Energy policy transition in Japan
Current Status and Outlook of Japanese PV Market

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RTS Corporation – founded in 1983, 35 year experience

Comprehensive Consultancy on Photovoltaic Power Generation (PV)

Business: Helping establish PV business strategy, “Go to Japanese market”

Clients: Government agencies, utilities, manufacturers (entire value chain of PV) project developers, financial institutes, industry associations, etc. in JP, US, DE, IT, FR, AT, NR, CHE, AUS, CHN, IND, KOR, Taiwan, Thailand, NORWAY, etc.

Consulting for PV projects

PV system

PV projects

Japan

World

R & D

Deployment Business models

Silicon feedstock for solar cell

Go to Japanese Market
Contents

1. Japan’s policy on renewable energy and PV power generation
2. Current status of market and FIT program
3. Emerged issues with the growth of PV market and solutions
4. Outlook of Japanese Market until FY 2030
RE Target set after Fukushima

METI “Long term energy supply-demand outlook” (July 2015)

**Renewables In FY 2030**

- **PV:** 7% = 64GW
The Fifth Strategic Energy Plan

**Long-term stable sustainable/independent energy supply**

- Improvement of citizens’ living, contribution to sustainable development of the world
- Improvement of self-sufficiency rate of technology, challenge for decarbonization, enhancement of Japan’s industrial competitiveness, etc.
- Start of competitiveness among technology for decarbonization, geopolitical risks, competitiveness among nations/businesses

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**Surely realize energy mix for FY 2030**

- **Renewable Energy**
  - Lay out foundations to become a mainstream power source
  - Reduce cost, overcome grid restrictions, secure power dispatching ability

- **Nuclear**
  - Reduce dependency as much as possible
  - Continuous improvement of safety and resuming operation
  - Promotion, etc. of self-development of fossil fuel, etc.

- **Fossil fuel**
  - Continuation of thorough energy conservation
  - Integrated conduction of Energy Conservation Act and supporting measures

- **Energy conservation**
  - Challenge for decarbonization through hydrogen/power storage
  - Local development of distributed energy system (Combination of next generation renewable energy/power storage, EV, microgrid, etc.)

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**Challenge for energy transition of FY 2050 and decarbonization**

- **Renewable Energy**
  - Aim to become an economically independent and carbon-free mainstream power source
  - Work on development of hydrogen/power storage/digital technology

- **Nuclear**
  - Alternative for decarbonization
  - Work on pursuing safe nuclear reactor/developing backend technology

- **Fossil fuel**
  - Mainstream power source during transition period, enhance resource diplomacy
  - Work on development of hydrogen for decarbonization

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Source: The Fifth Strategic Energy Plan (cabinet approved on July 3, 2018)
Landscape of Renewable Energy Policy in Japan

Cabinet Secretariat

Support for overseas deployment of infrastructure systems
- Infrastructure export strategy

Expanding introduction of renewable energy and promoting realization of hydrogen society
- Basic Hydrogen Strategy
  - Make hydrogen a new option of energy for decarbonization

METI

Cabinet Secretariat

Overseas deployment strategy
- Command function

5th Strategic Energy Plan

- Revitalizing rural areas by utilizing renewable energy
  - Promotion of renewable energy introduction with local initiative
  - Promotion of PV systems while continuing agricultural activities (solar sharing)

MAFF

- Make renewable energy a mainstream power source
  - Electric power/ railway/ information and communications sectors

5th Basic Environment Plan

- Setting 6 main cross-sectoral strategies
  - Leading the word with climate change countermeasures
  - Promotion of renewable energy diplomacy

- New energy diplomacy
  - Make buildings zero energy
  - Promoting commercialization of projects for distributed energy infrastructure
  - Promoting ZEH and ZEB by combining energy saving and energy creation

Source: Compiled by RTS Corp.
Contents

1. Japan’s policy on renewable energy and PV power generation
2. **Current status of market and FIT program**
3. Emerged issues with the growth of PV market and solutions
4. Outlook of Japanese Market until FY 2030
PV installed capacity in Japan

Cumulative installed capacity (MW) for different categories:
- Off-grid
- Utility scale
- C&I
- Residential
- Cumulative

Calendar Year:
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018

Installed capacity (MW):
- 225 483 991
- 1.3GW
- 1.7GW
- 7GW
- 9.7GW
- 10.8GW
- 7.9GW
- 42GW
- 49.5GW

Revenue (MW):
- 0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000 22,000 24,000 26,000 28,000 30,000 32,000 34,000 36,000 38,000 40,000 42,000 44,000 46,000 48,000 50,000

