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Definitions & Abbreviations	
A&M	Anchor and Mooring
CAPEX	Capital Expenses
DECEX	Decommission Expenses
FOWT	Floating Offshore Wind Turbine
FOWAT	Floating Offshore Wind Assessment Tool
GdF	Golf de Fos
GoM	Gulf of Maine
HIL	Hardware in loop
IAC	Inter-array Cable
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
LCOE	Levelized Cost of Energy
OPEX	Operational Expenses
O&M	Operation and Maintenance
TLP	Tension Leg Platform
WoB	West of Barra
WP	Work Package

Executive Summary

This report provides information regarding how risk, uncertainty and technology parameters choices taken during design phase can influence the levelized cost of energy (LCOE) of floating offshore wind turbines. Following an introduction into LCOE assessment, the second chapter of this deliverable provides details on the LCOE contributions from different life cycle stages for each of the 4 concepts, considering the results obtained in WP2. This is the basis for a sensitivity analysis and detailed analysis of parameters that contribute the most to the final cost as a result of technical decisions at the design phase.

Chapter 3 of this deliverable focuses on the sensitivity analysis of the LCOE values calculated in WP2 during the Phase I Evaluation and the analysis of the obtained results. The objective is to identify the parameters that influence the LCOE values the most and thus represent parameters with the highest cost reduction potentials for floating wind power plants. The results can be useful for floating wind turbine developers and researchers to improve the cost competitiveness of this technology and last but not least to accelerate the transition of floating wind to a mature technology. Chapter 4 is complementary to Chapter 3 as it presents the results of specific scenarios due to the variation of the LCOE by applying variation ranges based on uncertainty ranges defined by the designers and for the common components. The ranges are applied on the parameters that most influence the LCOE and that were obtained in Chapter 3. This analysis serves to identify how much the LCOE could actually vary based on the defined uncertainty ranges by the designers.

Chapter 5 focuses on disclosing about risk consideration during design that can also lead to a LCOE reduction. For example, a structured, detailed and well-recorded risk management can increase the confidence of insurers and financers leading to reduced insurance and cost of financing. Similarly, it can also reduce the risk contingency budget. In this report, whilst no risks to a specific FOWT are provided, a list of hazards that can affect any FOWT design is provided. It should be noted that the list is not exhaustive and the applicability of each hazard is design dependent.

It can be concluded that the parameters that most influence the LCOE are related to the capital expenses, which is also demonstrated in the life cycle cost contribution of the manufacturing phase in Chapter 3. This includes the cost of the substructure, turbine and offshore substation due to their capital intensive investment. For the three sites, the results show further that the discount rate has the largest influence on the LCOE value for all 4 floating wind turbine concepts. Besides that, it has been demonstrated that the environmental conditions have a significant impact on the cost. Severe conditions require the design of a more robust structure but in particular influence the choice of anchor and mooring system as well as the need for a more specialized installation spread, which impacts the costs. Besides costs, energy losses in the system are also significant for the LCOE and should tried to be minimized. Finally, operation and maintenance cost have also been identified as important parameters to consider especially for West of Barra, where a larger distance to shore is present with severe met-ocean conditions. The common parameters studied show mostly a similar effect on the LCOE among the different FOWT concepts. However, a differentiation is found among the offshore sites. The concept design dependent parameters such as substructure, anchor and mooring cost as well as installation vessel cost show a different influence among the FOWT concepts and sites, which is presented in Chapter 3. The extended sensitivity analysis performed in Chapter 4 based on the provided uncertainty values shows how the LCOE can potential increase or decrease with varying input parameters among the different FOWT concepts. The individual results for each parameter of this analysis and for each concept under consideration can be found as a complete list in Appendix 3.

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1 Introduction

1.1 Description of the deliverable

This report provides information regarding how risk, uncertainty and technology parameters choices taken at design phase can influence the Levelized Cost of Energy (LCOE) of floating offshore wind turbines. The deliverable is structured in different chapters, each of them analyses different aspects that can be considered during the design phase in order to reduce the final LCOE.

As a first analysis, the deliverable presents the results obtained in WP2 during Phase I Evaluation in order to analyse the contribution of the main life cycle stages to the total life cycle cost for each site and concept. This analysis will serve as basis to set the sensitivity analysis that will indicate the parameters that have the largest influence over the LCOE. Afterwards, the sensitivity of the LCOE for the different floating wind turbine concepts is analysed based on uncertainty values provided by the concept designers. This serves to identify how much the LCOE value could actually vary based on the provided sensitivity ranges.

The final chapter focuses on disclosing risk consideration during design that can also lead to LCOE reduction. For example, a structured, detailed and well-recorded risk management can increase the confidence of insurers and financers leading to reduced insurance and cost of financing. Similarly, it can also reduce the contingency. In this report, whilst no risks to a specific floating offshore wind turbine are provided, a list of hazards that can affect the design is provided. It should be noted that the list is not exhaustive and the applicability of each hazard is design dependent.

1.2 Introduction to the LIFES 50+ project and LCOE assessment

LIFES 50+ project focuses on floating wind turbines installed at water depths from 50m to about 200m. The consortium partners have chosen to focus on large floating wind turbines (10MW), which are seen as the most effective way of reducing the LCOE in a short term.

The objective of the proposed project is two-fold:

1. Optimize and qualify to a TRL of 5, two innovative floating substructure designs for 10MW wind turbines. The chosen concepts will originate from an existing list of four mature (TRL $\geq$ 4) candidates currently designed to support turbines in the region of 5MW. The selection of the two concepts will be based on technical, economical, and environmental criteria. The concepts will undergo an industrialization process to guarantee their MRL at the end of the project. An existing reference 10MW wind turbine design will be used throughout the project.

2. Develop a streamlined and KPI-based methodology for the evaluation and qualification process of floating substructures, focusing on technical, economic (LCOE) and environmental aspects as well as a risk assessment.

Both above-mentioned processes (upscaling of designs and improvement of evaluation/qualification processes) will culminate into guidelines/recommended practices. They will facilitate innovation and competition in the industry, reduce risks, and contribute to lower uncertainties in LCOE estimations.
End users for the project deliverables will be designers and manufacturers, but also decision makers who need to evaluate a concept based on given constraints. Figure 1 shows the four different floating wind turbine concept designs that are evaluated and qualified in the LIFES 50+ project.

Figure 1: Semi-submersible steel design, Semi-submersible concrete design; Barge concrete design, TLP steel design

Section 1 includes general information that has been agreed on for the LCOE assessment of the different floating wind turbine designs.

1.2.1 Site considerations

The four floating wind turbine designs have been assessed for three offshore sites. The sites were chosen by searching the most differentiation possible between their met-ocean conditions. This has led to three severity levels characterizing the sites, which are moderate, medium and severe environmental conditions. The main characteristics of the sites are presented below.

Site A

Moderate Environmental Conditions

Reference location:

Golfe de Fos – France

Water depth: 50-100m

Mean wind speed at 100m: >10m/s

Hs_50 years: 7m

Soil condition: Sand or Mud

Reference distance to onshore substation: 38km

Figure 2: Golfe de Fos (France) selected offshore site

Site B

Medium Environmental Conditions

Reference location:

Gulf of Maine – USA

Water depth: 100-140m

Mean wind speed at 100m: 10.18m/s

Hs_50 years: 10.48m

Soil condition: Mud/Clay or San

Reference distance to onshore substation:

57.8km

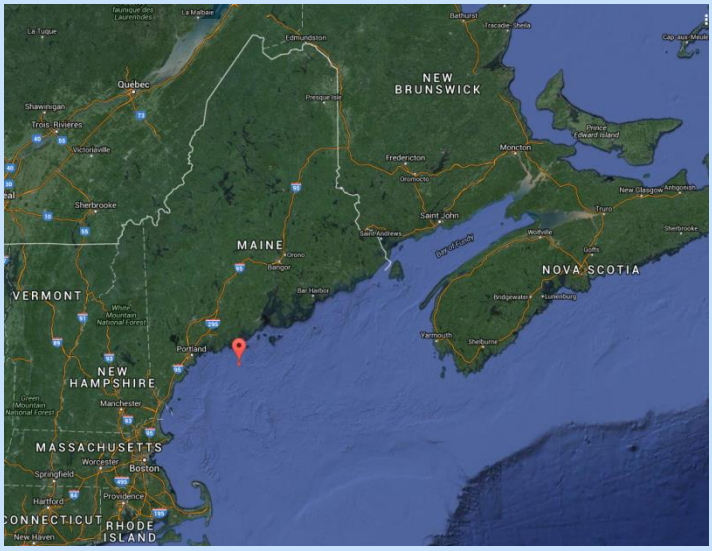


Figure 3: Gulf of Maine (US) selected offshore site

Site C

Severe Environmental Conditions

Reference location:

West of Barra – Scotland

Water depth: 56-118m

Mean wind speed at 100m: 11.26m/s

Hs_50 years: 14.27m

Soil condition: Rock

Reference distance to onshore substation:

180km

Figure 4: West of Barra (Scotland) selected offshore site

Once the three sites were selected, two additional considerations were done in order to completely define the met-ocean characterizations:

- Design water depth: The offshore sites are characterized for a certain depth that should be on the range of real depths of the site. This consideration leads to a better differentiation of the sites conditions. The final representative depths for which the concept designs are developed are presented in the following table.

Sites	Golfe de Fos	Gulf of Maine	West of Barra
Design Depth [m]	70	130	100

Table 1: Characterization depth selected for each site

- Soil conditions: Due to the difficulty to achieve accurate data of the soil conditions without the performance of a geophysical and/or geotechnical campaign (out of the scope of the project), it was decided to establish standard soil profiles for the sites, where each one of them are different depending on the general characterization of the soil that could be found in open references.

More information about the selected offshore sites is provided in the public deliverable D1.1 Oceanographic and meteorological conditions for the design [1].

1.2.2 LCOE calculation

The LCOE calculation is a method used to obtain the cost of one unit energy produced expressed in €/MWh and is typically applied to compare the cost competitiveness of different power generation technologies. The LCOE model relates the discounted life cycle cost (LCC) of the floating wind farm to the total energy provided during the lifetime [2].

$$\mathrm{LCOE} = \frac{\text{Life cycle cost}}{\text{Electrical energy provided}} = \frac{\sum_{t=1}^{n} \frac{\mathrm{CAPEX}_0 + \mathrm{OPEX}_t + \mathrm{DECEX}_{n+1}}{(1+r)^t}}{\sum_{t=1}^{n} \frac{\mathrm{E}_t - \mathrm{L}_t}{(1+r)^t}}$$

Here, t represents the years and r the discount rate. The life cycle costs include the capital expenses (CAPEX), which are the sum of the development, manufacturing, transportation and installation cost, the operation and maintenance expenses (OPEX) as well as the decommissioning expenses (DECEX). The LCC calculation is performed for all components of the floating wind farm such as the wind turbines, the floating foundations and the complete balance of plant. The wind energy that is available at one of the selected offshore sites Golfe the Fos, Gulf of Maine and West of Barra is calculated based on the wind data provided for each site and considering the standard Weibull distribution formula. The energy losses (Lt) take into consideration the wake effect, turbine losses, collection and transmission losses as well as availability.

The LCOE calculation has been carried out for the four floating wind turbine concepts and the three offshore locations. Furthermore, the calculation takes into account a 500MW offshore wind farm consisting of 50 units of the DTU 10MW reference wind turbine. The concept designers were required to provide detailed cost data covering the whole life cycle for their specific substructure design including inter-array cables and to define the cable lying between turbines. However, the wind farm layout for each site as well as the cost data for the wind turbine and balance of plant are common and the same for all concepts.

The LIFES 50+ Overall Evaluation tool named "Floating Offshore Wind Assessment Tool - FOWAT" has been used for the calculations. The tool has been developed within the project to qualify the four concepts under economic, environmental, risk and technical perspective. The economic assessment is performed by the calculation of the LCOE and included in the LCOE module of the tool. FOWAT performs its calculations using specific data regarding each design and site. A questionnaire has been prepared and distributed among all concept designers to collect the data that is required by the tool to compute the LCOE. This includes detailed data concerning the manufacturing, transportation, installation, operation and maintenance as well as decommissioning of the floating wind turbines. A common questionnaire was defined for the collection of the data used for the calculation of the life cycle cost of the common components of the floating wind farm such as the wind turbines, substations and export cables. Finally, the costs for each life cycle stage have been calculated in the tool, considering both concept designers data and literature data for common components.

The LCOE calculation is subjected to a certain degree of uncertainty due to the fact that some of the input data used for calculation of the life cycle costs is given with a specific uncertainty range. Furthermore, the results are affected by the accuracy and the source of the cost data. Thus, the comparison and conclusions made in this document are affected by these conditions as well. Although, the results are highly dependent on the input data both for the designer dependent data and the data provided for the common components, this makes it even more necessary to perform a sensitivity analysis to study the degree of uncertainty and to obtain the influence on the final results.

2 Life cycle cost in FOWT design process

This section details with the LCC results obtained by each FOWT design at the three selected sites. The presented results include the LCC breakdown (i.e., development, manufacturing, transportation and installation, operation and maintenance and decommissioning phase) for each of the analysed cases. More information about the LCOE, LCA and Risk assessment results obtained for each concept and site can be found in deliverable D2.6. Likewise, the methodology used to perform the calculations is presented in both deliverables D2.2 and D2.6. As in previous deliverables, the results shown here are focused on the analysis of a floating offshore wind farm with 50 floating wind turbine units.

2.1 Cost details and contribution identification

Figure 5 to 8 show LCC breakdown results (in %) for the four FOWT concepts evaluated (barge concrete, semi-submersible concrete, semi-submersible steel and TLP steel) and at the three sites considered within the project (Golfe de Fos - GdF, Gulf of Maine – GoM and West of Barra - WoB) without considering uncertainty ranges in selected input values.

As it can be noted, this LCC breakdown is divided into five main categories: development, manufacturing, transportation + installation, operation + maintenance and decommissioning. With the aim of not only to detail the differences among these aforementioned categories but also to analyse the influence of the site selected on the results obtained, all presented figures are shown in proportion to West of Barra location. Therefore, the sum of all designs phases of LCC do not result 100%, since they are referred to the West of Barra case. This allows also a better representation of the cost increases among the different sites by not showing only the life cycle cost contribution for a specific site.

Before focusing in any particular FOWT technology, two clear conclusions can be observed from the results obtained for all the cases evaluated. Firstly, as it can be seen in the figures, the manufacturing phase is the most influent activity within the LCC for the three selected sites. Such result was expected since this cost comprises the manufacturing or acquisition of individual components of the floating offshore wind farm such as wind turbines, substructures, mooring lines, anchors, power cables and the substation. Furthermore, it includes the storage cost in the port as well as the load-out process. Secondly, it can be noted that there is a common trend for all FOWT concepts considered that indicates that LCC costs for West of Barra are much higher than for the other two locations. One of the contributor to the higher costs is the longer distance from the offshore wind farm to the onshore substation in comparison with the other two sites (Golfe de Fos – 38km, Gulf of Maine – 57.8km and West of Barra – 180km). This fact affects very significantly the transportation and O&M tasks, as well as installation and decommissioning phases. Also, West of Barra has very severe environmental conditions in comparison with the other places, which impacts the costs. For instance, due to harsher met-ocean conditions the substructure besides of the mooring system, have to be more robust and costly. Besides that, the fact that weather windows in West of Barra are much more reduced than in the other sites due to the aforementioned harsh conditions implies the need of much larger and specialized vessels, which in turn represent an increment on the installation and transportation costs.

Moreover, soil conditions in West of Barra are more challenging than in Golfe de Fos and Gulf of Maine since the seabed in West of Barra is rock while at the other sites it consists basically of sand and mud. This requires a different anchor type than the one used in the other two locations and depending on the floating wind turbine concept this can impact the manufacturing and especially the installation cost of anchor and mooring lines.

Likewise, all cases present their lowest LCC cost values for Golfe de Fos site (although for some FOWT technologies the differences in costs between Golfe de Fos and Gulf of Maine locations is not very significant), because it has the shortest export cable distance, favourable soil conditions and moderate met-ocean conditions to install the FOWT considered in this study.

Once the common conclusions from the results obtained are discussed, specific outputs from each FOWT technology are described. Focusing on LCC (in %) resulted of barge concrete concept, it can be seen in Figure 5 that transportation and installation has a very relevant influence on the results having similar costs as O&M tasks mainly because of its highest number of days required to carry out the process. For the case of West of Barra, transportation and installation costs even overtake O&M costs as the second more expensive cost within the LCC due to its longer distance to shore and its more severe seabed conditions and environmental conditions.

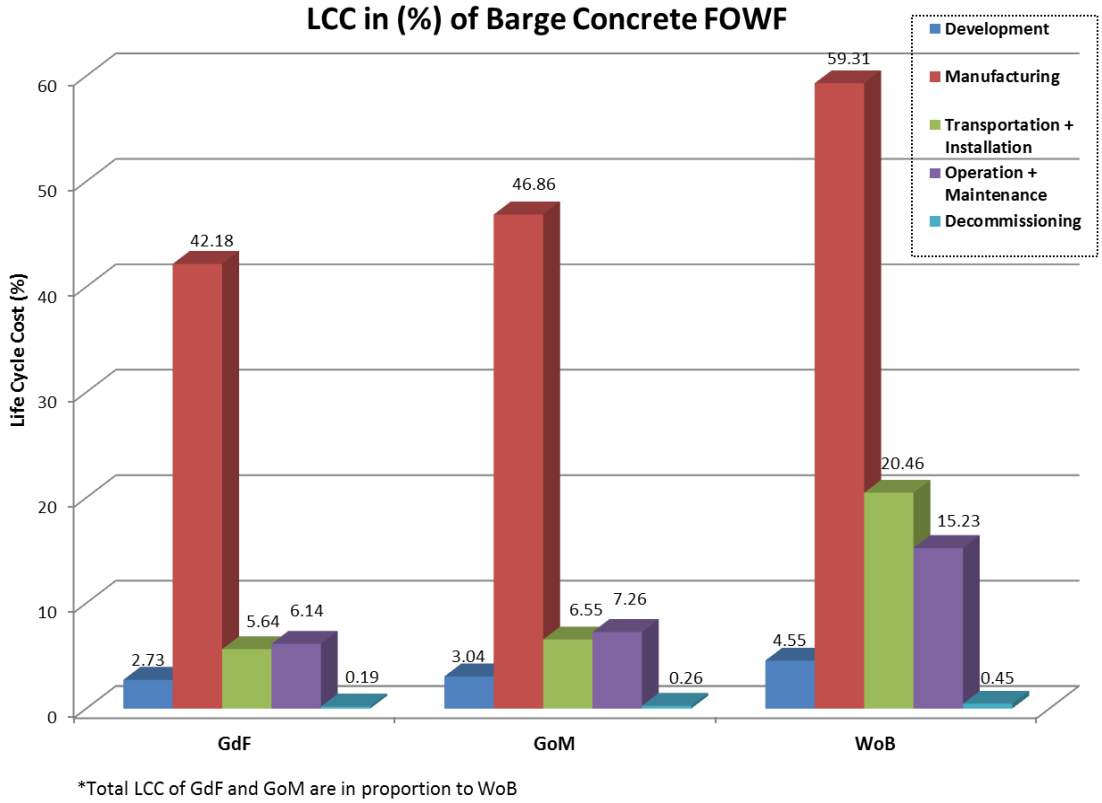


Figure 5: LCC breakdown of Barge concrete FOWT

Figure 6 shows the LCC breakdown results obtained for the concept of a semi-submersible concrete FOWT. In this particular case, the most noteworthy result is concerning the low cost resulted for transportation and installation phase. The reason why this cost has been drastically reduced is because of its large number of parallel actions performed during the process. Thus, this concept requires more vessels to perform such activities but the number of rental time can be significantly reduced.

LCC results of the TLP steel FOWT concept are detailed in Figure 7. As it can be seen, due to the higher cost of both transportation and installation and O&M activities, the ratio between them and manufacturing process is lower than from other designs (with the exception of the barge concrete FOWT concept where the same phenomenon occurs).

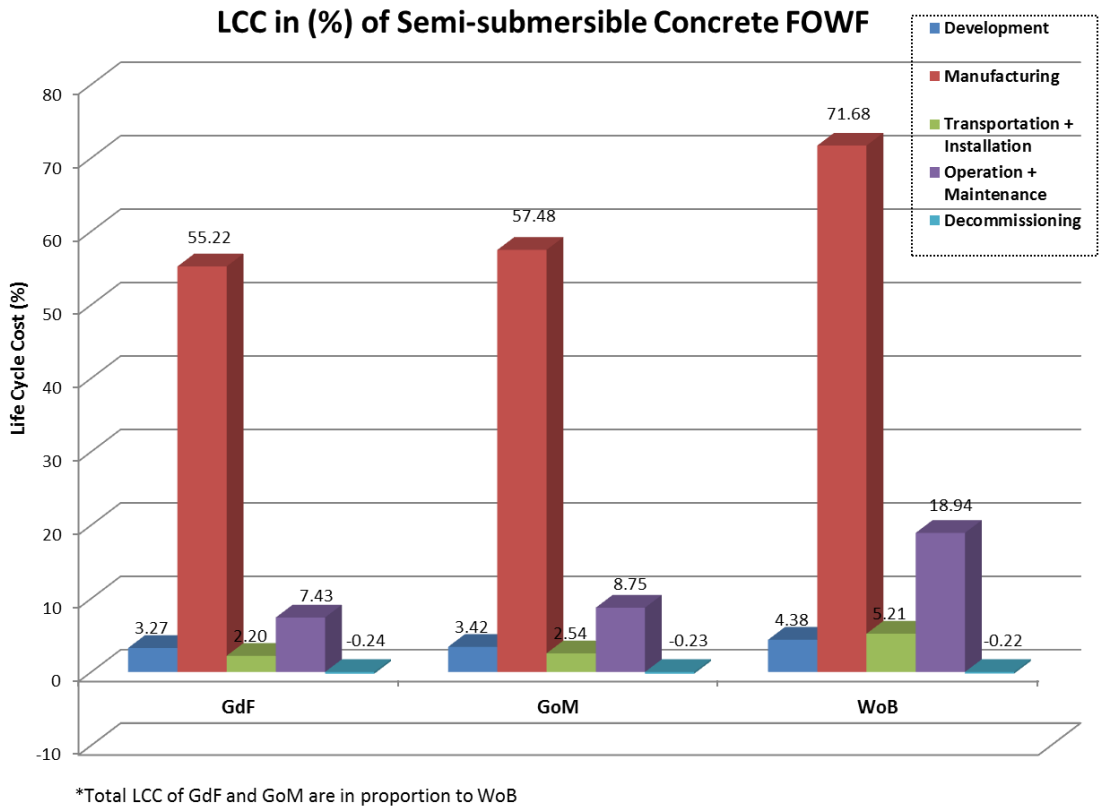


Figure 6: LCC breakdown of Semi-submersible concrete FOWT

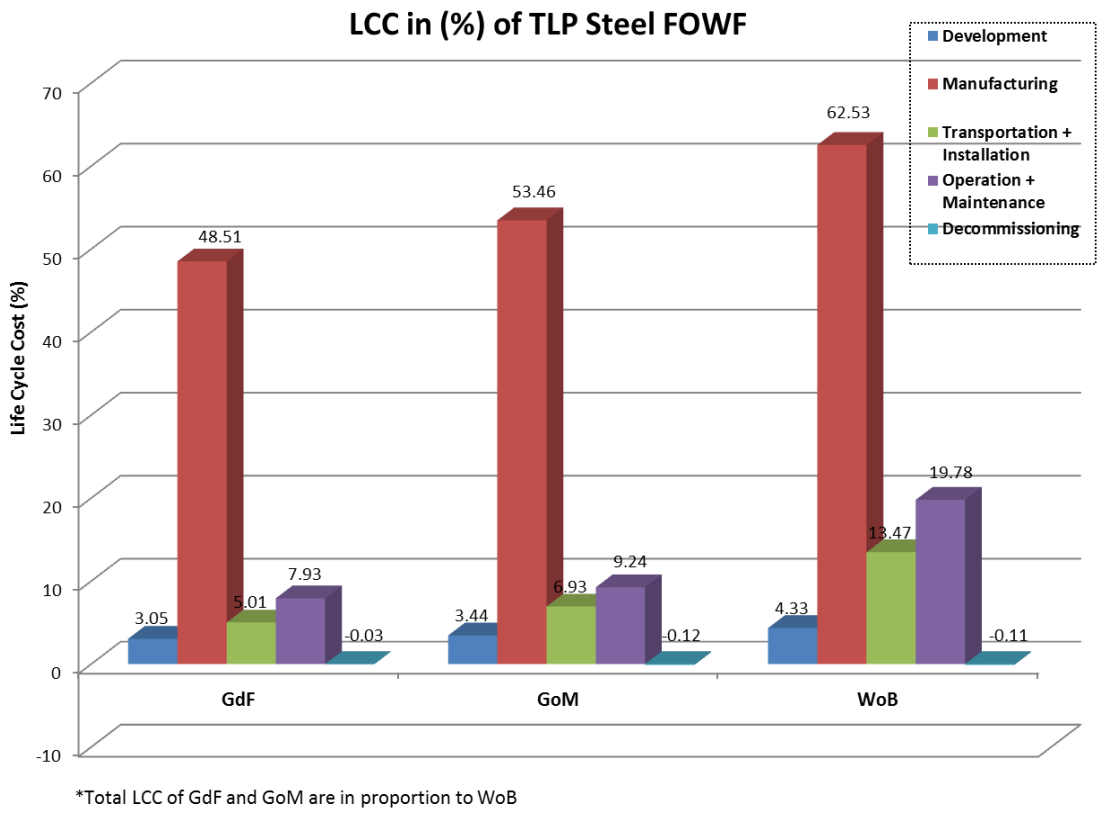


Figure 7: LCC breakdown of TLP steel FOWT

Finally, Figure 8 shows the LCC breakdown resulted for the semi-submersible steel FOWT design. As it can be noted, the outputs achieved reinforce the results trend observed in the other designs. Hence, manufacturing phase is the most costly phase of the whole LCC accounting for 50%-70% of the total LCC. Furthermore, installation and transportation phase for West of Barra is much higher (approximately double) than for the other two sites, as well as, it occurs with O&M costs.

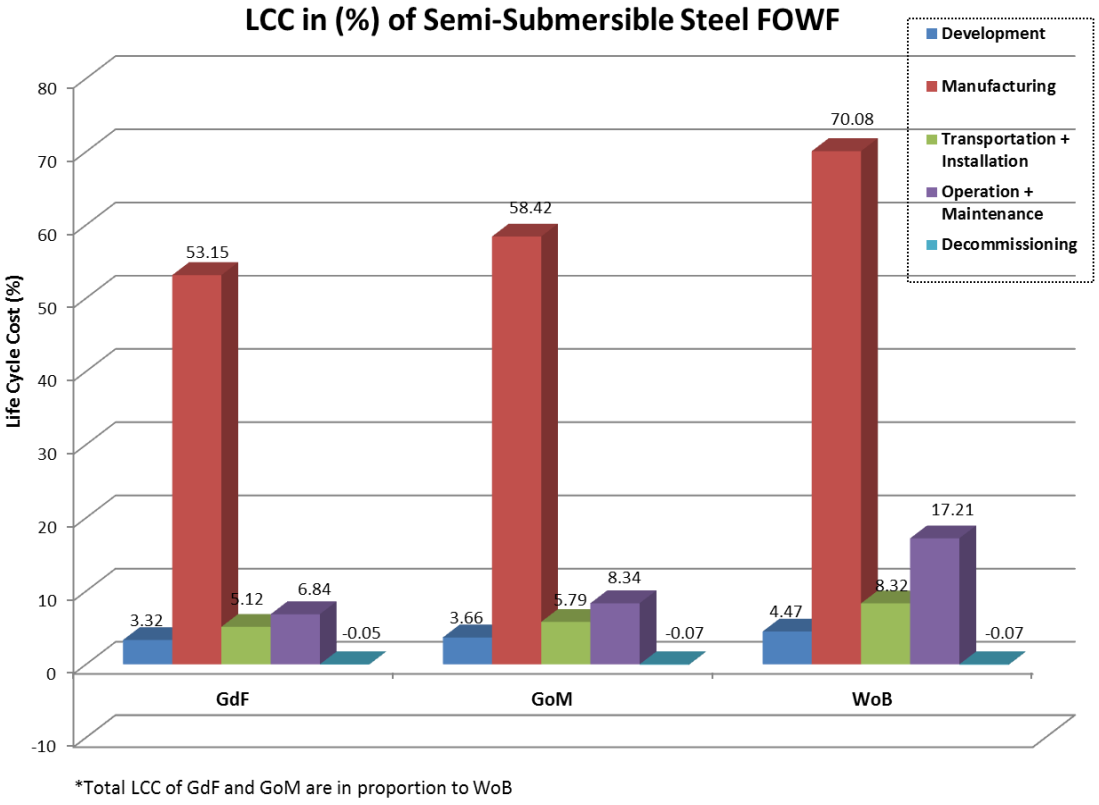


Figure 8: LCC breakdown of Semi-Submersible steel FOWT

For the four designs and sites, it can be noticed that the manufacturing stage is the one that contributes the most to the LCC. That means that decisions that are made during the design phase in terms of materials, cost of the components and structural requirements do affect the final cost of the substructure. In order to understand better which components have a major influence on the LCC and therefore on the LCOE, a sensitivity analysis is performed, focusing on those parameters dealing with manufacturing choices. The sensitivity analysis is presented in Chapter 3.

3 Sensitivity analysis

3.1 Methodology of the sensitivity analysis

A sensitivity analysis is generally used to identify how the output of a model reacts to variations in model inputs given by variables or parameters [3]. The output is defined in this study as the value of the LCOE of a floating offshore wind farm in €/MWh. The inputs are parameters that are needed for the calculation of the LCOE such as costs provided by the concept designers and common costs, financial variables and energy related parameters. In this study over 325 parameters were included and the complete list can be found in Appendix 1. The parameters are based mostly on the input data asked in the LCOE questionnaire with some additional parameters to consider energy losses and financial parameters such as the discount rate. However, a few parameters have been identified that could not been included in the sensitivity analysis due to how the FOWAT tool computes the LCOE. This list can be found in Appendix 2. The quantification of uncertainty in the input is given by a specific range of variation (e.g. in this case 50% above and below the mean value). The chosen range must be, however, the same for all input parameters to ensure that the results are comparable.

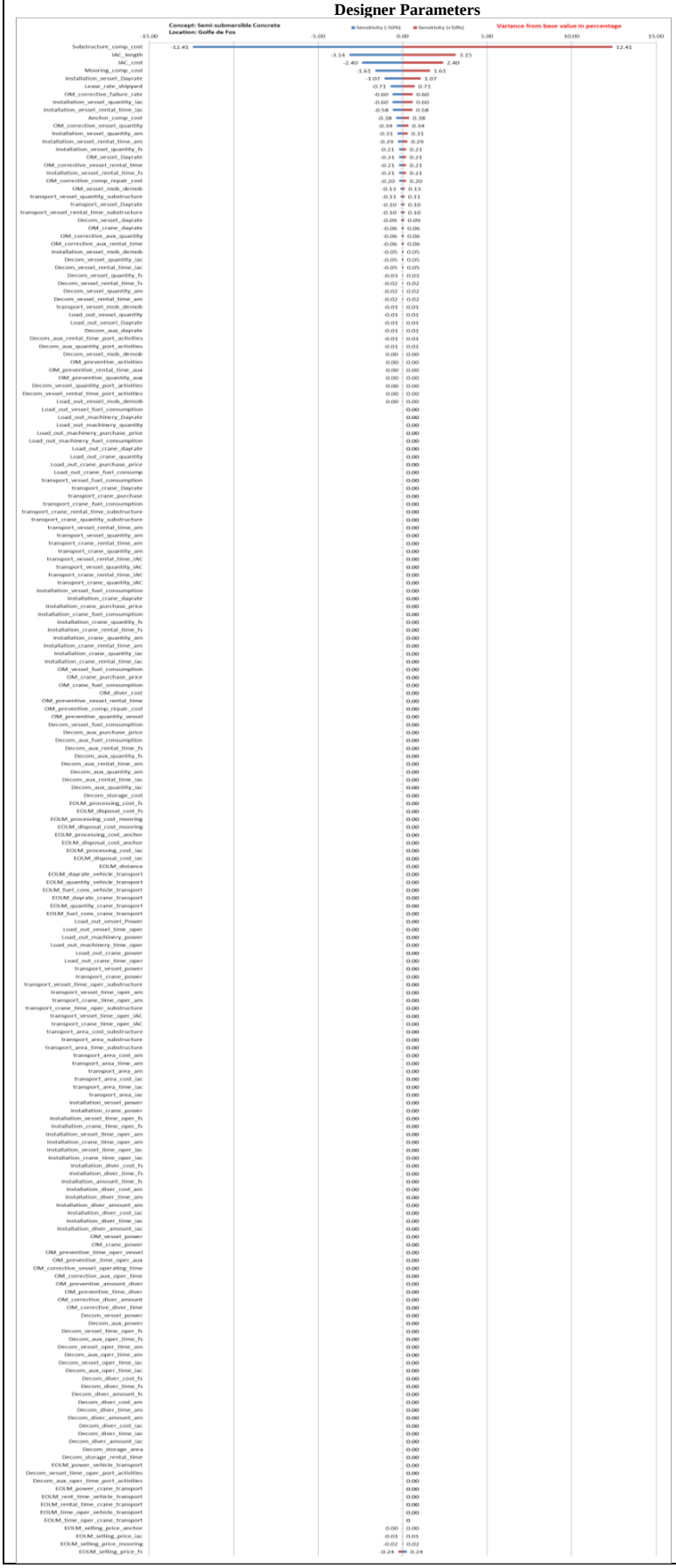
The sensitivity analysis is performed considering an entire floating wind power plant as well as the complete life cycle cost and energy losses of the system. The tool FOWAT (Floating Offshore Wind Assessment Tool) was used to perform the calculations. The sensitivity analysis is carried out for the 4 floating substructure concepts evaluated at phase I of LIFES50+ project. Furthermore, the three offshore locations West of Barra in Scotland, Gulf of Maine in the USA and Golfe de Fos in France are considered with their corresponding met-ocean conditions. This allows the comparison between the concepts and to analyse the influence of different offshore sites. There exist a number of different methods to perform a sensitivity analysis. The type that is applied in this paper is the One-at-a-time (OAT) method. It implies to vary one parameter at a time while holding the others fixed. The obtained results are presented in form of a tornado diagram to represent the effect on the LCOE by the variation of input data. A threshold value can then be defined that filters the results, which is in this case 1% on the LCOE value. This minimum variation is required to be counted as a significant input parameter and is only applied to individual parameters and not considering a group of similar ones. The filtered results are further studied by defining reasonable variation ranges and to obtain the actual influences on the LCOE. These results are presented in Chapter 4 and allow to highlight the parameters that need to be considered in order to reach a defined cost reduction target.

3.2 Results

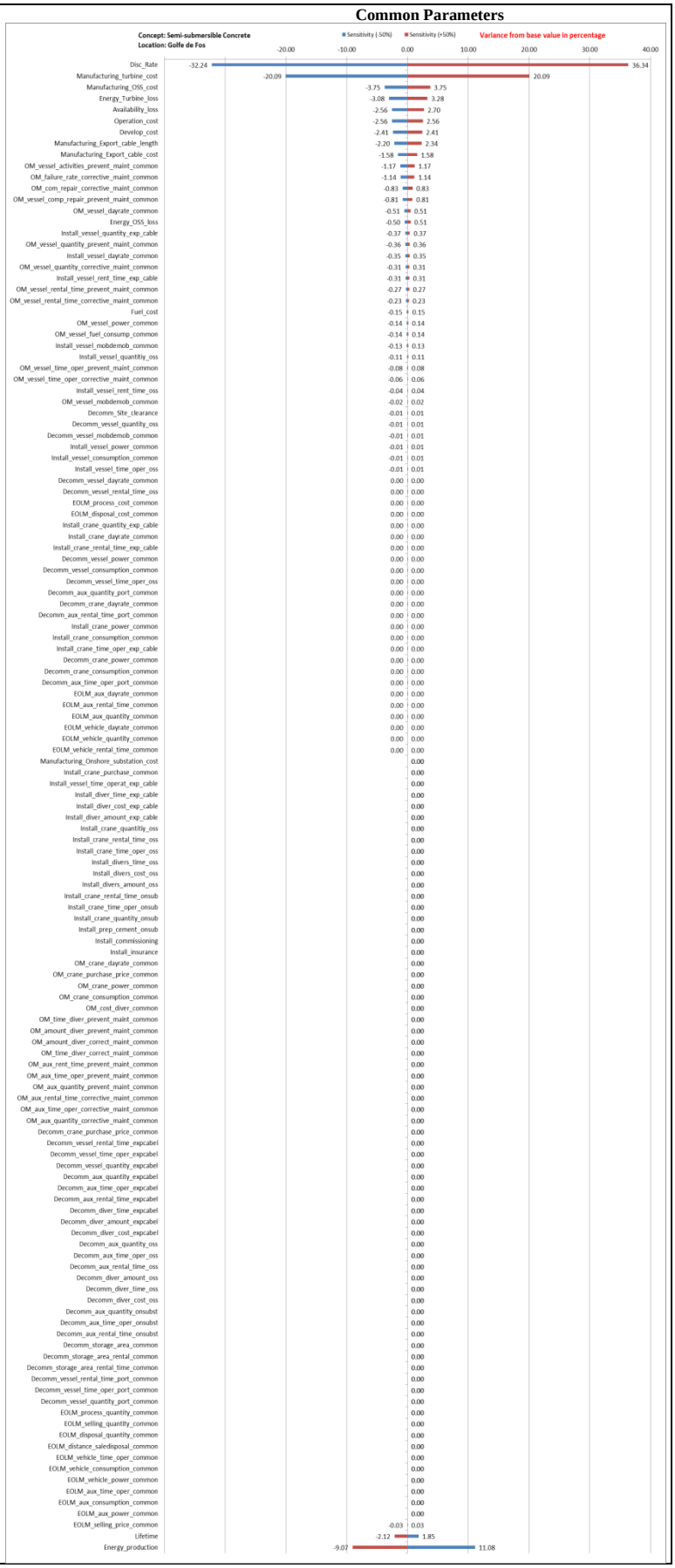
The obtained results of the parameter variation on the LCOE value are presented as tornado diagrams below. The different tornado diagrams account for the 4 floating wind turbine concepts and 3 offshore sites. The parameters are separated in design dependent parameters and common parameters and the results are presented in two individual graphs for each case. The most influencing parameters based on the 1% minimum variation criteria are summarized in Table 2 and discussed in Chapter 3.2.13.

