TERMINAL CONTAINER D'ALTURA DI VENEZIA

Allegato Relazione tecnica: Analisi dei costi VOL. 02.2

Venezia, 22 marzo 2012

AUTORITÀ PORTUALE DI VENEZIA

DIREZIONE PIANIFICAZIONE STRATEGICA E SVILUPPO

Il presente studio, svolto in collaborazione con le società Halcrow Lts ed Idroesse, ricostruisce i costi infrastrutturali ed operativi nelle fasi di progetto relative all'integrazione del terminale offshore con la base terrestre prevista nell'area Montesyndial.

Sulla base del modello d'esercizio e dei layout dei terminal, vengono stimati i costi comprensivi di infrastrutture, sovrastrutture, energia, consumi e personale impiegato.

Parametrando i costi con i volumi di contenitori movimentati viene poi calcolato il costo unitario nelle diverse fasi di trasferimento.

FINANCIAL (COST) ANALYSIS REPORT
VENICE CONTAINER TERMINAL AND LOGISTICS STUDY

Venice Newport Container and Logistics S.p.A.

Venezia, 16 February 2012

VENICE NEWPORT CONTAINER AND LOGISTICS

VENICE PORT AUTHORITY

Halcrow

idroesse infrastrutture

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EXECUTIVE SUMMARY

Venice Port Authority (VPA) appointed Halcrow/ Idroesse to undertake a concept and logistics study for an offshore container terminal that is to be linked to an inshore container terminal located at a defined site in Monte/Syndial as well as others. The offshore terminal location was established prior to this study and is approximately 150 minutes by waterway routes from the proposed Monte/Syndial terminal location.

The study was carried out in close cooperation with VPA and involved determining:

- a transport link that facilitates the transfer of containerized cargo between the offshore and onshore terminals
- the layouts for the offshore and onshore terminal at Monte/Syndial
- an organization structure for management of terminals
- capital and operating cost estimates

The report provides a brief explanation of the rationale of the concept developed to date and presents the main parameters on which it has been based. It is understood that the report contents may be issued to users of differing interest in either technical or commercial aspects and hence it has been split into the following three volumes:

- Volume 1 – Technical Study Report
- Volume 2 – Financial (Costs) Analysis Report
- Volume 3 – Financial (Viability) Analysis Report

This report covers **Volume 2** and concerns itself with the financial cost analysis.

COSTING METHODOLOGY

To evaluate the project costs, Halcrow developed a spreadsheet-based model, referred to as the Logistics-Cost (LogCost) model, to analyse the capital and operating cost factors associated with the logistics solution.

The LogCost model is structured to follow the phased terminals development as per defined throughput scenario and for each logistic cycle. It utilises the outputs from the operations simulation as well as the technical cost estimate.

Estimates are provided in 2011 price terms and do not account for indexation. Unless otherwise stated all costs presented are in undiscounted terms.

CAPITAL COSTS

Capital estimates were developed for the following main cost items for the Monte/Syndial Terminal and the Offshore terminal for each of the scenarios:

- Site Development and Civil Works, including all the main infrastructure costs;
- Power station requirement at the offshore terminal;
- Capital equipment required to transfer the proposed traffic throughput at each transfer cycle;
- Vessel fleet, including the mama vessels, barges and tugs; and
- Information Systems and related software development.

Table E-1 summarises the total lifecycle capital expenditure over the appraisal period split by main capital expenditure. The estimated figures in the table reflect the Base Capital Cost and *exclude* provisions for cost contingencies.

Total lifecycle capital expenditure during the 40 year appraisal period equates to EUR 6,009 million (or EUR 3,451 million discounted). This includes asset replacement and maintenance costs for equipment required for the operation.

It is estimated that the largest proportion of capital spend, approx. 48% of total lifecycle capital cost, occurs within Years 4, 5 and 6 i.e. Scenario 1. This corresponds to the construction and provision of equipment for the offshore terminal and the expansion at Monte/Syndial terminal.

