Power Management using Advance Metering Infrastructure in a renewable energy park, Kamphaeng Phet Rajabhat University

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ABSTRACT

Energy used from fossil fuels that are currently the world's primary energy source, are currently on large volume which is limited resource, namely, conventional energy and tend is insufficient in the future. Alternative energy such as solar energy, wind energy and gasifier might be necessary. The management of renewable energy is recently implemented with Smart grid. Choosing the appropriate available resources with information and communications technology (ICT), automatic meter reading (AMR), advance metering infrastructure (AMI), demand side management (DSM), plug-in electric vehicle (PEV), energy storage, and also distributed generation (DG) in a renewable energy park, Kamphaeng Phet Rajabhat University was to make the electricity grid of the future by integrating together of the newest wide range technologies for community and energy park.

The system was installed with an advance metering infrastructure (AMI) that can be used to measure the volume of electricity as the former power meter. Battery bank, storage supply and load (Negative load) were use to controll the power supply Included of. remote electronics volume measurement. Further development was to involve with computer system for managing power energy in the energy park such as controlling electrical energy volume via mobile phones. There are more comfortable and to save energy for users.

This article was aimed to study the smart meter as a guide to the installation of smart grids in the future. The smart meter could read the electrical energy used by the electronics circuit and the transmission of information in digital form to the control system by using automatic meter reading (AMR). It could communicate with electrical equipments in a renewable energy park, Kamphaeng Phet Rajabhat University. In order to help in energy management (such as demand side management (DSM) effectively, the smart meter will be adopted.
Main Content

The traditional power meter is a device used to measure the load and electrical measurement for a home-use purpose only. On the other hands, a new model of electricity meter or a new smart meter could control the power supply that will be investigated including of remotely electronics volume measurement. Besides, further deployment of the computer system will be contributed power management in the energy park such as electrical volume control via mobile phones. Its advantages were more comfortable and energy savings for users. If power supply exceeds a preset amount, the system could automatically control the electricity usage in each section on the building according to the priorities that the system was set up. For example, define electricity usage in energy park use up to 1 kW, and if it is used beyond the prescribed. Prioritize that, First, turn off the air conditioner, TV, lamp, respectively. The system shall cut off electricity current as we determine, and then supply power to the appliance when we reduce the use of electricity of other appliances. Alternatively, we can just turn on/off appliances via mobile apps as needed at all [3].

In addition to measuring the amount of electricity as well as the former power meter was also used battery bank for energy storing, it could be supply and load (negative Load). Former power meter and smart meter is shown in Figure 1, and the comparison of traditional gauge and intelligent electronic gauge shown in Table 1.
The comparison of traditional gauge and intelligent electronic gauge [6].

<table>
<thead>
<tr>
<th>Working ability</th>
<th>Traditional gauge</th>
<th>Intelligent electronic gauge</th>
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<tbody>
<tr>
<td>Power measurement</td>
<td>Capable</td>
<td>Capable</td>
</tr>
<tr>
<td>Optical communication(Optical port)</td>
<td>Capable</td>
<td>Capable</td>
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<tr>
<td>Communication via RS485 Interface</td>
<td>Capable</td>
<td>Capable</td>
</tr>
<tr>
<td>Intelligent network supports</td>
<td>Incapable</td>
<td>Capable</td>
</tr>
<tr>
<td>The ability to communicate with the control center wirelessly or wired.</td>
<td>Incapable</td>
<td>Capable</td>
</tr>
<tr>
<td>Detect fraud electricity bills such as while it was tampering, it will make an alert toward the control center.</td>
<td>Incapable</td>
<td>Capable</td>
</tr>
<tr>
<td>Record and alert to the control center automatically when the events occurred</td>
<td>Incapable</td>
<td>Capable</td>
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According to the study of smart grid and smart meter system, the researcher has applied this system in the Energy Park of Kamphaeng Phet Rajabhat University, for the purpose of electricity management in the energy park efficiency and smart technology Learning Center in the Energy Park, Kamphaeng Phet Rajabhat University. Energy resources that provide to the energy park consist of 2.4kW Solar cells, 0.68kW wind power, and 10kW gasifier as shown in Figure 2.

Figure 2: Renewable energy park, Kamphaeng Phet Rajabhat University
The power supply of the Energy Park, Kamphaeng Phet Rajabhat University as shown in Figure 3.

Shown on figure 3, was found that the energy park has had an energy management consist of a power supply from solar energy, wind energy and gasifier. Nowadays, an operation building uses of solar energy as a primary power source. Receiving energy is stored in the batteries as a Battery Bank to supply the load inside the building, divided into three categories (1) Resistance / Resistant Load (R) such as a light bulb and thermos. (2) Inductance / Inductive Load (L) is the electromagnetic coil motor devices such as refrigerators, air conditioners. (3) Conductance / Conductive Load (C) is the device that has a capacitor or condenser.

Figure 3: Smart grid system in the Energy Park, Kamphaeng Phet Rajabhat University.

Figure 4: Smart grid system in the Energy Park, Kamphaeng Phet Rajabhat University.
Shown on figure 4, Smart meter technology is part of the smart grid. Smart Meter is able to manage energy in The Energy Park is efficient, such as Knowing the power of the active load, Control switch on/off electrical applications in each section of the building automatically, and if power from the battery not enough to supply to the load, the smart meter will draw power from the Provincial Electricity Authority (PEA) automatically.

This research was aimed to study the application of smart meter, installation, system control (Automatic Meter Reading, AMR), and communication with electrical equipment. To help energy management as demand side management (DSM) in controlling the amount of electricity. Even if the power supply voltage exceeds a preset amount, the system can control turning ON/OFF electrical appliances in each section automatically to save more energy. Smart meter could control the power supply to loads in the Energy Park. If electricity power is not enough, the smart meter will draw power from the provincial electricity authority (PEA) or if energy is remaining, it will transfer into micro grid system. Smart meter will be installed to implement in the Energy Park, Kamphaeng Phet Rajabhat University that could help to reduce energy consumption by about 5-15%.
References