

European Scalable Offshore Renewable Energy Source (EU-SCORES)

D7.8: Report and case studies from use of SCORES
Financial Analysis Platform

March 2025

Delivery Date	11 th of April 2025
Dissemination Level	Public
Status	FINAL
Version	V2
Keywords	Financial modelling, Sensitivity Analysis, Optimisation, Combined Projects, Co-located Projects, wave, wind, offshore solar

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Document Information

Grant Agreement Number	101036457
Project Acronym	EU-SCORES
Work Package	WP7
Related Task(s)	T7.3
Deliverable	D7.8
Title	Report and case studies from use of SCORES Financial Analysis Platform
Author(s)	Exceedence Ltd.
File name	D7.8 Report and case studies from use of SCORES Financial Analysis Platform_V2_11.04.2025

Revision History

Revision	Date	Description	Reviewer
1	28.03.2025	Final	Ray Alcorn
2	11.04.2025	Consortium Review	Consortium



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1. Executive Summary

This deliverable, D7.8 Report and case studies from use of EU-SCORES Financial Analysis Platform, aims to provide a summary document along with case studies. It will outline the features and functionality of the Exceedence software, Exfin, along with case studies describing how it was used to analysis and optimise representative offshore multi-source park scenarios.

The deliverable briefly introduces Exfin, what it is and how to build a financial model. It also describes the new features added throughout the EU-SCORES project: Data Ownership, User Levels, Combined Projects, and Portfolio Analysis.

The deliverable then presents one overall case study, where the two different workflows to combine projects for a hypothetical multi-MW wind and wave park scenario is described. The case study details the different inputs and outputs along with also showcasing the sensitivity analysis module with Exfin: key cost driver analysis, goal seek, fine tuning and Portfolio analysis.

The case study shows that where technologies are combined or co-located using the same lifetimes and underlying financial drivers, then they can combined at a technology or yield level. On the other hand, where the underlying financial drivers are different between technologies, individual financial models for each technology are required. Once the cashflow is generated for each individual technology can the cashflows be synthesised to combined KPIs.

The overall results from the case study are consistent with the EU-SCORES project outcomes showcasing that co-locating/combining projects can greatly incentivise new technologies such as wave energy with a minimal increase in LCOE.



2. Introduction to Exfin

2.1 What is Exfin

Exfin is a user driven cloud based standardised techno-financial software tool that allows the user to quickly and intuitively build, analyse and optimise any number of renewable energy projects and then presents them in a sophisticated analysis and comparison dashboard. It allows the user to focus on analytics and to identify and reduce risks early on. One of the main appeals of this software is its sensitivity analysis features, which allows the user to quickly assess “what if” questions among other things.

KPIs	Analytics
<ul style="list-style-type: none">• Overview<ul style="list-style-type: none">• All key inputs• Financial<ul style="list-style-type: none">• LCOE, IRR, NPV, NPV/MW, ROI, Payback Period, Discounted Payback, Equivalent Annualised Charge• Full lifetime cashflow sheets• Technical<ul style="list-style-type: none">• AEP, ADE, Capacity Factor	<ul style="list-style-type: none">• What if and Optimisation<ul style="list-style-type: none">• Parametric Sensitivity• Goal Seek• Tornado View• Multi project Comparison• Reporting<ul style="list-style-type: none">• View• Export

Exfin has been calibrated against a number of existing financial tools including case studies with one of the big four accounting firms. To date, it has been used for prospecting, project development, product development, tariff analysis, test site development, and investment decisions. It has also been used in consulting projects and tenders for cost benefit analysis of materials, components lifetimes, blade types and locations.

2.2 How to build a project in Exfin

Exfin has an intuitive workflow, illustrated by the flow chart in Figure 1. The technical aspects of the model consist of location/resource and device selection. The financial aspect of the model requires development expenses (DEVEX), capital expenses (CAPEX), operational expenses (OPEX) and other financial inputs (e.g. discount rate, revenue, debt/equity, interest rate, inflation, etc). The software then calculates the final results of LCOE, Internal Rate of Return (IRR) and Net Present Value (NPV). At this stage, the analysis module can be used to ask the all-important “what if” questions by conducting a ‘goal seek’ to determine broad parametric sensitivities or gap analysis, or optimising project results through compounded changes using ‘fine tuning’ as well as understanding the key cost drivers on LCOE of a project through the ‘tornado chart’ functionality.

The sensitivity analysis module will be showcased as part of the case studies in Chapter 3.



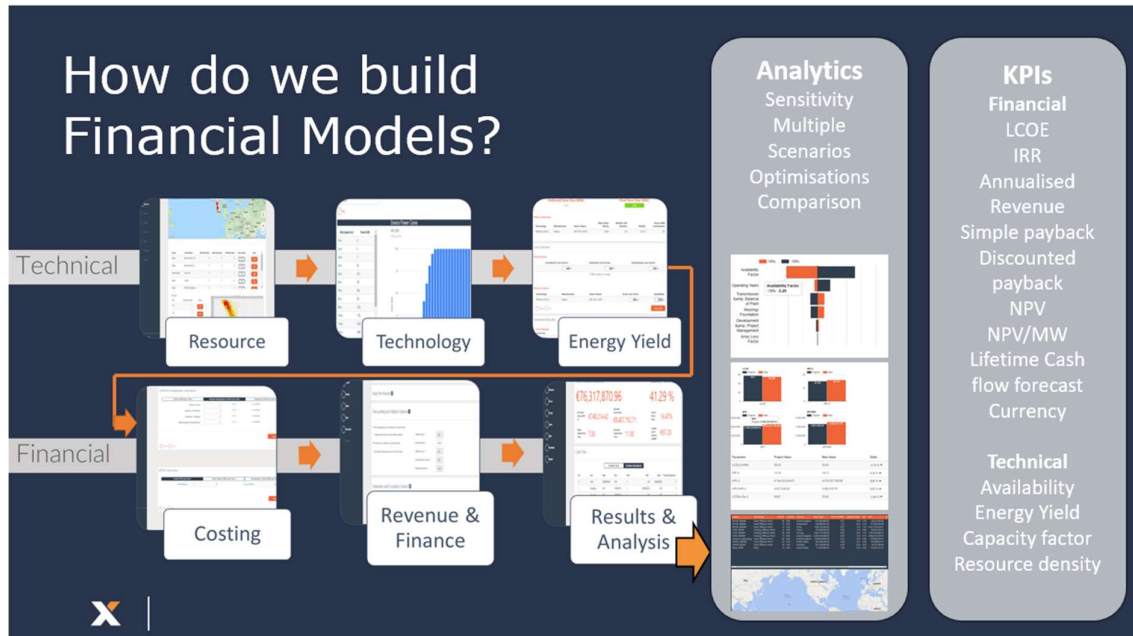


Figure 1: Flow schematic of Exfin, a techno-financial modelling software. © Exceedence Ltd, 2024

2.3 What's new in Exfin

During the EU-SCORES project, Exceedence developed new features in Exfin to support the analysis and optimisation of the financial models of offshore multi-source park scenarios. The features were identified together with the partnership through webinars, questionnaires and one-to-one engagement with individual EU-SCORES partners. The new features developed during EU-SCORES were as follows:

Data Ownership:

As before, any data that is provided with the user licence is “Public Data”, from publicly available information. Any project or uploaded device or resource data is owned exclusively by the company to which the user belongs and is known as “Customer Data”.

New to Exfin is that the data security and data ownership now also allows for “shared data”. This means that if a company wants to share their data (project, device or resource) with other specified users, or make it publicly available, this can be facilitated by Exceedence support staff. If a project is to be shared then its associated resource and device data must also be shared with the same users.

