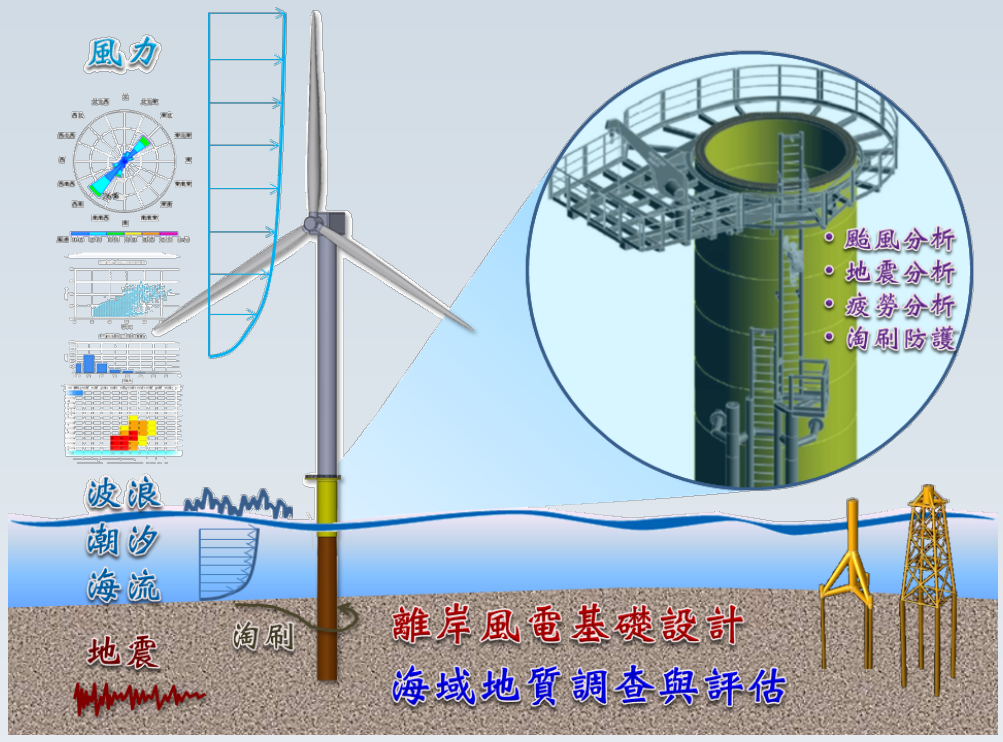
再生能源組

近年來全球致力減少溫室氣體排放以因應溫室效應所帶來之極端氣候威脅。我國目前主要的減碳作為以積極推動再生能源為主，根據臺灣2050淨零排放路徑規劃，2050年再生能源發電占比將超過60%。
本中心基於既有技術能量，積極切入「風力發電」、「地熱發電」與「碳封存」三項領域進行再生能源暨減碳關鍵技術研發。其中，風力發電鎖定離岸風場地工試驗與資料詮釋、地熱開發著重地熱探勘與資源評估、碳封存則置重點於二氧化碳封存規劃、監測與風險管理。相關技術將奠定中興工程集團於淨零排放相關領域之領先地位。

離岸風力發電–基礎設計

■ 離岸風電風機基礎優化設計

依照風場開發階段時程，分別進行概念設計(Concept Design)、前端工程設計(FEED)及細部設計(Detailed Design)等階段之場址調查，並運用地球物理探測、大地工程鑽探調查試驗、海氣象資料監測等方法，取得各設計階段所需之各項參數。
離岸風機基礎設計牽涉領域廣泛，涵蓋材料力學、結構學、大地工程學等，亦受風、浪、海流、地震等環境荷載影響，另需考量反覆荷載作用下之金屬疲勞問題及避開與上部風機運轉共振之問題，十分複雜。
不同風場因水深與上述環境條件不同，其設計結果亦將存在差異。設計時透過SACS程式詳細針對各元件與節點進行結構分析，以符合國際規範之設計要求。另結合最佳化方法可有效降低風機基礎建造、運輸及安裝之成本。