A subsequent peak in capital spend occurs in Year 6, reflecting the purchase of the fleet of vessels that provides the waterway transfer system between the onshore and offshore terminals.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
CIVILS COST	€281,960,000	€1,069,910,000	€283,270,000	€280,850,000	€1,916,000,000
Information Systems	€67,150,000	€76,590,000	€3,490,000	€3,320,000	€150,550,000
Capital Equipments	€143,440,000	€2,305,640,000	€494,730,000	€393,890,000	€3,337,690,000
Offshore Power Station	-	€15,790,000	€15,790,000	€21,050,000	€52,630,000
Barge Cost	-	€96,190,000	€15,750,000	€61,880,000	€173,810,000
Mama Vessel Cost	-	€195,640,000	€48,180,000	€94,900,000	€338,720,000
Tug Vessel Cost	-	€31,430,000	€7,740,000	-	€39,170,000
TOTAL CAPITAL EXPENDITURE	**€492,550,000**	**€3,791,190,000**	**€868,950,000**	**€855,890,000**	**€6,008,570,000**

Table E-1 – Total Lifecycle Capital Cost, (EUR, undiscounted)

Figures rounded to the nearest EUR10,000

CAPITAL COSTS BY TRANSFER CYCLE

Results from the evaluation of capital spend by transfer cycle indicated that:

- Transfer cycle 1, all logistics activities from the offshore terminal mainline vessel to the barge interface respectively, constitute the largest proportion of the project's lifecycle capital spend (58%)
- Transfer cycle 2, the waterway transfer connection between offshore-onshore terminal, accounts for 9% of total lifecycle capital expenditure.
- Transfer cycle 3, all activities from the the interface at Monte/Syndial termnal from the barge vessels onto the landside terminal yard at and from there to/from the gate (this includes any provisions for intermodal facilities to lift cargo onto trucks & rail), accounts for the remaining 33% of total project capex

OPERATING COSTS

Operating costs for the following activities have been evaluated:

- Land rental cost
- Staffing / labour provision required to operate both (onshore and offshore) terminals and the waterway transfer cycle
- Specialist subcontracted maintenance
- Mechanical & Electrical (M&E) and
- fuel consumption.

The methodology employed to estimate operating expenditure is based on there being sufficient capacity to facilitate at a minimum the average traffic throughput at the Monte/Syndial and offshore terminals. During peak periods, operating costs are expected to increase in some areas reflecting the need to deploy additional workforce and resources to maintain the efficiency of the proposed logistic solution.

Table E-2 presents a summary of the total lifecycle operating expenditure over the appraisal period.

Total lifecycle capital expenditure during the 40 year appraisal period equates to EUR 4,740 million (or EUR 1,901 million discounted).

OPERATING COSTS BY TRANSFER CYCLE

Results from the evaluation of operational spend by transfer cycle indicated that:

- Transfer cycles 1 accounts for 37% of total lifecycle operating expenditure
- Transfer cycle 2 accounts for 21% of total project capex).
- Transfer cycles 3 constitute the largest proportion of the project's lifecycle operating spend, 42% of the project's lifecycle operating expenditure

PROJECT OVERALL COST SUMMARY

Table E-3 summarises the overall lifecycle capital and operating costs of the project by Scenario.

Overall project cost (i.e. capital and operating) associated with Full Build are estimated to total EUR 10,749 million (or EUR 5,351 million in discounted terms).

