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# 因應再生能源之電價及需量反應改革策略研究

A Study on the Reform Strategy of Electricity Rate and Demand Response for  
Renewable Energy Development

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## 摘要

再生能源已成為現今國際間能源發展潮流，我國能源政策亦遵照此一趨勢，並已訂出「2025年達成再生能源發電占比20%」之目標。未來隨著大量再生能源併入電力系統，使得天氣條件對於發電的影響漸增外，也會影響供電穩定性，並使負載型態出現結構性改變，甚至出現鴨子曲線。再生能源將對電力成本、電價結構造成影響。為因應此一趨勢，國外電業已開始藉由調整時間帶與成本分攤方式、提出新型態需量反應方案等，以引導用戶進行電能管理。本研究透過參考不同再生能源發展階段之國外電業實際作法，探討電價制度及需量反應之改革方向與推動方式，規劃我國未來需求面管理措施之改革方向。

## Abstract

Renewable energy has become an international energy development trend. In line with the trend, Taiwan government set an energy policy goal of "20% renewable energy (RE) generation by 2025." In the future, as higher percentage of RE generation incorporating into the power system, the impact of weather conditions on power system will also increase—therefore, affecting the stability of power supply, causing structural changes of load patterns, e.g., the duck curve, and affecting the cost and tariff of electricity. In response to this trend, some foreign power companies have begun to guide their customers to manage their electricity use, by adjusting TOU time zones and cost allocation methods, proposing new types of demand response, among others. This study explores the reform direction and promotion method of electric utilities' electricity tariffs and demand response (DR) measures, by referring to the cases of foreign power companies experiencing different stages of RE development.

**關鍵詞(Key Words)**：電價方案(Electricity Tariff)、需量反應(Demand Response)、變動性再生能源(Variable Renewable Energy)、鴨子曲線(Duck Curve)。

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# 室內型鍋爐對鍋爐運轉的正負面影響及改善探討

Two-sided Effects of Indoor Boilers on Boiler Operation and the Improvements

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## 摘要

本研究針對室內型鍋爐房的熱效益進行分析，由於室內型鍋爐房相對於室外型鍋爐房能夠回收更多鍋爐逸散熱，使用於加熱送風機進口空氣，而使鍋爐獲得更多熱量用來提升熱效益。但此方式存在的負面影響卻很少被討論。因此本研究主要希望能透過各種分析，來思考目前的鍋爐房設計能夠再更佳化的可行性。

## Abstract

The purpose of this study is to analyze the thermal effects of indoor boilers. Indoor boilers, comparing to outdoor boilers, may recycle more dissipated heat, which can be used to warm the forced draft fan's inlet air, and therefore obtain more heat to raise the total thermal efficiency. Nevertheless, the method's negative effects are rarely discussed. Hence, this study aims to analyze from various aspects the feasibility of optimizing current design of a boiler room.

**關鍵詞(Key Words)**：室內型鍋爐(Indoor Boiler)、室外型鍋爐(Outdoor Boiler)、鍋爐效率(Boiler Efficiency)、送風機(Forced Draft Fan)、引風機(Induced Draft Fan)、查理-給呂薩克定律(Charles's Law)。

# 各類型發電機組高頻率、低頻率保護電驛設定規範研訂

Standardized Frequency Relay Setting for Different Types of Generators

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## 摘要

NERC頒布的可靠度標準PRC-024-1係針對發電機組之運轉頻率（包含：多功能數位電驛、保護裝置及電壓調整器等）設定訂出規範，本研究之目的是為了確保當系統遭遇擾動事件時，各發電機組之頻率設定，在保護發電機的前提下亦可支持整個電網維持穩定運轉。

檢視台電公司現行三項有關發電機頻率/電壓電驛設定之相關技術要點，「再生能源發電系統併聯技術要點」、「汽電共生併聯技術作業要點」及「電力系統運轉操作章則彙編」，可知現行頻率電驛規定58Hz以下與61Hz以上才可跳脫。本研究之動機乃鑒於科技進步及政府政策大力推動，再生能源發電發展越趨蓬勃，在分散式電源的大幅增加的情況下，頻率以及電壓的漂移範圍勢必擴大，若採用現行頻率電驛規定，則可能增加觸發高低頻電驛動作的機會，影響供電穩定度。再者，隨著發電設備形式越趨多樣化，傳統發電機技術日新月異，機組強健性也日益加強，機組對於高低頻以及電壓浮動的容忍度應較高。當系統規模與運轉形態逐漸轉變下，為兼顧發電機組設備保護與系統運轉穩定，理應針對各類型發電機組的高低頻電驛設定，做不同且具差異性的分析。

## Abstract

The reliability standard PRC-024-1 issued by NERC serves as a guideline for the setting of frequency relays of generating units-for the purposes of generator protection and keeping the power grid stable. In view of Taipower's current technical guidelines, e.g., "Standards of Parallel Operation of Cogeneration" and "Compilation of Operating Principles of Electric Power System", the generator frequency relay settings mostly range from 58Hz to 61Hz. Under the current relay setting, it is foreseeable that triggering of high/low frequency protection will occur more often, along with the increase of renewable energy generation. In view of the advancement of science and technology nowadays, newly installed generating resources shall have wider tolerance to the

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allowable range of abnormal frequency operation. In consideration of these factors, there is an urgent need to renew the guideline of generator frequency relay setting through comprehensive analyses aiming at various types of generating units. This report seeks to illustrate the findings and put forward recommendations for drafting guidelines of frequency relay setting for various generators.

