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# 變電設備資產管理系統整合之研究與建置

The Research and Implementation of Integrative Substation Asset Management System

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## 摘要

為提升變電設備維護管理便利性，本研究計畫整合變電設備與保護電驛資料，建置「變電設備資產管理系統」平台(包含網頁版與行動版)。該系統利用 RWD (Responsive Web Design，響應式網頁設計)技術與 OTP(One-Time-Password，一次性密碼)認證，維護人員可以隨時通過網頁或使用行動裝置查詢及輸入設備資料。

另一方面，本計畫於變電所內張貼變電設備 QR code，現場維護人員可以使用行動裝置掃描 QR code 以讀取系統 ID 資料庫中之設備資訊。本系統並內建商業智慧儀表板，包含設備資訊與使用年限分析，使用者可查詢不同的統計圖表，以了解各項設備之間的關係與資訊。

## Abstract

By integrating the substation equipment and protective relay database, a platform titled "Substation Asset Management System" (SAMA) has been established to elevate the convenience and efficiency of substation equipment maintenance management- the system has webpage and mobile versions. SAMA applies Responsive Web Design (RWD) technique and One-Time Password (OTP) certification to allow the maintenance personnel to access the equipment data (through webpage or mobile devices) whenever necessary. The maintenance personnel may use mobile devices to scan the QR codes posted on the surface of the substation equipment to access the system's ID database. Not only, SAMA has a built-in business intelligence dashboard allowing users to inquire and get themselves informed with the equipment information.

**關鍵詞 (Key Words)：**資產管理 (Asset Management)、變電設備(Substation Equipment)、系統整合(System Integration)。

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# S&S 製 69kV GCB 檢修報告

S&S-Built 69kV GCB Repair Report

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## 摘要

108年12月25日於山上 P/S 於進行 69kV #760 S&S 製 GCB 外檢工作，進行操作斷路器量測投入啟斷動作時間後，設備在儲能過程中發生馬達空轉，閉合彈簧無法儲能情形，為防止馬達過度空轉燒損人員立即關閉馬達電源。經檢修研判為傳導馬達動力之塑膠儲能齒輪齒牙磨損，在拆解過程中，因不熟悉閉合彈簧釋能方法，而導致馬達高速反轉損壞。經過多次摸索與推敲，順利修復完成，故透過此次檢修獲得技術與經驗供同仁參考與討論。

## Abstract

December 25, 2019, when conducting breaker close/open check (69KV #760 S&S-built GCB repair job at Shanshang primary substation (P/S) Tainan), an abnormal condition of an equipment in energy storage process was detected- motor idling and closing spring unable to store energy. To motor burn down due to excessive idling, the site personnel turned off the motor power immediately. After inspection, the cause of the accident was determined that the plastic energy storage gear transmitting power was worn out due to wrong disassembly procedure (site personnel unfamiliar with closing spring's energy relieving approach), which subsequently caused high speed reverse running and damage to the motor. After repeated trial and error, the repair had been completed successfully. The aforesaid experience hopefully may serve as a reference for TPC colleagues when they undertake similar affairs.

**關鍵詞 (Key Words)：**氣體絕緣斷路器(GCB)、馬達空轉(Motor Idling)、彈簧釋能(Energy Relieving of Spring)。

# 大量離岸風力發電設備併聯電力系統之過載檢討

Review on Transmission Congestion Caused by Large Amounts of Offshore Wind Farms  
Connection

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## 摘要

配合政府離岸風電發展政策，經濟部能源局 2015 年 7 月訂定離岸風力發電規劃場址申請作業要點，公布 36 處潛力場址及海域資料，總開發潛能預估可達 25GW 供離岸風電業者自行開發，並預定於 2025 年達到 5.5GW 併網目標。面對未來大量離岸風電業者併網需求，在不影響電網安全前提下，除須加強既有電網外，亦須配合電網相關管理機制及先進電網控制技術等，以確保供電穩定。本文針對大量離岸風力發電設備併聯電力系統之過載檢討進行分析，亦說明現行過載管理機制、再生能源發電設備設置特殊保護設備作業等，藉由再生能源發電設備裝設特殊保護設備作業要點，於各審查階段滾動檢討再生能源發電併聯後，對系統之輸電線路、變壓器等設備之影響，再者，亦針對彰化離岸風電開發區域及模擬情境檢討，依檢討結果規劃適切之安全發電容量，最後針對電力潮流、暫態穩定度進行檢討，結果皆能符合輸電系統規劃準則規定，確保系統之輸電線路、變壓器等設備，皆能在安全裕度下運轉，並提高供電可靠度。

