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先進讀表基礎建設建置效益研究與增值應用分析

Research on the Cost-Benefit Evaluation of AMI and Value-Added Application

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摘要

本研究目的為進行 AMI 建置成本效益評估及增值應用規劃。首先蒐集國外 AMI(另包含 B Route 以及 HEMS)建置現況及成果。接著進行 AMI 系統建置成本與效益評估模式建立，其應為參數化及符合國內的法規與環境，同時須考慮用戶的用電特性，以提高成本效益分析的可信度。提供評估模式之狀態邏輯，並於整體評估模式完成後，進行模擬測試，驗證各種情境下邏輯之狀態及結果之正確性。此外進行 AMI 系統增值應用評估，配合用電資訊大數據，評估電業端、用戶端需求資訊之運用。計畫最後比較本國與國外 AMI 系統建置方式差異比較，並以本國環境、國情等因素分析評估最適我國佈建方式。

Abstract

The purpose of this research is to conduct the cost-benefit evaluation and value-added application planning of Advanced Metering Infrastructure (AMI) construction. First, we collect the current status and achievements of foreign AMI (including B route and HEMS); then, establish cost and benefit evaluation model of AMI system construction, which should be parameterized and conform to domestic regulation and environmen. At the same time, users' consumption characteristics must be considered to improve the credibility of cost-benefit analysis. After completing the entire evaluation model, the status logic of the evaluation model will be examined to verify the correctness of the logic status and results in various situations. Besides, value-added application of the AMI system will be evaluated, cooperating with the big data of electricity consumption information of the utility side and the customer side. At the end of the research, we will compare the differences between domestic and foreign AMI system construction methods, and analyze the most suitable deployment method in Taiwan based on factors such as the domestic environment and national conditions.

關鍵詞(Key Words)：先進讀表基礎建設(AMI)、路由 B(B Route)、成本效益分析(Cost Benefit Analysis)。

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用戶用電設備設計資料審查暨審驗圖文管理系統開發

The Development of Electrical Equipment Design Data Review and Inspection Graphic Management System

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摘要

現行用戶用電設備設計資料審查申請採用紙本送件，審迄的歸檔亦採用紙本存放。由於用電戶數逐年攀升，累積的紙本文件量十分可觀，除了佔用了許多場地來存放資料，紙本資料未有明確的檔案管理機制，相關資料調閱不易，也不易控管。

為妥善解決資料管控與查閱面臨的問題，滿足電業法第 32 條子法「用戶用電設備檢驗辦法」的規範，同時提升本公司之雲端服務之能量。本研究計畫導入資訊系統，建置「用電設備設計資料審查」與「審驗圖文管理系統」，將圖審申請與審查、用電申請、歷史資料管理等作業線上化，申請者可透過系統提出圖審申請並查閱進度，台電同仁可使用系統進行審核並管理用電申請案件。

Abstract

At present, the application for the design review of users' electrical equipment is submitted in paper, as well as the filing of the review. As the number of customers increases year by year, the accumulated amount of paper documents is considerable. In addition to taking up space, there is no clear file management mechanism and it is not easy to access and control relevant materials. To properly solve the problems faced by data control and access, and to meet the specifications of Article 32 of the Electricity Act regarding "User Electrical Equipment Inspection Measures"; at the same time, to enhance the capacity of the company's cloud services, this research introduces a new information system, by building "Electrical Equipment Design Data Review" and "Inspection Graphic Management System" to make relevant procedures such as the applying, reviewing and historical data management of design review be done online. Applicants can apply for drawing review through the system and check the progress, while the colleagues of Taipower may use the system to review and manage the application cases.

關鍵詞(Key Words)：用戶用電設備設計資料管理系統(Electrical Equipment Design Data Review and Inspection Graphic Management System)、圖審(Drawing Review)、無紙化(Paperless)、數位簽章(Digital Signature)、圖文管理(Graphic Management)。

