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# 新創輸電線路運轉電流結合 LINE Message 即時推播 警示系統

Introduction of Newly Developed Transmission Line Operating Current Combined with LINE  
Message Real-time Push Warning System

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## 摘 要

電力系統負載狀況牽引輸電線路運轉電流大小，然輸電線路導線壓接處，會因受運轉電流變化，致壓接處易有溫度差等異狀，爰依據供電處訂定「紅外線接頭測溫」工作指導書辦理，其中每日查詢線路實際運轉電流工作，需以人力上網操作逐步取得所需資料，本系統提供自動查找各線路每日實際運轉電流，並即時推播異常負載電流警示訊息，讓同仁第一手掌握線路電流負載狀況，即時進行紅外線測溫工作，以達「弱點即時改善，避免事故發生」維護目標，進而大幅提升供電穩定。

## Abstract

The load condition of a power system affects the operating current of the transmission lines. However, the crimping point of transmission lines are susceptible to temperature differences and other abnormalities due to changes in operating current. In response to the above situation, the Power Supply Department of Taipower has issued the “Infrared Connector Temperature Measurement” work instructions. According to the provisions of the document, the daily query of the actual operating current of the line requires manual online operation to gradually obtain the required information. In response to the above needs, the “Line Operating Current Combined with LINE Message Real-time Push Warning System” was thus developed. In addition to automatic query of the actual daily operating current of each line, the system can also push abnormal load current warning messages in real time, allowing business-related colleagues to grasp the line current load status first-hand and conduct infrared temperature measurement in real time to achieve the maintenance goal of “immediately improve weaknesses and avoid accidents”, thereby greatly improving power supply stability.

**關鍵詞(Key Words)：** 運轉電流(Operating Current)、紅外線測溫(Infrared Temperature Measurement)、Excel VBA 程式語言(Excel Visual Basic Application Programming Language)、GAS 程式(Google App Script Program)。

# 電力變壓器有載分接頭切換器(OLTC)故障查修技術探討與實務改善案例

Discussion on Fault Troubleshooting Technology and Practical Improvement Cases of Power Transformer On-Load Tap Changer (OLTC)

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## 摘 要

屋外型電力變壓器經過多年運轉後，有載分接頭切換器(On-Load Tap Changer, OLTC)電阻轉盤可能因劣化或外力影響而產生濕氣入侵、斷裂、破損等異常，導致現場與調度人員無法操作並監控變壓器的 TAP 位置。基於此狀況，我們針對異常情形進行技術探討與研究。

基於對 OLTC 機構與 TAP 指示器之間運作原理以及對電阻轉盤內部結構的分析，我們將故障查修過程整理並撰寫為實務改善案例，並透過現場檢測、故障判定與細部零件檢驗，提出可行的改善策略，藉此有效提升設備穩定度。

## Abstract

After years of operation, the resistance dial of the on-load tap changer (OLTC) of outdoor power transformers may experience moisture intrusion, breakage, damage, etc. due to degradation or external force, making it impossible for on-site and dispatching personnel to operate and monitor the TAP position of the transformer. In response to the above situation, this project conducts technical research on related abnormal situations.

Based on the operation principle between the OLTC structure and TAP indicator, as well as the analysis of the internal structure of the resistance dial, we organized the troubleshooting process into a practical improvement case, and proposed feasible improvement case, and proposed feasible improvement strategies through on-site inspection, fault determination, and detailed parts inspection, thereby effectively improving the stability of the equipment.

