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PRS 濾袋資源再利用評估

Evaluation of PRS Filter Bag Reuse

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摘要

本計畫評估塵粒移除系統 (Particle Removable System, PRS)的廢濾袋，經物理和化學方式之再利用技術，將其結構為聚苯硫醚(Polyphenylene Sulfide, PPS)的廢棄 PRS 濾袋回收清洗後再利用，完成：PRS 濾袋基本特性分析，包含: DSC、Tcc、Td 和 FTIR，以及流變分析。將 PRS 廢濾袋進行物理回收，完成添加 40%玻纖的 PPS 複合材料 (脂粒)，其各項性能與市售品相當；進一步再將此 PPS 複合材料，經射出成型加工試製完成 3C 產品機殼。另外，將 PRS 廢濾袋利用硫解法和甲基化法的化學解聚方式，達到其解聚率 $\geq 50\%$ ；再將化學解聚後產物，製備成 PSMP 水性防蝕塗料，及二硫醇(Dithiol)油性防蝕塗料並初步完成塗料評估。

最後，針對每年 80 噸 PRS 集塵袋處理量，依上述物理和化學方式之再利用技術進行經濟評估分析。

Abstract

This project uses physical and chemical technology to recycle and clean the waste filter bags (chemical composition of polyphenylene sulfide (PPS)) of the Particle Removal System (PRS). The related tasks include: basic characteristic analysis of PRS filter bags, including DSC, Tcc, Td, FTIR and rheological analysis; physical recycling of waste filter bags and complete adding 40% glass fiber PPS composite material (fat particles), the performance is equivalent to that of commercially available products; further use this PPS composite material to trial-produce the 3C product casing through injection molding; chemical depolymerization of PPS waste filter bags using thiolysis and methylation methods to achieve a depolymerization rate of greater than or equal to 50%; the resulting oligomers are made into PSMP water-based anti-corrosion coatings and dithiol oil-based anti-corrosion coatings- the evaluation of the coating is preliminarily completed. Finally, according to the recycling technology of the above physical and chemical methods, an economic evaluation analysis is carried out for the processing capacity of 80 tons of PRS dust bags per year.

關鍵詞(Key Words)：塵粒移除系統(Particle Removable System, PRS)、濾袋(Filter Bag)、聚苯硫醚 (Polyphenylene Sulfide, PPS)、物理回收 (Physical Recycling)、化學解聚 (Chemical Depolymerization)、分析(Analysis)。

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創新 Excel 表格繪製輸電線路平面暨縱斷面圖

Innovative Excel Worksheets for Plane and Longitudinal Transmission Line Drawings

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摘要

輸電線路平面暨縱斷面圖為從事輸電線路初步設計規劃或設計規制定案後之重要參考藍圖，本報告除應用免費 QGIS 軟體取得鐵塔周邊等高線地形圖及線路路徑高程等資訊，加上自行開發由 Excel 軟體之表格欄位操作者(人機)介面，讓使用者可由 Excel 表格欄位直覺、快速輸入架線資料，並結合 Excel VB 及 Autolisp 程式語言，將該等資料自動轉化成 Autocad 環境繪製圖面等資訊，於 AutoCad 環境下自動將斷面圖繪製完成。

上述應用程式相互整合後，以人工繪圖作業模式為比對基準，著實有效縮減約90%時間，可說是只要往常十分一時間，即可完成所需斷面圖，提升電線路工程師在設計及繪製圖面階段之工作效率；另對於新手繪製圖面而言，藉由此應用程式，亦可輕鬆上手，迅速完成圖面繪製等任務。

Abstract

The plane and longitudinal diagrams of transmission lines are important reference blueprint both in the stage of preliminary design and planning, and after the design and planning is finalized. In this project, we not only use the free QGIS software to obtain information such as contour topographic maps around the tower and route path elevations, but also develop a table-field man-machine interface of the Excel software to allow users to intuitively use the Excel table field, quickly input wiring data, and combine Excel VB and Autolisp programming language to automatically convert relevant data into Autocad environment drawing graphics to complete the longitudinal diagrams.

After the above-mentioned applications are integrated with each other, we use the manual drawing operation mode as a benchmark to complete the required drawing, which not only reduces the time by about 90%, but also greatly improves the work efficiency of transmission line engineers. The afore-mentioned application can help novices get started easily and quickly complete their tasks.

