

# 台電工程月刊 866 期 (10 月號) 目錄

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## 再生能源：

- 離岸風力發電機基樁海床沖刷探討…………… 從文碩 等…………… (1)

## 輸 變 電：

- 高強度混凝土應用於變電所工程可行性探討…………… 呂浩魁…………… (7)  
應用脈波反射儀偵測地下電纜線路故障區間之研究…………… 徐益逢…………… (17)

## 資訊與電腦：

- 抄表資訊系統建置與應用研究…………… 朱漢農 等…………… (26)  
電力耗能負載預測與電量調度平台設計…………… 陳東弘 等…………… (44)

## 其 他：

- 用戶行業別代號校正方法之研究…………… 楊新全 等…………… (54)  
台灣主要家電產品持有情形及市場發展趨勢研究…………… 廖文華 等…………… (79)

## 核能發電：

- 台灣北部核能電廠附近海域浮游植物群聚之調查研究…………… 羅文增 等…………… (91)
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# 離岸風力發電機基樁海床沖刷探討

A Study on the Scouring around Offshore Wind Turbine Foundation

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## 摘要

本文主要瞭解離岸風機基礎在波浪海流之外力作用下所引致基樁周圍海床沖刷之問題，於海洋環境中設置離岸風機，風機基礎會遭受波浪及海流作用，並因基礎周圍受結構物本身影響之流場而產生沖刷情形，此沖刷現象將會影響結構基礎之穩定性。本文針對離岸風機基樁之沖刷進行探討，採本公司風場目前設計之水深、位置及海氣象資料，計算一般條件下的平衡沖刷深度，且進一步探討颱風波浪條件下的平衡沖刷深度，以瞭解上述條件下之沖刷深度評估值。

## Abstract

This study aims to explore the issues related to scouring phenomena around offshore wind turbine foundation. Scour is the result of erosion of soil particles at and near a submerged foundation and is caused by waves and current. Scour has negative impact to the stability of the wind turbine's structural foundation. In this study, we employed TPC windfarm design data, such as water depth, location and marine meteorology, to calculate the equilibrium scour depth of wave conditions under normal and abnormal weather, such as typhoon.

**關鍵詞 (Key Words)**：離岸風機(Offshore Wind Turbine)、基礎(Foundation)、沖刷(Scour)。

# 高強度混凝土應用於變電所工程可行性探討

The Feasibility Study of Using NEW RC in Substation Construction

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## 摘要

近年，國際間研發出一新型混凝土材料，此材料強度約為國內普遍應用之混凝土強度之 2 倍，介於 70~100MPa 之間，因混凝土強度之提升可解決鋼筋混凝土應用於高樓層建築物之困難，而日本已有用高強度混凝土新建高層建築物之案例，國內也有相關單位招集各個此專業領域之學者研究高強度混凝土，可以預見日後本國將會引進此種高強度混凝土材料並應用於高樓層建築物，故本文即探討日後若本公司新建高樓層之多目標變電所時，使用高強度混凝土是否有其效益，以及其設計與現行規範有何差異。

## Abstract

In recent years, a new type reinforced concrete (short as the New RC) has been invented and used around the world. The intensity of this new RC is around 70~100MPa, about twice that of ordinary RC widely used in Taiwan. RC of such high intensity helps solve the difficulties that ordinary RC has to confront in high-rise buildings. In Japan, a New RC high-rise building had completed construction in 2009. To promote the use of New RC in Taiwan, the National Center for Research on Earthquake Engineering (NCREE) started a New RC project in 2010. Predictably, more domestic cases will follow. Therefore, this study aims to explore the benefits and the specifications of design when applying New RC to the construction of TPC's high-rise/multi-objective substations.

**關鍵詞 (Key Words)**：高強度鋼筋混凝土 (New RC)、鋼結構(SS)、鋼骨結構(SRC)、鋼筋混凝土(RC)。

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# 應用脈波反射儀偵測地下電纜線路故障區間之研究

Research on Positioning Cable Fault Location Using Pulse Reflector

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## 摘要

本文將探討特高壓地下電纜線路應用先進科技維護地下電纜預防診斷經驗分享，及就加速輸電級地下電纜線路故障位置診斷之作法提出對策，期能取得最佳之偵測及研判技術，來提昇維護同仁本質技能及事故查修效率，確保供電安全。

## Abstract

This study aims to explore the technology of preventive diagnosis and its application on TPC underground cables for accelerating the diagnoses of EHV underground cable fault location. We look forward to acquiring the best practical technology to improve the efficiency of underground cable fault detection and to ensure security of power supply.

