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研究紀要

Financing Offshore Wind in Taiwan*

Charles Yates* **& *Mark Leybourne****

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** Master of Philosophy in Economics; University of Oxford; BSc (First Class Honours) in Economics & Accountancy; Bristol University. E-mail: charles@cmyconsultants.london.

*** Engineering Doctorate in Offshore renewable energy; University of Southampton; BEng in Aerospace, Aeronautical and Astronautical Engineering; University of Southampton. E-mail: mark.leybourne@itpenergised.com.

Abstract

This paper addresses how an estimated US$20bn of finance for 5.7GW of Offshore Wind (OSW) in Taiwan can be financed cost-efficiently over the next six years. Raising all this finance by 2025 will require a major co-ordinated effort by local and international banks using proven project financing techniques and accessing deep pools of global capital. There is a major opportunity for local banks to benefit from international collaborations and profit from lending to Taiwanese OSW projects and to the local supply chain. Continuing government commitment to OSW including sustained supportive policy, clear lines of communication with project developers and a structured approach to risk management are all required to attract low-cost, long-term funding at scale. To support the discussion on how to best finance Taiwan's offshore wind sector, this paper presents lessons from global best practice in financing OSW farms. These insights have been informed by experience raising equity and debt for European OSW farms.

Keywords: Offshore Wind, Project Finance, Risk Management, Policy Support, Taiwan

I. Introduction

Approximately US$20bn of finance for 5.7GW of Offshore Wind (OSW) in Taiwan is starting to be delivered by international developers and banks. While this finance is based on proven approaches to project finance from Northern Europe, significant innovation will be required to tailor these solutions for Taiwan – see Steffen (2018) for an introduction to project finance methods. Financiers, for example, will need to manage foreign exchange risk and to realise synergies between local and international banks. Doing this successfully will lead to commercial success and renewable electricity generation at scale.

The Taiwanese OSW boom is driven by the Government's ambitious renewable energy targets which depend on the development of OSW. According to Bloomberg NEF (2018), in 2017 renewable electricity accounted for 5.7% of total electricity produced and 16.6% of the total installed generating capacity in Taiwan. Government policy is to progressively phase out nuclear power and have an energy mix of 50% natural gas, 30% coal, and 20 % renewable energy by 2025.[1]

Beyond its 2025 target, the Taiwanese government is expected to set a target of 10GW of OSW to be operational by 2030, giving a positive signal to investors, manufacturers and developers that there is massive potential to further develop Taiwan's OSW market over the coming decade.

The Government's proposed reduction[2] of approximately 20% in the

1 Article 95 of the Electricity Act provides that nuclear energy power generation facilities will stop running by 2025.

2 The FiT for projects which signed their Power Purchase Agreements (PPAs) in 2018 was NT$5,849.8/MWh. In November 2018, the Government proposed that PPAs

2019 FiT for OSW caused some initial doubt about the future of this promising market, as is discussed in Watanabe et al. (2019). However, the OSW industry provided evidence of the high cost of local components and services such as OSW turbine foundations which led to a revision of this proposed tariff, as described by Russell (2019). A smaller reduction[3] in the FiT meant that projects are more likely to be financially viable and achieve financial close. Although uncertainties remain on how the revised FiT levels will impact the development and profits of OSW projects whilst meeting local content requirements, the industry is now starting to implement projects.

To achieve its renewable energy targets, the Government announced on 3rd July 2012, the “Thousand Wind Turbines Project”, ITRI (2015). This project is in three phases:

1. Demonstration round (2016-2020)
2. Transition round (2019-2020)
3. Zonal development round (2021-2025)

In July 2015, the Bureau of Energy released 36 Zones of Opportunity (ZoP) for future commercial wind farms. Almost all of the projects which make up the 5.7GW of capacity which have been awarded are in ZoPs (see Table 1). The projects awarded grid connections include two developer proposed zones that were outside of the ZoPs. The transition round and zonal development round projects were either awarded grid connections

signed in 2019 would get a FiT of NT$5,106/MWh, a reduction of 12.7%. In addition, the Government proposed limiting payments to the first 3,600 hours operations per year, and to end a fee structure that pays higher tariffs early in the project’s life to help service debt.

3 In January 2019, the Government decided that the 2019 FiT would be 6% lower than the 2018 Fit. Developers who sign their PPAs in 2019 can choose between a 20-year flat tariff of NT$5,516/MWh, or a tariff of NT$6,279.5/MWh for the first 10 years and NT$4,142.2/MWh for the subsequent 10 years. There is also a payment cap with three tiers.

