Asia-Pacific Economic Cooperation

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

Progress of Small and Medium PV System Database in the APEC Region

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Objective

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.
2. To initiate a strong institutional network for collecting, updating and maintaining the database for the PV systems in the APEC member economies.
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.

Recap 1st APEC Workshop on Small and Medium PV System Database in the APEC Region at Chiang Mai, Thailand

Recap 2nd APEC Workshop on Small and Medium PV System Database in the APEC Region at Tokyo, Japan

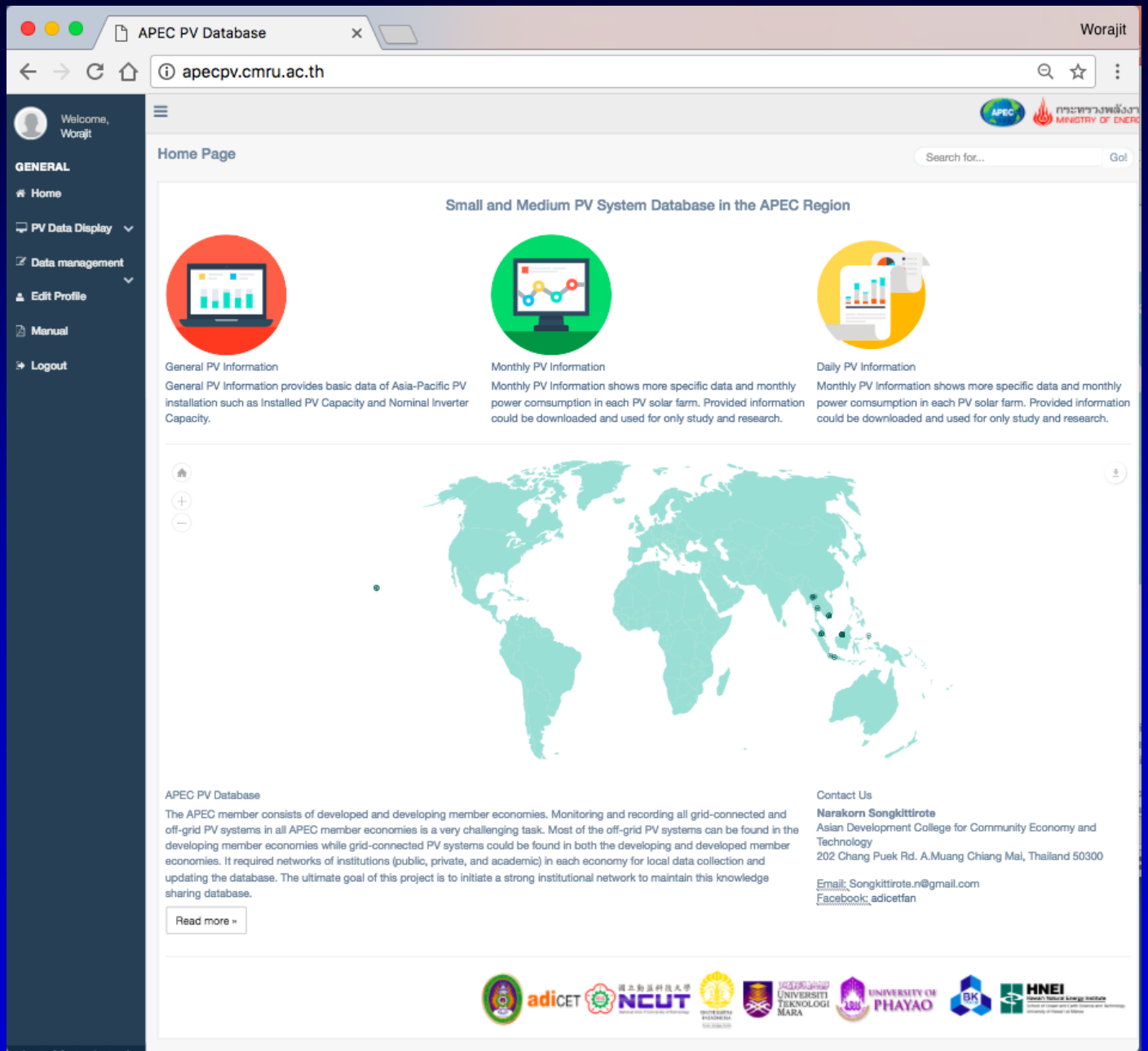
Workshop 1 Summary

- Data Collection and Compilation
- Processing, Analysis and Updating Database Methods
- Database Structure, Reporting, Maintenance and Sustainability