## Abstract

To comply with the government's "Developing Offshore Wind Farms Policy", the Bureau of Energy stipulated "the Application Guidelines of Offshore Wind Farms Site Planning" in July, 2015, and subsequently announced 36 potential sites and their corresponding sea area information. The policy target of grid connected offshore wind farm (OWF) capacity has been set at 5.5GW and will be accomplished in 2025. In the face of huge OWF connection demand, the power system shall reinforce the infrastructure of the power grid, develop management mechanisms of necessity, and develop advanced control technologies to ensure the reliability and stability of power supply. The contents of this study are as follows: the analysis of transmission congestion due to large amount OWF connection; the introduction of the current transmission congestion management mechanisms; the operating procedures of special equipment protection; the scenarios of transmission congestion at each stage; the review of Changhua sea area offshore wind farms and the generation capacity compliant with safety requirements under different scenarios; and the analysis of power flow and transient stability.

**關鍵詞 (Key Words)：**離岸風電(Offshore Wind Farms)、過載檢討(Congestion Study)、檢討機制(Study Mechanism)。

# 萬大發電廠環境教育設施場所經營管理及生態綠能環境教育推廣計畫

The Environmental Education Facility Management and Ecological Green Energy Promotion  
Project of Wanda Power Plant

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## 摘要

萬大發電廠已於 2017 年 5 月 4 日正式通過行政院環保署認證，成為全臺首座「生態綠能」環境教育設施場所。為深化萬大發電廠生態綠能環境教育基地整體之內涵，台電環境保護處委託中華生態資訊暨環境教育協會汪靜明教授主持執行「萬大發電廠環境教育設施場所經營管理及生態綠能環境教育推廣計畫」。自 2018 至 2019 年期間，本計畫執行團隊會同生態與環境教育夥伴合作完成「優化發展萬大發電廠環境教育既有課程及教材教具」、「彙編環教場所發展歷程紀實影片及成果專書」、「環境教育專業服務及宣導活動」、「建立完善之環境教育設施場域經營管理機制」、「規劃水電環境教育策略聯盟平台」、「培植環境教育專業人力」等六大項工作。

## Abstract

Granted with the accreditation of the Environmental Protection Agency (EPA) on May 4, 2017, Wanda Power Plant since then turned into the first Ecological Green Energy Environmental Education (EGEEE) Facilities and Venues in Taiwan. To deepen the connotation of EGEEE, the Department of Environmental Protection, Taiwan Power Company later on commissioned the Chinese Ecological Information and Environmental Education Association (CEIEEA) to conduct a research titled "Wanda Power Plant's Environmental Education Facility Management and Ecological Green Energy Promotion Project". From 2018 to 2019, cooperating with a number of ecological and environmental education partners, the project team had successively accomplished the six main tasks: 1) "optimizing the curricula and materials of environmental education", 2) "compiling the documentary films and achievements of the Environmental Education Facilities and Venues", 3) "providing professional services and organizing promotional activities", 4) "establishing complete environmental education facilities and management mechanisms", 5) "planning the strategy alliance platform of hydro power environmental education", and 6) "cultivating professional environmental education manpower".

**關鍵詞 (Key Words)**：環境教育(Environmental Education)、萬大發電廠(Wanda Power Plant)、環境教育設施場所(Environmental Education Certification)、生態綠能(Eco-green Energy)。

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# 台電發電業因應電業法修法之策略研究

A Study on the Strategies of TaiPower's Generation Industry Reacting to Electricity Act

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## 摘 要

新版《電業法》已於 106 年 1 月 26 日公布施行，台電公司須於 6 至 9 年間轉型為控股母公司，其下成立發電與輸配售電公司。因新版電業法讓台電公司同時面臨到能源轉型、綠電先行、市場開放等的壓力。簡而言之，台電公司之經營環境已經改變了，經營策略也必須跟著調整以反映時代脈動。基此，本研究透過公司國內外研討會之資料、網路及書籍期刊資料，彙整有用之資訊，包括國際電業案例作介紹與分析，及針對本公司發電業作適當建議。

## Abstract

The new version of "Electricity Act" was promulgated on January 26, 2017. Taiwan Power Company must be transformed to a pure holding company with subsidiaries of power generation company and power transmission/distribution/retail company. Because the new version of "Electricity Act" puts Taipower facing pressures such as energy transition, green power first, and market opening in the same time. In short, Taipower's business environment has changed, so its business strategy must also be adjusted to reflect the pulse of the times. Therefore, first, this research collects useful information from domestic and foreign seminars, the Internet, books and periodicals, Second, it introduces and analyzes international power industry cases. Finally, it makes appropriate recommendations for Taipower's power generation industry.

