

A Study on Integrated Application of Smart Green Community and Home Energy Management System (HEMS) - Taking the Dormitory Area of XingDa Power Plant as an Example

(Load Management Laboratory : Chang, Tso-fan Chen, Chia-hsiang)

Introduction :

This study is to cope with the plan of the Executive Yuan to implement AMI demonstrations of the scale of 1,000 households- deploying connections from AMI to both the utility end (Route A) and the user end (Route B).

The focus of this study is to aggregate individual AMI data through Route B so as to (1)calculate the overall electricity consumption of the whole community, (2) evaluate the ranking of individual electricity consumptions , and (3)promote the policy benefits of electricity saving incentives.

This study takes the Xingda Power Plant dormitory area as an example to create an experimental cloud energy management system, and to provide the four main functions as follows: (1)community energy management system (CEMS), (2)Home Energy Management System (HEMS), (3)Community WiFi Internet integration, and (4)Automated demand response and business model.

In order to ensure steady Internet coverage, we built WiFi wireless local network in the aforesaid dormitory area to collect data from the indoor gateway connected to smart plugs to allow the users to grasp their power consumption information in different time periods through a smartphone APP. The individuals in the community, when equipped with smart control units (SCUs) or smart plugs, which are connected to the HEMS through WiFi wireless network, will be granted with the functions of measuring and recording the electricity consumption patterns of their appliances. During off-peak hours, the system only record the user's power consumption data as a basis to calculate the power consumption baseline for ADR events.

The results of this study :

1. Accomplished surveying the cases of residential and commercial users participating in the integrated application of automated demand response, smart green community and home energy management system.

2. Accomplished implementing the Internet infrastructure for the smart green community, so as the entire community now covered with WiFi signals, and the smart green community provided with Internet service.
3. Accomplished installing the home energy management system (HEMS) to provide functions of real time power consumption measurement, a cloud platform for mobile data query, remote control of electrical appliances, and air conditioning power usage reduction. Installing external smart plugs or smart control units on specific circuits of the existing power distribution board helps realizet the functions of ADR event commands, power consumption measurement, remote control through a WiFi wireless network, and mobile phone accesss. The said mobile phone APP can display the power consumption information, and remotely control the appliances or circuits, to realize smart home concepts.
4. Accomplished implementing the Automated Demand Response (ADR): With the OpenADR 2.0b agreement, according to the instant dynamic power load data, the system may perform ADR mode to curtail the power demand.
5. Accomplished implementing the community energy management system (CEMS): the system may provide the functions of visualization of the electricity consumption of the entire community, energy consumption ranking of the residents, community safety monitoring, and promoting the policies of Taiwan Power Company.

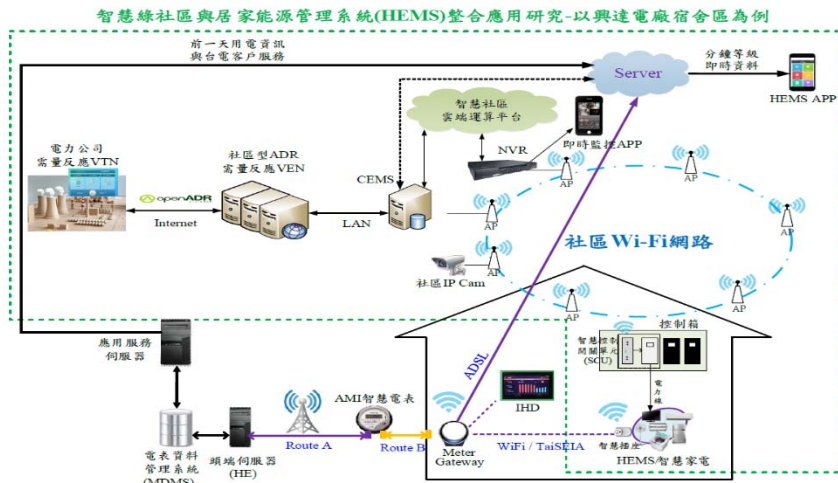


Fig.1 CEMS and HEMS integration System Architecture



Fig.2 HEMS APP Functions

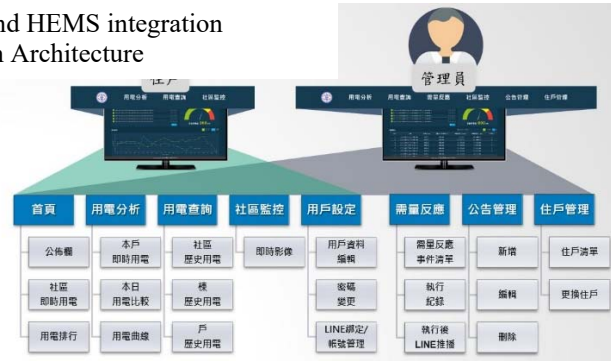


Fig.5 CEMS Web Functions

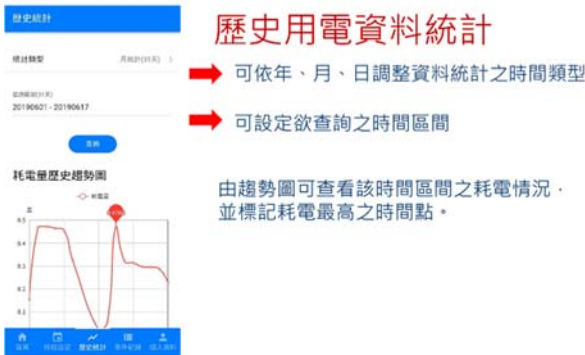


Fig.3 Energy consumption statistics on mobile APP



Fig.6 Community energy consumption comparison



Fig.4 Energy consumption analysis for AMI and smart appliances on mobile APP



Fig.7 User energy consumption ranking