**關鍵詞(Key Words)：**分接頭(TAP)、有載分接頭切換器(ON-Load Tap Changer)、變壓器(Transformer)。

# 台電鐵塔連接站工程施工案例探討

Discussion on Taipower's Transmission Tower Connection Station Construction Project

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## 摘 要

本文以中興工程顧問公司所承攬之台電公司監造技術服務案之鐵塔連接站工程為案例，連接站採用 4JP 塔型之鐵塔，主要結構分為井筒基礎、平台及鐵塔三部分，設計考量重點為依使用需求及鐵塔形式進行結構分析，決定相關結構物形式及尺寸；並以 BIM 軟體進行 3D 空間模擬，確認涵洞、井筒及扇形開口之設計尺寸能讓電纜順利延放及日後人員維護；施工流程及監造重點則分為井筒基礎、連接站平台、角鐵設定、鐵塔裝建及架空線等 5 個部分探討說明，希望提供相關實務經驗予後續台電相關工程參考。

## Abstract

This article takes the case of the transmission tower connection station project (requirements include supervision and technical services) undertaken by Sinotech Engineering Consultants, Ltd. for Taipower as an example. The project adopts the 4JP tower model, and its main structure is divided into three parts: well foundation, platform, and power pylon. The key design considerations include conducting structural analysis based on functional requirements and tower type to determine the form and size of related structures, and to use BIM software to perform 3D space simulation to confirm that the design dimensions of culverts, shafts, and fan-shaped openings can allow for smooth cable laying and future maintenance by personnel. The construction process and supervision focus are divided into five parts: shaft foundation, connection station platform, angle steel positioning tower assembly and overhead line installation. It is hoped that relevant practical experience may serve as reference for Taipower's subsequent projects.

**關鍵詞(Key Words)：**連接站(Transmission Tower Connection Station)、BIM(Building Information Modeling)、角鐵設定(Angle Steel Positioning)。

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# 儲能系統提供系統運轉加值應用服務之研析

Analysis of Battery Energy Storage Systems Providing Value-added System Operation Services

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## 摘 要

依我國能源政策之規劃，2025 年後再生能源之發電占比將超過 20%，系統慣量減少，使電網頻率及供需平衡更具挑戰。而儲能具快速反應且調度彈性之特性，在未來的電網所扮演的角色至關重要。本論文將蒐集國際電力系統營運商之儲能應用，尤其於輔助服務及電網相關作法，分析國內現有儲能之調頻服務執行貢獻，綜合國內外資料，並以 Python 數值模型及 MATLAB 電網模型進行模擬及量化分析，研析國內儲能未來之應用方向。

## Abstract

According to Taiwan's energy development target, the proportion of renewable energy generation will exceed 20% beyond 2025, and the system inertia will decrease, making the grid frequency and load balancing more challenging. Battery energy storage systems (BESS), owning the characteristics of rapid response and flexible dispatch capabilities, will play a vital role in future power grids. This study aims to collect energy storage applications (especially ancillary services and grid-related practices) from international power system operators, analyze the contribution of existing domestic energy storage equipment in providing frequency regulation services, integrate domestic and foreign data, and use Python numerical models and MATLAB power grid models for simulation and quantitative analysis to study the future application direction of domestic energy storage.

**關鍵詞(Key Words)：**儲能系統 (Battery Energy Storage System)、輔助服務(Ancillary Service)、電網應用(Grid Application)、技術要求(Technical Requirement)、可行性分析(Feasibility Analysis)。

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# 國外售電業電力供需預測及管理之研究

A Study on the Power Supply and Demand Forecast and Management Strategies of Abroad  
Electricity Retailing Licensees

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## 摘 要

在電業法改革下，我國電業將劃分為發、輸配及售電業。隨第二階段修法，傳統發電業和一般售電業將進入市場自由購售電，其意味公用售電業如何配置資源以制定購電策略成為重點。公用售電業需負責長期產銷計畫、中期電力採購及短期日前排程等。再生能源對排程的影響也需準確預測，從而提升購電部署效率。本研究參考國外先進國家電力供需預測方法，蒐集具公信力的售電業、政府及調度單位之案例，探討其預測目的、時間尺度、模型、變數及準確度校驗方式等。

根據國外案例和本團隊實務經驗，提出供需預測所需變數及資料來源，並設計短中長期電力供需預測模型架構。短期負載預測採用類神經網路模型，中長期負載預測則使用統計模型；短期再生能源發電量預測結合氣象預報與機器學習，中長期預測則主要使用機器學習方法，為未來公用售電業購電規劃提供參考依據。

## Abstract

The current Electricity Act divides electricity businesses into three categories: power generation, power transmission and distribution, and electricity retailing. Under the government's second phase of legislative reform, the licensees of traditional power generation and general electricity retailing will be able to sell and shop around for electricity. In the above scenario, how to allocate resources will become the focus of the public utility retailer (Taipower), in formulating its energy procurement strategies, including long-term production and sales plans, medium-term power procurement and short-term day-ahead scheduling. In addition, improving the accuracy of renewable energy generation forecasts will also help improve the efficiency of power purchase deployment.

