Innovation for Cool Earth Forum (ICEF)

Potential of Perovskite in Industrial Park

Thang Long Industrial Park (Vinh Phuc) (TLIPIII)
2023/10/04  Power Leader / Nguyen Minh Tien
Overview for Our Industrial Parks

- Sumitomo Corporation has owned and operated **8 industrial parks in 6 countries**, mainly in South East Asia.

![Map of industrial parks]

- **Bangladesh Special Economic Zone**
- **Thilawa Special Economic Zone**
- **ORIGINS by Mahindra Chennai**
- **AMATA CITY, CHONBURI**
- **AMATA CITY, RAYONG**
- **Tanger Automotive City / TAC**
- **Thang Long Industrial Park (Vinh Phuc) / TLIP III**
- **Thang Long Industrial Park / TLIP**
- **East Jakarta Industrial Park**
- **Phnom Penh Special Economic Zone (PPSEZ)**
- **Suryacista City of Industry (SCI)**
- **Sbang Smartpolitan**

Legend:
- Sumitomo Corporation as developer/operator (6 countries/8 IPs)
- Sumitomo Corporation as sales agent (4 countries/6 IPs)
Overview for TLIs in Vietnam

**Overview for Thang Long Industrial Park (TLIP)**

**Basic Information**

<table>
<thead>
<tr>
<th></th>
<th>TLIP (Hanoi)</th>
<th>TLIPII (Hung Yen)</th>
<th>TLIPIII (Vinh Phuc)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locatoin</strong></td>
<td>Hanoi (30min from city)</td>
<td>Hung Yen (50min from Hanoi)</td>
<td>Vinh Phuc (50min from Hanoi)</td>
</tr>
<tr>
<td><strong>Established</strong></td>
<td>Feb./1997</td>
<td>Nov./2006</td>
<td>Nov./2015</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td>274ha</td>
<td>346ha</td>
<td>213ha</td>
</tr>
<tr>
<td><strong>Share</strong></td>
<td>Sumitomo 58%</td>
<td>Sumitomo 92%</td>
<td>Sumitomo 100%</td>
</tr>
<tr>
<td><strong>Tenants</strong></td>
<td>107 tenants</td>
<td>80 tenants</td>
<td>47 tenants</td>
</tr>
<tr>
<td><strong>Employee</strong></td>
<td>63,000</td>
<td>28,000</td>
<td>7,000</td>
</tr>
</tbody>
</table>

**Countermeasure of 100-year probability calculation**
- In-house retention canal and pond, for rainwater
- Dyke surrounding boarder
- Drainage pump system to pump out to external canal

**The best electric stability**
- In-house substation and distribution
- Receiving electricity from 2 substation with high voltage
- Periodic maintenance by in-house operator

**Best quality of infrastructure and service**

**Security and safety**
- Surrounding fence prevent incursion
- Combination of in-house and outsourced security for 24h, 365 days
- Police station and fire fighting station inside park

**Various support “Continuous Support after signing contract”**
- Providing valuable information in monthly meeting with tenants
- Support recruit works by board, web site and job fair.
- Many events such as Summer festival, Ekiden, Golf cup, Football tournament.
Overview for Thang Long Industrial Park (TLIP)

Recent investment trend in TLIPs

<table>
<thead>
<tr>
<th>Investment trend</th>
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</thead>
<tbody>
<tr>
<td><strong>Various types of tenants</strong></td>
</tr>
<tr>
<td>Various type (Export oriented ⇔ domestic market oriented)</td>
</tr>
<tr>
<td>Various area (Hi-Tech ⇔ Labor intensive ⇔ Food/Life style)</td>
</tr>
<tr>
<td>Various size (Large enterprise ⇔ Small/Medium-sized)</td>
</tr>
</tbody>
</table>

**Expansion in Vietnam**
Second factory in Vietnam (South to North)
Good evaluation on investment environment in Vietnam

**Growth of Vietnamese companies**
4 local companies decided its investment in TLIPs (2020)
“NEW VIETNAM” generation enterprises.

