Taiwan Case Study

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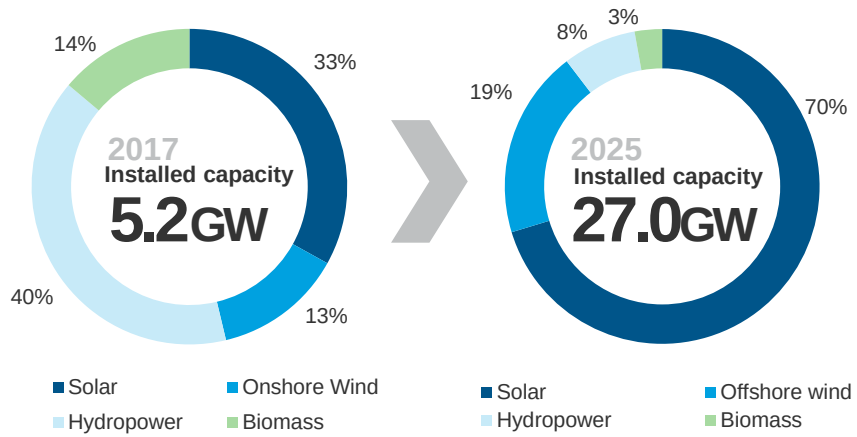
Taiwan – strong focus on renewables

The Government of Taiwan has committed to a target of 20% of electricity to be generated from renewable sources by 2025

Bright future for renewable energy in Taiwan

- Strong push from the Taiwan Government since 2009 to advance the growth of renewable energy – two key pieces of legislation
- The **Renewable Energy Development Act** promotes:
  - Feed-in-tariff regimes supported by 20 year PPAs from Taipower (State owned utility with credit rating of AA-)
  - Priority dispatch of renewable energy
- The **Electricity Act** aims to:
  - Liberalize the power generation market
  - Eliminate nuclear generation by 2025

Target for growth in renewable energy



Taiwan's offshore wind program

PHASE**ONE**

Offshore Demonstration Incentive Program

- Three projects selected as demo projects to be operational by 2020
- Government to provide subsidies for equipment and development processes
- **Formosa I is the only operational demonstration project to date**

PHASE**TWO**

Zone Application for Planning

- 36 Zones potential zones
- 22 Zones (~10GW) with preliminary EIA approval by end of 2017
- Grid allocation process underway for 5.5GW by 2025

PHASE**THREE**

Offshore Zonal Development

- To be announced late 2018 for projects post 2025

Source: Bureau of Energy, Ministry of Economic Affairs, Taiwan.

World class wind resources

The Taiwan Strait has excellent wind resources with a strong consistent prevailing wind from the northeast

Optimal conditions for offshore wind development

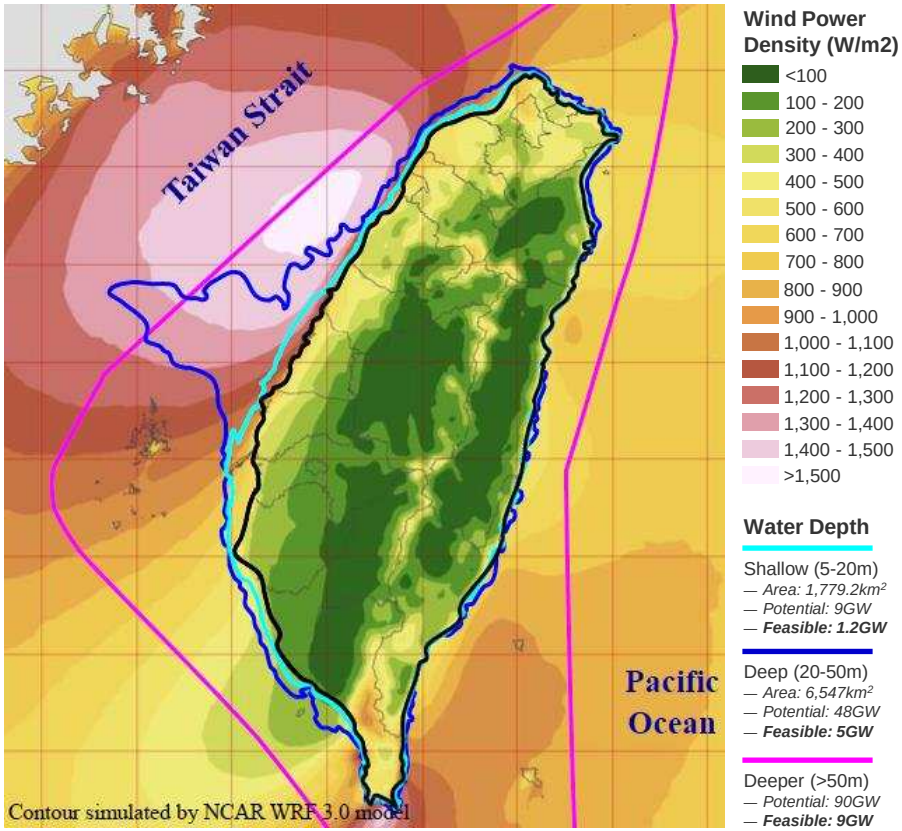
- Taiwan has some of the strongest wind speed seen globally
- 4C Offshore rank the Taiwan offshore sites with the best globally