**關鍵詞 (Key Words)：**電業法 (Electricity Act)、發電業(Generation Industry)。

# 需量競價平台資訊系統精進之研究

Research on the Improved Demand Bidding Platform Information System

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## 摘要

台電公司為擴大需量反應實施效益，自 104 年起持續精進需量反應措施，106 年朝「擴大實施期間、提升反應能力、強化誘因機制、需量競價新增方案」等方向修正，107 年朝「降低申請門檻」與「提高回饋誘因」之方向精進措施，並於 7 月 10 日奉經濟部同意備查，期擴大用戶參與。

近年來需量競價措施實施成效雖然大幅成長，對於舒緩供電緊澀有極大貢獻，惟為持續精進，規劃提出需量競價方案之可靠容量競比措施。可靠容量競比措施在用戶選用、競標方式、得標邏輯上皆為新的構想與設計，急需資訊系統之支援。透過需量競價平台資訊系統精進強化業務管理，協助用戶配合抑低用電，以提高執行率與抑低實績。

## Abstract

To maximize the benefits, Taipower since 2015 has periodically examined & improved the design of its demand response (DR) measures. The key points of the improvement in 2017 had been identified as “expanding the implementation period, improving the response capability, strengthening the incentive mechanism, and increasing the demand bidding plan”, and “reducing application threshold and strengthening incentives”, which later on agreed by the Ministry of Economic Affairs on July 10, 2017. In recent years, the substantial growth of demand bidding measures has significantly relieved the tension of power supply. To keep improving, a brand new measure titled “Capacity Bidding Program (CBP)” has been introduces. CBP along with the accompanying information system can improve Taipower’s business procedures and help consumers closely cooperate with CBP measures.

**關鍵詞 (Key Words)：**需求端管理(Demand Side Management)、需量競價(Demand Bidding)、需量反應(Demand Response)、多維度分析(Multi-dimensional Analysis)、可靠容量競比(Capacity Bidding Program)。

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# AMI 資料商業應用研究

A Study on Commercial Applications of Electric Utilities' AMI Data

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## 摘要

在資料經濟趨勢下，各界積極導入人工智慧(AI)、大數據(Big Data)與雲端(Cloud)的ABC科技，期望在商業決策上取得競爭優勢，因此數據資料管理應用、內外部資料整合串聯成為企業爭相發展的重點。電力大數據具有完整性、可靠性、即時性之優勢，可填補企業數據應用的缺口，是台電公司發展數據跨界應用的絕佳市場機會。為發展 AMI 資料創新商業應用模式，本文蒐集美、英、日 AMI 布建情形與 AMI 資料商業應用案例，發現國外電業多以能源管理應用為主，AMI 資料在電業以外的跨領域應用構想多處於啟蒙期之創新階段。從國外經驗來看，在遵循個人資料保護法、營業秘密法相關規範下，聚合型資料相較於個別用戶資料較具可行性。

## Abstract

In the era of data economy, numerous industries have implanted ABC technologies (AI, Big Data, and Cloud) to gain a competitive edge in their business decision making. Applications of data management as well as internal/external data integration have become the focus of enterprise development. Possessing the advantages of completeness, reliability, and timeliness, big data of electric power can not only help Taipower fill up the gap in corporate data application, but also provide an excellent market opportunity for the company to develop cross-industry data applications. In this research, worldwide cases (USA, UK and Japan) regarding AMI deployment and data commercial applications had been surveyed, and the results showed that foreign electric utilities mostly focus on the applications of energy management, e.g. energy efficiency and demand response, while cross-disciplinary AMI data applications (outside electric utilities) are largely in the innovation stage of enlightenment period. Judging from foreign experience, aggregative data, comparing with individual user data, are relatively in line with the regulations of personal information protection and trade secret.

**關鍵詞 (Key Words)**：創新商業應用(Innovative Commercial Application)、資料經濟(Data Economy)、AMI資料應用(AMI Data Application)、商業模式(Business Model)。

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# 林口發電廠輸煤系統之高效環保靜電除塵器安裝及測試

High Efficiency, Pollution-free Electrostatic Precipitator System Installation, Coal Conveyor Belt at Linkou Power Plant

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## 摘要

台灣近 30%發電量來自燃煤火力發電廠，近年來面對環保意識抬頭和空污法規要求日益嚴格下，燃煤在輸送過程產生之煤塵逸散問題，應提早因應，擬定防範對策，以友善環境。

本文就林口火力發電廠 C-4A 輸煤皮帶機安裝測試之靜電除塵器系統(Electrostatic Precipitator, ESP) 進行討論，該靜電除塵器系統係採用單電源多電場設計之原理，產生弱中強三段電場方式來收集逸塵，並透過振動方式將收集的煤塵掉落皮帶上回收，測試分析結果顯示該系統可有效減少轉運塔內之粉塵量，達成環保要求，並可回收外逸煤粉，減少資源浪費。

## Abstract

Nearly 30% electricity generation in Taiwan comes from coal-fired power plants (CPPs). To cope with increasing public awareness of environmental protection and stricter air pollution control regulations, fugitive coal dust and eco-friendly power plant environment have become two urgent issues for CPPs. This article discusses the installation of Electrostatic Precipitator System (ESP) on a coal conveyor belt at Linkou Power Plant. The Multi-Electric Field designed system can generate three levels of electrical field (weak, medium and strong) to collect and recycle the fugitive coal dust back to the conveyor belt by vibrating the coal collecting plates. The system can effectively reduce coal dust, reduce waste of resource, and above all meet environmental requirements.

