Electricity in Japan: Two Sports with One Name

February 2014

PHOTON Consulting, LLC
DATA IN THIS DOCUMENT PULLED FROM A LARGE NUMBER OF DATA SOURCES. **IN MANY CASES DATA ARE INCONSISTENT.** THE PURPOSE OF THIS DECK IS TO PROVIDE AN OVERVIEW. IF SPECIFIC DATA ARE IMPORTANT, PLEASE CONTACT PHOTON CONSULTING (INFO@PHOTONCONSULTING.COM) SO THAT WE CAN PROVIDE THE MOST UP-TO-DATE AND MOST CONSISTENT DATA.
Football (Overview)

In English, “football” is two sports with one name

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Electricity
(Overview)

In Japan, “electricity” is two sports with one name

Electricity - Traditional version

Electricity - New version

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Solar power share of consumption (% - 2013 consumption of electricity from PV)

Solar power was 1.4% of electricity consumption in Japan in 2013

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Solar power share of consumption (% - 2013 consumption of electricity from PV)

Japan is following footsteps of other countries → Greece, Germany and Italy already above 5%
Solar power installations
(MW/year)

Japan is following footsteps of other countries → ~5% of electricity consumption → Boom-bust cycle

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Germany electricity consumption (GWh/year)

Electricity consumption in Germany has shifted from historical growth pattern → Pattern is now flat-to-declining

Source: PHOTON Consulting, LLC based on AGEB and ENTSO-E. Note: All data are rough estimates.
Wholesale prices in Germany declined significantly → Both spot and futures (above) dropped → Futures prices down ~50% as solar penetration rose
RWE and EON stock price (Euro/share)

Declining volume, declining wholesale price, limited increases in retail price, rising cost → Rising risk → Lower market capitalization

Source: PHOTON Consulting, LLC based on Yahoo Finance. Note: All data are rough estimates.
RWE credit scores (Overview)

<table>
<thead>
<tr>
<th>Standard &amp; Poor’s</th>
<th>Moody’s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rating Date</strong></td>
<td><strong>Date</strong></td>
</tr>
<tr>
<td>Jul 2012</td>
<td>Jun 2013</td>
</tr>
<tr>
<td>Jun 2011</td>
<td>Jul 2011</td>
</tr>
<tr>
<td>Apr 2011</td>
<td>Apr 2011</td>
</tr>
<tr>
<td>Jan 2009</td>
<td>Nov 2009</td>
</tr>
<tr>
<td>Jun 2008</td>
<td>Jan 2009</td>
</tr>
<tr>
<td>Feb 2008</td>
<td>Feb 2008</td>
</tr>
<tr>
<td>Mar 2003</td>
<td>Apr 2005</td>
</tr>
<tr>
<td>Jun 2002</td>
<td>Mar 2002</td>
</tr>
<tr>
<td>Mar 2002</td>
<td>Dec 2001</td>
</tr>
<tr>
<td>Dec 2001</td>
<td>Sep 2001</td>
</tr>
<tr>
<td>Dec 2001</td>
<td>Feb 2000</td>
</tr>
<tr>
<td>Sep 2001</td>
<td>Feb 2000</td>
</tr>
<tr>
<td>Feb 2000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: PHOTON Consulting, LLC based on RWE. Note: All data are rough estimates.

Declining volume, declining wholesale price, limited increases in retail price, rising cost → **Rising risk** → Lower credit scores, lower dividends, asset sales, etc.
Japan solar revenue pool ($bn/year - New solar system sales)

PRELIMINARY

Japan solar revenue pool has expanded rapidly from $1bn in 2007 (~$12/person) to $25bn in 2013 (~$190/person) → Realistic potential for $28bn in 2014 (~$220/person)

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Solar revenue and operating profit
($mn/year – Total for 4 large Japanese solar companies)

Revenue ($mn/year)

Operating profit ($mn/year)

Source: PHOTON Consulting, LLC. Note: All data are rough estimates. Revenue and operating profit for solar power operations, including both Japan and rest of world. The majority of sales for these 4 large Japanese solar companies are within Japan. Companies are Sharp, Kyocera, Panasonic, Solar Frontier.

Aggregate revenue for 4 Japanese solar players $7.2bn with $0.6bn operating profit → Revenue increasing to $8bn in 2014 with $1.2bn operating profit
Commercial system price
($/W - 2013 through Sep-2013)

Source: PHOTON Consulting, LLC. Based on NYSERDA, APS, MA DOER, CSI and PHOTON Japan survey of more than 600 electricians and installers. Note: All data are rough estimates.

Japan’s solar system prices already lower than many comparable markets
→ Example: Price in Japan lower than U.S. markets
Commercial system price
($/W - Japan - 2013 through Sep 2013)

Source: PHOTON Consulting, LLC. Based on PHOTON Japan survey of more than 600 electricians/installers. Note: All data are rough estimates.

