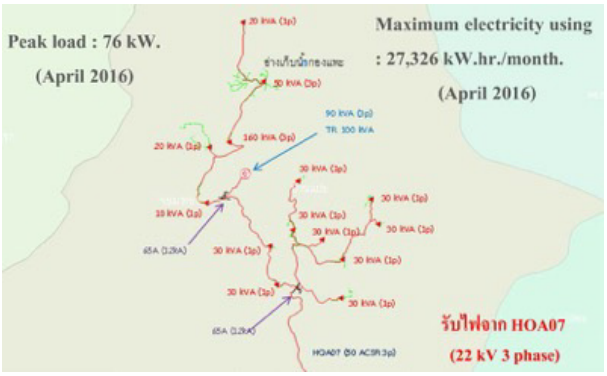
Case Study

NR Completed Thailand's First Hybrid Microgrid in Chiang Mai

Ensure reliable system availability, highest possible penetration of PV power, and guarantee the agriculture irrigation for local farms

At the end of the year 2017, NR has completed Thailand's first microgrid, at Ban Khun Pae Village, Chom Thong, Chiang Mai. It is the first smart hybrid microgrid site of Thailand, consisting of 100 kW PV power station, 100kW*1hour Lithium Battery Energy Storage System (BESS) and 90kW small hydro generator.

Project Overview



Ban Khun Paka Village is located about 35 km away from HOA substation and has approximately 483 households (mostly are agriculturists). The maximum load is 76 kW and 27,326 kWh (as of April 2016). In ever before, there was only one small hydropower plant of 90kW which was constructed in 1989, as the main power source for the Khun Pae Royal Development Project and nearby communities. So the distributed power system is very weak inherently. The output of hydropower plant depends on the amount of water, and there are dry and flood season, so the generation of the hydropower is seasonal. Furthermore, the local farms also required the water in the reservoir of hydropower plant for agriculture irrigation. So there are following main issues: unstable power supply of hydropower, electricity shortage and the conflicts between irrigation and hydropower generation. Hence, the Provincial Electricity Authority (PEA) decided to build a smart microgrid by integrating hydropower, PV generation and BESS to enhance the local power supply, the stability and resiliency of the power system.

The microgrid should has the ability to work in either Islanding mode or Grid Connected mode. It was planned to install a 100kW solar power system combined with a 100kW*1Hour Lithium BESS system for enhancing the stability and controllability of the system. A new microgrid EMS was installed to realize the system operation including mode switch of on-grid and off-grid, coordinating the agriculture irrigation with hydropower generation in irrigation period. During the irrigation season of local farms, the irrigation should be assured while the hydropower generator will be working in low power mode.

In 2017, NR Electric was selected as the full solution supplier to undertake the engineering, procurement, installation and commissioning for the first microgrid site in Thailand. On Nov. 21st, 2017, the microgrid project was successfully put into commercial operation. Besides NR also manufactured and delivered the following self-development instruments: EMS of PCS-9700-MG, PCS for BESS of PCS-9567, Microgrid controller of PCS-9617MG, and PV inverter of PCS-9563.