Revenue (MW):
- 0 10,000 20,000 30,000 40,000 50,000 60,000
FIT for <10 kW application: FIT for surplus power (10 years)

Source: METI, TEPCO compiled by RTS Corporation
Approved & commissioned capacity under the FIT program

- The cumulative approved capacity: 70.9 GW as of Dec. 2017
- The cumulative capacity starting operation: 37.8 GW
- ~32 GW of pipeline exists as of Dec. 2017

Source: Materials from METI, compiled by RTS Corporation
1. Japan’s policy on renewable energy and PV power generation
2. Current status of market and FIT program
3. Emerged issues with the growth of PV market and solutions
4. PV industry status in Japan
5. Outlook of Japanese Market until FY 2030
2 Issues raised with the growth of PV market

2.1 Explosive growth of approved PV projects under the FIT program
   → Concerns for the future burden of surcharges
      → Change of FIT level setting
      → Auction program started
      → Change of approved process (to cancel paper projects)

2.2 Concerns for installation quality and environmental damages and accidents caused by natural disasters
   → Requirement of O&M
   → Guideline issued
   → Local government reactions
   → Ministry of Environment started discuss “Environment assessment”

2.3 Lack of hosting capacity
   → Changes of grid management
   → Grid storage

2.4 Risk of curtailment
   → Clear rules for curtailment

2.5 Recycling of PV modules
   → Action plan established
Actions taken by the government with revision of the FIT program

- New approval scheme for business plan
- Framework to comply related laws and regulations
- Addressing safety of PV systems → O&M
- Addressing delayed/unrealistic projects

- Setting rules for FIT level
  - Middle-term price target
  - FIT level for multiple years
  - Tender program

- Off-takers of RE power
  - Distributor → Transmission & distribution operator

- Transparency for grid connection
  - Disclosure of connection capacity and price of GC work
  - Guideline for grid connection
  - More transparent rules for grid connection
  - Disclosure of supply and demand information

- Exemption of surcharge
  - Exemption rate based on energy efficiency efforts

Source: PV market in Japan 2016/2017
Status of commissioning of FIT-approved PV systems (as of the end of December 2017)

Over 20 GW of approved 36 Yen/kWh and 32 Yen/kWh PV projects have NOT started operation.

Source: Materials of the 7th meeting of the Subcommittee for Large-volume Introduction of Renewable Energy and Next Generation Electricity Network (Aug. 29, 2018), compiled by RTS Corporation
Concerns for rising surcharges

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Total Surcharges (Unit: BJPY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2012</td>
<td>250</td>
</tr>
<tr>
<td>FY2013</td>
<td>480</td>
</tr>
<tr>
<td>FY2014</td>
<td>650</td>
</tr>
<tr>
<td>FY2015</td>
<td>1320</td>
</tr>
<tr>
<td>FY2016</td>
<td>1800</td>
</tr>
<tr>
<td>FY2017</td>
<td>2140</td>
</tr>
<tr>
<td>FY2030</td>
<td>3700</td>
</tr>
</tbody>
</table>

Total purchase cost of electricity under FIT

- FY2012: 0.22 Yen/kWh
- FY2013: 0.35 Yen/kWh
- FY2014: 0.75 Yen/kWh
- FY2015: 1.58 Yen/kWh
- FY2016: 2.25 Yen/kWh
- FY2017: 2.64 Yen/kWh

Source: METI, compiled by RTS Corporation
Only PV is growing
Points of new approval procedure

Before (current procedure)  
Approval for facility  
(設備認定)

From FY 2017 (New procedure)  
Approval for business plan  
(事業認定)

Requirements under new procedure

Business plan will be approved by the Minister of METI if the plan
- contributes promotion of electricity from renewable energy
- is expected to be smoothly (or harmoniously) and surely
- realizes stable and efficient power generation

In case of violation of compliance rules

Guidance, advice  
(Article 13)

Order to improve  
(Article 14)

Revocation of approval  
(Article 15)

Violation of compliance rules in the government and ministry ordinances and guidelines may result in revocation of approval.
Facility approved, commissioned and approved PV business plan

As of March 2017
- 154,180 projects
- 28,418 MW

As of December 2017
- 274,979 projects
- 45,402 MW

Increased by 15 GW

Due date of deemed approval was in the end of September
Hot news, 15th October! : New measures for uncommissioned projects (for projects having concluded connection contracts by July 31, 2016)

### Projects which have not started operation

<table>
<thead>
<tr>
<th>Date of connection contract</th>
<th>By July 31, 2016</th>
<th>Aug. 1, 2016 and onwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deadline for starting operation</td>
<td>None</td>
<td>3 years</td>
</tr>
<tr>
<td>Changes in PV modules</td>
<td>×</td>
<td>○</td>
</tr>
</tbody>
</table>