User Levels:

New to Exfin is that different user levels can be assigned within a company's team of users. The idea being that within a team, all will need access to the software but want to use it in different ways. The different user levels are:

- 1) Viewer: with read only access and access to portfolio analysis;



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- 2) Analyst: with read only access, access to portfolio analysis and use of analytics functionality;
- 3) Editor: change, add, delete or edit all types of data, access to portfolio analysis and use of analytics functionality

Combined Projects:

Exceedence has developed two workflows through Exfin to support techno-financial modelling for combined projects. The first method is where a project is focused mainly on the technical solutions of yield contributions and shared cost opportunity, but where the financials (e.g. discount rate, revenue, debt/equity, etc) are kept the same for both technologies. The second method is where the financials are also in focus and will be different for each of the technologies. The workflows for each of these methods are depicted in Figure 2 and Figure 3.

The case studies in Chapter 3 will investigate the same overall projects using the two different methods.

Portfolio Analysis:

New to Exfin analysis module is the Portfolio Analysis functionality. Users can use this functionality to compare different renewable energy projects in different regions or compare several iterations of the same project. Portfolio Analysis allows a user to view the projects built to results page side by side, to compare and contrast the project KPIs, to sort and rank them to find their best project. There are a number of tabs within the Portfolio analysis feature for the user to view the chosen projects from a KPI, LCOE, IRR, NPV or Cashflow perspective.

This feature will be shown as part of the case studies in Chapter 3.

Improved User Experience:

General user experience updates have also been added such as help and info buttons along with help files as well as ranges and decimal input functionality throughout the software.



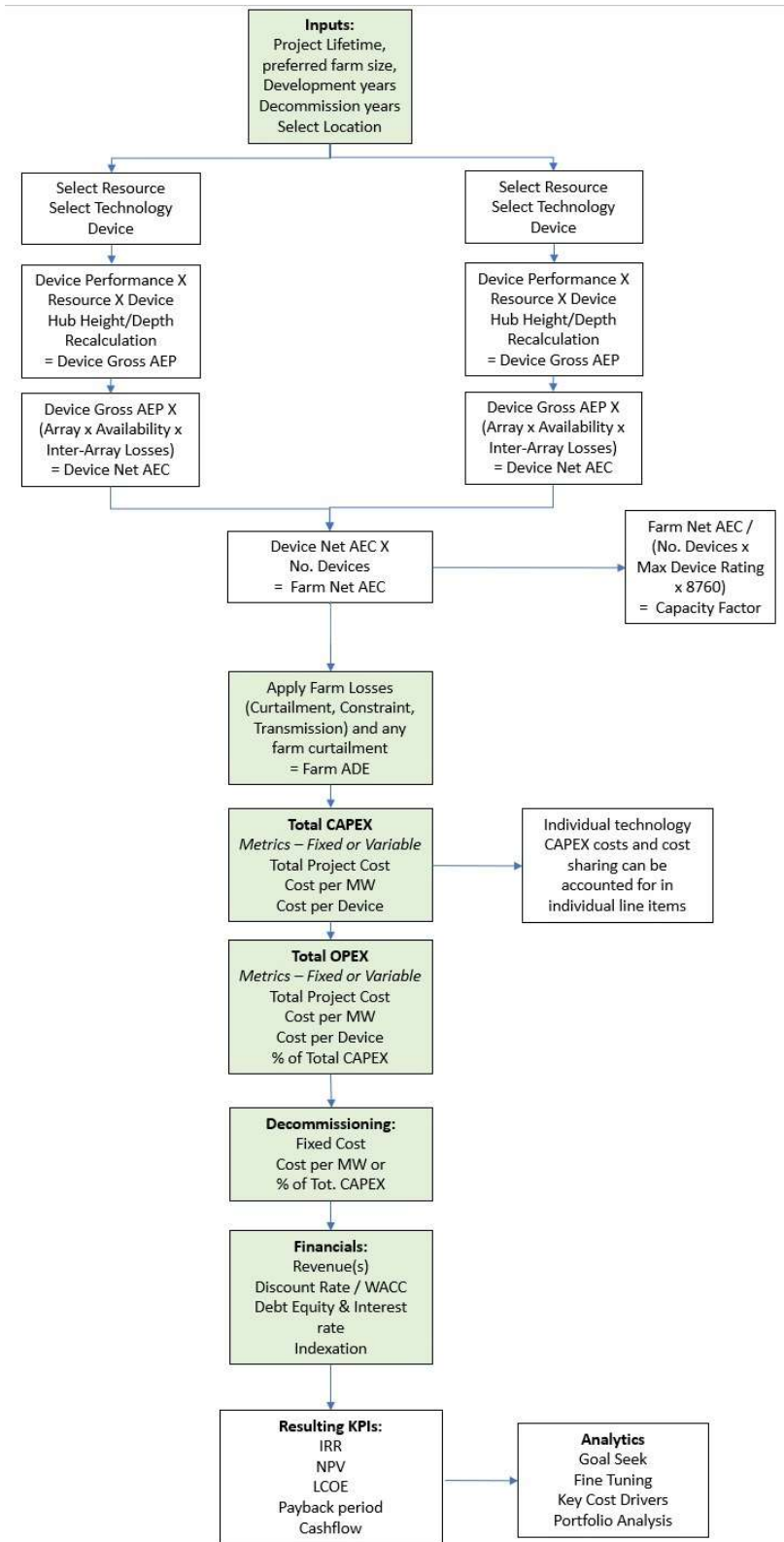


Figure 2: Combined projects with technical focus, where financial inputs are the same for both technologies. © Exceedence Ltd. 2025