Customer Needs

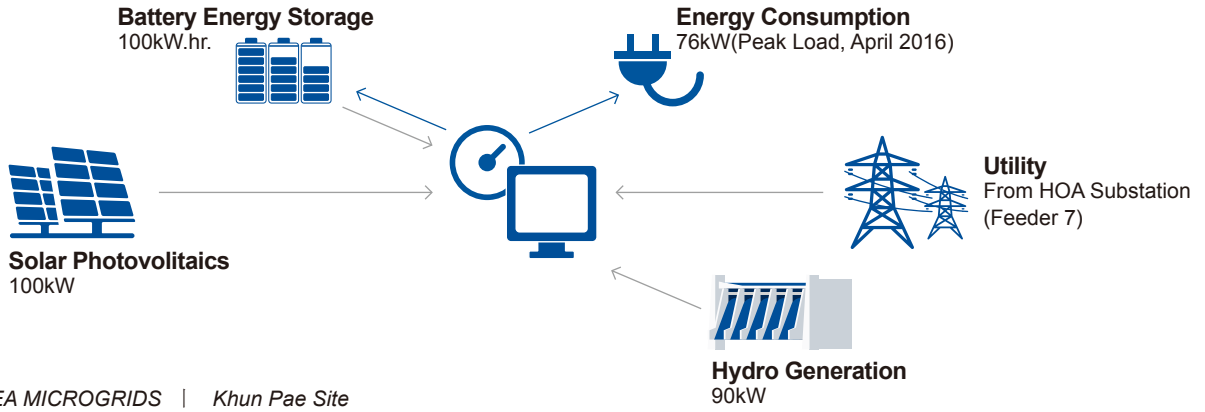
In accordance with Thailand government's policy to promote clean energy to supply power to the transmission and distribution system, PEA has made a power development plan, aiming to develop a secure and smart electrical system to support the application of distributed renewable energy resources. Microgrid is one of the projects in PEA's network development plan. So it is necessary for PEA to study the design of microgrid for remote areas, such as at Ban Khun Pae, Chom Thong District, Chiang Mai, to use renewable energy in communities such as solar power. This will allow the PEA to acquire a prototype model suitable for the microgrid for remote areas. It will be very beneficial to improve the knowledge of planning and managing the PEA power system in the most efficient and effective way in the future. So PEA committed to develop a clean energy generation based smart microgrid system at Ban Khun Pae Village, Chom Thong, Chiang Mai. The main needs of the PEA are as follows.

- To develop a clean power generation system using a smart microgrid system to provide stable power supply effectively.
- To be the prototype for the operation of clean energy production in areas where alternative energy sources are available.
- To be the center for learning clean energy production using microgrid system for PEA staff and educational institutes both in Thailand and abroad.

