

產學合作計畫 - 智慧電網技術產業落實計畫

執行單位

財團法人台灣經濟研究院

計畫主持人

陳彥豪 研究員

本計畫針對開發中國家、先進國家市場開發模組化微電網及虛擬電廠供電服務系統，該技術可應用於電網不及的偏遠、離島地區電力供應、都會區電力備援及負載中心的需量管理，商品化成果已設置於緬甸、印尼、深圳、崇明島、日本、捷克與芬蘭。

1. 電能供應系統發明專利

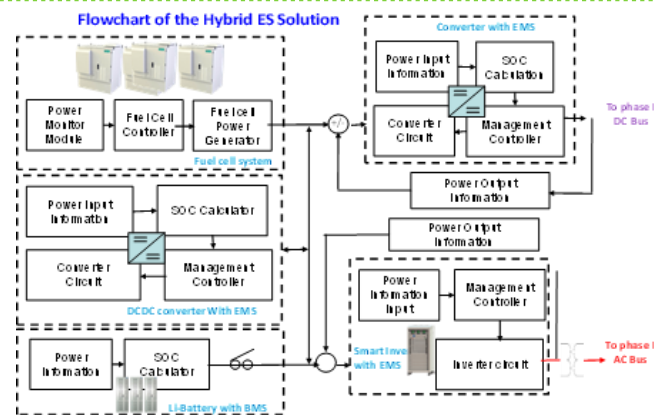
此專利為微電網之初步設計概念，將再生能源發電，如太陽能、燃料電池等直流電源結合儲能系統，於直流端進行整合，以提供交流電網及負載用電；當交流電網不穩定或切離時，此電能供應系統可穩定提供負載用電，以實現區域電力調度管理及緊急備援功能。參考文件：中華民國專利 I 470893，2015 / 美國專利 9,318,918，2016。

2. 微電網穩定裝置發明專利

儲能式微電網系統可接收再生能源所提供的電力，用以在市電不穩定或斷電時提供緊急電力予緊急裝置，並可在市電正常時產生一輔助電力予微電網用以與市電共同驅動負載，並可根據市電及 / 或再生能源儲存能量。參考文件：中華民國專利 I 562505，2016。

3. 移動型微電網系統與控制方法發明專利

開發鋰電池與甲醇燃料電池混合儲能與備援技術，鋰電池主要功能用於調度太陽能發電，甲醇燃料電池則於太陽能電池所產生之電力耗竭後，供應負載所需能量。能量管理系統以直流輸出端電壓與鋰電池電壓作為控制依據，利用用戶用電與太陽光電之歷史資料與即時資訊，進行鋰電池與甲醇燃料電池排程規劃。參考文件：中華民國專利 I 602374，2017。



儲能式微電網系統架構示意圖



PGM 潔淨能源創電與儲電模組

● 技術介紹

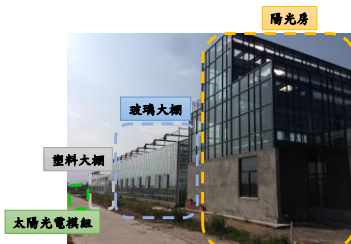
- **鋰電池與甲醇燃料電池混合儲能與備援技術**：鋰電池與甲醇燃料電池混合儲能與備援能量管理控制器透過無線電力品質感測器與智慧型逆變器，收集系統暫態資訊，在系統三相不平衡以及功率因數較低的狀態下，控制智慧型逆變器進行電壓平衡以及實虛功調整。
- **智慧家庭(建築)電能管理系統**：開發智慧家庭(建築)之電能管理系統整合智慧家電設備、太陽能、風機及電動車充電柱，驗證需量控制技術、整合性技術方案、市場機制及虛擬實境。

● 目前發展情形

推動國內智慧電網技術發展，完成緬甸太陽光電模組式微電網、捷克Třebíč第二科技學校獨立型微電網、中國大陸崇明島福美農場綠色能源示範點、深圳太陽能儲能與燃料電池微電網備援示範、日本長野家用型微電網系統、VTT Oulu研究中心虛擬電廠等海外智慧電網示範與銷售實績。



緬甸太陽光電模組式微電網



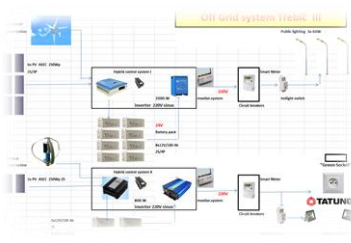
崇明島福美農場綠色能源示範



日本家用型微電網系統及電能管理系統



深圳太陽能儲能與燃料電池微電網



捷克Třebíč第二科技學校獨立型微電網



VTT Oulu研究中心虛擬電廠

The Commercialization and Implementation of Smart Grid Technology Project

Execution Unit

Taiwan Institute of Economic Research (TIER)

Project Director

CHEN Yenhaw, Ph.D., Research Fellow

This project aims at developing modular microgrid and virtual power plant power supply service system for developing and developed countries. The technology can be applied to supply power in outlying areas, supplying power to outlying islands, power backup in metropolitan areas and demand response of load center Management, commercialized results have already been set in Myanmar, Indonesia, Shenzhen, Chongming Island, Japan, the Czech Republic and Finland.

