Smart Campus Concept and Implementation in TNB Research with Advanced Virtual Energy Manager Solutions

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Introduction

Smart campuses have been implemented in many modern campus buildings such as in education and research centers. Smart campuses use advanced digital technology and the internet-of-things (IoT) to resolve customer pain points, building a digital foundation for intelligent campuses that achieves standardized connectivity and service-oriented applications. TNB Research is at the forefront of implementing a smart campus with advanced virtual energy manager (VEM) solutions. VEM is an integrated cloud-based energy management and monitoring system that combines an open end-to-end integrated IoT architecture, data management, and analytics platform that provides a web-based platform with high usability and functionality.

The Smart Campus at TNB Research

As shown in Fig. 1, the smart campus at TNB Research features the following:

1. Electric vehicle supply equipment (EVSE) with hybrid solar PV system, consisting of 24.15kWp solar PV, 650Ah/62.4kW battery energy storage system, 125A fast charger, and 30A slow charger.
2. 88.4kWp solar building integrated PV (BIPV) car park.
3. 10kWp grid-connected floating solar PV system.
4. 250kW/500kWh battery energy storage system for virtual power plant (VPP) application.

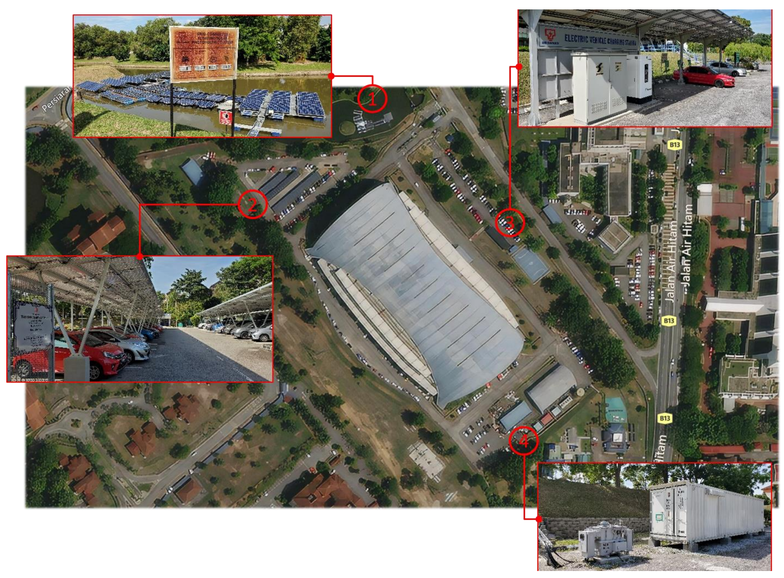

Fig. 1. Smart campus at TNB Research

The Need for EMS

Common challenges associated with the energy management include transitioning to sustainable and green energy targets, managing energy performance and identifying opportunities to improve, and taking key actions and obtaining improved energy efficiency (EE) and sustainability performance.

ENERGY CONSUMPTION VISIBILITY

Steps towards reducing energy consumption.

CO2 EMISSIONS VISIBILITY

Invaluable insights into achieving net zero emissions.

BUILDING ENERGY INDEX (BEI) VISIBILITY

Provides a means of measurement and indication of building energy performance.

Virtual Energy Manager (VEM)

VEM offers the following solutions, [See Fig. 2]:

CONNECTED GRID & ENERGY USAGE MONITORING

- VEM user is able to monitor total consumption and furthermore visualize individual energy usage profile for each of the connected loads. Preconfigured analysis of each electricity usage pattern, load capacity and grid import status can be monitored via individual energy KPI dashboards.

PEAK LOAD FORECASTING & ANOMALY DETECTION

- VEM detects changes in the load profile, connected loads, voltage, current, as well as any unusual behavior to the system, for optimal and energy efficient operation.

ENERGY EFFICIENCY ANALYTICS & GHG EMISSIONS MANAGEMENT

- VEM discovers and generates a higher energy saving potentials and furthermore account for GHG reduction efforts for the participating clients.

GREEN ENERGY MONITORING & MANAGEMENT

- VEM technology provides real-time data from connected RE generation and furthermore tracks green electricity supplied from other RE generation under Green Electricity Tariff quotas.

TRACKING OF COMMUNITY ENERGY PROJECTS

- VEM delivers on various fronts with track record for monitoring different community energy application such as Battery ESS, Solar PV system, Chiller BMS, and Multi-storey Building

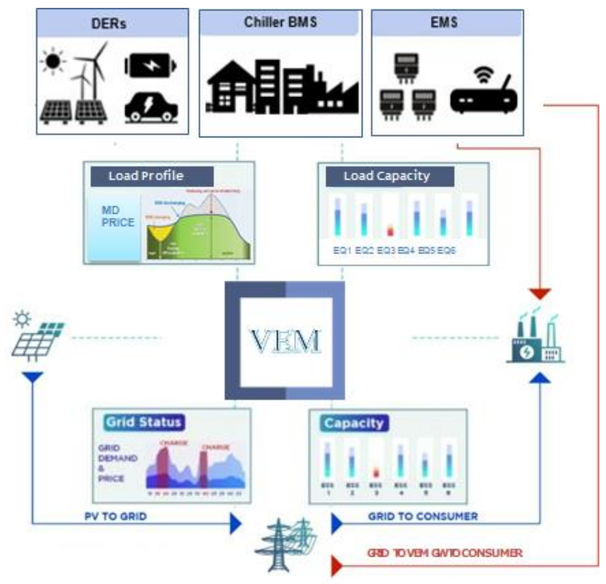

Fig. 2. Virtual energy manager (VEM) solutions

VEM Features

VEM features are as follows, [See Fig. 3]:

A. Initiation: Energy solutions tailored to business needs and plans.

B. RE Generation: Harness the power of RE with solar panels.

C. Building & Energy Management: Make the buildings smarter and more efficient.

D. Optimization & Storage: Manage on-site energy use with load management and battery energy storage.

E. Energy & Customer Insights: Enable interactive energy services connecting buildings to District Energy Manager, Virtual Power Plant and DSR Program.

Fig. 3. A case study of VEM in TNB Research.

A BUILDING

Data Analysis and Reporting

Data from multiple VEM On-site Meters is collected, stored and collated into instantly understandable reports. The information captured is real-time, transparent and automatically provides visualization of the aggregated data.

B SOLAR PV

C EV CHARGING

Contact

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