Taiwan Area	Wind Speed
Fujian Province, China (best globally)	12.1 m/s
Changhua area, Taiwan	12.0 m/s
Miaoli area, Taiwan	11.8 m/s
North Sea, Germany	10.0 m/s
Yellow Sea, Korea	7.8 m/s

Source: 4C Offshore – Global Offshore Wind Speeds Rankings

- Protected from typhoons due to the mountain range
- Nevertheless, significant considerations have been given to typhoons in turbine selection and foundation design

Strong wind resources in the Taiwan Strait



Development lifecycle of offshore wind

An offshore wind farm typically takes at least 6 years to successfully reach commercial operations

Environmental Impact Assessment
(up to 24 months)

- Site assessment for suitability
- Collection of data and approval of environmental permits
- **Site Control**

Development
(up to 24 months)

- Detailed site surveys, front end engineering design, detailed design
- **Grid allocation**
- PPA
- Procurement
- Financial Close

Construction Phase
(18 – 24 months)

- Construction delivery
- Multi-faceted procurement package – WTGs, foundations, cables, onshore works

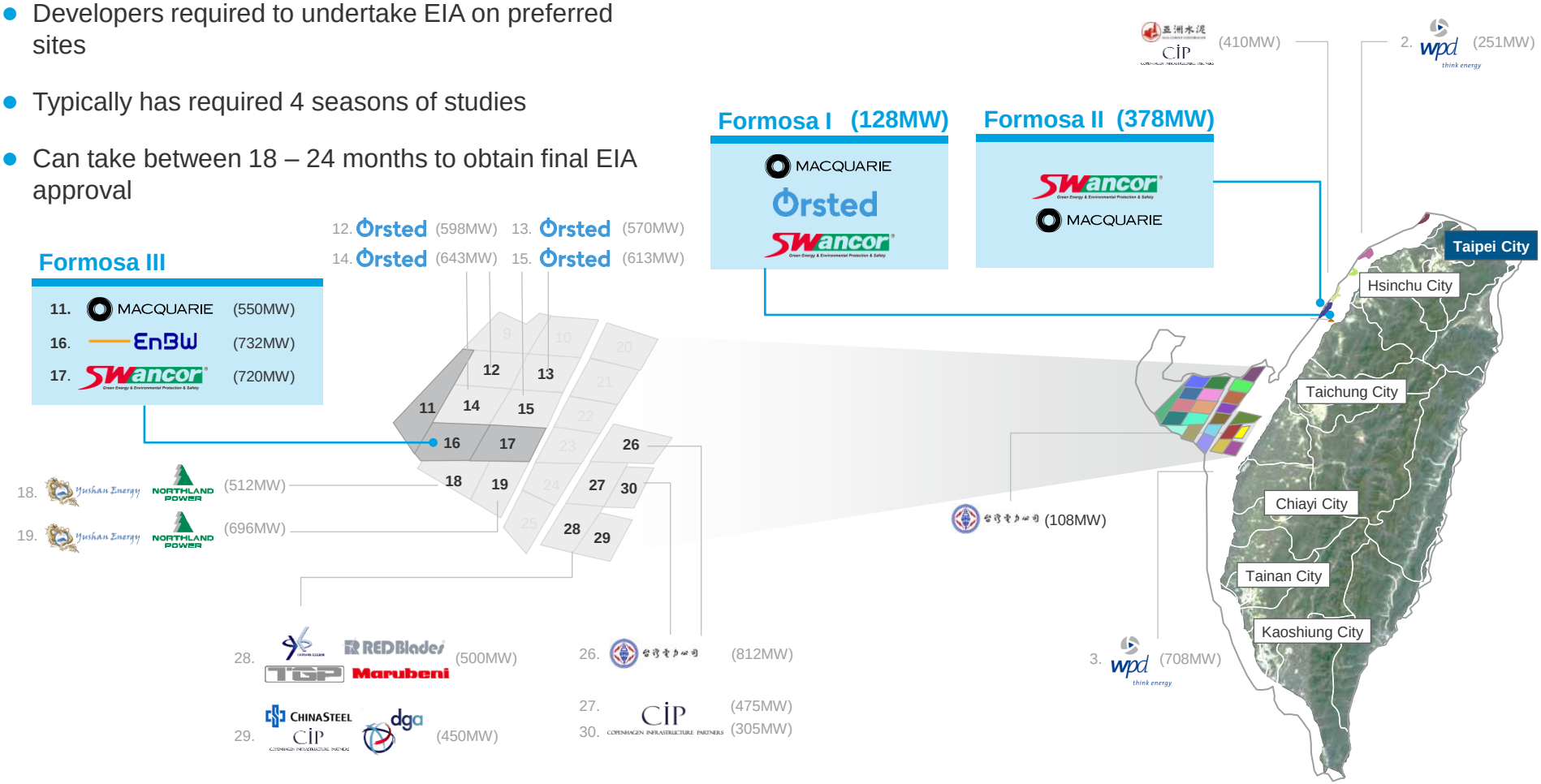
Operations Phase
(20 years)

- Long-term PPA
- Long-term service agreement, maintenance, spare parts supply

Site Control

Obtaining site control requires obtain final approval from Environmental Protection Administration

- Developers required to undertake EIA on preferred sites
- Typically has required 4 seasons of studies
- Can take between 18 – 24 months to obtain final EIA approval



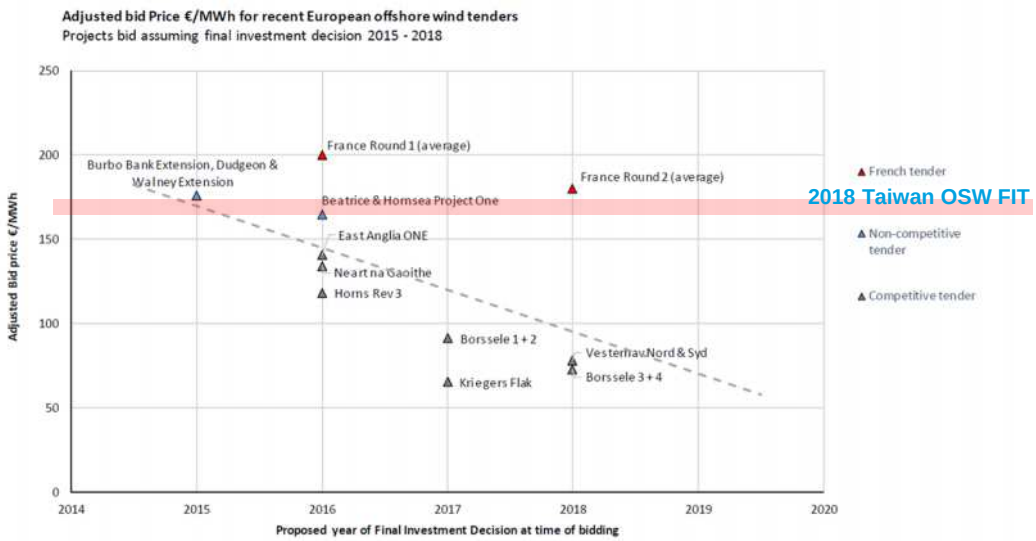
Source: Bureau of Energy, Ministry of Economic Affairs, Taiwan