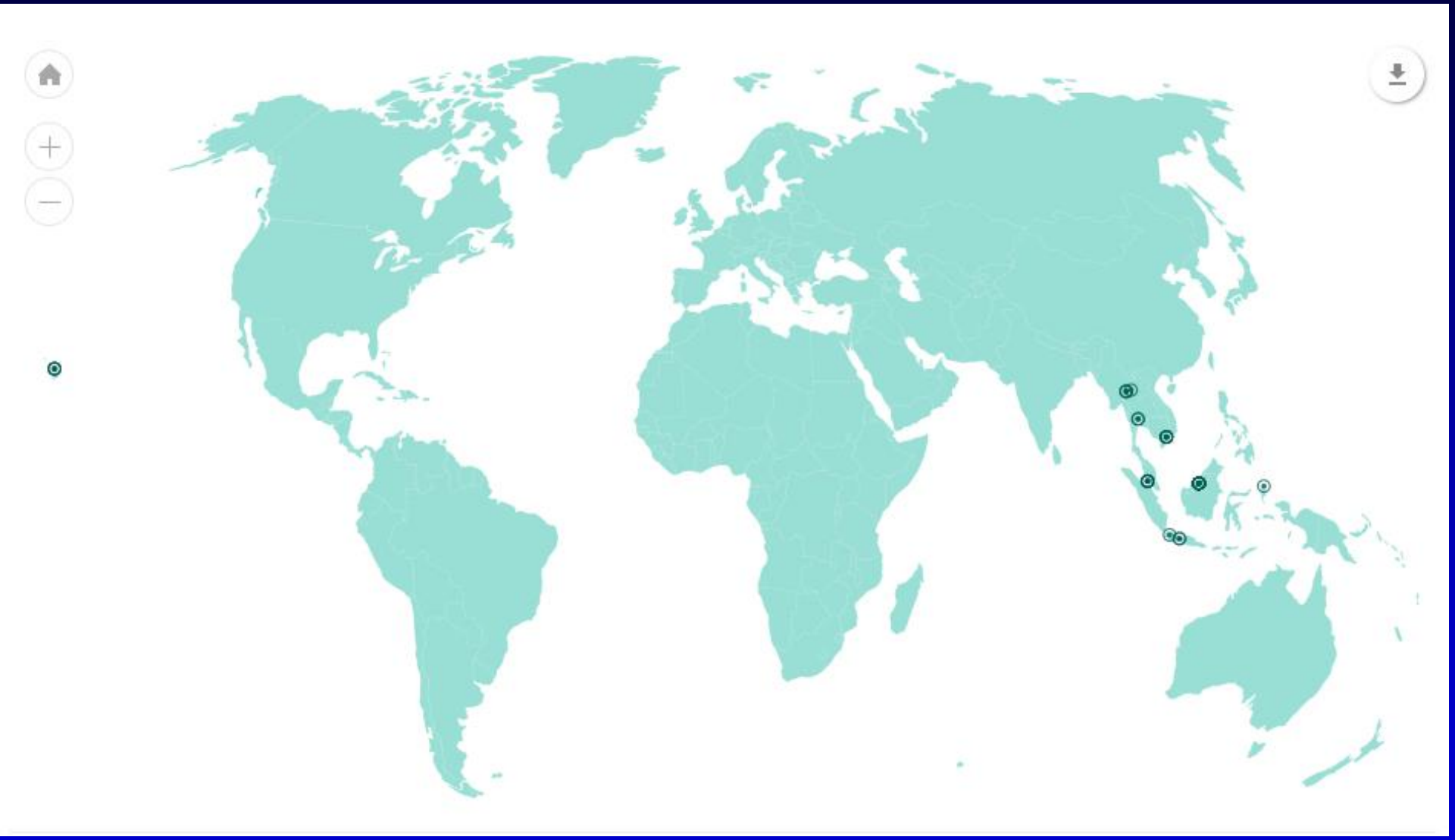
- Working Group Collaboration:
  - Economies: Thailand, Malaysia, Indonesia, Philippines, Vietnam
  - Participant: Authority/Ministry; Utility; University

- Data & Updating → Database Design
  - 3 Tiers:
    - 1. General Information (no data logging)
    - 2. Detailed Data (kWh, Solar Irradiation, etc.): 1/month
    - 3. Detailed Performance: 1-10 min data logger
  - Each economy send example data for 2 on-grid & 2 off-grid sites
  - Update every month
  - Develop initial database at Chiang Mai Rajabhat University

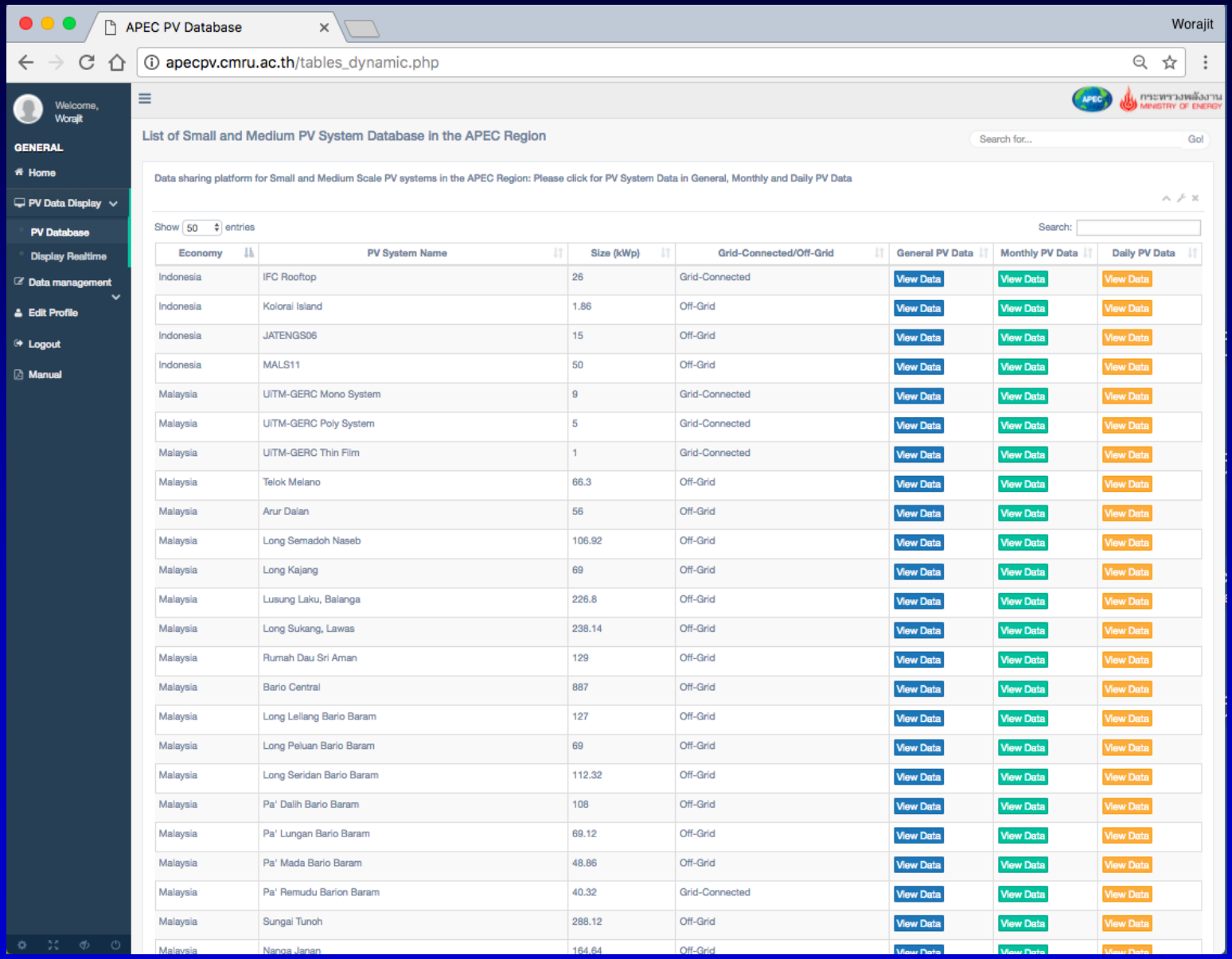
PV Database Portal – www.apecpv.cmru.ac.th