Table 1: Offshore wind projects awarded

Zop	Developer	Approved (MW)	Year complete	Capex US$m
Demonstration / Transition projects				
Demo 2	Macquarie, Ørsted, Swancor	128	2019	587
Demo 3	Taipower	110	2020	505
Total demonstration		238		1,092
Awarded administratively 30 April 2018				
2	Wpd	350	2021	1,169
5+6	Macquarie, Swancor	378	2020	1,735
14	Ørsted	295	2021	984
15	Ørsted	605	2021	2,020
19	Northland Power, Yushan Energy, Mitsui	300	2024	1,002
26	Taipower	300	2024	1,002
27	CIP	100	2021	334
27	CIP	452	2023	1,509
29	CSC, CIP, Diamond Generation	300	2024	1,002
Zone B	Wpd	360	2020	1,652
Zone B	Wpd	348	2021	1,162
Zone C	CIP	48	2024	161
Total awarded administratively		3,836		13,730
Awarded in July 2018 auctions				
12	Ørsted	583	2025	1,573
14	Ørsted	337	2025	1,121
18	Northland Power, Yushan Energy, Mitsui	512	2025	1,709
19	Northland Power, Yushan Energy, Mitsui	232	2025	774
Total awarded in auctions		1,664		5,178
Grand total		5,738		20,000

Source: Press reports and Government announcements in 2018 and author estimates.

by an administrative process on 30th April 2018 and those awarded tariffs in a competitive auction in July 2018.

The competition for OSW projects in Taiwan has been fierce; the total amount of OSW capacity that entered the competitive process was around double that of the Government’s initial market aim. Both international and local developers see Taiwan as an attractive OSW market due to the strong wind resources, political will, ease of doing business and the lure of comparatively high OSW tariffs. Taiwan’s OSW resources are highly energetic and can exceed those found in the European North Sea. Unlike Europe however, Taiwan is prone to typhoons which bring extreme wind speeds which can exceed the design conditions of current OSW turbine models. Wind turbine OEMs are therefore developing technical solutions for extreme typhoon winds based on their existing technology proven in Europe.

Working with international and Taiwanese banks, project developers will need to raise an estimated US$20bn to fund the projects – assuming capital costs taken from Lazard (2018). In addition, substantial investment will be made by third parties, including the public sector, to develop supporting infrastructure such as port facilities and a stronger onshore electrical transmission grid.

The remainder of this paper consists of:

1. a case study of the financing of the Formosa 1 OSW farm
2. a brief history of finance for OSW farms
3. an introduction to the key risks to an OSW project
4. an overview of how project finance banks determine interest rates
5. the role of banks while a wind farm is operating and
6. thoughts on the future for OSW in Taiwan.

A. Case study: Financing Formosa 1

The first Taiwanese OSW farm to be project financed is the 128MW Formosa 1 which is Taiwan's second demonstration project. On 8th June 2018, the project sponsors Macquarie Capital (50%), Ørsted (35%) and Swancor (15%), raised a NT$18.70 billion (US$613 million) banking facility, including a tranche guaranteed by Denmark's export credit agency EKF – see Ørsted (2018).

This bank facility, which has a tenor of 16 years, will be used to fund the development of Phase 2 of the project and to refinance the debt raised for Phase 1. Construction of the project is now underway and is expected to be completed by late 2019.

Eleven banks participated in the facility with BNP Paribas acting as the financial adviser and mandated lead arrangers. The remaining banks combine local knowledge with OSW experience: Cathay United Bank, Credit Agricole CIB, Société Générale, Taipei Fubon Commercial Bank, KGI Bank, ING Bank, DBS, ANZ, MUFG and Entie Commercial Bank.

II. Project finance for Taiwanese offshore wind

Historically, OSW investment and financing strategies in Europe have tended to be based on equity investments funded on the balance sheets of large utilities, Ioannou et Al (2017). In recent years, as the sector has matured, risks have reduced and non-recourse debt financing, known as project financing, has become commonplace with developer equity typically having a smaller stake in projects, Arapogianni and Moccia (2013). Further accounts of the evolution of OSW financing in Europe can be found in the papers by Guillet (2011) and Wadham (2018).

Approaches to financing in Taiwan will be based on project financing solutions proven in Northern Europe, however, significant innovation will be required to tailor these solutions for Taiwan – some of these general financing challenges are discussed by Karltorp (2016). For example, approaches are needed to manage foreign exchange risk, to realise synergies between local banks who understand Taiwan and international banks who understand OSW, and to develop the local supply chain. Furthermore, projects are required to source at least 20% of their debt from local banks: This is a major opportunity for local banks to learn from international collaborations, and to profit from lending to OSW projects and the emerging local supply chain. Lending to the local supply chain will also help banks understand the projects risks associated with locally supplied good and services.