關鍵詞 (Key Words)：地形資訊系統(Geographic information System, QGIS)、視覺化程式應用語言(Visual Basic for Applications, VBA)、等價跨距(Ruling Span)、等價跨距(Critical Span)、逗號分隔值(Comma-Separated Values, CSV)。

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智慧型安全監測技術應用探討-以 345kV 峨眉~中寮線 #156 塔基為例

Application of Smart Safety Monitoring System-Take #156 Tower Base of the 345kV
Emei~Zhongliao Transmission as an Example

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摘 要

本公司輸電鐵塔分遍全台灣，其中超高壓輸電線路大部分位於山區，部分鐵塔基礎位於較不穩定之邊坡，考量地質構造可能帶來的危害，各區設計課會針對該區域負責塔基應辦理邊坡穩定分析、鐵塔變形量監測或裝設傾斜管、水位計等監測儀器定期追蹤監測，一旦評估有安全疑慮即興辦邊坡保護工程、塔基補強或遷改建等維護措施。

雲端智慧監測應用於土木工程行之有年，然各項監測系統不外乎需要考量電源供應問題，在無市電供應下之監測儀器，需穩定、即時、有效傳輸及提供預警功能，就必須使用太陽能供電，背後的資料匯集設備也是各家智慧監測角逐的前端技術。本篇係因塔基旁大規模深層滑動下，以雙軸傾斜計配合雲端智慧監測系統之分享案例(345kV 峨眉~中寮線#156 塔基)，有助於日後進行類似案例施工之參考。

Abstract

Taipower's transmission towers are spread all over Taiwan. Most of the ultra-high voltage transmission lines are located in mountainous areas, and some of their foundations are located on unstable slopes. Considering the possible hazards caused by geological structures, the design division of each district will be responsible for issues such as slope stability analysis of the tower foundation in the area, monitoring of tower deformation, or installation of regular monitoring and tracking instruments, e.g., inclined casing and water level gauges. Once safety concerns are assessed, maintenance measures, e.g., slope protection projects, tower foundation reinforcement or relocation and reconstruction, will be carried out immediately.

Cloud-smart-monitoring has been used in civil engineering projects for many years. However, all monitoring instruments need to consider power supply issues. In the absence of grid power supply, in order to ensure stable, real-time, and effective information transmission and early warning functions of these monitoring equipment, solar power must be used. The data collection equipment is also a front-end technology where competition among various smart monitoring manufacturers is fierce. The article is a shared case of using a dual-axis inclinometer and a cloud smart monitoring system due to large-scale deep sliding next to the tower base (345kV Emei~Zhongliao Line #156 tower base), which will be helpful as a reference for similar case construction in the future.

關鍵詞(Key Words)：智能監測系統(Smart Safety Monitoring System)、順向坡(Dip-slope)、傾斜計(Tiltmeter)、邊坡滑動(Slope Sliding)。

應用電信業者之 E1 通信電路於多端子線路保護電驛 可行性驗證

Feasibility Verification of the Application of E1 Communication Circuits in Multi-terminal
Transmission Line Protective Relays

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摘要

依據台灣電力公司輸供電事業部電力系統保護電驛規劃準則^[1]，69kV 輸電線路最多以三點分歧併接點(五端子)為原則，若輸電線路發生故障時，併接於線路上所有電源均需同時跳脫隔離事故以降低影響範圍。近年來因應政府能源轉型政策，諸多再生能源業者併聯至台電輸電線路。業者站所至台電變電所間需使用光纖連接以啟用差流保護電驛(87L)。然業者之併網點有時候並無光纖可至台電變電所，將影響業者併網期程，為改善業者無光纖可銜接之情形，本文提出之改善方案，係透過研發之專用多工機，其具備適用直通光纖傳輸之專用卡板，同時租用電信業者 E1 電路，並實際於台電 5 所變電所進行電信業者 E1 電路於多端子線路保護電驛之保護功能相關模擬試驗。經驗證本改善方案可行且必要，可供所有再生能源業者參考。

Abstract

According to the Planning Guidelines for Power System Protective Relay Planning Guidelines of Taipower^[1], the 69kV transmission lines shall be planned with a maximum of three divergence and connection points (five terminals). If a transmission line fails, all the terminals connected to the line must be tripped and isolated at the same time to reduce the scope of the impact, e.g., affective areas. In recent years, in response to the government's energy transition policy, many renewable energy (RE) sources have connected to Taipower's transmission lines. To activate the differential transmission line protective relay (87L), optical fiber connections are required between terminals and Taipower substations. However, sometimes there is no available optical fiber at the grid-connection point of RE operators to Taipower substations, which will affect the grid-connection schedule. Regarding the situation that RE operators have no optical fiber to connect, the improvement plan proposed in this article is to use customized multiplexers, which has a special

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card board suitable for straight-through optical fiber transmission, and apply rented E1 circuits to the multi-terminal transmission line protective relays of Taipower's five substations for testing. The improvement plan has been proven to be feasible and necessary and can be used as a reference for RE operators.