Map of PV Systems – can compliment IEA PVPS Tasks

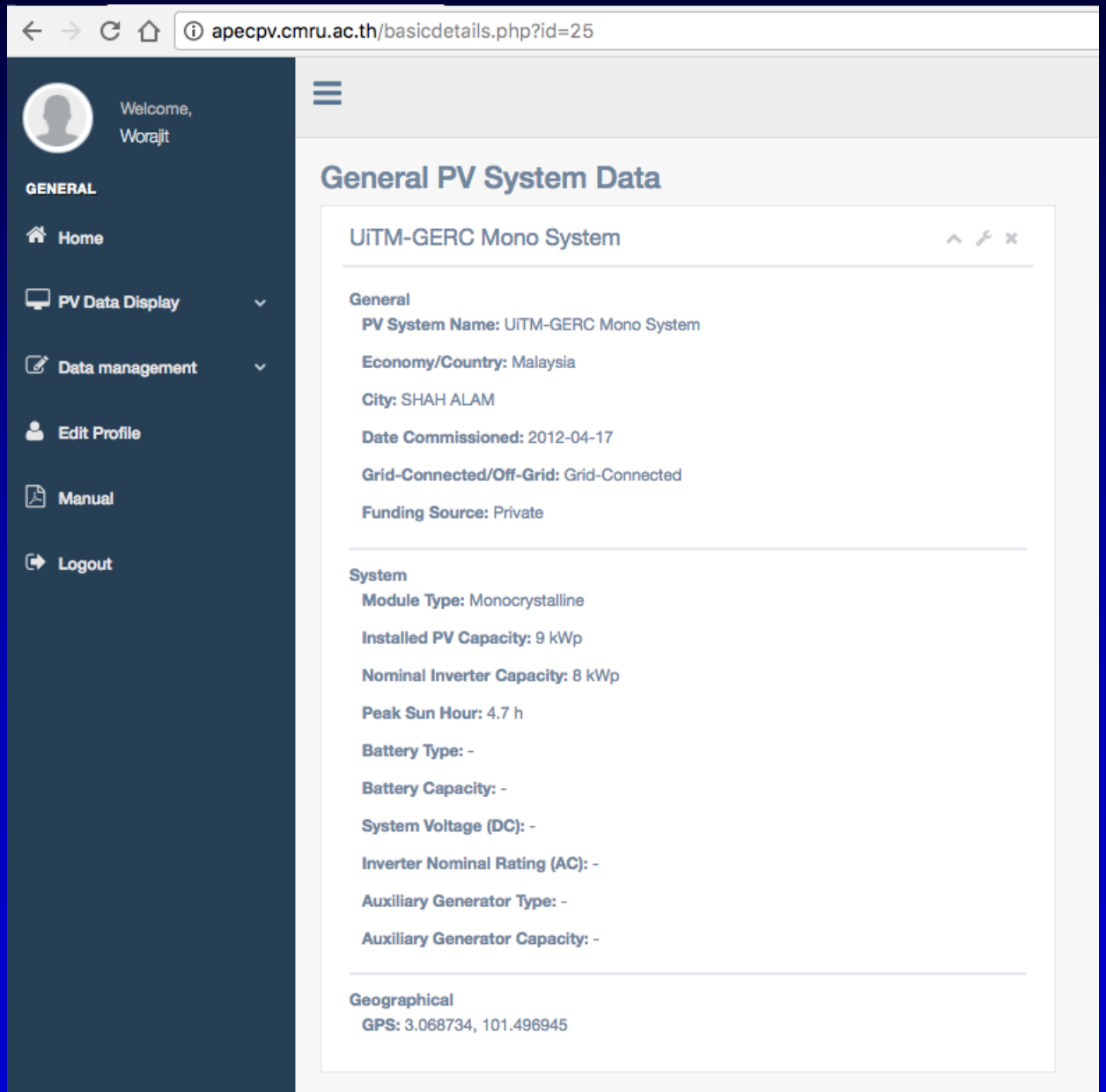


List of PV System Page ~ 50 sites from 5 Economies

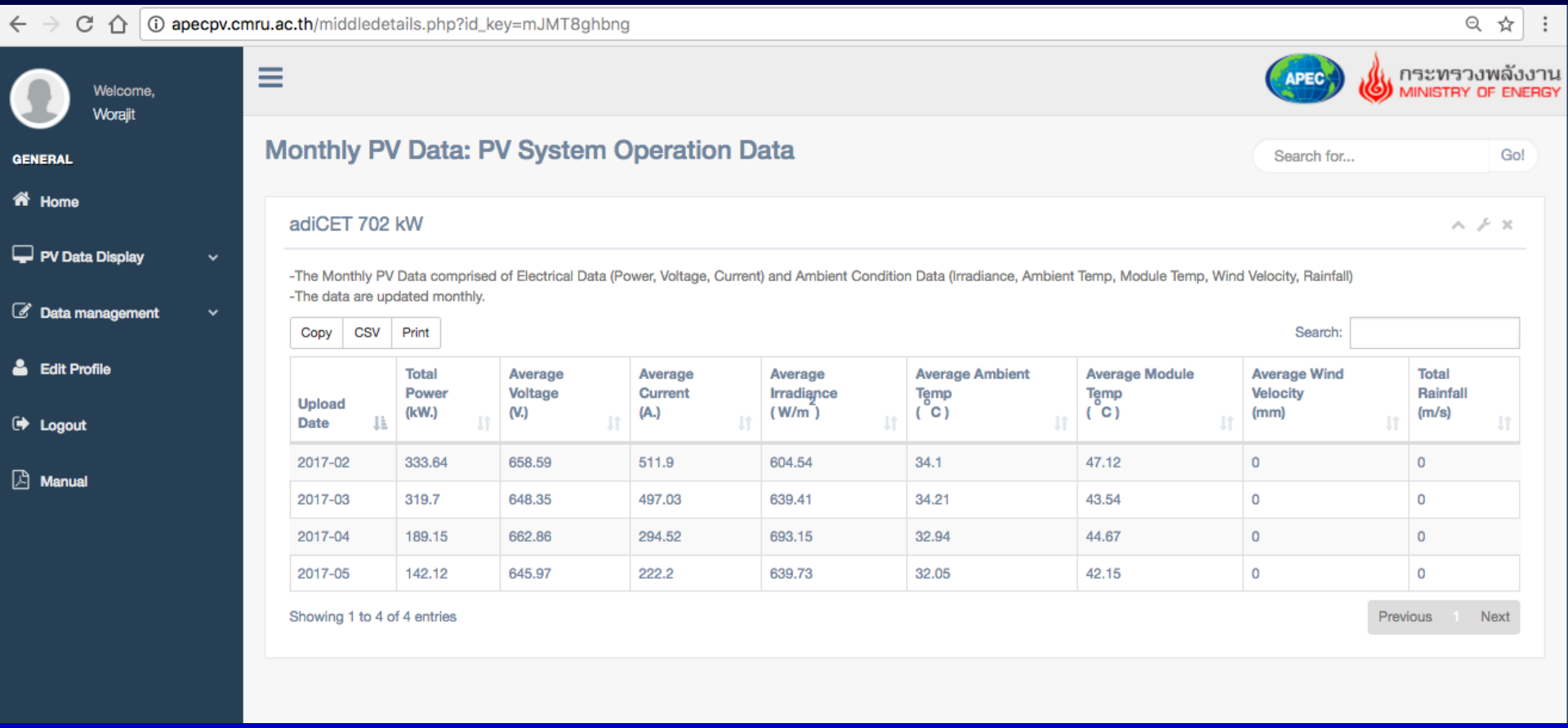


Economy	PV System Name	Size (kWp)	Grid-Connected/Off-Grid	General PV Data	Monthly PV Data	Daily PV Data
Indonesia	IFC Rooftop	26	Grid-Connected	View Data	View Data	View Data
Indonesia	Koloral Island	1.86	Off-Grid	View Data	View Data	View Data
Indonesia	JATENGS06	15	Off-Grid	View Data	View Data	View Data
Indonesia	MALS11	50	Off-Grid	View Data	View Data	View Data
Malaysia	UiTM-GERC Mono System	9	Grid-Connected	View Data	View Data	View Data
Malaysia	UiTM-GERC Poly System	5	Grid-Connected	View Data	View Data	View Data
Malaysia	UiTM-GERC Thin Film	1	Grid-Connected	View Data	View Data	View Data
Malaysia	Telok Melano	66.3	Off-Grid	View Data	View Data	View Data
Malaysia	Arur Dalan	56	Off-Grid	View Data	View Data	View Data
Malaysia	Long Semadoh Naseb	106.92	Off-Grid	View Data	View Data	View Data
