

台電工程月刊 928 期 (12 月) 目錄

配 電：

DISTRIBUTION：

基於BIM-MEP模型的電氣設計審查方法	蔡森洲 等	(1)
An Electrical Design Review Method Based on BIM-MEP Models.....	Tsai, Sen-Chou et al.....	(1)
通訊型故障指示器整合系統建置研究.....	甘凱文 等	(11)
Research on the Implementation of a Communication-Based Fault Current Indicator Integration System	Kan, Kai-Wen et al.	(11)

電力系統：

POWER SYSTEM：

國外電業線路設置費實務收費作法與調整方式之研究.....	吳彥儒 等	(17)
A Study on the Practical Charging Practices and Adjustment Mechanisms of Power Line Connection Charges in Foreign Utilities	Wu, Yen-Ju et al.....	(17)
配電圖資資料交換標準化研究.....	林必達 等	(23)
Research on the Standardization of Distribution Graphics and Data Exchange.....	Lin, Pi-Ta et al.	(23)

工程技術：

ENGINEERING TECHNIQUES：

台電潛盾洞道於卵礫石層施工案例探討.....	俞建華 等	(30)
Case Study of Shield Tunnel Construction in Cobble and Gravel Layers for Taipower.....	Yu, Chien-Hua et al.	(30)
太陽光電案場電力安全研究.....	林彥廷 等	(37)
Power Safety Research in Solar Photovoltaic Installations.....	Lin, Yen-Ting et al.	(37)

經營管理：

BUSINESS MANAGEMENT：

台電綠網之瀏覽滿意度與民眾參與活動意願分析.....	溫桓正 等	(55)
Browsing Satisfaction with Taipower's Green Net and Public Willingness to Participate in Activities	Wen, Huan-Cheng et al.	(55)
國營事業推行教練文化可行性之探討-以台電公司為例	林燦螢 等	(89)
The Feasibility of Implementing a Coaching Culture in State-Owned Enterprises: A Case Study of Taipower	Lin, Tsan-Ying et al.	(89)

基於 BIM-MEP 模型的電氣設計審查方法

An Electrical Design Review Method Based on BIM-MEP Models

蔡森洲*
Tsai, Sen-Chou

劉火炎**
Liu, Michael

黃毓棠*
Huang, Yu-Tang

林泰均**
Lin, Tai-Chun

謝冠群**
Hsieh, Guan-Chyun

王晴*
Wang, Ching

摘 要

本研究提出了一種使用建築資訊模型 (Building Information Modeling, BIM) 對機械、電氣和管道 (Mechanical, Electrical, and Plumbing, MEP) 進行電氣審查的方法。目的是可靠地簡化審查工作，直接評估電氣設備和佈線的佈局，並基於 BIM-MEP 模型計算短路電流和線路電壓降。本研究旨在簡化審核流程，減少人工審核錯誤，並提升審核的及時性和可靠性。此外，審查系統還能洞悉電線、管道和電氣設備精確整合到建築結構中的流程和正確性，提高建築電氣的安全性和可靠性。此外，亦可協助電機工程師運用 BIM 提升電路設計的準確性及自我檢測能力，並提升設計流程的時效性。最後，使用「Autodesk Revit」和「bimU」以及作業系統 Windows 11(虛擬機器)對審查單元進行了教育培訓並進行示範。

Abstract

This study proposes a method for conducting electrical design reviews of mechanical, electrical, and plumbing (MEP) systems using Building Information Modeling (BIM). The method aims to streamline the review process, directly assess the layout of electrical equipment and wiring, and calculate short-circuit currents and voltage drops based on BIM-MEP models. By reducing reliance on manual inspection, the approach minimizes human errors while enhancing the timeliness and reliability of reviews.

Furthermore, the review system enables the examination of the accuracy and integration of wiring, pipelines, and electrical equipment within the building structure, thereby improving the overall safety and reliability of electrical installations. It also supports electrical engineers in leveraging BIM to increase circuit design accuracy, strengthen self-checking capabilities, and improve design efficiency.

Finally, the review method was applied in training and demonstration sessions using Autodesk Revit and bimU, operated on a Windows 11 virtual machine, to validate its applicability in practical education and professional practice.