The French bank Société Générale has issued green bonds in NT$ to fund renewable energy projects in Taiwan, including the project financing of Formosa 1 as described by Schwob (2018). The total issue size of NT$1.6 billion is split into a five-year tranche of NT$900 million, a ten-year tranche of NT$500 million and a 15-year tranche of NT$200 million, at respective interest rates of 0.85%, 1.12% and 1.63%. These bonds are an example of international banks raising low cost finance in New Taiwan Dollars, managing forex risk and supporting OSW projects.

Innovations will include institutional investors actively engaging prior to financial close to shape contractual and financing structures which meets their requirements.

To deliver cost-effective finance on the scale required by the future Taiwanese OSW projects, equity and debt investors must:

1. Clearly define, estimate, mitigate and allocate risks including several ‘novel’ risks such as earthquakes and typhoons – which the industry has limited experience with
2. Arrange sound, highly leveraged finance (a financing with debt

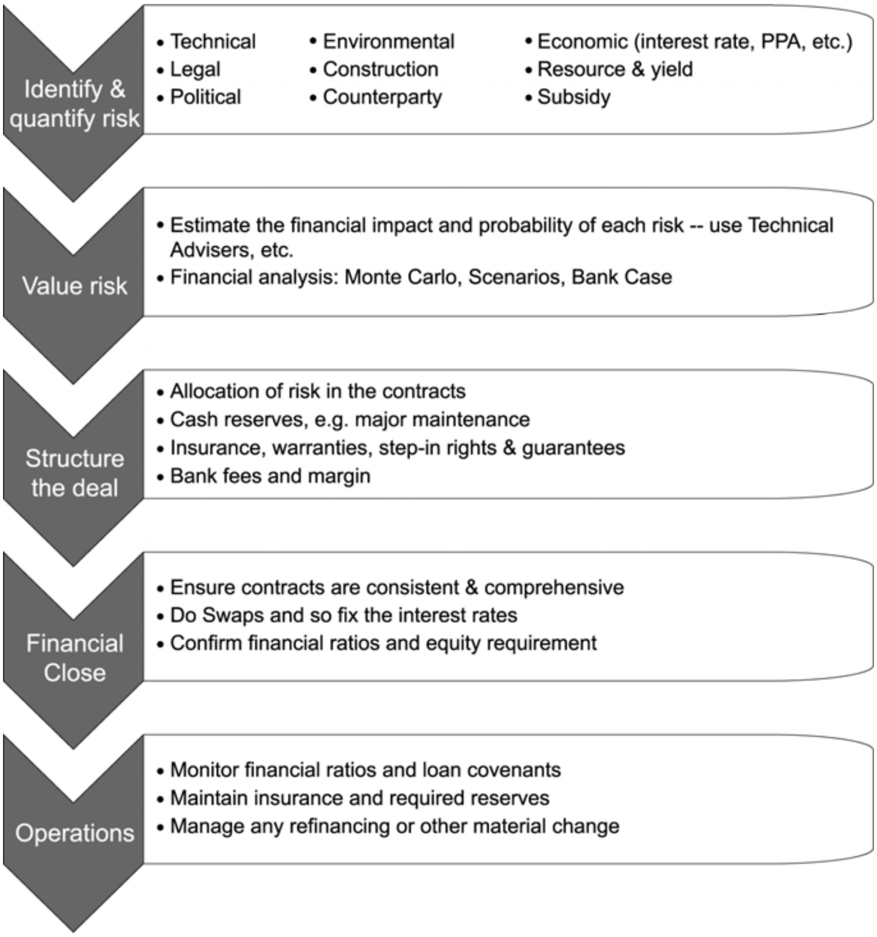
comprising say 70% of the total finance) with the flexibility to refinance and recycle capital into other projects

3. Drive down the cost of capital by taking advantage of low risk, long term cashflows while managing development, resource, construction, operation, power price and political risk using experienced developers and suppliers with a strong track record
4. Engineer project cost and revenues which are robust and provide an acceptable risk/return ratio
5. Have confidence in the Government's political commitment to OSW, supported by an ambitious OSW programme, a high Feed in Tariff, PPAs with Taipower, timely and deliverable plans for supporting infrastructure (grid, ports, etc) and a warm welcome for foreign investors. Note that the standard Taipower PPA does not provide investors with enough confidence that the revenue from OSW projects is low-risk. However, Taipower has signed side letters with projects which give sufficient certainty that projects will receive the PPA price.

There is a proven project finance lending process by which a project is analysed, optimised, financed and then operated (see Figure 1). Banks will work through this process with their technical advisers and lawyers, and use financial models of the project to test how robust the project cash flows are. Banks will focus on having adequate "head room" between expected project cashflows and the cash required to make timely and full debt service payments.