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Labour	€1,081,280,000	€1,284,360,000	€277,740,000	€272,330,000	€2,915,710,000
Specialist Subcontracted Maintenance	€91,200,000	€105,000,000	€99,000,000	€93,000,000	€388,200,000
Mechanical & Electrical	€34,710,000	€325,130,000	€129,390,000	€93,460,000	€582,690,000
Fuel Consumption		€137,040,000	€177,670,000	€273,110,000	€587,820,000
Land Rental		€266,400,000			€266,400,000
TOTAL OPERATING EXPENDITURE	**€1,207,190,000**	**€2,117,930,000**	**€683,800,000**	**€731,900,000**	**€4,740,820,000**

Table E-2 – Total Lifecycle Operating Cost (EUR, undiscounted)

Figures rounded to the nearest EUR10,000

The project cost by transfer cycle are presented in Table E-4. Table E-5 presents the derived implied average unit cost for a container handled based on the cost and port capacity asumption of the port.

Average unit cost for Scenario 0 and 1 have a tendency to be higher relative to later Scenarios (and for all transfer cycles). This is due to upfront investment which has been naturally skewed towards the earlier development phases.

Moreover, the reduction in the aver-age cost per container (TEU) handled is attributable to the growth in throughput thereby providing scale economies for the the capital asset purchased.

It should be noted that average cost per TEU is highly dependent on the capital (and to a lesser extent operat-ing) expenditure profiles. In the case where identified capital expenditure is apportioned over a longer period (greater than the 10-year build as-sumed) then average cost per TEU is likely to be relatively lower.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Total Capital Expenditure	€492,550,000	€3,791,190,000	€868,950,000	€855,890,000	€6,008,570,000
Total Operating Expenditure	€1,207,190,000	€2,117,930,000	€683,800,000	€731,900,000	€4,740,820,000
Project Lifecycle Cost	**€1,699,740,000**	**€5,909,110,000**	**€1,552,750,000**	**€1,587,790,000**	**€10,749,390,000**

Table E-3 – Total Project Lifecycle Cost (EUR, undiscounted)

Figures rounded to the nearest EUR10.000

[Figures in undiscounted terms]	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
TOTAL PROJECT COST (CAPITAL + OPERATING) EXPENDITURE:					
Transfer Cycle 1 – Offshore Development	-	€3,008,780,000	€1,187,390,000	€1,020,460,000	€5,216,630,000
Transfer Cycle 2 – Waterway Transfer	€92,080,000	€702,620,000	€268,890,000	€497,700,000	€1,561,280,000
Transfer Cycle 3 – Monte/Syndial Terminal	€1,607,660,000	€2,197,710,000	€96,470,000	€69,630,000	€3,971,470,000
TOTAL	**€1,699,740,000**	**€5,909,110,000**	**€1,552,750,000**	**€1,587,790,000**	**€10,749,390,000**

Table E-4 – Total Lifecycle Cost, by Transfer Cycle (EUR, undiscounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)
Average Cost per TEU				
Transfer Cycle 1 – Offshore Development	-	€81	€17	€11
Transfer Cycle 2 – Waterway Transfer	-	€24	€7	€9
Transfer Cycle 3 – Monte/Syndial Terminal	€67	€42	€2	€2
TOTAL	**€69**	**€147**	**€27**	**€21**

Table E-5 – Average Unit Cost of Handling TEU (EUR, undiscounted)

1. INTRODUCTION

Background

Venice has a long tradition in international sea trade and has over the past centuries exploited its strategic geographic position enabling trade between Europe and the East.

The hinterland of Venice is Italy's most important economic and industrial area. It is also an area that experiences a high level of international trade. In addition to its natural hinterland, Venice is ideally placed to take advantage of the European Commission's efforts to promote the mobility of passengers and freight within the EU via the Trans European Networks - Transport (TEN-T) initiative. Located on land corridor 5 (Lyon-Budapest-Ukraine) and close to land corridor 1 (Berlin-Palermo), Venice is strategically placed to facilitate intermodal services and provide a gateway to the EU Motorways of the Sea initiative. Please refer to Figure 1-1 .

Figure 1-1 Location of Venice in the Trans European network and within the region

In pursuit of its commercial objectives, Venice Port Authority (VPA) commissioned MDS Transmodal to investigate market demand further, revealing a shortage between supply and demand in the region.