Malaysia	Long Kajang	69	Off-Grid	View Data	View Data	View Data
Malaysia	Lusung Laku, Balanga	226.8	Off-Grid	View Data	View Data	View Data
Malaysia	Long Sukang, Lawas	238.14	Off-Grid	View Data	View Data	View Data
Malaysia	Rumah Dau Sri Aman	129	Off-Grid	View Data	View Data	View Data
Malaysia	Bario Central	887	Off-Grid	View Data	View Data	View Data
Malaysia	Long Lellang Bario Baram	127	Off-Grid	View Data	View Data	View Data
Malaysia	Long Peluan Bario Baram	69	Off-Grid	View Data	View Data	View Data
Malaysia	Long Seridan Bario Baram	112.32	Off-Grid	View Data	View Data	View Data
Malaysia	Pa' Dalih Bario Baram	108	Off-Grid	View Data	View Data	View Data
Malaysia	Pa' Lungan Bario Baram	69.12	Off-Grid	View Data	View Data	View Data
Malaysia	Pa' Mada Bario Baram	48.86	Off-Grid	View Data	View Data	View Data
Malaysia	Pa' Remudu Barion Baram	40.32	Grid-Connected	View Data	View Data	View Data
Malaysia	Sungai Tunoh	288.12	Off-Grid	View Data	View Data	View Data
Malaysia	Nanga Janan	164.64	Off-Grid	View Data	View Data	View Data

