台電工程月刊878期（10月）目錄

金門地區儲能規劃及再生能源併網量分析

Energy Storage Planning and Grid Connection Analysis for Renewable Energy in Kinmen

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摘　要

民國 111 年金門地區將有大量再生能源併網，台電公司須預為因應。本研究提出 1.依塔山跳機不觸動低頻電驛設定值 57.3Hz 之條件設置功率型儲能；2.依發電(柴油+再生能源)扣減負載後多餘電能存於儲能電池之條件設置能量型儲能。研究結果表明：若民國 111 年金門冬季午間時段負載 38MW 時，須增設功率型儲能 2MW/1MWh 及能量型儲能 8MW/48MWh，並依再生能源併網進度滾動檢討設置期程，最後提出在前述假設條件情形下之金門再生能源最大併網量。

Abstract

To cope with a large number of renewable energy sources to be connected to the grid of Kinmen in 2022, Taipower must respond in advance. The major contents of this research include 1) setting the power-type energy storage system, ESS, based on the condition that low frequency relays won't trip as the generators are subject to N-1 contingency; 2) setting the energy-type ESS according to the condition that after the power generation (diesel + renewable energy) minus the load, the residual electricity is stored in the ESS. The results of this study show that when the load is 38MW during the winter midday of Kinmen in 2022, both the 2MW/1MWh power-type ESS and the 8MW/48MWh energy-type ESS are needed. The ESS installation schedule is reviewed according to the condition of renewable energy connected to the grid. Finally, the maximum grid-connected renewable energy capacity in Kinmen under the above conditions is also proposed.

關鍵詞(Key Words)：儲能系統(Energy Storage System, ESS)、功率型儲能(Power-type ESS)、能量型儲能(Energy-tpe ESS)、再生能源(Renewable Energy)。

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以開放式圖台精進改善配電設備巡檢管理系統(DAMS)建置研究

The Study of Using Open Map Platform to Improve the Establishment of Distribution Asset Management System (DAMS)

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摘　要

　　隨著政府新能源政策和能源轉型的規劃方針，電力營運與管理業務變得較以往任何時期都更為繁雜。由於配電設備管理之種類與數量日益龐大、複雜的電氣拓墣結構、頻繁的電力調度，更顯示目前維運管理方式已難因應未來整體電力設備發展和維護需求。為達成此一目標，須採用資訊化的技術和行動化的方案來進行巡檢規劃和管理，以強化配電設備之資產管理、維運維護與監管等能力。

　　由於配電設備巡檢管理系統運行多年，已無法因應作業系統升級與行動裝置汰舊換新，因此系統須配合改版升級，但若採用商用圖台恐導致推廣成本過高。因此，本案將採開放式圖台精進改善配電設備巡檢管理系統，以取代既有之商用圖台，除可大幅降低軟體授權費用外，亦可擴展研發成果，且隨著行動設備與通訊技術的發展，巡檢業務也應朝行動化 APP 的方向開發，有助提升配電設備維護巡檢之效率，未來更可於現地即時收集配電設備的相關資訊。

　　綜上所述，本案將以配電設備巡檢管理系統為基礎，分析整合業務單位之配電設備巡檢的管理需求，以開放式架構建置配電設備的巡檢管理系統網頁平台與行動應用程式，輔助現場人員與管理者能充分掌握設備之維運狀況，透過系統化的巡查管理機制，能更加有效率提升供電的可靠度和預防性管理，進而為用戶提供高優質、高效率、高安全性的用電服務。

Abstract

Under the influence of the government's new energy policy and guidelines for energy transition, the operation and management of power system have become more complicated than ever. Due to the increasing variety and quantity of power distribution asset management, complex circuit topology and frequent power dispatch, the current operation management methods are no longer suitable to meet with the needs of future power asset development and maintenance. We therefore need to adopt information technology and mobile solutions to carry out inspection planning and management to achieve the goal of strengthening power distribution asset

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management, operation maintenance, supervision, among other abilities.

Since the power distribution equipment inspection management system has been running for many years, it is incapable of responding to the updating of operating system and mobile devices. Therefore, it must be upgraded. However, the use of commercial maps may lead to excessive promotion costs. Therefore, in this case, an open map platform has been used to improve the power distribution equipment inspection management system to replace the existing commercial map platform. In addition to considerably reducing the software license fee, it can also expand the research and development results. With mobile equipment and communication technology in the future, the inspection business should be developed toward the direction of mobile APPs, to improve the efficiency of power distribution equipment maintenance and inspection. In the future, it will be possible to collect on site power distribution equipment information in real time.