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國外輸電系統規劃制度與分析方法之探討

The Methods of Transmission System Planning in Foreign Countries

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摘要

隨著電網不確定能源占比提高，使電網規劃變得更具挑戰性，為確保電業改革推動順利且確保能源轉型後仍可維持電力系統可靠度，本文整理美國對於輸電系統規劃之原則與程序，作為電業管制機關之參考。並由過去輸電系統營運商對於電網規劃或相關可靠度標準的制定上，大多以確定性方式(即系統尖、離峰情境)進行模擬分析與電網規劃，但此方法容易導致電網過度投資與開發，為了使得每項改善方案同時確保系統可靠性與安全性又具經濟效益，近年來已開始導入機率性方式進行評估研究，本文分別蒐集美國對於輸電系統規劃的制度、國外針對電網規劃分析方法並比較，且於本論文補充介紹近期 ERCOT 機率性電網規劃方法與緣由，作為未來電網分析發展之方向。

Abstract

As the proportion of uncertain renewable energy sources in the grid increases, grid planning becomes more challenging. To ensure the smooth progress of electricity market reform and to ensure the reliability of power system after the energy transition, this article sorts out the principles and procedures for the planning of transmission systems in the United States as a reference for the regulator of electric industry in Taiwan. In the past, transmission system operators mostly used deterministic approach, i.e., system on-peak and off-peak scenarios, to conduct simulation analysis, power grid planning, and formulation of reliability standards. However, this method easily leads to over investment/development of the grid. In order to ensure the reliability, security and economic benefits of each investment plan, in recent years, probabilistic evaluation methods have been introduced. This paper collects and compares the methods of transmission system planning in the USA among others, especially the probabilistic power grid planning method in ERCOT, to serve as reference for the power grid planning in Taiwan.

關鍵詞(Key Words)：電網規劃 (Power Grid Planning)、機率性評估 (Probabilistic Assessment)、輸電系統 (Transmission System)。

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整合分散式能源之虛擬電廠推動策略與模式示範研究

Research on Promoting Strategy and Model Demonstration of Virtual Power Plants by Integrating Various Distributed Energy Resources

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摘要

隨著全球發展潔淨能源之趨勢，分散式能源(Distributed Energy Resources, DER)在世界各國電網及電力市場高度滲透，國際上已逐漸聚焦於虛擬電廠(Virtual Power Plant, VPP)之發展，以尋求可同時追求低碳及維持系統運行穩定之最佳方案。隨著我國綠能、儲能系統及需量反應等相關技術發展，電力產業已逐漸具備整合資源並發展創新營運模式之潛力，虛擬電廠之推動符合國際電業潮流，並可作為因應再生能源間歇性之解方。本研究旨在透過虛擬電廠之試驗研究，以釐清虛擬電廠於實務上之運作程序，盼能作為我國未來整合分散式能源技術之參考。本研究之內容包含虛擬電廠之國外資料蒐集、商業模式研析、機制與配套措施建立、電力市場試驗、及各期程推動策略規劃。

Abstract

With the global trend of developing clean energy, Distributed Energy Resources (DERs) are highly penetrated in power grids and electricity markets around the world. Some countries have gradually focused on the development of Virtual Power Plants (VPPs) in order to seek the best solution that can simultaneously pursue low carbon and maintain stable system operation. With the development of related technologies such as green energy, energy storage systems and demand response in Taiwan, the electric power industry has gradually possessed the potential to integrate resources and develop innovative business operation models. The promotion of VPPs is in line with the global trend and can be used as a solution to cope with the intermittent generation nature of renewable energy. This study aims to clarify the practical operation procedures of VPPs through the experimental research of VPPs, hoping to serve as a reference for the future integration of the DERs in Taiwan. The content of this study includes foreign VPPs information collection, business model analysis, establishment of mechanisms and supporting measures, electricity market experiments, and strategic planning for each phase.

關鍵詞(Key Words)： 虛擬電廠(Virtual Power Plant)、分散式能源(Distributed Energy)、商業模式(Business Model)、資源聚合(Resource Aggregation)。

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AMI 電表通訊應用層資安滲透測試研究

Research on Information Security Penetration Testing of AMI Meter Communication Applications

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摘要

本計畫主要針對台電低壓智慧型電表系統之資安滲透研究，研究內容包含智慧型電表本體與 AMI 通訊系統之資安滲透，可分為 AMI 計量單元與 Route A、B 通訊模組之安全評估、AMI 電表通訊資安檢測平台之建置、FIPS 140-2 密碼模組檢測標準研析、電表密碼模組演算法之安全評估、AMI 電表軟韌體升級安全功能研析、AMI 數位鑑識研析與 KMS 金鑰管理系統功能需求研析。透過本研究可建構低壓智慧型電表資安滲透平台，提供台電未來智慧電表資通安全相關管理參考。