Data from Tier 1– General information of PV systems

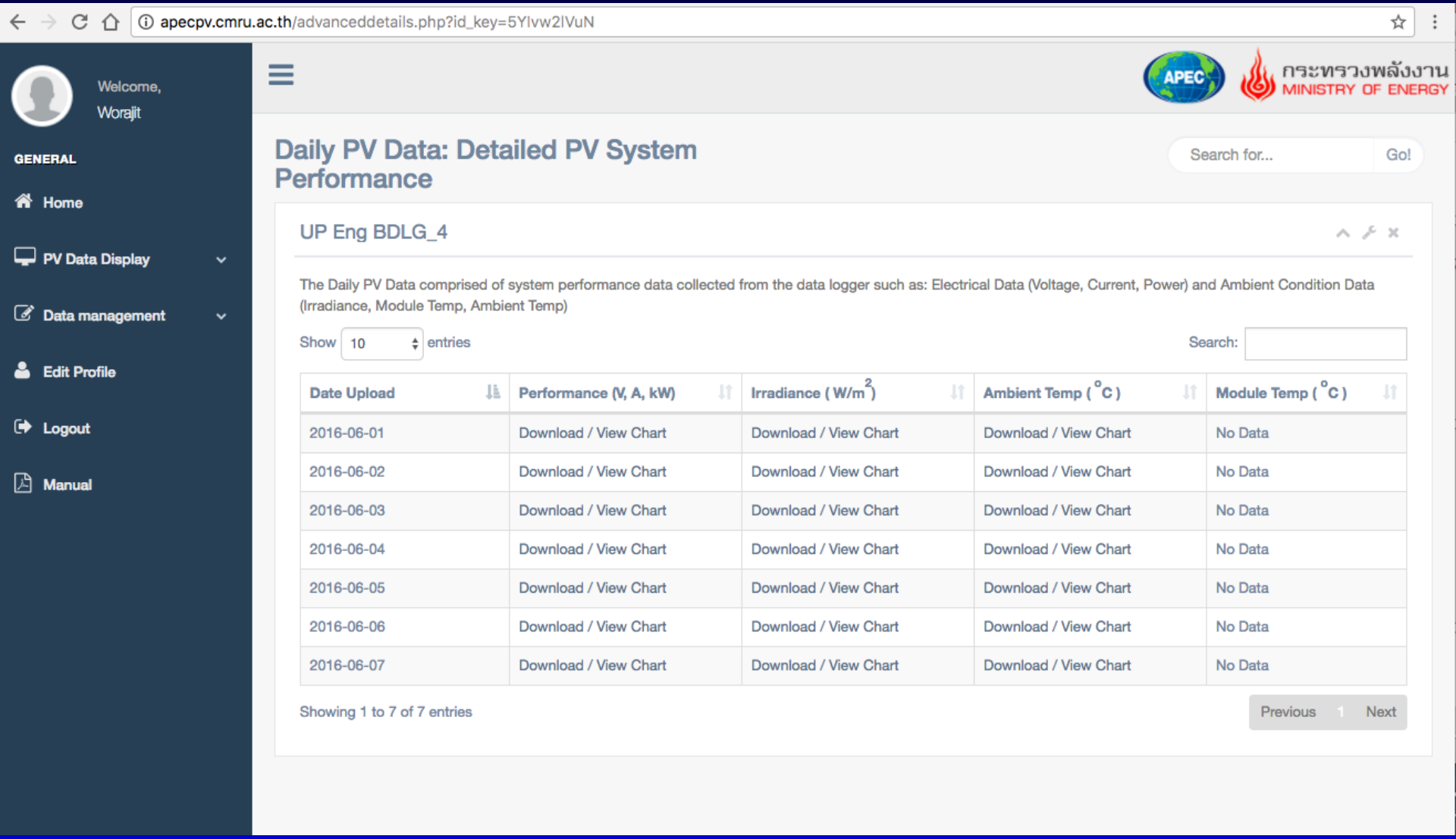


Data from Tier 2– Detailed system operation data (monthly)

