EXCEEDENCE
MAKING RENEWABLES COMMERCIAL

Case Study 2 - Belmullet Wave Energy Project

This exercise involves building a project with the following parameters shown in Table 1. Note that the values used in this project are purely for the purposes of showing the functionality and are not intended to be representative of real projects or the devices used in the case study.

Project Details

Farm Technology	Wave Energy
Farm Size	200 MW
Currency	Euros
Operating Duration	20 Years
Pre-development Years	3 Years
Decommissioning Years	4 Years

Table 1: Belmullet Wave Energy Project Details.

Select Resource

Location and Year	Belmullet 50 1995

Select Device

Device	Generic F-OWC 3310kW
	Generic F-2HB 1000kW

Calculate Energy

Loss Factors	
Farm Factor	
- **Curtailment Loss Factor**	90%
- **Constraints Loss Factor**	91%
- **Transmission Loss Factor**	92%
Device Factors	
'Generic F-OWC'	
- **Array Loss Factor**	95%
- **Availability Loss Factor**	90%
'Generic F-2HB'	
- **Array Loss Factor**	85%
- **Availability Loss Factor**	80%

Note a message will appear for both devices notifying the user that Exceedence Finance will perform the energy calculation using the converted scatterplots and not the original. Click OK to both messages.

EXCEEDENCE
MAKING RENEWABLES COMMERCIAL

CAPEX

Capex	Simple Breakdown of Capex per farm
Devise Cost	€450,000/MW
Balance of Plant	€350,000/MW
Cabling/Piping	€250,000/MW
Moorings/Foundations	€150,000/MW
'Component Lifetimes for Salvage' - **Moorings lifetime** - **Cabling lifetime**	 17 years 25 years
Staggered Capex - **Year -3** - **Year -2** - **Year -1** - **Year 0**	 10% 20% 30% 40%

OPEX

Opex	Total Yearly Opex per farm
Annual Cost	€20m per year €40m the year that the moorings have to be replaced ('Show additional Info')

Salvage & Decommissioning

Salvage	
- **Device Salvage** - **Other Salvage** - **Cable/Piping Salvage** - **Moorings/Foundation Salvage**	5% of Device Initial Cost €1m €10,000/MW 10% of Moorings/Fountation Initial Cost
Staggered Salvage	20% per year
Decommissioning - **Decommissioning Value**	 €500,000 per year

Financial Module

Revenue Inputs - **Revenue Basic Inputs**	FIT included, fixed rate of €400/MWh
Discounting and Inflation Options	Apply Cash Flows in Nominal Terms
Nominal Discount Rate	6%
Inflation Rate	2%
Debt/Equity Ratio	40/60

Debt Term (Years)	12 years
Borrowing Rate	3%
Monthly Loan Repayments	
Begin repayments Year 0	
Tax and Depreciation	Tax Rate 5%
Device Cost	100%; 'Straight Line'; 15 years
Cabling and Piping	100%; 'Variable'; 40% (Yr1), 30% (Yr2), 20% (Yr3), 10% (Yr4)
Mooring and Foundations	100%; 'Single year'

Results

Net Present Value (NPV) €	$55,350,369
Levelised Cost of Electricity (LCOE) €/MWh	$457.79
Internal Rate of Return %	9.39%
Capacity Factor 'Generic F-OWC'	7.16%
Capacity Factor 'Generic F-2HB'	8.69%

Sensitivity Analysis

1. Parametric Sensitivity
    a. What happens to the LCOE if you compare the nominal discount rate of 6% (base) to a nominal discount rate of 4% and 8%?
    b. What happens to the NPV if you compare the fixed Revenue of 400€/MWh to a fixed revenue of 500€/MWh and 300€/MWh?

2. Fine Tuning Sensitivity
    a. What happens to the LCOE and NPV if you decrease the CAPEX by 20% and increase the annual delivered energy by 20%?

3. Goal Seek Sensitivity
    a. How much energy would have to be delivered annually if the LCOE is set to 300€/MWh?
    b. How much would CAPEX need to decrease if the LCOE is set to 300€/MWh?

Charts

Go to 'Select Resources'. Find Belmullet 50m 1995 and click 'View Location'. Under tab 'Wave' select 1995 and display Scatterplot for percentage occurrence and hour occurrence. What wave height is most frequent? How many hours does this wave height occur at?