Conclusively, this Distribution Asset Management System (DAMS) based project aims to analyze and integrate the management needs of the corresponding business unit, and to establish a webpage platform and mobile apps for DAMS with an open framework to assist on site staff and managers to fully control the maintenance and operation situations. Through a systematized inspection management mechanism, it can further increase the reliability and ability of preventive management of power supply in a more efficient way, and provide services of higher quality, efficiency and safety.

再生能源控制建置與效益研究

Feasibility Study of Renewable Energy Generation Control

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摘 要

本文重點在於針對我國能源轉型，將有大量太陽光電及風力發電系統併接於台電電網，勢必對台電系統穩定運轉及供電品質造成極大之衝擊，為確保未來台電系統在綠能高佔比情境下之電壓品質，並解決輸電線路壅塞問題，本文模擬 2025 年台電系統在大量太陽光電及風力發電併網情境下，評估對台電系統正常運轉及當輸電線路發生 N-1 等緊急情況下，所造成之系統衝擊如線路壅塞及變電所電壓變動之影響。另外配合台電再生處所提供之彰濱 100MW 大型綠能發電案場，執行再生能源輔助服務調控功能之測試與驗証，包括由台電調度中心透過通訊網路，執行再生能源發電資訊之收集，並根據能源管理系統運轉資料執行系統潮流分析，及輔助服務調控制決策之推導，下載至測試案場之再生能源閘道器，執行再生能源發電系統之虛功與實功輸出調控，達成綠能發電系統之虛擬同步機功能示範，本文將可提供未來綠能高佔比台電系統運轉能力改善之參考。

Abstract

Along the way toward energy transition, there will be more and more renewable energy (RE) connecting to the power system and make severe impacts to the operation of power system and the quality of power supply. To ensure reliable and stable operation and avoid transmission congestion, this study aims to simulate the impacts of high RE penetration under various scenarios in 2025, including the impacts on system transient stability, substation voltage quality, and transmission line congestion under the situation of N-1 (one line tripping). The Zhangbin large scale PV system, with installed capacity of 100MW, was selected to verify the feasibility as RE serves as ancillary services. The operation status of the renewable system under test were collected and reported to the master station of transmission renewable energy management system (TREMS). The control strategy of RE, serving as ancillary services, has been derived and transmitted to PV gateway and smart inverters for RE output and power factor adjustment. In this study, virtual RE synchronous generation control modes had been successfully demonstrated. It is expected that the results of this study may serve as important reference for Taipower to enhance its system operation capability in the future.

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發電機組模型參數驗證之實際案例與量測方法比較

A Study of Generator Model Parameters Validation Methods and Cases of Unit Testing

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摘　要

電力系統模型對於研究系統穩定度安全性十分重要，模型與參數的準確性將影響系統穩態、動態及暫態模擬分析的參考價值。以 1996 年北美西部電力網停電事故為例，事故後檢討時發現模擬結果與量測紀錄相差甚遠，導致結果失準的原因在於發電機組模型不準確，使得系統分析模擬失去了意義，無法提前找出系統潛在弱點，並加以改善。電力系統模型就不同的模擬項目如穩態、動態及電磁暫態等。常見的發電機組模型含發電機、勵磁裝置、調速機與電力系統穩定器，動態分析的模擬結果正確與否，將取決於前述設備動態模型參數之準確性。因此我們需要透過量測試驗並驗證發電機組參數準確性，以確保結果的可靠性及準確性。本論文中，針對火力與水力機組進行了實際量測，藉此更深入了解發電機組模型參數驗證在執行上需要注意的事項與作法以及其試驗操作時的困難性。

Abstract

Power system models are important for system stability and safety analysis. The model itself and the accuracy of parameters will affect the results of simulation. In 1996, a blackout happened in Western North America. During the post-accident reviews, it's found that the simulation results were very different from the measurement records. Since the generator models were inaccurate, the system simulation cannot prevent the happening of the accident. Generally, power system models consist of steady state models, dynamic models, and electromagnetic transient models. Dynamic models include generators, excitation devices, governors, and power system stabilizers. Measurements are needed to validate the models to ensure the models' accuracy. This research focuses on how to measure generators. In this paper, we measure thermal and hydraulic generator units to verify the methods and difficulties of generator modeling.