關鍵詞(Key Words)：機械、電氣和管道 (Mechanical, Electrical, and Plumbing, MEP)、建築資訊模型(Building Information Modeling, BIM)、電氣審查方法(Electrical Review Method)、建築資訊模型軟體(Autodesk Revit)。

*台灣電力公司綜合研究所

**邁爾工程顧問股份有限公司

通訊型故障指示器整合系統建置研究

Research on the Implementation of a Communication-Based Fault Current Indicator Integration System

甘凱文*
Kan, Kai-Wen

李明峯*
Lee, Ming-Feng

黃千華**
Huang, Cian-Hua

摘要

台灣電力公司(台電)自 109 年起引入具通訊功能的故障指示器(FCI)，以提升事故分析與斷線判斷能力，縮短平均復電時間。系統架構規劃中，FCI 與資料集中器(DCU)間採藍牙近端通訊，而 DCU 與系統端透過 4G/NB-IoT。通訊協定方面，FCI 與 DCU 間使用改良 MODBUS 協定；DCU 與系統端則基於 IEC 61850，透過 MQTT 傳遞資訊。

研究案亦規劃設備安裝與運作情境，如新設或更換 DCU、FCI 裝置、故障事件回報等作業。資訊安全層面，藍牙連線採 PDU 加密。DCU 與台電機房則使用 MDVPN 專線，搭配硬體防火牆管控通訊。

測試驗證方面，研究團隊於測試場域，安裝各廠商設備進行互通性驗證。測試結果顯示，各廠商設備皆可互相連線，並達到高成功率的故障通報及負載電流回傳。此外，負載電流測試達 91.6%成功率，符合台電驗收標準。研究最終確認 FCI 系統架構、通訊協定與多家廠商設備的互通性，為台電未來布建提供彈性與標準化參考。

Abstract

Since 2020, Taipower has deployed fault current indicators (FCIs) with communication capabilities to enhance fault analysis and outage detection, thereby reducing average power restoration time. In the system architecture, FCIs connect to Data Collection Units (DCUs) via Bluetooth, while DCUs communicate with the backend system using 4G/NB-IoT. Regarding communication protocols, FCIs and DCUs employ a modified MODBUS protocol, whereas DCUs transmit data to the backend using MQTT based on IEC 61850 standards.

The study also defines operational and installation scenarios, including DCU and FCI deployment, device replacement, and fault reporting procedures. Security measures are implemented at multiple communication layers: Bluetooth connections are encrypted at the PDU level, and DCU-server communication utilizes MDVPN dedicated lines with hardware firewall protection.

To validate system functionality, Taipower conducted field tests with equipment from multiple manufacturers. The results confirmed interoperability among devices, with high success rates for fault reporting and load current transmission. Load current tests achieved a 91.6% success rate, meeting Taipower's acceptance criteria. This research ultimately confirms the FCI system architecture, communication protocols, and multi-vendor interoperability, providing a standardized and flexible reference for future large-scale deployments.

關鍵詞(Key Words)：故障指示器(Fault Current Indicator)、先進配電管理系統(Advanced Distribution Management System)、智慧電網(Smart Grid)、系統整合(System Integration)。

*工業技術研究院

**台灣電力公司綜合研究所

國外電業線路設置費實務收費作法與調整方式之研究

A Study on the Practical Charging Practices and Adjustment Mechanisms of Power Line Connection Charges in Foreign Utilities

吳彥儒*
Wu, Yen-Ju

郭婷瑋**
Kuo, Ting-Wei

摘 要

本研究蒐集國外電業對於線路設置費用訂定之成本分攤理論與實務作法，發現各國線路設置費的收費內涵大致相似，惟收費作法部分，德國、日本及韓國的計費項目相對明確，僅需用戶之電壓、電流、距離及容量資訊即可計算費用總額，優點是行政作業簡便透明，缺點是收費金額與預期用戶應分攤之成本可能略有差異。而新加坡及美國則是完全依照個案情況計收費用，優點是收費金額真實反映用戶應分攤之成本，缺點是收費較不透明，用戶不易參照收費項目事前評估費用總額，且行政作業上相對複雜。對於因應通膨之調價機制部分，僅韓國電力公司有設計原物料與人力成本價格變動調整公式，以因應環境狀況改變進而調整費用。

Abstract

This study reviews the cost allocation theories and practical approaches adopted by foreign utilities for determining power line connection charges. The findings indicate that while the underlying concepts of connection charges are broadly similar across countries, the charging methods differ. In Germany, Japan, and South Korea, the calculation items are relatively explicit. The total charge can be determined using only a customer's voltage, current, distance, and capacity information. The advantage of this approach lies in its administrative simplicity and transparency; however, the drawback is that the resulting charge may deviate slightly from the actual costs that customers are expected to bear.

