Offshore Wind Farm Foundation Technology Assessments

General Electric Wind Energy

MMI Engineering performed a study to develop and evaluate various types of structures that could be used to support large offshore wind turbine generators. An emphasis of the study was to identify and apply offshore oil and gas technology that may be applicable in the development of ocean-based wind power. MMI also addressed the definition of feasibility limits and compared concept costs relative to water depth, site soil conditions, and environmental (wind, wave, and current) loading.

The study included an assessment of the substructures currently in use for offshore wind power generation, identifying limits in their range of applicability. The survey addressed the design, fabrication, and installation issues that are encountered. The design standards that are currently applicable for offshore wind power development in Europe were compared against the design standards that are in use for U.S.-based offshore oil and gas platforms. MMI also identified the specific design and analysis methodologies that would need to be addressed in the development of wind farms in intermediate to deep water sites.

MMI classified all of the identified concept types on the basis of primary attributes (e.g. construction material, foundation type, structural configuration, and method of installation). The various concepts were then assessed qualitatively based on key performance attributes, such as in-service response, fabrication, and installation costs.

Selected concept types were taken through a complete analysis and design exercise. MMI addressed specific issues associated with dynamic response, fatigue and the potential for resonance during operation. Fabrication and installation cost estimates were developed for the most promising configurations. Total costs were compared for the various site conditions to identify cost sensitivities. The study provided a definition of the costs and applicability of alternative types of turbine support structures that can be used to develop options for potential offshore wind farm sites. The study also provided a framework for the continued development, analysis, and design of viable structural concepts, which will become the basis of future designs as the industry moves into deeper and less protected water.