關鍵詞(Key Words)：多端子線路差流保護電驛(Multi-terminal Differential Transmission Line Protective Relay)、光纖(Optical Fiber)、多工機(Multiplexer)。

大量離岸風電併網之諧波管制標準及分析研究

A Study on Harmonics Grid Code and Analysis for Mass Grid-Connected Offshore Wind Farms

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摘要

考量大型離岸風場透過數公里長的海底電纜和大型變壓器連接至變電所，未來電網可能發生諧波過高問題，導致設備損壞或事故，且隨著問題的複雜，部分離岸風電業者因併網共同耦合點在同一變電所匯流排，造成諧波電流方向性判斷困難，須及早針對電力諧波規範進行研討，以便未來釐清不同離岸風場業者對電網供電品質之責任。本文整理與台灣電網特性相近國之再生能源併網規範方面之經驗與做法，特別著重於諧波電壓管制，從電網特性、併網規範、系統模擬及量測驗證機制等方面，提出併網規範制定及驗證方式改進建議，協助達成政府再生能源發展政策，同時兼顧系統供電品質。

Abstract

Considering that large-scale offshore wind farms are connected to onshore substations through several kilometers of submarine cables and large transformers, excessive harmonics may occur in the future power grid and lead to equipment damage or accidents. In addition, since the common coupling points of some offshore wind farms are at the same substation, it is difficult to judge the directionality of harmonic current. It is necessary to conduct discussions on power harmonic regulations as soon as possible to clarify the responsibility of different offshore wind farm operators for the quality of grid power supply in the future. This article summarizes the experience and practices of renewable energy grid connection regulations in countries which have similar grid characteristics to Taiwan, with special emphasis on harmonic voltage control. From the aspects of grid characteristics, grid code, system simulation and measurement verification mechanisms, etc., we put forward suggestions for improving the grid connection specifications and verification methods to help achieve the government's renewable energy development policy while taking into account maintaining the quality of power supply.

關鍵詞(Key Words)：離岸風電(Offshore Wind Farm)、併網標準(Grid Code)、電力系統諧波(Power System Harmonics)、諧波模型(Harmonics Model)、諧波分析(Harmonics Analysis)、諧波共振(Harmonic Resonance)。

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結合閒置營區、綠能合作社、儲能系統之金門分散式能源策略

Distributed Energy Strategy in Kinmen-Combined Efforts of Idle Military Camps, Green Energy Cooperatives, and Energy Storage Systems

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摘要

為配合台灣 2025 年綠能(滲透率)發電占比 20%與金門低碳島 2.0 執行策略，以及思考閒置營區由軍事地景轉型為能源導向的利用形式，研究著重於如何善用本島之天然資源-陽光結合島上特有的資源-軍事營區，發展以再生能源為主之虛擬電廠(Virtual Power Plant, VPP)，並以分散式能源策略降低現有集中式電廠對燃油之需求，以區域微電網結合虛擬電廠、需量反應以及儲能系統做為營區「平封戰啟」(平時封閉再利用、戰時啟用)戰略目標。在分散式電力取代集中式電廠的減碳概念下，串連既有熱門觀光路線景點及就近之閒置營區，結合再生能源使之成為分散式小型電廠，並與電動汽機車之充電樁聯結(Vehicle-to-Grid，電動車電能回輸電網)，進而成為附近各聚落之虛擬電廠，更可進一步配合住戶再生能源儲能設備(Renewable Energy Storage, RES)和需量反應(Demand and Response, DR)，達成完善智慧微電網的實質意義。

Abstract

In order to cooperate with the government's implementation strategy of reaching 20% green energy generation by 2025 and building Kinmen into a low-carbon Island (version 2.0), as well as considering the transformation of idle military camps from military land to energy utilization, this study focuses on how to make good use of the island's natural resources, e.g., sunlight and military camps, combined with regional microgrids, demand response and energy storage systems, to develop virtual power plants (VPPs), so as to reduce the demand for fuel oil from existing centralized power plants, and serve as the military camps' strategic objective of "mothball in peacetime, unseal during war." Under the aforementioned carbon reduction concept of replacing centralized power plants with decentralized power, the existing popular tourist attractions will be combined with nearby idle campsites, renewable energy, charging piles for electric vehicles (vehicle-to-grid), to turn them into decentralized small power plants and virtual power plants. In addition, they can further cooperate

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with household renewable energy storage (RES) equipment and demand response (DR) to achieve the substantive significance of smart microgrids.

