



# Formosa 1 case study

Macquarie successfully leads Formosa 1 to complete construction with 4.33 million hours worked and an incident frequency rate of 0.23

## Entering the Taiwan market

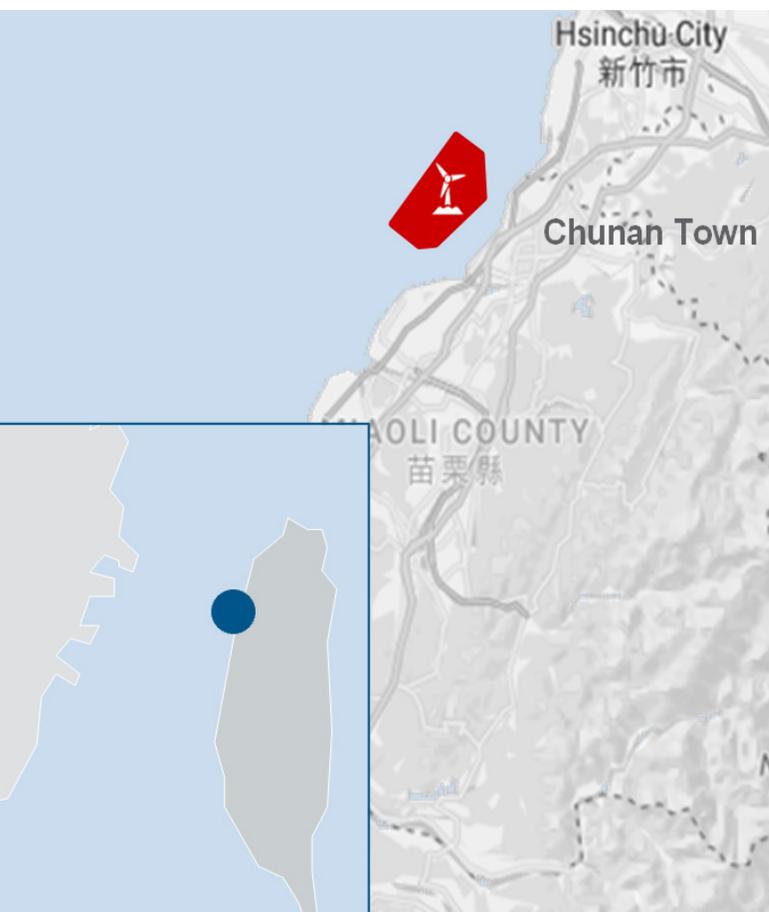
As part of Macquarie's Green Investment Group's (GIG) substantial and longstanding commitment to renewable energy, Taiwan was identified as a potential market due to its regulatory framework, good wind resource and reasonably shallow water depths. GIG having a strong technical team in Asia, and many years of experience operating in Taiwan, was well placed to make an early move in the market.

## Formosa 1

Formosa 1 is located between 2 - 6km off the coast of Chunan Town, Miaoli County on the north-western coast of Taiwan, and represents Taiwan's first commercial scale offshore wind farm.

### Key statistics

- 128 MW
- 22 wind turbine generators
- 2 - 6 km from shore
- 15 - 32 m water depth
- Monopile foundations
- 37 km of offshore cables
- 1 onshore substation
- 3 km of onshore cables





The last transition piece being installed

## GIG's Formosa story

In 2017, GIG joined the Formosa 1 offshore wind project. Working in an emerging market and having multiple contractors, GIG recognised that setting strong Health, Safety and Environmental (HSE) expectations was of utmost importance and fulfilled the key management roles with GIG technical experts from the offshore wind industry with high HSE standards and culture.

These roles included: EPC Director, all delivery packages, Commercial Management, HSE, risk and site management.

Within 6 months of joining the project, the GIG-led team successfully set up the project delivery team and plan, secured procurement, permits and financial close in June 2018 and proceeded to complete construction 15 months later in October 2019.