Applicable Fiscal Year (FY) will be extended by one FY annually

<table>
<thead>
<tr>
<th>Applicable Fiscal Year (FY)</th>
<th>This time</th>
<th>1 year later</th>
<th>2 years later</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2012 (40 Yen/kWh)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>FY 2013 (36 Yen/kWh)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>FY 2014 (32 Yen/kWh)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>FY 2015 (27 Yen/kWh)</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>FY 2016 (24 Yen/kWh)</td>
<td></td>
<td></td>
<td>○</td>
</tr>
</tbody>
</table>

Total capacity of target projects is in the range of almost 11 GW to almost 17 GW

Source: The 9th meeting of the Subcommittee for Large-volume Introduction of Renewable Energy and Next Generation Electricity Network
Image for the enforcement of new measures on April 1, 2019

Judgement shall be made depending on whether application for start of grid connection construction is received without any deficiency by power transmission/ distribution operator by the end of March 2019

Cases when the conventional FIT (40, 36, 32 Yen/kWh) is ensured

Date of receipt of application for starting construction without any deficiency by power transmission/ distribution operator

Deadline for starting operation
1 year from April 1, 2019

The purchase period is expected to be shortened by the length of time exceeding the deadline*

End of March 2019

* Decision will be made after discussion at the Procurement Price Calculation Committee

Case when the FIT is changed to 21 Yen/kWh

Date of receipt of application for starting construction without any deficiency by power transmission/ distribution operator

1 year after receipt of the first application for starting construction

The purchase period is expected to be shortened by the length of time exceeding the deadline*

End of March 2019

Source: The 9th meeting of the Subcommittee for Large-volume Introduction of Renewable Energy and Next Generation Electricity Network
Cost difference of PV system between domestic and overseas

Source: Materials of the Seventh Subcommittee for Large-volume Introduction of Renewable Energy and Next Generation Electricity Network (August 29, 2018), compiled by RTS Corporation

- Prices are further decreasing due to global competitions.
- Some emphasize importance of how installation cost in Japan (not under global competition) will be further reduced.
2. 2 Concerns for installation quality and environmental damages and accidents caused by natural disasters

https://www.huffingtonpost.jp/tenkijp/typhoon-21-strong-winds_a_23250873/

Typhoon Jebi (21st)

https://togetter.com/li/8652161036934335100678144

https://twitter.com/i/moments/1036934335100678144

https://t.co/y06jQLmWt5

https://t.co/DcdYTsqTks
Purpose and positioning of formulating the guidelines

1. Planning
   1) Research of land and surrounding environment, selection of land, and related procedures
   2) Establishing relations with local communities

2. Design and Installation
   1) Designing land development
   2) Designing power generation facilities
   3) Installation
   4) Consideration for surrounding environment

3. Operation & Maintenance (O&M)
   1) Formulation of plan on maintenance and inspection (M&I)/ operation and maintenance (O&M) and establishment of framework
   2) Efforts required in normal operation
   3) Responses required in emergency
   4) Consideration for local communities
   5) Renewing facilities

4. Removal and Disposal
   1) Planned removal and securing of disposal cost
   2) Removing and disposing facilities after termination of the project

Source: Materials by the Agency for Natural Resources and Energy (ANRE) under METI, compiled by RTS Corporation
### Example of conflicts between local citizens

<table>
<thead>
<tr>
<th>Place</th>
<th>Plan</th>
<th>Reason</th>
<th>Overview</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsukuba, Ibaraki</td>
<td>Large scale PV</td>
<td>Landscape protection</td>
<td>1 of 4 sites located in National Park</td>
<td>1 site withdrawn, 3 sites under negotiation</td>
</tr>
<tr>
<td>Bando, Ibaraki</td>
<td>Nature conservation</td>
<td>Swamps owned by prefecture and private owners. Protection for swans</td>
<td></td>
<td>Change of site</td>
</tr>
<tr>
<td>Fujimi, Nagano</td>
<td>28ha 24MW</td>
<td>Landscape protection, Water quality</td>
<td>Renova developed the plan. Water quality erosion and land slides were concerned</td>
<td>Withdraw</td>
</tr>
<tr>
<td>Yamanashi</td>
<td>Large scale PV</td>
<td>Landscape protection</td>
<td>Damages on landscape with Mt. Fuji</td>
<td>Withdraw</td>
</tr>
<tr>
<td>Fujieda, Shizuoka</td>
<td>Large scale PV, 1ha</td>
<td>Close to residential area</td>
<td>City revised guideline for land use</td>
<td>Withdraw</td>
</tr>
<tr>
<td>Izu Kogen, Shizuoka</td>
<td>105ha 40.7MW</td>
<td>Landscape protection</td>
<td>Deforestation and landscape damages concerned</td>
<td></td>
</tr>
<tr>
<td>Nosu, Shiga</td>
<td>4MW</td>
<td>Hazardous pollution concerned</td>
<td>Site was used by a pharmaceutical company and replacement of surface soils are requested</td>
<td>Plan aborted</td>
</tr>
<tr>
<td>Takashima, Shiga</td>
<td>20ha project</td>
<td>Landscape protection, Nature conservation</td>
<td>Deforestation concerned by residents nearby</td>
<td></td>
</tr>
<tr>
<td>Maniwa, Okayama</td>
<td>1.6ha</td>
<td>Landscape protection</td>
<td>Regulation was formulated</td>
<td>Plan aborted</td>
</tr>
</tbody>
</table>
2.3 Lack of hosting capacity