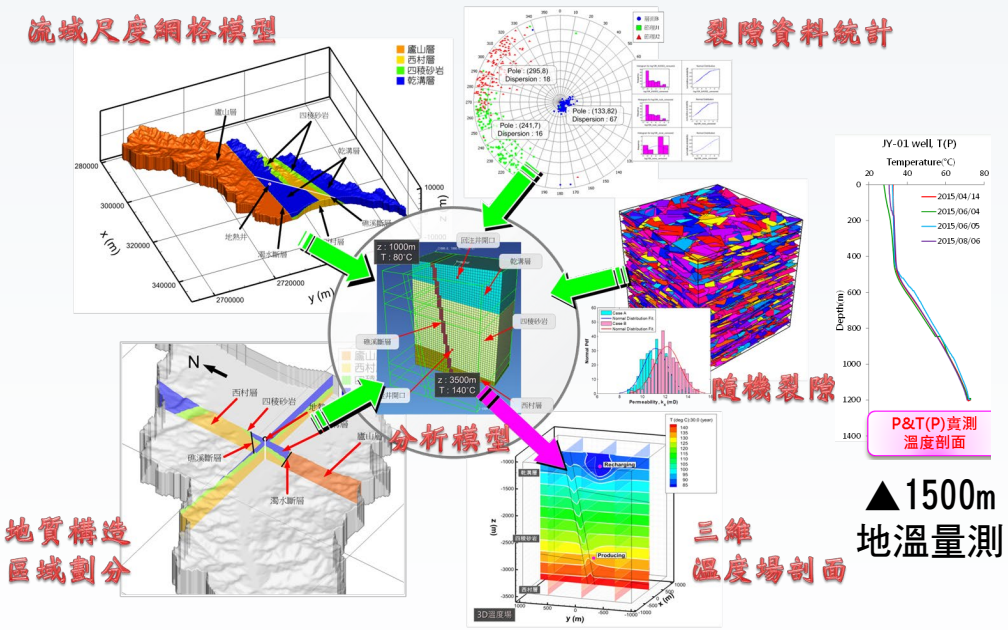


▲離岸風機基礎優化設計

地熱產能評估及深層地溫量測

■ 地熱產能評估與現地試驗

首先透過地質、水文、地溫量測與地球化學資訊建立三維地熱模型，作為地熱生產規劃、設計與營運之依據。再針對地熱井進行現地試驗，以瞭解井內地熱流體生產時之特性及地熱儲集層之水文地質性質以作為評估地熱發電量及發電廠規劃設計之基礎。



▲1500m
地溫量測

▲地熱調查與產能評估技術

二氧化碳地質封存風險評估管理

■ 二氧化碳地質封存移棲分析

採TOUGH2程式分析超臨界狀態二氧化碳受壓力、溫度及地下水流作用下於地底之移棲變化，藉以評估二氧化碳於地層中封存的穩定性與可能風險並進行管理改善以降低風險。另採Phast程式針對地面管線之可能洩漏情境進行大氣擴散風析，以掌握可能的洩漏方向與濃度分布，預作因應處置。

▲二氧化碳地質封存移棲分析與風險評估

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中興社大地工程研究中心

Geotechnical Engineering Research Center (GERC)

Renewable Energy Group

In recent years, the global trend of reducing greenhouse gas emissions against the Greenhouse effect which induced extreme climate threats is obviously. Taiwan's main activity of carbon reduction is to positively promote the renewable energy. According to the latest energy policy, the renewable energy will account for 20% by 2025.