關鍵詞 **(Key Words)**：發電機組模型參數驗證(Generator Unit Model Parameter Validation)、發電機組量測(Generator Unit Testing)、暫態模擬(Transient Simulation)。

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退役動力電池二次利用技術發展趨勢分析

An Analysis on the Development Trend of B2U Technologies for EV Retired Lithium-ion Batteries

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摘　要

目前全球電動車動力來源主要是以高能量密度的鋰離子電池為主，國際組織、研究機構、車廠與電池廠在投入提升鋰離子電池性能和增加產量來降低成本之際，也同時考慮以循環經濟概念推展退役動力電池二次利用技術(Battery Second Use, B2U)，將還有 70-80%容量的退役電池經過翻新後，應用於電網級電池儲能系統以穩定間歇式再生能源發電的輸出功率，並延長電池的總使用壽命，減少製造新電池所排放之溫室氣體。

本文探討國際役動力電池二次利用領域、技術創新趨勢，以及應用於儲能系統時的安全維護標準，作為本公司建置或維護管理儲能系統之參考。

Abstract

Global electric vehicles (EVs) are mainly driven by high-energy density lithium-ion batteries. When trying hard to improve the performance of lithium-ion batteries and to reduce costs by mass production, many international organizations, research institutions, car manufacturers and battery factories are also considering utilizing the concept of circular economy, such as refurbishing and utilizing retired batteries as grid-level energy storage systems, the Battery Second Use (B2U), to meet the purposes of stabilizing the output of intermittent renewable energy, extending battery lives, and reducing emission of Greenhouse gases by avoiding the production of new batteries.

This article discusses the application fields, innovation trends and prospects of B2U technologies, and the safety maintaining standards, when applying to energy storage systems, to serve as a reference for TPC.

關鍵詞(Key Words)：動力鋰離子電池(Power Lithium-ion Battery)、電池二次利用(Battery Second Use)、電池儲能系統(Battery Energy Storage System)、專利分析(Patent Analysis)。

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台灣低所得家庭家電持有現況分析

An Analysis of Low-income Households' Home Appliances in Taiwan

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摘　要

　　本研究以工研院綠能所「2019 年家庭用電消費習慣調查」資料作為基礎，將調查資料中的家庭年所得，由小至大進行排序，並按所得區分成五個所得分組，據以分析不同所得分組之家電持有特性及差異。

　　調查結果發現，「最高所得」家中平均電器數量為 40 台，「最低所得」則為 24 台，兩者電器數量相差約 16 台。另外，「最高所得」1 級之冷氣產品擁有率為 70.2%、「最低所得」1級冷氣產品擁有率為 46.7%，兩者擁有率差異高達 23.5%，顯示「最高所得」家庭持有節能家電產品比例有較高之趨勢。

　　此外，調查顯示「最低所得」家庭無論冷氣或冰箱，均較「最高所得」設備老舊許多。其中，超過 10 年的冷氣機「最低所得」(56.03%)較「最高所得」(38.41%)多 17.63%，超過 10 年的冰箱「最低所得」(50.04%)較「最高所得」(37.70%)多 12.34%，顯示低所得家庭家電能源效率不佳。另外，所得越低家庭之屋齡亦越高，建議未來可針對低收入戶或中低收入戶進行家電健檢，改善其生活環境並提升住宅用電效率。

Abstract

　　The research is based on the study of "the Year 2019 Survey of Household Electricity Consumption Behaviors" by ITRI GEL. The households under survey were sorted by their annual incomes and divided into five groups to analyze the characteristics and differences of their home electrical appliances.

　　As the results of the survey indicate, the average quantity of electrical appliances of the highest income group is 40, the lowest income group 24, and the difference between the two groups 16. In addition, the percentage of the highest income group owning level 1 air-conditioning product is 70.2%, the lowest income group 46.7%, and the difference between the two groups 23.5%. As the data show, the proportion of households with the highest income has higher percentage of energy-saving appliances.

