¥11.0/kWh
	Sekisui House	Ex-FIT buyback plan	For Sekisui House owners (In collaboration with Family Net Japan)	¥11.0/kWh
	Sekisui Heim	Smart Heim Denki	PV-only customers	¥9.0/kWh
		Smart Heim Denki	PV + battery customers (For customers who have purchased / installed battery + VtoH system at Sekisui Heim or Sekisui FamiS properties nationwide)	¥12.0/kWh

③ Research into options offered by retail electricity suppliers that buy back ex-FIT

【Premise and definitions】

- Investigating "options offered by retail electricity suppliers and other businesses that buy back ex-FIT nationwide"
- Identifying cases that may be useful as references in considering LPLC options for renewable energies from the following perspectives
  - i. Options other than plain buyback
  - ii. Options in partnership with local governments (including collaborations initiated by local governments)
  - iii. Options incorporating sale within the respective local communities

【Research method and data sources】

- Online research
  - The list of electricity suppliers, posted on the website of the Agency for Natural Resources and Energy
    https://www.enecho.meti.go.jp/category/saving_and_new/saiene/solar-2019after/retail_electricity_utility.html
  - Websites of the businesses listed on the above website

【Results】

- The list posted by the Agency for Natural Resources and Energy includes 54 companies that buy back ex-FIT, offering 105 options.
- ii . There are five businesses collaborating with local governments, offering eight options. They include iii. three businesses incorporating sale within the respective local communities offering six options.
  (See Table 5 for the overview of ii. options offered in collaboration with local governments)

Figure 3 | Number of retail electricity suppliers that buy back ex-FIT and options they offer

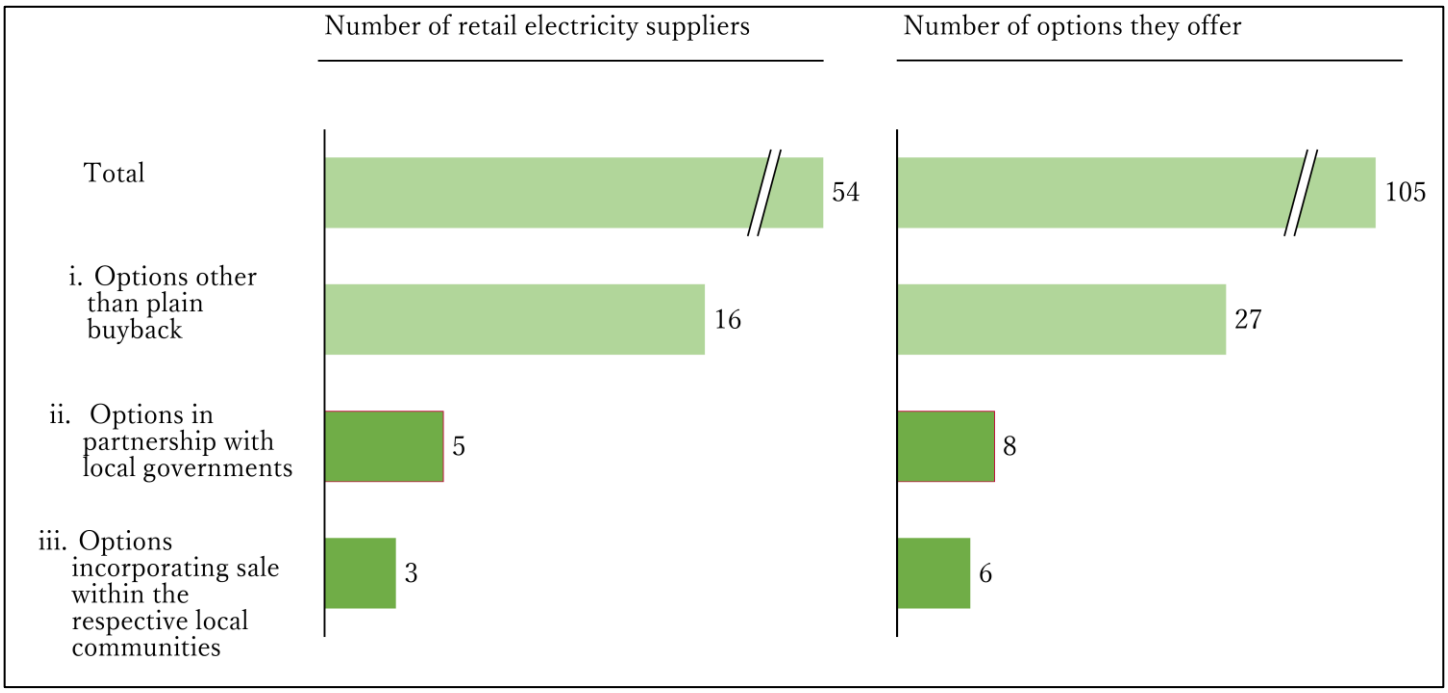


Table 5 | ii . Retail electricity suppliers in partnership with local governments and their description

#	Business name	Buyback option	Buyback unit price [incl. tax] (TEPCO territory)
		Name and description	
1	Marubeni Solar Trading	Community Support plan Offering points according to the amount of electricity generated each month by ex-FIT households (buyback electricity), and allowing subscribers to exchange the points with local delicacies	In kind (point system)
2	Chichibu PPS	Plan A Chichibu PPS buys back surplus electricity and consumes it within the Chichibu region to promote decarbonization of the local community.	¥8.7/kWh
3		Plan B Chichibu PPS buys back surplus electricity for local consumption and offers subscribers community currency equivalent to 3,000 yen (at the rate of ¥0.5/kWh per annum).	¥8.5/kWh
4	Hamamatsu Energy	Hamamatsu Energy buys back PV-generated electricity at the rate of ¥5/kWh and donates ¥5/kWh to primary and junior high schools as a contribution to the local community.	¥10.0/kWh
5	Fukaya e-Power	Fukaya e-Power buys back surplus electricity and consumes it in the City of Fukaya to achieve LPLC.	¥8.6/kWh
6	Tottori Shimin Electricity	Tottori Shimin Electricity PV surplus energy buyback service	¥8.5/kWh
7	Miyama Smart Energy	Miyama Denki ex-FIT buyback service (without contract)	¥7.7/kWh
8		Miyama Denki ex-FIT buyback service (with contract)	¥8.03/kWh

④ Research into the uptake of batteries by households that own photovoltaic systems

【Premise and definitions】

- Investigating the "uptake of batteries nationwide and in similar cities among households that own photovoltaic systems
- Estimating the uptake of batteries in Yokohama based on the results of the above investigation

【Research method and data sources】

- Using the following data obtained through online research
  - a. "Customers' opinion survey on ex-FIT" by Sekisui Chemical (n = 600) https://www.sekisui.co.jp/news/2020/__icsFiles/afieldfile/2020/03/25/200325.pdf
  - b. "Survey on the proliferation of stationary batteries and the use of aggregation services" by MRI (n = 768) https://www.meti.go.jp/meti_lib/report/H28FY/000479.pdf
  - c. "Overview of survey results concerning the expiration of FIT program for residential PV systems" by the City of Kawasai (n = 270) https://www.city.kawasaki.jp/300/page/0000106959.html
- Reflecting the above survey results and the availability of subsidization for the purchase of batteries in preparing estimation

【Results】

- About 12-14% of households with photovoltaic systems have stationary batteries installed nationwide and in the City of Kawasaki.
- The City of Kawasaki subsidizes the purchase of batteries, while the City of Yokohama does not offer such subsidization. This is why Yokohama is estimated to have a similar or slightly lower level of battery uptake.