關鍵詞(Key Words)：低碳島 2.0(Low Carbon Island 2.0)、閒置營區(Idle Military Camps)、虛擬電廠(Virtual Power Plants, VPP)、平封戰啟(Peace Closure and War Activating)、再生能源儲能設備(Renewable Energy Sources, RES)、需量反應(Demand Response, DR)。

台電數位發展策略與推動藍圖規劃評估

Digital Development Strategy and Blueprint Planning Evaluation of Taipower

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摘要

台電公司近年來致力推動「數位台電」之相關轉型，提出成為具備快速復原能力、以及前瞻思維的能源解決方案服務者的願景。本次專案台電攜手波士頓顧問公司(Boston Consulting Group, BCG)擬定數位發展策略藍圖規劃，透過 BCG 內部全球電業及公用事業資料庫比對、專家調研、並與台電共同進行質化與量化研究後，擬定整體公司數位發展策略。

經分析處長級以上填答數位化加速指數問卷之結果與高階主管訪談後，BCG 建議台電在短期內應先注重在「培育數位人才與文化」、「推動結合業務目標的數位應用案例」、「建立數據平台並進行資料共享」、「建立數位發展專責組織」四大方向。此外，團隊也透過訪談各系統/事業部副總盤點出相關數位應用案例，再從中挑選各系統/事業部未來之數位發展主軸。

Abstract

In recent years, Taipower has been committed to promoting digital transformation within the organization and proposed the vision of becoming an energy solution service provider with rapid recovery capability and a forward-looking mindset. During this project, Taipower worked with Boston Consulting Group (BCG) to formulate a blueprint for digital development strategy. Through BCG's internal database related to global electric industries and public utilities, expert research, and qualitative and quantitative studies conducted jointly with Taipower, the project developed a holistic corporate digital development strategy.

After analyzing the results of the quantitative digital survey and qualitative interviews with Taipower's senior executives, the BCG team suggested that Taipower should focus on the four major directions of “cultivating digital talent and culture,” “promoting digital application cases in line with the company’s business goals,” “establishing a data platform and conducting data sharing,” and “establishing a dedicated task force to coordinate digital transformation” in the short term. Also, in order to set the direction of future digital transformation, the team interviewed the vice presidents of each system/business unit to select useful digital application cases and future digital development focus of each system/business unit.

關鍵詞(Key Words)：數位轉型(Digital Transformation)、策略藍圖(Stratgy Blueprint)、數位發展成熟度(Digital Maturity)、穩定供電(Stabilized Power Supply)。

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台電多雲架構規劃之研究

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摘要

因應台灣電力股份有限公司(以下簡稱台電)配合電業法的公布施行,台電將轉型為控股母子公司,未來經營管理模式與組織型態將產生重大變革,配合現行內部各項規劃的推行,包含雲端資料中心的設計、建置與定位,期望借助雲端運算的力量,打造出適合集團化經營的雲計算基礎系統架構,以期使台電對內對外均能提供更高品質之資訊環境與更有效率之資訊服務。

本研究將運用勤業眾信的資訊策略架構、雲端運算架構與遷移等方法論,以業務需求、現況調研及最佳實務等資訊收集,作為本案基石。亦即,透過了解台電整體經營策略與現狀、國內外最佳實踐內容,設計適合台電建構的多雲架構及對應營運模式,包含私有雲甚至是未來可能衍生的電力生態系商業模式。進而打造與擘劃各雲的定位、服務模式、建置需求規劃等面向之內容,作為後續資源移轉與開立需求規格的輸入資訊。

Abstract

In response to the promulgation and implementation of the Electricity Act, Taipower will transform into a holding parent company, which will lead to major changes in its future business management model and organizational structure. In conjunction with the implementation of various internal plans, including the design, construction, and positioning of cloud data centers, we hope to leverage the power of cloud computing to create a cloud computing infrastructure system suitable for group operations to realize a higher quality information environment and more efficient information services.

This research adopts the methodologies of Deloitte Global, e.g., information strategy architecture, cloud computing architecture and migration, and collect information such as Taipower's overall business strategy and the best practices in Taiwan and abroad to serve as the cornerstone of this project, to design a multi-cloud architecture and corresponding operation model suitable for Taipower, including private cloud and the ecosystem of business models that may be derived in the future to serve as a basis for planning the positioning, service models, and construction requirements of each cloud.

關鍵詞 (Key Words)：雲端計算(Cloud Computing)、多雲架構(Multi-cloud Architecture)、雲端服務(Cloud Service)。

*台灣電力公司資訊系統處

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