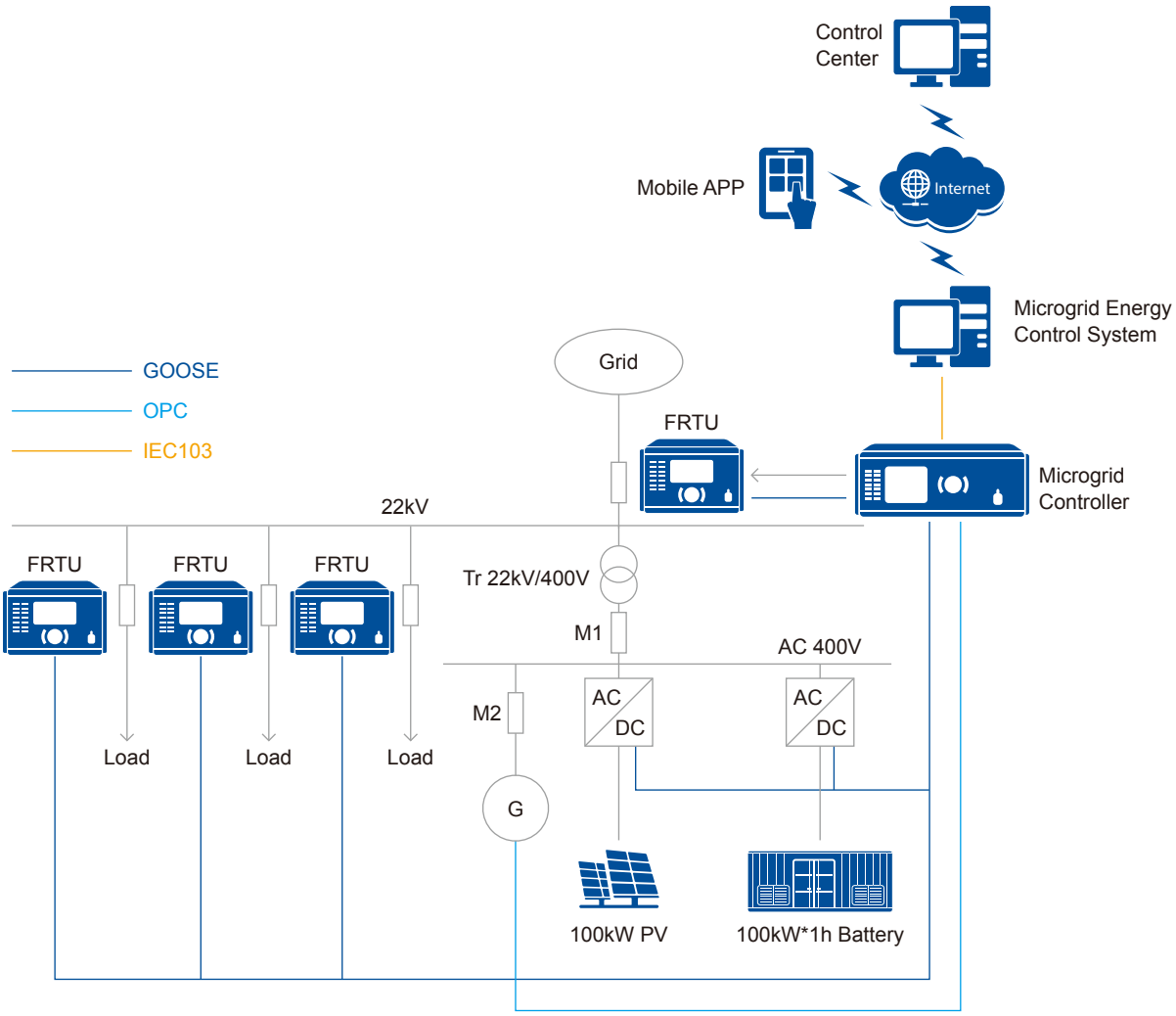

The Original Project Region

NR Solution

The smart and hybrid microgrid in Ban Khun Pae area is designed to combine PV power, energy storage, small hydropower unit, as well as microgrid system control and EMS. It is producing a clean energy based microgrid system, working in either Islanding or Grid-Connected mode with remote power control from the control center of PEA. Since the small Hydropower plant of rating of 90 kilowatt has been completed, so the main equipment to be procured is microgrid control system and EMS, 100 kilowatts solar panels, lithium battery energy storage system of 100kW*1Hour, and 3 sets of switchgears. As the full solution provider, NR supplies turnkey solution for the smart microgrid project, including system design, manufacturing, procurement and commissioning.