Table 6 | Battery uptake intentions and actual uptake

#	Survey items	Survey results		Source
		Battery uptake intentions	**Actual battery uptake**	
1	Ex-FIT households nationwide (excluding Okinawa)	-	**Uptake rate: Approx. 14%** (including 11% which took up batteries in response to the end of the FIT program)	a
2	Households nationwide (including households other than ex-FIT households)	Planned uptake: 17.5% ※Ratio of those who cited specific uptake timing	**Uptake rate：5.3%**	b
3	Ex-FIT households in Kawasaki	Those considering household consumption: 19%	**Uptake rate：12% (including households with PHV and V2H)**	c

⑤ Household responses to ex-FIT

【Premise and definitions】

- Defining household intentions and responses to the phase-out of FIT and investigating the intentions of households nationwide concerning the end of FIT

【Research method and data sources】

- Using the following data obtained through online research
  - a. "8th consumer opnion survey on the liberalization of the energy market" by Dentsu (n = 588)
    https://xtech.nikkei.com/dm/atcl/news/16/032912091/#:~:text=%E9%9B%BB%E9%80%9A%E3%81%AF3%E6%9C%8822,%E8%AA%BF%E6%9F%BB%E7%B5%90%E6%9E%9C%E3%82%92%E7%99%BA%E8%A1%A8%E3%81%97%E3%81%9F%E3%80%82
  - b. "Results of a survey on households with PV systems installed" by Goodfellows (n = 967)
    https://xtech.nikkei.com/dm/atcl/news/16/022011993/?i_cid=nbpnxt_reco_atype
  - c. Results of a joint survey by Showa Shell Sekiyu and Solar Frontier (n = 1,112)
    https://xtech.nikkei.com/dm/atcl/news/16/110811670/?ST=msb
  - d. "Customers' opinion survey on ex-FIT" by Sekisui Chemical (n = 600)
    https://www.sekisui.co.jp/news/2020/__icsFiles/afieldfile/2020/03/25/200325.pdf

【Results】

- 20%+ of respondents want to consume all the electricity they generate at home, whle over 50% want to acquire a battery and other facilities.
- Over 40% are focusing on buyback pricing in choosing who to sell their surplus electricity to.

Table 7 | Survey on household situations and intentions nationwide

#	Survey items		Survey results	Source
	Lv.1	Lv.2		
1	Aware of ex-FIT	-	**74.2%** (Total of those who know details and those who have heard of it)	a
2		Those who know details	**38.8%** (Those who know details)	a
3	With intention of household consumption	-	**23.3%** (Desire to use all generated electricity at home)	a
4		Uptake intentions for batteries, hot water systems, etc.	**54%** (Desire to install batteries or heat-pump hot water systems to use all generated electricity at home)	b
5	With intention of selling surplus electricity	Understanding about buy back services	**39.8%** (Understanding that ex-FIT expands the choice of buy-back services)	c
6		Status of considering who to sell electricity to	**69%** (Including 34% who have “changed or applied for” buyback services and plans) (Including 35% who have “considered” buyback services and plans)	d
7		Choice of buyback services	**41.5%** (Desire to find a service that offers the highest buy-back price) 9.9% (Desire to continue selling electricity to the current electric utility)	a

⑥ Response to ex-FIT in other cities

【Premise and definitions】

- Investigating local governments' LPLC initiatives and home consumption support (subsidization, etc.) concerning ex-FIT

【Research method and data sources】

- Using the following data obtained through online research
  - "What lies beyond ex-FIT in initiatives by local governments and PPSs" on the website of the Agency for Natural Resources and Energy
    https://www.enecho.meti.go.jp/category/saving_and_new/saiene/solar-2019after/regional.html
  - Industry newspaper websites (New Energy News, Environmental Business Online)

【Results】

- The cities of Shizuoka and Hamamatsu have built a mechanism of consuming ex-FIT electricity generated locally within the respective cities.
- The City of Kawasaki and the Tokyo Metropolitan Government subsidize household purchase of batteries and residential fuel cells.

Table 8 | Main ex-FIT initiatives by local governments

Main ex-FIT initiatives by local governments

	Local government	Main initiatives and description
LPLC (selling within the respective local governments)	• Shizuoka City	• Established a new scheme in which the local retail electricity supplier, Suzuyo Shoji, buys back ex-FIT electricity generated by households and supplies it to local elementary / junior high schools and municipal facilities
	• Hamamatsu City	• Consumes renewal energies generated within the local region at local public facilities and private enterprises at the rate of 80% on average
	• Tottori City	• Visualizes the status of renewable energy production / consumption in the city, including ex-FIT, to promote LPLC of electricity
	• Saitama Prefecture	• Sells CO2-offset electricity, including ex-FIT, to local users under the "Sai-no Kuni" brand
Subsidy for promoting consumption at home	• Kawasaki City • Nagoya City • Tokyo, etc.	• Total budget of 25 million yen (including items other than battery) • Residential fuel cell system: 30,000 yen • Stationary lithium-ion battery system: 10,000 yen per kWh (up to 100,000 yen) (in the case of Kawasaki City)
Others	• Kawasaki City • Osaka City etc.	• Organizes seminars Offering ex-FIT description, options after the end of FIT program (household consumption, buyback, etc.)

3 Exploring ways of promoting LPLC for ex-FIT

3.1 Consideration steps

- Analyzing the current status, based on the desirable state and survey results, so as to explore the direction for solutions
- Examining measures relevant to four methods in line with the direction for solutions, and assessing each of the methods in terms of the effectiveness and necessity of the solutions

【Overview of steps for examining promotion methods】

I. Analyzing the current status and exploring the direction for solutions
Based on the analysis of the current status in reflection of the desirable state and survey results, present the direction of required solutions for "A. consumption of ex-FIT at home" and "B. consumption of (locally produced) ex-FIT, sold to electricity suppliers, within the local community."

II. Exploring and assessing the method for promoting LPLC
Sort measures, applicable to the "informative method / fiscal method / regulatory method / behavioral design method" in line with the direction for solutions, based on "product planning and service design / promotion" and evaluate methods that are highly effective in solving issues and methods essential for solutions.

III. Selecting the target for drawing up project plans
Based on the evaluation results, select tasks and methods subject to project planning.

Figure 4 | Overview of steps for examining promotion methods

Implementation steps	Description
I . Analyzing the current status and exploring the direction for solutions	• Analyzing the current status based on the desirable state and survey results • Based on the analysis of the current status, presenting the direction of required solutions for "A. consumption of ex-FIT at home" and "B. consumption of (locally produced) ex-FIT, sold to electricity suppliers, within the local community
II . Exploring and assessing the method for promoting LPLC	• Sorting measures, applicable to four methods in line with the direction for solutions - 4 methods | Informative method / fiscal method / regulatory method / behavioral design method - 2 purposes | Product planning and service design / promotion • Evaluating methods that are highly effective in solving issues and methods essential for solutions
III. Selecting the target for drawing up project plans	• Selecting tasks and methods subject to project planning, based on the evaluation results

3.2 Step Ⅰ | Analyzing the current status and exploring the direction for solutions

Based on the analysis of the current status in reflection of the desirable state and survey results, present the direction of required solutions for "A. consumption of ex-FIT at home" and "B. consumption of (locally produced) ex-FIT, sold to electricity suppliers, within the local community."