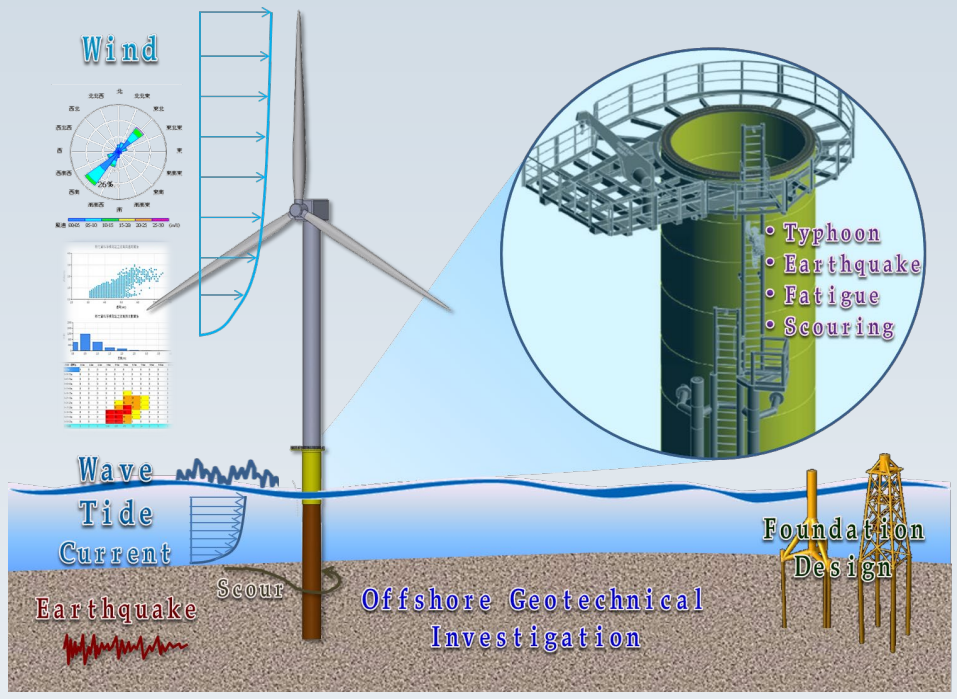
Based on our geotechnical background and technical capacities, we focus on the key technologies such as "wind energy", "geothermal energy" and "carbon dioxide storage". Among them, the offshore wind turbine foundation design, the geothermal power production assessment and deep geothermal temperature measurement, the migration analysis of supercritical carbon dioxide after injected in the deep stratum and risk assessment and management for carbon dioxide escape. Relevant achievements can help Sinotech Engineering Group to keep the leading position in Taiwan.

Offshore Wind Energy – Foundation Design

Optimized Design of Offshore Wind Turbine Foundation

According to the wind farm development process, the geophysical exploration, geotechnical drilling survey, met-ocean data monitoring will be conducted for the different phases of conceptual design, FEED study and detailed design, respectively, to obtain the required parameters for each design.

Foundation design of offshore wind turbine involved with numerous fields, such as mechanics of material, structural analysis and geotechnical engineering. Besides, the environmental loads such as wind, wave, current and earthquake also affect the design. The fatigue of steel and frequency of whole structure must be considered under the cyclic loadings and the wind turbine operation. The SACS program was adopted to analysis the structural safety to meet the international standards and codes. The optimized design can reduce the cost.