**Soft costs** (including customer acquisition, design, procurement, permitting, financing, contracting, installation, inspection, warranty) are already remarkably low in Japan
Commercial system price ($/W - Japan - 2013 through Sep 2013)

In contrast to soft costs, hardware costs are the highest among the world’s larger solar power markets → Large suppliers getting paid high prices

Source: PHOTON Consulting, LLC. Based on PHOTON Japan survey of more than 600 electricians/installers. Note: All data are rough estimates.
Although profitable today, nearly all Japanese installers are pessimistic about the future evolution of Japan’s solar power market.
View of Japanese electricians
(Based on in-person interactions with >600 Japanese electricians)

- Traditional Japanese electricity companies will be bankrupted and nationalized due to the rapid rise of distributed energy
- Japanese solar manufacturers do not make efforts to satisfy core needs of end-customers and electricians/installers
- Storage is essential to sustain the electricians' businesses, but Japanese suppliers not providing products addressing the needs of electricians and end-customers
- Overall: Expectations of major challenges ahead, including a downturn in the Japanese solar power market within 3 years

Source: PHOTON Consulting, LLC. Based on PHOTON Japan survey of more than 600 electricians/installers. Note: All data are rough estimates.
Solar power share of electricity consumption increased from 0.4% in 2010 to 1.4% in 2013 and is on track to reach 5% by 2018 or earlier.
Electricity consumption in Japan
(Billion kWh – From centralized sources)

Source: PHOTON Consulting, LLC based on EIA and IEA statistics. Note: All data are rough estimates.

Japan on path to follow pattern observed in other markets
→ Declining centralized electricity consumption
JEPX spot electricity price (JPY/kWh)

Source: PHOTON Consulting, LLC. Note: All data are rough estimates. The data is based on JEPX spot market 24-hour simple mean value of system price.

Japan wholesale electricity price rising since 2009 → Significant downside potential as solar power penetration rises
RWE and EON stock price (Euro/share)

Will Japan follow European pattern for lower market capitalization and lower credit scores?

Source: PHOTON Consulting, LLC based on Yahoo Finance. Note: All data are rough estimates.
Japan solar revenue pool
($bn/year - New solar system sales)

Overall, Japan likely to follow the boom-bust cycle observed in all other major solar power markets

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Local PV market stages (Overview)

Japan will likely follow pattern of other markets from "explosive growth" to "saturation" to "retroaction" → Major downside for players not taking responsibility

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Winning requires overcoming many obstacles

→ Winner must prove worthy of addressing problems
Electricity - Winning
(Overview)

Winning for traditional electricity companies requires overcoming many obstacles
Local electricians appear correct that these companies appear likely to lose

Electricity - Traditional version

Electricity - Winning

- Financing distributed power and energy
- Financing distributed storage and controls
- Cross-selling and up-selling other distributed infrastructure (e.g., communications, water)
- Delivering strong value proposition to existing local electricians (often over existing employees)
- Securing financial support for major write-down in traditional centralized assets
- Prioritizing specific local geographies (very small initial footprint)
- Addressing externalities caused in other local geographies (must address equity and access)
- Creating strong, positive brand

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
“Build Your Empire” for new energy players likely to follow pattern observed historically by successful energy companies

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Electricity - Winning (Overview)

“Build Your Empire” for new energy players follows 7-step action plan based on history of successful energy companies.
Units of measure - Winning (Overview)

$/$kg  $/$square meter  $/$watt  $/$kWh

IRR spread above discount rate

Winning requires focusing on the most important drivers of success → IRR spreads are predictive leading indicators of value creation and value capture

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Key actions for JREF community (Overview)

• Quantify the impacts more thoroughly, especially in finance terms (IRRs, IRR spreads)
  • Solar power adoption has major consequences for electricity revenue, profit pools and risk
  • JREF community (including Softbank with deep expertise in this area) should make this transparent

• Organize leaders in new energy financing
  • New electricity sector is largely driven by energy finance
  • JREF should host a new energy finance forum focusing on the core needs of traditional energy players (including toxic assets) and new energy players beyond current financing vehicles
  • JREF should be champion to drive change in new energy financing

• Share patterns with other markets
  • Japan is ~25% of global solar electricity revenue pool
  • Lessons learned in Japan should be shared with other markets
  • JREF should consider hosting fact-sharing mission with business, finance and (possibly) policy leaders in Spain, Italy, Germany, California, etc.

Source: PHOTON Consulting, LLC. Note: All data are rough estimates.
Electricity in Japan
(Overview)

Get ready for major hits because electricity in Japan is a “full-contact” sport → Winners must take responsibility for solving the many problems we face.

Source: PHOTON Consulting, LLC; ESPN. Note: All data are rough estimates.
DATA IN THIS DOCUMENT PULLED FROM A LARGE NUMBER OF DATA SOURCES. **IN MANY CASES DATA ARE INCONSISTENT.** THE PURPOSE OF THIS DECK IS TO PROVIDE AN OVERVIEW. IF SPECIFIC DATA ARE IMPORTANT, PLEASE CONTACT PHOTON CONSULTING (INFO@PHOTONCONSULTING.COM) SO THAT WE CAN PROVIDE THE MOST UP-TO-DATE AND MOST CONSISTENT DATA.