【Desirable state】

A) Promoting home consumption

Ex-FIT households in the city have expressed their intention of increasing home use of surplus electricity. They also own facilities that can increase home consumption.

B) Local consumption of ex-FIT electricity

Ex-FIT households in the city are selling surplus electricity to retail electricity suppliers promoting LPLC. These supplies offer LPLC options for local power users in the city. In addition, these power users in the city are opting to LPLC options to purchase ex-FIT electricity generated in the city.

【Direction of solutions】

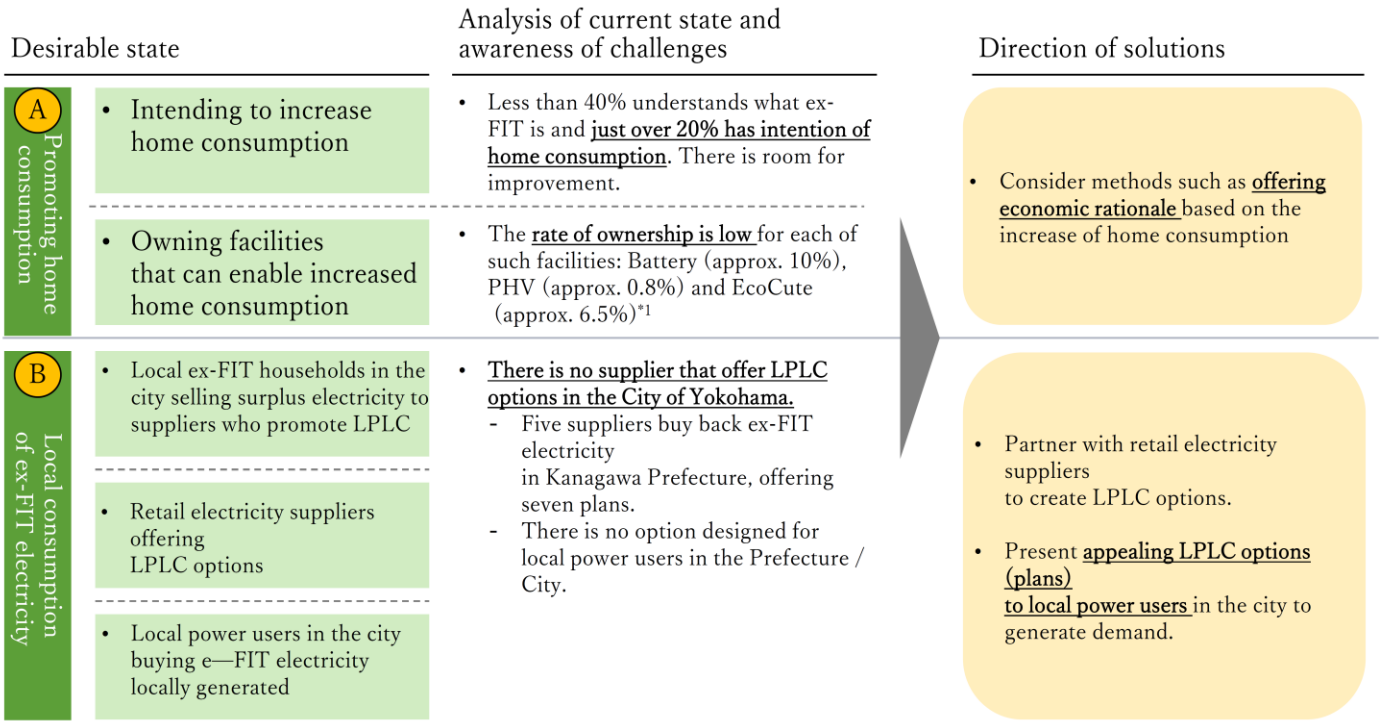
A) Providing economic rationale for home consumption in order to encourage ex-FIT households to consume electricity they generate at home

The current subsidization scheme for batteries, offered by various local governments, does not meet the "pricing level that offers economic advantage. (See Table 9 and Table 10). This is why ex-FIT households demonstrate a low level of home-consumption intention and system ownership (See Figure 5). To promote home consumption to ex-FIT households, it is necessary to offer some economic rationale that would justify home consumption.

B) Partnering with retail electricity suppliers to create appealing LPLC options, available to local power users in the city

Currently, there is no retail electricity supplier who offers LPLC options in the City of Yokohama. Firstly, it is necessary to create such LPLC options. There must be sufficient demand from power users for electricity bought back from ex-FIT households as an incentive for retail electricity suppliers to establish LPLC options. To this end, an effective approach would be to provide appealing LPLC options that spark demand from local power users in the city.

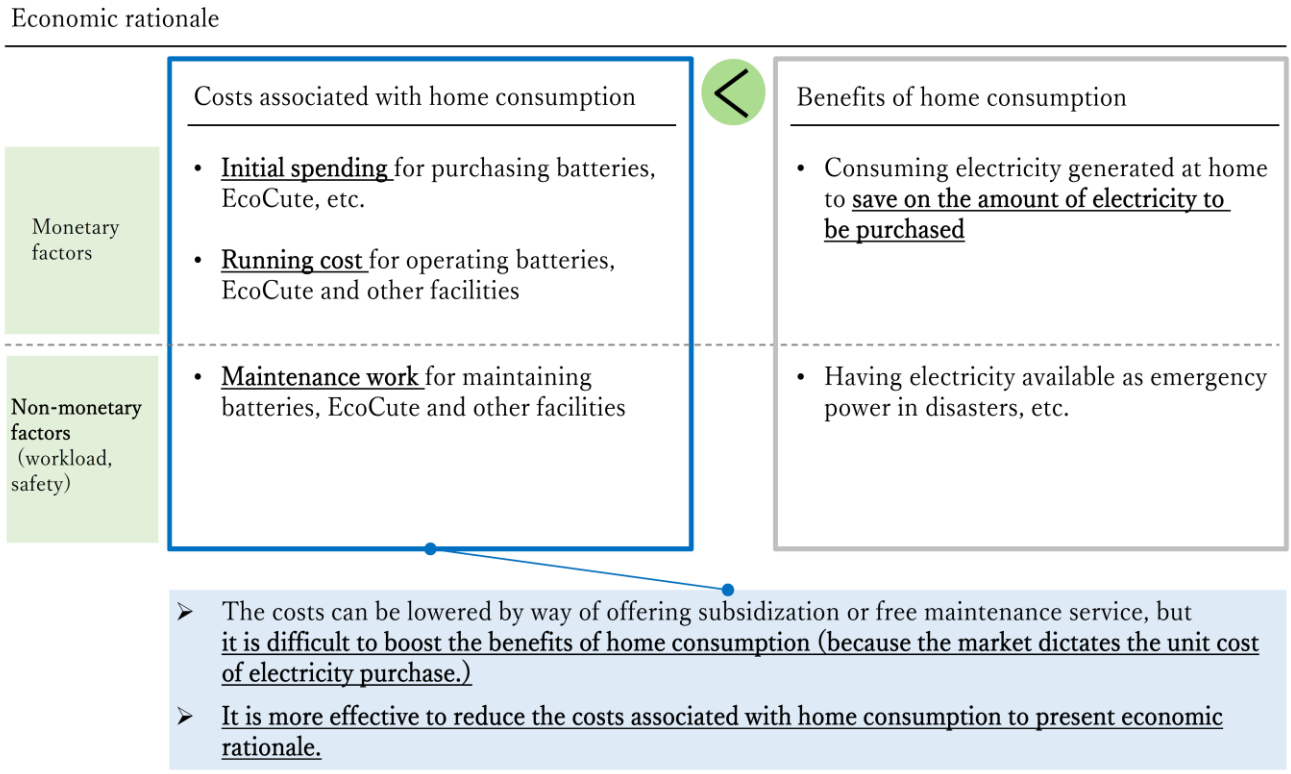
Figure 5 | Analysis of current status based on the desirable state and survey results, and the direction of solutions