1. Electrical energy supply system patents

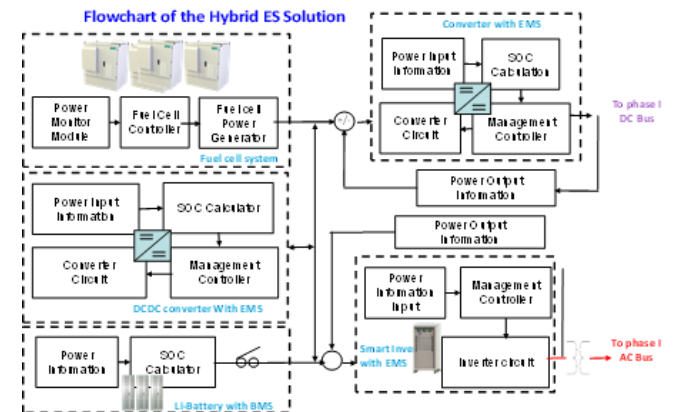
An electrical energy supply system providing voltage to a load and including an external power group and a DC supply device is disclosed. The external power group provides an external voltage. The DC supply device includes a bus, a converting unit, a storage unit and a smart energy management system (SEMS). The bus receives the external voltage and is coupled to the load. The converting unit converts the external voltage into a converted voltage or converts a stored voltage to generate a converted result and provides the converted result to the bus. The storage unit stores the converted voltage or provides the stored voltage to the converting unit. The SEMS controls at least one of the converting unit, the external power group and the load according to at least one of the external voltage, a voltage level of the bus and a voltage level of the storage unit. Reference: R.O.C. Patent I 470893, 2015 / US Patent 9,318,918, 2016.

2. Micro-grid stability device patents

An energy storage microgrid system can receive power from renewable energy to provide emergency power to emergency devices when the main power is unstable or out of power and can generate an auxiliary power to the microgrid for normal usage, and store energy based on utility and / or renewable energy. Reference: R.O.C. Patent I 562505, 2016.

3. Mobile micro-grid system and control method patents

The development of lithium batteries, methanol fuel cell hybrid energy storage and backup technology, the main function of lithium batteries is used to dispatch solar power, the supply of energy required for the load is methanol fuel cells after depletion of solar power. Energy management system uses DC output voltage and lithium battery voltage as a control basis, using user electricity usage and solar photovoltaic historical data and real-time information for lithium batteries and methanol fuel cell scheduling. Reference: R.O.C. Patent I602374, 2017.



Energy Storage Microgrid System Structure



Power Generating Module



第二期能源國家型科技計畫
National Energy Program-Phase II

● Introduction to the Technology

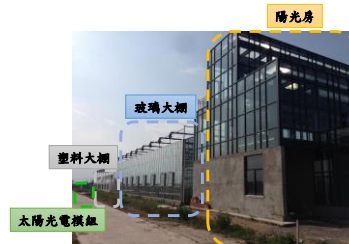
- **Hybrid Lithium Batteries, Methanol Fuel Cells Energy Storage and Backup Technology:** Hybrid Lithium Batteries, Methanol Fuel Batteries Energy Storage and Backup Energy Management Controllers Collect information on system transient via wireless power quality sensors and smart inverters. Under the condition of unbalanced three-phase system and low power factor, the intelligent inverter is controlled for voltage balance and real virtual power adjustment.
- **Smart Home (Building) Power Management System:** Developing a Smart Home (Building) Power Management System Integrating smart appliances, solar, wind turbine and electric vehicle charging columns, verifying demand control technologies, integrated technical solutions, market mechanisms and virtual reality .

● Current Development Situation

To promote domestic smart grid technology to complete the overseas smart grid demonstration and sales performance, such as the solar photovoltaic microgrid in Myanmar, independent microgrid in Czech Republic Třebíč, the Farm Green Energy Demonstration Point at Chongming Island, Shenzhen solar energy storage and fuel cell micro grid backup demonstration, Japan micro grid system for household, and virtual power plant demonstration at VTT Oulu Research Center.



Independent Photovoltaic and Pumping System in Myanmar



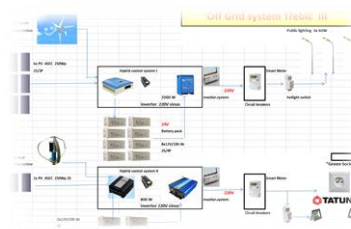
Fumei Farm Agricultural Greenhouse Smart Microgrid Demonstration System



Japan Nagano Prefecture – Micro Grid System for Household



PV, ESS, and Fuel Cell Based Microgrid in Shenzhen



Independently Complementary Wind and Solar Micro Grid System in Czech Republic



Collaborative Virtual Power Plant Demonstration between Finland and Taiwan