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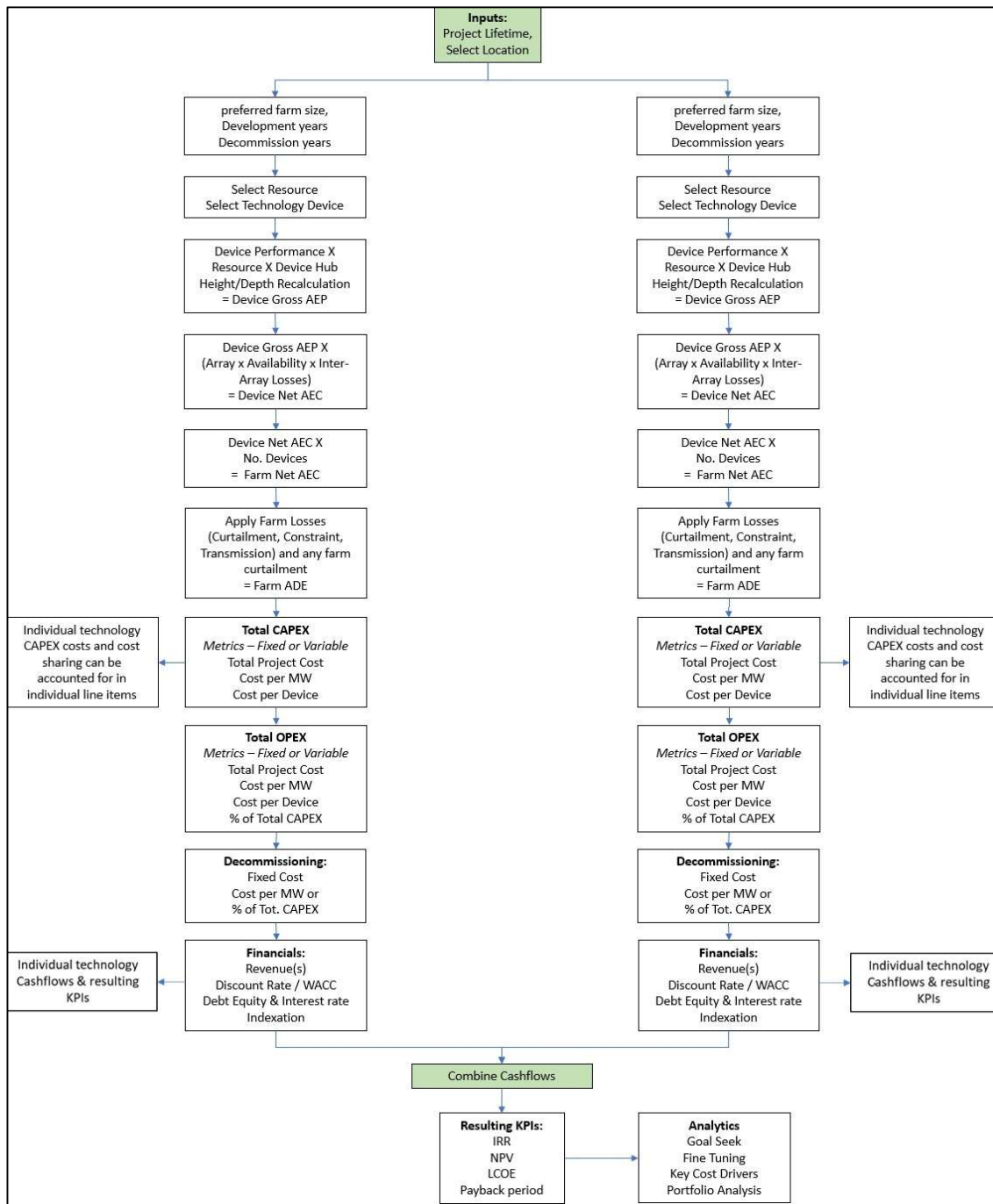


Figure 3: Combined projects where both technical and financial inputs are different. © Exceedence Ltd. 2025



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3. Combined Projects from a financial modelling perspective

Combining offshore renewable energy projects makes sense both from a physical footprint perspective but also from opportunities for cost sharing in DEVEX, CAPEX and OPEX. To combine projects from a financial modelling perspective, this means not only understanding the technical yield contributions from each technology, and the potential cost sharing, but also understanding the financial similarities and differences between the technologies. Currently, different technologies are likely to have different feed in tariffs, different rates of insurance, different levels of risk associated with different discount rates or weighted average cost of capital (WACC), different debt/equity ratios and interest rates. These similarities and differences are captured in Figure 4.

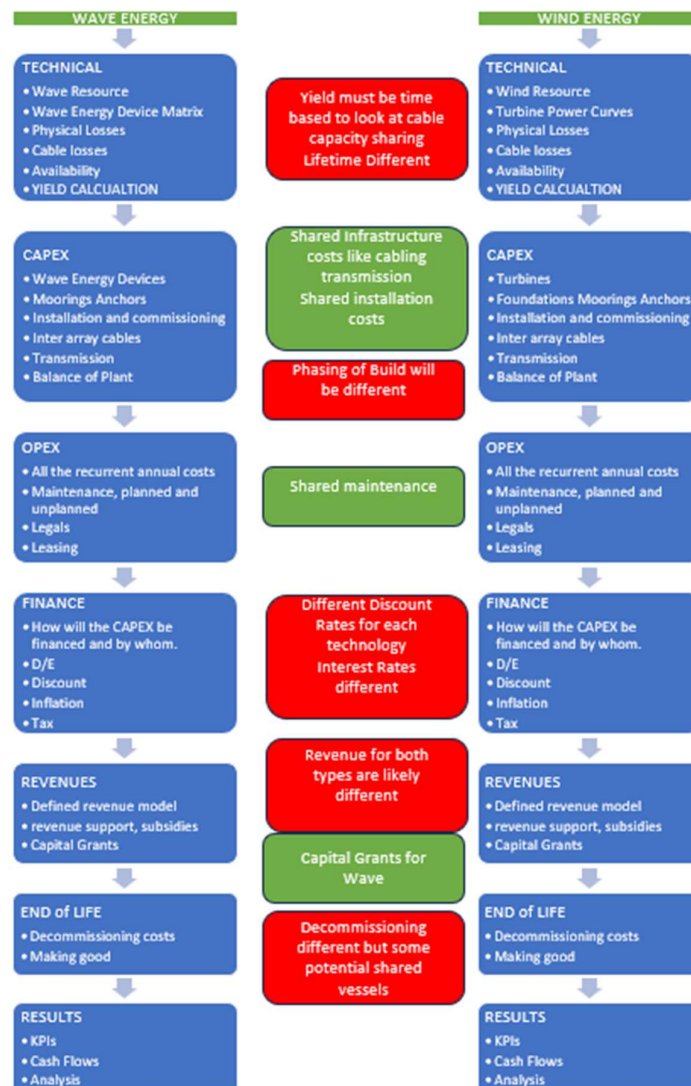


Figure 4: Common touch points and main differences in building financial models for combined projects. © Exceedence Ltd. 2025



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Exceedence has therefore developed two main methodologies to conduct techno-financial modelling through Exfin as described in Chapter 2.3 and Figure 2 and Figure 3. The first method is mainly focused on the technical yield contribution of each technology and the shared cost opportunities with the financial inputs being the same for both technologies. The second method is where the financial inputs are also different between the two technologies.

3.1 Case Study

The following case study describes a representative multi-source park scenario using the two different combined project workflows. The case study will firstly investigate the yield contribution for a hypothetical wind and wave park combination off the South East Coast of Ireland. Next, the costs applied to the wind and wave park are detailed. After this, the two methods will diverge, where the first method will keep the financials the same for both technologies (i.e. combined project with technical focus) and the other method will contain different financials (i.e. combined projects with a financial focus). Each of these methods will give different resulting KPIs. Lately, the analysis and optimisation functionality within Exfin will also be showcased in Chapter 3.1.3 using the resulting KPIs from the 'combined projects with technical focus' methodology.

3.1.1 Yield Contribution

A 1GW combined Wind and Wave farm was modelled, using 800MW wind and 200MW wave. A location was chosen off the South East Coast of Ireland in a DMAP area designated for potentially floating wind and wave energy. This is a hypothetical farm so as not to infringe on any commercially sensitive projects however the process followed and the figures used are all well referenced and realistic.

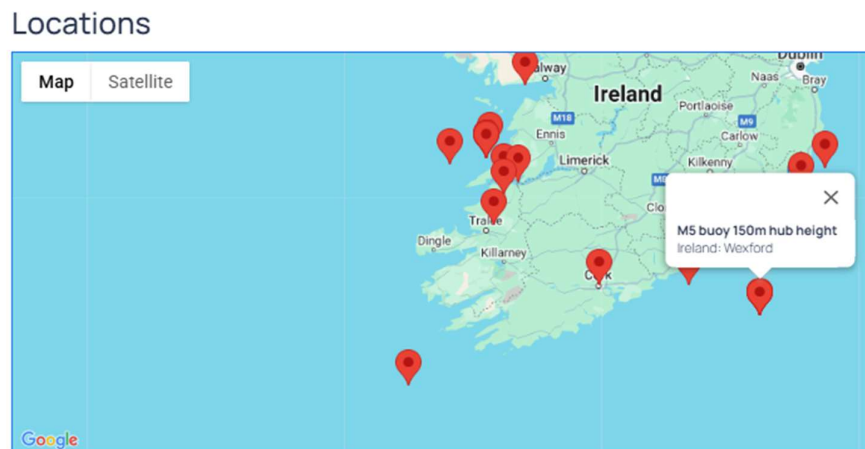


Figure 5: Screenshot of 'Locations' in Exfin, showing the selected location for this case study.