Therefore, this study refers to the methods of electricity supply and demand forecast in advanced countries, collects credible cases (retailers, government sector and power dispatching department, etc.), and discusses topics such as the purpose, time scale, model, variables and accuracy verification method of demand and supply forecast, and proposes a design for the framework of short-, medium- and long-term power supply and demand forecast models. In this study, a neural network model is used for short-term load forecast, while a statistical model is used for medium- and long-term load forecast. In terms of methodology, short-term renewable energy power generation forecast combine weather forecast and machine learning, while medium- and long-term forecast mainly use machine learning methods to serve as a reference for the future electricity purchasing plans of Taipower (the public utility retailer).

**關鍵詞(Key Words)：**公用售電業(Public Utility Retailer)、購電策略(Energy Procurement Strategy)、負載預測(Load Forecast)、再生能源預測(Renewable Forecast)、預測模型(Forecast Model)。

# 國際電動車普及對於電網影響評估方法之探討

Discussion on Assessing the Impact of the Popularization of Electric Vehicles on the Power Grid

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## 摘要

2050 淨零排放十二項關鍵策略中，提出 2030 年公車及公務車具指標性之目標，以減少碳排放。本文蒐集國外電動車普及對於電網影響評估方法，以協助國內電業及相關單位降低在推動行動載具電氣化之過程中所需之電網評估之參考。

## Abstract

In view of the twelve key strategies for net zero emissions by 2050, indicative targets for bus and government vehicles by 2030 are proposed to reduce carbon emissions. This article therefore collects foreign practices for evaluating the impact of the popularization of electric vehicles on the power grid to serve as a reference for the participants of the domestic electric power industry and related units.

**關鍵詞(Key Words)：**電網評估 (Power Grid Assessment)、電力系統 (Power System)、電動車 (Electric Vehicles)。



# 亞太地區現有脫碳路徑之研究分析

Reviews of the Decarbonization Paths in the Asia-Pacific Region

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## 摘要

本文為依據台電公司發展碳捕捉封存及再利用技術與氫能技術之低碳價值鏈分析計畫，彙整亞太地區在減碳技術發展較先進國家有關脫碳計畫之相關資訊，另結合各國對於脫碳計畫之擬定或發展可能遭遇之困難。對亞太地區而言，在發電業上使用低碳燃料和 CCUS 技術的潛在運用價值更為重要，其中如日本、南韓和新加坡等工業化國家受限於其再生能源發展限制，從鄰近他國進口低碳能源可能會是中短期內具吸引力的選項之一。

本文透過探討這三個國家的脫碳計畫以及電力部門脫碳的整體方案，此些國家為了應對可能的挑戰，必須制定全面性的策略，其中包含再生能源技術的整合，以減少能源轉型過渡階段對於液化天然氣和煤炭燃料的依賴。而台灣與上述國家所面臨到的挑戰類似，本計畫期能透過觀察這些國家與台灣的相似性與可能挑戰，發展出適合國內導入之脫碳路徑規劃。

## Abstract

This project aims to conduct research on Taipower's development of low carbon value chains, such as carbon capture, utilization and storage (CCUS) and hydrogen energy technology. Its main content includes compiling the decarbonization plans of leading countries in the Asia-Pacific region in terms of decarbonization technology development plans, and the difficulties that they may encounter in formulating or developing decarbonization plans. The potential value of applying low-carbon fuels and CCUS technologies is particularly important for the power generation sector in the Asia-Pacific region. Taking Japan, South Korea and Singapore as examples, due to restrictions on the development of renewable energy, importing low-carbon energy from neighboring countries may be one of the most attractive options in the short to medium term. This article explores the overall decarbonization plans of the three countries mentioned above and the decarbonization plans of their power sectors. In order to cope with possible challenges, these countries must develop comprehensive strategies, such as the integration of renewable energy technologies, to reduce their reliance on liquefied natural gas and coal fuels in the transition phase of the energy transition. Since Taiwan faces similar challenges to the above-mentioned countries, this project hopes to develop a decarbonization path plan suitable for Taiwan to introduce by observing the challenges these countries may encounter.