Expansion at the industrial port of Venice (Porto Marghera) is limited by the disposition of the existing infrastructure which consists of relatively narrow canals and relatively shallow water depths. Development of the port to accommodate the ever increasing size of commercial vessels (and especially container ships) would necessitate extensive deepening and widening of the canals and widespread reconstruction of the quays and wharves.

The unique nature of the lagoon and the old city (which is a UNESCO world heritage site) means that regulations are in place to protect the environment from damage, in particular flooding. Dredging of the canals is restricted to prevent enlargement of the tidal prism and a flood barrier system (the MOSE) is being installed at all entrances to the lagoon to protect the city from tidal surges that can occur in the Adriatic.

Hence, VPA have proposed an offshore island to be located some 8 nautical miles (15km) from the Malamocco inlet, to facilitate a future growth of traffic. It is anticipated that transhipment facilities will be provided for containers, with possible future development for other cargo. It is expected that trade to and from the mainland will be maintained by a system of shuttle barges or lighters, but a fixed link has not been entirely ruled out at this stage. A crude oil import terminal will also be provided, connected by pipeline to existing refineries located in Porto Marghera and Mantova (Mantua). The location of the island will permit calls by larger ships, giving economies of scale and realising a connection between the inland terminals and the globalised and inter-continental trade routes.

Terms of Reference

Venice Newport Container and Logistics S.p.A. commissioned Halcrow Group Ltd and Idroesse on the 8th September 2011 to study the concept of an offshore deep-sea container terminal in combination with a land based terminal and their operating model, layout and link. The work scope for delivery by 28.12.2011 included:

A1) conceptual configuration and schematic lay-out of the system comprising the deep water terminal and the coastal terminals;

A2) Infrastructure, layout of structures and the best facilities for the deep-sea container terminal planned at the mouth of the Malamocco;

A3) Infrastructure, structure, layout and best facilities for the container terminal in the former Montefibre/ Syndial AS area;

A4) definition of the type of movement facilities and their overall dimensions;

A5) definition of an operating model and calculation of the movement times in the various phases of the logistical chain relating to the various lay-out and facilities scenarios;

A6) identification of main infrastructure needed at the deep-water terminal and at the Montefibre/ Syndial terminal;

A7) identification of the organisation structure required to manage the deep-water terminal, Montefibre/ Syndial terminal and the links;

A8) evaluation of the parameters for the construction costs of the structures and civil engineering infrastructure;

A9) assessment of critical points and nodes that could affect flow of goods within the entire cycle;

A10) evaluation of the cost of facilities;

A11) identification of overall costs to produce a software package that can manage the entire cycle;

A12) evaluation of the costs of the individual operations in the transfer cycle.

Further, a particular requirement was that *"The study must be carried out in close collaboration with the Customer and with the Venice Port Authority, through meetings planned to agree the most suitable technical solution to adopt"*.

Studies by others concerning an offshore bulk liquid facility and breakwater layout are ongoing. Hence, liaison with Venice Port Authority (VPA) on these matters was an integral part of the project to enable a coherent and coordinated approach. However, these elements are outside the scope of this study and have been presented, where relevant indicative information is available, to provide context for the reader.

Approach

Given the strategic nature of the project and the need to quickly confirm decisions and assumptions, a step by step collaborative approach with VPA was developed.

This meant that Halcrow and Idroesse worked through the project scope and then presented their interim findings to VPA at a number of workshops to share context and progress.

Thus decision making was a team effort and assumptions, priorities and outcomes were provided and endorsed early to ensure the derivation of an accepted, suitable solution in the stipulated timeframe.

The following workshops and the decisions agreed therein provided direction to the study and the development of the scheme:-

- **Workshop 1,** 6 Oct 2011, Definition of Concept & SWOT Analysis

  Waterway transfer option was confirmed as the preferred modus operandi.