Downloading the ERA 5 modelled data for wind and wave for the same location and importing the time series into Exfin, gives an average windspeed of 10.56 m/s and the waves an average of 15.85kW/m at this location.



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Exfin uses the more detailed statistical data to do the yield calculations shown in both occurrence matrices for wind and wave in Figure 6 and Figure 7.

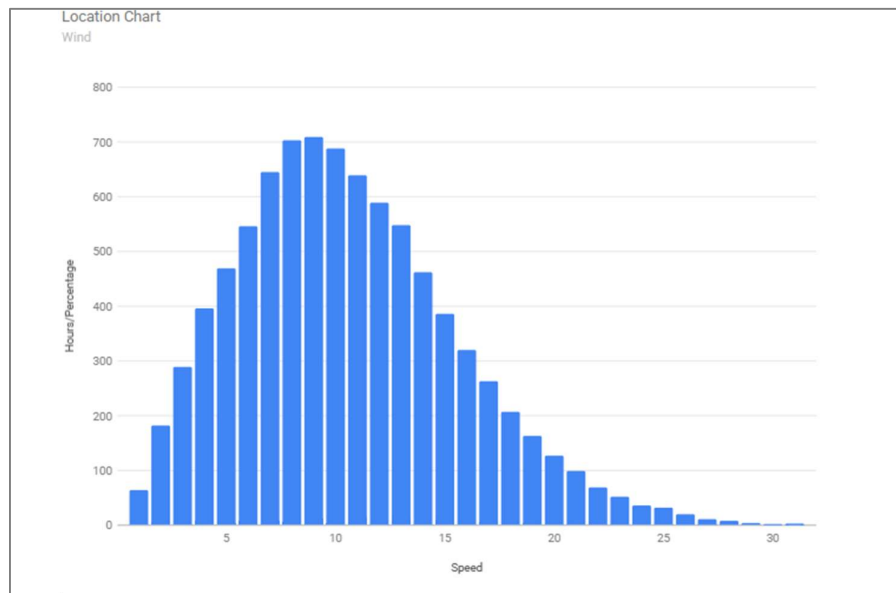


Figure 6: Wind histogram as shown in Exfin after uploading the timeseries data

Height (m)	0.5s	1.5s	2.5s	3.5s	4.5s	5.5s	6.5s	7.5s	8.5s	9.5s	10.5s	11.5s	12.5s	13.5s	14.5s	15.5s	16.5s	17.5s	18.5s	19.5s	20.5s	21.5s	22.5s	23.5s	24.5s	25+s
0.25m	0	0	0	9	62	101	77	25	17	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.75m	0	0	0	40	803	652	456	246	102	33	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.25m	0	0	0	1	379	682	456	295	166	53	15	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
1.75m	0	0	0	0	36	513	455	265	172	76	33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.25m	0	0	0	0	0	176	376	209	139	85	21	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.75m	0	0	0	0	0	13	208	223	141	64	20	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.25m	0	0	0	0	0	0	70	181	111	54	20	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.75m	0	0	0	0	0	0	8	83	87	37	13	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4.25m	0	0	0	0	0	0	0	38	68	35	12	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4.75m	0	0	0	0	0	0	0	8	44	30	9	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0
5.25m	0	0	0	0	0	0	0	1	14	17	8	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75m	0	0	0	0	0	0	0	0	7	12	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25m	0	0	0	0	0	0	0	0	1	5	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75m	0	0	0	0	0	0	0	0	0	4	4	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25m	0	0	0	0	0	0	0	0	0	0	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75m	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25m	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75m	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 7: Wave occurrence matrix as shown in Exfin after uploading the timeseries data

The wind histogram is then matched with an 8MW Vestas 164-8 wind turbine, and the wave resource is matched with a generic 1MW wave power matrix. The resulting wind yield contribution in Figure 8, shows the theoretical maximum (Gross Annual Energy Production), the reduction in power output due to availability and array losses (Net Annual Energy Capture), and the reduction in power output due to transmission losses (Annual Delivered Energy); the latter of



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which is sold to the grid. Exfin also calculates the Capacity Factor, in this case 49.33%. Similarly, Figure 9, shows the yield contribution from the wave farm. We have accounted for all the transmission loss into one technology.

The total Annual yield contribution from the farm is therefore 3,283,913.097 MWh (from 800MW wind) plus 576,694.464 MWh (from 200MW wave), giving a total annual yield of 3,860,607.561 MWh.

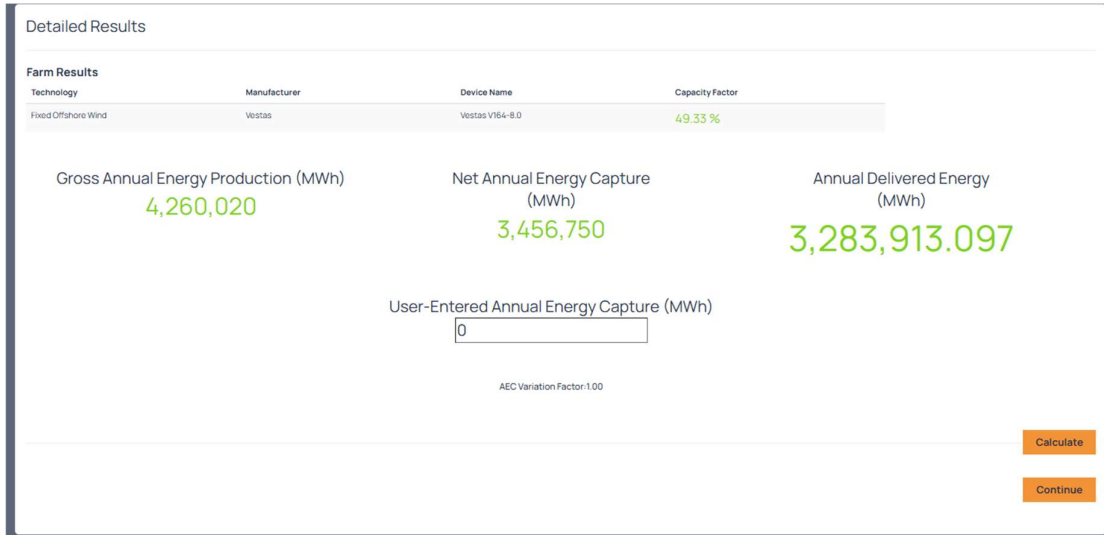


Figure 8: Screenshot from Exfin showing the Yield Contribution from the Wind farm

