

TPC Changhua Offshore Wind Farm Phase 2 Project Streamlines Data Analysis

SACS™ Reduces Design Time By 60%, Saves Five Petabytes of Local Storage Space, and Can Implement 2,000 Time-history Simulations Simultaneously

MODERNIZING WIND POWER GENERATION

The Taiwan Power Company (TPC) Changhua Offshore Wind Farm is located off the coast of the Lukang Township of Changhua County in Taiwan. TPC completed the 109.2-megawatt phase 1 in November 2021 and then developed the 295-megawatt phase 2 of the project, which includes 31 V174-9.5 megawatt turbines from Vestas. Phase 2 is slated to generate 1 gigawatt hours of power annually, delivering electricity to 270,000 households and reducing 403,611 tons of carbon emissions. This project will support Taiwan's goal of increasing the share of renewable energy to 20% of the country's total by 2025.

The project is led by Sinotech Engineering Consultants, a company established in 1970 as part of a government effort to modernize Taiwan. The company is composed of engineers working with large-scale infrastructure projects, such as hydroelectric and water resources projects, high-tech production plants, incinerators, nuclear decommissioning, and renewable energy. The team was tasked with designing the wind turbine generator (WTG) support structures. The project includes the designing, constructing, and testing the wind turbine generator set, including the tower.

NAVIGATING TIME-CONSUMING PROCESSES AND LARGE AMOUNTS OF DATA

The design process for an asset of this kind must consider thousands of load scenarios, including metocean and operational conditions and dynamic time-history analysis. Analyzing these scenarios was extremely time consuming, and the simulations generated a substantial amount of data. An 800-second time-history analysis would take two hours to complete, generating approximately 20 gigabytes of data.

Further, for an offshore WTG project, the foundation designer and WTG supplier must conduct the load iteration analysis (ILA) three times. This is an important process for both design parties to exchange the design data, information, and load series. Specifically, for this project, the systems must also perform 80,000 simulations in a single ILA process. This process used to take three and a half months to implement in a 64-core workstation locally, making it unfeasible for the design schedule. Sinotech understood that a new system was necessary.

MORE EFFICIENT MODELS

After considering their options, Sinotech chose SACS to execute 2,000 time-history concurrent simulations using Microsoft's Azure cloud computing platform. The project is the first offshore WTG detailed design project designed by a local team, and it is the first time that the team used SACS on detailed designs. SACS helped Sinotech reduce design time, save storage space, and streamline simulations, helping modernize their systems and improve efficiency. The team was able to download the final results of critical results needed for the design work, reducing the amount of data post-processing. Further, Sinotech's unique model construction reduces thousands of degrees of freedoms (DOFs) on the TP model to only a few DOFs connecting the jacket structure, making complex models more efficient and accurate.

The SACS implementation has evolved into an ongoing partnership. Bentley's development team continuously helps Sinotech by developing new features to support their offshore WTG support structures' analysis efforts.

"SACS's cloud services provides solutions that are able to deal with large computing-intensive simulations using the high-end hardware of Microsoft Azure and creates a storage place

PROJECT SUMMARY ORGANIZATION

Sinotech Engineering Consultants Inc.

SOLUTION

Structural Engineering

LOCATION

Changhua, Taiwan

PROJECT OBJECTIVES

- ♦ To reduce the time spent performing time-history analyses.
- ♦ To reduce the amount of data downloaded for post-processing by identifying and downloading critical design load cases.