3.2.1 Results for Semi-submersible Concrete, Golfe de Fos

Designer Parameters

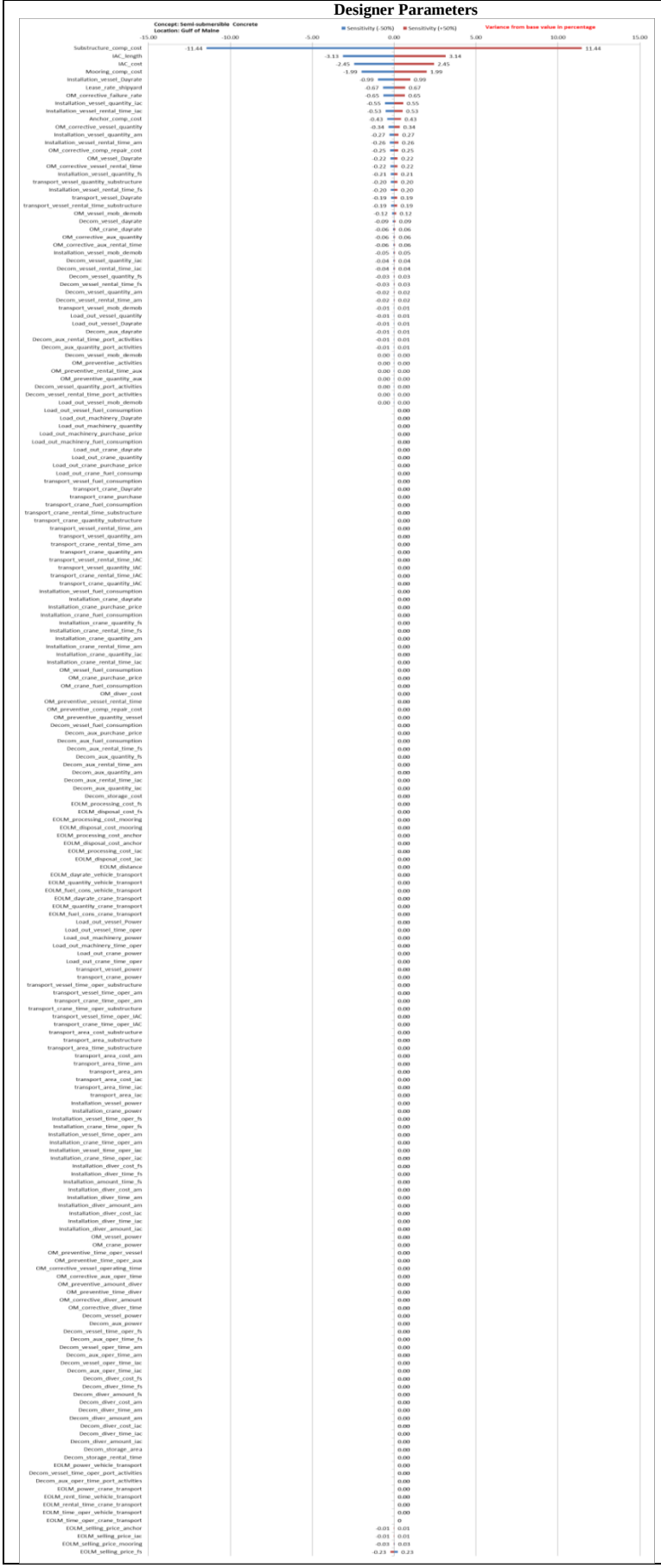


Common Parameters



3.2.2 Results for Semi-submersible Concrete, Gulf of Maine

Designer Parameters



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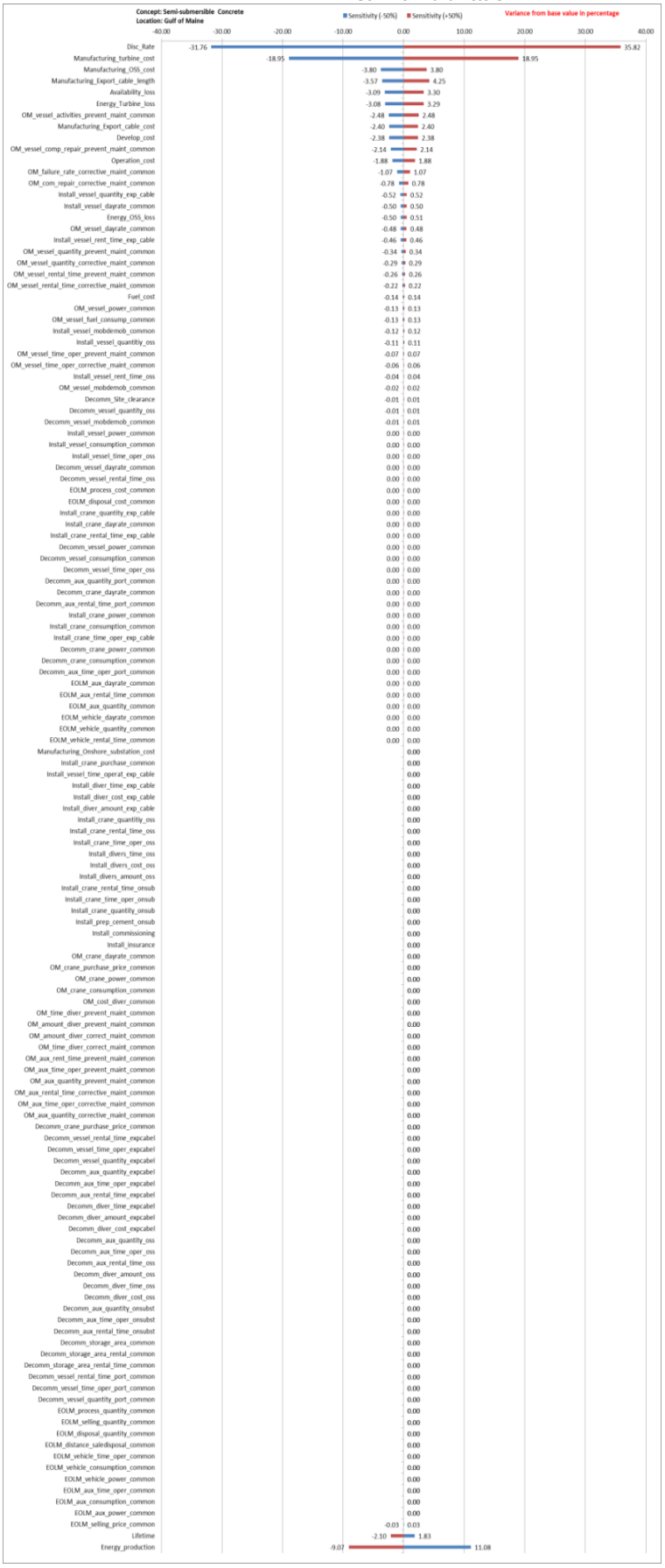
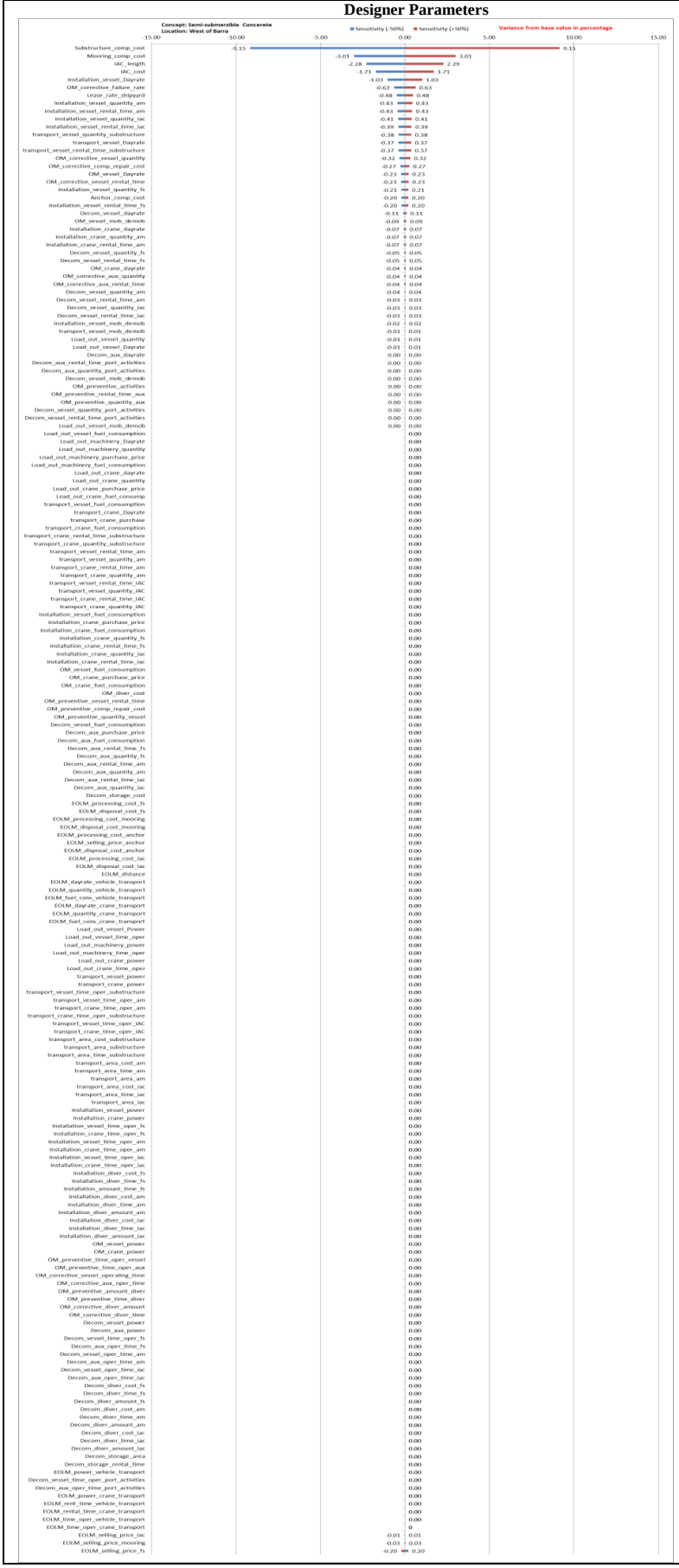


3.2.3 Results for Semi-submersible Concrete, West of Barra

Designer Parameters



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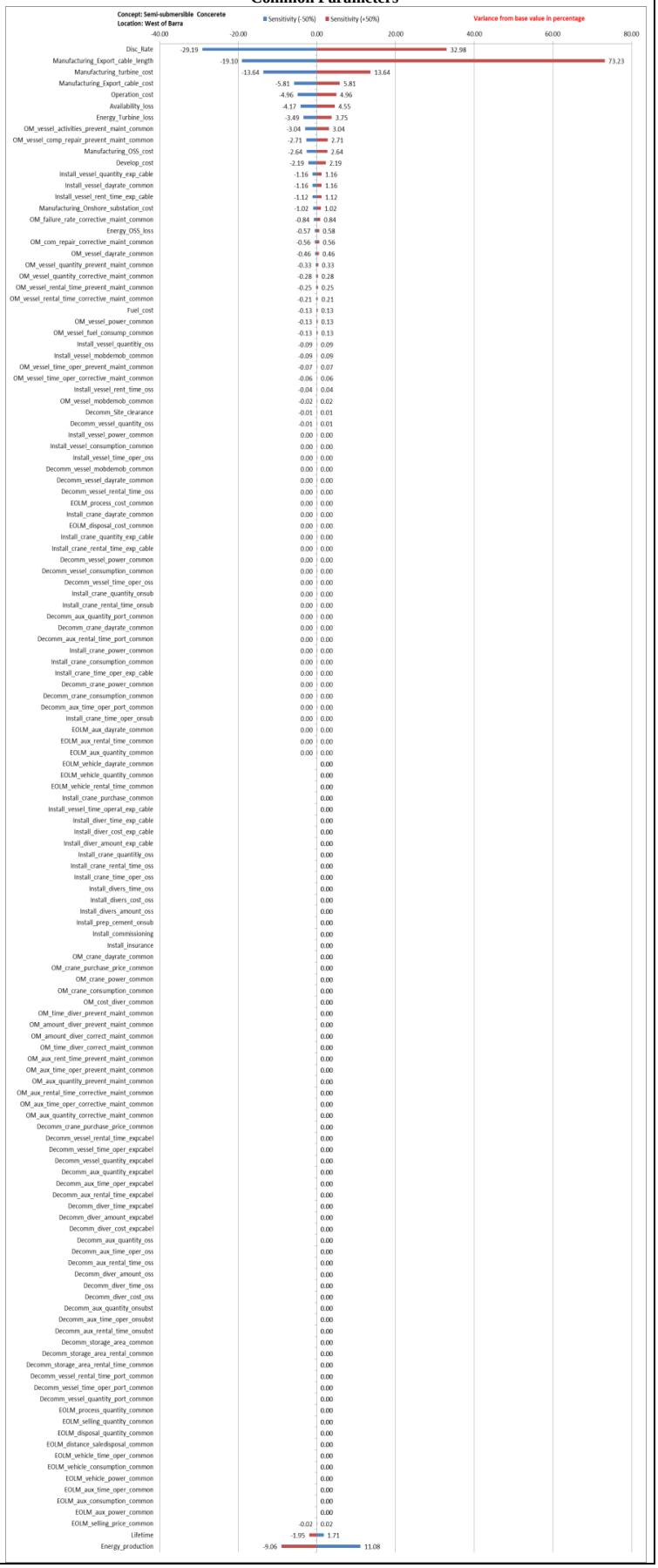
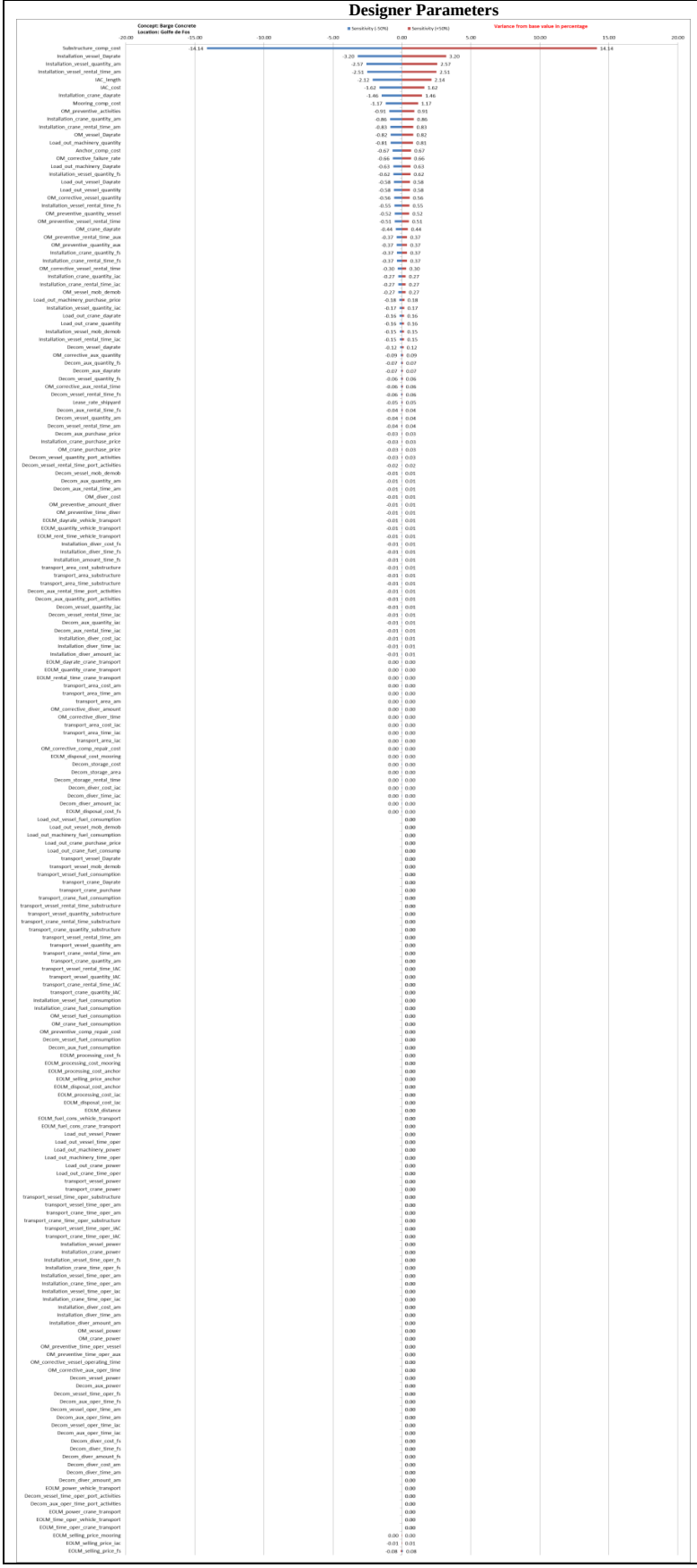
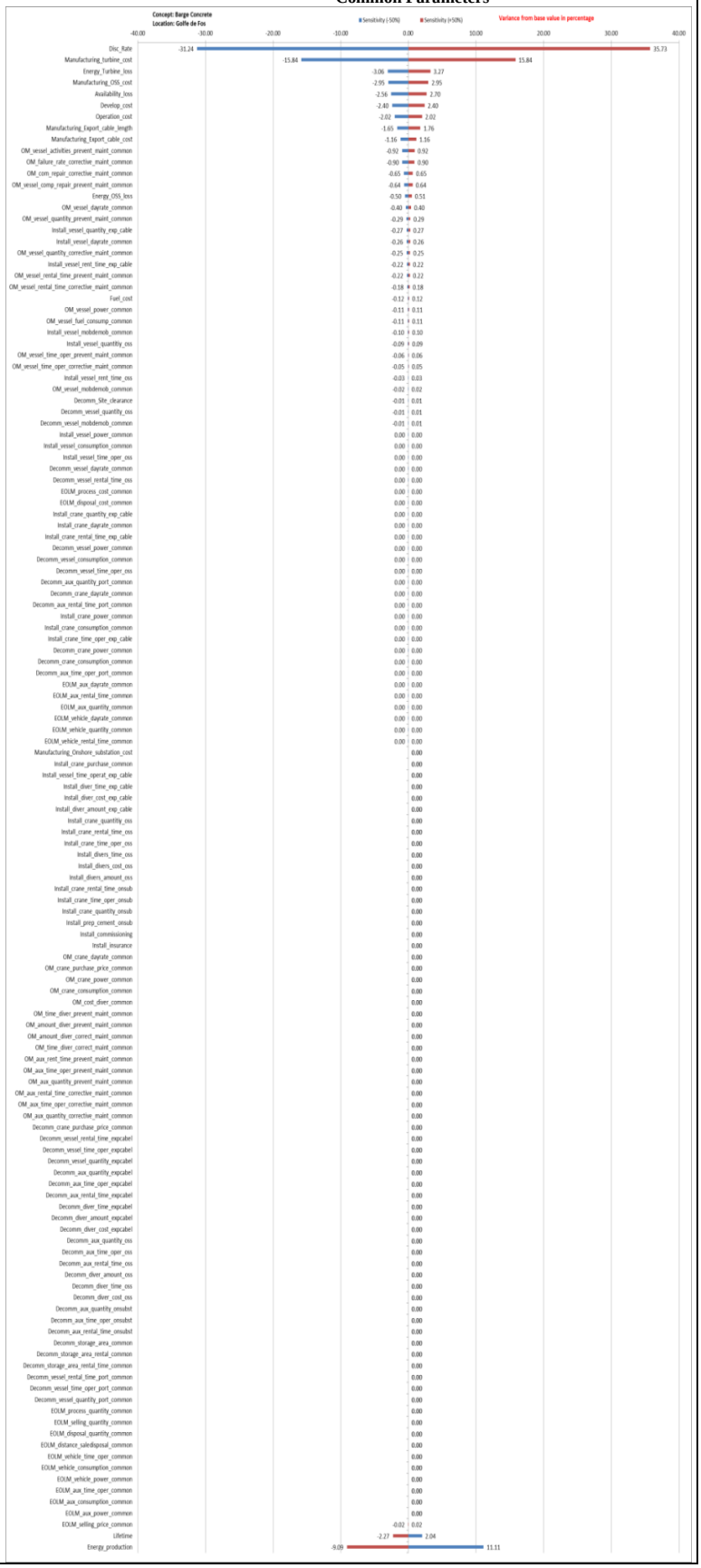


3.2.4 Results for Barge Concrete, Golfe de Fos

Designer Parameters

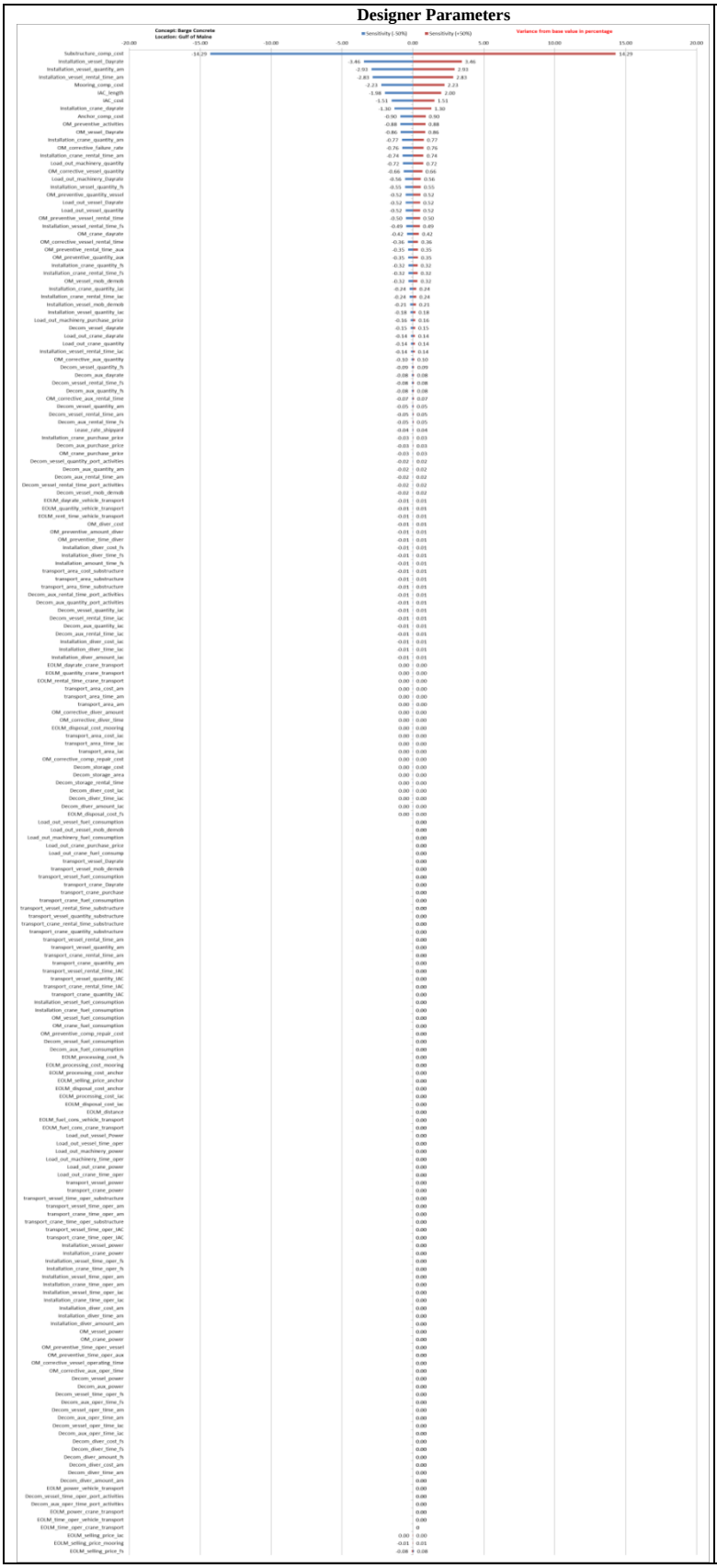


Common Parameters



3.2.5 Results for Barge Concrete, Gulf of Maine

Designer Parameters



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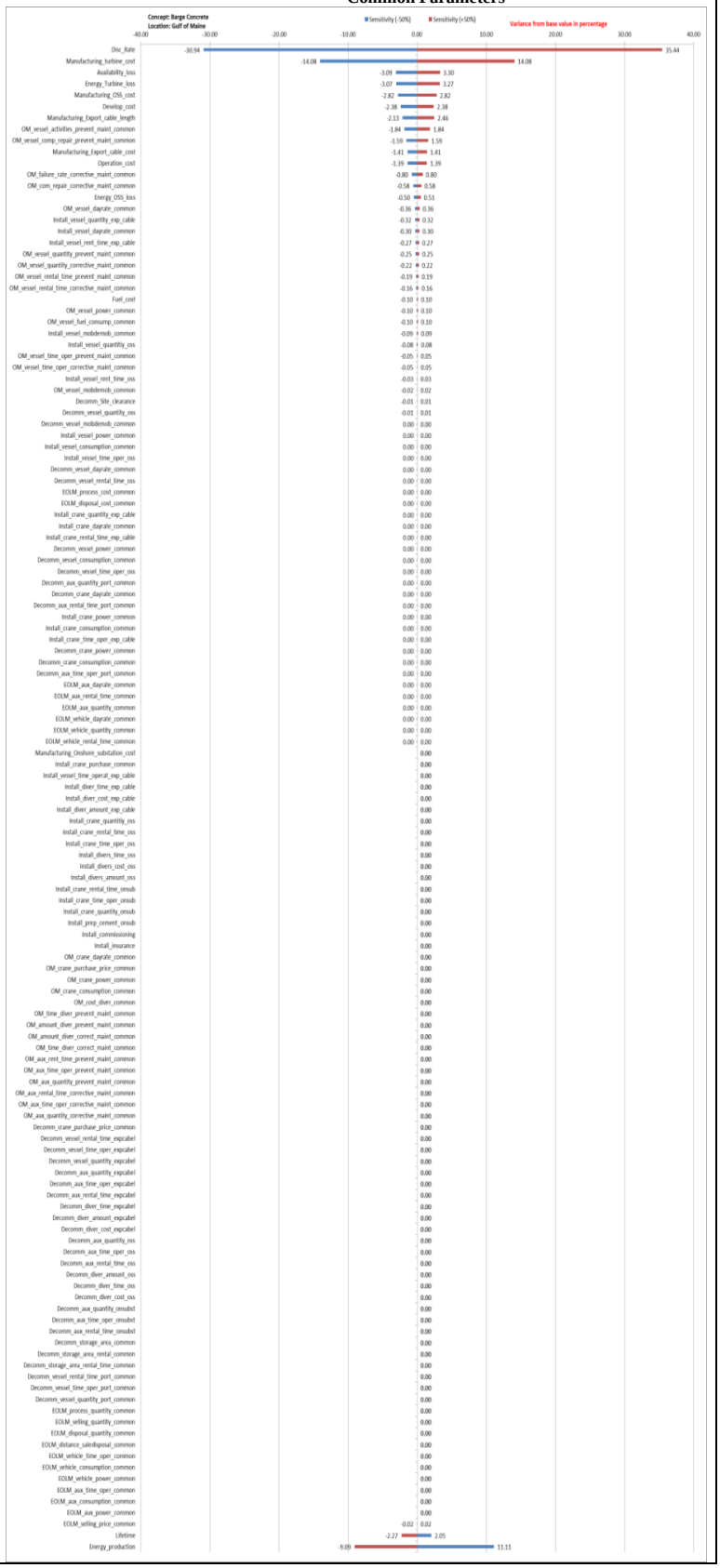
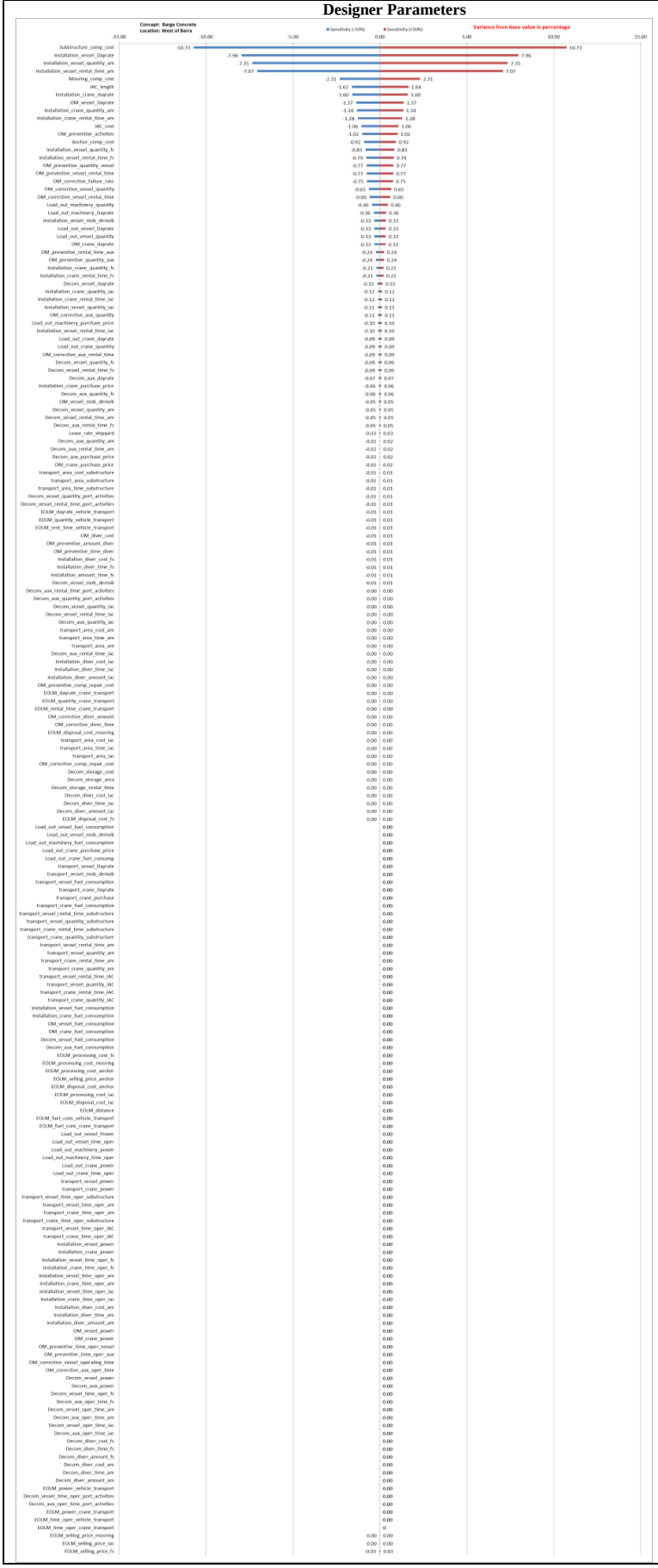


3.2.6 Results for Barge Concrete, West of Barra

Designer Parameters



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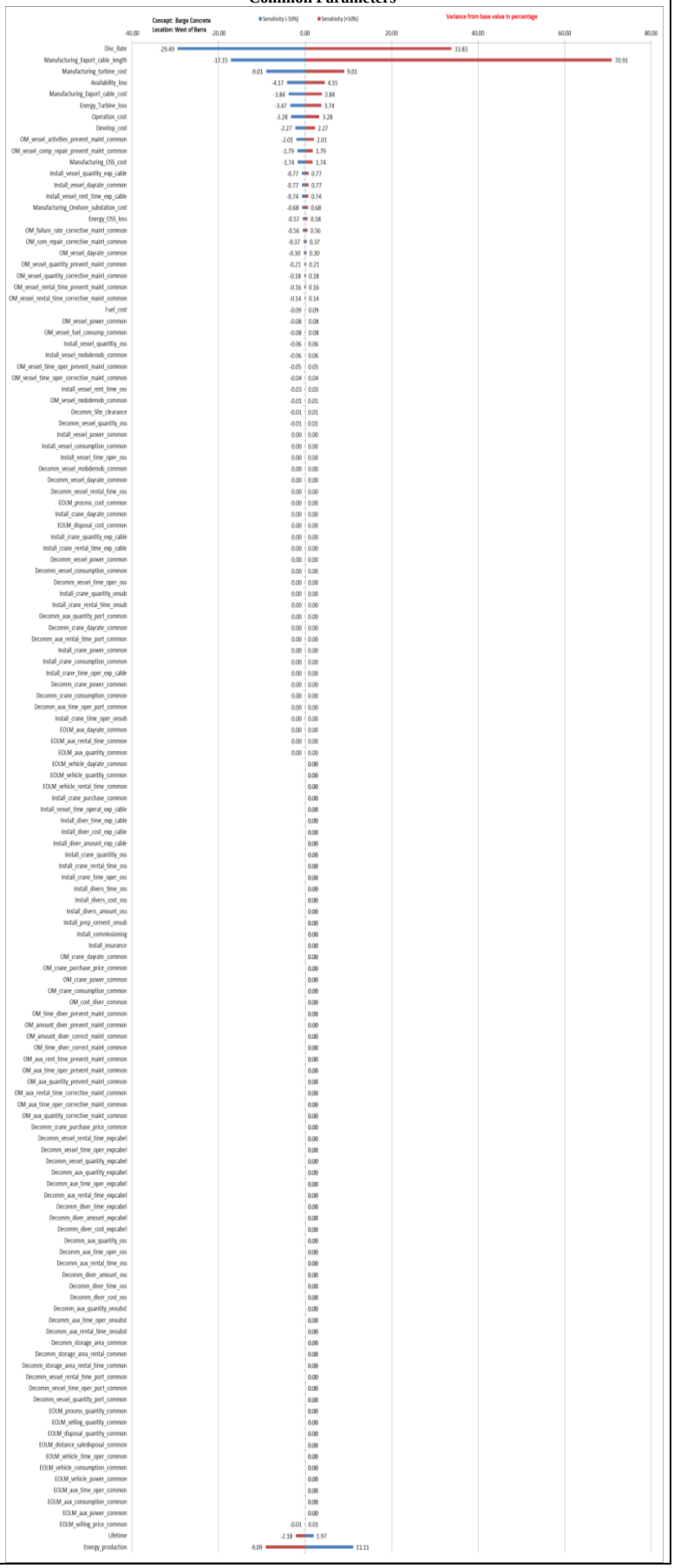

3.2.7 Results for Semi-submersible Steel, Golfe de Fos

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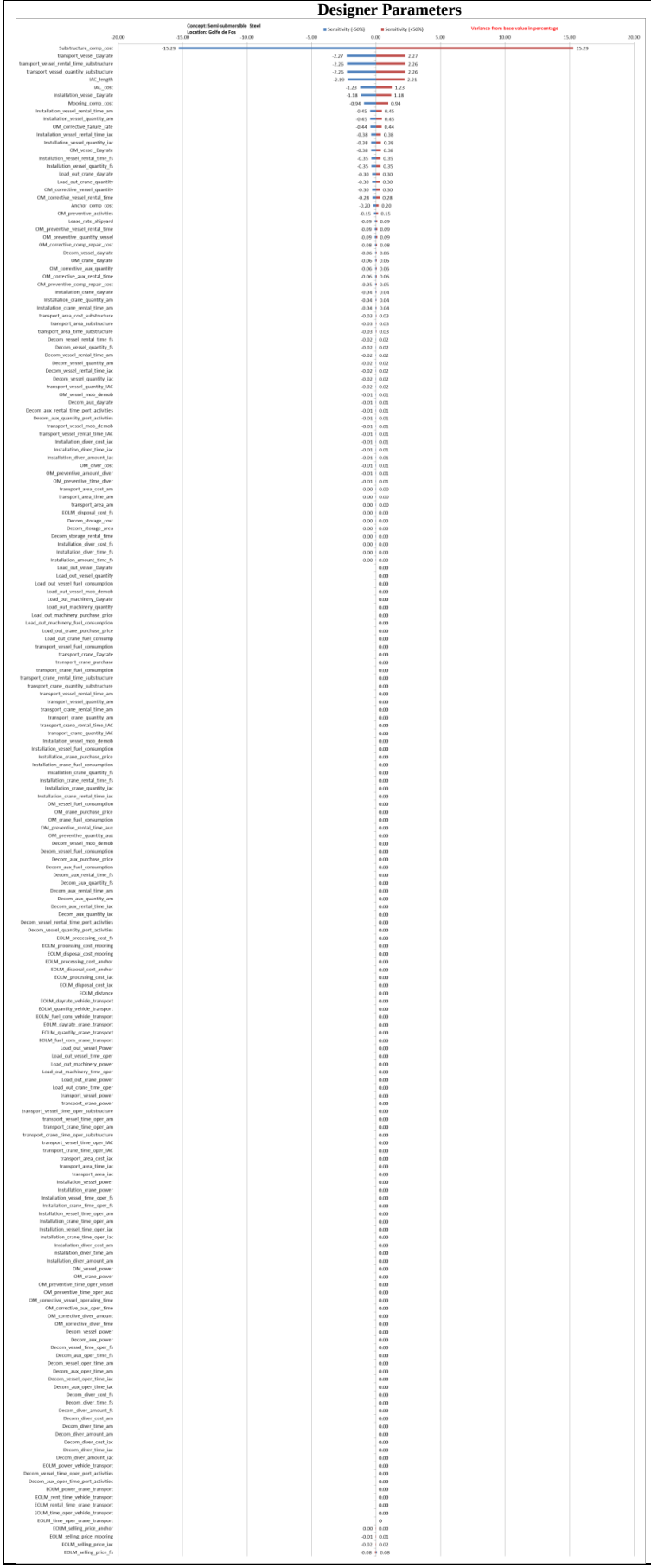