**關鍵詞(Key Words)：**電驛(Relay)、頻率(Frequency)、電壓(Voltage)、電網規範(Grid Codes)、再生能源(Renewable Energy)。

# 鳳山區處光電儲能管理系統規劃與設置

Planning and Implementation of Energy Management System for Solar PV/Battery Storage System at Fengshan District Branch Office

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## 摘要

為配合行政院推動「標竿節電智慧城市」及「永續智慧城市方案」的智慧節能政策發展，台電已建置國內第一座智慧綠社區，包含鳳山區營業處以及大林電廠、興達電廠、核能三廠之備勤宿舍區(面積約6.75公頃)，並於109年於鳳山智慧綠社區完成「1MWh企業型儲能系統」與「798kWp高效能太陽光電系統」之系統建置。

本文介紹鳳山區處光電儲能管理系統規劃與設置，並將上述社區內的企業型儲能系統與高效能太陽太陽光電系統透過此能源管理系統加以整合，達到可用電自主、孤島運轉的防災型社區、提供調度中心之緊急備用電源等功能，亦可參與用戶端需量反應及接受系統調度提供輔助服務，以進行電能貯存系統於配電等級之性能驗證與相關的功能開發。

## Abstract

To cooperate with the Executive Yuan's smart energy-saving policies of "Outstanding Energy-saving Intelligent City" and "Sustainable Intelligent City Program", Taipower retrofitted Fengshan community to be the first intelligent and green community in Taiwan, covering the area of the Fengshan District Branch Office and the dormitory areas of Dalin Power Plant, Xingda Power Plant and the 3<sup>rd</sup> Nuclear Power Plant (around 6.75 hectares). In 2020, the said Fengshan intelligent and green community accomplished the constructions of 1MWh enterprise battery energy storage system (EBESS) and 798kWp high-efficiency solar photovoltaic system (HESPS).

This paper aims to introduce the planning and implementation of energy management system (EMS) for the solar PV/battery storage system at Fengshan District Branch Office, and the integration of the EBESS and HESPS, through the EMS to realize the functions of power autonomy, islanding operation, disaster-resistant community, and providing emergency backup power to dispatch centers. The integrated system may also participate in demand

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response (DR) measures and accepting the system operator's dispatching order to provide ancillary services- all those functions are enabled by performance verification and the energy storage system installed at the power distribution level.

**關鍵詞(Key Words):** 能源管理系統 (Energy Management System)、儲能系統 (Battery Energy Storage System)、輔助服務(Ancillary Service)、需量反映 (Demand Response)、綠電優先負載追蹤 (Self-consumption)。

# 台電公司抵換專案查證機制建立與執行評析

A Study on the Establishment and Execution of the Verification Mechanism  
of Taipower's GHG Offset Projects

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## 摘 要

台電公司為因應火力發電機組改建/擴建案之環評要求及落實溫室氣體減量目標，自民國99年起依循行政院環境保護署「溫室氣體先期專案暨抵換專案推動原則」，積極推動抵換專案，期能獲取減量額度。

於103年9月，台電公司計有9件抵換專案進入環保署註冊審查程序，遂展開各案第一期額度查證工作，並建立一套抵換專案查證管理機制。

上述工作執行期間歷經環保署「溫室氣體減量及管理法」立法及抵換專案制度規範修訂，至109年2月，除通霄發電廠燃料替代專案經環保署駁回註冊申請，其餘8件專案經審查通過，取得減量額度共計1,077.7萬噸。

本研究計畫透過彙整台電公司第一期抵換專案查證工作執行成果，探討能源產業常見抵換專案之監測及減量額度申請遭遇問題，並分析因應作法，以增進相關單位對於抵換專案查證實務之瞭解，提供未來執行與策略研訂參考。

## Abstract

To comply with the environmental impact assessment (EIA) requirements for retrofitting and/or expanding thermal power generators, so as to meet the greenhouse gas (GHG) emission targets set by the government, Taiwan Power Company (Taipower) has incessantly pushed forward GHG Offset projects (GHGOP) to cope with the Promoting Principles for Early Project and GHG Offset Project, stipulated by EPA in 2010.

By Septemeber, 2014, there were in total nine GHGOP applications submitted to EPA for registration process review, and Taipower at the same time unfolded the said projects' verification actions.

After that, the Greenhouse Gas Reduction and Management Act and the GHGOP had been amended. By February 2020, the first period verification works of the nine GHGOP applications were completed-eight accepted, one rejected by EPA (the case of Tung-Hsiao

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thermal power plant), a total of 10.7 million tons certified emissions reductions (CERs).