Throughout the life-cycle of the project, the banks will monitor the wind farm and intervene if their interests are threatened. Normally banks play an important and active role early in the project, understanding the project risks, structuring contracts and approving key documents such as the construction contracts. Once the project is operational, banks will be less active if the project is proceeding according to plan. However, if cash flows are significantly lower than expected or the sponsors want to refinance the project[4] then the banks will engage actively to protect their interests.

Figure 1: Life cycle of an offshore wind project financing



Source: Authors

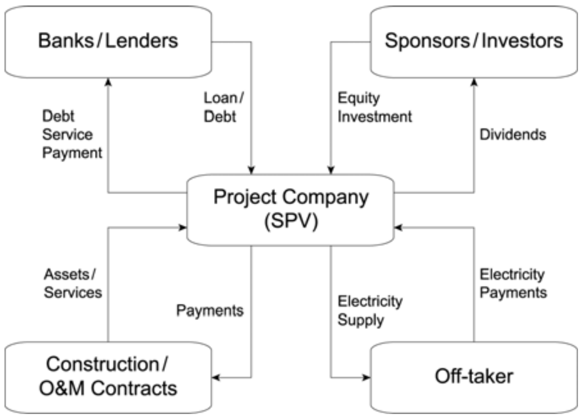
4 Issue new debt, normally on more favourable terms, which will be used among other things to repay the original debt.

A. Managing project risks

In project financing, lenders look to the project revenues as the source of repayment and security for their loans and will use these to manage their risks. The lenders have little or no recourse to the project sponsors and hence if cash flows from the project are insufficient to make full and timely debt service payments (interest plus debt repayments), the value of the loans may be impaired. To reduce the risk of such a loss, banks will critically review all key aspects of the project and put in place insurance policies and other mechanisms to protect their financial position.

To ensure that banks do not have recourse to the project sponsors, the project is structured as a Special Purpose Vehicle (SPV) which shields sponsor's assets in case of failure – see Figure 2. The SPV will be restricted to operating this project and the bank loans will be made to the SPV. As security for their loans the banks will have a charge over all the SPV's assets, guarantees and cash flows as well as the right to "step-in" and take control of the SPV if the project experiences difficulties.

Figure 2: The key relationships for an OSW SPV under a project financing.



Source: Authors

Typically, the lenders and investors will undertake due diligence reviews of the project and its financing using independent third parties. The aim of these reviews and assessments will be to identify the risks to a project and estimate their likelihood and severity.

In some cases, an initial review by the financier may find the project too risky to fund; this will depend on the risk appetite of the financier and whether they think that the risks could be sufficiently reduced by mitigations such as modifications to the design, the project's capital structure or the contracting structure.

While banks are increasingly comfortable with the risks associated with an operating OSW farm, they tend still to be wary of construction risk. Hence, until recently it has been difficult to get project finance for OSW projects during the construction period. In many cases, during construction the project is financed on the balance sheet of a major utility, or group of utilities. Once the project has successfully become operational, the SPV can borrow on a project finance basis and return some or all the proceeds from the loan to the utilities who financed development/ construction. Often utilities will "recycle" these funds into the development of other projects and so the utilities can continue to grow their OSW project portfolio.

As repayment of project debt is exposed to project risks, bankers drive rigorous risk analysis and mitigation in the project. This "due diligence" will be carried out by experts employed by the banks and specialising in engineering, OSW technology, complex legal contracts and modelling of the cash flow and financing of major infrastructure. Rigorous risk management has contributed to improvements in OSW technology (notably the wind turbines and offshore electrical infrastructure), the management of the construction of the wind farms, and risk allocation through contracting strategies and the performance guarantees provided by original equipment manufacturers (OEMs).

Weather risk is important during construction and if rough sea conditions delay the installation of the offshore infrastructure this can have a knock-on impact on the whole project. This topic is discussed in greater depth in Ahlgren & Grudic (2017). Although a probability of occurrence can be attached to the weather risk, the economic consequences of a delay is often too big for subcontractors or suppliers to be solely responsible for – subcontractors would require a large risk premium. Therefore, it is normal practice for the installation contractors and the project sponsor to share this risk and for the project to have contingencies for weather related delays and cost over-runs.

Experienced and expert staff are key to successful risk management for OSW projects, particularly for construction risks. Input from trained and experienced staff in several disciplines is the best way to identify, quantify and mitigate risks. The risk management process should build upon experience of other similar projects but also reflect the specifics of the project (sea conditions, turbines, seabed etc) and improvements in risk mitigation such as larger construction vessels which can operate in rougher weather.