【Direction of solutions | A. Promoting home consumption of ex-FIT electricity】

- The cost of enabling home consumption can be lowered by offering subsidization or free maintenance service. This cost includes monetary elements including initial spending for purchasing batteries, EcoCute and other systems, as well as their running cost, and non-monetary elements including workload for maintaining such facilities and other factors associated with safety.
- At the same time, although home consumption has its benefits such as reduced need to purchase electricity from suppliers, and availability as an emergency power source in disasters, etc., it is difficult to artificially boost the advantage of home consumption, given the fact that the market dictates the unit price of electricity buyback.
- For this reason, an effective approach to promote home consumption would be to reduce costs associated with home consumption, including non-monetary factors such as facility maintenance to present economic rationale.

Figure 6 | Concept of economic rationale



【Initial cost of home consumption and required assistance】

- The initial spending required to purchase battery, which represents the most expensive cost associated with home consumption, was investigated. The amount of subsidization required was then estimated, based on the pricing level that provides economic benefits. Results are, as shown in Table 9, the initial spending of 1.05 – 1.47 million yen and the required assistance of 0.7 – 1.26 million yen, considering the pricing level that provides economic benefits.
  [Calculation premise]
  - Assuming the ex-FIT buyback price of 6 – 10 yen/kWh and the electricity purchase price of 27 – 29 yen/kWh for electricity used
  - Assuming the battery capacity of 5.0kWh – 7.0kWh*1, which is the most common capacity adopted by a family of four

- Source
  - *1 | Calculated based on the cumulative proliferation rate of all-electric homes (Cumulative number of all-electric homes / Cumulative number of residential homes) [FY2015 / Fuji Keizai]

Table 9 | Current cost of adopting a power storage system and the pricing level that offers economic advantage

		(1) Retail price for major manufacturers' battery systems*1	(2) Pricing level that offers economic advantage*2	(1) – (2) Difference
Per kWh		210,000 yen/kWh	30,000 – 70,000 yen/kWh	140,000 – 180,000 yen/kWh
Total cost	5kWh capacity system	1.05 million yen	150K～350K yen	700K～900K yen
	7kWh capacity system	1.47 million yen	210K～490K yen	980K～1,260K yen

- Sources
  - *1 | Eco -Hatsu Chikudenchi https://www.eco-hatsu.com/battery/190/
  - *2 | Denki Shimbun, front page of the December 14, 2020 edition
    "The Energy Agency Committee examines the pricing level of power battery systems for greater uptake"
    https://www.digital.denkishimbun.com/PB5012_000/kiji.php?_P=login&_A=login&directkijiid=OK0000020121400101_06

- The current subsidization scheme for batteries, offered by various local governments, does not meet the "pricing level that offers economic advantage."

《Examples of local governments that offer subsidization for home consumption》
Saitama City | 20,000 yen/kWh～(up to 120,000 yen)
Kawasaki City | 10,000 yen/kWh～(up to 100,000 yen)
Tokyo | Half of the cost of hardware to be paid by users; 100,000 yen/kWh～(up to 600,000 yen)
[Tokyo's example]
A user who purchase a battery unit (5kWh) priced at 1.05 million yen is out of pocket by 530,000 yen. (=1.05 million yen×50%)

Table 10 | Main subsidization schemes for home consumption, offered by local governments

Local government	Subsidization target	Subsidy	Source
Kawasaki City	Residential fuel cell system (EneFarm)	30,000 yen	*1
	Stationary lithium-ion battery system	10,000 yen/kwh (up to 100,000 yen)	
	V2H system	50,000 yen	
Saitama City	Residential fuel cell system (EneFarm)	40,000 yen	*2
	Stationary lithium-ion battery system	20,000 yen/kWh (※Up to 120,000 yen)	
	V2H system	50,000 yen	
Tokyo	Residential fuel cell system (EneFarm)	・1/5 of the cost of hardware ・Up to 100,000 yen (detached houses) 150,000 yen (condominiums)	*3
	Battery system	・1/2 of the cost of hardware ・100,00 yen per kWh of battery capacity ・Up to 600,000 yen	
	V2H system	・1/2 of the cost of hardware ・Up to 300,000 yen	

- Sources
  - *1 | Kawasaki City https://www.city.kawasaki.jp/300/page/0000032302.html
  - *2 | Saitama City https://www.city.saitama.jp/001/009/015/002/p035077.html
  - *3 | Tainavi battery https://www.tainavi-battery.com/feature/after-fit/

【Direction of solutions | B. Local consumption of ex-FIT electricity generated in the city】

- Approaching ex-FIT households and power users in the city to spark demand for LPLC options is expected to increase the number of retail electricity suppliers who cater to such services.
- In the case of the Go To campaign (national policy) and PayPay (cashless payment) system, consumer demand was generated as the first step, resulting in subsequent increase in participating companies and users. It is therefore believed that approaching users within the city would be effective.

Figure 7 | Players to be approached to encourage local consumption of ex-FIT electricity generated in the city