## Key challenges faced

- A constrained timeframe of less than 12 months prior to offshore construction for engineering, fabrication, and transport
- Earthquake and typhoon risks new to offshore wind industry
- Limited local supply chain and contractors experienced in offshore wind industry
- Working with evolving legislation and permitting frameworks as they were adapting to the industry



Wind turbine nacelles at Taichung Port ready for installation

## Approaches

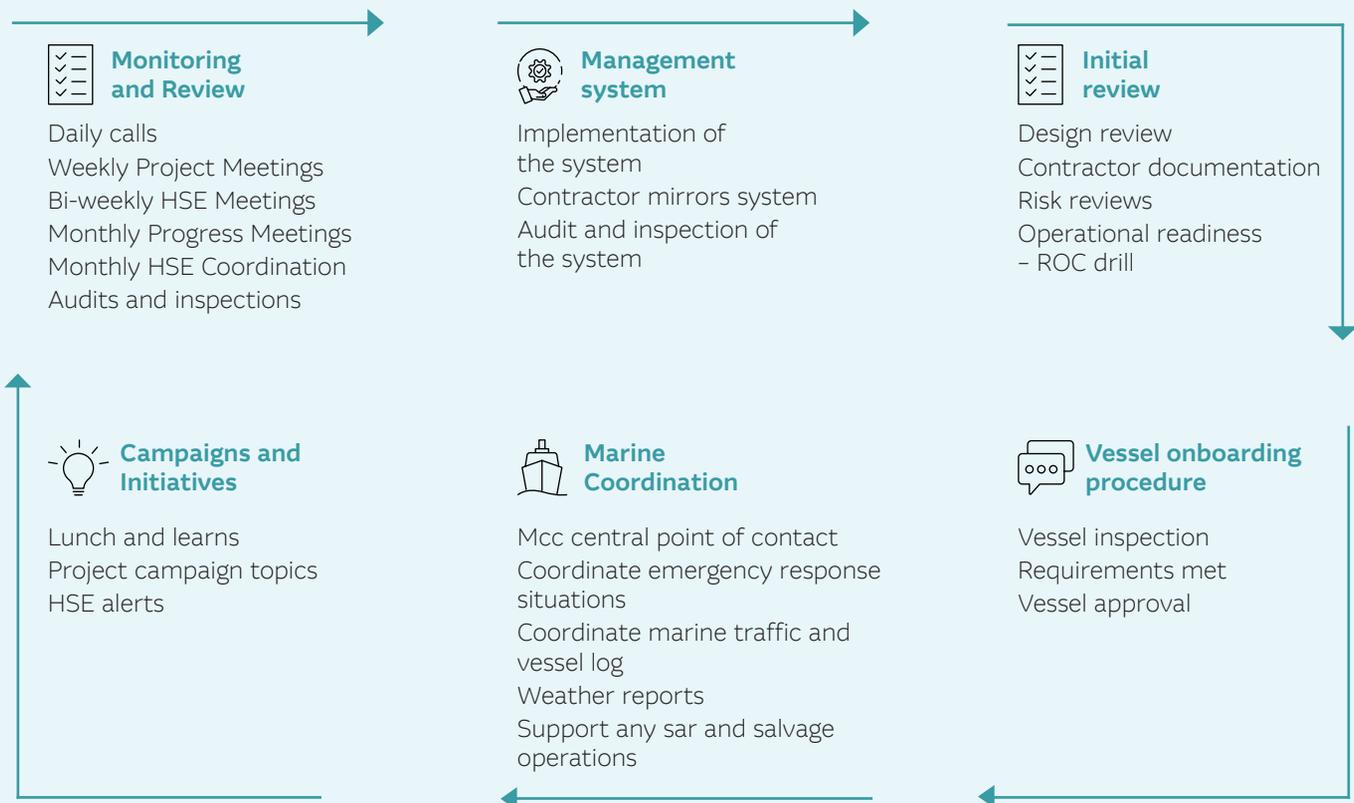
- Managing multiple contractors and an international supply chain within a constrained timeline required extensive interface management, design reviews and reinforcement so that HSE would not be compromised by time pressure. Components were manufactured in Germany, Denmark, UK, Vietnam, Thailand and Taiwan. Installation and support vessels and workers were from Europe and Taiwan
- The impacts of earthquake on seabed conditions both for the installation methodology and final design required a collaborative engineering exercise between the vessel operators, specialist consultants and turbine supplier coordinated by the project team, preventing potential collapse of vessels and structures whilst construction or post installation
- The optimum period for construction based on sea states and wind speeds meant that it coincided with typhoon season. The project successfully managed 4 typhoon pass overs through robust planning and reconfiguration of vessels to minimise any injuries or damage which could result in delays to the works
- To help achieve the HSE standards and expectations of the project, high levels of training and supervision were implemented. This involved several initiatives including risk awareness and embedding safety cultures such as speaking up and reporting
- Extensive fisheries and local community engagement was undertaken by the project team to prevent any negative social impacts. Underwater noise monitoring and mammal observers were also in place during construction to prevent damage to Taiwan's protected white dolphin species
- The project maintained continual dialogue with the authorities to give assurance of the project, and to support the development of country standards for the industry. This included the Health and Safety authority (OSHA), Environmental Protection Agency (EPA), national certification and standards authority (BSMI) and electricity transmission operator (TPC). This ensured that the project met both international best practice and local legislative requirements
- GIG has also collaborated with other developers in Taiwan to form the Taiwan Offshore Wind HSE Developers Forum in September 2018 to collectively address challenges and share best practice