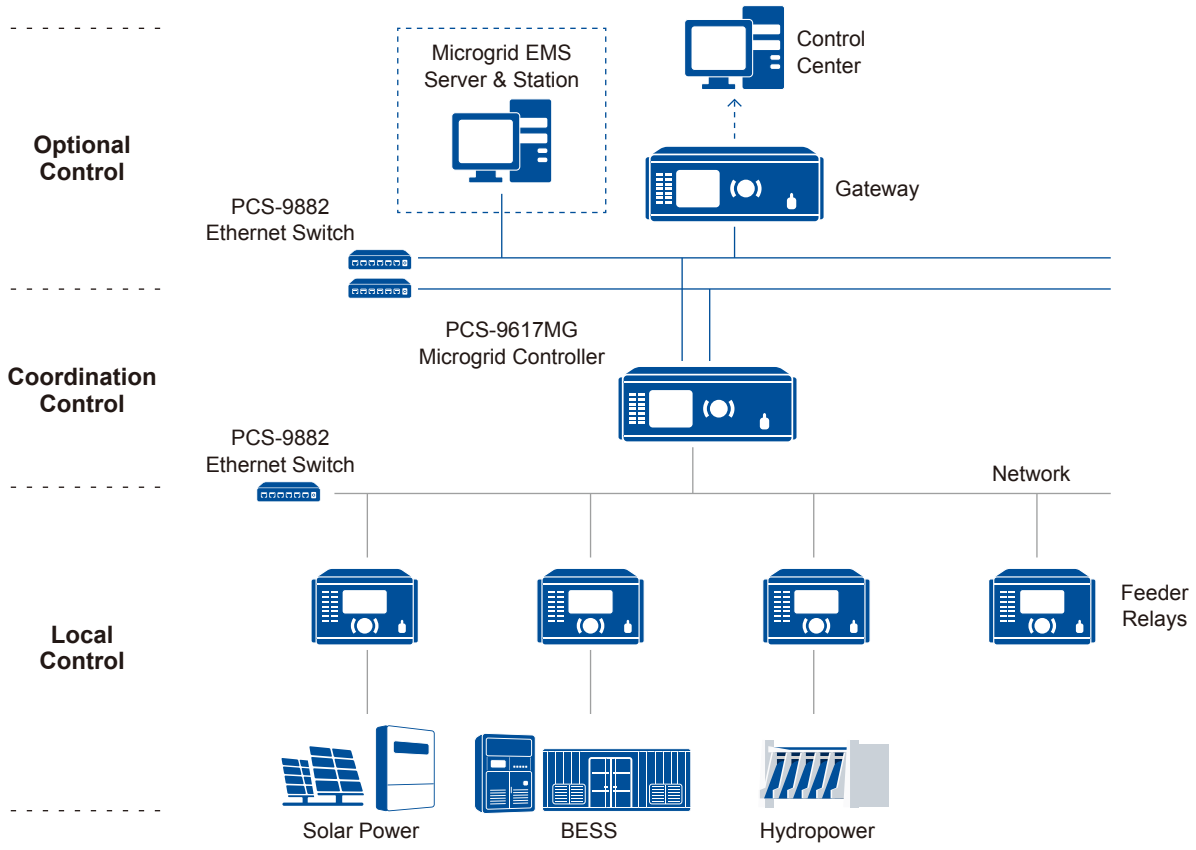


PEA MICROGRIDS | Khun Pae Site



System Architecture of Microgrid

The smart microgrid system with the autonomous control, protection and energy management system is expected to provide multiple advantages including higher energy utilization, higher level of power supply safety and reliability, less power transmission loss, low environmental impact and higher resiliency. For realizing the above advantages, NR provides a safe, stable and reliable microgrid control system, which adopts the design of layered and distributed control system with three levels of local control level, coordinative control level and optimal control level. The high-performance and ms-level response speed of the microgrid controller enables the seamless switch between different operation modes of microgrid. This system will greatly enhance the resiliency and availability of the microgrid, as well as realize the system operation optimization. Furthermore, with advanced coordination ability, the system can optimize the hydropower generator operation mode of lowest power command to save water and ensure the irrigation for the local agriculture.



Layered and Distributed Microgrid Control System

Customer Benefits

On December 21, 2017 Mr. Sermsuk Kaewkaew, Governor of PEA presided over the opening ceremony of Smart Microgrid of Ban Khun Pae area.

After the microgrid being put into operation, it is a center for learning technology of smart microgrid as well as a pilot area for research and development of electrical systems. Besides of being useful to the regional community, it is also a prototype for the development of smart hybrid microgrid since it is the first smart microgrid project in Thailand. This Project aims to develop renewable based smart microgrid system in remote and less developed region for sustainably expanding clean and affordable electricity supply reliably. The hybrid project combines PV system, BESS, small hydropower unit, and is equipped with flexible operation modes switch, black start, fluctuation smoothing, and other versatile functions. It' s effectively realized the flexible control, stable and reliable running of network system, guaranteeing the availability of the power supply, solving the region frequent power outages and effectively improving the level of local agricultural production.

NR Electric, as a power stability expert, is a leading power system solution provider across the world. Base on its strong technical background and vast professional experience, NR Electric will provide best performance, competitive cost and most reliable solutions to our clients.

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