In contrast, Singapore and the United States adopt a case-by-case charging approach. The benefit of this method is that the charges more accurately reflect the actual cost allocation for each customer. The disadvantage, however, is reduced transparency, making it difficult for customers to estimate charges in advance, and the administrative process is comparatively complex.

Regarding price adjustment mechanisms in response to inflation, only Korea Electric Power Corporation (KEPCO) has developed a formal adjustment formula that reflects changes in raw material and labor costs, allowing the charges to be revised in accordance with changing environmental and economic conditions.

關鍵詞(Key Words)：線路設置費(Connection Charge)、供電容量(Power Supply Capacity)、成本分攤(Cost Allocation)。

*財團法人台灣經濟研究院

**台灣電力公司綜合研究所

配電圖資資料交換標準化研究

Research on the Standardization of Distribution Graphics and Data Exchange

蔡森洲*
Tsai, Sen-Chou

林必達*
Lin, Pi-Ta

陳忠源**
Chen, Chung-Yuan

游晴幃*
Yu, Ching-Wei

韓豫***
Han, Yu

李明峯***
Lee, Ming-Feng

摘 要

圖資系統在配電工程、維運管理、資產管理和用戶服務都佔重要的角色。隨著近年來配電資訊技術提升，各系統對於圖資需求亦日趨增加，為因應台電內部各單位對於配電圖資需求，以避免重複開發介接格式與功能，須探討資料介接所需模型，提升既有圖資系統功能及架構，並透過相關標準介接。

台電現正建置先進配電管理系統，為使系統可發揮功能並正常運作，必須介接配電圖資系統，以取得設備基本資料以及拓樸連結性資訊。依據規範，導入共同資訊模型相關標準，以標準格式進行資料轉檔及系統介接。本研究工作與台電相關單位探討圖資系統中所需轉檔的設備類別，以及各設備的重要屬性資料，並與共同資訊模型相關標準進行對照，產出圖資系統轉檔的規範文件與介接訊息格式。

Abstract

Graphics and data systems play an important role in power distribution engineering, operation and maintenance management, asset management and customer services. With the rapid advancement of power distribution information technologies in recent years, demands for graphics and data across various systems have grown significantly. To address the diverse needs for power distribution graphics and data within Taipower and to prevent redundant development of interface formats and functions, it is essential to establish appropriate data exchange models, enhance the functionality and architecture of existing graphics and data systems, and enable interoperability through standardized interfaces.

Taipower is currently implementing an advanced power distribution management system (ADMS). For this system to fully function and operate reliably, it must interface with the power distribution data system to obtain essential equipment information and topological connectivity information. In compliance with technical specifications, this research introduces standards related to the common information model (CIM), adopting standardized formats for data conversion and system integration. In collaboration with relevant departments of Taipower, this research identifies the categories of equipment that require conversion within the graphics and data system, specifies the critical attribute data for each equipment type, and maps them to CIM-related standards. The outcome of this work is the development of standardized documentation and interface message formats for GIS data conversion and system integration.

關鍵詞(Key Words)：先進配電管理系統(Advanced Distribution Management System)、配電圖資管理系統(Distribution Mapping Management System)、共同資訊模型(Common Information Model)、智慧電網(Smart Grid)、系統整合(System Integration)。

*台灣電力公司綜合研究所

**台灣電力公司配售電事業部配電處

***工業技術研究院

台電潛盾洞道於卵礫石層施工案例探討

Case Study of Shield Tunnel Construction in Cobble and Gravel Layers for Taipower

俞建華*
Yu, Chien-Hua

賴永設**
Lai, Yung-She

何茂安**
Ho, Mau-On

鄭富中**
Cheng, Fu-Chung

黃又霖**
Huang, Yu-Lin

摘要

本案例為台灣電力公司輸變電工程處北區施工處發包之管路統包工程，其地點位於新竹縣湖口鄉主要道路及住宅密集處，為降低交通及環境影響，以及穿越台鐵軌道段和河川而採用潛盾工法，潛盾掘進路線全線為卵礫石層及高地下水位之困難地質。本文探討潛盾洞道於卵礫石層施工相關設計考量及施工與監造重點，期能提供相關實務經驗予後續潛盾工程參考。

Abstract

This case study examines a pipeline turnkey project commissioned by the Northern Region Construction Office of the Transmission and Substation Engineering Department, Taiwan Power Company. The project site is located in Hukou Township, Hsinchu County, traversing major roads and densely populated residential areas. To minimize traffic and environmental impacts, particularly when crossing Taiwan Railways tracks and river sections, the shield tunneling method was employed.