Safety Absolutes for use by Formosa 1



In November 2019, Kellie Field, HSE Manager for Formosa 1, presented at OHSA's conference on the project



Diagrammatic overview of Formosa 1's HSE management process

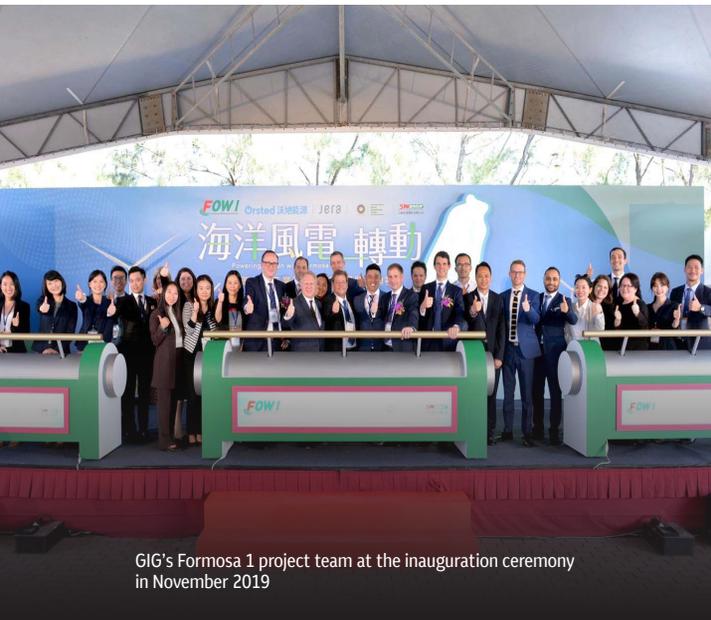
## Outcomes

- Project completed on time, on budget and safely achieving 4.33 million hours worked. During simultaneous offshore installation of foundation, cables and wind turbines, there was a peak of 20 vessels and 400 personnel on site
- No fatality or serious injury to workers and a Lost Time Injury Frequency Rate of 0.23 (comparable standard to European wind farms)
- Leaving a legacy of international HSE standards and culture in Taiwan and an experienced supply chain

## Project HSE Stats

Project HSE Stats	Accu. YTD
Lost time injury frequency rate (LTIFR)*	0.23
Total no. of fatalities	0
Total no. of lost time injuries	1
Total no. of medical treatment cases	7
Total no. of first aid cases	16
Total no. of man-hours worked	4.33m

\*Industry standard measure, calculated by the number of injuries resulting over a day's lost time from work per 1 million hours worked



GIG's Formosa 1 project team at the inauguration ceremony in November 2019



It was a pleasure to lead the team responsible for bringing this exciting project into operation.

Realising this complex project in a new region brought with it challenges which have not been encountered before in this industry. The collaboration with our project partners, wider industry and local community came together well and the whole team are very proud to have delivered the project successfully and most importantly safely.

**Matthew Green**  
Formosa 1 Project Director



Taiwan's President Tsai Ing-wen at the Formosa 1 inauguration ceremony in November 2019



We are delighted to deliver the first commercial scale offshore wind farm in Taiwan, helping to launch an important new industry and sustainable power service for the Taiwanese community. Our Taipei based development team have been working hard over the past two years to complete this project safely and on time.

Formosa 1 is a significant milestone in Taiwan's journey to becoming the offshore wind powerhouse of Asia. GIG is excited to be a part of its green energy story and we look forward to continuing to support Taiwan's transition to a greener economy.

**Mark Dooley, Global Head**  
Macquarie's Green Investment Group