Abstract

This project is mainly aimed at the information security penetration research of Taipower's low-voltage smart meter system. The research content includes the information security penetration of smart meter devices and the AMI communication system, which can be divided into the security assessment of the AMI measurement units and Route A and B communication modules, the establishment of AMI meter communication information security inspection platform, the analysis of the Federal Information Processing Standard (FIPS) 140-2 and Cryptographic Algorithm Validation Program, security function analysis of AMI firmware upgrading, digital forensics (DF) and the functional requirements of the Key Management System (KMS), etc. Through this research, a low-voltage smart meter information security AMI penetration platform may be constructed to serve as a reference for Taipower's future smart meter information security-related management.

關鍵詞 (Key Words)：智慧電表(Smart Meter)、資安滲透(Information Security Penetration Testing)、數位鑑識(Digital Forensics)、金鑰管理系統(Key Management System)。

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監造作業之數位化管理

Digital Management of Supervision Operations

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摘要

近年來公共工程因資通訊快速發展與普及，以及政府推動數位化和無紙化政策，數位轉型已成為各政府機關業務發展之優先目標。

中興工程顧問股份有限公司(以下簡稱中興公司)為配合政策及改善監造作業模式之繁瑣、耗時與使用大量紙張等缺點，自行研發專案管理資訊系統(PMIS)，藉由系統化、模組化及雲端化之數位管理工具，計畫成員可經由行動通訊裝置及電腦，透過網際網路無遠弗屆的即時傳送或存取工程資訊，讓監造作業跨越時間及距離障礙與限制，逐步達成數位化與無紙化的目標。

本篇說明目前中興公司承攬台灣電力股份有限公司輸變電工程處北區施工處「161kV 大潭(甲)~梅湖一、二工區統包委託監造技術服務工作」應用 PMIS 執行監造作業，將公共工程數位轉型執行架構與實際經驗提供業界參考。

Abstract

In recent years, due to the rapid development and popularization of information and communication technologies in public construction, as well as the government's policies of promoting digitalization and paperless, digital transformation has become a priority goal for the business development of various government agencies.

Sinotech Engineering Consulting Co., Ltd. (hereinafter referred to as Sinotech) developed its own project management information system (PMIS) in order to cooperate with government policies and improve the shortcomings of the traditional supervision operation mode, such as cumbersome, time-consuming and using a lot of paper. With systematic, modular and cloud-based digital management tools, project members can transmit or access engineering information in real time through mobile communication devices and computers, and through the Internet, allowing supervision operations to overcome barriers and restrictions of time and distance, and gradually achieve the goal of digitization and paperless.

This article aims to introduce the "161kV Datan (A)~Meihu No. 1 and No. 2 Work Area Turnkey Entrusted Manufacturing Supervision Technical Service Work", which uses PMIS to perform supervision operations and is contracted by the North District Construction Department of the Power Transmission and Transformation Engineering Department of Taiwan Power Company, to serve as reference of the implementation framework and practical experience of the digital transformation of public construction.

關鍵詞 (Key Words)：專案管理資訊系統(Project Management Information System)、數位化(Digitalization)、無紙化(Paperless)、系統化(Systematic)、雲端化(Cloud Based)。

集團資訊共享服務之規劃研究

Information Sharing Services for Group Companies-Taking Taipower as an Example

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摘要

因應民國 106 年 1 月 26 日經總統令修正公布施行之《電業法》，本研究將研析未來台灣電力股份有限公司基於專業分工轉型為控股母子公司，其下成立發電及輸配售電子公司，形成電力事業集團之營業型態。配合組織之轉型，本研究將考量母子公司間共通性業務之運作效益，規劃參考全球集團化經營之企業各子公司、分公司之資訊共享服務集中管理之作法，包含資訊共享服務之範疇規劃、計費計價機制之研擬、運作流程及管控措施、組織與人力配套等，透過資訊共享服務之設計與推動，避免各組織重複投入資源之外，並同時提升作業標準化及資訊處理時效。

Abstract

According to the Electricity Act promulgated and implemented on January 26, 2017, Taiwan Power Company shall transform into a holding parent company and three subsidiaries, based on functional separation, namely a power generation company, a transmission and distribution company, and an electricity retailing company. To be in line with the aforesaid requirements, this research by referring the operating benefits of businesses in common between a holding parent company and its subsidiaries, and the practices of centralized management of information sharing services for subsidiaries and branches of group companies around the world (including the scope of information sharing, R&D of billing and pricing mechanisms, operation process and control measures, supporting measures for organization and manpower, etc.) aims to help TPC avoid repeated investment of resources between different organizations, and improve operation standardization and information processing timeliness.