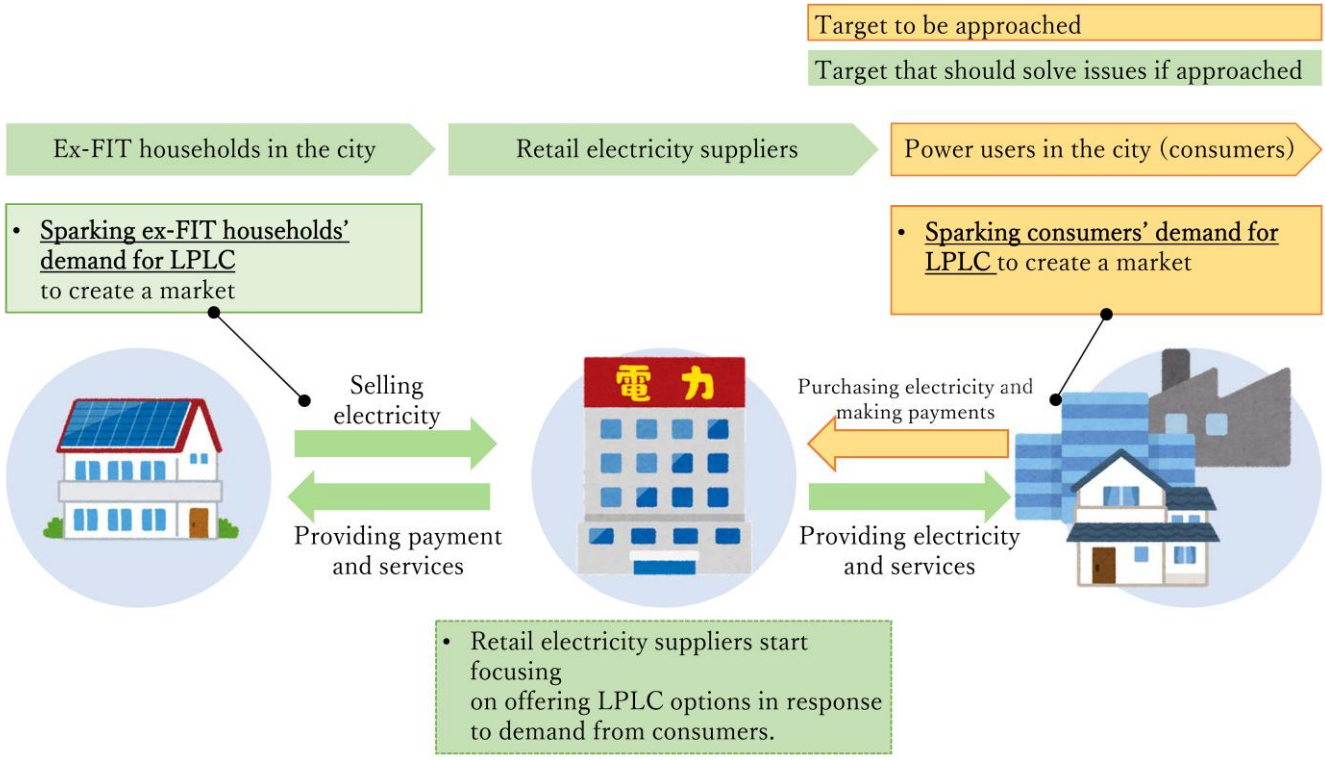


Figure 8 | 【Reference】Examples of business expansion resulting from sparking consumer demand

Examples	STEP1 (Sparking consumer demand)	STEP2 (Increasing participating companies)	STEP3 (Increasing users further)
PayPay	• Running campaigns such as 10-billion-yen redemption offer after service launch • Sudden increase of users from several tens of thousands to 5 million (February 2019)	• Increase of users resulting in (slightly delayed) increase of participating establishments • Rapid expansion to 500,000 establishments (around February – March 2019)	• The number of users topping 10 million (August 2019)
GOTO トラベル	• Providing 50% of the cost of accommodation and transportation up to 20,000 yen per night (including the handout of local coupons) • Increase of 13 million guest nights in the first month of the campaign	• Number of travel businesses : Approx. 6,600 • Number of accommodation businesses : Approx. 27,000 (both as of November)	• 39.76 million users in total (July – end of October 2020) • 190% year-on-year increase in the number of tourists for October 2020

3.3 Step Ⅱ｜Exploring and assessing the method for promoting LPLC

- Sorting measures, applicable to four methods in line with the direction for solutions, described in 3-2 Step Ⅰ
  - 4 methods: Informative method / fiscal method / regulatory method / behavioral design method
  - 2 purposes: Product planning and service design / promotion
- Evaluating each of the measures for their effectiveness and necessity in solving issues

【Exploring and assessing the method for promoting LPLC｜A. Promoting home consumption by ex-FIT households】

- An effective approach might be to plan products and design services in the fiscal method (②) to present economic rationale for home consumption, while using the other methods (①③④) for promoting LPLC to ex-FIT households.

Figure 9｜ Results of exploring and assessing the four methods (A)

Method	General evaluation	Product planning and service design (Specific method toward the direction of solutions)	Promotion: Mechanism for promoting action	Promotion: PR and information circulation
① Informative method	○	• Collective purchase of solar panels and batteries (examples｜Osaka City, Osaka Prefecture)	• Giving the concept of home consumption a name with an environmentally-friendly image • Visualizing the rate of home consumption	• Appealing benefits of battery systems, e.g. their emergency use • Using celebrities associated with Yokohama or local sport clubs for promotion
② Fiscal method	○	• Offering free facility maintenance services • Offering low-interest loans (EV) in partnership with Yokohama Bank, etc.	• Subsidizing the purchase of hardware such as batteries	-
③ Regulatory method	△	-	• Adding the rate of home consumption to the conditions of power supply tender for local governments	-
④ Behavioral design method	△	-	• Offering PV installation in combination with batteries as a standard option • Publicizing the rate of home use and commending top performers (wards and individuals)	• Publicizing the rate of home consumption as the target for “citizens”

◎｜Method considered to be essential and effective
○｜Method considered to be effective
△｜Method considered to have limited effectiveness

《Overview of the collective purchase case in Osaka City, Osaka》
https://www.city.osaka.lg.jp/kankyo/page/0000498182.html

- The Osaka Prefectural government selects and signs an agreement with support businesses, calls

for those who wish to purchase solar panels / batteries from across Osaka, and offers assistance in their installation in order to spread the use of PV systems.

- The collective purchase approach for all applicants provides a scale merit and cost reduction.
  - Solar panels and battery (Approx. 14% cheaper than market value)
  - Solar panels only (Approx. 17% cheaper than market value)
  - Battery only (Approx. 17 – 23% cheaper than market value)

【Exploring and assessing the method for promoting LPLC | B. Local consumption of ex-FIT electricity generated in the city】

- A promising approach might be to create LPLC options in the informative method (①), spark consumer demand in the fiscal method (②) and promote LPLC to ex-FIT households and power users in ③④.

Figure 10 | Results of exploring and assessing the four methods (B)

Method	General evaluation	Product planning and service design (Specific method toward the direction of solutions)	Promotion: Mechanism for promoting action	Promotion: PR and information circulation
1 Informative method	◎	• Creating collective buyback project for ex-FIT and LPLC options	• Giving LPLC options a name specific to the community to promote consumption Example) Sai-no Kuni (Saitama) • Visualizing the rate of LPLC	• Appealing microgrid as a power source resilient in emergency • Using celebrities associated with Yokohama or local sport clubs for promotion
2 Fiscal method	○	• Offering local revitalization coupons and thank-you gifts to those who take up LPLC options	-	-
3 Regulatory method	△	-	• Adding LPLC initiatives to the tender conditions for local government demand	-
4 Behavioral design method	△	-	• Having real estate agents recommend LPLC options • Publicizing the achievement rate of LPLC and commending top performers (wards and individuals)	• Publicizing local users (businesses) information • Publicizing the achievement rate of LPLC as the target for "citizens"

◎ | Method considered to be essential and effective

○ | Method considered to be effective

△ | Method considered to have limited effectiveness

3.4 Step Ⅲ | Selecting the target for drawing up project plans

- For ① (informative method) and ② (fiscal method), determined as effective for A (promoting home consumption of ex-FIT electricity), there are already numerous examples (model cases) by other local governments. The likelihood of identifying new perspectives is low, even with in-depth examination.
  - A-① | Osaka City, Osaka Prefecture [See P.26]
  - A-② | Kawasaki City, Saitama City, Tokyo, etc. [See Table 8 on P.18]
- At the same time, for ① (informative method), determined as effective for B (local consumption of ex-FIT electricity generated in the city), there are examples by other cities, but this approach is required to accept surplus electricity, generated beyond electricity that can be consumed at home. There is also room for considering this method in designing LPLC options, e.g. incentives for power users.
- Due to the above, B-① (Creating collective purchase project for ex-FIT and LPLC options) is selected for drawing up a project plan.