Banks providing project finance loans will require low exposure to risks. Important factors which give banks comfort include:

1. A stable or predictable long-term price for the power generated. This will often be due to a secure Government backed subsidy regime with strong and sustainable political support. Alternatively, a long-term Power Purchase Agreement (PPA) which guarantees a stable power price and route to market for the power generated by the project. For banks to confidently rely on a long-term PPA, the off-taker must have a low risk of default, e.g. a public body such as Taipower or a major and financially strong company such as Taiwan Semiconductor Manufacturing Co Ltd.
2. The equipment used in the project should have previously proven its reliability and this applies particularly to wind turbines which

are vital to the generation of power. If a critical piece of equipment does not have a long and strong operational track record, this can be compensated for by strong performance guarantees from a highly credit worthy counter-party. These guarantees normally include those provided by the turbine manufacturer such as MHI Vestas or Siemens Gamesa.

3. Banks also require the project sponsors be financially and technically strong and have a significant exposure to the project. As project equity takes the first financial loss if the project experiences issues, it provides a cushion for banks (a mild shock may reduce equity returns without preventing full and timely debt service payments) and incentivises the project sponsors to manage the project to optimise cash flow and manage risk.
4. If the banks are providing finance during construction and are exposed to construction risk,[5] they will require that the key construction partners are creditworthy and capable. Banks will also require that the installation contractors have the required experience, are financially secure, have a prudent installation plan and will contribute to any cost overruns. The banks will seek evidence that the installation plan allows a contingency for bad weather, and that the installation vessels can deal with the likely weather and have enough time within the construction programme.
5. Multilateral banks and Export Credit Agencies (ECAs) have successfully attracted new sources of capital to OSW projects. They can play a key role by taking risks through providing construction finance and taking first loss pieces which reduce the risk taken by other financiers.
6. To manage risks during the long operating period of an OSW farm,

[5] In some projects, banks lend during the construction period but do not directly take construction risk. Rather the project sponsors take all the construction risk by committing to protect the bank’s financial position, perhaps by funding cost overruns with equity. if there are difficulties during construction.

the banks will critically review the operation and maintenance contracts to ensure that they are robust and include appropriate contingencies.

7. A robust and comprehensive project insurance package will assist with risk management and increase the security of the project. Detailed analysis will ensure that the insurance package covers all the required risks and that the insurance wording provides the necessary coverage. It is generally more efficient for the Project Company to manage a comprehensive insurance package for the entire project. In this way the interfaces between different insurance policies, the coverage provided by different insurance providers and the interfaces between the tasks performed by the various project participants (sponsor, construction contractors, operation and maintenance (O&M) contractors, etc) will not result in overlaps or gaps in coverage.

III. Key risks

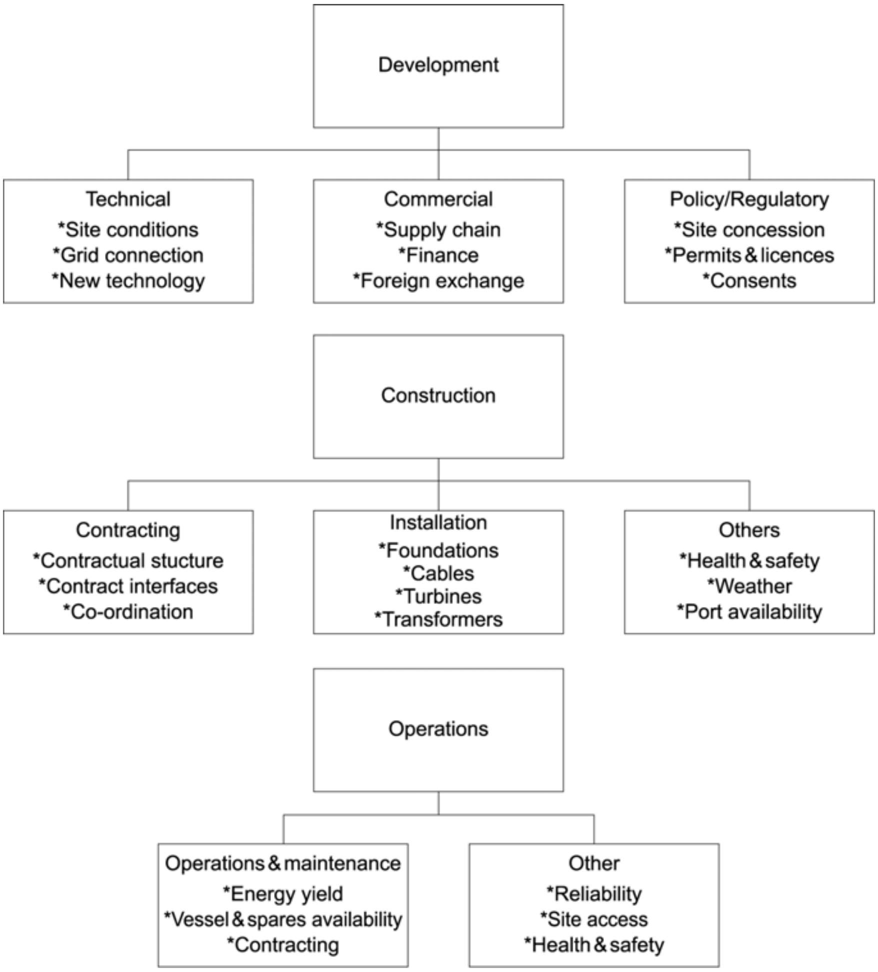
A perception of high project risk by investors and lenders will result in an increased cost of capital and, in some cases, may prevent investors and lenders committing at all.