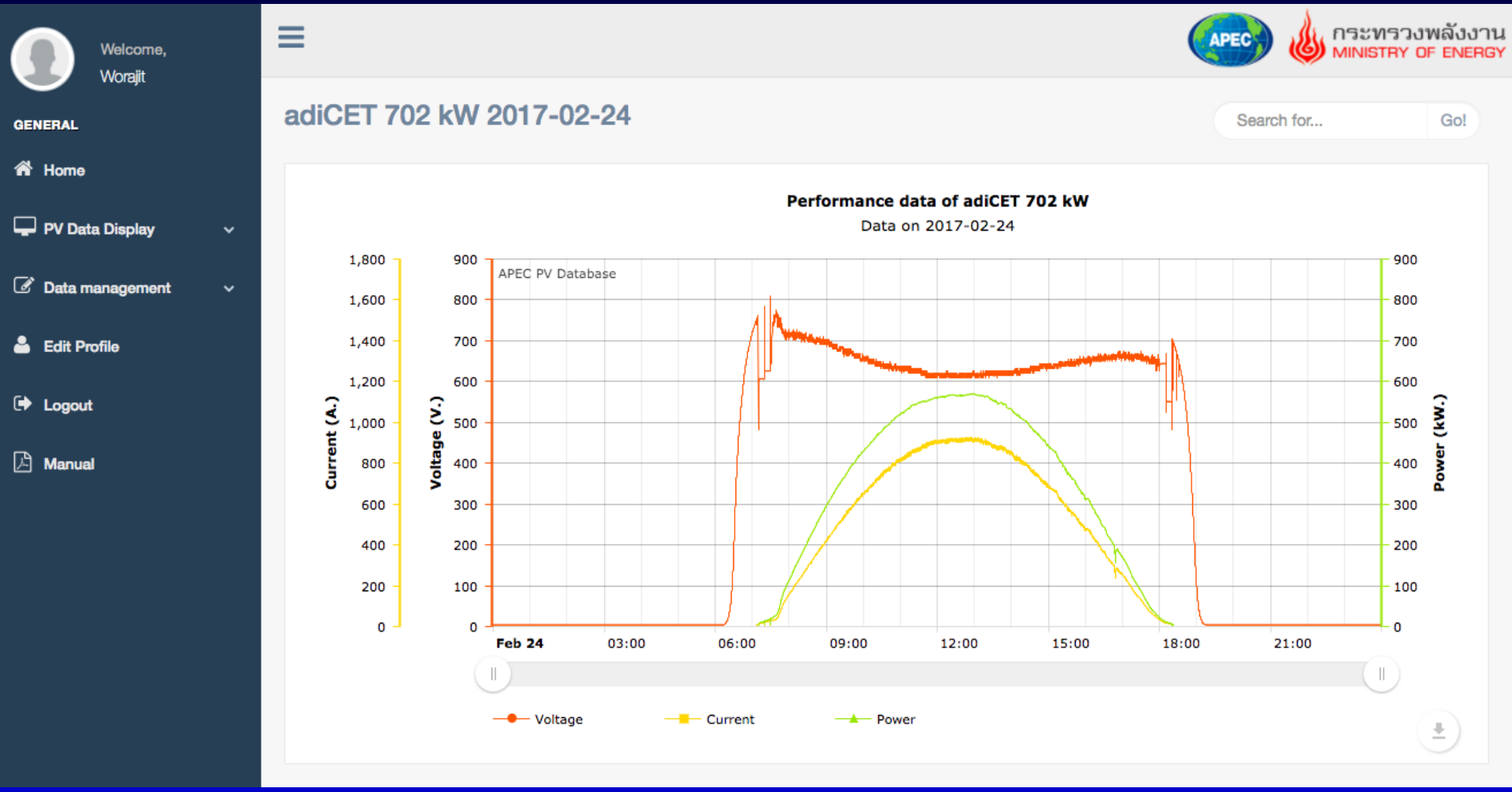


Data from Tier 3–

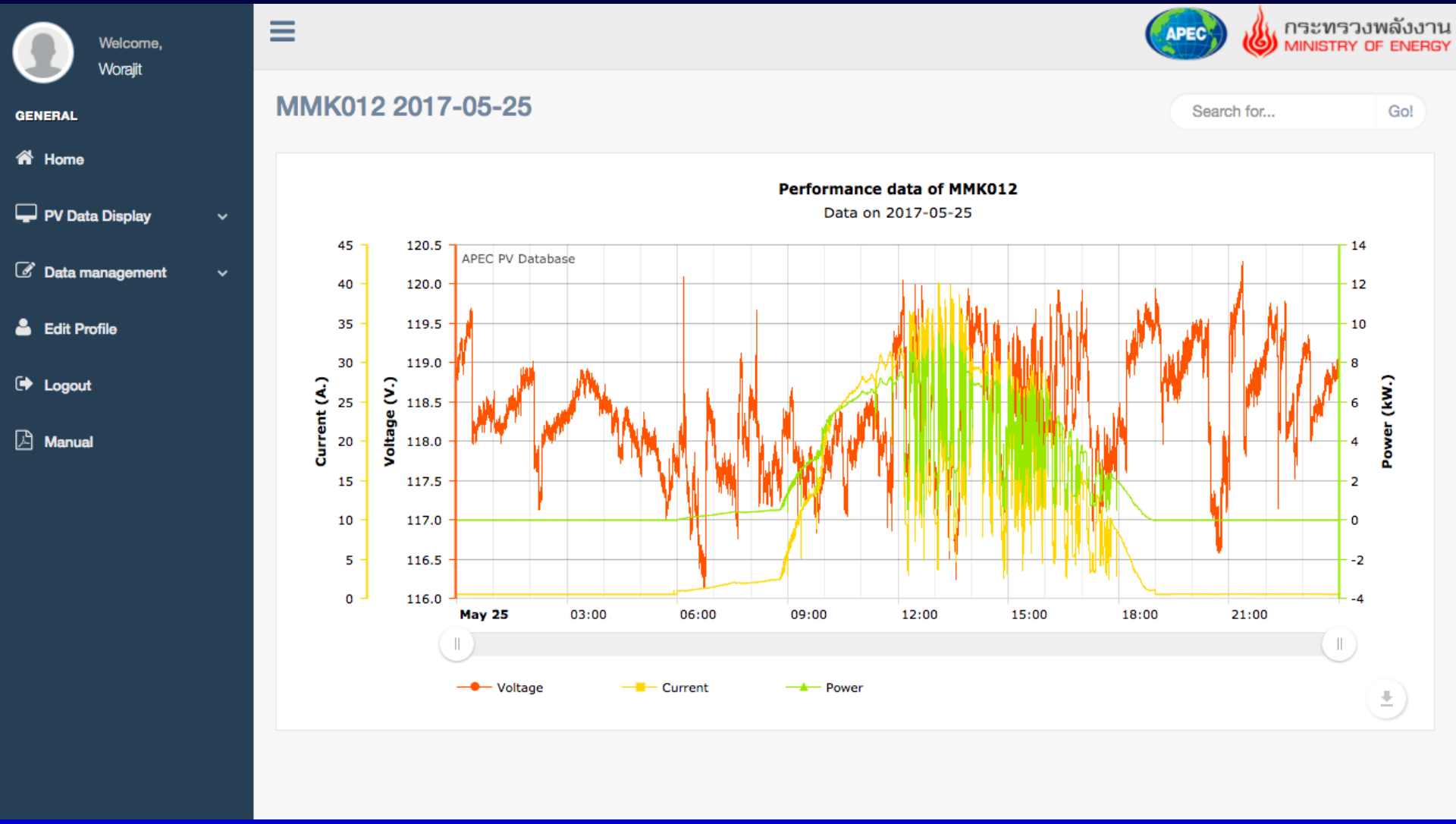
Detailed performance data: Download CSV file and Chart Display



