Small and Medium PV System Database in the APEC Region

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1. To compile, collate, analyze, report, disseminate profiling of small to medium scale PV system information in selected Grid Connected and Off-Grid PV systems.
   - Compiled Data for 45 PV systems

2. To initiate a strong institutional network for collecting, updating and maintaining the database for the PV systems in the APEC member economies.
   - Indonesia, Malaysia, Thailand, United States & Viet Nam

3. To share the information of small to medium scale PV system status in selected GC and OG PV systems in a common platform as an information cloud sharing environment.
   - www.apecpv.cmru.ac.th
Develop structure of the database platform & create institutional network
Experience of database usage and way forward with stakeholders, reporting and data analysis
PV Database Portal – www.apecpv.cmru.ac.th
### List of Small and Medium PV System Database in the APEC Region

Data sharing platform for Small and Medium Scale PV systems in the APEC Region: Please click for PV System Data in General, Monthly and Daily PV Data.

<table>
<thead>
<tr>
<th>Economy</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>5</td>
</tr>
<tr>
<td>Malaysia</td>
<td>23</td>
</tr>
<tr>
<td>Thailand</td>
<td>8</td>
</tr>
<tr>
<td>United States</td>
<td>4</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>5</td>
</tr>
</tbody>
</table>

#### Type

- **Grid-Connected**: 23
- **Off-Grid**: 22

#### Size kWp

- **1-100**: 31
- **100-200**: 7
- **200-1,000**: 7
Data from Tier 1—General information of PV systems

General PV System Data

UiTM-GERC Mono System

General
- PV System Name: UiTM-GERC Mono System
- Economy/Country: Malaysia
- City: SHAH ALAM
- Date Commissioned: 2012-04-17
- Grid-Connected/Off-Grid: Grid-Connected
- Funding Source: Private

System
- Module Type: Monocrystalline
- Installed PV Capacity: 9 kWp
- Nominal Inverter Capacity: 8 kWp
- Peak Sun Hour: 4.7 h
- Battery Type: -
- Battery Capacity: -
- System Voltage (DC): -
- Inverter Nominal Rating (AC): -
- Auxiliary Generator Type: -
- Auxiliary Generator Capacity: -

Geographical
- GPS: 3.068734, 101.496945
Data from Tier 2—Detailed system operation data (monthly)

Monthly PV Data: PV System Operation Data

adiCET 702 kW

- The Monthly PV Data comprised of Electrical Data (Power, Voltage, Current) and Ambient Condition Data (Irradiance, Ambient Temp, Module Temp, Wind Velocity, Rainfall).
- The data are updated monthly.

<table>
<thead>
<tr>
<th>Upload Date</th>
<th>Total Power (kW)</th>
<th>Average Voltage (V)</th>
<th>Average Current (A)</th>
<th>Average Irradiance (W/m²)</th>
<th>Average Ambient Temp (°C)</th>
<th>Average Module Temp (°C)</th>
<th>Average Wind Velocity (mm)</th>
<th>Total Rainfall (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-02</td>
<td>333.64</td>
<td>658.59</td>
<td>511.9</td>
<td>604.54</td>
<td>34.1</td>
<td>47.12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2017-03</td>
<td>319.7</td>
<td>648.35</td>
<td>497.03</td>
<td>639.41</td>
<td>34.21</td>
<td>43.54</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2017-04</td>
<td>180.15</td>
<td>662.66</td>
<td>294.52</td>
<td>693.15</td>
<td>32.94</td>
<td>44.67</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2017-05</td>
<td>142.12</td>
<td>645.97</td>
<td>222.2</td>
<td>639.73</td>
<td>32.05</td>
<td>42.15</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Data from Tier 3—
Detailed performance data: Download CSV file and Chart Display

Daily PV Data: Detailed PV System Performance

The Daily PV Data comprised of system performance data collected from the data logger such as: Electrical Data (Voltage, Current, Power) and Ambient Condition Data (Irradiance, Module Temp, Ambient Temp)

<table>
<thead>
<tr>
<th>Date Upload</th>
<th>Performance (V, A, kW)</th>
<th>Irradiance (W/m²)</th>
<th>Ambient Temp (°C)</th>
<th>Module Temp (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-06-01</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>No Data</td>
</tr>
<tr>
<td>2016-06-02</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>No Data</td>
</tr>
<tr>
<td>2016-06-03</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>No Data</td>
</tr>
<tr>
<td>2016-06-04</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>No Data</td>
</tr>
<tr>
<td>2016-06-05</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>No Data</td>
</tr>
<tr>
<td>2016-06-06</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>No Data</td>
</tr>
<tr>
<td>2016-06-07</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>Download/View Chart</td>
<td>No Data</td>
</tr>
</tbody>
</table>

Showing 1 to 7 of 7 entries
Data from Tier 3 – Chart Display
Real-time Data — Linked to PV monitoring system

adiCET 702 kW
Economy/Country: Thailand
City: Chiang Mai
Grid-Connected

Realtime monitor
More information

Monthly PV Data
Daily PV Data
Real-time Data – 702 kW, Chiang Mai, Thailand

http://apecpv.cmru.ac.th/monitor702.php
Data Compile and Collate

- Tier 1: General data – all sites provided data
  - Technology of PV, PV Size, Inverter Capacity, Location, Date of Commissioned
  - Some provide source of funding, some peak sun hour, most do not have battery and generator
- Tier 2: Monthly Data
  - Difficult for data input due to manual input – should make automatic average/sum from the Tier 3 data
- Tier 3: Detailed Performance Data
  - Data was provided from grid-connected sites with real time monitoring
  - Off grid do not have data for this tier
- Data were provided from academic/research institutions & affiliations
  - University of Teknologi Mara, Malaysia
  - University of Indonesia, Indonesia
  - Chiang Mai Rajabhat University, Thailand
  - University of Phayao, Thailand
  - NECTEC, NSTDA, Thailand
  - NHEI, University of Hawaii, United States
  - Ho Chi Minh City University of Technology, Viet Nam
- Difficult to share data from private or government entity
Database Experience Sharing

- **Data Updating → Progress & Barriers**
  - Need good data; should have some quality control protocol to determine good quality data
  - Standardize units, range of data
  - Time format: date, time zone
  - Easier data input, data sorting, monthly input split to daily
  - Size of file limitation

- **Data → Useful for Stakeholders**
  - Focused on Performance data (more detail)
    - Performance ratio, Energy Storage, Power Factor, kWh
  - Location Site Mapping/ Geographical View
  - PV structure
  - CO₂ Emission Computations
  - Energy consumption data
  - Algorithm for Forecasting

- **Way forward**
  - Use IEC 61724 and build upon IEA PVPS Task Force
  - Datasharing agreement
  - Data sharing should start with Universities with their own monitoring system
What’s Next – Way forward?

- Using Existing Network – for data collection
  - Categorize 3 types of data:
    - General
    - National Monitoring System (Monthly/Yearly)
    - Detailed Monitoring System (1-15 min)
  - Grouping/Analyze data based on similar sites
  - Connect with other Related Association
    - Indonesia Green Building Association
    - Malaysia National Monitoring System

- Build upon the network with EGNRET Network, IEA database, APERC, CSR, Industry Associations, Government Monitoring

- Continuation of the project
  - Phase 1: Data Collection 5 Economies
  - Phase 2: Capacity Building – Discuss with APEC Sec with HNEI Support
  - Phase 3: Continue Data Collection for other Economies; Grouping; Analysis for 3 group of stakeholders → Data Utilization
Acknowledgments

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- NECTEC, NSTDA
- NHEI, University of Hawaii
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- National Research Council of Thailand
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