5 electric utilities announced suspension of new grid connection contract in September 2014
<Voice and Opinions of Power Producers>

“Not connectable”
(Cannot connect even if the average utilization rate of transmission line is below 10%)

“Expensive”
(Cost to connect to grid is too high)

“Slow”
(Too much time to connect to grid)

Transmission capacity is not vacant but require certain margin to avoid power cut
- Upper limit: 50% (simple dual line)
- Assess peak time but not the total average

Some specific burden exists in majority of European nations as Japan (burden of power producers)
- To avoid moral hazard, it is hybrid of general burden and specific burden in majorities of countries

Require certain amount of time for land acquisition and construction for enhancement
- Shortage of transmission capacity in Germany connecting northern and southern grid due to delay of construction

Establishment of “New Grid Utilization Rule” responding to mass installation of renewable energy

Responding to individual cases by power transmission and distribution utilities

1. Liberalization of grid based on rules
2. Active introduction of overseas best practices

Issues asked to discuss in the committee meeting

1. Further utilization of gap of the transmission frame which is not utilized (Japanese version of “Connect and Menage”)
2. Leveling and review of cost burden
3. Thorough cost reduction (investigating cost for connection, reform of consignment system)
4. Acceleration of process (standard processing period etc.)
5. Thorough disclosure of information (improvement of business predictability)

<Establishment of rule by each organization + construction of dispute processing system>

Source: Material from second meeting of Subcommittee for Large-volume Introduction of Renewable Energy and Next Generation Electricity Network
## Consideration about Japanese version of Connect and Merge

| **Rationalization of assumed power flow** | Assessed probability of power function such as leveling effect to long-term hibernated power or naturally fluctuating power. Utilizing vacant capacity when assessing cases in which difference of demand and output become the largest |
| **Power control of N-1** | Enough capacity for power transmission is secured even if failure occurs in single line (N-1), the capacity is utilized by conducting power control in case of failure |
| **No-firm type connection** | New idea of power connection which allow power transmission if there is vacant capacity in grid (utilizing gap in grid). Output curtailment in crowded condition is prerequisite |

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**Image of power flow in Japanese version of Connect and Merge**

- **Current Situation**
- **Rationalization of expected power flow**
- **No-firm type connection**
- **N-1 Power Control**

**Full operation of power source, demand in estimated as minimum**

**Utilizing gap**

- **Heat capacity of dual line**
- **Heat capacity of single line**

**Capacity of power facility**

8760 hours

*Image below is only a image and specific management is considered in future*

Source: Material from second meeting of Subcommittee for Large-volume Introduction of Renewable Energy and Next Generation Electricity Network
Forecast on PV installed capacity in Japan by fiscal year

(Unit: GW(AC))

Actual  Forecasts

© RTS Corporation
Electricity supply of around 150 TWh/year accounting for 15% of Japan's total electricity demand

• PV can sufficiently play a role as a mainstream energy source

Promoting transition of energy supply-demand structure

• Leading the world through the establishment of a decarbonized society

Encouraging capital investment by private sector

Improvement of international competitiveness of the PV industry

Source: “Recommendation for development of the PV industry (PV150) A standard-bearer ‘PV power generation’ in the era of great energy transition - Aiming to achieve 150 GW installation in Japan in 2030-” (Feb. 2018) published by RTS Corporation
More detailed information of Japanese PV market by RTS Corporation

“PV Market in Japan 2017”
“PV Activities in Japan and Global Highlights”, Monthly Report
“Forecasting PV Installed Capacity in Japan toward FY 2020 and FY 2030 (2017 Edition)”

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