**關鍵詞(Key Words)：**低碳價值鏈(Low Carbon Value Chain)、氫能技術(Hydrogen Technology)、二氧化碳捕捉與封存技術(Carbon Capture, Utilization & Storage, CCUS)、脫碳路徑圖(Decarbonization Roadmap)、能源轉型(Energy Transition)。

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# 天然氣機組轉型燃用氫氣

## Conversion of Natural Gas Units to Hydrogen Co-Firing

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### 摘要

本文探討將氫氣混入天然氣機組燃燒，作為一種減少碳排放的策略。儘管火力發電機組的比例會逐年降低，但在 2050 年達到淨零排放的過渡期，它們仍然扮演著穩定供電的重要角色。氫氣燃燒時不產生二氧化碳，若能順利發展，預計可顯著減少碳排放。文中彙整分析了燃氣混氫燃燒技術，並介紹了 Ansaldo Energia、Siemens Energy 和 General Electric (GE) 等公司在該領域的應用實例。研究顯示，天然氣機組混氫燃燒是一種可行的減碳手段，但需要考量氫氣特性、基礎設施、排放控制和安全問題。若能改善，且大規模應用，可成為電力淨零轉型採取的策略選項。

### Abstract

This article aims to explore the strategy of hydrogen co-firing for natural gas units to reduce carbon emissions. Although the proportion of thermal power generation will decline over the years, thermal units will still play a crucial role in ensuring stable power supply during the transition to net-zero emissions by 2050.

Hydrogen does not produce carbon dioxide when it burns. If the hydrogen co-firing technology can be successfully developed, it will be able to significantly reduce carbon emissions. In this article, we analyze various hydrogen co-firing technologies and introduce the applications of companies such as Ansaldo Energia, Siemens Energy, and General Electric (GE).

The research results show that hydrogen co-firing in gas-fired units is a feasible means of carbon reduction, but the characteristics of hydrogen, infrastructure, emission control and safety issues need to be considered. If the above challenges can be improved and the technology can be applied on a large scale, hydrogen co-firing will become an important strategic option for the power sector's net zero transformation.

**關鍵詞(Key Words)：** 火力機組(Thermal Power Unit)、淨零排放(Net Zero Emissions)、燃氣機組(Gas-fired Unit)、減碳技術(Carbon Reduction Technology)、混燒(Co-Firing)、氫(Hydrogen)。

# 太陽光電結合儲能計量及再生能源電表數據應用擴充之研究

Research on Metering Data Applications Taking Solar PV Combined with Energy Storage System as an Example

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## 摘要

光儲計費因須配合調度處彈性調度，須以每 15 分鐘電量資料(LoadProfile)計算儲能系統充放電量及太陽光電發電量，彈性充放電時間適用不同費率，且配合光儲業者同時辦理轉供，需於同一案場裝設多組電表計量，計費樣態複雜。未來因應再生能源增長下，推動光儲政策以增加系統運作彈性及調度性，需有相關光儲實績分析，並進行深入探討與研究，以利台電公司配合政策執行及檢視調整契約及各項規定妥適性。

本案在既有再生能源購電中介系統(TaiPower Renewable Intermediary System, TPRE)基礎上，因應時間電價時間帶調整、光儲計量計費、共同升壓站多階層電表併聯樣態、離岸風力雙迴路電表等業務，進行了 TPRE 系統功能的擴充修訂，並利用光儲案場 AMI 電表資訊大數據，分析再生能源發電機組產生之光電與併聯之儲能電池間的充放電樣態，及因應我國再生能源快速發展提出可行之大數據應用方式，作為未來能源開發及需量反應業務方向參考。