Risk identification, assessment, management and mitigation are especially important in OSW projects because of their high upfront capital cost. A large investment is required early in the project followed by a long-period, typically around 25 years, during which the project generates revenue. Once the project has been constructed, the investment is committed and the project risks are significantly reduced.

Key project risks can be presented in a simple risk timeline (see Figure 3). The hierarchy illustrates risks during the three stages of the project life-cycle: development, construction and operations & maintenance.

The most important risks, and the loss resulting from crystallization of the risks, change substantially over the project life-cycle with the smallest amount of money at risk during the development stage, during construction large losses are possible and operational risks endure for the longest.

Figure 3: Offshore wind risk timeline



Source: Authors

For each of these key risks, the potential impact of the risk is estimated as part of the due diligence. This can be done based on inputs from technical and other advisers, the lender's experience with other OSW projects and analysis using the project's financial model.

For each risk the probability of it crystallising (i.e. an event occurring), its timing and its impact on the following is identified:

1. Costs (capital and operating)
2. Project timetable
3. Revenue after allowing for any subsidies paid to the project and any Power Purchase Agreement (PPA)

To estimate the value of a risk, the project model is run assuming that the risk crystallises and the effect on project cashflow and the ability to repay debt on time is assessed. The difference between the base case and the case in which the risk crystallises (the Risk Case) is the 'value of the risk'. For example, if the technical advisers find evidence of the risk of a 15% increase in operating costs, this Risk Case would be created by running the project financial model with operating costs increased by 15% in each year of operations. This Risk Case would then be examined to show the reduction in project returns, whether there is sufficient cash flow to make all debt service payments on schedule and to evaluate the deterioration in the financial ratios.

In valuing risk, the project financial model is typically used to carry out some or all the following analysis:

1. **Bank case:** a downside scenario which combines several risks crystallising, e.g. a 10% construction cost over-run and a 5% reduction in power output
2. **Scenario Analysis:** a technique for analysing possible future events by considering alternative possible outcomes (sometimes called "alternative worlds")
3. **Monte Carlo Analysis:** a statistical technique used to understand

the impact of risk and uncertainty in financial models. The variables being analysed are assumed to have a particular probability distribution, often a Normal Distribution, and the resulting distribution of project returns is estimated.

An example of the use of Monte Carlo analysis in the estimation of levelized cost of energy (LCOE) for OSW is presented in Ioannou et Al. (2016). This paper discusses different combinations of uncertainties in project costs and energy yields and is similar in approach to the models used for planning project finance deals.

IV. Interest rates and Bank fees

Debt for a windfarm is normally priced based on the underlying cost of funds to the lenders plus a fixed component (or “margin”) to cover default risk and the lenders’ other costs. Other costs include operating costs, the opportunity cost of capital allocations (e.g. the regulatory capital required to support the loan) and profit.

The margin will be determined by the lender’s perception of the residual risks to debt repayment once all the mitigations have been applied. This will be based upon the risk assessment and analysis undertaken by the lender and its advisers during their due diligence review of the opportunity.

The underlying cost of funds is typically based on floating interest rates (i.e. rates that fluctuate with market movements) such as interbank lending rates. In contrast to these floating rates, the revenues received by the Project Company do not generally change with financial market movements. This mismatch is typically remedied using an interest rate swap, through which the Project Company pays a fixed interest rate (this is referred to as “hedging”). The swaps used to hedge interest costs may result in “breakage costs” in certain termination situations.

A bank will normally charge fees to cover administration and out of pocket costs incurred to make the loan. Some of these fees are charged upfront and others are ongoing charges paid each year during the loan life. Typical bank fees include:

1. A loan arrangement fee
2. A commitment fee, often 50% of the loan margin
3. A modelling fee, particularly when a lead bank carries out the financial modelling on behalf of a banking syndicate
4. An agency fee where a lead bank monitors and administers the loan on behalf of a banking syndicate
5. A syndication fee
6. Fees to cover the cost of due diligence and advice by lawyers, advisers, any credit rating agency, etc

V. Operations

Following financial close, one of the lending banks is typically appointed to monitor the project’s progress and adherence to schedules and specifications, usually working with the independent engineer (lender’s technical adviser) to coordinate fund disbursements against a project’s actual achievement. Once the project is operational a bank will monitor the project to ensure compliance with the financial ratios and banking covenants. This will include maintaining the agreed project insurances and building up any reserves required by the loan documentation.