PROJECT PLAYBOOK

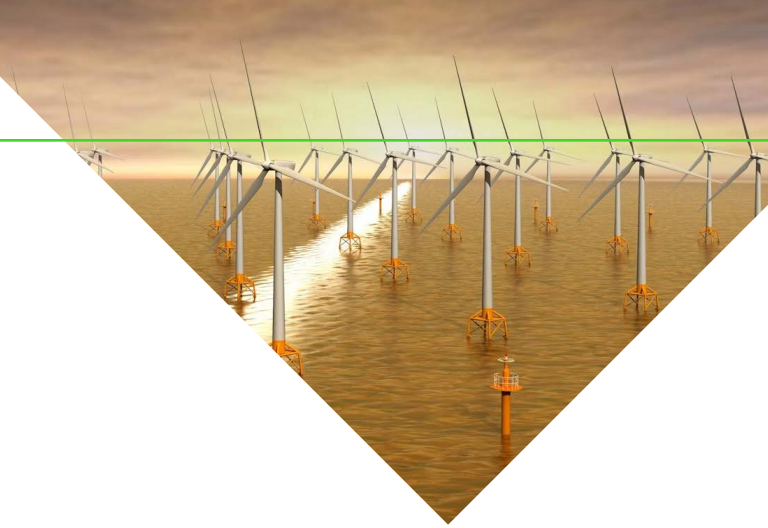
SACS

FAST FACTS

- ♦ TPC Changhua Offshore Wind Farm Project has a total power generation capacity of approximately 300 megawatts, including 31 wind turbines with 9.5-megawatt capacity each.
- ♦ This project will support Taiwan's goal of increasing the share of renewable energy to 20% of the country's total by 2025.
- ♦ Sinotech implemented SACS to make offshore WTG's simulations and analysis more efficient.

ROI

- ♦ SACS reduced the design time by 60%, saved five petabytes of local storage space, and helped implement 2,000 time-history simulations at the same time using Microsoft Azure.



“SACS’s cloud services provides solutions that are able to deal with large computing-intensive simulations using the high-end hardware of Microsoft Azure and creates a storage place for hundreds of terabytes of data.”



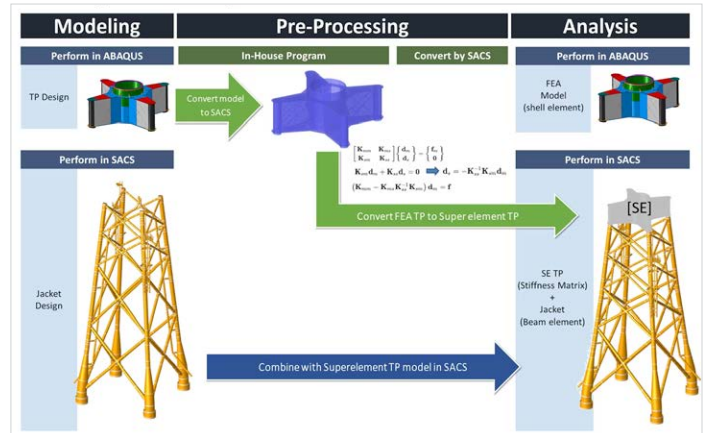
– Wan-Chien Kung, Structural Engineer for Offshore WTG Support Structure, Sinotech Engineering Consultants Inc.

for hundreds of terabytes of data,” said Wan-Chien Kung, structural engineer for offshore WTG support structure at Sinotech.

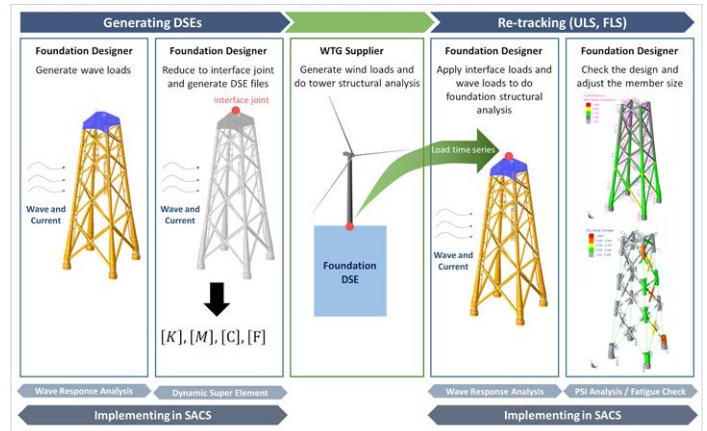
SACS CLOUD SERVICES HELP SAVE TIME

Using SACS, Sinotech cut their timeline from 3.5 months to just a month and a half, a design time reduction of 60%. The software also saves approximately five petabytes of local storage space by implementing all the simulations for 3 ILAs on SACS.

Since the implementation process, the new features of SACS and OpenWindPower® have already covered most of the design process requirements of offshore WTG fixed foundation. It is now a more effective tool for foundation designers to use when executing analysis work, helping all stakeholders save time and do more with less.



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