**關鍵詞 (Key Words)**：脈波反射儀(Pulse Reflector)、電纜(Cable)、故障定位(Fault Location)、診斷(Diagnosis)。

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# 抄表資訊系統建置與應用研究

Research on Implementation and Application of Meter Reading Information System

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## 摘要

本研究案探討有關台電因應資訊科技發展，進行抄表作業流程、系統功能的適切性分析，以及未來低壓 AMI 全面普及後，對抄表作業流程與組織制度結構帶來的衝擊與改變該如何因應。本研究案首先探討未來抄表資訊系統建置，以及抄表作業流程與抄表組織制度結構帶來的衝擊與改變。透過未來的作業模式與可以精簡的時間與人力，提出業務抄表作業流程與抄表組織制度，以及區處與服務所抄表服務功能的調整建議。其次，本案需要規劃未來資料傳輸作業。透過無線網路加密上、下傳輸抄表資料，減化表務人員人工操作流程，系統自動校核、彙整抄表資料並顯示異常戶數等統計資料，降低人工作業流程產生之錯誤率。最後，建置新的抄表資訊系統，轉置現行系統之相關資料，載入新抄表資訊系統，並測試系統之完整性與可用性。

## Abstract

This study aims to analyze (1) the impacts of universal application of low voltage Advanced Metering Infrastructure (AMI) and (2) the appropriateness of meter reading procedures and organization structure for Taiwan Power Company (TPC) to best follow the rapid changes of information technology. The contents of this study are as follows: (1) propose improved meter reading procedures and organization structure with simulation of the future operating mode, time and manpower saved, and adjustments to the meter reading functions and services of TPC District/Service Offices, (2) configuration of metering data transmission, encrypted via wireless network, (3) minimize human interventions, (4) automatically collect, check and validate metering data and produce statistics (i.e. abnormal households) to minimize errors caused by human operation, (5) establish a new meter reading information system, transfer data from the old system to the new system, and test the completeness and availability of the new system.

**關鍵詞 (Key Words)**：抄表器(Hand-Held Meter Reading Device)、抄表資訊系統(Meter Reading Information System)、無線網路加密(Wireless Network Encryption)、低壓 AMI(Low Voltage Advanced Metering Infrastructure)。

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# 電力耗能負載預測與電量調度平台設計

Electric Load Forecast and Electric Power Dispatch Platform Design

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## 摘要

本論文透過電力負載預測，提供未來每 15 分鐘電力用量及用電趨勢，並發展需量反應系統技術之用戶群代表之用戶端用電預測與調度最佳化軟體平台。應用 SVR(Support Vector Regression)機器學習演算法，以歷史用電量及溫度等資訊作為輸入特徵參數，建立用電需量之預測模型，再經由模型預測計算出各個客戶可卸負載量，提供代表戶能在進行電力調度前進行評估，並決策出各個客戶需要抑低的用電量，以達到減少電費支出的目的。

## Abstract

The purposes of this study are as follows: (1) apply electric load forecast techniques to provide every 15 minutes load forecast, and (2) develop optimized load forecast and electric power dispatch software system aiming at demand-side resources, such as Demand Response (DR). To meet the purposes, we applied Support Vector Regression (SVR) algorithm and used historical power demand and temperature data as the input characteristic parameters to establish power demand predictive model to forecast each of the customers' curtailable load quantity to serve as reference for least-cost power dispatch decisions.