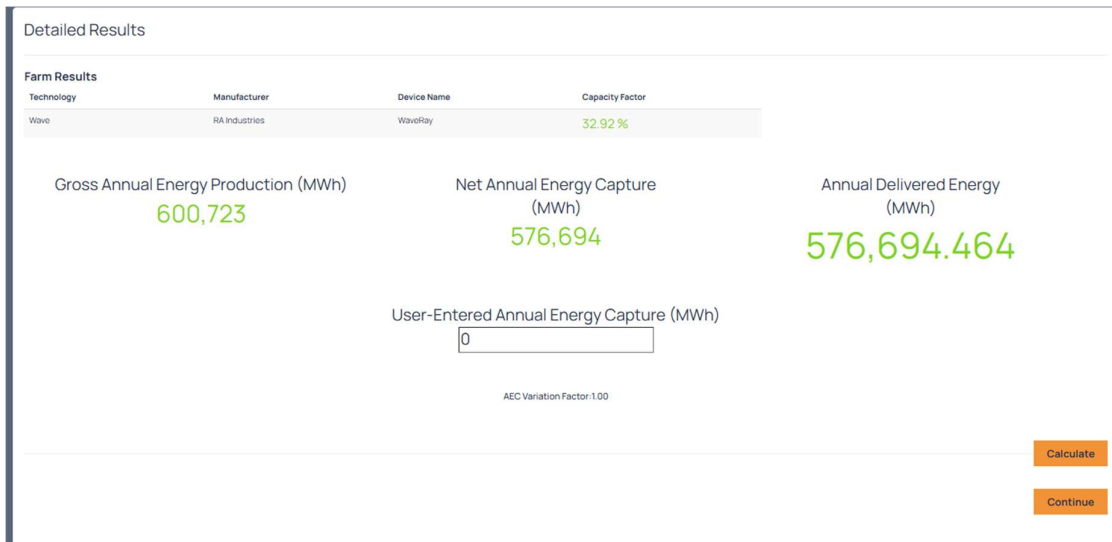


Figure 9: Screenshot from Exfin showing the Yield Contribution from the Wave farm



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3.1.2 Cost sharing Opportunities

The hypothetical cost¹ inputs shown in Table 1, already include the opportunities for cost sharing; In this case cables, infrastructure and OPEX costs.

Table 1: Cost inputs already accounting for cost sharing opportunities

	Wind	Wave
Capacity	800MW	200MW
Technology	Vestas 164-8	WaveRay 1MW
TOTAL CAPEX (€/MW)	5,200,000	7,371,000
Development	795,600	226,800
Infrastructure BOP	722,800	356,400
Moorings and Anchors	119,600	988,200
Device & PTO	2,860,000	4,560,300
Installation	702,000	1,239,300
TOTAL OPEX (€/MW/Year)	208,000	140,000
Decommissioning	5% of total CAPEX	1% of total CAPEX

3.1.3 Combined projects with technical focus methodology

In the workflow shown in Figure 2, the 'combined projects with technical focus', is as the name suggests, mainly concerned with the yield contributions from each technology as well as the cost sharing opportunities. The remaining inputs to the financial model such as but not limited to the lifetime, revenue, discount rate, and other financing are considered to be the same for both technologies. From this point onward therefore, the combined project can now be seen as one project within the Exfin setup. The summary inputs for this continued workflow method are shown in Table 2, where to inputs in **bold** indicate the inputs that are required to be the same for this methodology to be applied.

Table 2: Summary inputs for the 'combined projects with technical focus' workflow

	Wind	Wave	Combined
Capacity	800MW	200MW	1000MW
Technology	Vestas 164-8	WaveRay 1MW	
Yield contribution (MWh)	3,283,913.0.97	576,694.464	3,860,607.561
Lifetime			30 years
CAPEX / MW	5,200,000	7,371,000	
OPEX/MW/Year	208,000	140,000	
Decommissioning	5% CAPEX Y30	1% CAPEX Y30	
Discount Rate			7%
Revenue			€165
Loan Term			15 years
D/E			20/80
Interest Rate			4.5%


¹ 2022, UoE, Deriving current cost requirements from future targets.



Running the inputs in Table 2 through Exfin calculates the resulting KPIs shown in Table 4 along with the PDF printout from Exfin in Figure 10.

Table 3: Resulting KPIs from the inputs used in the 'combined projects with a technical focus' workflow

LCOE	€ 164.71
IRR	7.03%
NPV	€ 13,473,733.91
Simple Payback Period	14 years
Discounted Payback Period	30 years



28 March 2025
Version: 3.0.0.2

Project Name: **SCORES 78 Combination Technical focus workflow**

Project Summary Generated by Exfin

Main Project Details		Resource Details	
Farm Technology	Floating Offshore Wind	Country	Ireland
Final Farm Size (MW)	1000 MW	Location Name	M5 buoy 150m hub height
Operating Years	30 year(s)	Data Year(s)	2019
Development Years	1 year(s)	Water Depth (m)	100 m
Decommissioning Years	0 year(s)	Measuring Height (m)	150 m
Project Currency	EUR - Euro [€]	Comments	

Device Details						
#	Renewable Technology	Manufacturer	Device Name	Deployment Depth/Height (m)	Power Rating (kW)	Capacity Factor (%)
1		Vestas	Vestas V164-8.0	140m	8000 kW	44.07 %

Farm Energy Output Results		Cost Information	
Farm Annual Energy Production (MWh)	5,323,023 MWh		
Farm Actual Energy Capture (MWh)	4,320,938 MWh	CAPEX	€ 5,634,200,000 / € 5,634,200 / MW
User-Entered Actual Energy Capture (MWh)	3,860,608 MWh	OPEX (Annual)	€ 194,400,000 / € 194,400 / MW
Farm Annual Delivered Energy (MWh)	3,860,608 MWh	Decommissioning	€ 222,742,000 / € 222,742 / MW

Financial Inputs	Results
Total Revenue Rate (EUR [€]/MWh)	€ 165.00 / MWh
Discount Rate (%)	7 %
Inflation Rate (%)	0 %
Debt/Equity Ratio	20 % / 80 %
Borrowing Rate (%)	4.50 %
Tax Rate (%)	0.00 %
Revenue Indexation Rate (%)	0 %
Opex Escalation Rate (%)	3 %
Borrowing Term	15 year(s)
Levelised Cost of Electricity [LCOE] (EUR [€]/MWh)	€ 164.71 / MWh
Net Present Value [NPV] (EUR [€])	€ 13,473,733.91
Internal Rate of Return [IRR] (%)	7.03 %
Net Present Value [NPV] per MW (EUR [€]/MW)	€ 13,473.73 / MW
Equivalent Annual Charge (EUR [€])	€ 1,085,799.75
Simple Payback Period	14.00 year(s)
Discounted Payback Period	30.00 year(s)
Farm Capacity Factor (%)	44.07 %

Figure 10: PDF Printout of the inputs and resulting outputs of the 'combined projects with a technical focus'



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3.1.4 Sensitivity analysis and optimisation

Sensitivity analysis and optimisation can now be applied to the resulting KPIs shown in Chapter 3.1.3, calculated using the ‘combined project with technical focus’ methodology. In Exfin, there are now four different analysis functionalities: key cost driver analysis, goal seek, fine tuning, and portfolio analysis. Each view the KPIs from a different perspective and support the user in understanding the financial health of a project.

Key Cost Driver analysis

The Key cost driver analysis allows a user to better understand what the main cost drivers are in a project. In other words, what perhaps can be optimised for the biggest impact. By selecting each of the inputs that a user wishes to compare, and then applying a fixed percentage change, for example + or – 10%, on each individual input in turn, the impact on LCOE is recorded. The visual forms a typical ‘Tornado Chart’, where the input with the largest impact on LCOE is at the top and the input with the smallest impact on LCOE is at the bottom. As shown in Figure 11, the percentage change is selected to +/-10%, and the inputs to which the percentage change is applied are: Annual Delivered energy, Total CAPEX, along with both the cost shared items and individual cost items per technology, and Total OPEX. The impact of the percentage change on LCOE for each individual input is recorded in the visual tornado chart as well as the table below.

