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# 「DNV-RP-J101 遙測方法評估」對於光達應用於驗證 台灣離岸風場的適用性評估

Evaluation of Applicability of “DNV-RP-J101 Remote Sensing for Wind Energy Assessment” to  
Verification of Wind Energy for Offshore Wind Farm in Taiwan

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## 摘要

台電公司26號離岸風場使用WindSim來模擬風場的風況與風資源評估，並且在選定的地點使用光達來驗證模擬的風場。光達經在陸地上的測風塔以及在海上的海氣象觀測塔比對校驗，並符合允收標準。因此再使用光達海上量測來驗證WindSim模擬的風場。驗證的標準採用DNV-RP-J101所建議的標準，即線性回歸模型的斜率介於0.98與1.02之間，截距在0.25m/s之內。本研究主要目的在於針對同時間內光達所量測到的數據與WindSim計算的結果作驗證，作為修正WindSim模擬風場的依據，並根據分析的結果，探討DNV準則對於驗證本風場的適用性。

## Abstract

In this study, WindSim is used to simulate the wind conditions and perform the wind resource assessment for Taipower's #26 offshore wind farm. In addition to the calculation by WindSim, LiDAR is also used to verify the simulated wind conditions at the selected scenarios. The LiDAR has been tested and verified at an onshore meteorological mast and an offshore meteorological mast before it is deployed at the designated locations of the TPC's offshore wind farm. The criteria used by LiDAR for verifying the simulated wind include: its intercept being less than 0.25 m/s; and its slope being in the range of 0.98 to 1.02 in a linear regression model curve – which is derived from the correlation between the LiDAR measurement and WindSim's calculation. This study is to discuss the applicability of DNV-RP-J101 in the simulated wind farm for verification purpose.

**關鍵詞(Key Words)**：光達(LiDAR)、數值模擬(Numerical Simulation)、驗證(Verification)、DNV-RP-J101。

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## #26 離岸風力廠址風能評估及驗證

Wind Energy Assessment and Verification of Offshore Wind Site #26

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### 摘要

本研究使用台電公司第一期離岸95公尺高測風塔及陸域彰工70公尺高測風塔之風力資料，以WindSim非線性風能評估軟體，推算第二期(#26)離岸風電場之風能與發電量，並以氣象光達於海上進行驗證量測，以修正風能評估結果。本研究除取得離岸風場風況實測資料，並據以估算及驗證風場風能外，亦進行氣象光達應用於驗證台灣離岸風場風能之適用性評估，並探討台灣離岸風能評估之風場模擬的影響因子。

### Abstract

This study uses wind data collected out of Taipower Offshore Wind Project Phase I offshore meteorological mast (95m) and Changbin's onshore meteorological mast (70m) and WindSim to estimate the wind energy resource and energy production of the Phase II (#26) offshore wind farm. The wind field simulated by WindSim has been compared with in-situ LiDAR measurement, and the results are corrected by the actual measured data. In addition to acquiring the on-site offshore wind data and using the data to calculate and verify the wind energy yield of the wind farm, this study also evaluates the applicability of LiDAR in the assessment and verification of wind energy yield calculated from the computer simulation, while investigating the influences of input parameters in the simulation of wind farm for the assessment of offshore wind energy around Taiwan.

**關鍵詞(Key Words)**：離岸風電(Offshore Wind)、風能評估(Wind Energy Assessment)、光達(LiDAR)、風力驗證(Wind Verification)。

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# 台北供電區營運處氣候變遷調適研究

A Study of Climate Change Adaptation Strategies on Taipei Power Supply Branch

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## 摘要

全球氣候變遷預期將增加極端氣候災害發生的頻率及強度。電力設施是重要民生設施，一旦遭受氣候變遷衝擊而損害，不但會造成產業、社會經濟等嚴重傷害，更將影響人民生活品質。台灣電力公司是我國最主要的電力供應者，也是唯一的綜合電業業者，為降低氣候變遷對電力系統之衝擊，確保電力穩定供給，本文以輸變電設備負載常態性處於偏高之台電公司台北供電區營運處作為研究對象。

首先透過風險辨識由原先的24項氣候衝擊項目篩選出12項進行災害潛勢分析，並從中彙整最具衝擊的9項進行各項設施的危害度與脆弱度評估，接續針對此9項氣候衝擊下各項設施之風險評估結果，得知風險等級3(含)以上之設施，於變電所有2項氣候衝擊；線務段有3項氣候衝擊，並提出對應的調適策略。最後透過上述評估，提出台北供電區營運處之調適建議方案，其結果可作為後續其他供電單位平行展開之參考。

## Abstract

It has been expected that extreme weathers caused by global climate change will lead to an increase in the frequency and intensity of natural disasters worldwide. Damages being done to electric power infrastructure from climate change will not only result in serious impacts on industries and economic system, but also affect the quality of the people's life. As a sole state-run power utility in Taiwan, Taiwan Power company (TPC) is designed to be a vertically integrated organization and responsible for stable electric supply around the country. To reduce the climate impacts on electricity infrastructure and stabilize the power supply, the aim of this paper is to study the situation of constant over-loading of power supply grid and equipment system at the operation area of Taipei Power Supply Branch (TPSB).