**關鍵詞 (Key Words)**：電力負載預測(Electricity Load Forecasting)、耗能分析(Energy Consumption Analysis)、節能應用(Energy Saving Applications)。

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### 摘要

根據台電公司 105 年底統計，電力用戶為 316,884 戶、表燈營業用戶為 977,161 戶。台電公司初步將電力用戶資料與表燈營業用戶資料與行政院主計總處工業及服務業普查及其他資料比對，進行行業別代號判斷，剩餘無法判斷行業別代號的戶數為電力用戶 7,530 戶與表燈營業用戶 460,713 戶，此為本次行業別代號校正與蒐集調查作業主要範疇。

本研究主要目的係以多元方式(電話訪問、網路爬蒐、人工查找及人員親訪)，設計並執行行業別代號蒐集作業，完成上述電力用戶 7,530 戶與表燈營業用戶 460,713 戶的行業別代號校正與蒐集，並依調查結果驗證校正方法之合理性與正確性。

行業別用戶數以大行業別分類批發、零售及餐飲業，行業別校正前後戶數差異較大；服務業由於行業別組成版本定義變動，行業別間組成歸類因素，導致戶數變動較大。整體行業別大分類平均變動率 17.6%、行業別中分類平均變動率 37.5%、行業別小分類平均變動率 41.9%。多數行業別變動率偏高，建議行業別調查更新必須為定期定時更新，藉以瞭解行業別實際變動之差異。

### Abstract

According to the statistics published by Taiwan Power Company (TPC), the numbers of its Power Service (PS) and Meter Rate Lighting- Business (MRL-B) customers served at the end of 2016 were in total 316,884 and 977,161 respectively. We compared the aforesaid data with some other data, such as the Industry and Service Census of DGBAS (the Directorate-General of Budget, Accounting and Statistics) under Executive Yuan, for the purpose of determining each of the customers' industrial code and thus filtered out 7,530 PS and 460,713 MRL-B customers whose industrial codes not classified.

This purpose of this study are twofold : (1) to design and implement industrial code collection operations (aiming at not yet classified customers), by applying multi-investigation methods, such as phone interview, web crawling and collecting, manual searching and personal visits..., (2) to verify the rationality and the correctness of the correction method based on the survey results.

The customers were classified into three main industries, the Wholesale, the Retail and the Catering. The numbers of not yet unclassified customers before and after industrial code correction are quite different- the Service Industry especially, due to the difference of industry composition definitions and composition classification factors among industries. The average difference rate of for large industrial category is 17.6%. The average difference rate for medium industrial category is 37.5%. The average difference rate for small industrial category is 41.9%. Since the difference rates of most industries are rather high, we recommend that industry survey must be updated regularly to keep TPC in line with the actual variation.

**關鍵詞 (Key Words) :** 行業別 (Industrial Code)、多元調查方式(Multi-Investigation Methods)、行業別代號校正方法(Correction Method for Industrial Code)。

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# 台灣主要家電產品持有情形及市場發展趨勢研究

The Research of the Trend of Home Appliances in Taiwan

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## 摘要

本研究以工研院綠能所 2012 年至 2019 年家庭用電消費習慣調查資料為基礎，輔以訪談生產端有關空調、冷凍及生活飲水等家電設備變化，透過需求端量化調查及供給端質化深度訪談，掌握主要家電產品發展趨勢及脈絡。

調查結果發現，「變頻冷氣」從 2012 年 25.30% 提升至 2019 年 54.31%，「分離式」漸取代「窗型」；2019 年空氣清淨除濕機首次調查普及率有 7.6%，顯示複合式功能除濕機深受民眾喜愛，而民眾對空汙議題日漸重視，也讓空氣清淨機日使用時數從 2012 年 1.34 小時提高至 2019 年 5.77 小時。

觀察冰箱發展，以小型化及多門設計為趨勢，冷凍櫃普及率從 2012 年 6.80% 提升至 2019 年 12.27%，顯示冷凍櫃漸成家電需求產品。此外，飲料店林立及快煮壺崛起，也襲奪熱水瓶或開飲機市場。未來產品發展尤以節能變頻產品、智慧化家電科技、小家電產品創新等趨勢持續推進。