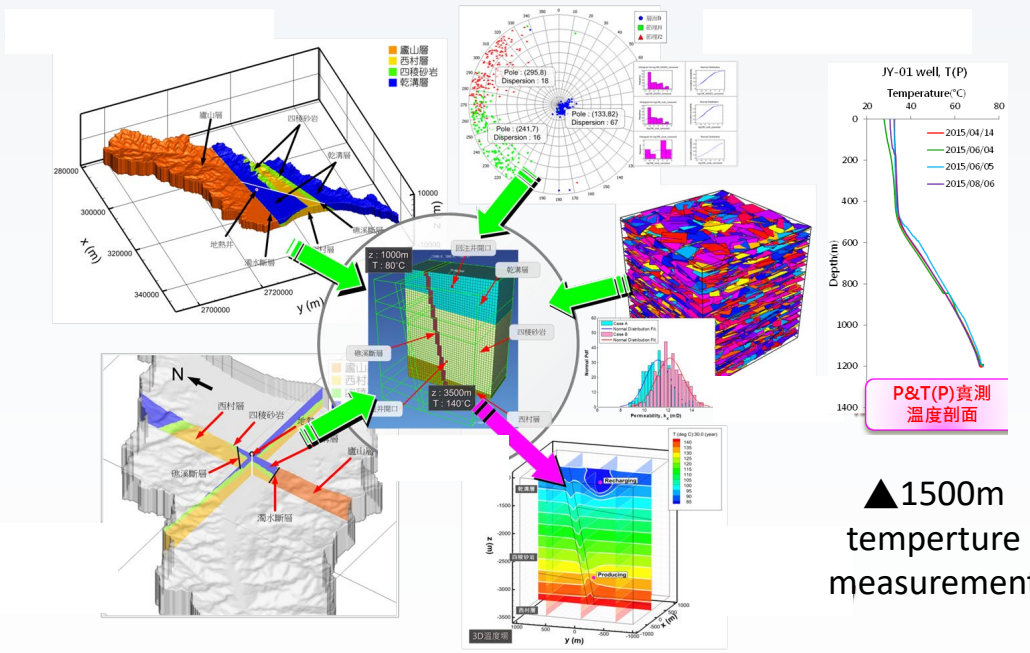


▲ Optimized Foundation Design of Offshore Wind Turbine

Geothermal Estimate & Measurement

Geothermal Production Assessment

First, we integrate the geological, hydrologic, geothermal, and geochemical conditions into the 3D geothermal model to estimate the heat production rate. Then, in-situ tests were conducted to obtain geothermal parameters and the heat reservoir properties to be power plant design basis.



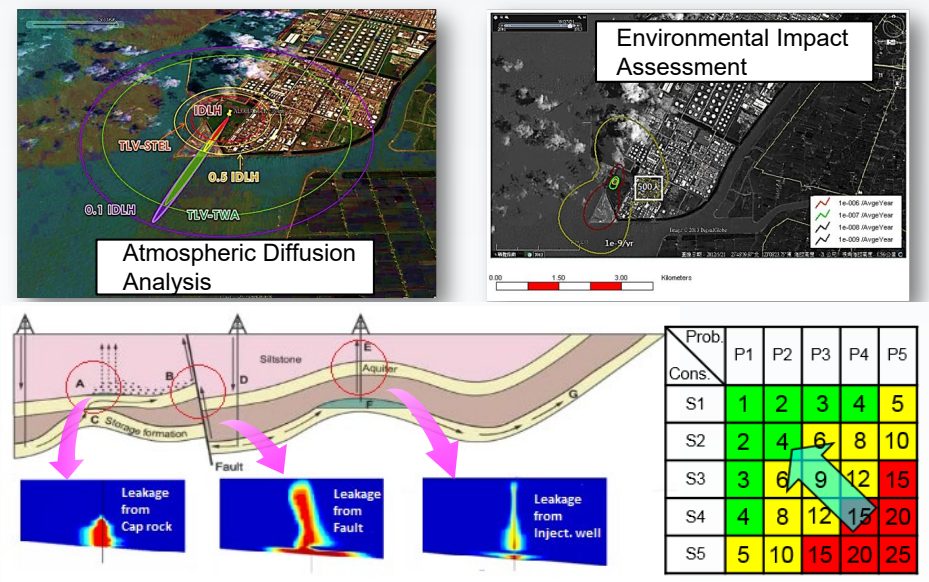
▲1500m temperture measurement

▲ Geothermal Investigation and Assessment

CO_2 Storage and Risk Management

CO_2 Migration Analysis and Risk Simulation

TOUGH2 program was adopted to analyze the super critical CO_2 Migration under the change of pressure, temperature and groundwater flow to reduce the risk. Besides, PHAST program was used to carry out the risk scenario of CO_2 release in the atm. to obtain the dominant direction and concentration distribution as well as to manage the risk.



▲ CO_2 Migration Analysis and Leakage Scenario Simulation

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