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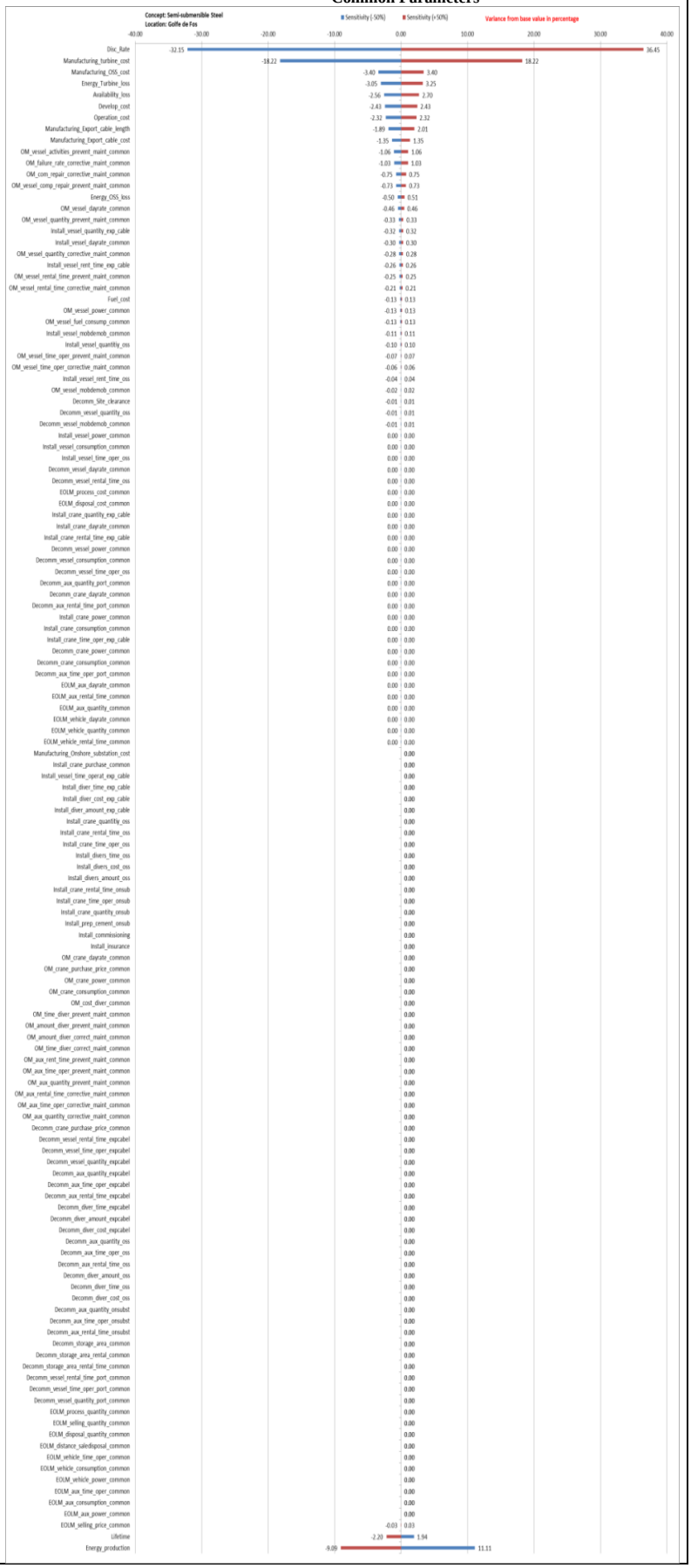
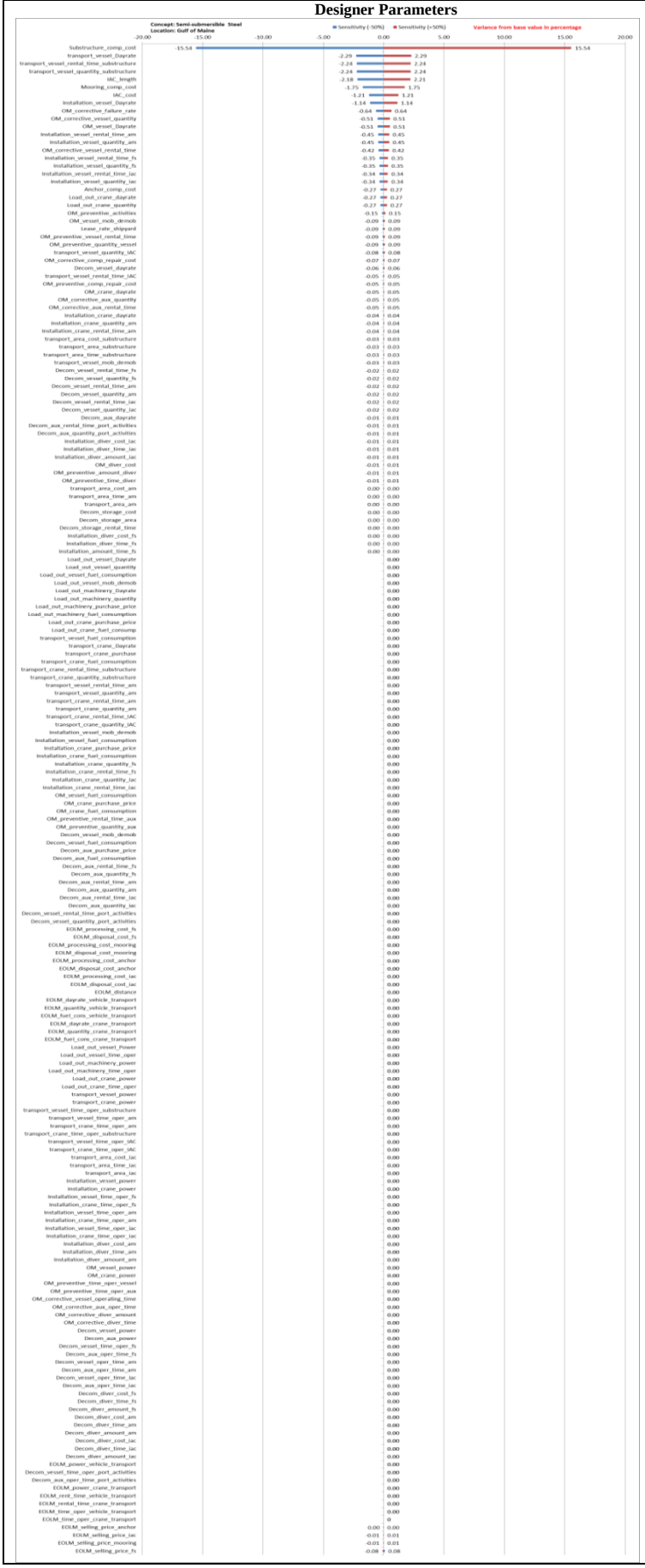


3.2.8 Results for Semi-submersible Steel, Gulf of Maine

Designer Parameters



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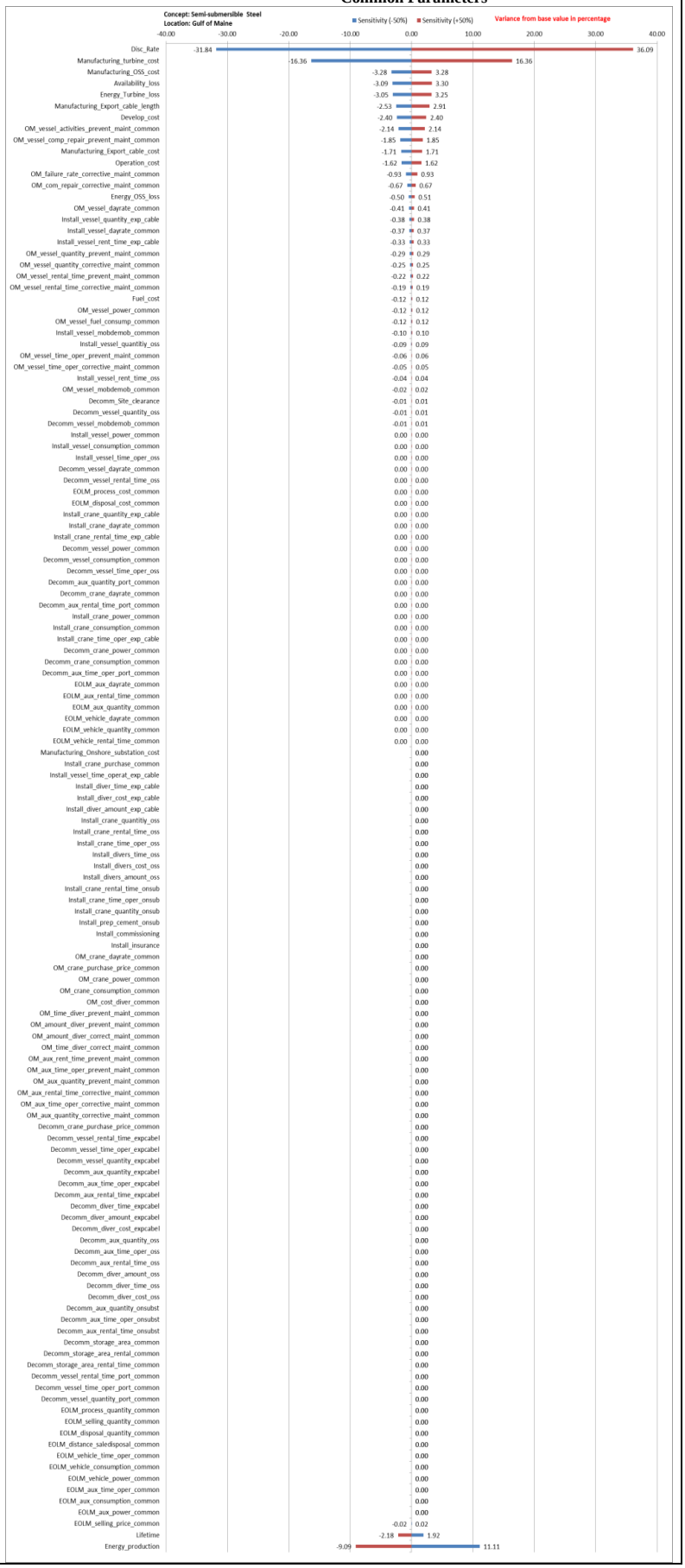
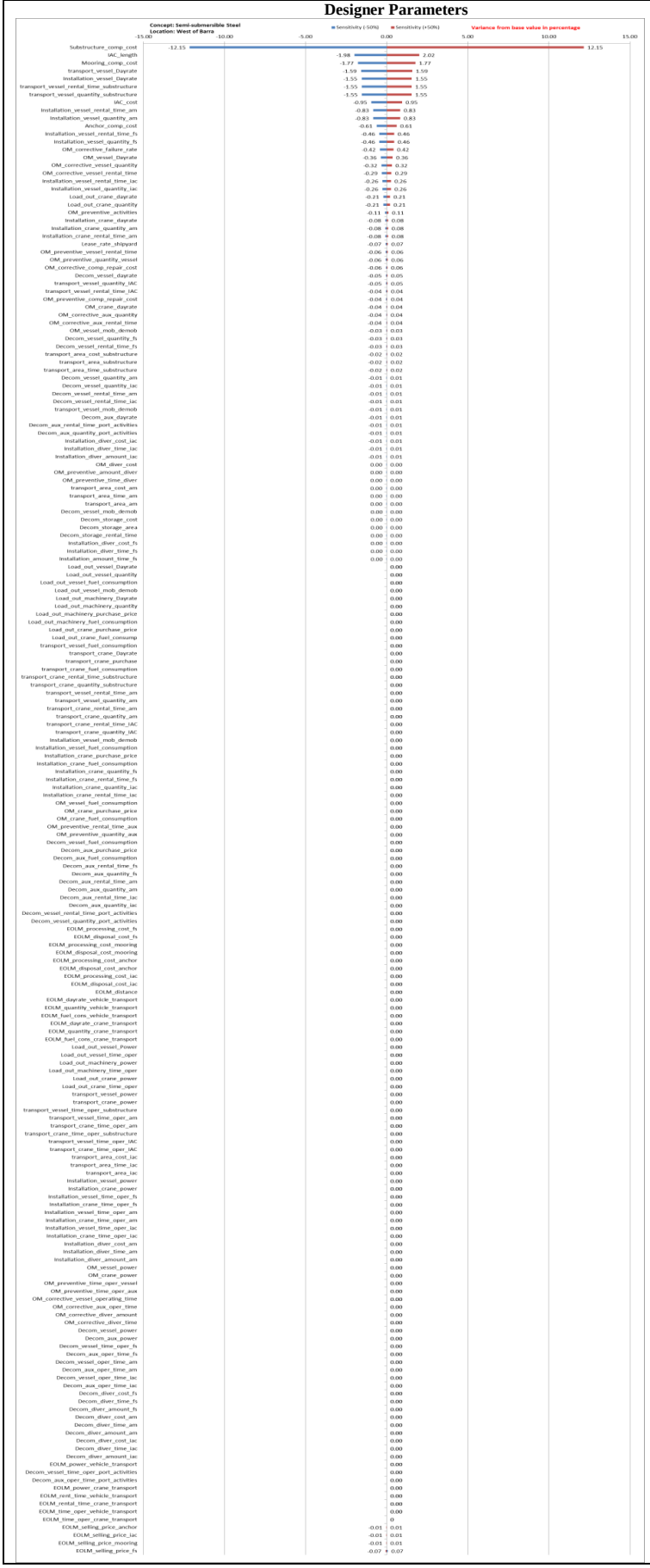


3.2.9 Results for Semi-submersible Steel, West of Barra

Designer Parameters



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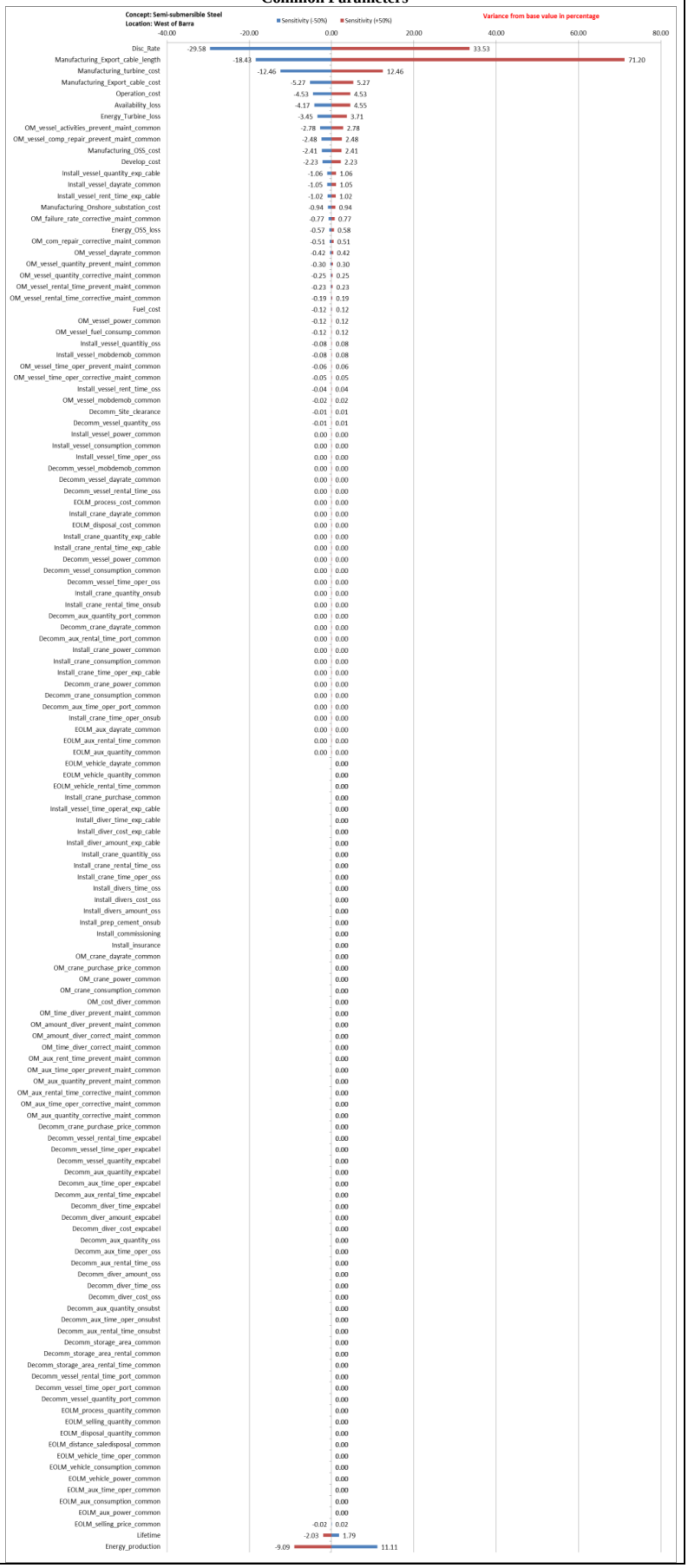
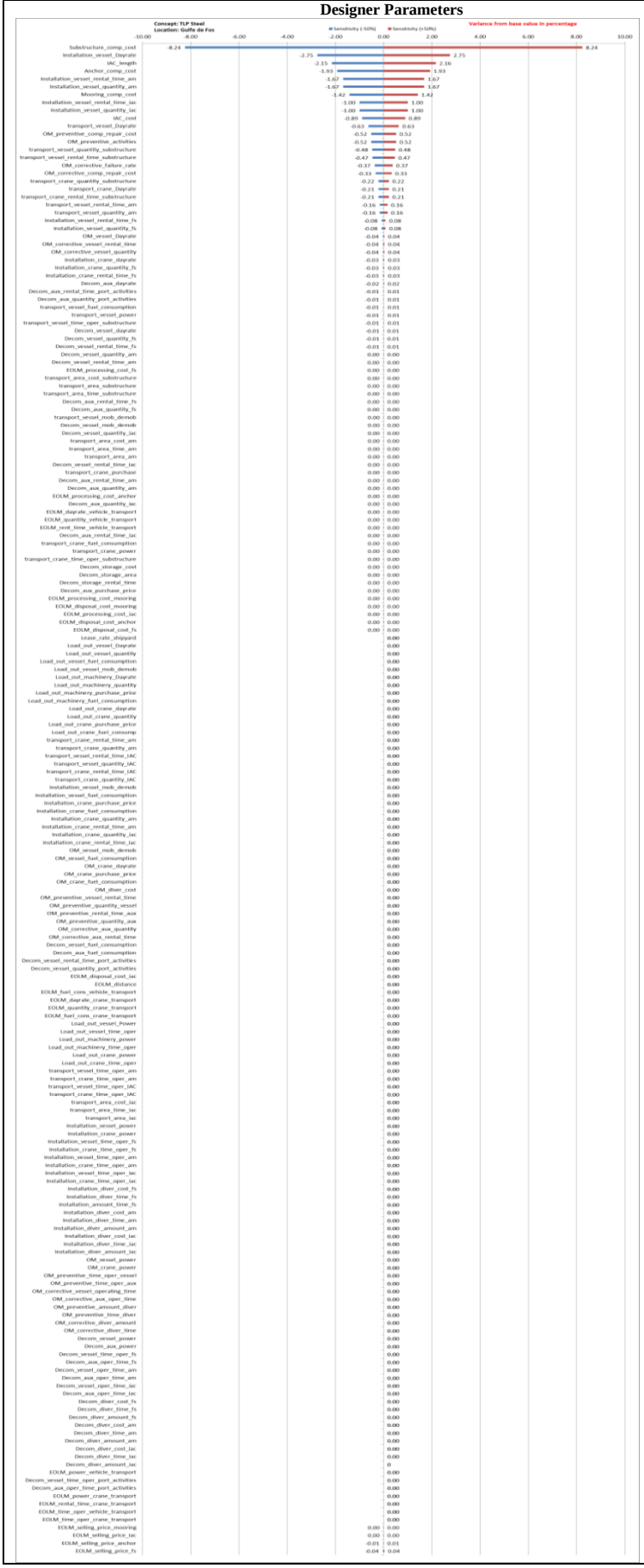


3.2.10 Results for TLP Steel, Golfe de Fos

Designer Parameters



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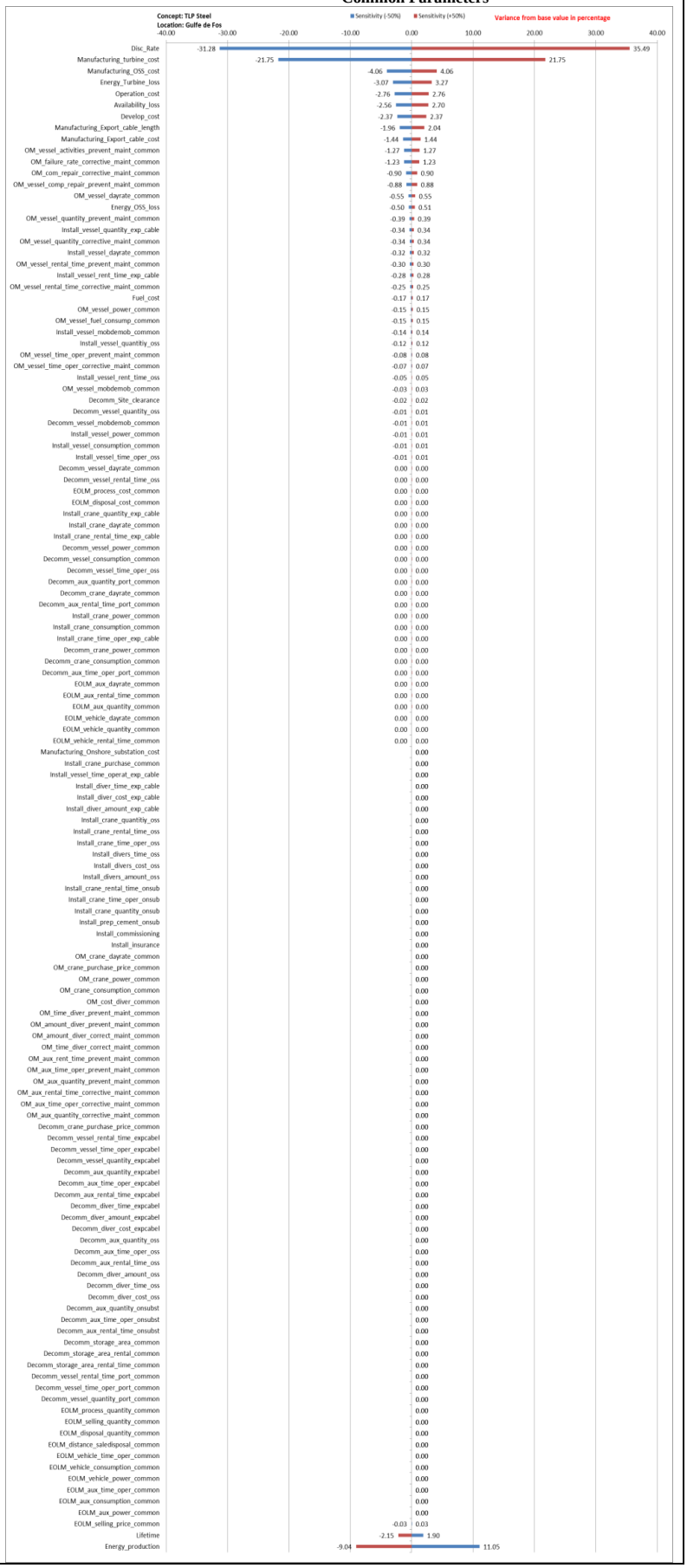
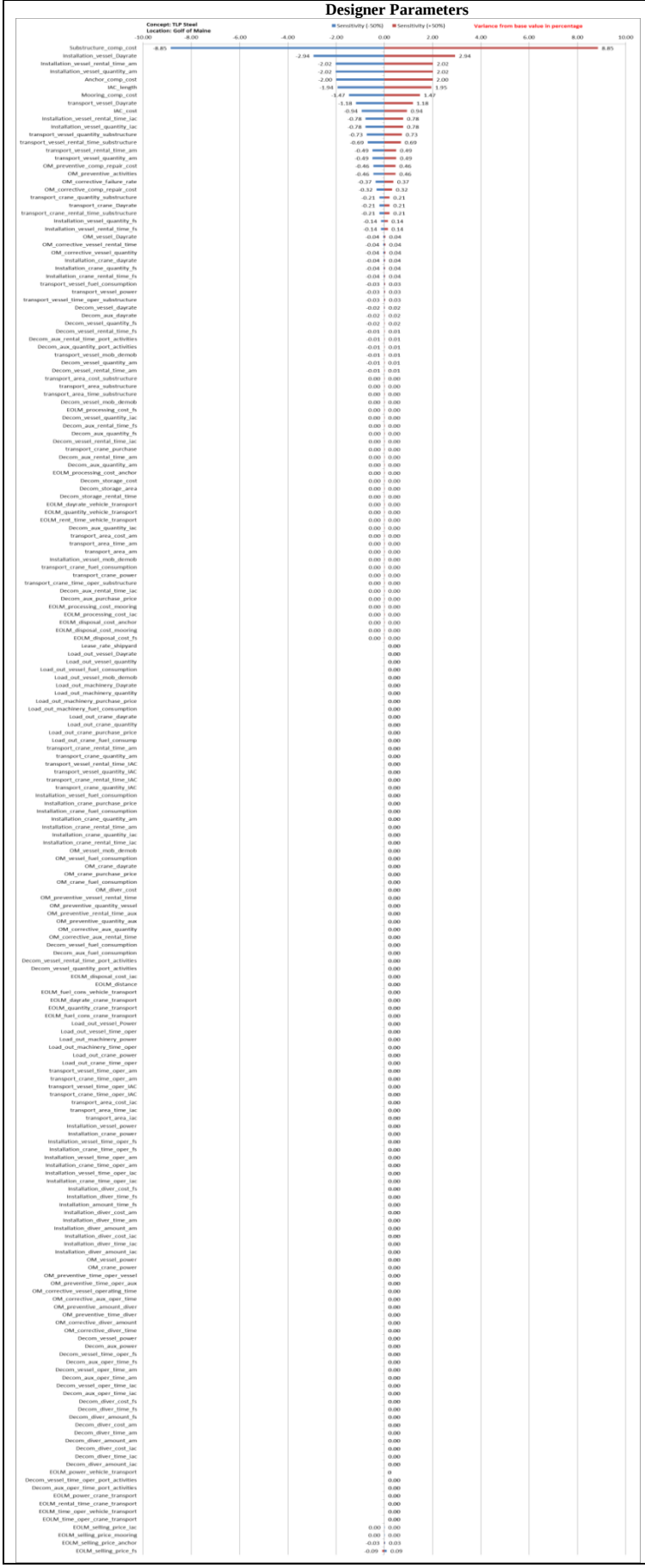


3.2.11 Results for TLP Steel, Gulf of Maine

Designer Parameters



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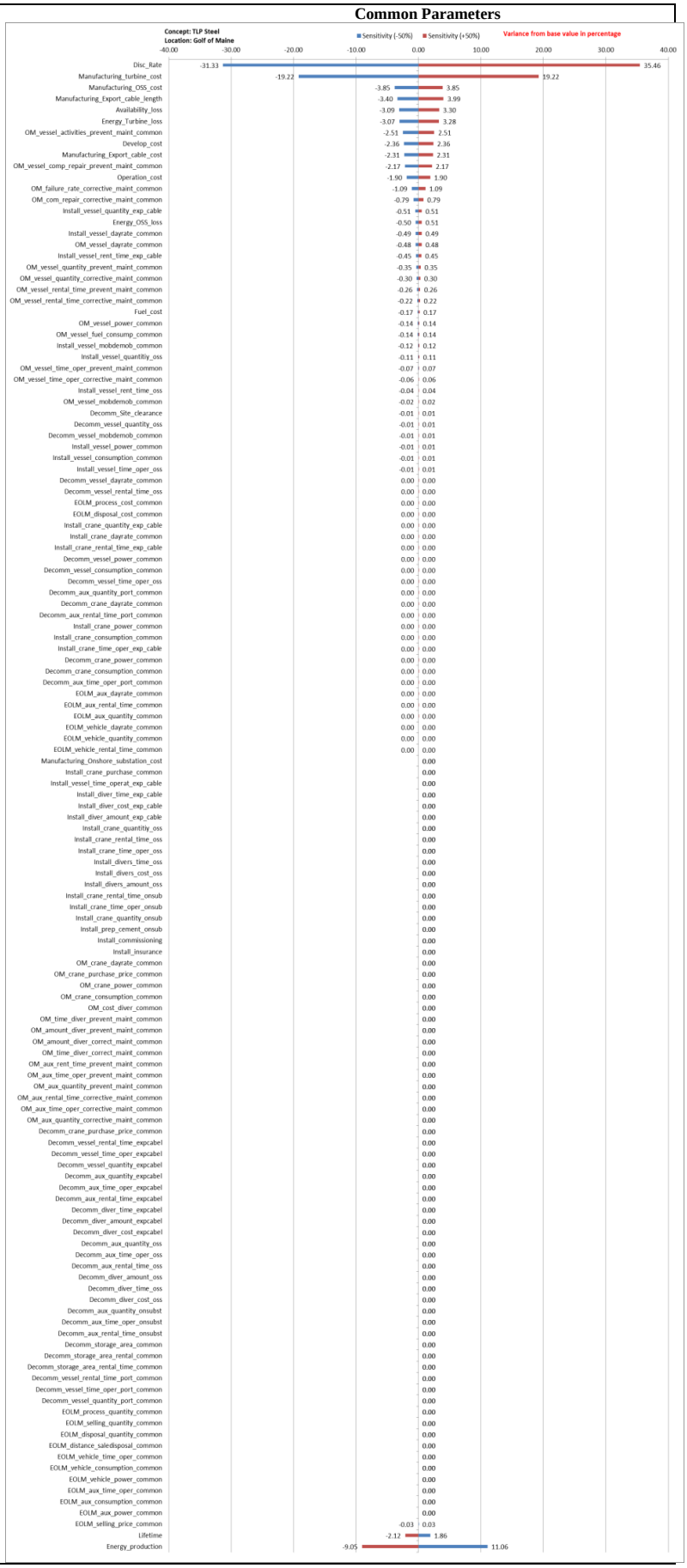
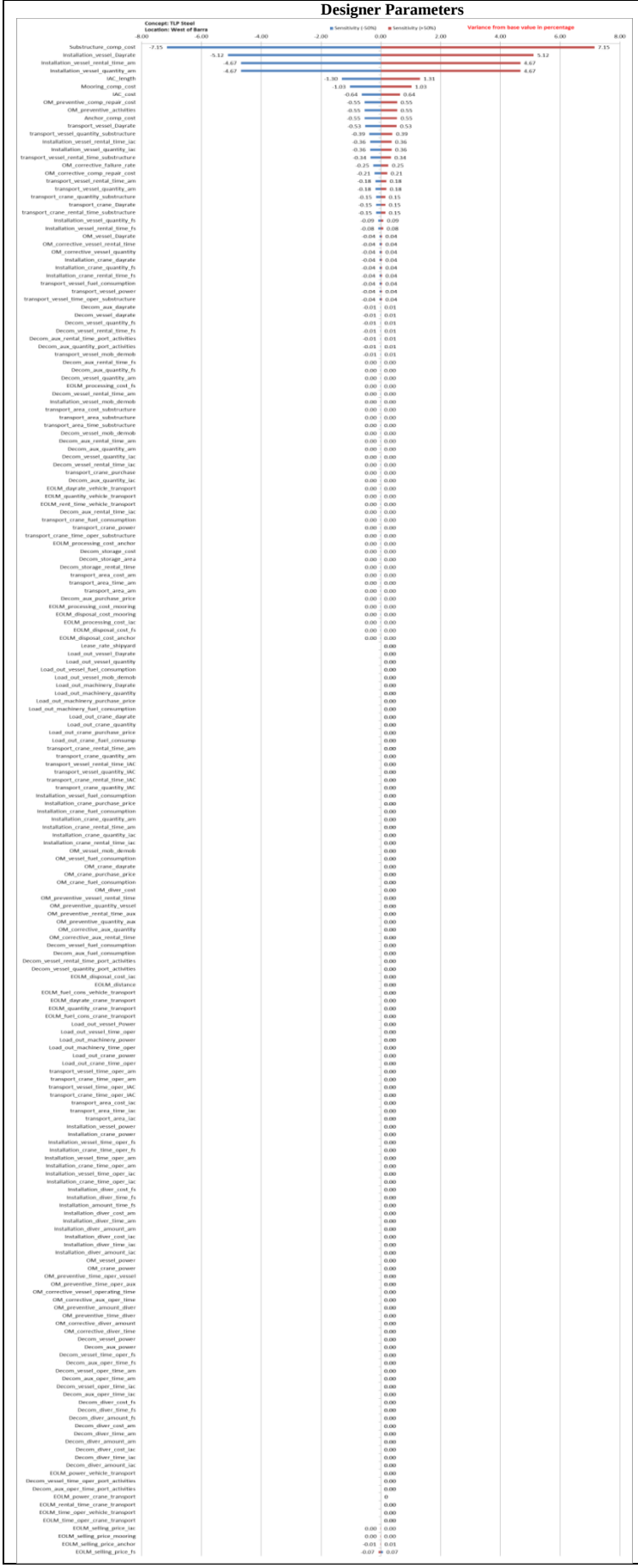


3.2.12 Results for TLP Steel, West of Barra

Designer Parameters



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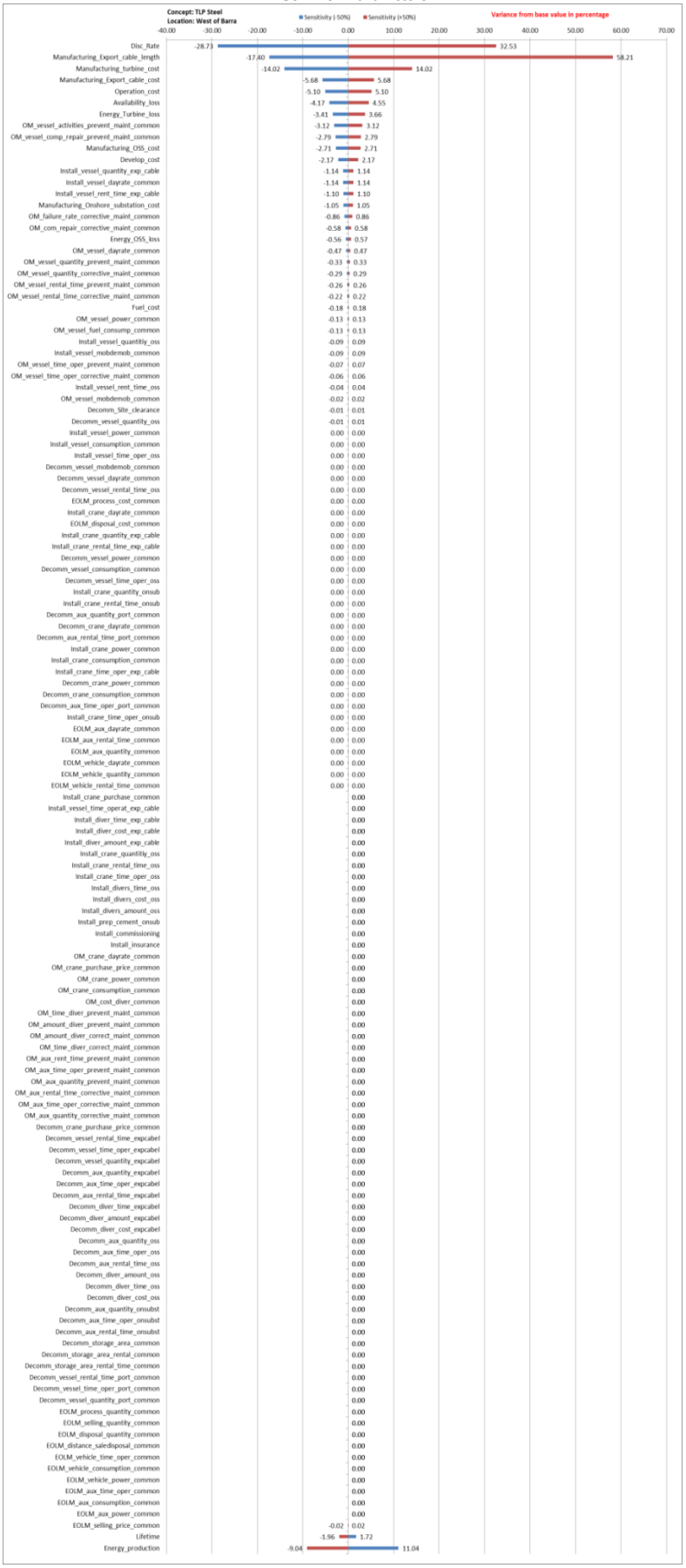


3.2.13 Most influencing parameters

Table 2 shows the most influencing design dependent parameters for the different floating wind turbine concepts and offshore sites with their respective variation on the LCOE value in percentage. The resulting LCOE variations are obtained from the 50% change in the input parameters. The ones that have a significant impact on the LCOE (larger than 1%) are presented below in the tables.