The entire tunneling route passes through geologically challenging cobble and gravel layers with a high groundwater table. This paper focuses on design considerations for shield tunneling under such conditions, as well as critical aspects of construction and supervision. The aim is to provide practical experience and insights to guide future shield tunneling projects in similar geological settings.

關鍵詞(Key Words): 潛盾工法(Shield Tunneling Method)、卵礫石層(Cobble and Gravel Layers)、高地下水位(High Groundwater Table)。

*台灣電力公司輸變電工程處北區施工處

**中興工程顧問股份有限公司台電大潭梅湖工程處

太陽光電案場電力安全研究

Power Safety Research in Solar Photovoltaic Installations

林彥廷*
Lin, Yen-Ting

林閔洲*
Lin, Ming-Jhou

陳柏江*
Chen, Bo-Jiang

曹書崙**
Tsao, Shu-Lun

鄭信宣**
Samuel Tang Sin Shuan

郭政謙**
Kuo, Cheng-Chien

摘要

隨著台灣積極推動再生能源發展，屋頂型與農漁牧結合型太陽光電場域快速增加，然而近期多起火災、雷擊及牲畜感電事故引發關注，影響社會對太陽光電安全性的信任。本研究將分析太陽光電案場的事故原因與系統弱點，並探討不同場域因系統故障引發的電流、電壓及地電位上升問題對內部線路與周邊環境(如養豬場)的影響。研究將利用 EMTP-ATP 軟體進行模擬分析，並實地訪查三處案場，以驗證模擬結果的準確性。最後檢討現行國內外規範，並提出適用於不同環境的太陽光電發電系統避雷與接地建議，以提升案場安全性與穩定性。

Abstract

As Taiwan actively advances renewable energy development, rooftop and agrivoltaic (agriculture-, fishery-, and livestock-integrated) solar photovoltaic (PV) installations have expanded rapidly. However, recent incidents involving fires, lightning strikes, and livestock electric shocks have raised concerns and undermined public confidence in PV system safety. This study analyzes the causes of accidents and system vulnerabilities in solar PV installations. It further examines the effects of system faults (such as overcurrent, overvoltage, and ground potential rise) on internal wiring and surrounding environments, including facilities like pig farms.

The analysis employs EMTP-ATP simulation software, complemented by field investigations at three selected sites to validate the simulation results. Finally, current domestic and international standards are reviewed, and environment-specific lightning protection and grounding recommendations are proposed to improve the safety and operational stability of PV installations.

關鍵詞(Key Words)：太陽光電系統(Solar Photovoltaic System)、系統事故(System Incidents)、雷擊(Lightning Strikes)、地電位上升(Ground Potential Rise)、接地系統(Grounding System)。

*台灣電力公司綜合研究所

**國立臺灣科技大學

台電綠網之瀏覽滿意度與民眾參與活動意願分析

Browsing Satisfaction with Taipower's Green Net and Public Willingness to Participate in Activities

溫桓正*
Wen, Huan-Cheng

吳政宏*
Wu, Cheng-Hung

李福順*
Lee, Fu-Shun

許景喬*
Hsu, Ching-Chiao

林容瑜**
Lin, Rong-Yu

謝岳罡**
Hsieh, Yueh-Kang

摘要

台電環保處於 2015 年建置「台電綠網」，為評估網站營運成效並優化經營策略，本研究透過量化調查，期具體掌握受眾輪廓、瀏覽滿意度、以及參與活動偏好，並評估綠網對於環保理念推廣的影響力。

據分析，綠網受眾年齡中位數 37 歲、眾數 42 歲、平均數 38.79 歲，主要受眾群體介於 30 至 49 歲之間，居住地區集中六都並以雙北為主，台電員工占 53.91%。

受訪者對藝文/社群/體育活動的感興趣比例超過 8 成，知性活動則每三人即有一人於近半年內參與過；受訪者觸及活動的來源主要為親友與社群媒體，善用口碑行銷將是往後辦理活動的重要策略。

受訪者對於綠網滿意度有 92.61% 的正面評價，影響因素包含對資訊充實性的評價、對資訊查找方便性的評價等。而瀏覽滿意度則對於台電的企業社會責任、電業知識科普、再生能源的發展重要性、環境保護理念等四大項的了解與認同，均有正向影響關係。

Abstract

In 2015, the Environmental Protection Department of Taipower launched the "Green Net" website. To evaluate its operational performance and refine management strategies, this study employs a quantitative survey to examine audience profiles, browsing satisfaction, preferences for participation in activities, and the website's effectiveness in promoting environmental awareness.