First, the study identifies 24 potential climate-impact-related items, and chooses 12 items out of them. The next step is to select 9 major items for the further assessment of their vulnerability and risk, and then to decide which are the high-risk facilities. The study results indicate that the substations have 2 major climate impact items, the transmission towers have 3 major climate impact items, and proceed to propose suitable countermeasure strategies. The study can serve as a reference for future planning of new equipment projects by other the power supply branches of TPC.

**關鍵詞 (Key Words)：** 氣候變遷(Climate Change)、變電所(Substation)、輸電鐵塔(Transmission Tower)、危害度(Hazard)、脆弱度(Vulnerability)、風險評估(Risk Assessment)、調適策略(Adaptation Strategy)。

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# 電力變壓器突入電流與故障電流之辨識

Recognizing Power Transformer Inrush Current or Internal Fault Current

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## 摘要

電力變壓器加壓時，因電網特性與鐵心的關係，會形成各種狀態的突入電流，同時也有 1~2% 的機率伴隨發生變壓器內部故障，激發變壓器的保護裝置，例如差動電驛 (Differential Protection Relay, 87T)、保氏電驛 (Buchholz Relay, 96B)、突壓電驛 (Sudden Pressure Relay, 96P)、釋壓電驛 (Pressure Relief Device, 96D) 等動作，迫使變壓器加壓失效，甚致故障；在電網供電吃緊情況下，若變壓器無法在預定時間加入電網系統，有可能使電力用戶承受高風險的限電危機，所以電力從業人員急須迅速辨別變壓器是否可以安全送電？如果無法迅速辨識，則按照相關規定，要實施冗長的檢查程序，但有經驗者，也許可以縮短檢驗程序，能夠辨別突入電流以區分是否故障，就可以快速恢復供電，本文從變壓器之突入電流與故障電流理論探索以 MATLAB 程式及實例驗證比對，提出簡易的辨識方法。

## Abstract

When a power transformer is energized, due to the relationship between the power grid characteristics and the transformer core, the inrush currents of various states will be formed; and there is also a 1~2% probability that the transformer internal fault will occur, and the protection device of the transformer, such as Differential Protection Relay (87T), Buchholz Relay (96B), Sudden Pressure Relay (96P), and Pressure Relief Device (96D) will force the transformer to fail. In case the power supply capability is not enough and the transformer cannot be added to the power grid in time, a power shortage may happen. Therefore, an electrical technician needs to quickly identify whether the transformer can be safely energized for operation. If it is not possible to identify it quickly, according to relevant regulations, it is necessary to implement a complicate inspection procedure. If the technician is an experienced one, he may be able to shorten the inspection and make a judgement as to whether the inrush current may lead to the transformer failure, so that the transformer can operate and supply power to customers as quickly as possible. This article uses MATLAB program and the examples of power grid failures for its verification and compare the transformer inrush current and fault current, aiming to offer a simple identification method in this area.

**關鍵詞(Key Words)：**突入電流(Inrush Current)、差動電驛(Differential Protection Relay, 87T)、保氏電驛(Buchholz Relay, 96B)、突壓電驛(Sudden Pressure Relay, 96P)、釋壓電驛(Pressure Relief Device, 96D)、FFT(Fast Fourier Transform)、斷路器失效電驛(Breaker Failure Relay)、母線電驛(Bus Relay)。

# 沸水式反應器起動過程之組件材料腐蝕行為研究

Evaluation of Corrosion Behavior of Structural Materials in Simulated BWR Environments under Startup Conditions

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## 摘要

沸水式反應器(Boiling Water Reactor, BWR)的壓力槽不銹鋼結構組件經多年運轉後，不少反應器的壓力槽內部組件產生應力腐蝕龜裂 (Stress Corrosion Cracking, SCC)的問題，組件的裂化將嚴重影響運轉安全，修復的工作也須耗費鉅資。BWR在運轉時，因輻射分解效應(Radiolysis)使爐水中產生大量氧氣，高溶氧是造成沿晶應力腐蝕龜裂(Intergranular Stress Corrosion Cracking, IGSCC)的主要環境因素。加氫水化學技術的發展是為了降低爐水溶氧量，即可降低金屬組件的電化學腐蝕電位，降低發生IGSCC的機率。為使BWR結構組件的設計與材料的選擇能充分符合運轉安全的要求，本研究透過電化學分析及慢應變速率拉伸實驗測試在高溫純水環境中304L不銹鋼的應力腐蝕劣化敏感性，探討其發生應力腐蝕龜裂的原因及機制。

## Abstract

As the boiling water reactors (BWRs) age, incidents of stress corrosion cracking (SCC) is more likely to occur in the vessel internals. For BWRs, degradation of structural materials has mainly resulted from SCC. Higher dissolving oxygen level was recognized as a major factor for increasing the SCC susceptibility of stainless steel. The hydrogen water chemistry(HWC) technology was applied for BWRs to mitigate SCC by reducing the oxidants concentration and lowering the electrochemical corrosion potential. In order to have a better understanding of the SCC behavior in 304L stainless steel, the SCC behavior were investigated via the polarization measurements and slow strain rate test(SSRT) in high temperature pure water with different water chemistry conditions.