It should be remarked that the results of the sensitivity analysis here reported are subjected to the validity of the data supplied by the concept designer's and conclusions are limited to those specific designs and scenarios.

Concept / Offshore Site	Parameter	Semi-submersible Concrete Variation (%)		Barge Concrete Variation (%)		Semi-submersible Steel Variation (%)		Tension Leg Platform Steel Variation (%)	
Golfe de Fos	Substructure cost	- 12.41	+ 12.41	- 14.14	+ 14.14	-15.29	+ 15.29	- 8.24	+ 8.24
	IAC length	- 3.14	+ 3.15	- 2.12	+ 2.14	- 2.19	+ 2.21	- 2.15	+ 2.16
	IAC cost	- 2.40	+ 2.40	- 1.62	+ 1.62	- 1.23	+ 1.23	- 0.89	+ 0.89
	Mooring cost	- 1.61	+ 1.61	- 1.17	+ 1.17	- 0.94	+ 0.94	- 1.42	+ 1.42
	Install. vessel dayrate	- 1.07	+ 1.07	- 3.20	+ 3.20	- 1.18	+ 1.18	- 2.75	+ 2.75
	Anchor cost	- 0.38	+ 0.38	- 0.67	+ 0.67	- 0.20	+ 0.20	- 1.93	+ 1.93
	A&M vessel rental time	- 0.29	+ 0.29	- 2.51	+ 2.51	- 0.45	+ 0.45	- 1.67	+ 1.67
Gulf of Maine	Substructure cost	- 11.44	+ 11.44	- 14.29	+ 14.29	- 15.54	+ 15.54	- 8.85	+ 8.85
	IAC length	- 3.13	+ 3.14	- 1.98	2.00	- 2.18	+ 2.21	- 1.94	+ 1.95
	IAC cost	- 2.45	+ 2.45	- 1.51	+ 1.51	- 1.21	+ 1.21	- 0.94	+ 0.94
	Mooring cost	- 1.99	+ 1.99	- 2.23	+ 2.23	- 1.75	+ 1.75	- 1.47	+ 1.47
	Anchor cost	- 0.43	+ 0.43	- 0.90	+ 0.90	- 0.27	+ 0.27	- 2.00	+ 2.00
	Install. vessel dayrate	- 0.99	+ 0.99	- 3.46	+ 3.46	- 1.14	+ 1.14	- 2.94	+ 2.94
	A&M vessel rental time	- 0.26	+ 0.26	- 2.83	+ 2.83	- 0.45	+ 0.45	- 2.02	+ 2.02
West of Barra	Substructure cost	- 9.15	+ 9.15	- 10.73	+ 10.73	- 12.15	+ 12.15	- 7.15	+ 7.15
	Mooring cost	- 3.01	+ 3.01	- 2.31	+ 2.31	- 1.77	+ 1.77	- 1.03	+ 1.03
	IAC length	- 2.28	+ 2.29	- 1.62	+ 1.64	- 1.98	+ 2.02	- 1.30	+ 1.31
	IAC cost	- 1.71	+ 1.71	- 1.06	+ 1.06	- 0.95	+ 0.95	- 0.64	+ 0.64
	Anchor cost	- 0.20	+ 0.20	- 0.92	+ 0.92	- 0.61	+ 0.61	- 0.55	+ 0.55
	Install. vessel dayrate	- 1.03	+ 1.03	- 7.96	+ 7.96	- 1.55	+ 1.55	- 5.12	+ 5.12
	A&M vessel rental time	- 0.43	+ 0.43	- 7.07	+ 7.07	- 0.83	+ 0.83	- 4.67	+ 4.67

Table 2: Most influencing floating substructure dependent parameters

Next, each of the parameters is explained as well as the results presented and compared among the concepts and offshore sites. The floating substructure dependent parameter that shows the largest influence on the LCOE across all sites and FOWT concepts is the substructure cost.

This parameter represents the total manufacturing cost of the substructure including all components and equipment as well as the tower, because the tower has been considered as a design dependent component. The highest effect on the LCOE caused by the 50% variation of this parameter is seen by the Gulf of Maine site for the semi-submersible steel and the barge concrete concept. The TLP steel and semi-submersible concepts experience the highest LCOE variation caused by this parameter for Golf de Fos offshore site. The LCOE variation caused by an increase and decrease of the substructure cost becomes less for West of Barra for all 4 concepts, but it is still the most influent of the floating substructure design dependent parameters. However, one should not assume that the lower variation of the LCOE means lower substructure cost. The opposite is the case. The substructure manufacturing cost increased for the West of Barra site, because of the harsher environmental conditions, but the total cost of the manufacturing phase increased even more, which causes the portion of the substructure cost to be less. The TLP is the less affected concept among the 4 FOWT studied concerning the change of the substructure cost. The reason is the lower cost of the floating substructure without considering mooring and anchor system.

The inter-array cable length and cost are the next predominant parameters that influence the LCOE. Whereas an increase or decrease of the cable cost only affects the cost of the manufacturing and decommissioning phase, the cable length affects the entire life cycle, because the length influences the acquisition cost, the transportation and installation time and cost, as well as the cost for maintenance and decommissioning. Furthermore, with a longer power cable the energy losses increase and thus affect negatively the LCOE. However, it should be noted that no changes of the wake effect have been considered in the variation of the inter-array cable length parameter study. A larger influence of the inter-array cable length and cost among the different FOWT can be seen for the semi-submersible concrete concept. However, comparing between the offshore sites there is no large difference between Golfe de Fos and Gulf of Maine observable. However, West of Barra experiences a slightly lower variation of the LCOE value based on the change of inter-array cable length and cost.

The mooring and anchor cost possess also a significant impact on the LCOE. In Table 2 the influence of both components on the LCOE is presented separately. However, combining both parameters could even result into having a larger influence on the LCOE than the inter-array cable for some FOWT concepts and offshore sites. As expected the TLP concepts shows the largest effect on the LCOE by the variation of both anchor and mooring cost for Golfe de Fos and Gulf of Maine, because due to the nature of this concept the anchor and mooring system needs to be well designed to ensure stability and station keeping. Furthermore, a different type of anchor is needed to take the high loads predominantly in vertical direction. This results to increased cost for the anchor and mooring system and a larger influence on the LCOE. West of Barra shows a slightly different picture. Because soil conditions at this site are more challenging than in Golfe de Fos and Gulf of Maine, a different anchor type is required also for the semi-submersible and barge concepts. The more severe environmental conditions require in addition to either choose a more robust mooring system or to increase the number of mooring lines. These provisions result in increased costs and are also reflected in a higher LCOE variation at this site for 3 of the 4 FOWT concepts. It can be seen from Table 2 that the mooring cost becomes more important at this site for the semi-submersibles and barge concept, where it represents for 2 of the 4 concepts the second most influent parameter. It can also be seen that the LCOE of the TLP concept is less sensitive to a variation of anchor and mooring cost for West of Barra. However, the influence of the installation vessel day rate and the anchor and mooring (A&M) vessel rental time has increased since higher specialized vessels spread are required for installing anchor and mooring system in reduced weather windows at this site.

It can be concluded that the floating substructure design dependent parameters that most vary the LCOE across all concepts and offshore sites are capital cost related. This includes the cost of the substructure, inter-array power cable cost and length as well as mooring and anchor cost. Besides that, the installation vessel day rate and rental time have also a significant influence. Table 3 shows the most influencing common parameter, which account for the turbine, balance of plant, energy related and economic parameters.

Offshore Site / Concept	Parameter	Semi-submersible Concrete Variation (%)		Barge Concrete Variation (%)		Semi-submersible Steel Variation (%)		Tension Leg Platform Steel Variation (%)	
Golfe de Fos	Discount rate	- 32.24	+ 36.34	- 31.24	+ 35.73	- 32.15	+ 36.45	- 31.28	+ 35.49
	Turbine cost	- 20.09	+ 20.09	- 15.84	+ 15.84	- 18.22	+ 18.22	- 21.75	+ 21.77
	Energy production	+ 11.08	- 9.07	+ 11.11	- 9.09	+ 11.11	- 9.09	+ 11.05	- 9.04
	Offshore substation cost	- 3.75	+ 3.75	- 2.95	+ 2.95	- 3.40	+ 3.40	- 4.06	+ 4.06
	Turbine elec. loss	- 3.08	+ 3.28	- 3.06	- 3.27	- 3.05	+ 3.25	- 3.07	+ 3.27
	Availability loss	- 2.56	+ 2.70	- 2.56	+ 2.70	- 2.56	+ 2.70	- 2.56	+ 2.70
	Operation cost	- 2.56	+ 2.56	- 2.02	+ 2.02	- 2.32	+ 2.32	- 2.76	+ 2.76
	Development cost	- 2.41	+ 2.41	- 2.40	+ 2.40	- 2.43	+ 2.43	- 2.37	+ 2.37
	Export cable length	- 2.20	+ 2.34	- 1.65	+ 1.76	- 1.89	+ 2.01	- 1.96	+ 2.04
	Export cable cost	- 1.58	+ 1.58	- 1.16	+ 1.16	- 1.35	+ 1.35	- 1.44	+ 1.44
	O&M prev. activities	- 1.17	+ 1.17	- 0.92	+ 0.92	- 1.06	+ 1.06	- 1.27	+ 1.27
	O&M corr. failure rate	- 1.14	+ 1.14	- 0.90	+ 0.90	- 1.03	+ 1.03	- 1.23	+ 1.23
	Lifetime	+ 1.85	- 2.12	+ 2.04	- 2.27	+ 1.94	- 2.20	+ 1.90	- 2.15
Gulf of Maine	Discount rate	- 31.76	+ 35.82	- 30.94	+ 35.44	- 31.84	+ 36.09	- 31.33	+ 35.46
	Turbine cost	- 18.95	+ 18.95	- 14.08	+ 14.08	- 16.36	+ 16.36	- 19.22	+ 19.22
	Energy production	+ 11.08	- 9.07	+ 11.11	- 9.09	+ 11.11	- 9.09	+ 11.06	- 9.05
	Offshore substation cost	- 3.80	+ 3.80	- 2.82	+ 2.82	- 3.28	+ 3.28	- 3.85	+ 3.85
	Availability loss	- 3.09	+ 3.30	- 3.09	+ 3.30	- 3.09	+ 3.30	- 3.09	+ 3.30
	Turbine elec. loss	- 3.08	+ 3.29	- 3.07	+ 3.27	- 3.05	+ 3.25	- 3.07	+ 3.28
	Export cable length	- 3.57	+ 4.25	- 2.13	+ 2.46	- 2.53	+ 2.91	- 3.40	+ 3.99
	O&M prev. activities	- 2.48	+ 2.48	- 1.84	+ 1.84	- 2.14	+ 2.14	- 2.51	+ 2.51
	Export cable cost	- 2.40	+ 2.40	- 1.41	+ 1.41	- 1.71	+ 1.71	- 2.31	+ 2.31
	Development cost	- 2.38	+ 2.38	- 2.38	+ 2.38	- 2.40	+ 2.40	- 2.36	+ 2.36
	O&M prev. repair cost	- 2.14	+ 2.14	- 1.59	+ 1.59	- 1.85	+ 1.85	- 2.17	+ 2.17
	Operation cost	- 1.88	+ 1.88	- 1.39	+ 1.39	- 1.62	+ 1.62	- 1.90	+ 1.90
	O&M corr. failure rate	- 1.07	+ 1.07	- 0.80	+ 0.80	- 0.93	+ 0.93	- 1.09	+ 1.09
	Lifetime	+ 1.83	- 2.10	+ 2.05	- 2.27	+ 1.92	- 2.18	+ 1.86	- 2.12
West of Barra	Discount rate	- 29.19	+ 32.98	- 29.49	+ 33.83	- 29.58	33.53	- 28.73	+ 32.53
	Export cable length	- 19.10	+ 73.23	- 17.15	+ 70.91	- 18.43	+ 71.20	- 17.40	+ 58.21
	Turbine cost	- 13.64	+ 13.64	- 9.01	+ 9.01	- 12.46	+ 12.46	- 14.02	+ 14.02
	Energy production	+ 11.08	- 9.06	+ 11.11	- 9.09	+ 11.11	- 9.09	+ 11.04	- 9.04
	Export cable cost	- 5.81	+ 5.81	- 3.84	+ 3.84	- 5.27	+ 5.27	- 5.68	+ 5.68
	Operation cost	- 4.96	+ 4.96	- 3.28	+ 3.28	- 4.53	+ 4.53	- 5.10	+ 5.10
	Availability loss	- 4.17	+ 4.55	- 4.17	+ 4.55	- 4.17	+ 4.55	- 4.17	+ 4.55
	Turbine elec. loss	- 3.49	+ 3.75	- 3.47	+ 3.74	- 3.45	+ 3.71	- 3.41	+ 3.66
	O&M prev. activities	- 3.04	+ 3.04	- 2.01	+ 2.01	- 2.78	+ 2.78	- 3.12	+ 3.12
	O&M prev. repair cost	- 2.71	+ 2.71	- 1.79	+ 1.79	- 2.48	+ 2.48	- 2.79	+ 2.79
	OSS cost	- 2.64	+ 2.64	- 1.74	+ 1.74	- 0.57	+ 0.58	- 2.71	+ 2.71
	Development cost	- 2.19	+ 2.19	- 2.27	+ 2.27	- 2.23	+ 2.23	- 2.17	+ 2.17
	Install vessel Ex Cable	- 1.16	+ 1.16	- 0.77	+ 0.77	- 1.06	+ 1.06	- 1.14	+ 1.14
	Lifetime	+ 1.71	- 1.95	+ 1.97	- 2.18	+ 1.79	- 2.03	+ 1.72	- 1.96

Table 3: Most influencing common parameters

As the common parameters are the same for the FOWT concepts there is no large difference among them concerning the LCOE variation. However, there are some differences among the offshore sites and the most significant common parameters that influence the LCOE are presented here. The discount rate, which is based on the weighted average cost of capital (WACC), is the first parameter listed in Table 3 and is the one that has the highest influence on the LCOE among all input parameters studied for all FOWT and offshore sites. A 50% increase or decrease of the mean value causes a variation of the LCOE by around 30% or more in positive and negative direction. Thus, a well-chosen discount rate is of high importance for the LCOE calculation. The cost of the wind turbine has the second highest influence among the common parameters. It covers the acquisition cost of all components of the wind turbine excluding the tower and is the same for all three offshore sites. Table 3 shows that the influence on the LCOE by the cost of the wind turbine from Golfe de Fos to West of Barra decreases, which is based on the decreasing ratio of the wind turbine cost to the total manufacturing cost and LCC since other cost components are increasing their share. For example the parameters export cable cost and length increase their influence and especially for West of Barra, where the export cable length is the second most influent common parameter, which is based on the longer distance to shore from the floating offshore wind farm location. In particular, the longer export cable increases not only the cost but also the energy loss in the cable.

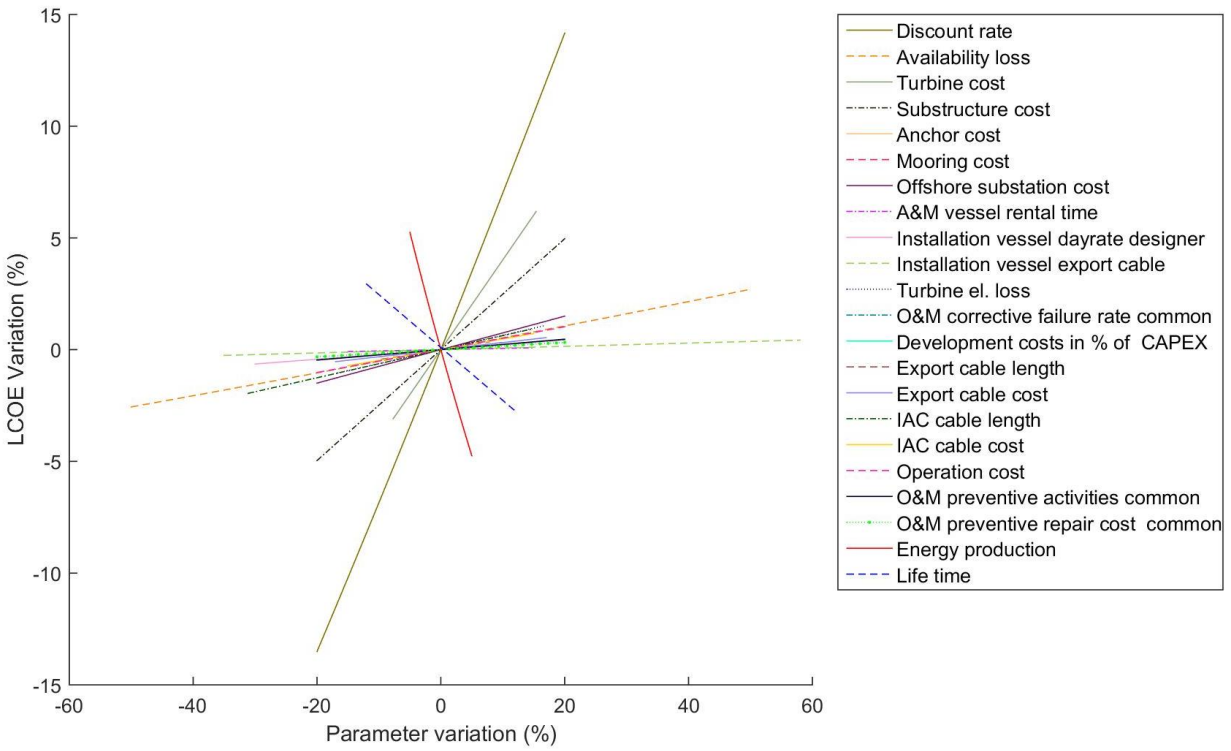
Energy related parameters that were analysed such as the overall net production, availability loss and turbine electrical losses have also a larger impact on the LCOE. Therefore, energy losses in the system in general should be tried to be minimized. Furthermore, it should be noted that a different variation range was chosen for the lifetime and energy production because these are highly sensitive parameters. A 10% range was applied instead of the 50%. Table 3 shows also that increasing the energy production and the lifetime by 10% cause a decrease of the LCOE value, whereas an increase of the other parameters result into a higher LCOE. The offshore substation cost has also a significant effect on the LCOE due to large capital investment required. For Golfe de Fos and Gulf of Maine it is the fourth most influent parameter with a LCOE change of 3 to 4% in positive and negative direction, whereas West of Barra is less sensitive. The operation cost and development cost have also a larger influence on the LCOE value. The operation cost includes expenses such as annual seabed rent, insurance or transmission charges. Furthermore, West of Barra shows a larger sensitivity to the operation cost than the other two sites reflecting the transmission charges at the site. Moreover it was found that maintenance has a larger impact on the LCOE with about 1-3% depending on the site. In particular, the number of preventive maintenance activities and the component repair cost. In addition, the corrective maintenance failure rate has also larger influence on the LCOE.

4 Scenarios analysis

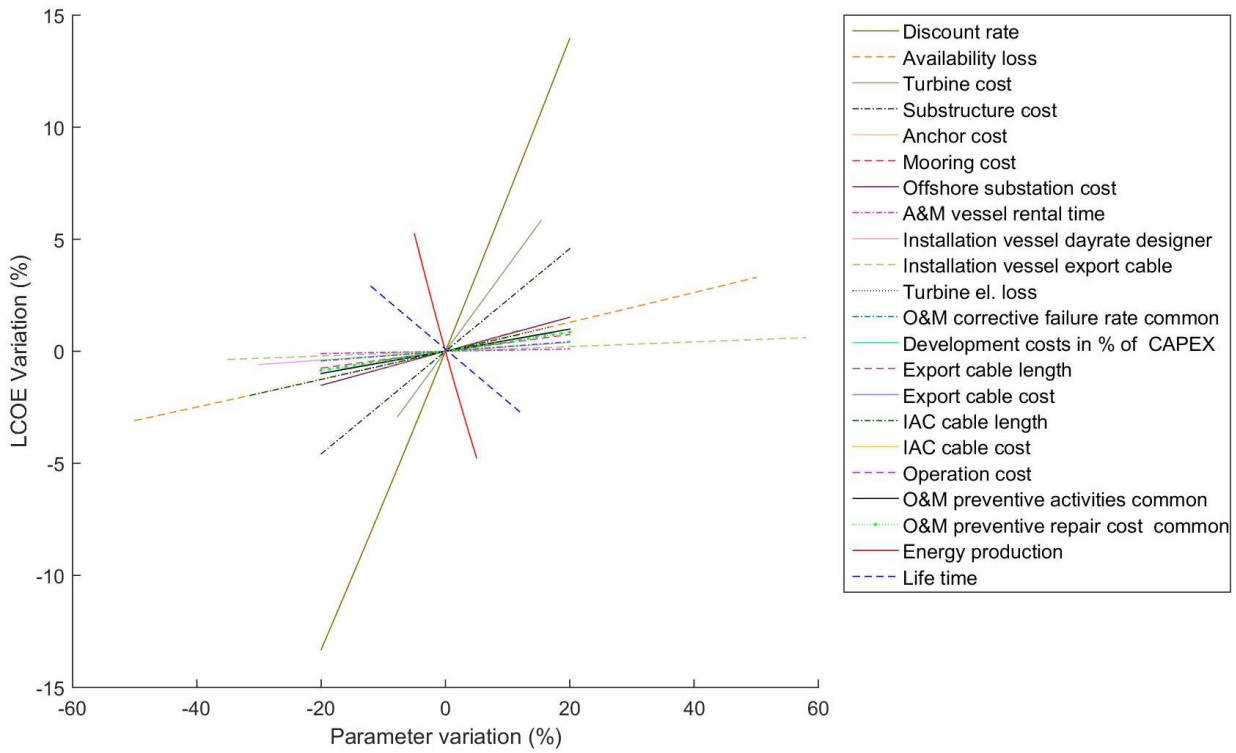
This chapter is complementary to Chapter 3 as it presents the results of specific scenarios due to the variation of the LCOE by applying variation ranges based on uncertainty ranges defined by the designers and for the common components. The ranges are applied on the parameters that most influence the LCOE and that were obtained in Chapter 3. This analysis serves to identify how much the LCOE could actually vary based on the defined uncertainty ranges defined by the concept designers. The complete list of results can be found in Appendix 3, whereas in this chapter the results are graphically presented and discussed with reference to each of floating offshore wind farms based on the different FOWT concepts.

4.1 Results for semi-submersible concrete floating offshore wind farm

Golfe de Fos



Gulf of Maine



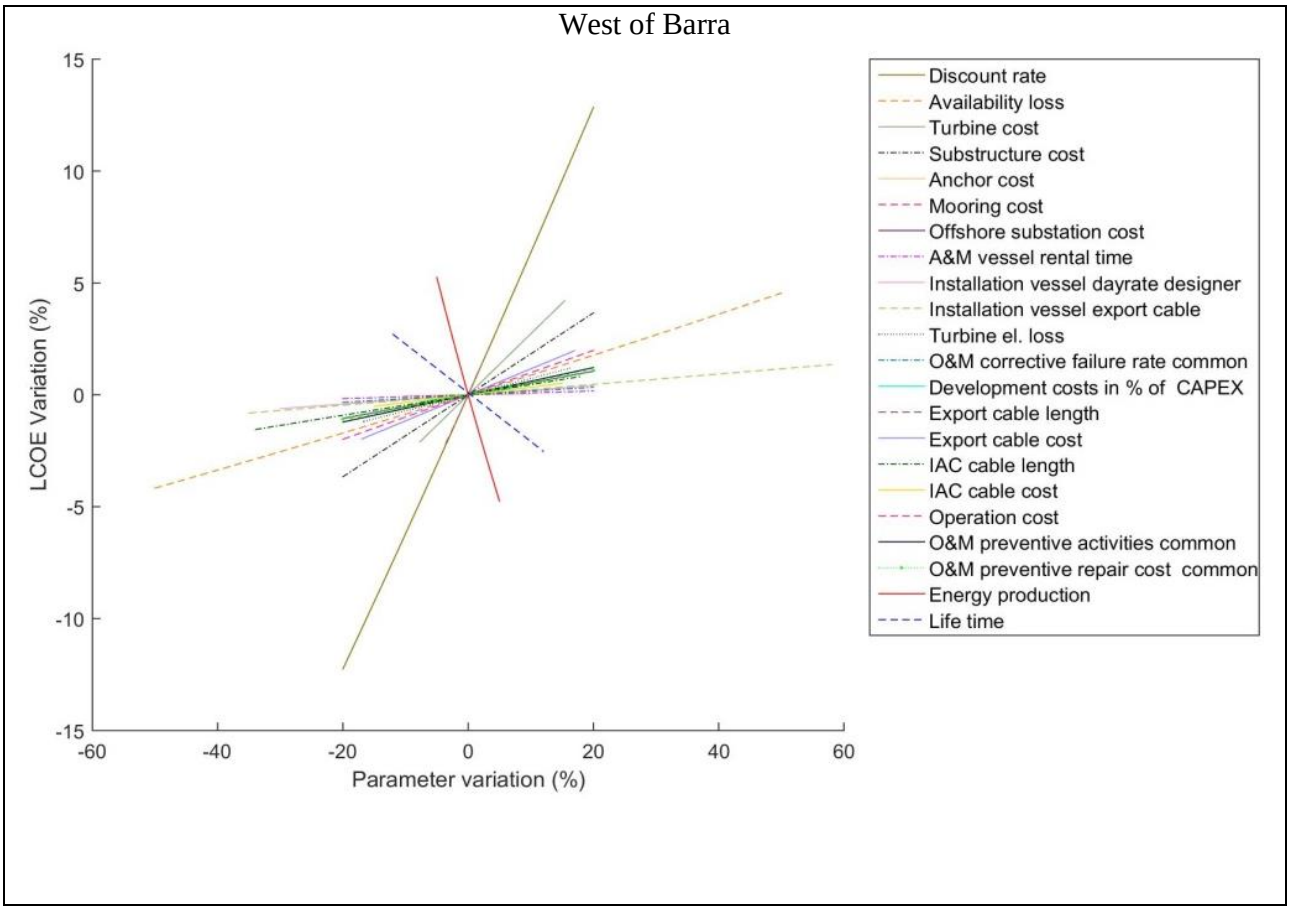


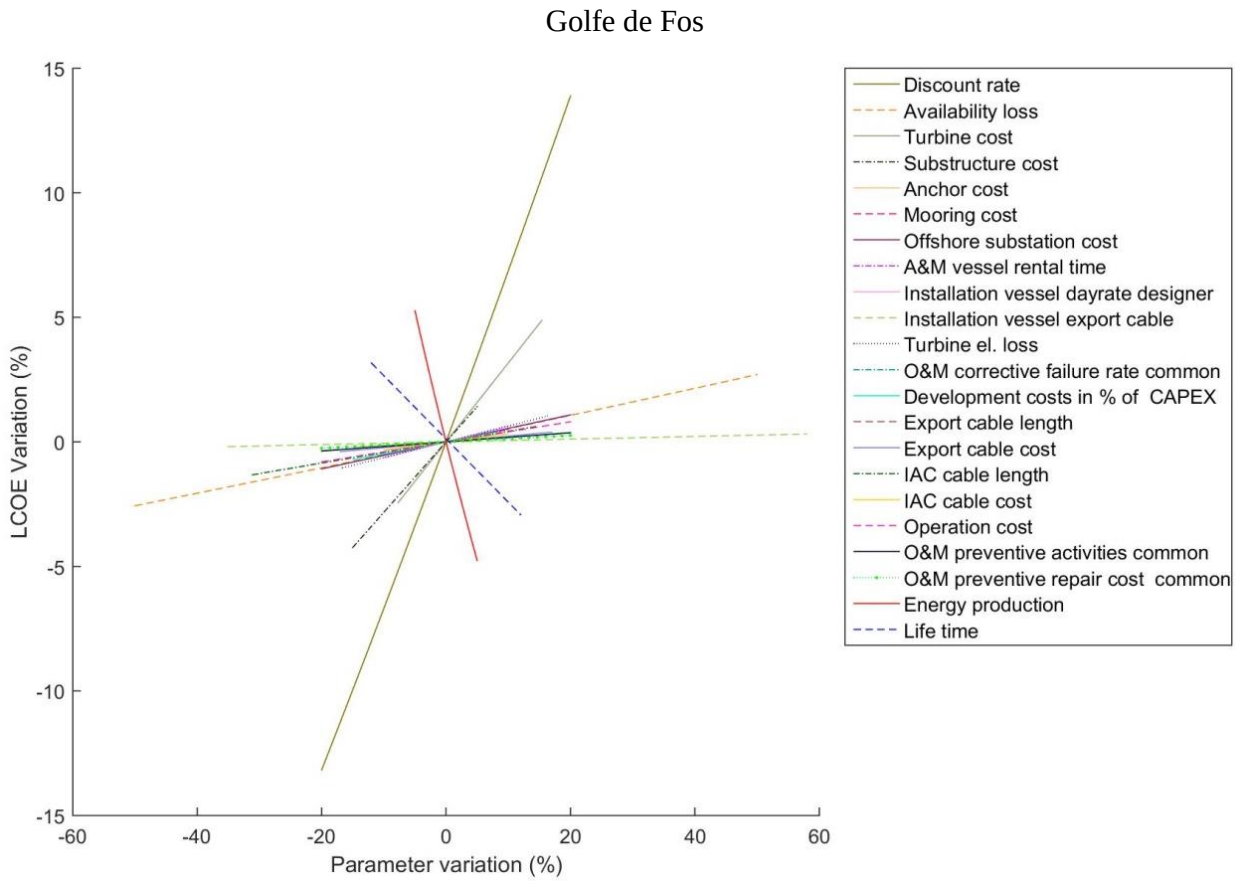
Figure 9: Specific scenarios results for semi-submersible concrete concept

For the floating offshore wind farm based on the semi-submersible concrete concept it can be seen that the discount rate has the largest influence on the LCOE with the highest slope of the LCOE variation line among the parameters studied and for the three offshore sites. For example, a 13% decrease of the LCOE is achievable by lowering the discount rate by around 20%. On the other hand when the discount rate is chosen too high, for example with a 20% increase, the LCOE can rise by about 14%. The energy production possesses the second highest LCOE variation potential with a negative slope representing a LCOE decrease with a higher energy yield. For instance, a 5% higher energy production results for this concept in a 4.75% lower LCOE value. Similar to the energy production, the availability loss has also a significant influence on the LCOE. Thus, energy losses in the system should be tried to be minimized. The next important parameter, based on the provided sensitivity ranges by the concept designer, is the substructure cost. For the offshore site Golfe de Fos a 20% lower substructure cost can cause a LCOE decline by nearly 5%, whereas an increase of the substructure cost has the opposite effect and rises the LCOE by 5%. The sensitivity to this parameter decreases a bit with the different offshore site. For West of Barra the LCOE varies about 3.6% with the same substructure cost variation.

The wind turbine cost shows also a greater influence on the LCOE value represented by its steep line. For example, a LCOE decrease of 3% can be achieved by lower the cost of the wind turbine by about 7%. The lifetime has also a significant influence. By increasing the lifetime 3 years the LCOE value can be lowered by 2.5 to 3% due to the higher energy production. However, in case of a further expansion of the lifetime investments would be required that have been considered here and which would affect negatively the LCOE.

Furthermore, some parameters show an increased impact on the LCOE for the offshore site West of Barra such as the export cable length and the operation cost, which have also been found as significant parameters for this site in Chapter 3. For instance, a 6km shorter export cable can reduce the LCOE for this site by more than 2.1%. Further parameters to be mentioned here that are significant for all three sites and result in a LCOE variation larger than 1% are the inter-array cable length and offshore sub-station cost. Parameters that possess a lower influence on the LCOE based on the sensitivity ranges provided by the concept designer are the anchor and mooring cost, installation vessel day rate and preventive maintenance activities. However, it is observable that for West of Barra the influence on the LCOE of the preventive maintenance activities and cost slightly increases.

4.2 Results for barge concrete floating offshore wind farm



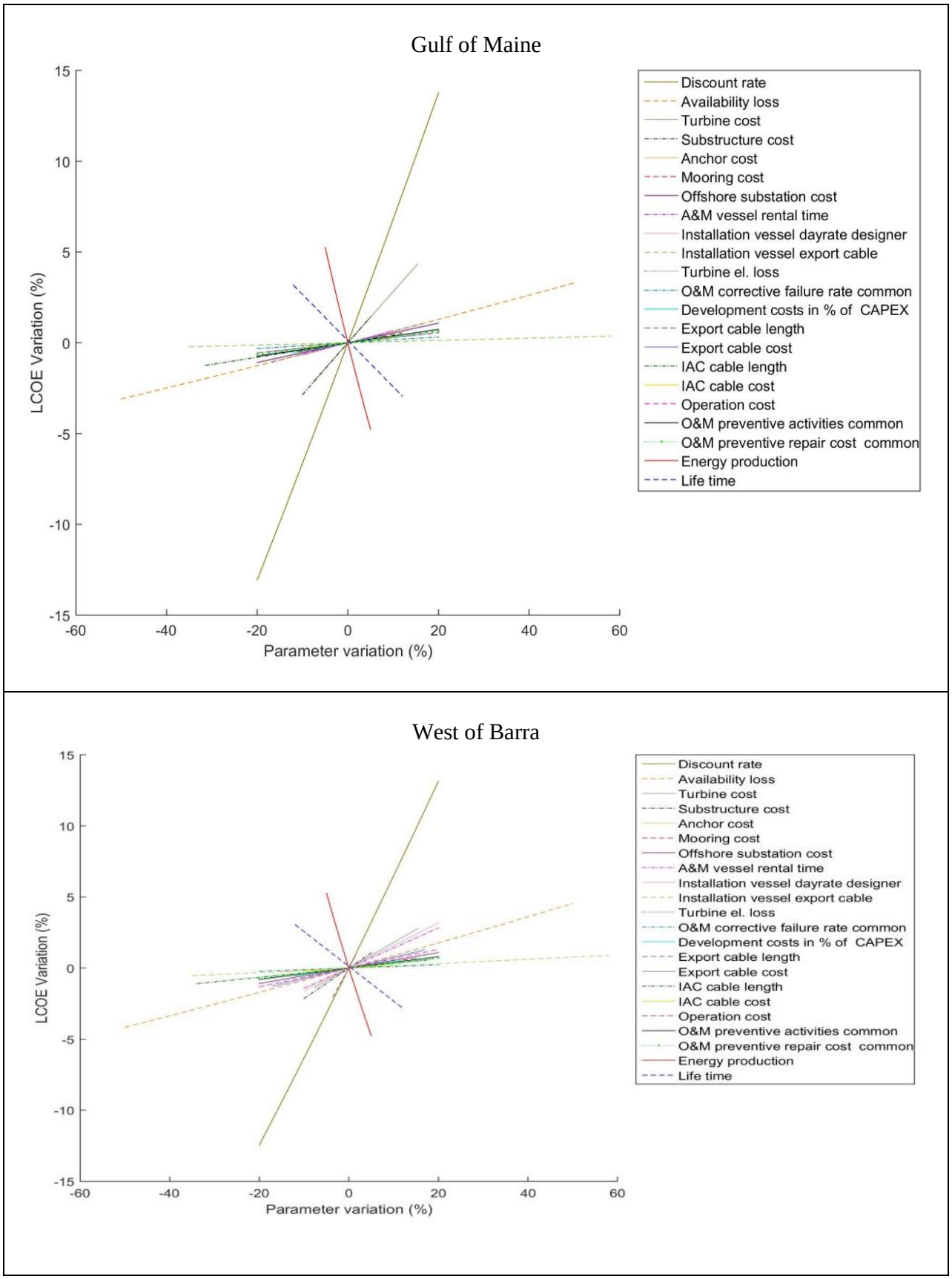


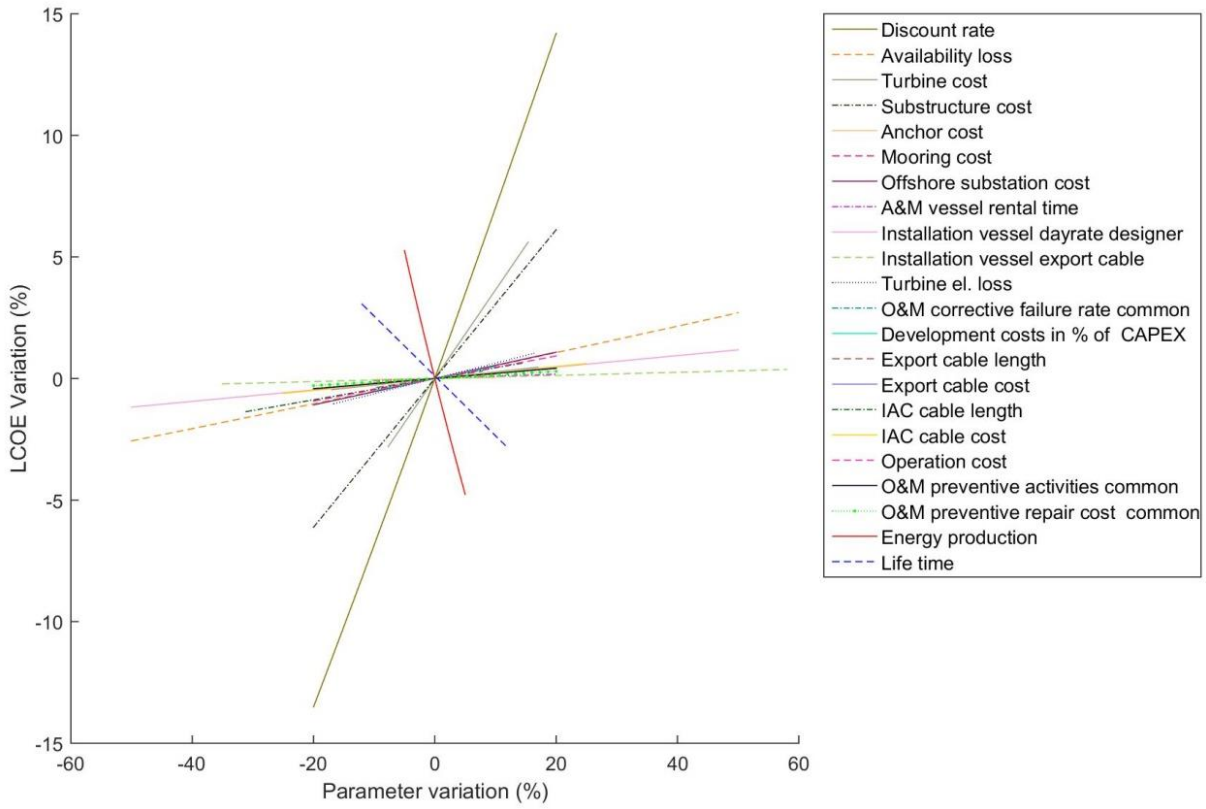
Figure 10: Specific scenarios results for barge concrete concept

For the floating offshore wind farm based on the barge concrete concept it can be seen similar to the previous concept that the discount rate has the largest influence on the LCOE with the highest slope of the LCOE variation line among the parameters studied. The LCOE variation is also similar with a 13% decrease of the LCOE achievable by lowering the discount rate by 20%. The energy production possesses the second highest LCOE variation potential. For example, a 5% higher energy production results for this concept in a 4.7% lower LCOE value. Similar to the energy production, the availability loss has also a significant influence on the LCOE. The substructure cost can be identified has the third most influent parameter based on the provided sensitivity ranges by the concept designer. For the offshore site Golfe de Fos a 15% lower substructure cost causes a LCOE decline by about 4.2%, whereas an increase of the substructure cost by 5%, which is the highest anticipated variation range, results in a 1.4% increase of the LCOE. The sensitivity to this parameter decreases with the different offshore sites. For example, for West of Barra a potential substructure cost decline of 10% results in a 2.1% decrease of the LCOE value. Another significant parameter is the lifetime, which shows a LCOE decline by about 2.8% for a 3 years life extension.