The financial model and the viability of the project are dependent on the projected costs of operations. If an operating cost increases, lenders will want to be protected to the extent that it will impact the cash available for debt service. For instance, insurance is one of the key costs of operation of an OSW project. To some extent, costs can be locked in through contracts but there will be some costs that are not hedged and the lenders will want to ensure that cost variability is limited. For instance, to ensure that there is headroom in the financial model for increased costs or that the cost of insurance can be managed by varying the level of cover. Another key cost in operations will be the cost of workers and an assumption for wage inflation is usually built into the financial model by reference to an index such as the retail price index. It is important to ensure that the index covers increases in the specific costs incurred by the project.

The other key risk during the operations period is performance. The investors are likely to have chosen an experienced operator for the project but there will be operating risks such as out of warranty equipment failures and the Project Company failing to meet performance requirements and so facing penalties and even the risk of termination of the PPA. Lenders will seek to mitigate these risks through warranties and step-in rights. Lenders will also tend to prefer long-term O&M agreements with much of the risk passed on to the third-party providers.

A. Refinancing

When project construction is complete, the project risks reduce and the Project Company may choose to prepay the project debt and refinance with new debt at a lower interest rate and / or with a longer repayment period. In deciding whether to refinance, any bank prepayment fees, and hedge breakage costs need to be considered by the Project Company. Breaking the interest rate hedges may be permitted only with the payment of a ‘make-whole’ amount. This is calculated to compensate the hedge provider for the profits lost as a result of breaking the hedge.

If a new lender enters the project, the lending cycle will start once again, with the new bank assessing the risks it is taking, the cost if those risks crystallise, and the subsequent structuring of the loan. This process will typically start with a due diligence review of the project by independent, third party advisers. The review will identify and assess all mitigated and residual risks to the project to provide the lenders with a solid understanding of the likelihood that the project will make all future debt service payments on time.

VI. Future challenges and opportunities

The Taiwanese OSW programme has rapidly gathered momentum and now sustained effort is required to successfully deliver operational projects. Within a few years, the Government has successfully awarded licences for 4.1GW and auctioned off a further 1.6GW and it is likely that additional capacity will be added to this programme after 2025. The first commercial scale project, Formosa 1, has been financed by banks and is expected to be operational in 2019. However, raising the US$20bn required by 2025 to finance these projects will require a major, co-ordinated effort by local and international banks and the programme timetable has no allowance for major delays that could be caused by external factors such as future elections.

Taiwanese OSW projects pose many of the same financing risks found in European projects but there are also some specific local risks. Earthquakes, typhoons and political risks are key differences which are challenging to appropriately mitigate to make the risk acceptable to lenders and reduce the cost of finance. International lenders will have comfort in that the Taiwanese projects will either be led by experienced European OSW developers or capable local developers, supported by experienced European contractors. Initially, international lenders will lead most of the debt financings and include local banks in lending syndicates. As the local banks become more familiar with lending to OSW projects and assessing their risks, they are likely to take a more prominent role in financing OSW projects. Furthermore, there is likely to be a large role for local financiers in the refinancing of projects during their commercial operations.

At the same time as meeting the financing challenge, the rapid construction of several major wind farms and supporting infrastructure will be required. The international OSW supply chain is prepared to provide expertise, key equipment such as turbines and experienced management. Locally there will be demand for many Taiwanese technicians with the skills and training to carry out construction and O&M activities. Major works will be required to prepare ports with OSW construction facilities, and to strengthen the electricity grid so that it can reliably transmit, even at times of high wind, all the power produced to load centres such as Taipei. Taipower’s standard PPA allocates the significant risk of grid congestion to the project owners who are not able to manage that risk. We expect that the side letters which Taipower has issued with PPAs mitigate this risk for investors.

There is an important role for local banks to finance the Taiwanese OSW supply chain so that it can expand and increase its range of capabilities more quickly. For the local supply chain to achieve its full potential, it will need to invest in specialist equipment, staff training, large specialist vessels and new facilities such as large port-side lay-down areas for turbines, foundations, etc. Local banks have relationships with the supply chain and can provide finance which will effectively meet the needs of the supply chain. As well as creating a significant lending opportunity for local banks, it will also help them to build their expertise in OSW technology, reduce the risks associated with long supply chains stretching to Europe and to understand and get comfortable with supply chain risks.