**關鍵詞(Key Words):** 沸水式反應器(Boiling Water Reactor, BWR)、應力腐蝕龜裂 (Stress Corrosion Cracking, SCC)、電化學腐蝕電位(Electrochemical Corrosion Potential, ECP)、慢應變速率拉伸測試 (Slow Strain Rate Test, SSRT) 、304L 不銹鋼(304L Stainless Steel, 304L SS)。

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# 電業資料治理策略研究

The Strategy and Planning of Data Governance for Taiwan Power Company

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## 摘要

『資料』已是各產業新興經濟資產，資料治理成為賦予價值與發展大數據的基礎核心關鍵，建立完善的資料治理機制包含政策與程序，並透過相關權責機構協調可提高企業重要資料串連擴大加值利用與資料品質之正確性。

為釐清企業推動資料治理成功關鍵，本研究藉由產業案例提出電業資料治理之可行建議，主要成果包括：一、掌握國內外三家不同領域之企業(中華電信、美國雪弗龍、康尼機電)有關資料治理處理方式。二、針對台電公司開放資料與資訊揭露資料進行全面盤點，透過重點業務單位訪談歸納台電公司現今之資料治理面臨的挑戰與問題，並提出相關因應方式。三、釐清台電公司資料治理目標，以經營決策數據共享作為資料治理核心對象，將資料視為公司資產的一部分。四、完成資料共享驗證平台建置，從資訊技術面的角度驗證資料共享與管理機制之可行性。

## Abstract

The Era of Big Data has been encouraging numerous innovations in data application, which many industries have adopted as a important part of their strategic efforts in order to strengthen their business competitiveness, improve operationa capability and efficiency, and even more, to create a new business model.

The objective of this project is to resolve the related problems TPC is facing under current operation situation by helping define the Data Governance related principles, rules, and propose adequate strategies that are relevant for the operation of the company. The study are performed by conducting research into how some prestigious enterprises have conducted their data governance in related fields and how successful they have been in their efforts, and by studying Compliance of Government's Open Data Principles, as well as investigating and evaluating TPC's organization infrastructure and business model.

**關鍵詞(Key Words)**：資料治理(Data Governance)、開放資料(Open Data)、概念驗證(Proof of Concept)、資料品質(Data Quality)、資料標準(Data Standard)、大數據(Big Data)。

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# 減少表燈用戶夏季尖峰用電群眾外包創意之研究

Creative Crowdsourcing Research of the Summer Peak Electricity Consumption Reduction  
for Lighting Service Customer

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## 摘要

本研究參酌先進國家實務經驗，研究歐美日韓等國應用群眾外包(Crowdsourcing)之具體作法於負載管理上，藉由架設表燈用戶群眾外包參與平台，號召廣大用戶共同參與節電發想，並挑選當中最具可行之三項創意作法實地實施，評估節電成效，以作為台電公司未來推廣抑低尖峰用電施行之建議與策略。

研究成果發現，包括美國、英國、法國、日本、新加坡等國家之電業皆有透過群眾外包之模式，蒐集民眾對於能源、節電、改善住宅能耗之創新作法。本研究亦針對表燈用戶進行群眾外包創意蒐集之活動。研究發現，未來透過群眾外包形式集結節電創意時，在蒐集群眾創意想法後，仍需透過專家學者進行改良及調整，方可落實；而研究亦針對群眾外包創意成果進行實地實施節電創新驗證，研究發現，住宅用戶對於隱私權外洩議題有所疑慮，較容易排斥；而營業用戶之節電成效易受到商業行為之改變而有明顯波動。

## Abstract

By referring to the experiences in the crowdsourcing practice of foreign developed countries, the study is intended to establish a local crowdsourcing platform for the low voltage users, calling for them to save energy through the crowdsourcing platform. Finally, the study will propose a long-term business strategy to assist Taiwan power company in running this crowdsourcing platform.

Through the case study of Crowdsourcing in United State, United Kingdom, France, Japan and Singapore the study adopts the mode of mass outsourcing to collect public ideas on energy use, energy saving, and residential energy consumption. The study has found that, through the form of crowdsourcing, although creative in concepts, there exists some difficulty to be overcome in its implementation. The finding of this study is that, after collecting creative ideas, they still need to be properly improved or revised by experts and scholars before they can be implemented successfully.

In this study, we have conducted an experiment with the implementation of innovation power-saving ideas for one residential user and two business users (travel agency and chain restaurant). Moreover, the study has found that users usually have misgivings about whether the installation of monitoring instruments will affect the original electrical equipment, and about right of privacy and other related issues. The study has found that the energy-saving effect of the business user sector is easily subject to changes due to their business practices.

**關鍵詞(Key Words)：**表燈用戶(Lighting Service Customer)、群眾外包(Crowdsourcing)、節電創意活動(Creative Energy Saving Idea)。

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