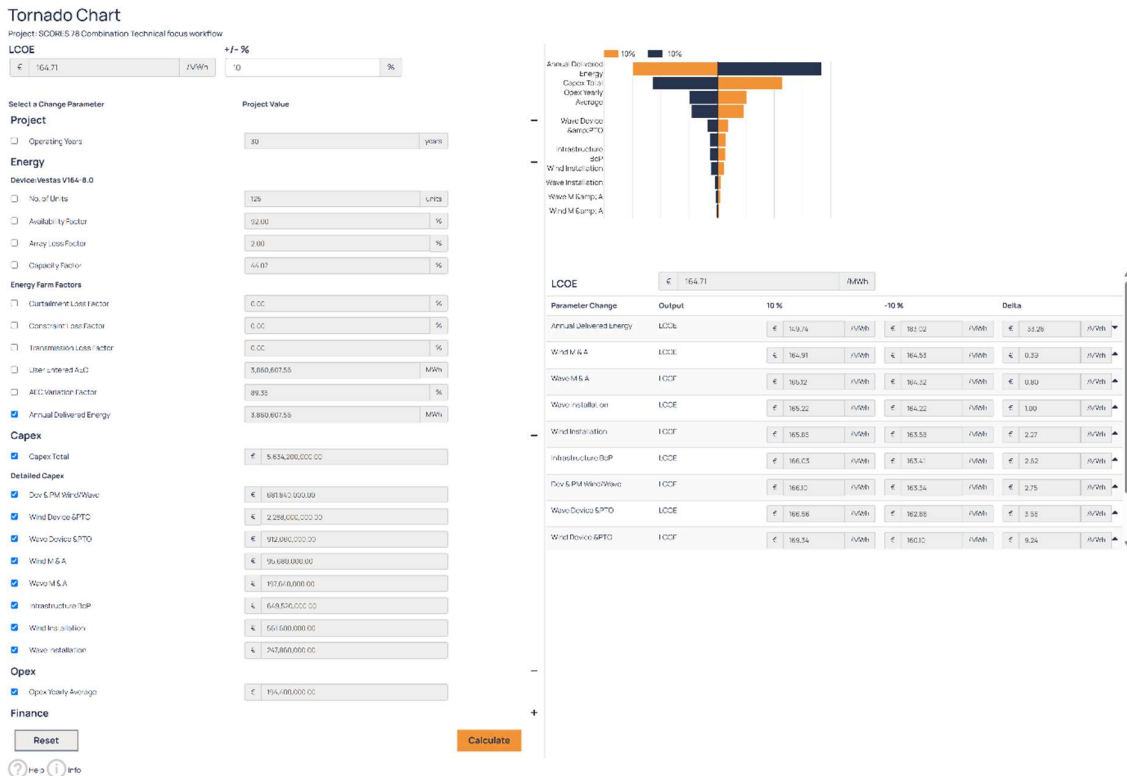


Figure 11: Screenshot of Key cost driver or ‘Tornado Chart’ in Exfin



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For clarity, in this particular example, the top 5 key cost drivers are the Annual Delivered Energy, the total CAPEX, the yearly OPEX, the cost of the Wind Device & PTO, and in fifth place, the cost of the Wave Device & PTO.

Goal Seek

Goal seek is an analysis function that allows a user to better understand the broad parametric sensitivities within a project or to perform gap analysis. It allows for a user to select the KPI that they wish to goal seek for: LCOE, IRR or NPV, and then select one input at a time to see the size of change required to reach the new target. For gap analysis, there may be one or two known unknown input items within a project. By having a target range for LCOE or IRR, the range for that cost item can be determined. In other words, how much is that item allowed to cost to reach the KPI target or target range. Figure 12 shows the Goal Seek functionality in Exfin, where the original IRR is 7.03%, but the target value is 10%. The selected input to change in this example is revenue. On the righthand side it shows that revenue would need to increase from 165 €/MWh to 197€/MWh (or a delta of 19.6%) to reach the 10% IRR target.

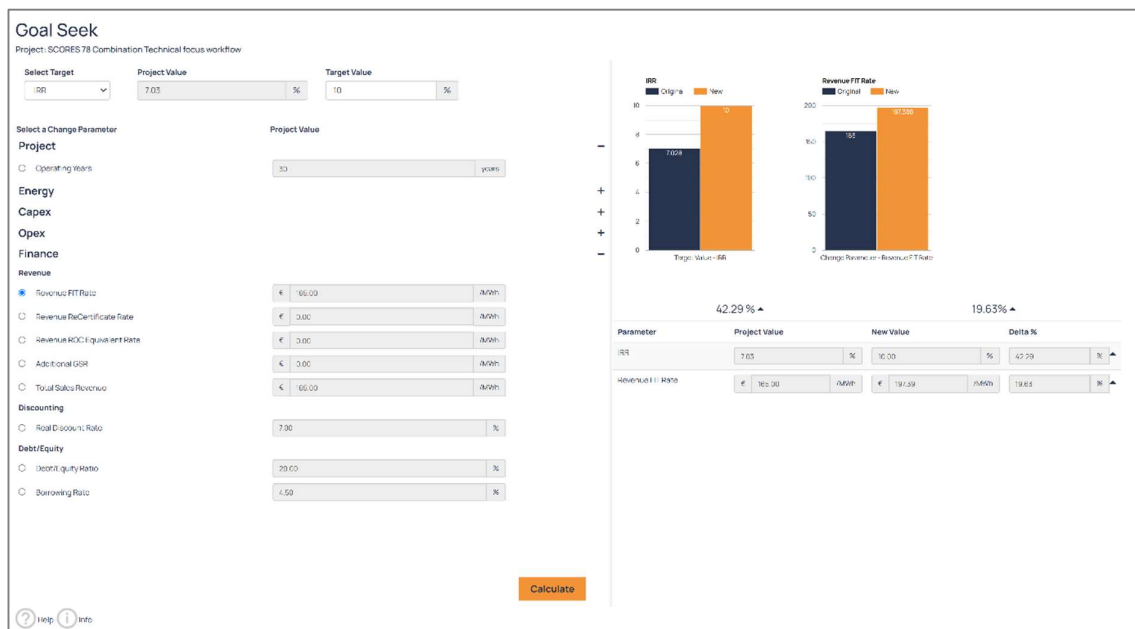


Figure 12: Screenshot of Goal Seek functionality in Exfin

Fine tuning

The fine tuning analysis functionality allows a user to optimise and compound changes to the inputs within a project and see the changes on LCOE, IRR and NPV instantaneously. Figure 13 shows the example where compounded changes are made to the project to optimise the KPIs. A 10% cost reduction is applied to the cost of the wind device & PTO and a 5% cost increase is applied to the wave device & PTO. At the same time the OPEX cost is also increased by 5%, and the discount rate is decreased from 7% to 6.5%. The resulting KPIs shown on the right-hand side in the bar charts shows a decrease in LCOE, and an increase in both IRR and NPV. The



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overall changes made have positively impacted the project as shown in the bar chart graphs on the right-hand side.