## Abstract

Since the billing of solar photovoltaic (PV) energy storage system must be coordinated with the flexible dispatch of the system operator, the charge/discharge amount of energy storage systems and the power generation of solar PV shall be calculated based on the load profile every 15 minutes, and different flexible charge and discharge periods are subject to different rates. In addition, when solar PV and energy storage operators at the same time engage in power wheeling business, Taipower has to install multiple sets of electricity meters at the specific site, which makes the billing pattern especially complicated. In the future, in response to the growth of renewable energy, the promotion of solar PV and energy storage systems to increase the flexibility and dispatchability of system operation requires relevant performance analysis and in-depth research to facilitate Taipower's policy implementation and review of contract content and relevant regulations.

In this project, we not only expand and revise the TaiPower Renewable Intermediary System's functions to cope with the adjustment of time-of-use tariff, solar PV energy storage billing, multi-level meter merger pattern for co-booster stations, and offshore wind power dual-loop meters, but also utilize the big data of AMI meters to analyze the charge/discharge patterns of solar PV system and energy storage batteries, so as to propose feasible big data application methods to serve as a reference for future energy development and promotion of demand response program.

**關鍵詞(Key Words)：**再生能源(Renewable Energy)、智慧型電表基礎建設(Automated Metering Infrastructure, AMI)、電表資料管理系統(Meter Data Management System, MDMS)、光儲(Solar Photovoltaic Energy Storage)、再生能源購電中介系統(TaiPower Renewable Intermediary System)。

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# 實現淨零碳排綠色充電站電力調控策略

Power Control Strategy to Achieve Net Zero Carbon Emission for Green Charging Stations

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## 摘要

本文探討淨零碳排直流充電站的電力調控策略，該充電站系統結合電力調節系統、儲能系統、再生能源及直流充電樁。通過再生能源與儲能系統的調節，不僅實現淨零碳排，同時確保電動車充電所用電能百分之百來自綠色能源。

目前，充電站電力仍依賴市電，難以應對市電波動，且無法實現真正的綠色充電，因其充電之電能來源仍會排放溫室氣體。新一代綠色充電站採用多台高功率直流充電樁併聯運轉，提高充電效率並縮短充電時間，並整合再生能源並設置儲能系統，提供穩定的電力輸出。這種系統不僅提升性能，還為充電站提供實現淨零碳排的調控手段。

沒有連接市電的自主運行綠色快速充電站仰賴先進的電力系統調控技術來實現電能的穩定供應和高效使用。利用再生能源、儲能技術及先進電力管理系統，可以有效地支持充電站在各種環境條件下的持續運行。

## Abstract

This article explores the power control strategies of a net-zero carbon emission DC charging station (green charging station), which is composed of a power control system, energy storage systems, renewable energy sources and DC chargers. Through the adjustment of renewable energy and energy storage systems, not only net-zero carbon emissions can be achieved, but also the electricity used to charge electric vehicles can be ensured to be 100% from green energy.

Currently, the power supply for charging stations still relies on the grid, which makes it difficult to cope with voltages and frequency fluctuations of the grid, and cannot achieve genuine green charging, as the electricity source for charging still emits greenhouse gases. The new generation of green charging stations use multiple high-power DC chargers operating in parallel to improve charging efficiency and shorten charging time. It also integrates renewable energy and sets up energy storage systems to provide stable power output. The aforementioned system not only improves performance, but also provides a means for charging stations to achieve net-zero carbon emissions.

Green fast charging stations that operate autonomously (not connected to the grid) rely on advanced power system control technology to ensure stable power supply and efficient use of electricity. In summary, the use of renewable energy, energy storage technology and advanced power management systems can effectively support the continuous operation of charging stations under various environmental conditions.

**關鍵詞(Key Words)：**綠色充電站(Green Charging Station)、直流充電樁(DC Charger)、淨零碳排(Net-zero Carbon Emission)、調控策略(Control Strategy)。

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