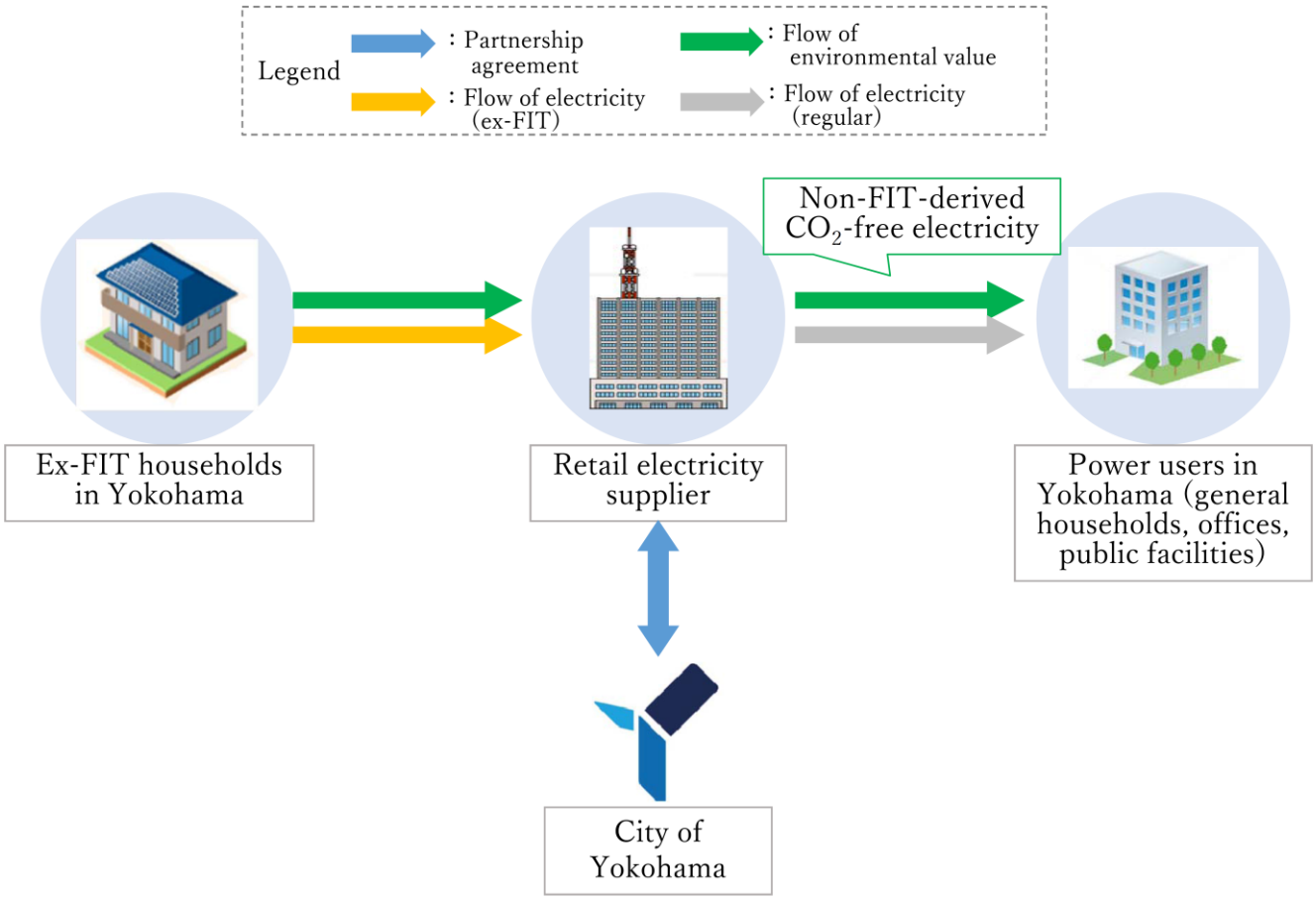
4 Project plan

4.1 Overview of the project model / services

The project model / services for B-① (Creating collective purchase project for ex-FIT and LPLC options), chosen for drawing up a project plan in Chapter 3 of this document, can be summarized as follows:

- A retail electricity supplier buys back surplus electricity generated by ex-FIT households in Yokohama City.
- The retail electricity supplier develops options for selling the environmental value contained in the ex-FIT electricity to power users (general households, offices and public facilities) in Yokohama City. Subscribers of LPLC options are supplied with electricity generated from all power sources, not limited to ex-FIT in Yokohama City, with CO2 offset based on ex-FIT's environmental value.
- The City of Yokohama signs a partnership agreement with the retail electricity supplier and provides fiscal assistance and budget allocation for circulating information and sparking demand to increase public awareness. (See 4.4.2 Tasks and Distribution of Roles for details)

Figure 11 | Overview of the ex-FIT collective buyback project



4.1.1 Anticipated customers and supply areas

【Anticipated customers】

- Anticipated customers are "all power users in the city." Power users can be categorized into the following three types, but they are all anticipated customers as there is no difference among them for the purpose of promoting ex-FIT LPLC.
  - General households in Yokohama
  - Companies with business sites in Yokohama
  - Public facilities in Yokohama (city office, gymnasiums, sporting grounds, stadiums, swimming pools, schools, etc.)
- "Public facilities in Yokohama" have top priority, as the City of Yokohama benefits from it in its initiative to switch to 100% renewable energies for the city office under the City of Yokohama Renewable Energy Strategy, provides high assurance for consumption as a major customer, and contributes to reducing administration man-hours because of its scale as a customer.
- Similarly, "companies with business sites in Yokohama" have the next priority as their scale can reduce administration man-hours. "General households in Yokohama" will be the last group to be approached.
- If the main policy gives top priority to building up a momentum for LPLC of renewable energies, it should be an effective approach to prioritize general households in offering LPLC options.

【Supply areas】

- Entire Yokohama City

Table 11 | Anticipated number of customers in Yokohama (Number of user sites)

General households in Yokohama	1,731,071 households
Companies with business sites in Yokohama (number of business sites)	114,930 sites
Public facilities in Yokohama	1,315 facilities

【Source】

- City of Yokohama website
  - https://www.city.yokohama.lg.jp/kanagawa/kusei/tokei/tokeijoho/sangyo/jigyousyo.html
  - https://www.city.yokohama.lg.jp/city-info/yokohamashi/tokei-chosa/portal/jinko/maitsuki/saishin-news.html
  - https://www.city.yokohama.lg.jp/city-info/zaisei/kokyo/minna/manejiment_hakusho.files/0020_20200330.xlsx

4.2 Anticipated effect

The decline in greenhouse gas emissions (CO2) has been estimated as an anticipated effect. If the creation of LPLC options results in full consumption of surplus ex-FIT electricity within Yokohama, the amount of greenhouse gas emissions (CO2) is expected to decline by approx. 5,500 – 8,700 tons per annum. (See Table 12)

【Estimation results of the anticipated effect】

- Surplus electricity generated by ex-FIT sites in Yokohama totals approx. 14,000K – 22,000K kWh. TEPCO EP would be able to buy back approx. 12,000K – 20,000K kWh at the current share (= suppliable amount).
- The suppliable amount equates to approx. 0.1% of total electricity consumption in Yokohama. It can therefore be assumed that the entire amount will be consumed in Yokohama.
- If so, this leads to reduction in greenhouse gas emissions (CO2) by approx. 5,500 – 8,700 tons per annum or the cumulative total of approx. 17,000 tons by 2023. The cumulative effect of approx. 8,700 tons per annum is anticipated thereafter.