關鍵詞(Key Words): 資訊共享服務(IT Shared Service)、組織轉型(Organization Transformation)、計費計價機制(Pricing and Billing Mechanism)。

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核能設施附近海域生態放射性物質調查

Investigation of Radionuclides in the Sea Area Near the Nuclear Facilities in Taiwan

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摘要

本調查計畫乃執行 110 至 111 年間台灣地區鄰近核能設施海域環境中放射性核種的監測工作，此乃延續過往之長期且連續性之作業。海域環境試樣種類包括海水、海魚、海藻、岸砂、海底沉積物與植物，採集之試樣經前處理後以加馬能譜核種分析儀計測。天然放射性核種(^7Be 、 ^{40}K 、 ^{232}Th 、 ^{238}U)與人工放射性核種(^{54}Mn 、 ^{60}Co 、 ^{137}Cs 等)均可依其特性加馬射線而被測定。調查期間(110~111 年)共計完成 632 件次的核種分析，各類試樣主要均測得天然放射性核種，僅少數試樣測得 ^{60}Co ， ^{54}Mn 與 ^{137}Cs 等微量人工放射性核種，然而其值遠低於環境輻射監測規範所訂之調查基準，且其活度均落於歷史變動範圍。

Abstract

This investigation plan aims to carry out the monitoring work of radionuclide concentration and distribution in the sea area near the nuclear facilities in Taiwan. The plan period of is from 2021 to 2022, a long-term and continuous operation. The types of sea environment samples include seawater, sea fish, sea weed, shore sand, seabed sediment and plants. The collected samples are pre-treated and then measured with a gamma-ray spectrometer. Both naturally occurring radionuclides (^7Be , ^{40}K , ^{232}Th , ^{238}U) and artificial radionuclides (^{54}Mn , ^{60}Co , ^{137}Cs , etc) can be determined according to their characteristic gamma rays. During 2021 to 2022, a total of 632 pieces of nuclear species analysis were completed. Naturally occurring radionuclides were commonly detected in various samples, and only a small amount of artificial radionuclides such as ^{60}Co , ^{54}Mn and ^{137}Cs were detected in a few samples. It is far lower than the survey standard stipulated in the environmental radiation monitoring regulations, and its activity falls within the range of historical fluctuations.

關鍵詞 (Key Words)：核能設施 (Nuclear Facilities)、放射性物質調查 (Monitoring of Radionuclides)、加馬能譜分析儀 (Gamma-ray Spectrometer)、天然放射性核種 (Naturally Occurring Radionuclides)。

ASME 法規管路裂紋失效評定圖評估

Failure Assessment Diagram (FAD) Evaluation Method Recommended by ASME Codes for Piping Flaws

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摘要

除了傳統的線彈性破壞、彈塑性破壞、及極限負荷分析，ASME 法規自 2004 年版開始採納失效評定圖，作為龜裂管路的變通評估方法。本文首先介紹失效評定圖的發展與變革，之後描述 ASME 法規建議的失效評定圖安全評估流程，並參考國際管路計畫完成的龜裂管路測試數據，以及核二廠實際檢測發現的龜裂管路案例，說明此評估方法的應用程序。

Abstract

In addition to the traditional methods of Linear Elastic Fracture Mechanics, Elasto-plastic Fracture Mechanics, and Limit Load Analysis, ASME codes have adopted Failure Assessment Diagram (FAD) since its 2004 edition as an alternative evaluation method for cracked pipes. This paper first introduces the development and evolution of FAD; then describes the safety assessment process of FAD recommended by ASME; and, by referring to the cracked pipe test data completed by the International Pipe Project and the cracks found in the second nuclear power plant, illustrates the application procedure of this evaluation method.

關鍵詞(Key Words)：失效評定圖(Failure Assessment Diagram)、失效評定圖曲線(FAD Curve)、ASME 法規(ASME Codes)、安全評估流程(Safety Evaluation Process)。

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