**關鍵詞 (Key Words)：**靜電除塵(Electrostatic Precipitator, ESP)、輸煤皮帶機(Coal Conveyor)、煤塵(Coal Dust)、多電場(Multi-electric Field)、燃爆(Dust Explosion)。

# 69kV 霧峰~員林線 PEA 型鐵柱改設電纜連接站引接用戶之案例分享

Case Study of PEA Type Transmission Post Retrofitted Cable Joining Station

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## 摘要

台灣電力公司台中供電區營運處轄屬「69kV 霧峰~員林線」配合輸電系統改接前夕，同時面臨地方政府興辦市地重劃而要求架空線地下化，以及特高壓用戶要求改善供電可靠度等問題，經過多次內、外部會議研討以及多方拜訪、協調相關單位後，最終採行「PEA 型懸垂鐵柱」改設電纜連接站再引接用戶之作法，該作法兼滿足台灣電力公司系統規劃處、彰化縣政府以及特高壓用戶等三方需求。面對當前輸電線遷改與地下化等業務執行日益艱困的環境，期許本篇所載鐵柱改設電纜連接站之應用、架空線下地規劃以及分期程排定停電施工之技術與經驗，可作為日後線路設計與現場施工之參考，使助於業務推動。

## Abstract

The operation of 69kV Wufeng~Yuanlin Line is in charge by Taichung Power Supply Branch (TPSB). Due to various considerations and after a lot of hard work of meetings, discussions, coordination with relevant units, TPSB adopted the method of PEA type transmission post retrofitted cable joining station to connect its UHV consumers. The construction took into account the requirements of the System Planning Department, Changhua County Government and the consumers of UHV. In the face of tougher situations of power line relocation and underground, the technologies and applications introduced in this article hopefully may serve as a reference for the design and construction of TPC transmission lines in the future.

**關鍵詞 (Key Words) :** PEA型鐵柱(PEA Type Transmission Post)、地下電纜連接站(Underground Cable Joint Station)、輸電系統(Transmission Power System)。

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# 核能電廠除役先期研究

## A Preliminary Research on Nuclear Power Plant Decommissioning

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### 摘要

在我國政府「非核家園」之政策推動下，台電公司各核電機組將於運轉執照有效期間屆滿時逐一退役。由於我國核電廠已陸續面臨除役，但相關的細部工作規劃及實際採用之核能技術仍需進一步研究與確認，方能在 25 年的法規年限內順利完成工作。台電公司具備多年運營核電廠之經驗，而我國工業能力也具有一定的水準，若能藉此契機尋訪整合國內具實力之廠家，配合台電公司實際工作需求，不但兼顧核電廠工作，更能整合我國有能力的廠家成為核能產業的一環，進一步培植廠家核能技術，創造國家產值。為協助台電核電廠人力轉型、活化再升級；建立台電自有除役工程能力，領導國內團隊，降低台電除役費用；進而成為具備核電廠建廠、營運、及除役之一條龍的工程服務公司，擁有國際競爭優勢爭取訂單，創造新價值。本計畫將以盤點除役相關核能產業技術做為先導，並邀集國內相關廠商，作為我國核能產業的起頭。

### Abstract

To comply with the government's "Non-Nuclear Homeland" policy and the corresponding regulations, the nuclear power plants (NPPs) in Taiwan will have to retire when their operating licenses expire, then subsequently move on and accomplish the decommissioning within 25 years. The comprehensive planning of the decommissioning related tasks and technologies in need however remain for further research. In view of the facts that Taipower has accumulated years of experiences in NPP operation, and the capability of related industries in Taiwan has reached a fairly high level, Taipower may very well take this opportunity to cultivate its own capability of NPP decommissioning, and realize the following benefits at the same time: 1) smooth transformation of the company's NPP manpower, 2) reduce the decommissioning costs, 3) establish a new company in charge of NPP construction, operation, and retirement. The purposes of this research are twofold: the first, technology inventory of the nuclear energy industry; the second, inviting domestic manufacturers to join in this grand event.

**關鍵詞 (Key Words)：** 除役技術供應鏈(Decommissioning Technology Supply Chain)、除役技術盤點(Inventory of Decommissioning Technology)、技術規範(Technical Specification)。

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