The analysis shows that Green Net users have a median age of 37, a mode of 42, and an average age of 38.79 years. The majority are between 30 and 49 years old, reside mainly in metropolitan areas (especially Taipei and New Taipei City), and 53.91% are Taipower employees.

More than 80% of respondents expressed interest in cultural, social, and sports activities, while one-third participated in intellectual activities within the past six months. Friends and social media were the main channels through which participants learned about events, suggesting that word-of-mouth marketing will be a crucial strategy for future activities.

Overall, 92.61% of respondents gave positive evaluations of Green Net, with satisfaction shaped by perceptions of information comprehensiveness and ease of access. Browsing satisfaction was positively associated with greater understanding and recognition of four dimensions: Taipower's corporate social responsibility, dissemination of electricity-related knowledge, the importance of renewable energy development, and environmental protection principles.

This study provides empirical evidence of Green Net's impact on audience engagement and environmental communication, offering a reference for the platform's long-term monitoring and the development of future promotional strategies.

關鍵詞(Key Words)：台電綠網(Taipower Green Net)、活動參與(Activity Participation)、瀏覽經驗(Browsing Experience)、瀏覽滿意度(Browsing Satisfaction)、企業形象(Corporate Image)、企業社會責任(Corporate Social Responsibility)、環保網站(Environmental Protection Website)。

*台灣電力公司環境保護處

**群策公關顧問有限公司

國營事業推行教練文化可行性之探討-以台電公司為例

The Feasibility of Implementing a Coaching Culture in State-Owned Enterprises: A Case Study of Taipower

林燦螢*
Lin, Tsan-Ying

方翊倫*
Farn, Yih-Lune

林彥文*
Lin, Yen-Wen

邱曉培*
Chiu, Hsiao-Pei

張立欣**
Chang, Li-Hsin

陳瑩郢***
Chen, Ying-Mei

廖秦僊***
Liao, Chin-Ssu

黃惠渝***
Huang, Hui-Yu

摘要

台電為因應公司經營環境之轉變，選拔及培育具卓越管理及前瞻領導等才能之管理人才，應從以往培養技術或職能的專業領導模式，轉型為強調支持、指導與賦能的領導風格，新一代領導者應透過教練式領導技巧，經由引導與提問，幫助團隊成員發展潛能、提升績效，並促進個人成長。本文首先介紹教練及教練式領導，接著說明教練文化推行的拉力與推力，此外，也闡述現代領導者必須能夠平衡地扮演三種角色：主管、老師及教練，並介紹教練的技術和特質，提出研究計畫中教練文化推廣及教練課程的成果，並基於實務經驗，針對台電教練文化的發展與應用提供評估建議。

Abstract

In response to changes in its operating environment, Taipower seeks to identify and develop managerial talent with outstanding management capabilities and forward-looking leadership skills. This requires a shift from the traditional leadership model (centered on cultivating technical or functional expertise) to one that emphasizes support, guidance, and empowerment. The new generation of leaders is expected to adopt coaching-based leadership, using inquiry and facilitation to help team members realize their potential, improve performance, and foster personal growth.

This article first introduces the concepts of coaching and coaching leadership, followed by an analysis of the driving and restraining forces affecting the promotion of a coaching culture. It further argues that modern leaders must balance three roles: supervisor, teacher, and coach. The article also discusses the key techniques and qualities of effective coaching, and presents the outcomes of coaching culture initiatives and training programs implemented as part of this study. Finally, drawing on practical experience, it offers recommendations for the development and application of a coaching culture within Taipower.

關鍵詞(Key Words)：教練文化(Coaching Culture)、教練式領導(Coaching-leadership)、個人發展計畫 (Individual Development Program)、台灣電力公司(Taiwan Power Company)。

*共好管理顧問股份有限公司

**台灣電力公司綜合研究所

***台灣電力公司人力資源處