The contents of this study, such as the verification results of the offset projects, discussion regarding GHGOP monitoring and CER application, and analysis of possible countermeasures, may serve as reference for stakeholders to further understand GHGOP or to develop coping strategies.

**關鍵詞(Key Words)：**溫室氣體減量(GHG Reduction)、抵換專案(Offset Project)、監測報告書(Monitoring Report)、查證(Verification)、減量額度(Reduction Credit)。

# 台電 PLC 應用於智慧電網探討

A Study on Taipower's PLC Applications in Smart Grid

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## 摘要

電力公司的電網經由不同電壓等級的電力纜線，將各電壓等級的用戶連結成一個網路系統，而利用電網的電力線作為通信的傳輸媒介的通信技術稱為電力線通信(Power Line Communication, PLC)，電力公司因有電力線的獨有資源，因此電力公司具PLC通信技術應用的優勢，本論文就台電公司測試PLC通信技術應用於不同場域的經驗及遭遇問題，提出解決及應用方案。

本論文提出兩項不同場域的測試，首先，測試寬頻電力線通信(HD-PLC)數據機及電感式耦合器使用於11kV等級配電線路的通信效果，可應用於緊急光纖斷線無法施工時的臨時通信，再者，我們使用電力網路橋接器應用變電所內最後一哩路的通信，前述兩項測試結果可提供未來電力場域通信的多元選項。

## Abstract

The power grid connects consumers of various voltage levels into a network system through power cables of different voltage levels. The communication technology that uses power lines as the transmission medium of communication is called power line communication (PLC). Power lines are the proprietary resources of power companies, so they have the advantages in PLC technology applications. In this paper, we propose solutions and applications drawn from Taipower's experience and problems encountered in testing PLC in different fields.

In this paper, we propose our tests in two different fields. One is the communication effect test of the High Definition Power Line Communication (HD-PLC) modem and inductive coupler used in 11kV power distribution lines, which can be applied to the emergency optical fiber disconnection for the temporary communication. The other, we use the Powerline Ethernet Adapter to apply the last mile communication to the substation. The results may serve as alternative options for PLC.

**關鍵詞(Key Words)**：電力線通信(Power Line Communication)、寬頻電力線通信(High Definition Power Line Communication)、電力網路橋接器(Powerline Ethernet Adapter)。

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# 運用大數據與人工智慧建構公用售電業用戶服務 數位行銷策略

Using Big Data and Artificial Intelligence to Develop a Digital Marketing Strategy for  
Customer Services of the Licensee of Public Retailer

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## 摘要

本研究案開發建置了台電公司用戶專屬帳號服務平台系統(簡稱MyAccount)，此系統在單一專屬帳號整合之設計上，雖根據各系統現行可配合之條件下進行，然亦進一步提出了台電公司未來MyAccount短/長期用戶帳號整合建議作法，以逐步整合台電公司現行六個用戶服務系統之用戶登入帳號、密碼與基本資料(主要以EBPPS、HVCS、台灣電力APP為主)，方便使用者使用台電公司目前所推出之各式用戶服務系統。

本研究案並檢視了目前各用戶服務系統所提供之服務內容，並參考多個國外電業公司MyAccount平台服務功能，提出了系統功能重組建議，實踐於未來MyAccount平台完整的用戶服務功能，達到系統精簡目標。另透過本案提出之行銷通路異業結盟服務措施，提供台電公司多元行銷通路方向建議，引入異業結盟，建議未來可朝三大面向著手，分別為行銷通路、優惠活動及生活附加價值服務，透過三者相輔相成滿足用戶多元需求。最後本案利用大數據人工智慧之非監督式學習方法，實作了部分低壓用戶之用戶區隔分析與特性分析，並建議台電公司未來應定期進行用戶區隔分析參數之檢討與實作，以隨時觀察用戶特性與區隔屬性作為精準行銷之參考。

## Abstract

This project aims to develop TAIPOWER's user-specific account service platform system (also known as MyAccount) to integrate the six existing systems into a single user account. Feasible short-term and long-term solutions were proposed to gradually integrate user accounts, passwords and basic information of the six existing accounts (mainly EBPPS, HVCS and Taiwan Power APP) into MyAccount, to facilitate seamless multichannel experiences for TAIPOWER users.

First, after examining the service contents of the six existing systems and foreign cases of MyAccount, we proposed a system function reconfiguration to complete user service functions of the future MyAccount to streamline the system. Second, we proposed service measures of

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marketing channel alliances to provide TAIPOWER with various marketing multichannel direction and strategic cross-industry alliance. Third, we recommended TAIPOWER to launch three complementary approaches—namely marketing channels, promotional activities, and value-added services—to satisfy customers' diverse needs. Finally, an unsupervised learning model for big data and artificial intelligence was adopted to perform customer segmentation of a small number of low-voltage users, and regular review should be conducted to update segmentation variables to keep an eye on the emerging features of customers for precision marketing in the future.

**關鍵詞(Key Words)：**大數據(Big Data)、人工智慧(Artificial Intelligence)、精準行銷(Precision Marketing)、單一登入(Single Sign-on)、異業結盟(Cross-industry Alliance)。