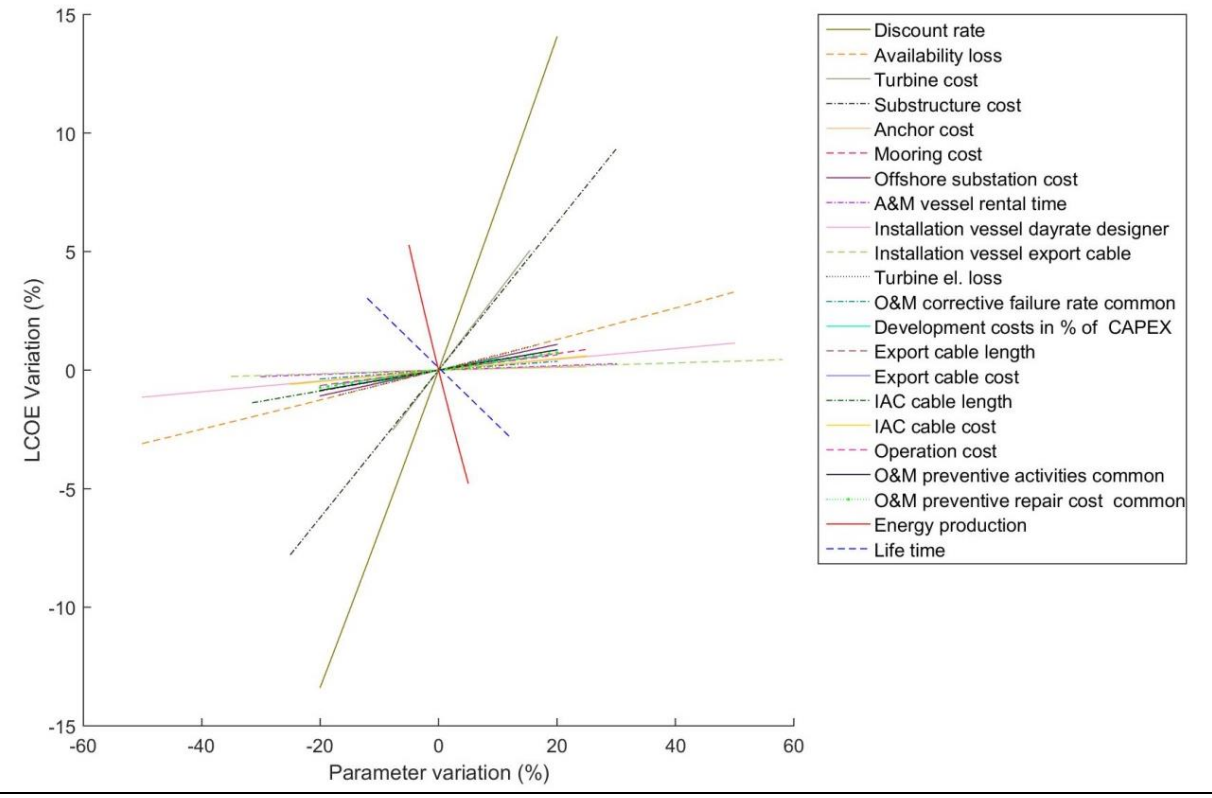
The next most influencing parameters for this concept based on the defined sensitivity ranges are the wind turbine cost and availability rate. For example, a LCOE decrease of 2.2% can be achieved by lower the cost of the wind turbine by about 7%. Increasing the wind turbine availability achieves also a lower LCOE and for this concept the highest decline can be reached for West of Barra resulting in a 4.1% decrease of the LCOE value. Similar to the previous FOWT concept and since they are common components it can be seen that the parameters exporter cable length and operation cost cause a higher LCOE variation for the West of Barra site. However, in particular for this concept and the site West of Barra it can be observed that the anchor and mooring vessel rental time and vessel day rate have a higher LCOE variation potential. For example, a 10% shorter anchor and mooring vessel rental time decreases the LCOE by 1.4% and a 20% higher rental time on the contrary could increase the LCOE by 2.8%. For the installation vessel day rate, a 10% lower rate could decrease the LCOE by more than 1.5%. Further parameters to be mentioned here that are significant for all three sites and result in a LCOE variation larger than 1% are the inter-array cable length and offshore substation cost. Parameters that possess a lower influence on the LCOE based on the sensitivity ranges provided by the concept designer are the anchor and mooring cost, development cost and preventive maintenance activities.

4.3 Results for semi-submersible steel floating offshore wind farm

Golfe de Fos



Gulf of Maine



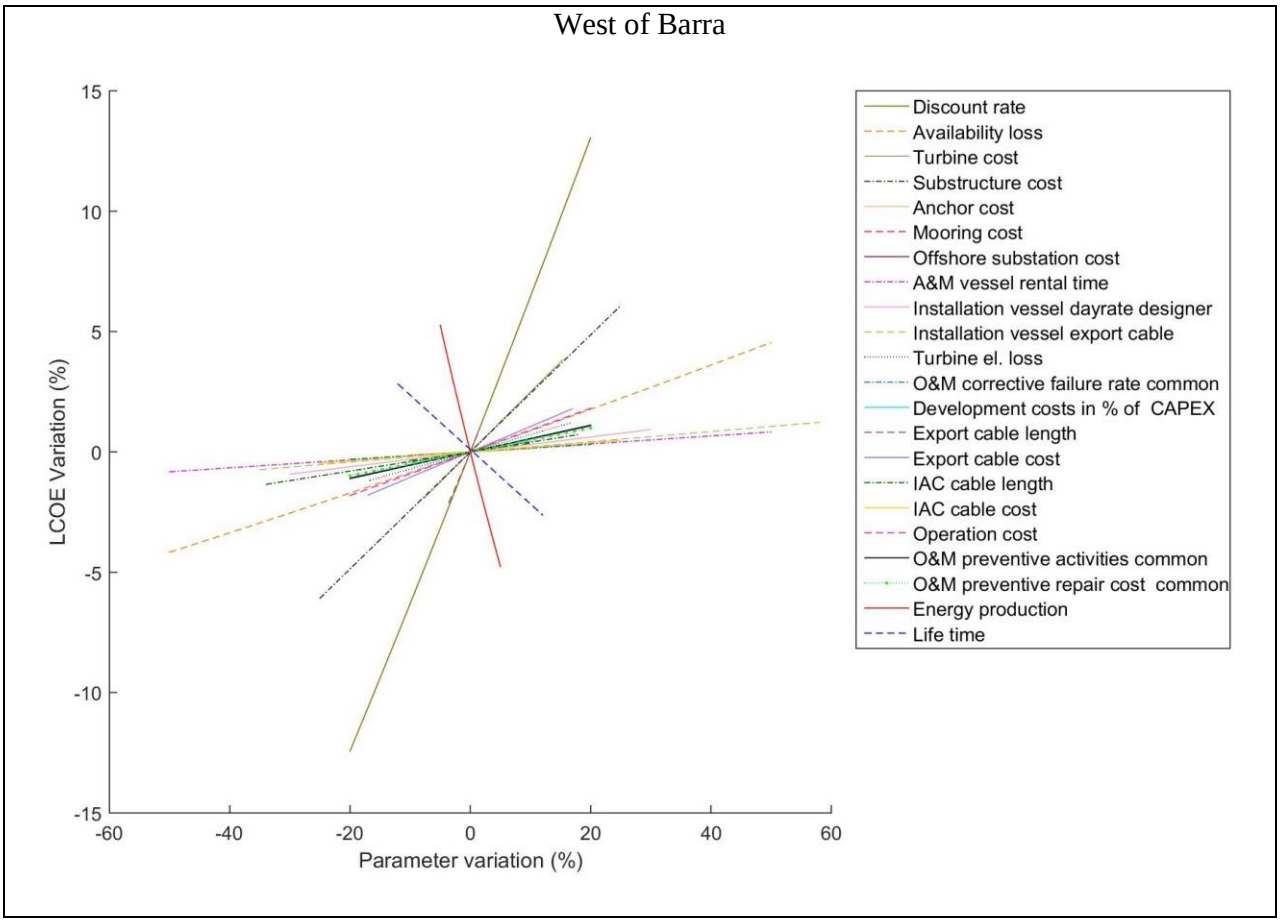
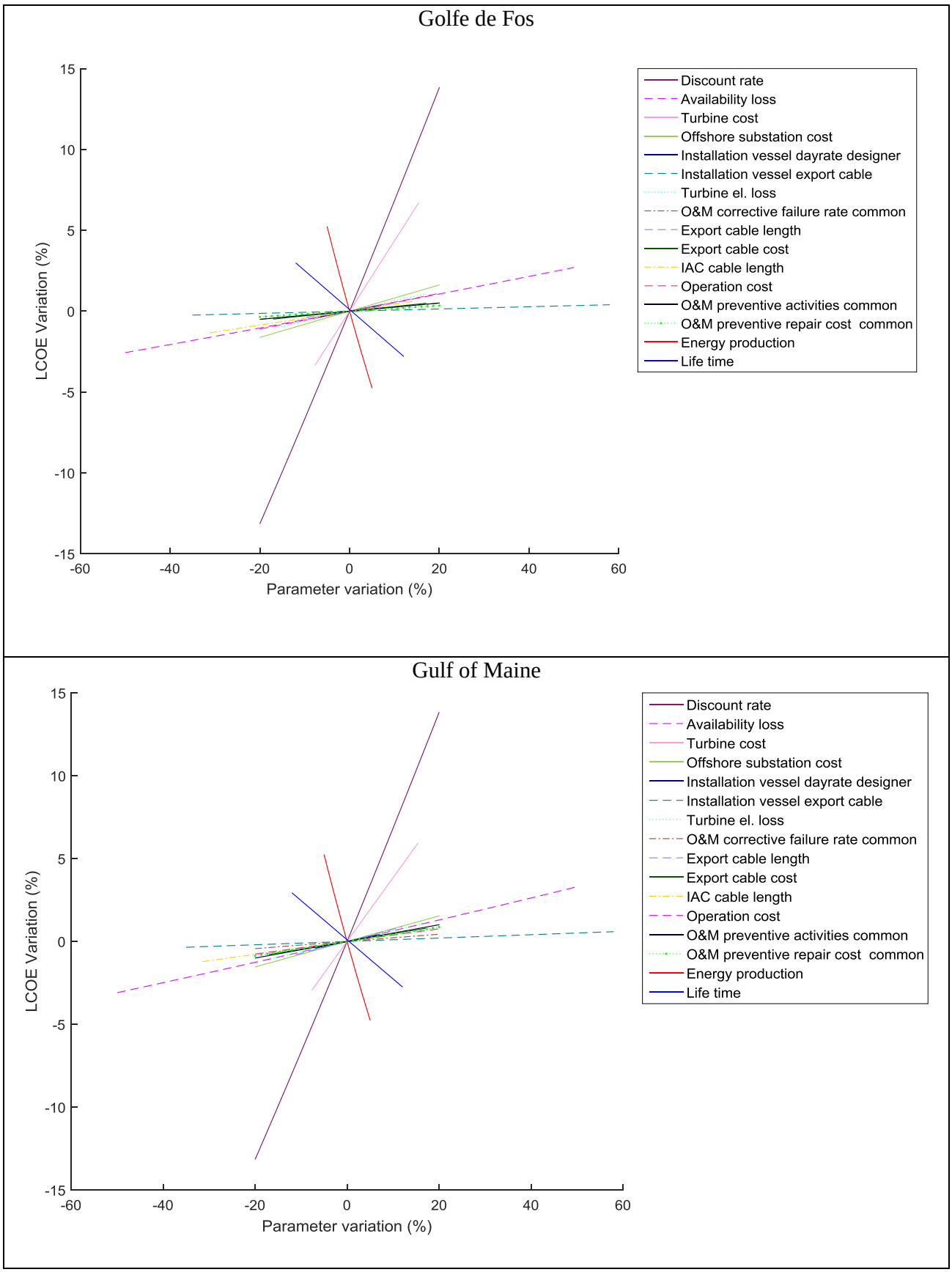


Figure 11: Specific scenarios results for semi-submersible steel concept

For the floating offshore wind farm based on the semi-submersible steel FOWT concept it can be seen that similar to the previous concepts parameters such as the discount rate, energy production and substructure cost possess the largest influence on the LCOE. For instance, a 20% reduction in the floating substructure cost results in a decrease of more than 6.1% of the LCOE for the case of Golfe de Fos site. For Gulf of Maine, a 25% decrease in the substructure cost can result in a LCOE decline of more than 7.7%. The wind turbine cost and availability show also a greater influence on the LCOE value represented by its steep lines. For example, a LCOE decrease of 2.8% can be achieved by lower the cost of the wind turbine by about 7.6%. The lifetime has also a significant influence. By increasing the lifetime 3 years the LCOE value can be lowered by 2.5 to 2.8% depending on the different offshore site. Parameters that have a lower potential but still can vary the LCOE by around 1% are installation vessel day rate, offshore substation cost and turbine electrical loss. However, in case of the vessel day rate a higher variation range was defined than for the other FOWTs concepts to reach the 1% LCOE variation. For West of Barra a similar tendency to the increased influence on the LCOE can be observed for the export cable length and operation cost than for the previous concepts. For instance, a 6km shorter export cable can reduce the LCOE for this site by more than 2.1%. Parameters that possess a lower influence on the LCOE (<1%) based on the sensitivity ranges provided by the concept designer are the anchor and mooring cost, anchor and mooring installation vessel rent and installation vessel day rate, as well as inter-array cable cost and development cost. However, it can be overserved that the West of Barra offshore site shows a slightly higher sensitivity to the preventive maintenance activities than the other offshore sites. For instance, a 20% decline in the preventive maintenance cost can cause a 1.1% reduction in the LCOE value.

4.4 Results for TLP steel floating offshore wind farm



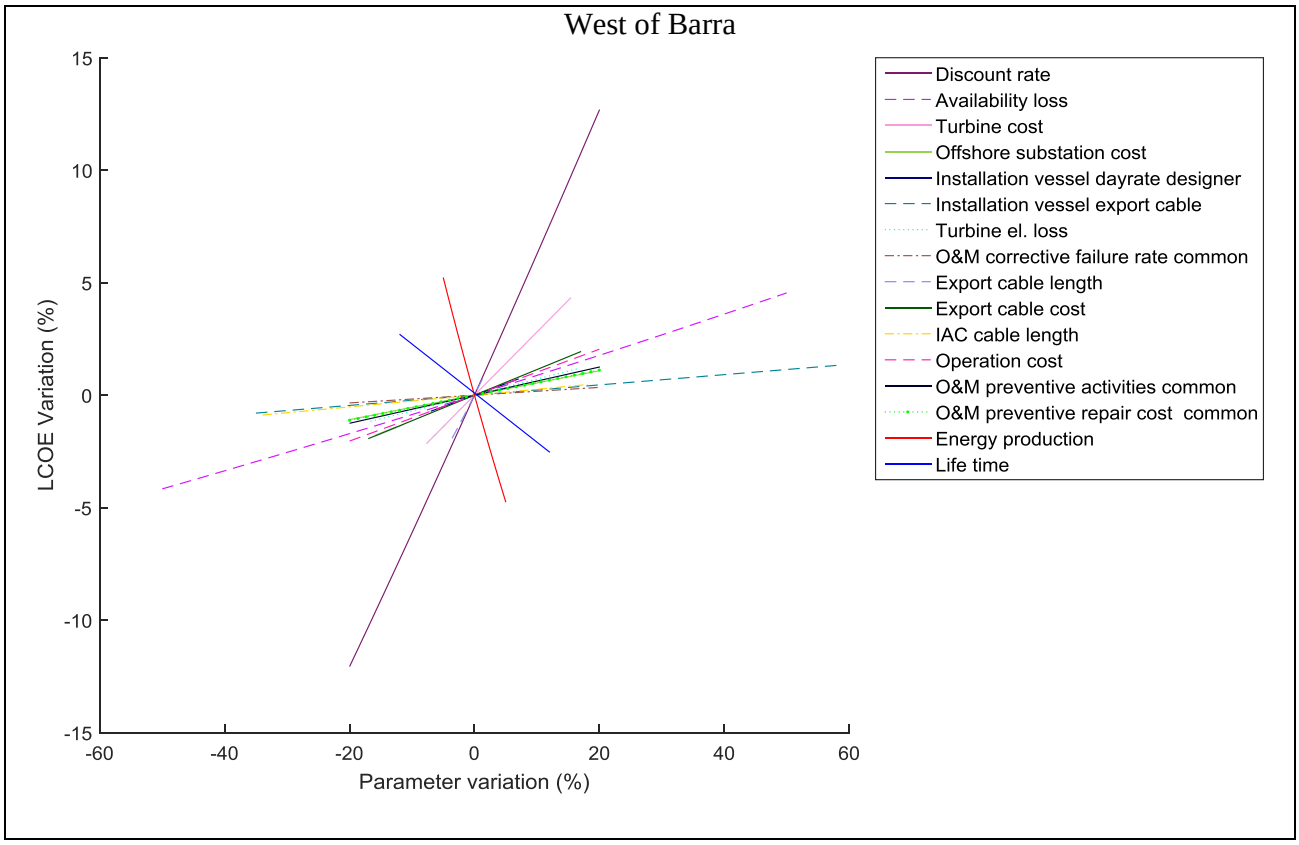


Figure 12: Specific scenarios results for TLP steel concept

For the floating offshore wind farm based on the TLP steel concept it can be seen that the discount rate has the largest influence on the LCOE. For example, lowering the discount rate by 20 can decrease the LCOE by 12-13% for the three offshore sites. On the other hand when the discount rate is chosen too high, for example with a 20% increase, the LCOE can rise by about 12 to 14%. The energy production possesses the second highest LCOE variation potential with a negative slope representing a LCOE decrease with a higher energy yield. For instance, a 5% higher energy production at the Gulfe de Fos site would result in a 4.5% lower LCOE. Similar to the energy production, the availability of the wind turbines has also a significant influence on the LCOE. By reducing the availability loss rate by half the LCOE value can be decreased by more than 2.5%. The next important parameter, based on the defined sensitivity ranges, is the wind turbine cost. For example for the offshore Golfe de Fos a LCOE decrease of 3.3% can be achieved by lowering the cost of the wind turbine by about 7.6%. The life-time has also a significant influence. By increasing the lifetime 3 years the LCOE value can be lowered by 2.4 to 2.7% due to the higher energy production. However, in case of a further expansion of the lifetime investments would be required that have been considered here and which would affect negatively the LCOE. Furthermore, some parameters show an increased impact on the LCOE for the offshore site West of Barra such as the export cable length and the operation cost. For instance, at the West of Barra offshore site a 7km shorter export cable can reduce the LCOE for this site by nearly 2%. Further parameters to be mentioned here that are significant for all three sites and result in a LCOE variation larger than 1% are the inter-array cable length, turbine electrical loss and offshore substation cost. Parameters that possess a lower influence on the LCOE based on the sensitivity ranges provided by the concept designer are installation vessel day rate, preventive maintenance repair cost and corrective failure rate. However, it is observable that for West of Barra the influence on the LCOE of the preventive maintenance activities and cost slightly increases.

5 Risk inclusion

Risk consideration during the design stage of a FOWT is crucial. It can aid in choosing between different design options (e.g. to have a single or multiple landing points) and reduce future expenditure and reputational damage by considering and modifying hazards before they occur (e.g. identifying an O&M hazard that leads to a design alteration and prevents the FOWT from having a catastrophic failure that would have led to reputational damage).

Risk consideration during design can also lead to LCOE reduction. For example, a structured, detailed and well-recorded risk management can increase the confidence of insurers and financers leading to reduced insurance and cost of financing. Similarly, it can also reduce the contingency.

Risk management, including as a part of the design process, can be extensive and depends, among other things, on the particular system, the complexity of the system and tools/methods used to perform it (e.g. a detailed failure mode effect and criticality analysis can take a lot of time and be resource intensive).

In this report, whilst no risks to a specific FOWT are provided, a list of hazards that can affect design is provided in Table 4. It should be noted that the list is not exhaustive and the applicability of each hazard is design dependant.

The hazards provided below mainly cover the areas of FOWT physical scaled testing and numerical simulations. However, other areas such as lack of experience and equipment requalification are also highlighted.

No.	Hazard
1	Reduced blade clearance due to a FOWT motions and blade deflection combination (both water and tower clearance)
2	Reduced substructure design envelope compared to bottom-fixed and onshore wind turbine foundations due to additional constraints from the mooring system, dynamic cable(s) and additional motions.
3	Possible negative damping / instability
4	Equipment physical compatibility with the environment (e.g. use of the personnel lift designed for bottom-fixed wind turbines in the wind turbine tower of a FOWT that is exposed to motions in 6 degrees-of-freedom, heel angles and system accelerations)
5	No or low level of experience / no track record in designing FOWTs
6	Lack of information sharing between wind turbine manufacturers and substructure developers
7	Lack of typology and component specific standards for FOWTs (e.g. for dynamic cables)
8	Possible modified control and safety system (e.g. control modifications to Hywind and Principle Power prototypes that led to invalidation of the wind turbine warranties)
9	Possible requalification of tower (e.g. use of a bespoke tower designs that will be exposed to mean heel angles, but also larger bending moments at the tower base as the FOWT “leans” into wind)

10	Requalification of drive-train (e.g. different load profiles due to movements of FOWTs (mean and dynamic heel angles, and nacelle accelerations))
11	Hydrodynamic damping measurement and upscaling errors from model tests
12	Complexity and time constraints associated with use of high-fidelity computational models
13	Increased uncertainties with respect to simulations in floating wind compared to bottom-fixed
14	Aerodynamic code breakdown due to large blade deflections (e.g. due to large rotor and/or FOWT motions)
15	Aerodynamic code breakdown due to rotor operation in its own wake
16	Simplification of aerodynamics due to high computational demand (e.g. to be able to run hardware in the loop in real-time, rotor design for physical tests)
17	Lack of tools to model wake effects in FOWT arrays
18	Increased relevance of induction lag calculation models (i.e. dynamic inflow)
19	Inaccurately predicted unsteady aerodynamic loads (change in phase and amplitude of loads)
20	Lack of full-scale measurements to verify simulations tools
21	Simplifications in basin tests (e.g. alignment of scaling laws (redesign of rotor), mooring scaling)
22	Unaccounted structural flexibility of the substructure

Table 4: Design hazards for FOWTs

The hazards provided above, in addition to all other hazards identified in LIFES50+, have intentionally not been translated into multipliers for the LCOE, as these are design dependent and are highly subjective when applied to hypothetical examples (e.g. the 10 MW wind turbine used in LIFES50+ is not an optimized commercial wind turbine). However, some broad findings can be drawn from the hazard list above and other work performed in LIFES50+. These are:

- Low-fidelity computational models and simplified physical testing will lead to sub-optimal designs, which will reflect in higher whole-life costs;
- Lack of available information and information sharing with respect to the tower, rotor-nacelle assembly, substructure, etc. between different parties can lead to increased project costs (e.g. either via increased design time or via a sub-optimal design). For example, Hywind had to change wind turbine pitch actuators after a few months of operations as these were designed for bottom-fixed wind and less frequent use.

For those hazards dealing with computational models, it is clear that the use of less complex models can lead to sub-optimal design choices that might result in a cost increase.

Moreover, those hazards dealing with the lack of information regarding the tower design, turbine and substructure have a significant contribution in the LCOE. In fact, from the sensitivity analysis, it can be noticed that costs related to the turbine and substructure manufacturing have a clear influence on the final value of the LCOE.

6 Conclusions

This report has provided information regarding how concept design and common parameters, as well as risk, uncertainty and technology parameters choices taken at design phase can influence the LCOE of floating offshores wind farms.

The second chapter has provided details on the cost contribution of the different life cycle stages for each of the 4 concepts and considering a 500MW floating offshore wind located at three different offshore sits. The results are based on the work done in WP2 of the LIFES50+ project. Findings show that for the 4 design concepts, the manufacturing phase is the one that contributes the most to the cost of the floating substructures. This phase includes the manufacturing and acquisitions costs of all components of the floating offshore wind farm as well as storage cost and the load-out process. A comparison between the three offshore sites has shown that there is a significant cost increase for West of Barra, which is the offshore site with severe environmental conditions. A sensitivity analysis has been performed in Chapter 3 to understand which parameters that have been introduced to calculate the LCOE have a major influence and contribute most to the value. This study severed also to identify the parameters and cost components that cause the cost and LCOE increase in West of Barra. The findings show that the discount rate has by far the largest influence among all input parameters studied. A 50% increase or decrease of the mean value causes a variation of the LCOE by around 30% or more in positive and negative direction for all study cases. Thus, a well-chosen discount rate is from significant importance for the LCOE calculation. The second largest influence on the LCOE has the wind turbine cost, which is a common parameter and its influence is similar for all concepts and sites. The substructure cost, which is a concept design dependent parameter, has the third highest influence on the LCOE. It has been observed that the influence of this parameter between the sites decreased. For example for West of Barra, the export cable length becomes the second most influent parameter. This is due to longer distance to shore at the site and increases the export cable cost and transmission losses. The severe environmental conditions at this site cause also the anchor and mooring system cost to be more significant at this site for some of the FOWT concepts as well as to increase the installation cost, because a more specialized vessel spread is needed to operate within reduced weather windows. Furthermore, it has been seen that West of Barra is more sensitive to the operation and maintenance cost than the other two offshore sites. In general for all sites it has been seen that Energy related parameters such as the net production, availability loss and turbine electrical losses possess also a larger impact on the LCOE. Therefore, energy losses in the system in general should be tried to be minimized.

Chapter 4 is complementary to the sensitivity analysis as it presents the results of specific scenarios due to the variation of the LCOE by applying variation ranges based on uncertainty ranges defined by the designers and for the common components. The ranges are applied on the parameters that most influence the LCOE and that were obtained in Chapter 3. This analysis has served to identify how much the LCOE could actually vary based on the defined uncertainty ranges. For the three sites, the results show that the discount rate has the largest influence on the LCOE value for all 4 floating wind turbine concepts. Focusing on the energy production, an increase of this parameter by 5% will directly lead to a LCOE reduction of about 4.5-4.7%. Similar to the energy production, the availability loss has also a significant influence on the LCOE. Since the substructure cost represents a larger part of the CAPEX it has also a significant influence on the LCOE. For instance, for the floating wind farm based on the semi-submersible concrete concept a 20% cost reduction in the substructures can result into a 5% decrease of the LCOE value.

Furthermore, it can be see seen that based on the defined variation ranges for the cost of anchor and mooring and installation vessel, a variation of the LCOE is not very significant (below 1%) for all floating wind farm concepts in Gulf de Fos and Golf of Main offshore site. A further significant parameter among the different concepts is the turbine costs that allows a decrease of the LCOE in the range of 2% to 3% by a reduction of the cost by over 7%. A similar effect has the increase of the lifetime by 3 years.

For the West of Barra site, due to the larger distance to shore in this particular site the parameters that are related to the distance have a larger influence on the LCOE than in the other two offshore sites. For instance, by reducing the export cable length by 3.6% or the export cable cost by 17% a reduction of the LCOE of more than 2% can be reached for the floating wind farm based on the semi-submersible steel concept. The operation and maintenance activities and repair cost show also a larger influence for this offshore site with a cost reduction potential of up to 1.1%, whereas in the previous sites the influence was below 1%. Besides that, the operation cost shows a larger influence at this offshore site based on the transmission charges, which are considered in West of Barra. A decrease of the operation cost by 20% can result, for example for the floating wind farm based on the barge concrete concept, in a reduction of the LCOE of more than 1.3%.

It can be concluded that the parameters that most influence the LCOE are related to the capital expenses, which is also demonstrated in the LCC contribution of manufacturing phase in Chapter 2. This includes the cost of the substructure, turbine and offshore substation due to their capital intensive investment. Further has been demonstrated that the environmental conditions have a significant impact on the cost. Severe conditions require the design of a more robust structure but in particular influence the choice of anchor and mooring system as well as the need for a more specialized installation spread, which impacts the costs. Besides costs, energy losses in the system are also very significant for the LCOE and should tried to be minimized. Last but not least, operation and maintenance cost have also been identified as important parameters to consider especially for West of Barra, where a larger distance to shore is present combined with severe met-ocean conditions.

Finally, Chapter 5 has focused on disclosing risk consideration during design that can also lead to LCOE reduction. For example, a structured, detailed and well-recorded risk management can increase the confidence of insurers and financers leading to reduced insurance and cost of financing. Similarly, it can also reduce the contingency. In this report, whilst no risks to a specific FOWT are provided, a list of hazards that can affect design is provided. It should be noted that the list is not exhaustive and the applicability of each hazard is design dependent.

7 References

[1] LIFES50+, Deliverable 1.1 Oceanographic and meteorological conditions for the design, online: http://lifes50plus.eu/wp-content/uploads/2015/12/GA_640741_LIFES50-_D1.1.pdf, accessed 10.09.2017

[2] IRENA, Renewable Energy Technologies: Cost Analysis Series Wind Power, Bonn 2012

[3] Fasso A, Perri P, Sensitivity Analysis Encyclopedia of Environmetrics, Volume 4, Chichester 2002

Appendix 1: List of parameters included in the sensitivity analysis

Designer Parameters				
No.	**Parameter name**	**Life cycle**	**Description**	**Unit**
1	Lease_rate_shipyard	Manufacturing	Area lease rate shipyard	€/m2/d
2	Substructure_comp_cost	Manufacturing	Cost of substructure components	€
3	Mooring_comp_cost	Manufacturing	Cost of mooring components	€
4	Anchor_comp_cost	Manufacturing	Cost of anchor components	€
5	IAC_cost	Manufacturing	Cost of inter-array cable	€/m
6	IAC_length	Manufacturing	Length of inter-array cable	m
7	Load_out_vessel_Dayrate	Manufacturing Load-out	Dayrate of vessel	€/d
8	Load_out_vessel_quantity	Manufacturing Load-out	Quantity of vessel	Number
9	Load_out_vessel_fuel_consumption	Manufacturing Load-out	Fuel consumption of vessel	l/kW
10	Load_out_vessel_mob_demob	Manufacturing Load-out	Mobilization/demobilization of vessel	€
11	Load_out_machinery_Dayrate	Manufacturing Load-out	Dayrate of machinery	€/d
12	Load_out_machinery_quantity	Manufacturing Load-out	Quantity of machinery	Number
13	Load_out_machinery_purchase_price	Manufacturing Load-out	Purchase price of machinery	€
14	Load_out_machinery_fuel_consumption	Manufacturing Load-out	Fuel consumption of machinery	l/kW
15	Load_out_crane_dayrate	Manufacturing Load-out	Dayrate of crane	€/d
16	Load_out_crane_quantity	Manufacturing Load-out	Quantity of crane	Number
17	Load_out_crane_purchase_price	Manufacturing Load-out	Purchase price of crane	€
18	Load_out_crane_fuel_consump	Manufacturing Load-out	Fuel consumption of crane	l/kW
19	Load_out_vessel_Power	Manufacturing Load-out	Power of vessel	kW
20	Load_out_vessel_time_oper	Manufacturing Load-out	Operating time of vessel	Number
21	Load_out_machinery_power	Manufacturing Load-out	Power of machinery	€
22	Load_out_machinery_time_oper	Manufacturing Load-out	Operating time of machinery	h
23	Load_out_crane_power	Manufacturing Load-out	Power of crane	kW
24	Load_out_crane_time_oper	Manufacturing Load-out	Operating time of crane	h
25	transport_vessel_Dayrate	Transport	Dayrate of vessel	€/d
26	transport_vessel_mob_demob	Transport	Mobilization/demobilization of vessel	€
27	transport_vessel_fuel_consumption	Transport	Fuel consumption of vessel	l/kW
28	transport_crane_Dayrate	Transport	Dayrate of crane	€/d
29	transport_crane_purchase	Transport	Purchase price of crane	€
30	transport_crane_fuel_consumption	Transport	Fuel consumption of crane	l/kW
31	transport_vessel_rental_time_substructure	Transport	Rental time vessel	d
32	transport_vessel_quantity_substructure	Transport	Quantity of vessel	Number
33	transport_crane_rental_time_substructure	Transport	Rental time crane	d
34	transport_crane_quantity_substructure	Transport	Quantity of crane	Number
35	transport_vessel_rental_time_am	Transport	Rental time vessel	d
36	transport_vessel_quantity_am	Transport	Quantity of vessel	Number
37	transport_crane_rental_time_am	Transport	Rental time crane	d
38	transport_crane_quantity_am	Transport	Quantity of crane	Number
39	transport_vessel_rental_time_IAC	Transport	Rental time vessel	d
40	transport_vessel_quantity_IAC	Transport	Quantity of vessel	Number
41	transport_crane_rental_time_IAC	Transport	Rental time crane	d
42	transport_crane_quantity_IAC	Transport	Quantity of crane	Number
43	transport_vessel_power	Transport	Power of vessel	kW
44	transport_crane_power	Transport	Power of crane	kW
45	transport_vessel_time_oper_substructure	Transport	Operating time of vessel for substructure	h
46	transport_vessel_time_oper_am	Transport	Operating time vessel for anchor and mooring	h
47	transport_crane_time_oper_am	Transport	Operating time crane for anchor and mooring	h
48	transport_crane_time_oper_substructure	Transport	Operating time of crane for substructure	h
49	transport_vessel_time_oper_IAC	Transport	Operating time of vessel for IAC	h
50	transport_crane_time_oper_IAC	Transport	Operating time of crane for IAC	h
51	transport_area_cost_substructure	Transport	Area rental cost for floating substructure	€/m2/d
52	transport_area_substructure	Transport	Area required for floating substructure	m2
53	transport_area_time_substructure	Transport	Area rental time for floating substructure	d
54	transport_area_cost_am	Transport	Area rental cost for anchor and mooring	€/m2/d
55	transport_area_time_am	Transport	Area rental time for anchor and mooring	d
56	transport_area_am	Transport	Area required for anchor and mooring	m2
57	transport_area_cost_iac	Transport	Area rental cost for IAC	€/m2/d
58	transport_area_time_iac	Transport	Area rental time for IAC	d
59	transport_area_iac	Transport	Area required for IAC	m2
60	Installation_vessel_Dayrate	Installation	Dayrate of vessel	€/d
61	Installation_vessel_mob_demob	Installation	Mobilization/demobilization of vessel	€
62	Installation_vessel_fuel_consumption	Installation	Fuel consumption of vessel	l/kW
63	Installation_crane_dayrate	Installation	Dayrate of crane	€/d
64	Installation_crane_purchase_price	Installation	Purchase price of crane	€
65	Installation_crane_fuel_consumption	Installation	Fuel consumption of crane	l/kW
66	Installation_vessel_rental_time_fs	Installation	Rental time vessel for floating substructure	d
67	Installation_vessel_quantity_fs	Installation	Quantity of vessel for floating substructure	Number
68	Installation_crane_quantity_fs	Installation	Quantity of crane for floating substructure	Number
69	Installation_crane_rental_time_fs	Installation	Rental time crane for floating substructure	d
70	Installation_vessel_rental_time_am	Installation	Rental time vessel for anchor and mooring	d

