

高占比再生能源離島微電網技術發展與應用

執行單位

原能會核研所

計畫主持人

林金福副所長

- 為提高再生能源使用占比，並降低離島發電成本，本計畫開發微電網相關技術，實際應用於於東吉嶼及金門大小型離島，並將此技術移轉國內廠商，未來推廣應用於東南亞離島或偏遠地區，創造新興產業契機。

中華民國專利：

1. 「可允許電感值變化之換流器負載阻抗估測控制方法」(證書號: I513154)
2. 「多用途電網控制器」(證書號: I502840)
3. 「電網之雙套儲能系統」(證書號: I492472)
4. 「應用於微電網換流器之模式切換控制裝置」(證書號: I506920)
5. 「應用於太陽發電系統並具有最大功率追蹤之市電並聯換流器」(證書號: I487239)



- 進行離島微電網系統工程整合與應用、儲能電力輔助控制技術開發、以智慧變流器進行饋線穩壓與提升再生能源容納能力之研究、微電網饋線電壓調控技術開發、離島機組排程與即時調度、離島電網解併聯技術研究、高占比再生能源與儲能配置之系統衝擊分析、及高占比再生能源及儲能系統之電網緊急運轉系統設計。
- (1)完成本所048館舍微電網系統孤島100小時連續運轉測試，再生能源瞬間滲透率最高135%，發電量占比54%。
- (2)完成應用於東吉嶼的機組即時調度與調控程式開發，瞬間再生能源占比提升至92.8% (106年3月27)，系統仍可穩定運轉，技術達國際水準。
- (3)完成於金門塔山電廠監控室建置微基礎架構之太陽能監視系統，可監控金門共計31處案場，其裝置容量為4.8MWp約占整體再生能源裝置容量之90%，提供台電塔山電廠人員進行機組排程與電力調度之參考。
- (1) 2015年本計畫技轉大同公司建置之屏東縣政府林邊「光采濕地智慧微型電網示範區」，獲得亞太經合會議(APEC)能源智慧社區倡議(ESCI)智慧電網最佳案例評選競賽銀質獎。
- (2) 2017年本計畫與中興電工公司合作以「澎湖東吉嶼微電網供電系統」參加亞太經合會議能源智慧社區倡議智慧電網最佳案例競賽，於21個國家197競爭案例中脫穎而出，榮獲銀質獎。

Development and Application of High-Penetration Renewable Energy System Technology for Island Microgrid

Execution Unit

Institute of Nuclear Energy Research Atomic Energy Council

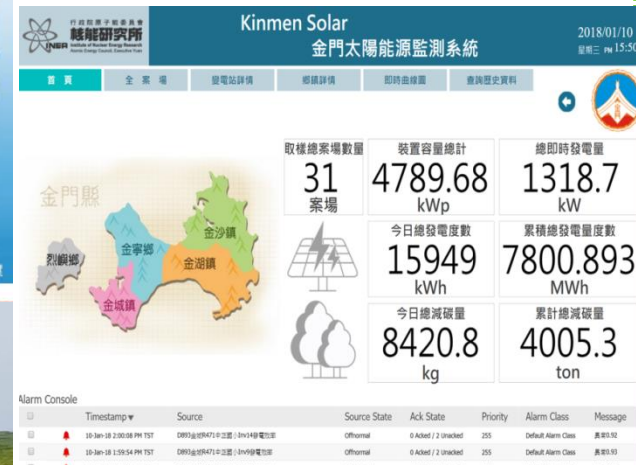
Project Director

Lin, Kin-Fu

- Content: To increase the penetration of renewable energy generation and reduce the power generation cost of out-skirting islands, the microgrid-related technologies were developed and applied to Dongji islet and Kinmen through this project. In addition, these technologies have been transferred to domestic manufacturers and would help them to explore new business for building microgrids on the islands of southeastern Asia.

Patents:

- Load impedance estimation and iterative learning control method capable of allowing inductance variation for inverter (ROC, Permitted)
- Multi-purpose controller of distribution grid (ROC, Permitted)
- Grid system having two energy storage sets (ROC, Permitted)
- Device of mode-switching controller for micro-grid current converter (ROC, Applying)
- Household power parallel converter applied to solar power generation system with maximum power tracking effect(ROC, Permitted)



- The technologies developed in this project include: integration and application of the islanding microgrid system, ancillary control technology of the energy storage system (ESS), utilizing smart inverter to stabilize voltage and increase capacity of renewable energy in the feeder, feeder voltage control within the islanding microgrid, scheduling and on-line dispatch of genset, paralleling and dis-paralleling among islanding microgrids, system impact analysis due to the configuration of high penetrating renewable energy ESS, as well as emergency operation system design of electricity grid with high renewable energy penetration and ESS.
- Achievement 1: 100-hour continuous islanding operation test of INER micro-grid applying Building 048 as load. The instantaneous penetration rate of renewable energy is up to 135% , and the renewable energy power generation ratio is 54% compared to total power generation.
- Achievement 2: the on-line dispatch and control program development of gensets in Dongji islet(東吉嶼). The maximum penetration of green energy generation was 92.8% on March 27, of 2017, which reached the international level, while the system remained stable operation.
- Achievement 3: the PV generation monitoring system installed at Tashan Plant (塔山電廠) of Kinmen, which can monitor up to 31 sites with 4.8MW capacity in total covering 90% of total renewable energy devices, and is helpful for power scheduling of generator sets and evaluation of generators power dispatch for the staff of Tashan power plant.
- Construction and Establishment of the Smart Micro-grid Demonstration Park in Linbain Township won the silver medal of APEC 2015 Energy Smart Communities Initiative Best Practices Awards Program (Smart Grid).
- Microgrid system at Dongjiyu in Peng-Hu, in cooperation with ZhongXing Electric Company, won the silver medal of APEC 2017 Energy Smart Communities Initiative Best Practices Awards Program (Smart Grid).