FIT / PPA

All permits required for financial close have been secured

Permits overview

- 20 year PPA with fixed FIT price with Taipower
  - Depending on when the PPA is signed, the FIT price announced for that year apply under the PPA for the next 20 years
  - The FIT is reviewed every year to determine the new FIT rates for the following year
- Under legislation, Taipower is obligated to purchase all power produced from renewable energy
- The FIT regime in Taiwan compares favourably with current levels being seen in Europe



Source: 4C Offshore Market Overview Report – October 2017

Taiwan OSW FIT	2015 FIT	2016 FIT	2017 FIT	2018 FIT
20 year fixed, NTD	NTD5.7405 / kWh	NTD5.7405 / kWh	NTD6.0437 / kWh	NTD5.8498 / kWh
20 year fixed, EUR equivalent	€163 / MWh	€163 / MWh	€172 / MWh	€167 / MWh

Grid allocation process

Grid allocation providers certainty for export of power

- One issue that Taiwan has is there are more GWs under development than grid available – allocation process to provider certainty to grid
- Taiwan Government allocating grid connection to developers across a two stage process

—**Round 1 – FIT allocation round** – announced in May 2018 – 3.8GW allocated across 7 developer consortiums

—**Round 2 – Auction round** – bids submitted on 19 June 2019

Grid allocation mechanism overview

	Phase	Capacity for connection	Key selection criteria
2020	FIT Selection	0.7GW allocated	2 projects
2021-2025	FIT Selection	3.1GW allocated	10 projects
2021-2025	Competitive Auction	1.7GW remaining for allocation	Lowest tariff

FIT allocation developers

MACQUARIE
SWancor
wpd think energy
NORTHLAND POWER
Ørsted
台灣電力公司
CIP COPENHAGEN INFRASTRUCTURE PARTNERS
CHINASTEEL

Formosa 1 – First OSW Project Finance in Taiwan

Offshore wind is bankable in Asia

- Formosa 1 reached financial close with its bank group on 8 June 2018
  - —First project financing for an offshore wind farm in Taiwan
  - —Bank group of 11 banks, domestic and international and EKF
- Key lessons:
  - —Technology is accepted by banks in Asian conditions
  - —Typhoon and earthquake conditions can be understood and accepted by banks
  - —Long date debt is available – 16 year tenor
  - —Importance of Government's commitment and support of offshore wind was also a key factor
  - —MacCap played a key role in the financing of the project

Local and International Lenders

ANZ · BNP PARIBAS · CIB · 國泰世華銀行 Cathay United Bank · EnTie Bank · DBS · ING · Fubon Bank 富邦銀行 · 凱基銀行 KGI BANK · MUFG · SOCIETE GENERALE · EKF

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BUSINESS GUIDE

Formosa 1 Completes Financial Close

Formosa 1, Taiwan's first offshore wind farm, has reached financial close.

A financial consortium of eleven international and local Taiwanese banks and EKF Denmark's Export Credit Agency has completed this TWD 18.7 billion (EUR 533 million), 16-year project financing, the first project financing in the Taiwanese offshore

Formosa 1 Completes Financial Close

Taiwan Offshore Wind – Risks

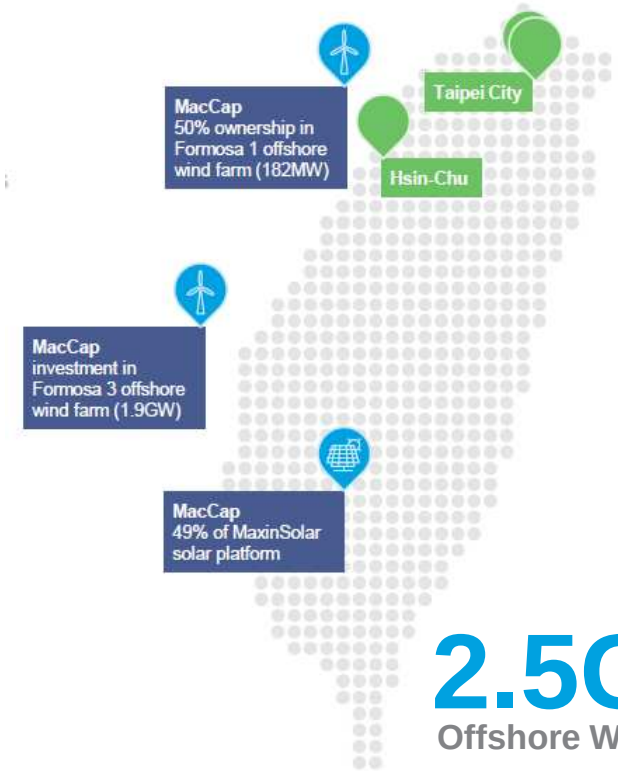
Risks that were encountered in Taiwan will be applicable to Korea OSW