71	Installation_vessel_quantity_am	Installation	Quantity of vessel for anchor and mooring	Number
72	Installation_crane_quantity_am	Installation	Quantity of crane for anchor and mooring	Number
73	Installation_crane_rental_time_am	Installation	Rental time of crane for anchor and mooring	d
74	Installation_vessel_rental_time_iac	Installation	Rental time of vessel for IAC	d
75	Installation_vessel_quantity_iac	Installation	Quantity of vessel for IAC	Number
76	Installation_crane_quantity_iac	Installation	Quantity of crane for IAC	Number
77	Installation_crane_rental_time_iac	Installation	Rental time of crane for IAC	d
78	Installation_vessel_power	Installation	Power of vessel	kW
79	Installation_crane_power	Installation	Power of crane	kW
80	Installation_vessel_time_oper_fs	Installation	Operating time of vessel for substructure	h
81	Installation_crane_time_oper_fs	Installation	Operating time crane for substructure	h
82	Installation_vessel_time_oper_am	Installation	Operating time vessel for anchor and mooring	h
83	Installation_crane_time_oper_am	Installation	Operating time crane for anchor and mooring	h
84	Installation_vessel_time_oper_iac	Installation	Operating time of vessel for IAC	h
85	Installation_crane_time_oper_iac	Installation	Operating time of crane for IAC	h
86	Installation_diver_cost_fs	Installation	Cost of diver floating substructure	€/d
87	Installation_diver_time_fs	Installation	Time required diver floating substructure	d
88	Installation_amount_time_fs	Installation	Amount of divers floating substructure	Number
89	Installation_diver_cost_am	Installation	Cost of diver anchor & mooring	€/d
90	Installation_diver_time_am	Installation	Time required diver anchor & mooring	d
91	Installation_diver_amount_am	Installation	Amount of divers anchor & mooring	Number
92	Installation_diver_cost_iac	Installation	Cost of diver inter-array cables	€/d
93	Installation_diver_time_iac	Installation	Time required diver inter-array cables	d
94	Installation_diver_amount_iac	Installation	Amount of divers inter-array cables	Number
95	OM_vessel_Dayrate	Operation & Maintenance	Dayrate of vessel	€/d
96	OM_vessel_mob_demob	Operation & Maintenance	Mobilization/demobilization of vessel	€
97	OM_vessel_fuel_consumption	Operation & Maintenance	Fuel consumption of vessel	l/kW
98	OM_crane_dayrate	Operation & Maintenance	Dayrate of crane	€/d
99	OM_crane_purchase_price	Operation & Maintenance	Purchase price of crane	€
100	OM_crane_fuel_consumption	Operation & Maintenance	Fuel consumption of crane	l/kW
101	OM_diver_cost	Operation & Maintenance	Cost of diver floating substructure	€/d
102	OM_preventive_vessel_rental_time	Operation & Maintenance	Vessel rental time preventive maintenance	d
103	OM_preventive_comp_repair_cost	Operation & Maintenance	Component repair cost preventive maintenance	€
104	OM_preventive_activities	Operation & Maintenance	Activities per year preventive maintenance	Number/year
105	OM_preventive_quantity_vessel	Operation & Maintenance	Quantity vessel preventive maintenance	Number
106	OM_preventive_rental_time_aux	Operation & Maintenance	Rental time auxiliary means preventive maintenance	d
107	OM_preventive_quantity_aux	Operation & Maintenance	Quantity auxiliary preventive maintenance	Number
108	OM_corrective_vessel_rental_time	Operation & Maintenance	Vessel rental time corrective maintenance	d
109	OM_corrective_vessel_quantity	Operation & Maintenance	Quantity vessel corrective maintenance	Number
110	OM_corrective_aux_quantity	Operation & Maintenance	Quantity auxiliary corrective maintenance	Number
111	OM_corrective_comp_repair_cost	Operation & Maintenance	Component repair cost corrective maintenance	€
112	OM_corrective_failure_rate	Operation & Maintenance	Failure rate corrective maintenance	Failure/year
113	OM_corrective_aux_rental_time	Operation & Maintenance	Rental time auxiliary means corrective maintenance	d
114	OM_vessel_power	Operation & Maintenance	Vessels power	kW
115	OM_crane_power	Operation & Maintenance	Crane&Auxiliaries power	kW
116	OM_preventive_time_oper_vessel	Operation & Maintenance	Time operating vessel preventive maintenance	h
117	OM_preventive_time_oper_aux	Operation & Maintenance	Time operating auxiliary means preventive maintenance	h
118	OM_corrective_vessel_operating_time	Operation & Maintenance	Time operating vessel corrective maintenance	h
119	OM_corrective_aux_oper_time	Operation & Maintenance	Time operating auxiliary means corrective maintenance	h
120	OM_preventive_amount_diver	Operation & Maintenance	Amount of divers preventive maintenance	Number
121	OM_preventive_time_diver	Operation & Maintenance	Time required diver preventive maintenance	d
122	OM_corrective_diver_amount	Operation & Maintenance	Amount of divers corrective maintenance	Number
123	OM_corrective_diver_time	Operation & Maintenance	Time required diver corrective maintenance	d
124	Decom_vessel_dayrate	Decommissioning	Dayrate of vessel	€/d
125	Decom_vessel_mob_demob	Decommissioning	Mobilization/demobilization of vessel	€
126	Decom_vessel_fuel_consumption	Decommissioning	Fuel consumption of vessel	l/kW
127	Decom_aux_dayrate	Decommissioning	Dayrate of aux means	€/d
128	Decom_aux_purchase_price	Decommissioning	Purchase price of aux means	€
129	Decom_aux_fuel_consumption	Decommissioning	Fuel consumption of aux means	l/kW
130	Decom_vessel_rental_time_fs	Decommissioning	Rental time vessel for floating substructure	d
131	Decom_vessel_quantity_fs	Decommissioning	Quantity of vessel for floating substructure	Number
132	Decom_aux_rental_time_fs	Decommissioning	Rental time aux means for floating substructure	d
133	Decom_aux_quantity_fs	Decommissioning	Quantity time aux means for floating substructure	Number
134	Decom_vessel_rental_time_am	Decommissioning	Rental time vessel for anchor and mooring	d
135	Decom_vessel_quantity_am	Decommissioning	Quantity of vessel for anchor and mooring	Number
136	Decom_aux_rental_time_am	Decommissioning	Rental time of aux means for anchor and mooring	d
137	Decom_aux_quantity_am	Decommissioning	Quantity of aux means for anchor and mooring	Number
138	Decom_vessel_rental_time_iac	Decommissioning	Rental time of vessel for IAC	d
139	Decom_vessel_quantity_iac	Decommissioning	Quantity of vessel for IAC	Number
140	Decom_aux_rental_time_iac	Decommissioning	Rental time of aux means for IAC	d
141	Decom_aux_quantity_iac	Decommissioning	Quantity of aux means for IAC	Number
142	Decom_storage_cost	Decommissioning	Storage area rental cost	€/m2/d
143	Decom_vessel_rental_time_port_activities	Decommissioning	Vessel rental time port activities	d
144	Decom_vessel_quantity_port_activities	Decommissioning	Vessel quantity port activities	Number
145	Decom_aux_rental_time_port_activities	Decommissioning	Aux means rental time port activities	d
146	Decom_aux_quantity_port_activities	Decommissioning	Aux means quantity port activities	Number
147	Decom_vessel_power	Decommissioning	Power of vessel	kW

148	Decom_aux_power	Decommissioning	Power of crane	kW
149	Decom_vessel_time_oper_fs	Decommissioning	Operating time of vessel for substructure	h
150	Decom_aux_oper_time_fs	Decommissioning	Operating time crane for substructure	h
151	Decom_vessel_oper_time_am	Decommissioning	Operating time vessel for anchor and mooring	h
152	Decom_aux_oper_time_am	Decommissioning	Operating time crane for anchor and mooring	h
153	Decom_vessel_oper_time_iac	Decommissioning	Operating time of vessel for IAC	h
154	Decom_aux_oper_time_iac	Decommissioning	Operating time of crane for IAC	h
155	Decom_diver_cost_fs	Decommissioning	Cost of diver floating substructure	€/d
156	Decom_diver_time_fs	Decommissioning	Time required diver floating substructure	d
157	Decom_diver_amount_fs	Decommissioning	Amount of divers floating substructure	Number
158	Decom_diver_cost_am	Decommissioning	Cost of diver anchor & mooring	€/d
159	Decom_diver_time_am	Decommissioning	Time required diver anchor & mooring	d
160	Decom_diver_amount_am	Decommissioning	Amount of divers anchor & mooring	Number
161	Decom_diver_cost_iac	Decommissioning	Cost of diver inter-array cables	€/d
162	Decom_diver_time_iac	Decommissioning	Time required diver inter-array cables	d
163	Decom_diver_amount_iac	Decommissioning	Amount of divers inter-array cables	Number
164	Decom_storage_area	Decommissioning	Storage area	m2
165	Decom_storage_rental_time	Decommissioning	Storage area rental time	d
166	Decom_vessel_time_oper_port_activities	Decommissioning	Time operating vessel in port	h
167	Decom_aux_oper_time_port_activities	Decommissioning	Time operating aux means in port	h
168	EOLM_processing_cost_fs	Decommissioning End of Life Management	Processing cost floating substructure	€/t
169	EOLM_selling_price_fs	Decommissioning End of Life Management	Selling price floating substructure	€/t
170	EOLM_disposal_cost_fs	Decommissioning End of Life Management	Disposal cost floating substructure	€/t
171	EOLM_processing_cost_mooring	Decommissioning End of Life Management	Processing cost mooring	€/t
172	EOLM_selling_price_mooring	Decommissioning End of Life Management	Selling price mooring	€/t
173	EOLM_disposal_cost_mooring	Decommissioning End of Life Management	Disposal cost mooring	€/t
174	EOLM_processing_cost_anchor	Decommissioning End of Life Management	Processing cost anchor	€/t
175	EOLM_selling_price_anchor	Decommissioning End of Life Management	Selling price anchor	€/t
176	EOLM_disposal_cost_anchor	Decommissioning End of Life Management	Disposal cost anchor	€/t
177	EOLM_processing_cost_iac	Decommissioning End of Life Management	Processing cost inter-array cables	€/t
178	EOLM_selling_price_iac	Decommissioning End of Life Management	Selling price inter-array cables	€/t
179	EOLM_disposal_cost_iac	Decommissioning End of Life Management	Disposal cost inter-array cables	€/t
180	EOLM_distance	Decommissioning End of Life Management	Distance point of sale and disposal place	km
181	EOLM_dayrate_vehicle_transport	Decommissioning End of Life Management	Dayrate vehicle transportation to point of sale	€/d
182	EOLM_quantity_vehicle_transport	Decommissioning End of Life Management	Quantity vehicle transportation to point of sale	Number
183	EOLM_fuel_cons_vehicle_transport	Decommissioning End of Life Management	Fuel consumption vehicle transportation to point of sale	l/kWh
184	EOLM_dayrate_crane_transport	Decommissioning End of Life Management	Dayrate crane transportation to point of sale	€/d
185	EOLM_quantity_crane_transport	Decommissioning End of Life Management	Quantity crane transportation to point of sale	Number
186	EOLM_fuel_cons_crane_transport	Decommissioning End of Life Management	Fuel consumption crane transportation to point of sale	l/kWh
187	EOLM_power_vehicle_transport	Decommissioning End of Life Management	Power vehicle transportation to point of sale	kW
188	EOLM_power_crane_transport	Decommissioning End of Life Management	Power crame transportation to point of sale	kW
189	EOLM_rent_time_vehicle_transport	Decommissioning End of Life Management	Rental time vehicle transportation to point of sale	d
190	EOLM_rental_time_crane_transport	Decommissioning End of Life Management	Rental time crane transportation to point of sale	d
191	EOLM_time_oper_vehicle_transport	Decommissioning End of Life Management	Operating time vehicle transportation to point of sale	h
192	EOLM_time_oper_crane_transport	Decommissioning End of Life Management	Operating time crane transportation to point of sale	h

Common Parameters

No.	Parameter name	Life cycle	Description	Unit
1	Disc_Rate	Life cycle cost	Discount rate (WACC)	%
2	Energy_Turbine_loss	Energy	Electrical energy loss in turbine	%
3	Energy_OSS_loss	Energy	Offshore substation energy loss	%
4	Availability_loss	Energy	Availability loss	%
5	Energy_production	Energy	Net energy production	MWh
6	Lifetime	Energy and Life Cycle Cost	Operating lifetime	Years
7	Fuel_cost	All life cyles	Fuel price	€/l
8	Develop_cost	Development	Development cost in percentage of CAPEX	%
9	Manufacturing_Export_cable_cost	Manufacturing	Export cable cost per length	€/m
10	Manufacturing_Export_cable_length	Manufacturing	Export cable length	km
11	Manufacturing_OSS_cost	Manufacturing	Offshore substation cost	€
12	Manufacturing_Onshore_substation_cost	Manufacturing	Onshore substation cost	€
13	Manufacturing_turbine_cost	Manufacturing	Turbine cost	€/MW
14	Install_vessel_dayrate_common	Installation	Dayrate of installation vessel	€/d
15	Install_vessel_mobdemob_common	Installation	Mobilization/demobilization of vessel	€
16	Install_vessel_power_common	Installation	Power of vessel	kW
17	Install_vessel_consumption_common	Installation	Fuel consumption of vessel	l/kW
18	Install_crane_dayrate_common	Installation	Dayrate of crane	€/d
19	Install_crane_purchase_common	Installation	Mobilization/demobilization of crane	€
20	Install_crane_power_common	Installation	Power of crane	kW
21	Install_crane_consumption_common	Installation	Fuel consumption of crane	l/kW
22	Install_vessel_rent_time_exp_cable	Installation	Rental time vessel for export cable	d
23	Install_vessel_quantity_exp_cable	Installation	Quantity of vessel for export cable	Number
24	Install_vessel_time_operat_exp_cable	Installation	Operating time vessel for export cable	h
25	Install_crane_quantity_exp_cable	Installation	Quantity of crane for export cable	Number
26	Install_crane_rental_time_exp_cable	Installation	Rental time crane for export cable	d
27	Install_crane_time_oper_exp_cable	Installation	Operating time crane for export cable	h
28	Install_diver_time_exp_cable	Installation	Diver time required for export cable	d
29	Install_diver_cost_exp_cable	Installation	Diver cost for export cable	€/d

30	Install_diver_amount_exp_cable	Installation	Amount of divers for for export cable	Number
31	Install_vessel_rent_time_oss	Installation	Rental time vessel for offshore substation	d
32	Install_vessel_time_oper_oss	Installation	Operating time of vessel for offshore substation	h
33	Install_vessel_quantitiy_oss	Installation	Quantity of vessel for offshore substation	Number
34	Install_crane_quantitiy_oss	Installation	Quantity of crane for offshore substation	Number
35	Install_crane_rental_time_oss	Installation	Rental time crane for offshore substation	d
36	Install_crane_time_oper_oss	Installation	Operating time crane for offshore substation	h
37	Install_divers_time_oss	Installation	Diver time required for offshore substation	d
38	Install_divers_cost_oss	Installation	Diver cost for offshore substation	€/d
39	Install_divers_amount_oss	Installation	Amount of divers for offshore substation	Number
40	Install_crane_rental_time_onsub	Installation	Rental time crane for onshore substation	d
41	Install_crane_time_oper_onsub	Installation	Operating time of crane for onshore substation	h
42	Install_crane_quantity_onsub	Installation	Quantity of crane for onshore substation	Number
43	Install_prep_cement_onsub	Installation	Preparation and cementation work for onshore substation	€
44	Install_commissioning	Installation	Commissioning	€
45	Install_insurance	Installation	Insurance	€
46	Operation_cost	Operation & Maintenance	Operating cost	€/year
47	OM_vessel_dayrate_common	Operation & Maintenance	Dayrate of vessel	€/d
48	OM_vessel_mobdemob_common	Operation & Maintenance	Mobilization/demobilization of vessel	€
49	OM_vessel_power_common	Operation & Maintenance	Power of vessel	kW
50	OM_vessel_fuel_consump_common	Operation & Maintenance	Fuel consumption of vessel	l/kW
51	OM_crane_dayrate_common	Operation & Maintenance	Dayrate of crane	€/d
52	OM_crane_purchase_price_common	Operation & Maintenance	Purchase price of crane	€
53	OM_crane_power_common	Operation & Maintenance	Power of crane	kW
54	OM_crane_consumption_common	Operation & Maintenance	Fuel consumption of crane	l/kW
55	OM_cost_diver_common	Operation & Maintenance	Cost of diver	€/d
56	OM_time_diver_prevent_maint_common	Operation & Maintenance	Time required diver preventive maintenance	d
57	OM_amount_diver_prevent_maint_common	Operation & Maintenance	Amount of diver preventive maintenance	Number
58	OM_amount_diver_correct_maint_common	Operation & Maintenance	Amount of diver corrective maintenance	Number
59	OM_time_diver_correct_maint_common	Operation & Maintenance	Time required of diver corrective maintenance	d
60	OM_vessel_rental_time_prevent_maint_common	Operation & Maintenance	Vessel rental time preventive maintenance	d
61	OM_vessel_comp_repair_prevent_maint_common	Operation & Maintenance	Component repair cost preventive maintenance	h
62	OM_vessel_activities_prevent_maint_common	Operation & Maintenance	Activities per year preventive maintenance	€
63	OM_vessel_quantity_prevent_maint_common	Operation & Maintenance	Quantity vessel preventive maintenance	Number/year
64	OM_vessel_time_oper_prevent_maint_common	Operation & Maintenance	Time operating vessel preventive maintenance	h
65	OM_aux_rent_time_prevent_maint_common	Operation & Maintenance	Rental time auxiliary means preventive maintenance	d
66	OM_aux_time_oper_prevent_maint_common	Operation & Maintenance	Time operating aux means preventive maintenance	h
67	OM_aux_quantity_prevent_maint_common	Operation & Maintenance	Quantity auxiliary preventive maintenance	Number
68	OM_vessel_rental_time_corrective_maint_common	Operation & Maintenance	Vessel rental time corrective maintenance	d
69	OM_vessel_time_oper_corrective_maint_common	Operation & Maintenance	Time operating vessel corrective maintenance	h
70	OM_com_repair_corrective_maint_common	Operation & Maintenance	Component repair cost corrective maintenance	€
71	OM_failure_rate_corrective_maint_common	Operation & Maintenance	Failure rate corrective maintenance	Failure/year
72	OM_vessel_quantity_corrective_maint_common	Operation & Maintenance	Quantity vessel corrective maintenance	Number
73	OM_aux_rental_time_corrective_maint_common	Operation & Maintenance	Rental time aux means corrective maintenance	d
74	OM_aux_time_oper_corrective_maint_common	Operation & Maintenance	Time operating aux means corrective maintenance	h
75	OM_aux_quantity_corrective_maint_common	Operation & Maintenance	Quantity auxiliary corrective maintenance	Number
76	Decomm_vessel_dayrate_common	Decommissioning	Dayrate of vessel	€/d
77	Decomm_vessel_mobdemob_common	Decommissioning	Mobilization/demobilization of vessel	€
78	Decomm_vessel_power_common	Decommissioning	Power of vessel	kW
79	Decomm_vessel_consumption_common	Decommissioning	Fuel consumption of vessel	l/kW
80	Decomm_crane_dayrate_common	Decommissioning	Dayrate of aux means	€/d
81	Decomm_crane_purchase_price_common	Decommissioning	Purchase price of aux means	€
82	Decomm_crane_power_common	Decommissioning	Power of crane	kW
83	Decomm_crane_consumption_common	Decommissioning	Fuel consumption of crane	l/kW
84	Decomm_vessel_rental_time_expcabel	Decommissioning	Rental time vessel for export cable	d
85	Decomm_vessel_time_oper_expcabel	Decommissioning	Time operating vessel for export cable	h
86	Decomm_vessel_quantity_expcabel	Decommissioning	Quantity of vessel for export cable	Number
87	Decomm_aux_quantity_expcabel	Decommissioning	Quantity of aux means for export cable	Number
88	Decomm_aux_time_oper_expcabel	Decommissioning	Time operating aux means for export cable	h
89	Decomm_aux_rental_time_expcabel	Decommissioning	Rental time aux means for export cable	d
90	Decomm_diver_time_expcabel	Decommissioning	Time required diver export cable	d
91	Decomm_diver_amount_expcabel	Decommissioning	Amount of divers export cable	Number
92	Decomm_diver_cost_expcabel	Decommissioning	Cost of diver export cable	€/d
93	Decomm_vessel_rental_time_oss	Decommissioning	Rental time vessel for offshore substation	d
94	Decomm_vessel_quantity_oss	Decommissioning	Quantity of vessel for offshore substation	Number
95	Decomm_vessel_time_oper_oss	Decommissioning	Time operating vessel for offshore substation	h
96	Decomm_aux_quantity_oss	Decommissioning	Quantity of aux means for offshore substation	Number
97	Decomm_aux_time_oper_oss	Decommissioning	Time operating aux means for offshore substation	h
98	Decomm_aux_rental_time_oss	Decommissioning	Rental time aux means for offshore substation	d
99	Decomm_diver_amount_oss	Decommissioning	Amount of divers offshore substation	Number
100	Decomm_diver_time_oss	Decommissioning	Time required diver offshore substation	d
101	Decomm_diver_cost_oss	Decommissioning	Cost of diver offshore substation	€/d
102	Decomm_aux_quantity_onsubst	Decommissioning	Quantity of aux means for onshore substation	Number
103	Decomm_aux_time_oper_onsubst	Decommissioning	Time operating aux means for onshore substation	h
104	Decomm_aux_rental_time_onsubst	Decommissioning	Rental time aux means for onshore substation	d
105	Decomm_storage_area_common	Decommissioning	Storage area	m2
106	Decomm_storage_area_rental_common	Decommissioning	Storage area cost	€/m2/d
107	Decomm_storage_area_rental_time_common	Decommissioning	Storage area rental time	d
108	Decomm_vessel_rental_time_port_common	Decommissioning	Vessel rental time port activities	d
109	Decomm_vessel_time_oper_port_common	Decommissioning	Time operating vessel port activities	h
110	Decomm_vessel_quantity_port_common	Decommissioning	Vessel quantity port activities	Number

111	Decomm_aux_quantity_port_common	Decommissioning	Aux means quantity port activities	Number
112	Decomm_aux_time_oper_port_common	Decommissioning	Aux means time operating port activities	h
113	Decomm_aux_rental_time_port_common	Decommissioning	Aux means rental time port activities	d
114	EOLM_process_cost_common	Decommissioning	Processing cost	€/t
115	EOLM_process_quantity_common	End of Life Management	Processing quantity	t
116	EOLM_selling_price_common	End of Life Management	Selling price	€/t
117	EOLM_selling_quantity_common	End of Life Management	Selling quantity	t
118	EOLM_disposal_cost_common	End of Life Management	Disposal cost	€/t
119	EOLM_disposal_quantity_common	End of Life Management	Disposal quantity	t
120	EOLM_distance_saledisposal_common	End of Life Management	Distance point of sale and disposal place	km
121	EOLM_vehicle_dayrate_common	End of Life Management	Dayrate vehicle transportation to point of sale	€/d
122	EOLM_vehicle_quantity_common	End of Life Management	Quantity vehicle transportation to point of sale	Number
123	EOLM_vehicle_rental_time_common	End of Life Management	Rental time vehicle transportation to point of sale	d
124	EOLM_vehicle_time_oper_common	End of Life Management	Operating time vehicle transportation to point of sale	h
125	EOLM_vehicle_consumption_common	End of Life Management	Fuel consumption vehicle	l/kW
126	EOLM_vehicle_power_common	End of Life Management	Power vehicle	kW
127	EOLM_aux_dayrate_common	End of Life Management	Dayrate aux means transportation to point of sale	€/d
128	EOLM_aux_time_oper_common	End of Life Management	Operating time aux means transportation to point of sale	h
129	EOLM_aux_rental_time_common	End of Life Management	Rental time aux means transportation to point of sale	d
130	EOLM_aux_quantity_common	End of Life Management	Quantity aux means transportation to point of sale	Number
131	EOLM_aux_consumption_common	End of Life Management	Fuel consumption aux means	l/kW
132	EOLM_aux_power_common	End of Life Management	Power aux means	kW
133	Decomm_Site_clearance	End of Life Management	Site clearance cost	€/m2

Appendix 2: Parameters excluded from the sensitivity analysis

No.	Parameter	Life Cycle	Unit	Comment
1	Exchange rate	All	-	Not possible to include due to how the costs are computed in the tool
2	Material cost	Manufacturing	€/t	Manufacturing cost are calculated based on the component cost not on the material
3	Material weight	Manufacturing	t	Manufacturing cost are calculated based on the component cost not on the material
4	Transport distance	Transportation	km	The tool considers vessel rental times and does not calculate based on the distance
5	Transmission fee	Operation & Maintenance	€	Is included in annual operating cost
6	License fee	Operation & Maintenance	€	No cost available
7	Weather windows/availability	Transport/Installat./O&M/Decomm.	-	No data available

Appendix 3: Results of analysis of most influencing parameters

Appendix 3.1: Semi-submersible Concrete, Golfe de Fos

No	Parameter	Parameter variation (%) / LCOE variation (%)																															
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-13.51	-12.64	-11.75	-10.87	-9.98	-9.09	-8.20	-7.30	-6.40	-5.49	-4.58	-3.67	-2.76	-1.84	-0.92	0.00	0.93	1.85	2.79	3.72	4.66	5.60	6.54	7.48	8.43	9.38	10.33	11.29	12.24	13.20	14.16	
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00	
		-2.56	-2.40	-2.23	-2.06	-1.89	-1.72	-1.55	-1.38	-1.21	-1.04	-0.87	-0.70	-0.52	-0.35	-0.18	0.00	0.18	0.35	0.53	0.71	0.88	1.06	1.24	1.42	1.60	1.79	1.97	2.15	2.33	2.52	2.70	
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38	
		-3.09	-2.88	-2.68	-2.47	-2.27	-2.06	-1.85	-1.65	-1.44	-1.24	-1.03	-0.82	-0.62	-0.41	-0.21	0.00	0.41	0.82	1.24	1.65	2.06	2.47	2.88	3.30	3.71	4.12	4.53	4.94	5.36	5.77	6.18	
4	Substructure cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-4.97	-4.63	-4.30	-3.97	-3.64	-3.31	-2.98	-2.65	-2.32	-1.99	-1.66	-1.32	-0.99	-0.66	-0.33	0.00	0.33	0.66	0.99	1.32	1.66	1.99	2.32	2.65	2.98	3.31	3.64	3.97	4.30	4.63	4.97	
5	Anchor cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00	
		-0.08	-0.07	-0.07	-0.06	-0.06	-0.05	-0.05	-0.04	-0.04	-0.03	-0.03	-0.02	-0.02	-0.01	-0.01	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	
6	Mooring cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00	
		-0.32	-0.30	-0.28	-0.26	-0.24	-0.22	-0.19	-0.17	-0.15	-0.13	-0.11	-0.09	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.09	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.26	0.28	0.30	0.32	
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-1.50	-1.40	-1.30	-1.20	-1.10	-1.00	-0.90	-0.80	-0.70	-0.60	-0.50	-0.40	-0.30	-0.20	-0.10	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	
8	A&M vessel rental time	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	
		-0.09	-0.08	-0.08	-0.07	-0.06	-0.06	-0.05	-0.05	-0.04	-0.03	-0.03	-0.02	-0.02	-0.01	-0.01	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.08	0.09	
9	Installation vessel dayrate designer	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-0.64	-0.60	-0.56	-0.51	-0.47	-0.43	-0.39	-0.34	-0.30	-0.26	-0.21	-0.17	-0.13	-0.09	-0.04	0.00	0.03	0.06	0.09	0.11	0.14	0.17	0.20	0.23	0.26	0.29	0.31	0.34	0.37	0.40	0.43	
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00	
		-0.26	-0.24	-0.22	-0.21	-0.19	-0.17	-0.15	-0.14	-0.12	-0.10	-0.09	-0.07	-0.05	-0.03	-0.02	0.00	0.03	0.06	0.09	0.11	0.14	0.17	0.20	0.23	0.26	0.28	0.31	0.34	0.37	0.40	0.43	
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67	
		-1.05	-0.98	-0.91	-0.84	-0.77	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.43	0.50	0.57	0.64	0.71	0.78	0.85	0.93	1.00	1.07	
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-0.46	-0.43	-0.39	-0.36	-0.33	-0.30	-0.27	-0.24	-0.21	-0.18	-0.15	-0.12	-0.09	-0.06	-0.03	0.00	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.43	0.46	
13	Development costs	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00	
		-0.24	-0.23	-0.21	-0.19	-0.18	-0.16	-0.14	-0.13	-0.11	-0.10	-0.08	-0.06	-0.05	-0.03	-0.02	0.00	0.02	0.03	0.05	0.06	0.08	0.10	0.11	0.13	0.14	0.16	0.18	0.19	0.21	0.23	0.24	
14	Export cable length	-9.59	-8.95	-8.31	-7.67	-7.03	-6.39	-5.75	-5.11	-4.48	-3.84	-3.20	-2.56	-1.92	-1.28	-0.64	0.00	0.52	1.05	1.57	2.10	2.62	3.15	3.67	4.20	4.72	5.25	5.77	6.30	6.82	7.35	7.87	
		-0.43	-0.40	-0.37	-0.34	-0.32	-0.29	-0.26	-0.23	-0.20	-0.17	-0.14	-0.12	-0.09	-0.06	-0.03	0.00	0.02	0.05	0.07	0.09	0.12	0.14	0.17	0.19	0.21	0.24	0.26	0.29	0.31	0.33	0.36	
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00	
		-0.54	-0.50	-0.47	-0.43	-0.39	-0.36	-0.32	-0.29	-0.25	-0.22	-0.18	-0.14	-0.11	-0.07	-0.04	0.00	0.04	0.07	0.11	0.14	0.18	0.22	0.25	0.29	0.32	0.36	0.39	0.43	0.47	0.50	0.54	
16	IAC cable length	-31.12	-29.05	-26.97	-24.90	-22.82	-20.75	-18.67	-16.60	-14.52	-12.45	-10.37	-8.30	-6.22	-4.15	-2.07	0.00	0.98	1.96	2.95	3.93	4.91	5.89	6.87	7.86	8.84	9.82	10.80	11.78	12.77	13.75	14.73	
		-1.96	-1.83	-1.70	-1.57	-1.44	-1.30	-1.17	-1.04	-0.91	-0.78	-0.65	-0.52	-0.39	-0.26	-0.13	0.00	0.06	0.12	0.19	0.25	0.31	0.37	0.43	0.49	0.56	0.62	0.68	0.74	0.80	0.87	0.93	
17	IAC cable cost	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	
		-0.72	-0.67	-0.62	-0.58	-0.53	-0.48	-0.43	-0.38	-0.34	-0.29	-0.24	-0.19	-0.14	-0.10	-0.05	0.00	0.05	0.10	0.14	0.19	0.24	0.29	0.34	0.38	0.43	0.48	0.53	0.58	0.62	0.67	0.72	
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-1.02	-0.95	-0.89	-0.82	-0.75	-0.68	-0.61	-0.55	-0.48	-0.41	-0.34	-0.27	-0.20	-0.14	-0.07	0.00	0.07	0.14	0.20	0.27	0.34	0.41	0.48	0.55	0.61	0.68	0.75	0.82	0.89	0.95	1.02	
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-0.47	-0.44	-0.41	-0.37	-0.34	-0.31	-0.28	-0.25	-0.22	-0.19	-0.16	-0.12	-0.09	-0.06	-0.03	0.00	0.03	0.06	0.09	0.12	0.16	0.19	0.22	0.25	0.28	0.31	0.34	0.37	0.41	0.44	0.47	
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	
		-0.32	-0.30	-0.28	-0.26	-0.24	-0.22	-0.19	-0.17	-0.15	-0.13	-0.11	-0.09	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.09	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.26	0.28	0.30	0.32	
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00	
		5.25	4.88	4.52	4.16	3.80	3.44	3.08	2.73	2.38	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.31	-1.64	-1.96	-2.27	-2.59	-2.91	-3.22	-3.53	-3.84	-4.14	-4.45	-4.75	
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00	
		2.98	1.83	1.84	1.85	1.86	1.87	0.85	0.86	0.86	0.87	0.88	-0.03	-0.02	-0.01	-0.01	0.00	-0.81	-0.80	-0.80	-0.79	-0.78	-1.51	-1.50	-1.50	-1.49	-1.48	-2.13	-2.13	-2.12	-2.12	-2.70	

Appendix 3.2: Semi-submersible Concrete, Gulf of Maine

No	Parameter	Parameter variation (%) / LCOE variation (%)																														
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-13.32	-12.45	-11.58	-10.71	-9.84	-8.96	-8.08	-7.19	-6.30	-5.41	-4.52	-3.62	-2.72	-1.82	-0.91	0.00	0.91	1.83	2.74	3.67	4.59	5.51	6.44	7.37	8.31	9.24	10.18	11.12	12.07	13.01	13.96
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-3.09	-2.89	-2.69	-2.49	-2.29	-2.08	-1.88	-1.67	-1.47	-1.26	-1.05	-0.84	-0.63	-0.42	-0.21	0.00	0.21	0.43	0.64	0.86	1.08	1.29	1.51	1.73	1.95	2.17	2.40	2.62	2.84	3.07	3.30
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-2.92	-2.72	-2.53	-2.33	-2.14	-1.94	-1.75	-1.55	-1.36	-1.17	-0.97	-0.78	-0.58	-0.39	-0.19	0.00	0.39	0.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.66	5.05	5.44	5.83
4	Substructure cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-4.58	-4.27	-3.97	-3.66	-3.36	-3.05	-2.75	-2.44	-2.14	-1.83	-1.53	-1.22	-0.92	-0.61	-0.31	0.00	0.31	0.61	0.92	1.22	1.53	1.83	2.14	2.44	2.75	3.05	3.36	3.66	3.97	4.27	4.58
5	Anchor cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.09	-0.08	-0.07	-0.07	-0.06	-0.06	-0.05	-0.05	-0.04	-0.03	-0.03	-0.02	-0.02	-0.01	-0.01	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.09
6	Mooring cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.40	-0.37	-0.34	-0.32	-0.29	-0.26	-0.24	-0.21	-0.19	-0.16	-0.13	-0.11	-0.08	-0.05	-0.03	0.00	0.03	0.05	0.08	0.11	0.13	0.16	0.19	0.21	0.24	0.26	0.29	0.32	0.34	0.37	0.40
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.52	-1.42	-1.32	-1.22	-1.11	-1.01	-0.91	-0.81	-0.71	-0.61	-0.51	-0.41	-0.30	-0.20	-0.10	0.00	0.10	0.20	0.30	0.41	0.51	0.61	0.71	0.81	0.91	1.01	1.11	1.22	1.32	1.42	1.52
8	A&M vessel rental time	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.10	-0.10	-0.09	-0.08	-0.08	-0.07	-0.06	-0.06	-0.05	-0.04	-0.03	-0.03	-0.02	-0.01	-0.01	0.00	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.10	0.10
9	Installation vessel dayrate designer	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.59	-0.55	-0.51	-0.47	-0.43	-0.40	-0.36	-0.32	-0.28	-0.24	-0.20	-0.16	-0.12	-0.08	-0.04	0.00	0.03	0.05	0.08	0.11	0.13	0.16	0.18	0.21	0.24	0.26	0.29	0.32	0.34	0.37	0.40
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.36	-0.34	-0.32	-0.29	-0.27	-0.24	-0.22	-0.19	-0.17	-0.15	-0.12	-0.10	-0.07	-0.05	-0.02	0.00	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.05	-0.98	-0.91	-0.84	-0.77	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.43	0.50	0.57	0.64	0.71	0.78	0.86	0.93	1.00	1.07
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.43	-0.40	-0.37	-0.34	-0.32	-0.29	-0.26	-0.23	-0.20	-0.17	-0.14	-0.11	-0.09	-0.06	-0.03	0.00	0.03	0.06	0.09	0.11	0.14	0.17	0.20	0.23	0.26	0.29	0.32	0.34	0.37	0.40	0.43
13	Development costs	-6.00	-5.60	-5.20	-4.80	-4.40	-4.00	-3.60	-3.20	-2.80	-2.40	-2.00	-1.60	-1.20	-0.80	-0.40	0.00	0.40	0.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60	4.00	4.40	4.80	5.20	5.60	6.00
		-0.29	-0.27	-0.25	-0.23	-0.21	-0.19	-0.17	-0.15	-0.13	-0.11	-0.10	-0.08	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.08	0.10	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29
14	Export cable length	-11.18	-10.43	-9.69	-8.94	-8.20	-7.45	-6.71	-5.96	-5.22	-4.47	-3.73	-2.98	-2.24	-1.49	-0.75	0.00	0.80	1.60	2.40	3.19	3.99	4.79	5.59	6.39	7.19	7.99	8.79	9.58	10.38	11.18	11.98
		-0.84	-0.79	-0.73	-0.68	-0.62	-0.57	-0.51	-0.45	-0.40	-0.34	-0.28	-0.23	-0.17	-0.11	-0.06	0.00	0.06	0.12	0.18	0.25	0.31	0.37	0.43	0.50	0.56	0.62	0.69	0.75	0.81	0.88	0.94
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-0.82	-0.76	-0.71	-0.65	-0.60	-0.54	-0.49	-0.43	-0.38	-0.33	-0.27	-0.22	-0.16	-0.11	-0.05	0.00	0.05	0.11	0.16	0.22	0.27	0.33	0.38	0.43	0.49	0.54	0.60	0.65	0.71	0.76	0.82
16	IAC cable length	-31.41	-29.32	-27.22	-25.13	-23.03	-20.94	-18.85	-16.75	-14.66	-12.56	-10.47	-8.38	-6.28	-4.19	-2.09	0.00	0.78	1.57	2.35	3.14	3.92	4.71	5.49	6.28	7.06	7.85	8.63	9.42	10.20	10.99	11.77
		-1.97	-1.84	-1.71	-1.57	-1.44	-1.31	-1.18	-1.05	-0.92	-0.79	-0.66	-0.53	-0.39	-0.26	-0.13	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.34	0.39	0.44	0.49	0.54	0.59	0.64	0.69	0.74
17	IAC cable cost	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
		-0.73	-0.68	-0.64	-0.59	-0.54	-0.49	-0.44	-0.39	-0.34	-0.29	-0.24	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.20	0.24	0.29	0.34	0.39	0.44	0.49	0.54	0.59	0.64	0.68	0.73
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.75	-0.70	-0.65	-0.60	-0.55	-0.50	-0.45	-0.40	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.99	-0.93	-0.86	-0.79	-0.73	-0.66	-0.59	-0.53	-0.46	-0.40	-0.33	-0.26	-0.20	-0.13	-0.07	0.00	0.07	0.13	0.20	0.26	0.33	0.40	0.46	0.53	0.59	0.66	0.73	0.79	0.86	0.93	0.99
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.86	-0.80	-0.74	-0.68	-0.63	-0.57	-0.51	-0.46	-0.40	-0.34	-0.29	-0.23	-0.17	-0.11	-0.06	0.00	0.06	0.11	0.17	0.23	0.29	0.34	0.40	0.46	0.51	0.57	0.63	0.68	0.74	0.80	0.86
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.25	4.88	4.52	4.16	3.80	3.44	3.09	2.73	2.38	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.31	-1.64	-1.96	-2.27	-2.59	-2.91	-3.22	-3.53	-3.84	-4.14	-4.45	-4.75
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		2.95	1.81	1.82	1.83	1.84	1.85	0.84	0.85	0.86	0.86	0.87	-0.03	-0.02	-0.01	-0.01	0.00	-0.80	-0.79	-0.79	-0.78	-0.78	-1.49	-1.48	-1.48	-1.47	-1.47	-2.11	-2.10	-2.10	-2.09	-2.66