# of tenants
234
Total for 3 TLIPs

# of employees
100,000
Total for 3 TLIPs

Operation
25 years
TLIP : since 1997

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Rooftop Solar Project for TLIPs

- Since February, 2021, TLIP2 started pilot project for Rooftop Solar Project (RTS). Since April, 2022 in TLIP1, since May, 2022 in TLIP3, the RTS project has been started.
- Our RTS project directly supplies to the tenants by installing RTS on the roof of tenants.
- The number of tenants who are interested in our RTS projects is more than 30 companies with 70MWp potential.

<table>
<thead>
<tr>
<th>TLIP</th>
<th>Tenants/Rental Factory</th>
<th>Capacity (MWp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLIP1</td>
<td>14 tenants + Rental Factory</td>
<td>16.8</td>
</tr>
<tr>
<td>TLIP2</td>
<td>3 tenants + Rental factory</td>
<td>12.7</td>
</tr>
<tr>
<td>TLIP3</td>
<td>4 tenants</td>
<td>7.2</td>
</tr>
</tbody>
</table>

- TLIPs’ annual consumption volume in total is approx. 1,000GWh. We aim at achieving 100MW of installed capacity (approx. 100GWh) by 2030, which results in contributing to green power demand not only of tenants but also of Vietnam.
- This business model of RTS will be spread out to our industrial parks in other countries such as Bangladesh (BSEZ).
Rooftop Solar Project for TLIPs

- Our RTS project directly supplies to the electrical room of the tenants. The surplus energy will be flown as reverse flow to TLIPs' grid, which do not have reverse flow to EVN's national grid.
Potential for Perovskite

- Power shortage issue in the North of Vietnam affects the production activities of Tenants, so we need to research and come up with solutions to ensure the power source for Tenant’s production in our IP.

**Current status**

- In 2023, Vietnam suffered from power shortage due to El Niño, power plants trouble, and lack of water in some of hydropower plants.
- In 2024, the same power shortage may happen again in summer season due to lack of capacity around 1,600 ~ 4,900 MW.

**PDP8 policy**

In the Power development plan until 2030 (PDP8) of Vietnam, Vietnamese government encourages renewable energy sources:

- Zero coal-fired power plant (→Ammonia/Biomass mixed).
- Promotion of Offshore wind power
- **Promotion of Self-consumption type of Rooftop Solar (expected to increase by 2,600 MW until 2030)**
- Strengthen the transmission line throughout the country
Potential for Perovskite

- In some cases, we could not install the solar system on the factories with the lack of load capacity.
- Many factories were built without consideration of PV panel installation at that time.

**Current PV panel**

- Manufacture: JA Solar
- Rated maximum power (Pmax): 540 W
- Dimensions: 2279x1134x35
- Weight: **28.6kg ~ 11.07 kg/m²**

Total actual load of Rooftop solar power system (RTS) around **15kg/m²**
(include PV panel, mounting structure, cleaning system, walk ways, DC&AC cable trays…)

**Load capacity requirement**

- Requirement from Vietnam regulations:
  + Factories shall have live load at least **30kg/m²** for safety.
  + Dead load and hanging load based on factory design, which shall endure against additional **15kg/m²** for RTS system.

Therefore, the Perovskite solar cell with lighter weight with high efficiency is one of the potential solutions for the factories with the lack of load capacity.
Rooftop Solar Project in Thang Long Industrial Park

Potential for Perovskite

- Potential for solar power development with high efficiencies

Current solar radiation in our IP (TLIPIII)

Perovskite solar cell efficiencies

Currently we are using the JA solar with module efficiency is 20.9%.

As information on the website: [https://www.energy.gov](https://www.energy.gov)
Perovskite solar cells have shown remarkable progress in recent years with rapid increases in efficiency, from reports of about 3% in 2009 to over 25% today.

The solar radiation at our IP is only **664 kWh/m² per year**, this index is lower, compared with South of Vietnam such as Ninh Thuan province, which have high radiation up to **1,800 kWh/m² per year**.

Therefore, finding solar panels with higher efficiency is an issue we are very interested in.
Thank you for listening