

風能系統工程技術開發與研究

執行單位

行政院原子能委員會核能研究所

計畫主持人

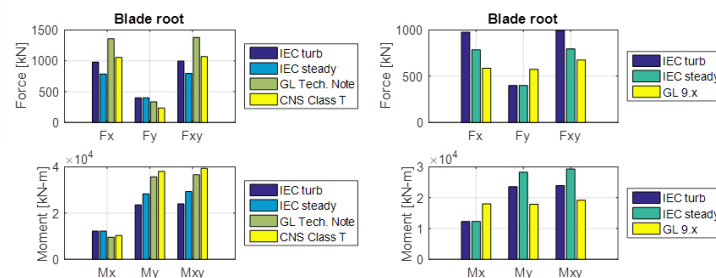
黃金城

- 中小型風機技術主要開發5 kW垂直軸風機，將應用於住宅與都會區。
- 大型及離岸風機技術主要進行本土化環境設計負載分析，建立本土化離岸風機系統設計驗證程序，應用於離岸風機系統本土設計驗證。

1. 可增加旋轉直徑之垂直軸風力機(15/715160)
2. 風力發電機葉片及包含此風力發電機葉片的垂直軸風力發電機(106138498)
3. 過轉保護裝置及應用其之風機(106138643)
4. 垂直軸風力發電機可變葉片傾角機構(發明第I561730號)
5. 小型垂直軸風力發電機被動式葉片傾角調變裝置(發明第I554682號)
6. 用於固定風力發電機葉片扭力輸出的裝置(US9,567,977,B2)



5 kW風機機構改良與實測



颱風及地震對本土離岸風機之影響分析



安裝VG



原始葉片



風機減噪設計分析與安裝

- **計畫總目標**：精進中小型風機系統設計、分析、測試及運轉之技術，並建立自主化大型陸域及離岸風機之技術。
- **核心技術項目**：
 - a) **5 kW風機系統**：運轉測試結果顯示改良後之風機機構確實展現幫助啟動與過轉保護功能。
 - b) **風機減噪技術**：減噪用之渦流產生器可在較低轉速達到相同發電量，達成減噪目的。
 - c) **離岸風機設計驗證程序**：配合本土環境條件之颱風與地震條件，提出符合本土化離岸風機系統設計負載案例。
 - d) **風機自我故障診斷技術**：使用高頻解調法於150 kW風機系統分析故障特徵行為。
- **重要國際活動**：
 - a) 舉辦IEA Task 27國際會議，展示台灣小型風力機產業環境，行銷台灣促進國際技術交流合作與互動。
 - b) 與丹麥Aalborg University之J. D. Sorensen教授合作，探討臺灣極端氣候條件對於大型離岸風機之影響。

Research and Development of System Engineering Technology on Wind Energy

Execution Unit

Institute of Nuclear Energy Research
Atomic Energy Council, Executive Yuan

Project Director

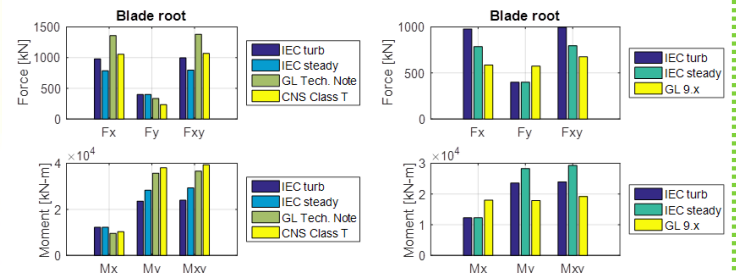
Huang, Chin-Cheng

- Developing a novel 5 kW vertical axis wind turbine to be used in urban area.
- Development of design and verification procedures of offshore wind turbines under domestic extreme environmental conditions.

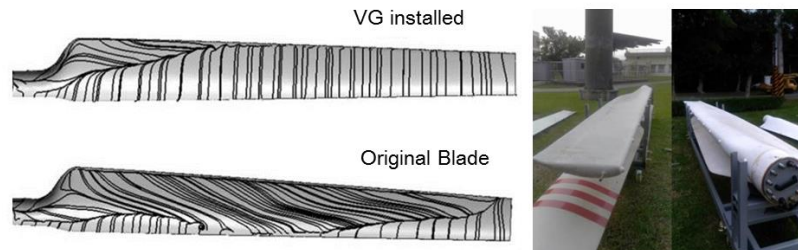
1. Vertical axis wind turbine with telescopic rotational diameter(15/715160)
2. Turbine blade and vertical axis wind turbine including the same(106138498)
3. Overspeed protection device and a wind turbine using the same(106138643)
4. Vertical-axis wind turbine having device for changing blade angle(1561730)
5. Passive pitch angle control mechanism for small vertical axis wind turbines(1554682)
6. Device for controlling torque output of wind turbine blades (US9,567,977,B2)



Test of 5 kW VAWT with improved mechanism



Analyses for the effect of domestic typhoon and earthquake on offshore wind turbines



Analysis and installation of noise reduction device on wind turbines

- **Overall objectives:** (1) Technology improvement of design, analysis, test and operation for small-and-medium scale wind turbines; (2) Develop self-sustainable large onshore and offshore wind turbine techniques.
- **Important techniques:**
 - a) **5 kW VAWT:** Higher starting torque and over-speed protection by the improved mechanism have been developed and confirmed during operation test.
 - b) **Noise reduction:** With the proposed vortex generator, rated-power can be achieved with slower rotational speed and smaller noise.
 - c) **Design and verification procedure:** Design load cases incorporating the effects of domestic typhoon and earthquake for the offshore wind turbine have been successfully evaluated and proposed.
 - d) **Self-diagnostic system:** Fault characteristics of the self-developed 150 kW wind turbine are analyzed by the high-frequency resonance technique.
- **Important international activities:**
 - a) INER and Standard Bureau of Taiwan co-hosted the IEA Task 27 2016 meeting in Taiwan. Development of the latest small wind turbine industrial status in Taiwan has been presented to promote future international recognitions and technical exchange.
 - b) INER cooperated with Aalborg University of Denmark (Prof. J.D. Sorensen) to investigate the effect of extreme climate conditions in Taiwan on the large offshore wind turbine system.