Appendix 3.3: Semi-submersible Concrete, West of Barra

No	Parameter	Parameter variation (%) / LCOE variation (%)																												
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-12.25	-11.45	-10.65	-9.85	-9.05	-8.24	-7.43	-6.62	-5.80	-4.98	-4.16	-3.33	-2.50	-1.67	-0.84	0.00	0.84	1.68	2.53	3.37	4.22	5.07	5.93	6.79	7.65	8.51	9.37	10.24	11.10	11.98	12.85
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-4.17	-3.90	-3.63	-3.36	-3.09	-2.82	-2.54	-2.27	-1.99	-1.71	-1.43	-1.15	-0.86	-0.58	-0.29	0.00	0.29	0.58	0.88	1.17	1.47	1.77	2.07	2.37	2.68	2.99	3.29	3.60	3.92	4.23	4.55
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-2.10	-1.96	-1.82	-1.68	-1.54	-1.40	-1.26	-1.12	-0.98	-0.84	-0.70	-0.56	-0.42	-0.28	-0.14	0.00	0.28	0.56	0.84	1.12	1.40	1.68	1.96	2.24	2.52	2.80	3.08	3.36	3.64	3.92	4.20
4	Substructure cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-3.66	-3.42	-3.17	-2.93	-2.68	-2.44	-2.20	-1.95	-1.71	-1.46	-1.22	-0.98	-0.73	-0.49	-0.24	0.00	0.24	0.49	0.73	0.98	1.22	1.46	1.71	1.95	2.20	2.44	2.68	2.93	3.17	3.42	3.66
5	Anchor cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.04	-0.04	-0.04	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04
6	Mooring cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.60	-0.56	-0.52	-0.48	-0.44	-0.40	-0.36	-0.32	-0.28	-0.24	-0.20	-0.16	-0.12	-0.08	-0.04	0.00	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.06	-0.98	-0.91	-0.84	-0.77	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.56	0.63	0.70	0.77	0.84	0.91	0.98	1.06
8	A&M vessel rental time	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.17	-0.16	-0.15	-0.14	-0.13	-0.12	-0.10	-0.09	-0.08	-0.07	-0.06	-0.05	-0.03	-0.02	-0.01	0.00	0.01	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.14	0.15	0.16	0.17
9	Installation vessel dayrate designer	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.62	-0.57	-0.53	-0.49	-0.45	-0.41	-0.37	-0.33	-0.29	-0.25	-0.21	-0.16	-0.12	-0.08	-0.04	0.00	0.03	0.05	0.08	0.11	0.14	0.16	0.19	0.22	0.25	0.27	0.30	0.33	0.36	0.38	0.41
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.81	-0.76	-0.71	-0.65	-0.60	-0.54	-0.49	-0.43	-0.38	-0.33	-0.27	-0.22	-0.16	-0.11	-0.05	0.00	0.09	0.18	0.27	0.36	0.45	0.54	0.63	0.72	0.81	0.90	0.99	1.08	1.17	1.26	1.35
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.19	-1.11	-1.03	-0.95	-0.88	-0.80	-0.72	-0.64	-0.56	-0.48	-0.40	-0.32	-0.24	-0.16	-0.08	0.00	0.08	0.16	0.24	0.32	0.40	0.48	0.57	0.65	0.73	0.81	0.89	0.97	1.06	1.14	1.22
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.34	-0.31	-0.29	-0.27	-0.25	-0.22	-0.20	-0.18	-0.16	-0.13	-0.11	-0.09	-0.07	-0.04	-0.02	0.00	0.02	0.04	0.07	0.09	0.11	0.13	0.16	0.18	0.20	0.22	0.25	0.27	0.29	0.31	0.34
13	Development costs	-7.00	-6.53	-6.07	-5.60	-5.13	-4.67	-4.20	-3.73	-3.27	-2.80	-2.33	-1.87	-1.40	-0.93	-0.47	0.00	0.47	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60	6.07	6.53	7.00
		-0.31	-0.29	-0.27	-0.25	-0.22	-0.20	-0.18	-0.16	-0.14	-0.12	-0.10	-0.08	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.25	0.27	0.29	0.31
14	Export cable length	-3.58	-3.34	-3.10	-2.86	-2.63	-2.39	-2.15	-1.91	-1.67	-1.43	-1.19	-0.95	-0.72	-0.48	-0.24	0.00	0.10	0.21	0.31	0.42	0.52	0.63	0.73	0.84	0.94	1.05	1.15	1.26	1.36	1.47	1.57
		-2.17	-2.03	-1.89	-1.75	-1.61	-1.47	-1.33	-1.18	-1.04	-0.89	-0.74	-0.60	-0.45	-0.30	-0.15	0.00	0.07	0.13	0.20	0.27	0.33	0.40	0.47	0.54	0.60	0.67	0.74	0.81	0.88	0.94	1.01
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-1.97	-1.84	-1.71	-1.58	-1.45	-1.32	-1.18	-1.05	-0.92	-0.79	-0.66	-0.53	-0.39	-0.26	-0.13	0.00	0.13	0.26	0.39	0.53	0.66	0.79	0.92	1.05	1.18	1.32	1.45	1.58	1.71	1.84	1.97
16	IAC cable length	-33.92	-31.66	-29.40	-27.14	-24.87	-22.61	-20.35	-18.09	-15.83	-13.57	-11.31	-9.05	-6.78	-4.52	-2.26	0.00	1.21	2.41	3.62	4.83	6.04	7.24	8.45	9.66	10.87	12.07	13.28	14.49	15.70	16.90	18.11
		-1.55	-1.44	-1.34	-1.24	-1.13	-1.03	-0.93	-0.83	-0.72	-0.62	-0.52	-0.41	-0.31	-0.21	-0.10	0.00	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.55	0.61	0.66	0.72	0.77	0.83
17	IAC cable cost	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
		-0.51	-0.48	-0.45	-0.41	-0.38	-0.34	-0.31	-0.27	-0.24	-0.21	-0.17	-0.14	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.14	0.17	0.21	0.24	0.27	0.31	0.34	0.38	0.41	0.45	0.48	0.51
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.98	-1.85	-1.72	-1.59	-1.46	-1.32	-1.19	-1.06	-0.93	-0.79	-0.66	-0.53	-0.40	-0.26	-0.13	0.00	0.13	0.26	0.40	0.53	0.66	0.79	0.93	1.06	1.19	1.32	1.46	1.59	1.72	1.85	1.98
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.22	-1.13	-1.05	-0.97	-0.89	-0.81	-0.73	-0.65	-0.57	-0.49	-0.41	-0.32	-0.24	-0.16	-0.08	0.00	0.08	0.16	0.24	0.32	0.41	0.49	0.57	0.65	0.73	0.81	0.89	0.97	1.05	1.13	1.22
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.09	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.09
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.25	4.88	4.52	4.15	3.80	3.44	3.08	2.73	2.38	2.03	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.31	-1.63	-1.96	-2.27	-2.59	-2.90	-3.22	-3.53	-3.83	-4.14	-4.45	-4.75
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		2.75	1.70	1.71	1.71	1.72	1.72	0.79	0.80	0.80	0.81	0.81	-0.02	-0.01	-0.01	0.00	0.00	-0.74	-0.73	-0.73	-0.73	-0.72	-1.38	-1.38	-1.37	-1.37	-1.37	-1.96	-1.96	-1.95	-1.95	-2.48

Appendix 3.4: Barge Concrete, Golfe de Fos

No	Parameter	Parameter variation (%) / LCOE variation (%)																														
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-13.17	-12.32	-11.46	-10.60	-9.74	-8.87	-8.00	-7.12	-6.25	-5.36	-4.48	-3.59	-2.70	-1.80	-0.90	0.00	0.91	1.81	2.73	3.64	4.56	5.48	6.40	7.33	8.26	9.19	10.12	11.06	12.00	12.94	13.89
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-2.56	-2.40	-2.23	-2.06	-1.89	-1.72	-1.55	-1.38	-1.21	-1.04	-0.87	-0.70	-0.52	-0.35	-0.18	0.00	0.18	0.35	0.53	0.71	0.88	1.06	1.24	1.42	1.60	1.79	1.97	2.15	2.33	2.52	2.70
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-2.44	-2.27	-2.11	-1.95	-1.79	-1.62	-1.46	-1.30	-1.14	-0.97	-0.81	-0.65	-0.49	-0.32	-0.16	0.00	0.32	0.65	0.97	1.30	1.62	1.95	2.27	2.60	2.92	3.25	3.57	3.90	4.22	4.55	4.87
4	Substructure cost	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		-4.24	-3.96	-3.68	-3.39	-3.11	-2.83	-2.54	-2.26	-1.98	-1.70	-1.41	-1.13	-0.85	-0.57	-0.28	0.00	0.09	0.19	0.28	0.38	0.47	0.57	0.66	0.75	0.85	0.94	1.04	1.13	1.23	1.32	1.41
5	Anchor cost	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		-0.20	-0.19	-0.17	-0.16	-0.15	-0.13	-0.12	-0.11	-0.09	-0.08	-0.07	-0.05	-0.04	-0.03	-0.01	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07
6	Mooring cost	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		-0.35	-0.33	-0.30	-0.28	-0.26	-0.23	-0.21	-0.19	-0.16	-0.14	-0.12	-0.09	-0.07	-0.05	-0.02	0.00	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.08	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.08
8	A&M vessel rental time	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.50	-0.47	-0.43	-0.40	-0.37	-0.33	-0.30	-0.27	-0.23	-0.20	-0.17	-0.13	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.13	0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50
9	Installation vessel dayrate designer	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.64	-0.60	-0.56	-0.51	-0.47	-0.43	-0.38	-0.34	-0.30	-0.26	-0.21	-0.17	-0.13	-0.09	-0.04	0.00	0.04	0.09	0.13	0.17	0.21	0.26	0.30	0.34	0.38	0.43	0.47	0.51	0.56	0.60	0.64
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.19	-0.18	-0.17	-0.15	-0.14	-0.13	-0.11	-0.10	-0.09	-0.08	-0.06	-0.05	-0.04	-0.03	-0.01	0.00	0.02	0.04	0.06	0.08	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.32
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.04	-0.97	-0.91	-0.84	-0.77	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.57	0.64	0.71	0.78	0.85	0.92	0.99	1.07
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.36	-0.34	-0.31	-0.29	-0.26	-0.24	-0.22	-0.19	-0.17	-0.14	-0.12	-0.10	-0.07	-0.05	-0.02	0.00	0.02	0.05	0.07	0.10	0.12	0.14	0.17	0.19	0.22	0.24	0.26	0.29	0.31	0.34	0.36
13	Development costs	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	0.53	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
		-0.72	-0.67	-0.62	-0.58	-0.53	-0.48	-0.43	-0.38	-0.34	-0.29	-0.24	-0.19	-0.14	-0.10	-0.05	0.00	0.03	0.05	0.08	0.10	0.13	0.15	0.18	0.20	0.23	0.26	0.28	0.31	0.33	0.36	0.38
14	Export cable length	-9.59	-8.95	-8.31	-7.67	-7.03	-6.39	-5.75	-5.11	-4.48	-3.84	-3.20	-2.56	-1.92	-1.28	-0.64	0.00	0.52	1.05	1.57	2.10	2.62	3.15	3.67	4.20	4.72	5.25	5.77	6.30	6.82	7.35	7.87
		-0.32	-0.30	-0.28	-0.26	-0.24	-0.22	-0.19	-0.17	-0.15	-0.13	-0.11	-0.09	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.05	0.07	0.09	0.11	0.12	0.14	0.16	0.18	0.20	0.21	0.23	0.25	0.27
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-0.39	-0.37	-0.34	-0.31	-0.29	-0.26	-0.24	-0.21	-0.18	-0.16	-0.13	-0.10	-0.08	-0.05	-0.03	0.00	0.03	0.05	0.08	0.10	0.13	0.16	0.18	0.21	0.24	0.26	0.29	0.31	0.34	0.37	0.39
16	IAC cable length	-31.12	-29.05	-26.97	-24.90	-22.82	-20.75	-18.67	-16.60	-14.52	-12.45	-10.37	-8.30	-6.22	-4.15	-2.07	0.00	0.98	1.96	2.95	3.93	4.91	5.89	6.87	7.86	8.84	9.82	10.80	11.78	12.77	13.75	14.73
		-1.32	-1.23	-1.15	-1.06	-0.97	-0.88	-0.79	-0.71	-0.62	-0.53	-0.44	-0.35	-0.26	-0.18	-0.09	0.00	0.04	0.08	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.54	0.59	0.63
17	IAC cable cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.32	-0.30	-0.28	-0.26	-0.24	-0.22	-0.19	-0.17	-0.15	-0.13	-0.11	-0.09	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.09	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.26	0.28	0.30	0.32
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.81	-0.75	-0.70	-0.64	-0.59	-0.54	-0.48	-0.43	-0.38	-0.32	-0.27	-0.21	-0.16	-0.11	-0.05	0.00	0.05	0.11	0.16	0.21	0.27	0.32	0.38	0.43	0.48	0.54	0.59	0.64	0.70	0.75	0.81
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.37	-0.34	-0.32	-0.30	-0.27	-0.25	-0.22	-0.20	-0.17	-0.15	-0.12	-0.10	-0.07	-0.05	-0.02	0.00	0.02	0.05	0.07	0.10	0.12	0.15	0.17	0.20	0.22	0.25	0.27	0.30	0.32	0.34	0.37
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.25	-0.24	-0.22	-0.20	-0.19	-0.17	-0.15	-0.14	-0.12	-0.10	-0.08	-0.07	-0.05	-0.03	-0.02	0.00	0.02	0.03	0.05	0.07	0.08	0.10	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.25
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.26	4.90	4.53	4.17	3.81	3.45	3.09	2.74	2.39	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.32	-1.64	-1.96	-2.28	-2.60	-2.91	-3.23	-3.54	-3.85	-4.15	-4.46	-4.76
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		3.22	2.05	2.04	2.04	2.03	2.02	0.98	0.97	0.97	0.96	0.95	0.03	0.02	0.01	0.01	0.00	-0.82	-0.83	-0.84	-0.84	-0.85	-1.58	-1.59	-1.59	-1.60	-1.61	-2.26	-2.27	-2.27	-2.28	-2.87

Appendix 3.5: Barge Concrete, Gulf of Maine

No	Parameter	Parameter variation (%) / LCOE variation (%)																																
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-13.06	-12.21	-11.36	-10.51	-9.65	-8.79	-7.93	-7.06	-6.19	-5.32	-4.44	-3.56	-2.67	-1.79	-0.89	0.00	0.90	1.80	2.70	3.61	4.52	5.43	6.35	7.26	8.19	9.11	10.04	10.97	11.90	12.83	13.77		
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00		
		-3.09	-2.89	-2.69	-2.49	-2.29	-2.08	-1.88	-1.67	-1.47	-1.26	-1.05	-0.84	-0.63	-0.42	-0.21	0.00	0.21	0.43	0.64	0.86	1.08	1.29	1.51	1.73	1.95	2.17	2.40	2.62	2.84	3.07	3.30		
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38		
		-2.17	-2.02	-1.88	-1.73	-1.59	-1.44	-1.30	-1.16	-1.01	-0.87	-0.72	-0.58	-0.43	-0.29	-0.14	0.00	0.29	0.58	0.87	1.16	1.44	1.73	2.02	2.31	2.60	2.89	3.18	3.47	3.75	4.04	4.33		
4	Substructure cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00		
		-2.86	-2.67	-2.48	-2.29	-2.10	-1.91	-1.72	-1.52	-1.33	-1.14	-0.95	-0.76	-0.57	-0.38	-0.19	0.00	0.10	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.95	1.05	1.14	1.24	1.33	1.43		
5	Anchor cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		-0.18	-0.17	-0.16	-0.14	-0.13	-0.12	-0.11	-0.10	-0.08	-0.07	-0.06	-0.05	-0.04	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
6	Mooring cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		-0.45	-0.42	-0.39	-0.36	-0.33	-0.30	-0.27	-0.24	-0.21	-0.18	-0.15	-0.12	-0.09	-0.06	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-1.08	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.08		
8	A&M vessel rental time	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00		
		-0.57	-0.53	-0.49	-0.45	-0.42	-0.38	-0.34	-0.30	-0.26	-0.23	-0.19	-0.15	-0.11	-0.08	-0.04	0.00	0.04	0.08	0.11	0.15	0.19	0.23	0.26	0.30	0.34	0.38	0.42	0.45	0.49	0.53	0.57		
9	Installation vessel dayrate designer	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00		
		-0.69	-0.65	-0.60	-0.55	-0.51	-0.46	-0.41	-0.37	-0.32	-0.28	-0.23	-0.18	-0.14	-0.09	-0.05	0.00	0.05	0.09	0.14	0.18	0.23	0.28	0.32	0.37	0.41	0.46	0.51	0.55	0.60	0.65	0.69		
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00		
		-0.22	-0.21	-0.19	-0.18	-0.16	-0.15	-0.13	-0.12	-0.10	-0.09	-0.07	-0.06	-0.04	-0.03	-0.01	0.00	0.02	0.05	0.07	0.10	0.12	0.15	0.17	0.20	0.22	0.24	0.27	0.29	0.32	0.34	0.37		
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67		
		-1.04	-0.97	-0.91	-0.84	-0.77	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.57	0.64	0.71	0.78	0.85	0.92	0.99	1.07		
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-0.32	-0.30	-0.28	-0.26	-0.23	-0.21	-0.19	-0.17	-0.15	-0.13	-0.11	-0.09	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.26	0.28	0.30	0.32		
13	Development costs	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.53	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00		
		-0.57	-0.53	-0.49	-0.46	-0.42	-0.38	-0.34	-0.30	-0.27	-0.23	-0.19	-0.15	-0.11	-0.08	-0.04	0.00	0.03	0.05	0.08	0.10	0.13	0.15	0.18	0.20	0.23	0.25	0.28	0.30	0.33	0.36	0.38		
14	Export cable length	-11.18	-10.43	-9.69	-8.94	-8.20	-7.45	-6.71	-5.96	-5.22	-4.47	-3.73	-2.98	-2.24	-1.49	-0.75	0.00	0.80	1.60	2.40	3.19	3.99	4.79	5.59	6.39	7.19	7.99	8.79	9.58	10.38	11.18	11.98		
		-0.50	-0.47	-0.43	-0.40	-0.37	-0.33	-0.30	-0.27	-0.23	-0.20	-0.17	-0.13	-0.10	-0.07	-0.03	0.00	0.04	0.07	0.11	0.15	0.18	0.22	0.26	0.29	0.33	0.37	0.40	0.44	0.48	0.52	0.55		
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00		
		-0.48	-0.45	-0.42	-0.38	-0.35	-0.32	-0.29	-0.26	-0.22	-0.19	-0.16	-0.13	-0.10	-0.06	-0.03	0.00	0.03	0.06	0.10	0.13	0.16	0.19	0.22	0.26	0.29	0.32	0.35	0.38	0.42	0.45	0.48		
16	IAC cable length	-31.41	-29.32	-27.22	-25.13	-23.03	-20.94	-18.85	-16.75	-14.66	-12.56	-10.47	-8.38	-6.28	-4.19	-2.09	0.00	0.78	1.57	2.35	3.14	3.92	4.71	5.49	6.28	7.06	7.85	8.63	9.42	10.20	10.99	11.77		
		-1.25	-1.16	-1.08	-1.00	-0.91	-0.83	-0.75	-0.67	-0.58	-0.50	-0.42	-0.33	-0.25	-0.17	-0.08	0.00	0.03	0.06	0.09	0.12	0.16	0.19	0.22	0.25	0.28	0.31	0.34	0.37	0.41	0.44	0.47		
17	IAC cable cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00		
		-0.30	-0.28	-0.26	-0.24	-0.22	-0.20	-0.18	-0.16	-0.14	-0.12	-0.10	-0.08	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30		
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-0.56	-0.52	-0.48	-0.45	-0.41	-0.37	-0.33	-0.30	-0.26	-0.22	-0.19	-0.15	-0.11	-0.07	-0.04	0.00	0.04	0.07	0.11	0.15	0.19	0.22	0.26	0.30	0.33	0.37	0.41	0.45	0.48	0.52	0.56		
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-0.74	-0.69	-0.64	-0.59	-0.54	-0.49	-0.44	-0.39	-0.34	-0.29	-0.25	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.20	0.25	0.29	0.34	0.39	0.44	0.49	0.54	0.59	0.64	0.69	0.74		
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-0.64	-0.59	-0.55	-0.51	-0.47	-0.42	-0.38	-0.34	-0.30	-0.25	-0.21	-0.17	-0.13	-0.08	-0.04	0.00	0.04	0.08	0.13	0.17	0.21	0.25	0.30	0.34	0.38	0.42	0.47	0.51	0.55	0.59	0.64		
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00		
		5.26	4.90	4.53	4.17	3.81	3.45	3.09	2.74	2.39	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.32	-1.64	-1.96	-2.28	-2.60	-2.91	-3.23	-3.54	-3.85	-4.15	-4.46	-4.76		
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00		
		3.23	2.06	2.05	2.04	2.03	2.02	0.99	0.98	0.97	0.96	0.95	0.03	0.02	0.02	0.01	0.00	-0.82	-0.83	-0.83	-0.84	-0.85	-1.58	-1.59	-1.59	-1.60	-1.61	-2.26	-2.27	-2.27	-2.28	-2.87		

Appendix 3.6: Barge Concrete, West of Barra

No	Parameter	Parameter variation (%) / LCOE variation (%)																																
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-12.45	-11.65	-10.84	-10.03	-9.21	-8.39	-7.56	-6.74	-5.91	-5.07	-4.24	-3.39	-2.55	-1.70	-0.85	0.00	0.86	1.72	2.58	3.44	4.31	5.18	6.06	6.93	7.81	8.69	9.58	10.47	11.35	12.25	13.14
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-4.17	-3.90	-3.63	-3.36	-3.09	-2.82	-2.54	-2.27	-1.99	-1.71	-1.43	-1.15	-0.86	-0.58	-0.29	0.00	0.29	0.58	0.88	1.17	1.47	1.77	2.07	2.37	2.68	2.99	3.29	3.60	3.92	4.23	4.55
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-1.39	-1.29	-1.20	-1.11	-1.02	-0.92	-0.83	-0.74	-0.65	-0.55	-0.46	-0.37	-0.28	-0.18	-0.09	0.00	0.18	0.37	0.55	0.74	0.92	1.11	1.29	1.48	1.66	1.85	2.03	2.22	2.40	2.59	2.77
4	Substructure cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		-2.15	-2.00	-1.86	-1.72	-1.57	-1.43	-1.29	-1.14	-1.00	-0.86	-0.72	-0.57	-0.43	-0.29	-0.14	0.00	0.07	0.14	0.21	0.29	0.36	0.43	0.50	0.57	0.64	0.72	0.79	0.86	0.93	1.00	1.07
5	Anchor cost	-15.00	-14.00	-13.00	-12.00	-11.00	-10.00	-9.00	-8.00	-7.00	-6.00	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		-0.28	-0.26	-0.24	-0.22	-0.20	-0.18	-0.17	-0.15	-0.13	-0.11	-0.09	-0.07	-0.06	-0.04	-0.02	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.06	0.07	0.07	0.08	0.09	0.09
6	Mooring cost	15.00	14.00	13.00	12.00	11.00	10.00	9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00	1.00	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		0.69	0.65	0.60	0.56	0.51	0.46	0.42	0.37	0.32	0.28	0.23	0.19	0.14	0.09	0.05	0.00	0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.23
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.08	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.08
8	A&M vessel rental time	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.41	-1.32	-1.23	-1.13	-1.04	-0.94	-0.85	-0.75	-0.66	-0.57	-0.47	-0.38	-0.28	-0.19	-0.09	0.00	0.19	0.38	0.57	0.75	0.94	1.13	1.32	1.51	1.70	1.88	2.07	2.26	2.45	2.64	2.83
9	Installation vessel dayrate designer	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.59	-1.49	-1.38	-1.27	-1.17	-1.06	-0.96	-0.85	-0.74	-0.64	-0.53	-0.42	-0.32	-0.21	-0.11	0.00	0.21	0.42	0.64	0.85	1.06	1.27	1.49	1.70	1.91	2.12	2.34	2.55	2.76	2.97	3.19
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.54	-0.50	-0.47	-0.43	-0.40	-0.36	-0.32	-0.29	-0.25	-0.22	-0.18	-0.14	-0.11	-0.07	-0.04	0.00	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54	0.60	0.66	0.71	0.77	0.83	0.89
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.19	-1.11	-1.03	-0.95	-0.87	-0.79	-0.72	-0.64	-0.56	-0.48	-0.40	-0.32	-0.24	-0.16	-0.08	0.00	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.73	0.81	0.89	0.97	1.05	1.13	1.22
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.22	-0.21	-0.19	-0.18	-0.16	-0.15	-0.13	-0.12	-0.10	-0.09	-0.07	-0.06	-0.04	-0.03	-0.01	0.00	0.01	0.03	0.04	0.06	0.07	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.19	0.21	0.22
13	Development costs	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		-0.55	-0.51	-0.47	-0.44	-0.40	-0.36	-0.33	-0.29	-0.25	-0.22	-0.18	-0.15	-0.11	-0.07	-0.04	0.00	0.04	0.07	0.11	0.15	0.18	0.22	0.25	0.29	0.33	0.36	0.40	0.44	0.47	0.51	0.55
14	Export cable length	-3.58	-3.34	-3.10	-2.86	-2.63	-2.39	-2.15	-1.91	-1.67	-1.43	-1.19	-0.95	-0.72	-0.48	-0.24	0.00	0.10	0.21	0.31	0.42	0.52	0.63	0.73	0.84	0.94	1.05	1.15	1.26	1.36	1.47	1.57
		-2.03	-1.90	-1.77	-1.63	-1.50	-1.37	-1.24	-1.10	-0.97	-0.83	-0.70	-0.56	-0.42	-0.28	-0.14	0.00	0.06	0.12	0.19	0.25	0.31	0.37	0.44	0.50	0.56	0.63	0.69	0.76	0.82	0.88	0.95
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-1.31	-1.22	-1.13	-1.05	-0.96	-0.87	-0.78	-0.70	-0.61	-0.52	-0.44	-0.35	-0.26	-0.17	-0.09	0.00	0.09	0.17	0.26	0.35	0.44	0.52	0.61	0.70	0.78	0.87	0.96	1.05	1.13	1.22	1.31
16	IAC cable length	-33.92	-31.66	-29.40	-27.14	-24.87	-22.61	-20.35	-18.09	-15.83	-13.57	-11.31	-9.05	-6.78	-4.52	-2.26	0.00	1.21	2.41	3.62	4.83	6.04	7.24	8.45	9.66	10.87	12.07	13.28	14.49	15.70	16.90	18.11
		-1.10	-1.03	-0.95	-0.88	-0.81	-0.73	-0.66	-0.59	-0.51	-0.44	-0.37	-0.29	-0.22	-0.15	-0.07	0.00	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.31	0.35	0.39	0.43	0.47	0.51	0.55	0.59
17	IAC cable cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.21	-0.20	-0.18	-0.17	-0.16	-0.14	-0.13	-0.11	-0.10	-0.09	-0.07	-0.06	-0.04	-0.03	-0.01	0.00	0.01	0.03	0.04	0.06	0.07	0.09	0.10	0.11	0.13	0.14	0.16	0.17	0.18	0.20	0.21
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.31	-1.22	-1.14	-1.05	-0.96	-0.87	-0.79	-0.70	-0.61	-0.52	-0.44	-0.35	-0.26	-0.17	-0.09	0.00	0.09	0.17	0.26	0.35	0.44	0.52	0.61	0.70	0.79	0.87	0.96	1.05	1.14	1.22	1.31
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.80	-0.75	-0.70	-0.64	-0.59	-0.54	-0.48	-0.43	-0.37	-0.32	-0.27	-0.21	-0.16	-0.11	-0.05	0.00	0.05	0.11	0.16	0.21	0.27	0.32	0.37	0.43	0.48	0.54	0.59	0.64	0.70	0.75	0.80
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.72	-0.67	-0.62	-0.57	-0.53	-0.48	-0.43	-0.38	-0.33	-0.29	-0.24	-0.19	-0.14	-0.10	-0.05	0.00	0.05	0.10	0.14	0.19	0.24	0.29	0.33	0.38	0.43	0.48	0.53	0.57	0.62	0.67	0.72
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.26	4.90	4.53	4.17	3.81	3.45	3.09	2.74	2.39	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.32	-1.64	-1.96	-2.28	-2.60	-2.91	-3.23	-3.54	-3.85	-4.15	-4.46	-4.76
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		3.11	1.99	1.98	1.97	1.96	1.95	0.96	0.95	0.94	0.93	0.92	0.04	0.03	0.02	0.01	0.00	-0.78	-0.79	-0.80	-0.81	-0.82	-1.52	-1.53	-1.53	-1.54	-1.55	-2.17	-2.18	-2.19	-2.19	-2.76

Appendix 3.7: Semi-submersible Steel, Golfe de Fos

No	Parameter	Parameter variation (%)																														
		LCOE variation (%)																														
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-13.51	-12.63	-11.75	-10.87	-9.98	-9.09	-8.20	-7.30	-6.40	-5.49	-4.59	-3.68	-2.76	-1.84	-0.92	0.00	0.93	1.86	2.79	3.72	4.66	5.60	6.55	7.49	8.44	9.39	10.35	11.30	12.26	13.23	14.19
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-2.56	-2.40	-2.23	-2.06	-1.89	-1.72	-1.55	-1.38	-1.21	-1.04	-0.87	-0.70	-0.52	-0.35	-0.18	0.00	0.18	0.35	0.53	0.71	0.88	1.06	1.24	1.42	1.60	1.79	1.97	2.15	2.33	2.52	2.70
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-2.80	-2.62	-2.43	-2.24	-2.06	-1.87	-1.68	-1.49	-1.31	-1.12	-0.93	-0.75	-0.56	-0.37	-0.19	0.00	0.37	0.75	1.12	1.49	1.87	2.24	2.62	2.99	3.36	3.74	4.11	4.48	4.86	5.23	5.61
4	Substructure cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-6.12	-5.71	-5.30	-4.89	-4.49	-4.08	-3.67	-3.26	-2.85	-2.45	-2.04	-1.63	-1.22	-0.82	-0.41	0.00	0.41	0.82	1.22	1.63	2.04	2.45	2.85	3.26	3.67	4.08	4.49	4.89	5.30	5.71	6.12
5	Anchor cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.04	-0.04	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04
6	Mooring cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.19	-0.17	-0.16	-0.15	-0.14	-0.12	-0.11	-0.10	-0.09	-0.07	-0.06	-0.05	-0.04	-0.02	-0.01	0.00	0.01	0.02	0.04	0.05	0.06	0.07	0.09	0.10	0.11	0.12	0.14	0.15	0.16	0.17	0.19
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.08	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.08
8	A&M vessel rental time	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.09	-0.08	-0.08	-0.07	-0.07	-0.06	-0.05	-0.05	-0.04	-0.04	-0.03	-0.02	-0.02	-0.01	-0.01	0.00	0.01	0.02	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.13	0.14	0.16	0.17	0.18
9	Installation vessel dayrate designer	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-1.18	-1.10	-1.02	-0.94	-0.86	-0.78	-0.71	-0.63	-0.55	-0.47	-0.39	-0.31	-0.24	-0.16	-0.08	0.00	0.08	0.16	0.24	0.31	0.39	0.47	0.55	0.63	0.71	0.78	0.86	0.94	1.02	1.10	1.18
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.22	-0.21	-0.19	-0.18	-0.16	-0.15	-0.13	-0.12	-0.10	-0.09	-0.07	-0.06	-0.04	-0.03	-0.01	0.00	0.02	0.05	0.07	0.10	0.12	0.15	0.17	0.20	0.22	0.25	0.27	0.29	0.32	0.34	0.37
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.04	-0.97	-0.90	-0.83	-0.76	-0.69	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.56	0.63	0.70	0.78	0.85	0.92	0.99	1.06
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.41	-0.39	-0.36	-0.33	-0.30	-0.28	-0.25	-0.22	-0.19	-0.17	-0.14	-0.11	-0.08	-0.06	-0.03	0.00	0.03	0.06	0.08	0.11	0.14	0.17	0.19	0.22	0.25	0.28	0.30	0.33	0.36	0.39	0.41
13	Development costs	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.49	-0.45	-0.42	-0.39	-0.36	-0.32	-0.29	-0.26	-0.23	-0.19	-0.16	-0.13	-0.10	-0.06	-0.03	0.00	0.03	0.06	0.10	0.13	0.16	0.19	0.23	0.26	0.29	0.32	0.36	0.39	0.42	0.45	0.49
14	Export cable length	-9.59	-8.95	-8.31	-7.67	-7.03	-6.39	-5.75	-5.11	-4.48	-3.84	-3.20	-2.56	-1.92	-1.28	-0.64	0.00	0.52	1.05	1.57	2.10	2.62	3.15	3.67	4.20	4.72	5.25	5.77	6.30	6.82	7.35	7.87
		-0.37	-0.35	-0.32	-0.30	-0.27	-0.25	-0.22	-0.20	-0.17	-0.15	-0.12	-0.10	-0.07	-0.05	-0.02	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.25	0.27	0.29	0.31
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-0.46	-0.43	-0.40	-0.37	-0.34	-0.31	-0.28	-0.25	-0.21	-0.18	-0.15	-0.12	-0.09	-0.06	-0.03	0.00	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.25	0.28	0.31	0.34	0.37	0.40	0.43	0.46
16	IAC cable length	-31.12	-29.05	-26.97	-24.90	-22.82	-20.75	-18.67	-16.60	-14.52	-12.45	-10.37	-8.30	-6.22	-4.15	-2.07	0.00	0.98	1.96	2.95	3.93	4.91	5.89	6.87	7.86	8.84	9.82	10.80	11.78	12.77	13.75	14.73
		-1.36	-1.27	-1.18	-1.09	-1.00	-0.91	-0.82	-0.73	-0.64	-0.55	-0.46	-0.36	-0.27	-0.18	-0.09	0.00	0.04	0.09	0.13	0.17	0.22	0.26	0.30	0.35	0.39	0.43	0.48	0.52	0.56	0.61	0.65
17	IAC cable cost	-25.00	-23.33	-21.67	-20.00	-18.33	-16.67	-15.00	-13.33	-11.67	-10.00	-8.33	-6.67	-5.00	-3.33	-1.67	0.00	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	16.67	18.33	20.00	21.67	23.33	25.00
		-0.62	-0.57	-0.53	-0.49	-0.45	-0.41	-0.37	-0.33	-0.29	-0.25	-0.21	-0.16	-0.12	-0.08	-0.04	0.00	0.04	0.08	0.12	0.16	0.21	0.25	0.29	0.33	0.37	0.41	0.45	0.49	0.53	0.57	0.62
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.93	-0.87	-0.80	-0.74	-0.68	-0.62	-0.56	-0.49	-0.43	-0.37	-0.31	-0.25	-0.19	-0.12	-0.06	0.00	0.06	0.12	0.19	0.25	0.31	0.37	0.43	0.49	0.56	0.62	0.68	0.74	0.80	0.87	0.93
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.42	-0.40	-0.37	-0.34	-0.31	-0.28	-0.25	-0.23	-0.20	-0.17	-0.14	-0.11	-0.08	-0.06	-0.03	0.00	0.03	0.06	0.08	0.11	0.14	0.17	0.20	0.23	0.25	0.28	0.31	0.34	0.37	0.40	0.42
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.29	-0.27	-0.25	-0.23	-0.22	-0.20	-0.18	-0.16	-0.14	-0.12	-0.10	-0.08	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.23	0.25	0.27	0.29
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.26	4.90	4.53	4.17	3.81	3.45	3.09	2.74	2.39	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.32	-1.64	-1.96	-2.28	-2.60	-2.91	-3.23	-3.54	-3.85	-4.15	-4.46	-4.76
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		3.11	1.94	1.94	1.94	1.95	1.95	0.91	0.91	0.91	0.92	0.92	-0.01	0.00	0.00	0.00	0.00	-0.82	-0.82	-0.82	-0.82	-0.82	-1.55	-1.55	-1.55	-1.55	-1.55	-2.21	-2.21	-2.20	-2.20	-2.79