Table 12 | Yokohama's ex-FIT surplus electricity and its effect of CO2 reduction

Items for estimating the anticipated effect		2021	2022	2023	Annually thereafter
A	Surplus electricity generated by ex-FIT in Yokohama [Estimation]	13,846K kWh	15,456K kWh	14,490K kWh	21,896K kWh
B	Buyout by TEPCO EP = Suppliable amount [A× TEPCO share 90%]	12,461K kWh	13,910K kWh	13,041K kWh	19,706K kWh
C	Decline in greenhouse gas (CO2) emissions (annual) [B×CO_2 emission coefficient]	5,495 tons	6,134 tons	5.751 tons	8,691 tons
	Decline in greenhouse gas (CO2) emissions (cumulative)	5,495 tons	11,630 tons	17,381 tons	8,691-ton increase

【Premise and procedure for estimating the anticipated effect】

- Surplus electricity generated by ex-FIT in Yokohama is about 0.1% of the city's total power consumption. The effect is estimated on the assumption that all of this electricity can be consumed within Yokohama through LPLC options.
  - The calculation assumes Yokohama's total power consumption at 17 billion kWh per annum*1.
- Details of estimating the anticipated effect
  A) The following research data, shown in this report, is used to determine the amount of ex-FIT surplus electricity in Yokohama.
  "2. Investigation into the current status of ex-FIT ① Research into the number of ex-FIT cases in Yokohama"
  B) Assuming TEPCO EP as the retail electricity supplier, its buyout share (90%) for ex-FIT electricity is applied to A. TEPCO EP is assumed as the supplier as the company is found to have the share of 90% in the research into trends in ex-FIT market share (2.2 ②), and is therefore capable of maximizing this project's anticipated effect.
  C) Assuming TEPCO EP as the retail electricity supplier, as described above, the amount of CO2 emission reduction is calculated based on TEPCO EP's published emission coefficient of 0.462 tons/thousand kWh*3.
- Source
  - *1 | City of Yokohama Renewable Energy Strategy
    https://www.city.yokohama.lg.jp/kurashi/machizukuri-kankyo/ondanka/jikkou/saiene.files/saiene_honpen.pdf
  - *2 | Federation of Electric Power Companies of Japan
    https://www.fepc.or.jp/smp/enterprise/jigyou/japan/index.html
  - *3 | TEPCO Energy Partner "CO2 emission coefficient for FY2019"
    https://www.tepco.co.jp/ep/notice/news/2020/1549626_8908.html

4.3 Anticipated cost

- This project is not expected to create any cost burden on the City of Yokohama.
- Separate expenses may apply if some services such as promotional campaigns are outsourced to external parties. This project plan does not cover specific estimation of such expenses as they vary depending on the contents of promotions and the choice of service providers.
- The anticipated cost of the "fiscal method (B-1)," described in 3.3 (Exploring and assessing the method for promoting LPLC), has been calculated as an example of promotional expenses. Since the B-1 measure targets general households, the calculation is made on the premise that general households purchase all ex-FIT electricity in Yokohama. (See Table 13)

Table 13 | Anticipated cost of measures in the fiscal method (e.g. handing out community coupons, offering gifts)

	2021	2022	2023	Annually thereafter
In the case of 3,000 yen per annum per household	¥13 million	¥14 million	¥14 million	¥20 million
In the case of 5,000 yen per annum per household	¥21 million	¥23 million	¥22 million	¥33 million
In the case of 10,000 yen per annum per household	¥42 million	¥47 million	¥44 million	¥66 million
Number of households used as the premise of estimation (targets for coupons, gifts, etc.)	4,190 households	4,680 households	4,390 households	6,630 households

【Premise of calculation】

- The calculation assumes that all of ex-FIT surplus electricity generated in Yokohama (13,846K - 21,896K kWh per annum) is consumed by general households in Yokohama. In this calculation, the number of households is assumed to be 4,190 – 6,630.
- Financial incentives such as community coupons and gifts, are to be provided at the time of signing up for an LPLC option, and not given continuously every year to existing subscribers. This is because a power supply contract is an on-going agreement by nature, involving monthly invoicing and payment, which reduces the frequency of switching between different suppliers. The measure places a greater focus on encouraging subscription to LPLC options.

4.4 Activity (action) plan

4.4.1 Promotion structure

- City of Yokohama | Manages this project, seeking expression of interest from retail electricity suppliers, choosing a successful retail electricity supplier and canvassing power users for participation in collective power purchase
- Retail electricity supplier | Buying back electricity from ex-FIT households, building options to power users in the city and selling electricity according to the options

4.4.2 Tasks and distribution of roles

- The retail electricity supplier primarily designs options, while the City of Yokohama handles areas associated with the fiscal method requiring budget approval.
- The retail electricity supplier develops options, drawing up and designing specific tasks for buying electricity back from ex-FIT households in the city and selling electricity to power users in the city.
- For promotional activities, the City of Yokohama names options, while the retail electricity supplier handles other tasks such as trademark registration. The City of Yokohama and the retail electricity supplier jointly issue press releases.
- Once the options are launched, the City of Yokohama and the retail electricity supplier handle communication with their respective stakeholders in mutual coordination.
- The City of Yokohama canvasses power users for collective electricity purchase.

Table 14 | Tasks and distribution of roles from the launch of LPLC options to their administration

○：Main party (in charge)　△：Partial contributor (checks and follow-up)

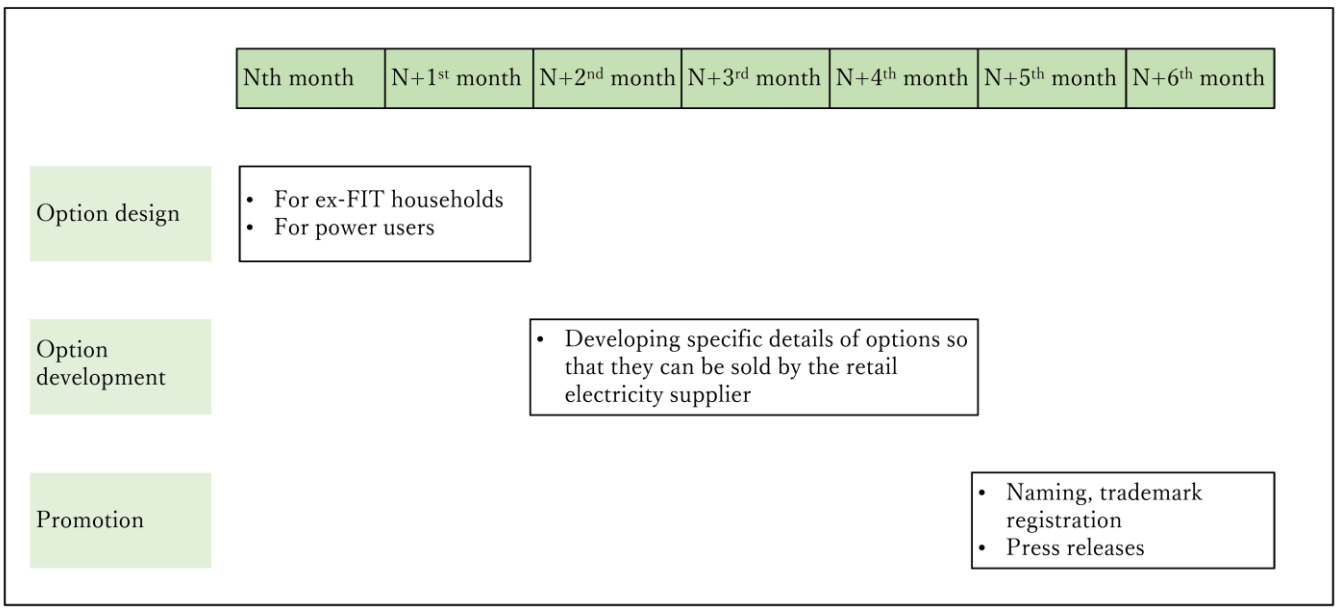
Category	Item	Activity	Description	Party in charge	
				City of Yokohama	Retail electricity supplier
1	**Option design**		Requiring about 1 – 2 months		
	1	For ex-FIT households in Yokohama City	Considering whether it is necessary to design new ex-FIT buyback options Drawing up terms and conditions of use	△	○
	2	For power users in Yokohama City	Designing fees that incorporate environmental value, determining sales volume Considering measures for sparking demand	△	○
	3	Implementing the fiscal method ※If applicable (Offering gifts and community coupons)	Determining the contents and budget for the fiscal method Selecting a partnering electricity supplier	○	△
			Drawing up terms and conditions of use	○	-
2	**Option development**		Requiring about 2 – 3 months		
	1	For ex-FIT households in Yokohama City	※To be fully handled by the retail electricity supplier	-	○
	2	For power users in Yokohama City	※To be fully handled by the retail electricity supplier	-	○
3	**Promotion (Notice / canvassing power users)**		Requiring about 1 month		
	1	Naming	Considering the name for LPLC options	○	△
			Trademark research	△	○
	2	Trademark registration	Filing an application with the Patent Agency for the name of the LPLC options	△	○
	3	Website posting	Preparing web pages to be posted (layout, materials)	△	○
			Preparing and posting a notice to retail electricity suppliers on the website	△	○
			Preparing and posting the notice on the City of Yokohama's website	○	△
	4	Individual promotion	Considering and implementing the promotional policy	△	○
	5	Press release	Preparing draft press releases	○	△
			Preparing Q&A for reporters	△	○

