Case Study 3 - EMEC Wave and Wind Energy Project

This exercise involves a pre-loaded project with the following parameters shown in the different sections below. 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. This exercise will investigate larger changes to the different tabs in ExceedenceFinance.

Original Project Details

Farm Technology	Combination Wave and Offshore Wind
Farm Size	300 MW
Currency	US Dollars
Operating Duration	20 Years
Location and Year	EMEC 2005
Devices	Generic F-3OF 1665kW & Vestas V90 3000kW 'Power Law Exponent' of 0.142
Capex **Generic F-3OF** **Vestas V90 3.0MW**	Detailed Capex Farm Share and Interarray Cabling/Piping Electrical Cabling 'Moorings' 'Foundation'
F-3OF – Device Costs - **Hull** - **PTO** - **Control System** - **Miscellaneous**	 $850,000 $1,000,000 $350,000 $750,000
F-3OF – Balance of Plant - **Balance of System**	 $1,000,000
F-O3F – Moorings - **Mooring Line** - **Anchor** - **Deployment**	 $250,000 $150,000 $350,000
F-3oF – Cabling (Whole Farm) - **Export** - **Substation** - **Onshore** - **Interarray**	 $15m $25m $20m $10m
V90 – Device Costs - **Turbine** - **Tower** - **Blades** - **Transition Piece**	 $255,000 $250,000 $550,000 $550,000
V90 – Balance of Plant - **Balance of System**	 $500,000
V90 – Foundations - **Materials** - **Fabrications** - **Transport**	 $100,000 $100,000 $100,000
Opex **'Planned O&M'**	Breakdown Total Opex per Farm Fixed $20m per year

'Unplanned O&M' **'Spare Parts'**	Variable ($10m every year except for year 5, 10, 15 and 20 - $20m) Fixed $15/MWh
Revenue Inputs - **Revenue Basic Inputs**	'Fixed' $100/MWh (CHANGE TO **$160/MWh)**
Input per Annum - **Grant**	$10m per year for first 5 operating years
Apply Cash Flows in Nominal Terms - **Nominal Discount Rate** - **Inflation Rate**	6% 3%
Debt/Equity Ratio	50/50
Debt term	20 years
Borrowing Rate	2% Annual Repayments
RESULTS **Net Present Value (NPV)** **Levelised Cost of Electricity (LCOE)** **Internal Rate of Return %**	 $339,438,662 (CHANGES TO $1,255,312,153) $105.62/MWh (SAME) 16.54% (CHANGES TO 38.70%)

Questions

1. An investor sees this project and thinks there must be a mistake in the calculations with an IRR of 38.70%. They have some concerns that the mistake might in the resources or in the energy calculations. Find the mistake and fix it. Their threshold is an IRR of 12%. After fixing the issue does the project deliver above that threshold?
   Add the missing losses to each of the devices (use similar values as in Case Study 2)
   Curtailment loss factors: 90%
   Constraint loss factors: 91%
   Transmission loss factors: 92%
   Wave Array loss factor: 95%; Availability loss factor: 90%
   Wind Array loss factor: 85%; Availability loss factor: 80%

   NPV 206,753,436
   LCOE 183.04
   IRR 12.80%

   NOTE: Total OPEX is reduced by this change as well due to the cost of Spare parts being set as 'fixed' $15/MWh → less MWh are produced with losses taken into account

2. At what interest rate from the bank does the project not make any more sense? What is a reasonable interest rate for this project?
   NOTE: borrowing rate is low at 2% but we'll keep it at that for this exercise so as not to change too much…
   A nominal discount rate of 12.8% is the maximum for positive NPV about that and NPV goes into negative digits.
   Ray was saying that real interest rate is at 3.5% in the current climate? Which would mean that nominal interest rate should be 6.6%

   NVP 180,790,588
   LCOE 184.95 $/MWh
   IRR 12.80%

3. Project Operator is interested in buying the project. However, they are concerned about the risk of getting a grant. What happens to the project viability if there is no grant?

   NPV 135,633,856
   LCOE 184.95 $/MWh
   IRR 10.98%

4. With this new information how much does CAPEX need to decrease to produce an IRR of 12%? How does this affect LCOE and NPV?

   CAPAX needs to decrease to 584,608,459.47
   LCOE ~180 $/MWh
   IRR 12%

5. Export the results from Q.3 to Excel
6. Save and Close down current project. Compare Ex1, Ex 2 & Ex3
   a. Which would you invest in and why?
   b. How could you improve the other projects?