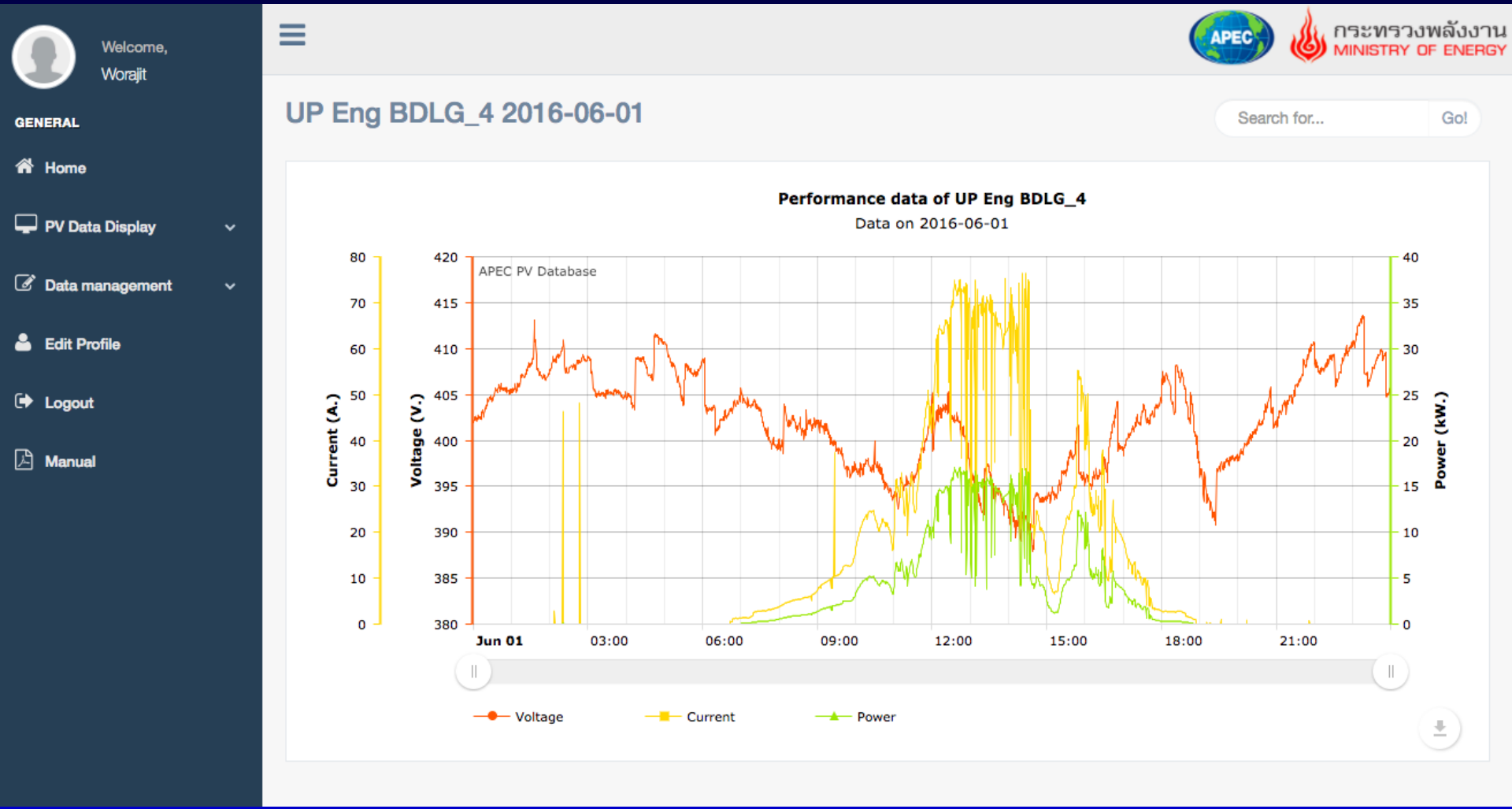
Data from Tier 3 – Chart Display



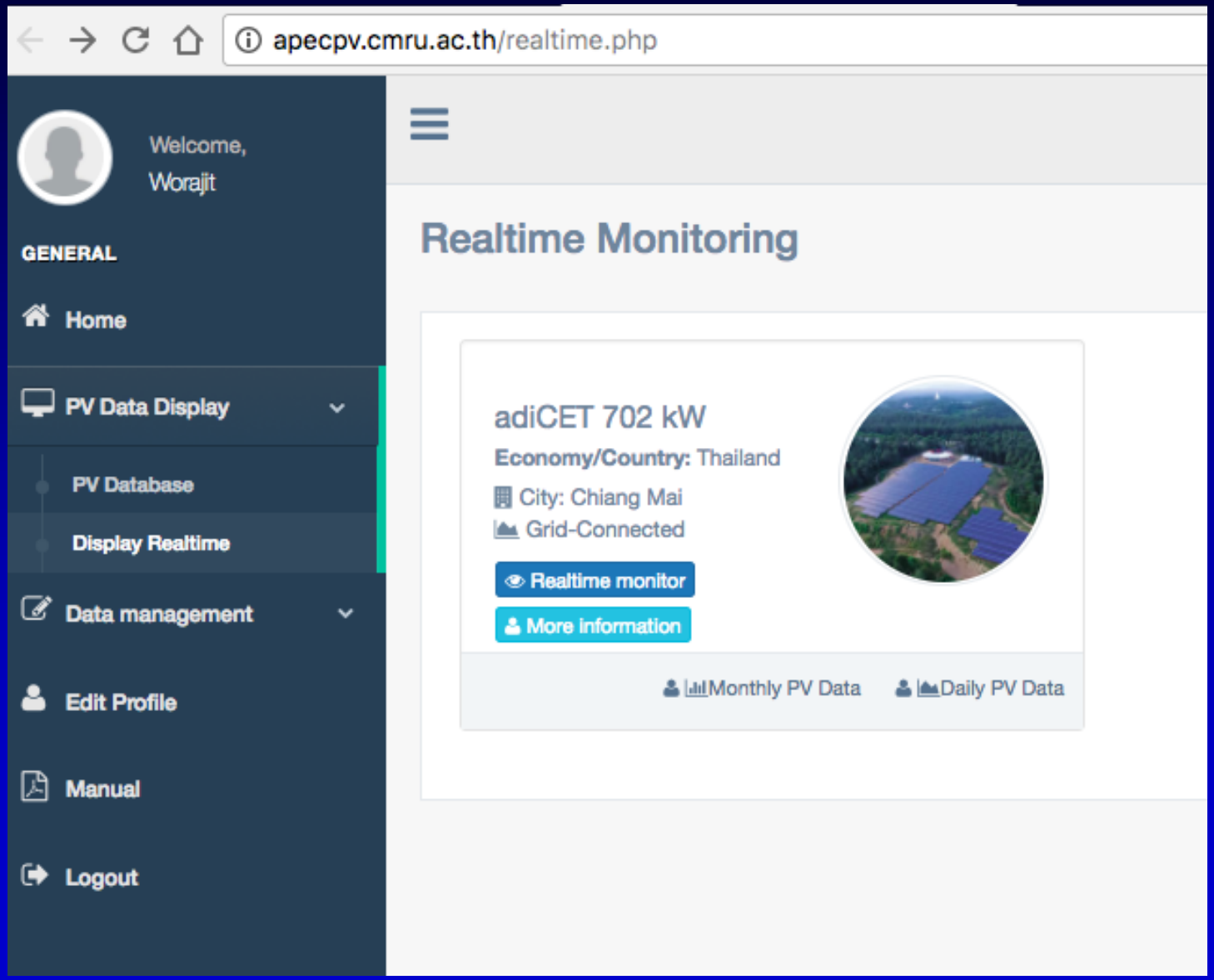
Data from Tier 3 – Chart Display



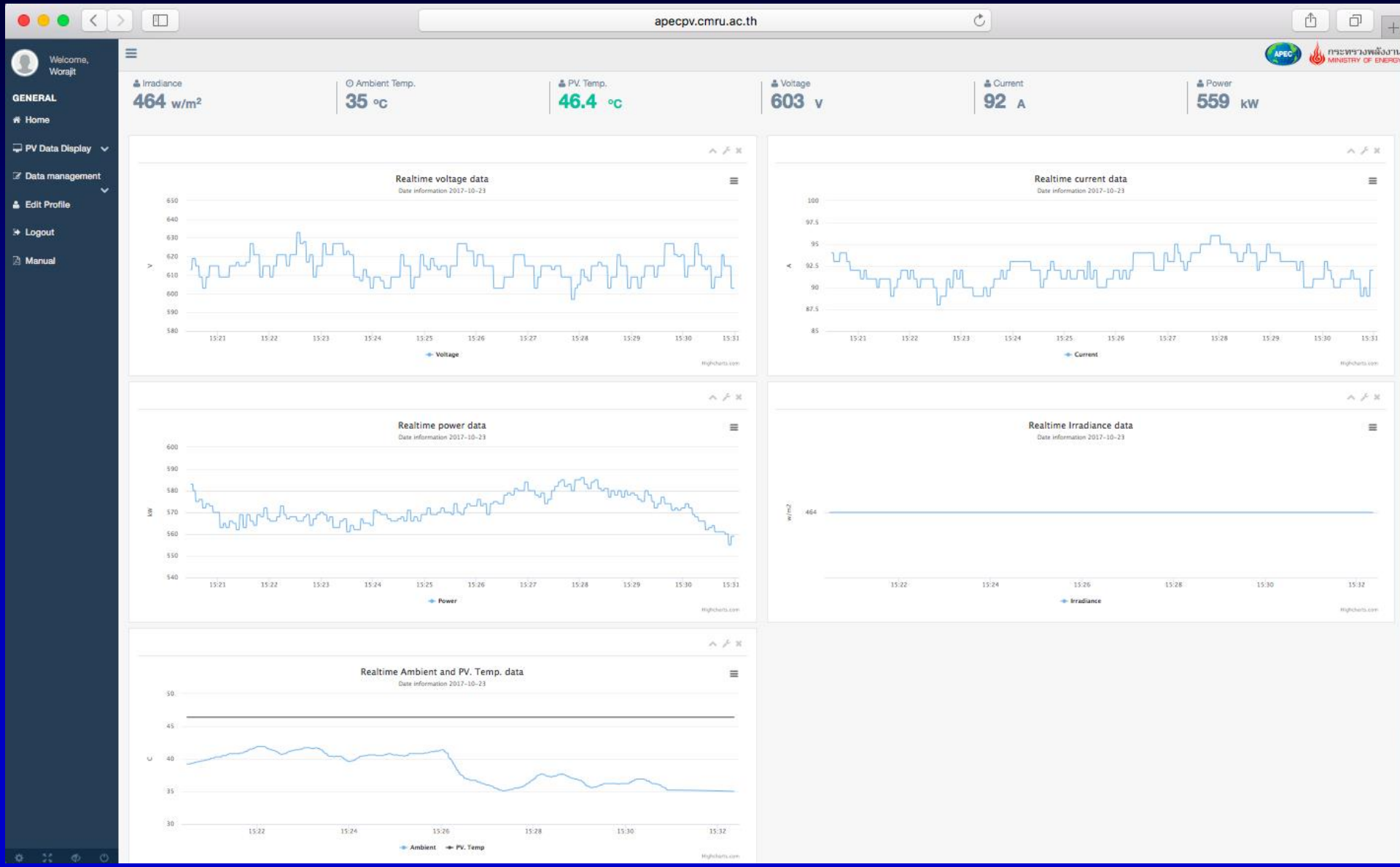
Data from Tier 3 – Chart Display



Real-time Data – Linked to PV monitoring system



Real-time Data – 702 kW, Chiang Mai, Thailand



http://apecpv.cmru.ac.th/monitor702.php

Workshop 2 Summary

- Database initiated: http://apecpv.cmru.ac.th
- Working Group Collaboration:
  - Economies: Thailand, Malaysia, Indonesia, USA, Vietnam ~ 50 sites
  - Participants: University; Research Institute; Utility
- Keynote Speaker & Invited Talk
  - Existing Databases – Performance, PV Fault Report Portal, Solar PV Map
    - Current – limited data set, need for Asia hot/humid climate → Connect with IEA
    - Easy for data sharing/ simple form
    - Must PR to keep the database alive
  - Data Collection and Analysis
    - Alignment: Standard, collection method
    - IEC 62446 Grid Connected photovoltaic systems – Minimum requirement for system documentation, commissioning tests and inspection
    - IEC 61724 Photovoltaic system performance monitoring – guidelines for measurement, data exchange and analysis
  - Data Analytics and Data Utilization
    - Data monitoring device – wireless, low cost, stable (long range)
    - Big Data Analytics – Machine Learning – useful analytic tools for data analysis

Workshop 2 – 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
  - CO_2 Emission Computations
  - Energy consumption data
  - Algorithm for Forecasting
- Way forward
  - Use IEC 61724 and build upon IEA PVPS Task Force
  - Datasharing agreement

Group 1:
Network – Collaboration, Activities

- Increase awareness/ benefit of the Database
- Define specific purpose of stakeholder: Policy maker/ government/ academia/ research
- Challenges
  - Proprietary technology; Business strategy
- How to approach