Appendix 3.8: Semi-submersible Steel, Gulf of Maine

No	Parameter	Parameter variation (%)																														
		LCOE variation (%)																														
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-13.38	-12.51	-11.64	-10.76	-9.88	-9.00	-8.12	-7.23	-6.34	-5.44	-4.54	-3.64	-2.73	-1.83	-0.91	0.00	0.92	1.84	2.76	3.69	4.62	5.55	6.48	7.42	8.36	9.30	10.25	11.19	12.14	13.10	14.05
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-3.09	-2.89	-2.69	-2.49	-2.29	-2.08	-1.88	-1.67	-1.47	-1.26	-1.05	-0.84	-0.63	-0.42	-0.21	0.00	0.21	0.43	0.64	0.86	1.08	1.29	1.51	1.73	1.95	2.17	2.40	2.62	2.84	3.07	3.30
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-2.52	-2.35	-2.18	-2.01	-1.85	-1.68	-1.51	-1.34	-1.17	-1.01	-0.84	-0.67	-0.50	-0.34	-0.17	0.00	0.34	0.67	1.01	1.34	1.68	2.01	2.35	2.69	3.02	3.36	3.69	4.03	4.36	4.70	5.03
4	Substructure cost	-25.00	-23.33	-21.67	-20.00	-18.33	-16.67	-15.00	-13.33	-11.67	-10.00	-8.33	-6.67	-5.00	-3.33	-1.67	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00
		-7.77	-7.25	-6.74	-6.22	-5.70	-5.18	-4.66	-4.14	-3.63	-3.11	-2.59	-2.07	-1.55	-1.04	-0.52	0.00	0.62	1.24	1.87	2.49	3.11	3.73	4.35	4.97	5.60	6.22	6.84	7.46	8.08	8.70	9.33
5	Anchor cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	16.67	18.33	20.00	21.67	23.33	25.00
		-0.05	-0.05	-0.05	-0.04	-0.04	-0.04	-0.03	-0.03	-0.03	-0.02	-0.02	-0.01	-0.01	-0.01	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14
6	Mooring cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	16.67	18.33	20.00	21.67	23.33	25.00
		-0.35	-0.33	-0.30	-0.28	-0.26	-0.23	-0.21	-0.19	-0.16	-0.14	-0.12	-0.09	-0.07	-0.05	-0.02	0.00	0.06	0.12	0.17	0.23	0.29	0.35	0.41	0.47	0.52	0.58	0.64	0.70	0.76	0.81	0.87
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.08	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.08
8	A&M vessel rental time	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00
		-0.27	-0.25	-0.24	-0.22	-0.20	-0.18	-0.16	-0.15	-0.13	-0.11	-0.09	-0.07	-0.05	-0.04	-0.02	0.00	0.02	0.04	0.05	0.07	0.09	0.11	0.13	0.15	0.16	0.18	0.20	0.22	0.24	0.25	0.27
9	Installation vessel dayrate designer	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-1.14	-1.06	-0.99	-0.91	-0.84	-0.76	-0.68	-0.61	-0.53	-0.46	-0.38	-0.30	-0.23	-0.15	-0.08	0.00	0.08	0.15	0.23	0.30	0.38	0.46	0.53	0.61	0.68	0.76	0.84	0.91	0.99	1.06	1.14
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.27	-0.25	-0.23	-0.21	-0.20	-0.18	-0.16	-0.14	-0.12	-0.11	-0.09	-0.07	-0.05	-0.04	-0.02	0.00	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.29	0.32	0.35	0.38	0.41	0.44
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.04	-0.97	-0.90	-0.83	-0.76	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.56	0.63	0.70	0.78	0.85	0.92	0.99	1.06
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.37	-0.35	-0.32	-0.30	-0.27	-0.25	-0.22	-0.20	-0.17	-0.15	-0.12	-0.10	-0.07	-0.05	-0.02	0.00	0.02	0.05	0.07	0.10	0.12	0.15	0.17	0.20	0.22	0.25	0.27	0.30	0.32	0.35	0.37
13	Development costs	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.48	-0.45	-0.42	-0.38	-0.35	-0.32	-0.29	-0.26	-0.22	-0.19	-0.16	-0.13	-0.10	-0.06	-0.03	0.00	0.03	0.06	0.10	0.13	0.16	0.19	0.22	0.26	0.29	0.32	0.35	0.38	0.42	0.45	0.48
14	Export cable length	-11.18	-10.43	-9.69	-8.94	-8.20	-7.45	-6.71	-5.96	-5.22	-4.47	-3.73	-2.98	-2.24	-1.49	-0.75	0.00	0.80	1.60	2.40	3.19	3.99	4.79	5.59	6.39	7.19	7.99	8.79	9.58	10.38	11.18	11.98
		-0.59	-0.55	-0.51	-0.47	-0.44	-0.40	-0.36	-0.32	-0.28	-0.24	-0.20	-0.16	-0.12	-0.08	-0.04	0.00	0.04	0.09	0.13	0.17	0.22	0.26	0.30	0.35	0.39	0.43	0.48	0.52	0.57	0.61	0.65
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-0.58	-0.54	-0.50	-0.47	-0.43	-0.39	-0.35	-0.31	-0.27	-0.23	-0.19	-0.16	-0.12	-0.08	-0.04	0.00	0.04	0.08	0.12	0.16	0.19	0.23	0.27	0.31	0.35	0.39	0.43	0.47	0.50	0.54	0.58
16	IAC cable length	-31.41	-29.32	-27.22	-25.13	-23.03	-20.94	-18.85	-16.75	-14.66	-12.56	-10.47	-8.38	-6.28	-4.19	-2.09	0.00	0.78	1.57	2.35	3.14	3.92	4.71	5.49	6.28	7.06	7.85	8.63	9.42	10.20	10.99	11.77
		-1.38	-1.28	-1.19	-1.10	-1.01	-0.92	-0.83	-0.73	-0.64	-0.55	-0.46	-0.37	-0.28	-0.18	-0.09	0.00	0.03	0.07	0.10	0.14	0.17	0.21	0.24	0.28	0.31	0.35	0.38	0.41	0.45	0.48	0.52
17	IAC cable cost	-25.00	-23.33	-21.67	-20.00	-18.33	-16.67	-15.00	-13.33	-11.67	-10.00	-8.33	-6.67	-5.00	-3.33	-1.67	0.00	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	16.67	18.33	20.00	21.67	23.33	25.00
		-0.60	-0.56	-0.52	-0.48	-0.44	-0.40	-0.36	-0.32	-0.28	-0.24	-0.20	-0.16	-0.12	-0.08	-0.04	0.00	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.65	-0.61	-0.56	-0.52	-0.48	-0.43	-0.39	-0.35	-0.30	-0.26	-0.22	-0.17	-0.13	-0.09	-0.04	0.00	0.04	0.09	0.13	0.17	0.22	0.26	0.30	0.35	0.39	0.43	0.48	0.52	0.56	0.61	0.65
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.86	-0.80	-0.74	-0.69	-0.63	-0.57	-0.51	-0.46	-0.40	-0.34	-0.29	-0.23	-0.17	-0.11	-0.06	0.00	0.06	0.11	0.17	0.23	0.29	0.34	0.40	0.46	0.51	0.57	0.63	0.69	0.74	0.80	0.86
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.74	-0.69	-0.64	-0.59	-0.54	-0.49	-0.44	-0.39	-0.34	-0.30	-0.25	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.34	0.39	0.44	0.49	0.54	0.59	0.64	0.69	0.74
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.26	4.90	4.53	4.17	3.81	3.45	3.09	2.74	2.39	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.32	-1.64	-1.96	-2.28	-2.60	-2.91	-3.23	-3.54	-3.85	-4.15	-4.46	-4.76
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		3.07	1.91	1.92	1.92	1.92	1.92	0.90	0.90	0.90	0.90	0.91	-0.01	-0.01	0.00	0.00	0.00	-0.81	-0.81	-0.81	-0.81	-0.81	-1.53	-1.53	-1.53	-1.53	-1.53	-2.18	-2.18	-2.18	-2.17	-2.76

Appendix 3.9: Semi-submersible Steel, West of Barra

No	Parameter	Parameter variation (%) / LCOE variation (%)																																				
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-12.43	-11.62	-10.81	-10.00	-9.18	-8.36	-7.54	-6.72	-5.89	-5.05	-4.22	-3.38	-2.54	-1.70	-0.85	0.00	0.85	1.71	2.57	3.43	4.29	5.15	6.02	6.89	7.77	8.64	9.52	10.40	11.28	12.17	13.06
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-4.17	-3.90	-3.63	-3.36	-3.09	-2.82	-2.54	-2.27	-1.99	-1.71	-1.43	-1.15	-0.86	-0.58	-0.29	0.00	0.29	0.58	0.88	1.17	1.47	1.77	2.07	2.37	2.68	2.99	3.29	3.60	3.92	4.23	4.55
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-1.92	-1.79	-1.66	-1.53	-1.41	-1.28	-1.15	-1.02	-0.89	-0.77	-0.64	-0.51	-0.38	-0.26	-0.13	0.00	0.26	0.51	0.77	1.02	1.28	1.53	1.79	2.04	2.30	2.56	2.81	3.07	3.32	3.58	3.83
4	Substructure cost	-25.00	-23.33	-21.67	-20.00	-18.33	-16.67	-15.00	-13.33	-11.67	-10.00	-8.33	-6.67	-5.00	-3.33	-1.67	0.00	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	16.67	18.33	20.00	21.67	23.33	25.00
		-6.08	-5.67	-5.27	-4.86	-4.46	-4.05	-3.65	-3.24	-2.84	-2.43	-2.03	-1.62	-1.22	-0.81	-0.41	0.00	0.41	0.81	1.22	1.62	2.03	2.43	2.84	3.24	3.65	4.05	4.46	4.86	5.27	5.67	6.08
5	Anchor cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.12	-0.11	-0.11	-0.10	-0.09	-0.08	-0.07	-0.07	-0.06	-0.05	-0.04	-0.03	-0.02	-0.02	-0.01	0.00	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.07	0.08	0.09	0.10	0.11	0.11	0.12
6	Mooring cost	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.35	-0.33	-0.31	-0.28	-0.26	-0.24	-0.21	-0.19	-0.17	-0.14	-0.12	-0.09	-0.07	-0.05	-0.02	0.00	0.02	0.05	0.07	0.09	0.12	0.14	0.17	0.19	0.21	0.24	0.26	0.28	0.31	0.33	0.35
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.08	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.08
8	A&M vessel rental time	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-0.83	-0.77	-0.72	-0.66	-0.61	-0.55	-0.50	-0.44	-0.39	-0.33	-0.28	-0.22	-0.17	-0.11	-0.06	0.00	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.55	0.61	0.66	0.72	0.77	0.83
9	Installation vessel dayrate designer	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00
		-0.93	-0.87	-0.80	-0.74	-0.68	-0.62	-0.56	-0.49	-0.43	-0.37	-0.31	-0.25	-0.19	-0.12	-0.06	0.00	0.06	0.12	0.19	0.25	0.31	0.37	0.43	0.49	0.56	0.62	0.68	0.74	0.80	0.87	0.93
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.74	-0.69	-0.64	-0.59	-0.54	-0.49	-0.44	-0.39	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	-0.05	0.00	0.08	0.16	0.25	0.33	0.41	0.49	0.57	0.65	0.74	0.82	0.90	0.98	1.06	1.14	1.23
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.18	-1.10	-1.02	-0.94	-0.87	-0.79	-0.71	-0.63	-0.55	-0.47	-0.40	-0.32	-0.24	-0.16	-0.08	0.00	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	0.96	1.04	1.12	1.21
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.31	-0.29	-0.27	-0.25	-0.23	-0.20	-0.18	-0.16	-0.14	-0.12	-0.10	-0.08	-0.06	-0.04	-0.02	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.23	0.25	0.27	0.29	0.31
13	Development costs	-10.00	-9.33	-8.67	-8.00	-7.33	-6.67	-6.00	-5.33	-4.67	-4.00	-3.33	-2.67	-2.00	-1.33	-0.67	0.00	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
		-0.45	-0.42	-0.39	-0.36	-0.33	-0.30	-0.27	-0.24	-0.21	-0.18	-0.15	-0.12	-0.09	-0.06	-0.03	0.00	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.45
14	Export cable length	-3.58	-3.34	-3.10	-2.86	-2.63	-2.39	-2.15	-1.91	-1.67	-1.43	-1.19	-0.95	-0.72	-0.48	-0.24	0.00	0.10	0.21	0.31	0.42	0.52	0.63	0.73	0.84	0.94	1.05	1.15	1.26	1.36	1.47	1.57
		-2.11	-1.97	-1.84	-1.70	-1.56	-1.43	-1.29	-1.15	-1.01	-0.87	-0.72	-0.58	-0.44	-0.29	-0.15	0.00	0.06	0.13	0.19	0.26	0.32	0.39	0.46	0.52	0.59	0.65	0.72	0.79	0.85	0.92	0.99
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-1.79	-1.67	-1.55	-1.43	-1.31	-1.20	-1.08	-0.96	-0.84	-0.72	-0.60	-0.48	-0.36	-0.24	-0.12	0.00	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96	1.08	1.20	1.31	1.43	1.55	1.67	1.79
16	IAC cable length	-33.92	-31.66	-29.40	-27.14	-24.87	-22.61	-20.35	-18.09	-15.83	-13.57	-11.31	-9.05	-6.78	-4.52	-2.26	0.00	1.21	2.41	3.62	4.83	6.04	7.24	8.45	9.66	10.87	12.07	13.28	14.49	15.70	16.90	18.11
		-1.35	-1.26	-1.17	-1.08	-0.99	-0.90	-0.81	-0.72	-0.63	-0.54	-0.45	-0.36	-0.27	-0.18	-0.09	0.00	0.05	0.10	0.14	0.19	0.24	0.29	0.34	0.39	0.43	0.48	0.53	0.58	0.63	0.68	0.73
17	IAC cable cost	-25.00	-23.33	-21.67	-20.00	-18.33	-16.67	-15.00	-13.33	-11.67	-10.00	-8.33	-6.67	-5.00	-3.33	-1.67	0.00	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	16.67	18.33	20.00	21.67	23.33	25.00
		-0.48	-0.44	-0.41	-0.38	-0.35	-0.32	-0.29	-0.25	-0.22	-0.19	-0.16	-0.13	-0.10	-0.06	-0.03	0.00	0.03	0.06	0.10	0.13	0.16	0.19	0.22	0.25	0.29	0.32	0.35	0.38	0.41	0.44	0.48
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.81	-1.69	-1.57	-1.45	-1.33	-1.21	-1.09	-0.97	-0.85	-0.73	-0.60	-0.48	-0.36	-0.24	-0.12	0.00	0.12	0.24	0.36	0.48	0.60	0.73	0.85	0.97	1.09	1.21	1.33	1.45	1.57	1.69	1.81
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.11	-1.04	-0.96	-0.89	-0.81	-0.74	-0.67	-0.59	-0.52	-0.44	-0.37	-0.30	-0.22	-0.15	-0.07	0.00	0.07	0.15	0.22	0.30	0.37	0.44	0.52	0.59	0.67	0.74	0.81	0.89	0.96	1.04	1.11
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.99	-0.93	-0.86	-0.79	-0.73	-0.66	-0.59	-0.53	-0.46	-0.40	-0.33	-0.26	-0.20	-0.13	-0.07	0.00	0.07	0.13	0.20	0.26	0.33	0.40	0.46	0.53	0.59	0.66	0.73	0.79	0.86	0.93	0.99
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.26	4.90	4.53	4.17	3.81	3.45	3.09	2.74	2.39	2.04	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.32	-1.64	-1.96	-2.28	-2.60	-2.91	-3.23	-3.54	-3.85	-4.15	-4.46	-4.76
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		2.86	1.79	1.79	1.79	1.79	1.79	0.84	0.84	0.84	0.84	0.84	-0.01	0.00	0.00	0.00	0.00	-0.76	-0.76	-0.75	-0.75	-0.75	-1.43	-1.43	-1.43	-1.43	-1.42	-2.03	-2.03	-2.03	-2.03	-2.57

Appendix 3.10: TLP Steel, Golfe de Fos

No	Parameter	Parameter variation (%) / LCOE variation (%)																																
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-13.15	-12.30	-11.44	-10.58	-9.72	-8.85	-7.98	-7.11	-6.23	-5.35	-4.46	-3.58	-2.69	-1.79	-0.90	0.00	0.90	1.81	2.71	3.63	4.54	5.45	6.37	7.29	8.22	9.15	10.07	11.01	11.94	12.88	13.82		
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00		
		-2.56	-2.40	-2.23	-2.06	-1.89	-1.72	-1.55	-1.38	-1.21	-1.04	-0.87	-0.70	-0.52	-0.35	-0.18	0.00	0.18	0.35	0.53	0.71	0.88	1.06	1.24	1.42	1.60	1.79	1.97	2.15	2.33	2.52	2.70		
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38		
		-3.35	-3.12	-2.90	-2.68	-2.45	-2.23	-2.01	-1.78	-1.56	-1.34	-1.12	-0.89	-0.67	-0.45	-0.22	0.00	0.45	0.89	1.34	1.78	2.23	2.68	3.12	3.57	4.02	4.46	4.91	5.35	5.80	6.25	6.69		
4	Substructure cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
5	Anchor cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
6	Mooring cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-1.62	-1.51	-1.41	-1.30	-1.19	-1.08	-0.97	-0.87	-0.76	-0.65	-0.54	-0.43	-0.32	-0.22	-0.11	0.00	0.11	0.22	0.32	0.43	0.54	0.65	0.76	0.87	0.97	1.08	1.19	1.30	1.41	1.51	1.62		
8	A&M vessel rental time	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
9	Installation vessel dayrate designer	-7.00	-6.53	-6.07	-5.60	-5.13	-4.67	-4.20	-3.73	-3.27	-2.80	-2.33	-1.87	-1.40	-0.93	-0.47	0.00	0.47	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60	6.07	6.53	7.00		
		-0.39	-0.36	-0.33	-0.31	-0.28	-0.26	-0.23	-0.21	-0.18	-0.15	-0.13	-0.10	-0.08	-0.05	-0.03	0.00	0.03	0.05	0.08	0.10	0.13	0.15	0.18	0.21	0.23	0.26	0.28	0.31	0.33	0.36	0.39		
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00		
		-0.24	-0.22	-0.21	-0.19	-0.18	-0.16	-0.14	-0.13	-0.11	-0.10	-0.08	-0.06	-0.05	-0.03	-0.02	0.00	0.03	0.05	0.08	0.11	0.13	0.16	0.19	0.21	0.24	0.27	0.29	0.32	0.35	0.37	0.40		
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67		
		-1.04	-0.98	-0.91	-0.84	-0.77	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.50	0.57	0.64	0.71	0.78	0.85	0.92	1.00	1.07		
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-0.49	-0.46	-0.43	-0.39	-0.36	-0.33	-0.30	-0.26	-0.23	-0.20	-0.16	-0.13	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.13	0.16	0.20	0.23	0.26	0.30	0.33	0.36	0.39	0.43	0.46	0.49		
13	Development costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
14	Export cable length	-9.59	-8.95	-8.31	-7.67	-7.03	-6.39	-5.75	-5.11	-4.48	-3.84	-3.20	-2.56	-1.92	-1.28	-0.64	0.00	0.52	1.05	1.57	2.10	2.62	3.15	3.67	4.20	4.72	5.25	5.77	6.30	6.82	7.35	7.87		
		-0.38	-0.36	-0.33	-0.30	-0.28	-0.25	-0.23	-0.20	-0.18	-0.15	-0.13	-0.10	-0.08	-0.05	-0.03	0.00	0.02	0.04	0.06	0.08	0.10	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31		
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00		
		-0.49	-0.46	-0.42	-0.39	-0.36	-0.33	-0.29	-0.26	-0.23	-0.20	-0.16	-0.13	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.13	0.16	0.20	0.23	0.26	0.29	0.33	0.36	0.39	0.42	0.46	0.49		
16	IAC cable length	-31.12	-29.05	-26.97	-24.90	-22.82	-20.75	-18.67	-16.60	-14.52	-12.45	-10.37	-8.30	-6.22	-4.15	-2.07	0.00	0.98	1.96	2.95	3.93	4.91	5.89	6.87	7.86	8.84	9.82	10.80	11.78	12.77	13.75	14.73		
		-1.34	-1.25	-1.16	-1.07	-0.98	-0.89	-0.80	-0.71	-0.62	-0.54	-0.45	-0.36	-0.27	-0.18	-0.09	0.00	0.04	0.08	0.13	0.17	0.21	0.25	0.30	0.34	0.38	0.42	0.47	0.51	0.55	0.59	0.63		
17	IAC cable cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-1.10	-1.03	-0.96	-0.88	-0.81	-0.74	-0.66	-0.59	-0.51	-0.44	-0.37	-0.29	-0.22	-0.15	-0.07	0.00	0.07	0.15	0.22	0.29	0.37	0.44	0.51	0.59	0.66	0.74	0.81	0.88	0.96	1.03	1.10		
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-0.51	-0.47	-0.44	-0.41	-0.37	-0.34	-0.30	-0.27	-0.24	-0.20	-0.17	-0.14	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.14	0.17	0.20	0.24	0.27	0.30	0.34	0.37	0.41	0.44	0.47	0.51		
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00		
		-0.35	-0.33	-0.30	-0.28	-0.26	-0.23	-0.21	-0.19	-0.16	-0.14	-0.12	-0.09	-0.07	-0.05	-0.02	0.00	0.02	0.05	0.07	0.09	0.12	0.14	0.16	0.19	0.21	0.23	0.26	0.28	0.30	0.33	0.35		
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00		
		5.24	4.87	4.51	4.14	3.79	3.43	3.08	2.73	2.38	2.03	1.69	1.34	1.00	0.67	0.33	0.00	-0.33	-0.66	-0.98	-1.31	-1.63	-1.95	-2.27	-2.58	-2.90	-3.21	-3.52	-3.83	-4.13	-4.44	-4.74		
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00		
		3.04	1.90	1.90	1.90	1.90	1.90	0.89	0.89	0.89	0.90	0.90	0.00	0.00	0.00	0.00	0.00	-0.80	-0.80	-0.80	-0.80	-0.80	-1.52	-1.52	-1.52	-1.51	-1.51	-2.16	-2.15	-2.15	-2.15	-2.73		

Appendix 3.11: TLP Steel, Gulf of Maine

No	Parameter	Parameter variation (%) / LCOE variation (%)																																
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-13.16	-12.30	-11.44	-10.58	-9.72	-8.85	-7.98	-7.11	-6.23	-5.35	-4.46	-3.58	-2.69	-1.79	-0.90	0.00	0.90	1.81	2.71	3.62	4.54	5.45	6.37	7.29	8.22	9.14	10.07	11.00	11.94	12.87	13.81
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-3.09	-2.89	-2.69	-2.49	-2.29	-2.08	-1.88	-1.67	-1.47	-1.26	-1.05	-0.84	-0.63	-0.42	-0.21	0.00	0.21	0.43	0.64	0.86	1.08	1.29	1.51	1.73	1.95	2.17	2.40	2.62	2.84	3.07	3.30
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-2.96	-2.76	-2.56	-2.37	-2.17	-1.97	-1.77	-1.58	-1.38	-1.18	-0.99	-0.79	-0.59	-0.39	-0.20	0.00	0.39	0.79	1.18	1.58	1.97	2.37	2.76	3.15	3.55	3.94	4.34	4.73	5.12	5.52	5.91
4	Substructure cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Anchor cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Mooring cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.54	-1.44	-1.34	-1.23	-1.13	-1.03	-0.92	-0.82	-0.72	-0.62	-0.51	-0.41	-0.31	-0.21	-0.10	0.00	0.10	0.21	0.31	0.41	0.51	0.62	0.72	0.82	0.92	1.03	1.13	1.23	1.34	1.44	1.54
8	A&M vessel rental time	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Installation vessel dayrate designer	-7.00	-6.53	-6.07	-5.60	-5.13	-4.67	-4.20	-3.73	-3.27	-2.80	-2.33	-1.87	-1.40	-0.93	-0.47	0.00	0.47	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60	6.07	6.53	7.00
		-0.41	-0.38	-0.36	-0.33	-0.30	-0.27	-0.25	-0.22	-0.19	-0.16	-0.14	-0.11	-0.08	-0.05	-0.03	0.00	0.03	0.05	0.08	0.11	0.14	0.16	0.19	0.22	0.25	0.27	0.30	0.33	0.36	0.38	0.41
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.35	-0.33	-0.31	-0.28	-0.26	-0.24	-0.21	-0.19	-0.17	-0.14	-0.12	-0.09	-0.07	-0.05	-0.02	0.00	0.04	0.08	0.12	0.16	0.20	0.23	0.27	0.31	0.35	0.39	0.43	0.47	0.51	0.55	0.59
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.05	-0.98	-0.91	-0.84	-0.77	-0.70	-0.63	-0.56	-0.49	-0.42	-0.35	-0.28	-0.21	-0.14	-0.07	0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.50	0.57	0.64	0.71	0.78	0.85	0.93	1.00	1.07
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.44	-0.41	-0.38	-0.35	-0.32	-0.29	-0.26	-0.23	-0.20	-0.17	-0.15	-0.12	-0.09	-0.06	-0.03	0.00	0.03	0.06	0.09	0.12	0.15	0.17	0.20	0.23	0.26	0.29	0.32	0.35	0.38	0.41	0.44
13	Development costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Export cable length	-11.18	-10.43	-9.69	-8.94	-8.20	-7.45	-6.71	-5.96	-5.22	-4.47	-3.73	-2.98	-2.24	-1.49	-0.75	0.00	0.80	1.60	2.40	3.19	3.99	4.79	5.59	6.39	7.19	7.99	8.79	9.58	10.38	11.18	11.98
		-0.80	-0.75	-0.70	-0.64	-0.59	-0.54	-0.48	-0.43	-0.38	-0.32	-0.27	-0.22	-0.16	-0.11	-0.05	0.00	0.06	0.12	0.18	0.23	0.29	0.35	0.41	0.47	0.53	0.59	0.65	0.71	0.77	0.83	0.89
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-0.79	-0.73	-0.68	-0.63	-0.58	-0.52	-0.47	-0.42	-0.37	-0.31	-0.26	-0.21	-0.16	-0.10	-0.05	0.00	0.05	0.10	0.16	0.21	0.26	0.31	0.37	0.42	0.47	0.52	0.58	0.63	0.68	0.73	0.79
16	IAC cable length	-31.41	-29.32	-27.22	-25.13	-23.03	-20.94	-18.85	-16.75	-14.66	-12.56	-10.47	-8.38	-6.28	-4.19	-2.09	0.00	0.78	1.57	2.35	3.14	3.92	4.71	5.49	6.28	7.06	7.85	8.63	9.42	10.20	10.99	11.77
		-1.22	-1.14	-1.06	-0.98	-0.90	-0.81	-0.73	-0.65	-0.57	-0.49	-0.41	-0.33	-0.24	-0.16	-0.08	0.00	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.28	0.31	0.34	0.37	0.40	0.43	0.46
17	IAC cable cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.76	-0.71	-0.66	-0.61	-0.56	-0.51	-0.46	-0.41	-0.36	-0.30	-0.25	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.36	0.41	0.46	0.51	0.56	0.61	0.66	0.71	0.76
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.01	-0.94	-0.87	-0.80	-0.74	-0.67	-0.60	-0.54	-0.47	-0.40	-0.34	-0.27	-0.20	-0.13	-0.07	0.00	0.07	0.13	0.20	0.27	0.34	0.40	0.47	0.54	0.60	0.67	0.74	0.80	0.87	0.94	1.01
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.87	-0.81	-0.75	-0.69	-0.64	-0.58	-0.52	-0.46	-0.40	-0.35	-0.29	-0.23	-0.17	-0.12	-0.06	0.00	0.06	0.12	0.17	0.23	0.29	0.35	0.40	0.46	0.52	0.58	0.64	0.69	0.75	0.81	0.87
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.24	4.87	4.51	4.15	3.79	3.43	3.08	2.73	2.38	2.03	1.69	1.35	1.01	0.67	0.33	0.00	-0.33	-0.66	-0.99	-1.31	-1.63	-1.95	-2.27	-2.59	-2.90	-3.21	-3.52	-3.83	-4.13	-4.44	-4.74
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		2.99	1.85	1.86	1.86	1.87	1.87	0.87	0.87	0.87	0.88	0.88	-0.01	-0.01	-0.01	0.00	0.00	-0.80	-0.79	-0.79	-0.79	-0.79	-1.50	-1.49	-1.49	-1.49	-1.49	-2.12	-2.12	-2.12	-2.12	-2.69

Appendix 3.12: TLP Steel, West of Barra

No	Parameter	Parameter variation (%) / LCOE variation (%)																																
1	Discount rate	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-12.07	-11.28	-10.50	-9.71	-8.91	-8.12	-7.32	-6.52	-5.71	-4.91	-4.10	-3.28	-2.47	-1.65	-0.82	0.00	0.83	1.66	2.49	3.32	4.16	5.00	5.85	6.69	7.54	8.39	9.24	10.09	10.95	11.81	12.67
2	Availability loss	-50.00	-46.67	-43.33	-40.00	-36.67	-33.33	-30.00	-26.67	-23.33	-20.00	-16.67	-13.33	-10.00	-6.67	-3.33	0.00	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00
		-4.17	-3.90	-3.63	-3.36	-3.09	-2.82	-2.54	-2.27	-1.99	-1.71	-1.43	-1.15	-0.86	-0.58	-0.29	0.00	0.29	0.58	0.88	1.17	1.47	1.77	2.07	2.37	2.68	2.99	3.29	3.60	3.92	4.23	4.55
3	Turbine cost	-7.69	-7.18	-6.67	-6.15	-5.64	-5.13	-4.62	-4.10	-3.59	-3.08	-2.56	-2.05	-1.54	-1.03	-0.51	0.00	1.03	2.05	3.08	4.10	5.13	6.15	7.18	8.21	9.23	10.26	11.28	12.31	13.33	14.36	15.38
		-2.16	-2.01	-1.87	-1.73	-1.58	-1.44	-1.29	-1.15	-1.01	-0.86	-0.72	-0.58	-0.43	-0.29	-0.14	0.00	0.29	0.58	0.86	1.15	1.44	1.73	2.01	2.30	2.59	2.88	3.16	3.45	3.74	4.03	4.31
4	Substructure cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Anchor cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Mooring cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Offshore substation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.08	-1.01	-0.94	-0.87	-0.80	-0.72	-0.65	-0.58	-0.51	-0.43	-0.36	-0.29	-0.22	-0.14	-0.07	0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65	0.72	0.80	0.87	0.94	1.01	1.08
8	A&M vessel rental time	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Installation vessel dayrate designer	-7.00	-6.53	-6.07	-5.60	-5.13	-4.67	-4.20	-3.73	-3.27	-2.80	-2.33	-1.87	-1.40	-0.93	-0.47	0.00	0.47	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60	6.07	6.53	7.00
		-0.72	-0.67	-0.62	-0.57	-0.53	-0.48	-0.43	-0.38	-0.33	-0.29	-0.24	-0.19	-0.14	-0.10	-0.05	0.00	0.05	0.10	0.14	0.19	0.24	0.29	0.33	0.38	0.43	0.48	0.53	0.57	0.62	0.67	0.72
10	Installation vessel export cable	-35.00	-32.67	-30.33	-28.00	-25.67	-23.33	-21.00	-18.67	-16.33	-14.00	-11.67	-9.33	-7.00	-4.67	-2.33	0.00	3.87	7.73	11.60	15.47	19.33	23.20	27.07	30.93	34.80	38.67	42.53	46.40	50.27	54.13	58.00
		-0.80	-0.74	-0.69	-0.64	-0.59	-0.53	-0.48	-0.43	-0.37	-0.32	-0.27	-0.21	-0.16	-0.11	-0.05	0.00	0.09	0.18	0.26	0.35	0.44	0.53	0.62	0.71	0.79	0.88	0.97	1.06	1.15	1.23	1.32
11	Turbine el. loss	-16.67	-15.56	-14.44	-13.33	-12.22	-11.11	-10.00	-8.89	-7.78	-6.67	-5.56	-4.44	-3.33	-2.22	-1.11	0.00	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	11.11	12.22	13.33	14.44	15.56	16.67
		-1.16	-1.09	-1.01	-0.93	-0.86	-0.78	-0.70	-0.62	-0.55	-0.47	-0.39	-0.31	-0.23	-0.16	-0.08	0.00	0.08	0.16	0.24	0.31	0.39	0.47	0.55	0.63	0.71	0.79	0.87	0.95	1.03	1.11	1.19
12	O&M corrective failure rate common	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-0.35	-0.32	-0.30	-0.28	-0.25	-0.23	-0.21	-0.18	-0.16	-0.14	-0.12	-0.09	-0.07	-0.05	-0.02	0.00	0.02	0.05	0.07	0.09	0.12	0.14	0.16	0.18	0.21	0.23	0.25	0.28	0.30	0.32	0.35
13	Development costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Export cable length	-3.58	-3.34	-3.10	-2.86	-2.63	-2.39	-2.15	-1.91	-1.67	-1.43	-1.19	-0.95	-0.72	-0.48	-0.24	0.00	0.10	0.21	0.31	0.42	0.52	0.63	0.73	0.84	0.94	1.05	1.15	1.26	1.36	1.47	1.57
		-1.92	-1.79	-1.67	-1.54	-1.42	-1.29	-1.17	-1.04	-0.91	-0.78	-0.66	-0.53	-0.40	-0.26	-0.13	0.00	0.06	0.12	0.18	0.23	0.29	0.35	0.41	0.47	0.53	0.59	0.65	0.71	0.77	0.83	0.89
15	Export cable cost	-17.00	-15.87	-14.73	-13.60	-12.47	-11.33	-10.20	-9.07	-7.93	-6.80	-5.67	-4.53	-3.40	-2.27	-1.13	0.00	1.13	2.27	3.40	4.53	5.67	6.80	7.93	9.07	10.20	11.33	12.47	13.60	14.73	15.87	17.00
		-1.93	-1.80	-1.67	-1.55	-1.42	-1.29	-1.16	-1.03	-0.90	-0.77	-0.64	-0.52	-0.39	-0.26	-0.13	0.00	0.13	0.26	0.39	0.52	0.64	0.77	0.90	1.03	1.16	1.29	1.42	1.55	1.67	1.80	1.93
16	IAC cable length	-33.92	-31.66	-29.40	-27.14	-24.87	-22.61	-20.35	-18.09	-15.83	-13.57	-11.31	-9.05	-6.78	-4.52	-2.26	0.00	1.21	2.41	3.62	4.83	6.04	7.24	8.45	9.66	10.87	12.07	13.28	14.49	15.70	16.90	18.11
		-0.88	-0.82	-0.77	-0.71	-0.65	-0.59	-0.53	-0.47	-0.41	-0.35	-0.29	-0.24	-0.18	-0.12	-0.06	0.00	0.03	0.06	0.09	0.13	0.16	0.19	0.22	0.25	0.28	0.31	0.35	0.38	0.41	0.44	0.47
17	IAC cable cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Operation cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-2.04	-1.90	-1.77	-1.63	-1.50	-1.36	-1.22	-1.09	-0.95	-0.82	-0.68	-0.54	-0.41	-0.27	-0.14	0.00	0.14	0.27	0.41	0.54	0.68	0.82	0.95	1.09	1.22	1.36	1.50	1.63	1.77	1.90	2.04
19	O&M preventive activities	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.25	-1.17	-1.08	-1.00	-0.92	-0.83	-0.75	-0.67	-0.58	-0.50	-0.42	-0.33	-0.25	-0.17	-0.08	0.00	0.08	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25
20	O&M preventive repair cost	-20.00	-18.67	-17.33	-16.00	-14.67	-13.33	-12.00	-10.67	-9.33	-8.00	-6.67	-5.33	-4.00	-2.67	-1.33	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00
		-1.12	-1.04	-0.97	-0.89	-0.82	-0.74	-0.67	-0.60	-0.52	-0.45	-0.37	-0.30	-0.22	-0.15	-0.07	0.00	0.07	0.15	0.22	0.30	0.37	0.45	0.52	0.60	0.67	0.74	0.82	0.89	0.97	1.04	1.12
21	Energy production	-5.00	-4.67	-4.33	-4.00	-3.67	-3.33	-3.00	-2.67	-2.33	-2.00	-1.67	-1.33	-1.00	-0.67	-0.33	0.00	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
		5.23	4.87	4.50	4.14	3.78	3.43	3.07	2.72	2.37	2.03	1.68	1.34	1.00	0.67	0.33	0.00	-0.33	-0.66	-0.98	-1.31	-1.63	-1.95	-2.27	-2.58	-2.90	-3.21	-3.52	-3.82	-4.13	-4.43	-4.73
22	Life time	-12.00	-11.20	-10.40	-9.60	-8.80	-8.00	-7.20	-6.40	-5.60	-4.80	-4.00	-3.20	-2.40	-1.60	-0.80	0.00	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60	10.40	11.20	12.00
		2.76	1.71	1.72	1.72	1.72	1.73	0.80	0.81	0.81	0.81	0.81	-0.01	-0.01	0.00	0.00	0.00	-0.73	-0.73	-0.73	-0.73	-0.72	-1.38	-1.38	-1.38	-1.37	-1.37	-1.96	-1.96	-1.95	-1.95	-2.48