Key risks	Mitigants
Development risk / site control	— Risk of spending significant devex without certainty of site control — Taiwan addressed this through a clear regime for obtain site control – EIA approval process — Clear process and standard around what EPA required developers to study
Typhoons / Earthquakes	— Taiwan has combination of typhoons and earthquakes which cause risk to design and execution — Technical solution is able to deal with this — Experience on Formosa I demonstrates certification for the specific site wind conditions is required — Proper geotech work and information required to ensure foundations are suitable given earthquake conditions
Regulatory risk	— Changing views of Government on renewable / offshore wind — Strong support for both sides of Government around offshore wind — Clear program to deliver 5.5GW by 2025 and 17GW by 2050 — Strong 20 fixed price PPA with Taipower
Local Stakeholders	— Key factor to ensure local stakeholders are supportive of project development — Requires strong engagement from developers — Local stakeholders also like experienced developers that will deliver the project
Localisation	— What is Government's position of local content? — Taiwan tried to include this as grid allocation evaluation factor – ultimately removed it — In order to build local supply, need to ensure pipeline is delivered and strong certainty to revenue profile to allow development of market

Macquarie Capital – Taiwan Portfolio

2.5GW of offshore wind and solar under development – growing technical team to support our offshore wind business across Asia

MacCap Portfolio



2.5GW
Offshore Wind

MacCap OSW Team

Richard Evans
Project Director
Formosa 3
25 years relevant experience

Matthew Green
Project Director
Formosa 1
23 years relevant experience

Kimberly Cram
Head of Commercial
Formosa 1 & 3
13 years relevant experience

Mark Norman
Technical Package Manager (Foundations)
Formosa 1 & 3
13 years relevant experience

John Senior
Commercial Package Manager (Foundations)
Formosa 1 & 3
30 years relevant experience

Julian Day
Technical Package Manager (Electrical & Onshore)
Formosa 1 & 3
20 years relevant experience

Pete Geddes
Technical Package Manager (WTG)
Formosa 1 & 3
12 years relevant experience

Sharn Ward
Permitting & Approvals Manager
Formosa 1 & 3
10 years relevant experience

Christian Tomaziu
O&M Manager
Formosa 1
28 years relevant experience

Kelly-Ann Ee
Work, Health, Safety & Environment (WHSE) Director
10 years relevant experience

Andrei Yang
Project Engineer
Formosa 1 & 3
8 years relevant experience

Jens Orfelt
Commercial Package Manager (Electrical & Onshore)
Formosa 1 & 3
10 years relevant experience

Key Points for Korean Market

Ability to learn from the Taiwan market and achieve the best result for the Korean OSW

Key Learnings

1. **Provide developers with clear transparent process to site control**

   —Developers are less willing to develop if there is large amounts of devex at risk before site control

2. **Grid availability**

   —Ensure that there is sufficient grid available, clear plans and commitment from grid companies to any reinforcements

3. **Clear mandate and support from Government for offshore wind**

   —Need to have a clear long term commitment from Government for offshore wind – offshore wind is a long term infrastructure asset

4. **Localisations**

   —Balancing Government's desire for local content versus ensuring enough price support to allow local market to upskill to be able to competitively participate in the market

5. **Bankability**

   —Need to ensure the PPA, grid connection agreement, EPC contracting structure and developer consortium are acceptable to financiers