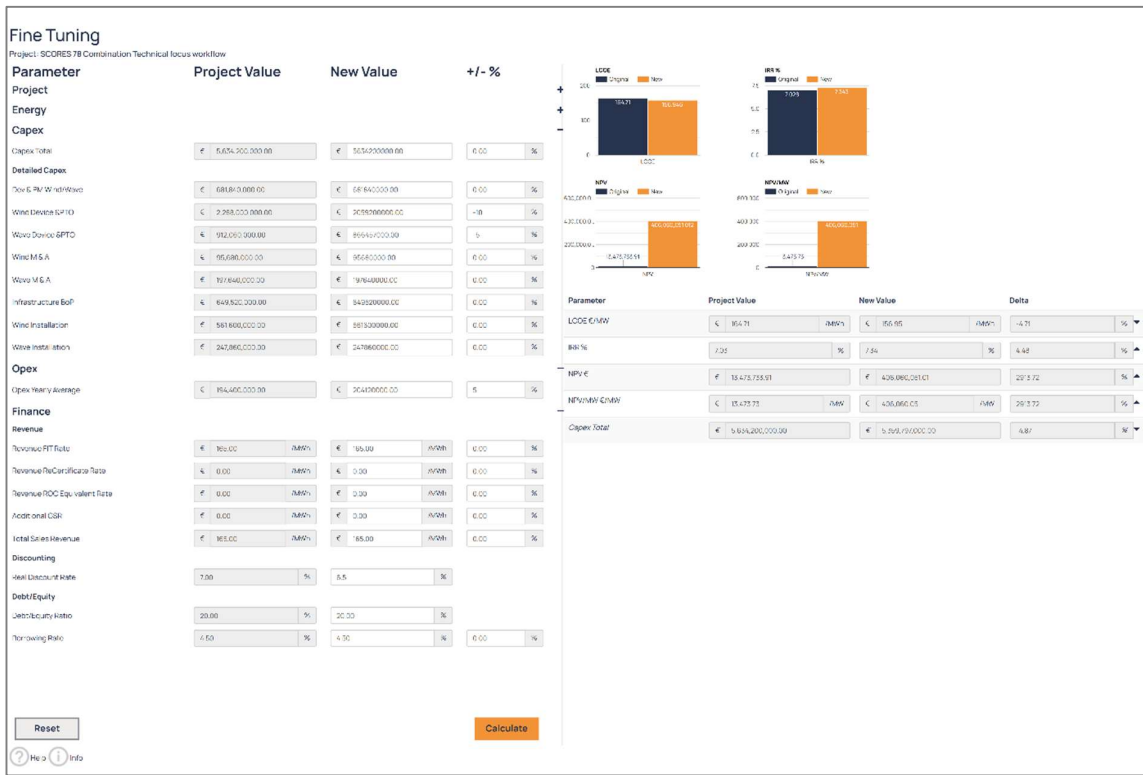


Figure 13: Screenshot of Fine tuning functionality in Exfin

Portfolio analysis

The portfolio analysis functionality in Exfin, allows a user to view all of the projects that have been built to results page, side by side. The projects are listed along with the main inputs and outputs, which allows the user to search for and rank their projects based on whatever KPI is most important to them. This functionality can be used to find the best renewable energy project, whether that be fixed offshore wind, floating offshore wind, wave or offshore PV. It can be used to find the best project in a region or globally. It can also be used to compare several iterations of the same project, to find which version may be the best according to the user. Figure 14 shows a screenshot of portfolio analysis in Exfin, where a number of projects are listed in the left-hand column and across the top, a number of KPIs which can be compared, as well as the map showing the location of the projects.



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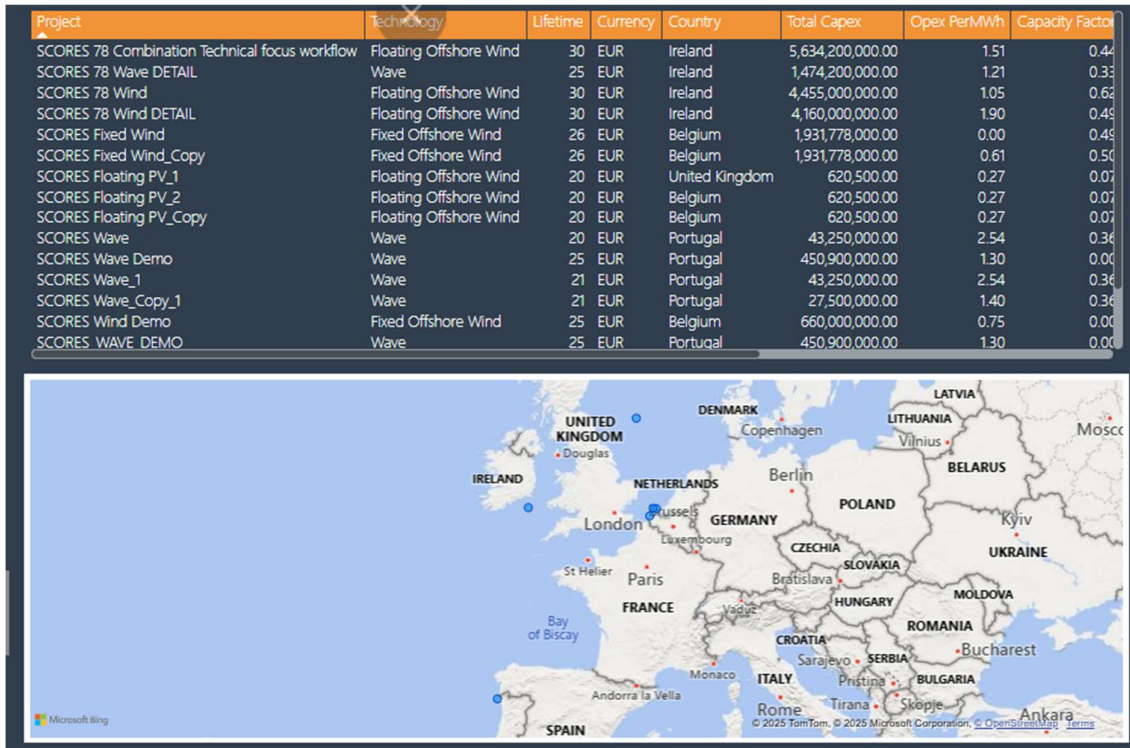


Figure 14: Screenshot of Portfolio analysis in Exfin

3.1.5 Combined projects with a financial focus methodology

In the workflow shown in Figure 3, the ‘combined projects with financial focus’, is as the name suggests, not only concerned with the yield contributions from each technology as well as the cost sharing opportunities but also concerned with the financial inputs. In this workflow methodology all of the remaining inputs to the financial model are different for each technology, as shown in Table 4, such as but not limited to, lifetime, debt/equity ratio, interest rate, discount rate, timing of decommissioning, and revenue. This workflow requires two separate financial model builds through Exfin, which results in individual KPIs and cashflows. At this point, the individual cashflows are combined into one cashflow from which the combined KPIs can be calculated.

Table 4: Summary inputs for the ‘combined projects with a financial focus’ workflow

	Wind	Wave
Capacity	800MW	200MW
Technology	Vestas 164-8	WaveRay 1MW
Lifetime	30 Years	25 Years
CAPEX / MW		
Development	795,600 €/MW	226,800 €/MW
Infrastructure BOP	722,800 €/MW	356,400 €/MW
Moorings and Anchors	119,600 €/MW	988,200 €/MW
Device & PTO	2,860,000 €/MW	4,560,300 €/MW
Installation	702,000 €/MW	1,239,300 €/MW
OPEX/MW/Year	208,000 €/MW/Year	140,000 €/MW/Year
Decommissioning	5% CAPEX Y30	1% CAPEX Y25



This project has received funding from the Europeans Union’s Horizon 2020 research & innovation programme under grant agreement number 101036457.

Discount Rate	6.5%	7%
Revenue	€165	€300
Loan Term	15 Years	15 Years
D/E	20/80	10/90
Interest Rate	4%	4.5%

Exfin supports the export of the cashflows, as shown in Figure 15, for each project so that they can be combined. All of the relevant data to determine the combined metrics can be selected and outputted to CSV format for combination.