## Abstract

To acquaint Taiwan Power Company with the trend of home appliances, the following information were collected for the follow-up analysis: (1) home appliance investigations from year 2012 to 2019, conducted by Green Energy and 回頁首 ent Research Laboratories under the administration of Industrial Technology Research Institute (ITRI), (2) quantity investigations & in depth interviews with supply-side and demand-side stakeholders, regarding the appliances such as air conditioning, refrigeration, water drinking. The results of this study are summarized as follows: (1) inverter air conditioners increased from 25.30% (year 2012) to 54.31% (year 2019); window type air conditioners being substituted for Separate Air Conditioners, (2) the penetration rate of Air Purifiers & Dehumidifiers (first included in the investigation) was 7.6% in year 2019 (indicating the popularity of the appliance); the daily usage hours of air purifiers increased from 1.34 hours in 2012 to 5.77 hours in 2019 (affected by growing attention on air pollution issues), (3) the trend of miniaturization and multi-door design been observed for refrigerators; the penetration rate of freezers increased from 6.80% in 2012 to 12.27% in 2019 (indicating the prevalence of the appliance), (4) the rise of beverage shops and electric kettles invaded the traditional market of electric hot water pots and drink dispensers. Lastly, the trend of household electric appliances in the future are concluded as follows: (1) energy-saving inverter appliances, (2) smart high technology appliances, (3) innovative small appliances.

**關鍵詞 (Key Words)**：家電產品(Home Appliances)、入戶調查(In-house Visit)、深入訪談(In Depth Interviews)、電力消費(Electricity Consumption)、節能政策(Energy Saving Policy)。



# 台灣北部核能電廠附近海域浮游植物群聚之調查研究

Phytoplankton Communities in the Adjacent Waters of Nuclear Power Plants  
in Northern Taiwan

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## 摘要

本研究是探討 2017 年至 2018 年期間於台灣北部核一及核二電廠附近海域浮游植物群聚組成及季節分布。在 2017 年及 2018 年分別鑑定出 159 及 166 種浮游植物，平均豐度各為  $3.6 \pm 0.2 \times 10^3$  cells/L 及  $7.5 \pm 0.4 \times 10^3$  cells/L；兩年共鑑定出 187 種浮游植物，平均豐度為  $5.6 \pm 0.3 \times 10^3$  cells/L。浮游植物豐度有明顯的季節及年度變化，但兩年的主要優勢種類組成相似，主要包括菱形海線藻(*Thalassionema nitzschioides*)、斯拖根管藻(*Rhizosolenia stolterfothii*)及丹麥細柱藻(*Leptocylindrus danicus*)等。浮游植物豐度在不同季節之測站分布趨向不甚一致，2017 年 3 月、5 月及 8 月近岸豐度高於遠岸，而 11 月則以遠岸豐度較高；2018 年 5 月和 11 月略有由近岸向遠岸遞增趨向，而 3 月及 8 月則以近岸較高。綜合兩年調查研究結果顯示，兩個核電廠出水口附近測站所發現的浮游植物豐度、種類數目及種歧異度一般均與季平均值相近或較高，顯見核電廠之溫排水對附近海域浮游植物群聚之數量及多樣性並無明顯的影響。

## Abstract

This study aims to investigate the species composition and seasonal distribution of phytoplankton in the adjacent waters of the first and second nuclear power plants (NPP1, NPP2). In 2017 and 2018, 159 and 166 phytoplankton taxa were recorded with mean abundances of  $3.6 \pm 0.2 \times 10^3$  cells/L and  $7.5 \pm 0.4 \times 10^3$  cells/L respectively. The investigation results of phytoplankton abundances (PAs) exhibited obvious seasonal and yearly changes and nevertheless similar predominant species composition, including *Thalassionema nitzschioides*, *Rhizosolenia stolterfothii*, *Leptocylindrus danicus*, etc. Taking year 2017 as an example, inshore PAs were higher than offshore PAs in March, May and August, but the circumstances reversed in November. In addition, PAs gradually increased from inshore to offshore waters in May and November, 2018, but higher offshore PAs were observed in March and August the same year. Since the PAs, numbers of species, and species diversity near the NPP outlets remained equal or higher than the seasonal means, we concluded that NPP thermal discharge had no obvious influence on the abundance and biodiversity of phytoplankton.

**關鍵詞 (Key Words):** 浮游植物(Phytoplankton)、種類組成(Species Composition)、季節分布(Seasonal Distribution)、核能電廠(Nuclear Power Plant)。

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