  - Policy; Awareness; Corporate Social Responsibility
- Collaboration Activities
  - Remote Island Grid
    - Technical Issues; Joint Research; APEC Activities
  - Socio-Economic Issues
    - PV system relations with improve socio-economic activities
    - Common factors/category on socio-economics
  - Gender
    - Gender related activities; women promotion of renewable energy
  - Harmonizing Documents
    - Standard of documents for economies

Group 2

Resources – Facility, Equipment, Capacity Building, Funding

- Facilities & Equipment
  - Data sharing should start with Universities with their own monitoring system
  - Provide central database
- Capacity Building
  - Indonesia: University can invite expert for training
  - Thailand/Australia/Philippines: Government training
  - Chinese Taipei: Government pay 50% for training for PV home user
  - Korea: Call center to provide support
- Way Forward
  - 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

What's Next – Way forward?

- Using Existing Network – for data collection
- Build upon the network with EGNRET Network, IEA database, APERC, CSR, Industry Associations, Government Monitoring
- Proposal – Continue 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
- Proposal – New Projects to APEC
  - Remote Island Grid
  - Socio-Economic Issues
  - Gender
  - Harmonizing Documents

Acknowledgments

- Ministry of Energy, Thailand
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- Chiang Mai Rajabhat University
- University of Teknologi Mara
- University of Phayao
- Ho Chi Minh City University of Technology
- University of Indonesia
- National Chin-Yi University of Technology
- NECTEC, NSTDA
- NHEI, University of Hawaii
- Office of Naval Research, USA
- National Research Council of Thailand

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Thank you – Kob Khun Ka

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