20	Operating	0.00	28,000,000.00	7.00	0.00	0.00	0.00	173,008,339.20	0.00	145,008,339.20	145,008,339.20	145,008,339.20	0.00	145,008,339.20	1,377,706,154.81	0.00	0.00
21	Operating	0.00	28,000,000.00	7.00	0.00	0.00	0.00	173,008,339.20	0.00	145,008,339.20	145,008,339.20	145,008,339.20	0.00	145,008,339.20	1,522,314,494.01	0.00	0.00
22	Operating	0.00	28,000,000.00	7.00	0.00	0.00	0.00	173,008,339.20	0.00	145,008,339.20	145,008,339.20	145,008,339.20	0.00	145,008,339.20	1,667,122,833.21	0.00	0.00
23	Operating	0.00	28,000,000.00	7.00	0.00	0.00	0.00	173,008,339.20	0.00	145,008,339.20	145,008,339.20	145,008,339.20	0.00	145,008,339.20	1,812,131,72.41	0.00	0.00
24	Operating	0.00	28,000,000.00	7.00	0.00	0.00	0.00	173,008,339.20	0.00	145,008,339.20	145,008,339.20	145,008,339.20	0.00	145,008,339.20	1,957,139,511.61	0.00	0.00
25	Operating	0.00	28,000,000.00	7.00	0.00	14,742,000.00	0.00	173,008,339.20	0.00	130,266,339.20	130,266,339.20	130,266,339.20	0.00	130,266,339.20	2,087,405,850.81	0.00	0.00

Select table columns to display

<input checked="" type="checkbox"/> Capex <input checked="" type="checkbox"/> Salvage <input type="checkbox"/> Interest Repayments <input checked="" type="checkbox"/> Cumulative Loss <input checked="" type="checkbox"/> Net Cash Flow <input checked="" type="checkbox"/> Debt	<input checked="" type="checkbox"/> Opex <input checked="" type="checkbox"/> Decommission <input checked="" type="checkbox"/> Profit <input checked="" type="checkbox"/> Taxable Profit After Loss <input checked="" type="checkbox"/> Cumulative Net Cash Flow <input checked="" type="checkbox"/> Equity	<input checked="" type="checkbox"/> Discount Factor <input checked="" type="checkbox"/> Grid Sales Revenue <input type="checkbox"/> Depreciation <input type="checkbox"/> Tax <input type="checkbox"/> Discounted Net Cash <input type="checkbox"/> Debt Repayments	<input type="checkbox"/> Capital Grant <input checked="" type="checkbox"/> Annual Revenues <input checked="" type="checkbox"/> Taxable Profit <input checked="" type="checkbox"/> After Tax Profit <input type="checkbox"/> Cumulative Discounted Net Cash <input type="checkbox"/> Principal Repayments
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Create CSV

Figure 15: Screenshot of Cashflow export functionality in Exfin

Once each of the individual cashflows have been generated, it is not as simple as adding these together to calculate the combined KPIs. In this case, due to the lifetime and the discount rate being different, some additional calculation steps are required. Firstly, the combined cashflows must be considered at the greater of the 2 project lifetimes, in this case 30 years. Secondly, the net cash flow and the discounted net cash flow can be summed at each year but a new cumulative net cash flow must be derived along with a new cumulative discounted net cash flow. These must then be used to calculate for each year an apparent discount rate (and indexation and inflation etc if included). The apparent discount rate is needed to calculate a combined LCOE. This rate is not the average of discount rates nor is it a constant.


For clarity the individual and summary KPIs are shown in Table 5 along with the PDF printout of the inputs and resulting combination outputs in Figure 16.



Table 5: Summary KPIs from individual financial model and the combined farm

Wave		Wind		Combined	
MW	200	MW	800	MW	1,000
MWh	576,694	MWh	3,283,913	MWh	3,860,607
Cap Factor	33.26%	Cap Factor	47.35%	Cap Factor	44.53%
NPV	€ 241,190,068	NPV	€ 281,988,606	NPV	€ 523,178,675
IRR	8.9%	IRR	7.3%	IRR	7.7%
LCOE	€ 264.11	LCOE	€ 158.42	LCOE	€ 172.12

26 March 2025
 Version: 3.0.0.2



Project name: SCORES 78 DETAIL Combined

Project Summary

Main Project Detail		Resource Details				
Farm Technology	Wind & Wave	Country	Ireland		Wave	
Final Farm Size (MW)	1000MW	Location Name	M5 Buoy 150m			
Operating Years	30 Years	Data Years	2019		2019	
Development Years	0 years	Water Depth	100m		100m	
Decommissioning Years	0 years	Comments	for SCORES 7.8			
Project Currency	EUR - Euro [€]	Measuring height	150m			
Device Details						
#	Renewable Technology	Manufacturer	Device Name	Development Depth/Height	Power Rating (kW)	Capacity Factor (%)
1	Wind	Vestas	V164-8.0	50m+	8000kW	49.33%
2	Wave	RA Industries	WaveRay	From 20m to 1000m	1000kW	32.62%
Farm Energy Output Results			Cost Information			
Farm Annual Energy Production (MWh)	4860723	CAPEX	EUR[€]	EUR[€]	EUR [€]/MWh	
Farm Actual Energy Capture (MWh)	4033484	OPEX (Annual)	€ 5,634,200,000.00	€ 5,634,200.00	€ 61.13	
Farm Annual Delivered Energy (MWh)	3860607	Decommissioning	€ 236,000,000.00	€ 222,742,000.00	€ 500,225,259.91	
Financial Inputs			Combined Results			
Total Revenue Rate	Wind: 165	Wave: 300	Levelised Cost of Energy (EUR [€]/MWh)	€	172.12	
Discount Rate	6.5	7	Net Present Value [NPV] (EUR[€])	€	523,178,675.01	
Inflation Rate	0	0	Internal Rate of Return [IRR] (%)		7.69%	
Debt Equity Ratio	20/80%	10/90 %	Net Present Value [NPV] per MW (EUR[€])	€	523,178.68	
Borrowing Rate (%)	4.50%	4.00%	Farm Capacity Factor		44.5%	
Tax Rate (%)	0	0				
Revenue Indexation Rate (%)	0	0				
Opex Escalation Rate (%)	0	0				
Borrowing Term	15 Years	15 Years				

Figure 16: PDF Printout of the inputs and resulting outputs of the 'combined projects with a financial focus'

The results are as expected. Adding wave energy at higher LCOE than the underlying wind does bring up the LCOE of the overall farm but not by huge margins, in this case less than 10%.



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3.2 Conclusions from the Case Study

Several conclusions can be drawn from both the methodology and the outcome of combined projects.

In general, when combining projects that are co-located but yet share infrastructure and operational costs, each of the technologies need to be modelled individually and then the resultant outputs combined at a cash flow level. This is because it is not possible to simply combine projects that have differing revenues, discount rates, lifetimes, debt structures and other model variables. However, it is possible to combine them at a cashflow level and this has been demonstrated. In terms of sensitivity analysis within Exfin, this can be viewed at a technology level.

In the specific case where technologies are to be combined or co-located using the same lifetimes and underlying financial drivers, then they can be combined at a technology or yield level. Sensitivity can then be applied to each technology to understand their relative contributions and merits.

Finally, the results are consistent with the EU-SCORES project outcomes in that co-locating/combining projects can greatly incentivise new technologies such as wave energy with a minimal increase in LCOE.