			Joint announcement with the City of Yokohama and the retail electricity supplier	○	○
4	**Considering administration and building the structure after the launch of LPLC options**				
	1	Communicating with all stakeholders	Clarifying the roles of the City of Yokohama and the retail electricity supplier	△	○
			Setting up a liaison office	○	○
	2	Building an escalation system	Defining matters that should be escalated Building a communication system 【Example】If other local governments asks the retail electricity supplier for more information about this initiative, the query should be escalated to the City of Yokohama.	△	○

4.4.3 Schedule

- It is anticipated to take approx. six months from the start of considering the project to the commencement of the service. This period is broken down as shown below.
  ※Not including the period for selecting the retail electricity supplier to partner with the City of Yokohama
  Option design 1 – 2 months
  Option development 2 – 3 months
  Promotion 1 – 2 months

Figure 12 | Anticipated schedule



4.5 Tasks and risks for establishing the project

【Anticipated tasks and responses】

1. In order to ensure that all ex-FIT surplus electricity is consumed in the city, power users must be aware of LPLC options, or the number of applications would not grow. It is therefore necessary to boost public awareness of LPLC options. An effective approach would be to use the informative method, such as PR activities, featuring a celebrity associated with Yokohama or a local sport club.
2. In order to ensure that all ex-FIT surplus electricity is consumed in the city, there has to be some motivation for power users to subscribe to LPLC options. Demand must be boosted. An effective approach would be to spark demand by offering local revitalization coupons or offering gifts to option subscribers, as described in "B-1 Fiscal method" in "3.3 Exploring and assessing the method for promoting LPLC."
3. Surplus electricity currently generated by ex-FIT in Yokohama is about 0.1% of the city's total power consumption. The absolute number of PV-installed households must be increased. Considered measures should be applied not only to power users but also to PV-installing households in Yokohama to expand the future number of ex-FIT households, thereby boosting surplus electricity generated by them.
4. In the collective purchase program, it is necessary to ensure fairness in what the local government implements, clarify the scope of business or technical requirements, and coordinate unit price and other details with the electricity supplier, making it difficult to implement the project at an early stage. For this reason, an effective approach would be to start with promoting LPLC options to boost the name value of Yokohama's LPLC initiative, before exploring specific details of the collective purchase program.

【Anticipated risks and responses】

5. The risk of ex-FIT surplus electricity, generated in Yokohama, dipping below the power demand of LPLC option subscribers, is countered by having the retail electricity supplier provide non-ex-FIT environmental value to power users.
6. There is a risk of the retail electricity supplier, chosen by the City of Yokohama, losing its ex-FIT buyback share, resulting in reduction in the sales volume of LPLC options available to power users in Yokohama. In response, the retail electricity supplier may offer new ex-FIT buyback options, limited to LPLC, to the City of Yokohama and set the buyback unit price high in order to maintain its market share. In addition, ex-FIT households that sign a buyback agreement with the retail electricity supplier, chosen by the City of Yokohama, can be financially assisted in the fiscal method, as required by the city, so as to maintain the suppliable amount of electricity under LPLC options.
7. If LPLC options attract more applications than anticipated, there is a risk of exceeding the budget for the fiscal method. An effective approach would be to set the upper limit for the amount of electricity sold and the fiscal method in advance, or to set up a computer system to

handle the application procedure for real-time checking on whether the number of applications has exceeded the upper limit.

Table 15 | Tasks and risks in the collective purchase program and LPLC options involving ex-FIT

#	Tasks and risks		Response	
	Classification	Description	Policy / method	Description
1	Tasks	In order to ensure that all ex-FIT surplus electricity is consumed in the city, it is necessary to boost power users' awareness of LPLC options.	Informative method	Conduct PR activities featuring a celebrity associated with Yokohama or a local sport club.
2		In order to ensure that all ex-FIT surplus electricity is consumed in the city, it is necessary to spark demand among power users for LPLC options.	Fiscal method	Spark demand by offering community revitalization coupons and gifts to LPLC option subscribers.
3		It is necessary to increase the number of PV-installed households.	Combination of all methods	Apply the methods that have been considered (Figure 9) not only to power users but also to Yokohama households that are installing PV systems to expand the future number of ex-FIT households, thereby boosting surplus electricity generated by them. 【Specific examples (excerpt from Figure 9)】 • Fiscal method Offering community revitalization coupons and gifts to option subscribers • Informative method Appealing the fact that LPLC of renewable energy can form a microgrid resilient to emergencies.
4	Risks	Ex-FIT surplus electricity, generated in Yokohama, could dip below the power demand of LPLC option subscribers.	Risk transfer	The retail electricity supplier could provide non-ex-FIT environmental value to power users when such a risk arises.
5		The retail electricity supplier, chosen by the City of Yokohama, may lose its ex-FIT buyback share, resulting in reduction in the sales volume of LPLC options available to power users.	Risk reduction	・The retail electricity supplier may offer new ex-FIT buyback options, limited to LPLC, to the City of Yokohama and set the buyback unit price high in order to maintain its market share ・The City of Yokohama may, as

				required, use the fiscal method to offer financial assistance to ex-FIT households, maintaining the suppliable amount of electricity under LPLC options.
6		When the fiscal method is applied, LPLC options may attract more applications than anticipated, exceeding the budge allocated.	Risk aversion	・Set the upper limit in advance for the amount of electricity to be sold and the fiscal method to be adopted. ・A computer system should be developed, setting the number of applications subject to the upper limit for real-time checks.