　　However, in terms of the time span owning aged/inefficient appliances, the survey results indicate that the lowest income group has longer time span owning aged/inefficient appliances than the highest income group. For example, the percentage of owning air conditioners that have been used for more than 10 years, the lowest income group is 56.03%, the highest income group 38.41%, and the difference between the two groups 17.63%. For refrigerators that have been used for more than 10 years of use, the lowest income group is 50.04%, the highest income group 37.70%, and the difference between the two groups 12.34%. The data also shows that low-income households have lower energy efficiency in terms of home appliances, and the houses of lower income households incline to be timeworn. The results of this research concludes that electrical health check may benefit low income and low-to-middle income households in the ways of better life quality and higher energy efficiency.

關鍵詞(Key Words)：家電產品(Appliance Products)、入戶調查(In-house Visit)、低收入戶(Low- income Household)、電力消費(Electricity Consumption)、家電健檢(Home Appliance Test)。

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公用事業公共關係強化策略模糊決策分析模式

A Fuzzy Decision Analysis Model to Strengthen Public Utilities' Public Relations Strategies

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摘　要

　　公共關係的建立、維持與發展，是企業經營動態調整及符合社會期待不可或缺的活動。良好的公共關係可維持與公眾的和諧及促進公共工程的順利推展。為探討公用事業公共關係現況，本研究發展一套模糊多準則決策分析模式(Fuzzy Multi-criteria Decision Making, FMCDM)，採用模糊品質機能展開法(Fuzzy Quality Function Deployment, FQFD)建立研究架構，以一致性模糊語意偏好關係法(Consistent Fuzzy Linguistic Preference Relations Method, CFLPRM)衡量台電公共關係成功關鍵因素、目前執行績效與強化策略，作為公用事業發展公共關係的指引。研究發現取得公眾信任是公共關係成功最重要的因素，要取得公眾信任必須優先提升公關人員的形象與能力。另外，要取得公眾信任，台電工程的資訊透明度應加以改善。

Abstract

To be in line with social expectations, establishing, maintaining and developing public relations (PR) are indispensable for enterprises to dynamically adjust their business operations. PR not only helps maintain harmonious relation with the public, but also enables smooth implementation of public construction. To explore the status quo of public utilities' PR, this research develops a set of fuzzy multi-criteria decision making (FMCDM) and uses Fuzzy quality function deployment (FQFD) to establish a research framework. In addition, this research uses consistent fuzzy linguistic preference relations method (CFLPRM) to measure the key success factors of the PR, current performance and strengthening strategies of TPC. The said analysis model may serve as a reference guide for developing public utilities' PR. As the research results indicate, gaining public trust is the most important factor to ensure the success of PR. Nevertheless, to gain public trust, TPC shall not only upgrade the image and capability of their PR personnel, but also improve the transparency of its engineering information..

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核電廠嚴重事故模擬能力提升及嚴重事故處理指引精進

Improvement of Severe Accident Simulation and Guidelines for Nuclear Power Plants

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摘 要

本計畫由台電公司核安處委託核能研究所核子工程組執行，計畫期程自 108 年 2 月 1 日至 110 年 1 月 31 日共計二年。本計畫主要進行核一、二、三廠 MAAP5 模式更新及用過燃料池模式建立以及核三廠嚴重事故處理指引(SAMG)更新先期研究，本計畫完成可增進嚴重事故模擬與事故處理能力，完整建立各種電廠狀態下的事故模擬分析技術，強化緊急計畫演習之內容，並提升電廠營運安全。

Abstract

This project was funded by the Department of Nuclear Safety of Taiwan Power Company and conducted by the Division of Nuclear Engineering of INER. The project lasted for two years, from 2019 to 2021. The primary purposes of the project are to update the MAAP5 model, establish the spent fuel pool model of Chinshan, Kuosheng, and Maanshan nuclear power plants (NPPs), and improve severe accident management guidelines (SAMG) of Maanshan NPP. The project will not only improve the plants' capabilities of simulation and accident management regarding severe accidents, but also fully establish their accident simulation analysis techniques under various power conditions, strengthen the content of emergency drills, and enhance the safety of power plant operations.

關鍵詞**(Key Words)**：嚴重事故分析(Severe Accident Analysis)、用過燃料池 (Spent Fuel Pool)、嚴重事故處理指引 (Severe Accident Management Guideline)、技術移轉訓練 (Technical Transfer Training)、MAAP5.05 程式。

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