While the early projects will have a high import content, the local content must rise over time to cut costs and to sustain political support for OSW. Delivering local content quickly can be challenging and requires investment in a wide range of new engineering facilities as well as training a large local work force in a variety of specialist skills. It will be critical to manage the quality and performance of new contractors to mitigate project risks.

The determination of the Taiwanese Government to make its OSW programme a success coupled with the vigorous response from the local and international OSW supply chain gives grounds for confidence that the projects and programme will be successful. As the local OSW supply chain matures it will seek opportunities to expand further by making Taiwan a hub for the development, construction and management of OSW farms elsewhere in Southeast Asia.

Glossary

Capex	Capital Expenditure.
Cash flow	The amounts of money being transferred into and out of a business over a specified period (often a year).
Corporate finance / on – balance sheet financing	Includes all investments in wind power generating and transmission assets financed either through the equity of project owners or through debt raised at corporate level.
Power purchase agreement (PPA)	A long-term bilateral agreement for the purchase of power from a specific renewable energy project.
Credit rating agency	A company that assigns ratings of a debtor's ability to pay back debt by making timely interest and principal payments.
Debt principal	The amount of debt due and owing to pay off the underlying obligation, less interest or other charges. Initially the principal is the amount of the loan.
DCSR	Debt Service Cover Ratio. It is the ratio of cash available for debt service to the sum of interest, principal and lease payments. The DSCR is normally calculated on an annual basis
ECA	Export Credit Agency.
FiT	Feed in Tariff.
Interface risk	Risks that arise where different contracts or guarantees interface due to lack of clarity of responsibilities and allocation of risks.
Key financial ratios	The key financial ratios used by banks to size their debt and to monitor performance of the debt. These ratios include the DCSR and LLCR
LCOE	Levelised Cost of Energy.
Letter of credit	A facility, usually provided by equity holders or a bank on their behalf to demonstrate that they have funds available for the project under circumstances specified in the project agreements.

Capex	Capital Expenditure.
LLCR	Loan life Cover Ratio. It is the ratio of the NPV of cash available for debt service to the NPV of interest, principal and lease payments. The NPV is calculated using the interest rate on the debt.
Non-recourse debt	Debt raised in project finance transactions.
Non-recourse project	The project is established as a separate company and lenders are repaid only from the cash flow generated by the project or, in the event of failure, from the value of the project's assets. Lenders therefore do not have any recourse to the owners or equity investors of the project.
NPV	Net present value is the difference between the present value of cash inflows and the present value of cash outflows.
O&M	Operations and Maintenance.
OEM	Original Equipment Manufacturer.
Project bond	Includes bonds issued at project level, the proceedings of which will be used to finance a specific project.
Project finance	A general term to describe financing a project through non-recourse debt and equity provided to a special purpose vehicle set up with the sole aim of constructing and operating a project. The term is also used to describe the debt finance provided through this means.
Project Owner	The owner is responsible for the day to day running of the project.
Project sponsor	A sponsor is responsible for the allocation of finance within a project and ensures that the project meets its long-term objectives.
Refinancing	The repayment of existing debt by the issue of new debt. Often the new debt is for a larger amount or on more favourable terms, e.g. with a lower interest rate.
SPVs	Special Purpose Vehicle.

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論台灣離岸風力發電融資

Charles Yates** & *Mark Leybourne**

摘　　要

本文主要說明如何以符合成本效率的方式在未來六年爲臺灣 5.7GW 的離岸風力發電提供約 200 億美元的融資。爲在 2025 年前達成籌資目標，需要本地與國際銀行共同協調運用國外普及之專案融資技術與資本評估方式才能有效推動。對本地銀行而言，不僅有機會從國際合作中獲益，亦能因提供融資給臺灣離岸風力發電專案及本地供應鏈業者而獲利。此外，政府需持續致力於離岸風力發電之相關承諾，包括持續的支持性政策、與專案開發商保持明確溝通管道以及結構化的風險管理方法，以吸引低成本且長期的大規模資金。有鑑於此，本文彙整全球最佳風場之融資專案案例，以及歐洲離岸風力發電風場之籌集資金和發行債券等經驗，爲臺灣離岸風力發電融資之相關議題與討論提供參考依據。

關鍵詞：離岸風力發電、專案融資、風險管理、政策支持、臺灣

* Master of Philosophy in Economics; University of Oxford; BSc (First Class Honours) in Economics & Accountancy; Bristol University.
E-mail: charles@cmyconsultants. london.

** Engineering Doctorate in Offshore renewable energy; University of Southampton; BEng in Aerospace, Aeronautical and Astronautical Engineering; University of Southampton.
E-mail: mark.leybourne@itpenergised.com.