- **Workshop 2,** 18 Oct 2011, Definition of Waterway System

  Waterway transfer mechanisms were considered and the use of barges to be transported by LASH vessels were confirmed

- **Workshop 3,** 27 Oct 2011, Definition of Simulation System

  Endorsed the concept for the fast unloading and loading system that would be provided to minimise barge time at berth. The scope of the simulation model was also agreed together with the range of scenarios to be tested.

- **Workshop 4,** 17 Nov 2011, Interim Results of Simulation System, outline layout and concept for costing

  Discussed the preliminary findings of the simulation modelling studies relating to feasible solutions, and identified those configurations of barge and ship to be tested as part of the study

- **Workshop 5,** 12 Dec 2011, Interim Results of costing and refined layout

  The interim results of the costing were presented as well as a refined layout for both Montefibre/ Syndial and the Offshore terminal. The approach was endorsed by VPA.

- **Workshop 6**, 22 Dec 2011 – Results of Study

  Presentation of all results and handover of first draft report

Purpose and Structure of Report

The aim of this report is to serve as a point of reference concerning client requirements and to act as a baseline for future work. The report provides a brief explanation of the rationale of the concept developed to date and presents the main parameters on which it has been based. It is understood that the report contents may be issued to users of differing interest in either technical or commercial aspects and hence it has been split into three volumes:

- Volume 1 – Technical Study Report
- Volume 2 – Financial (Costs) Analysis Report
- Volume 3 – Financial (Viability) Analysis Report

This volume is Volume 2 of this study is Volume 2 of this study and covers the scope elements A8, A10, A11 and A12.

2. PROJECT REQUIREMENTS

Introduction

Port development typically takes place over an extended period of time with port users' requirements and cargo handling technology evolving during its life. The scheme concept has been created with the intention of allowing the port to adapt to changing circumstances whilst maintaining a state of the art facility. A modular terminal concept has been employed to allow flexible demand driven expansion. These terminal modules can readily be constructed on a "just in time" basis, in phases to accommodate the growth in traffic and varied to suit new technologies.

The stated key requirements by VPA for the concept are as follows:

- Utilise an offshore terminal to enable deep drafted container vessels to call and to link with several other terminals including Montefibre/Syndial, Chioggia, Levante and potentially others
- Utilise the available land at Monte/Syndial for a container terminal
- Offshore: Include Maersk EEE class vessels or similar, Exclude MalaccaMax/ Post-Suez Max vessels with a draft of 21m
- Inshore: Limit dredging requirements where possible to reduce environmental impact on the lagoon
- Meet the throughout demand identified by VPA
- Modern innovative infrastructure and state of the art IT/communications infrastructure
- Rapid turnaround times and minimum transit times
- Excellent safety and security
- Competitive cost structure
- Provide for containerised cargo

Figure 2-1 Maersk E – Class vessel at berth

In terms of technological choices, the concept has been prepared to incorporate a number of the most advanced cargo handling equipment, IT/communication and security systems etc to ensure a state of the art facility.

Estimated costs relating to the innovative concepts, such as the Bridge Cranes and Mama vessels, have been estimated based on the available information to date. Further detailed studies should be undertaken to further refine the cost estimate, feasibility and acceptability to industry.

Throughput

During workshop 1, on the 6th Oct. 2011, the annual throughput scenarios to be assumed in the option development were refined by VPA. A key stated requirement is the ability for phased development and to enable traffic to be sent to a variety of destinations including Monte/Syndial, Porto Levante, Chioggia Port as well as others.

Scenario 0:

This scenario comprises an initial terminal for direct calls at Monte/Syndial to enable an early start up of operations. It is assumed that at this stage the offshore terminal is not yet operational, but is under construction.

Key assumptions:

- No offshore terminal,
- Monte/Syndial 0.6m TEU[1] throughput on 600 meters of quay.

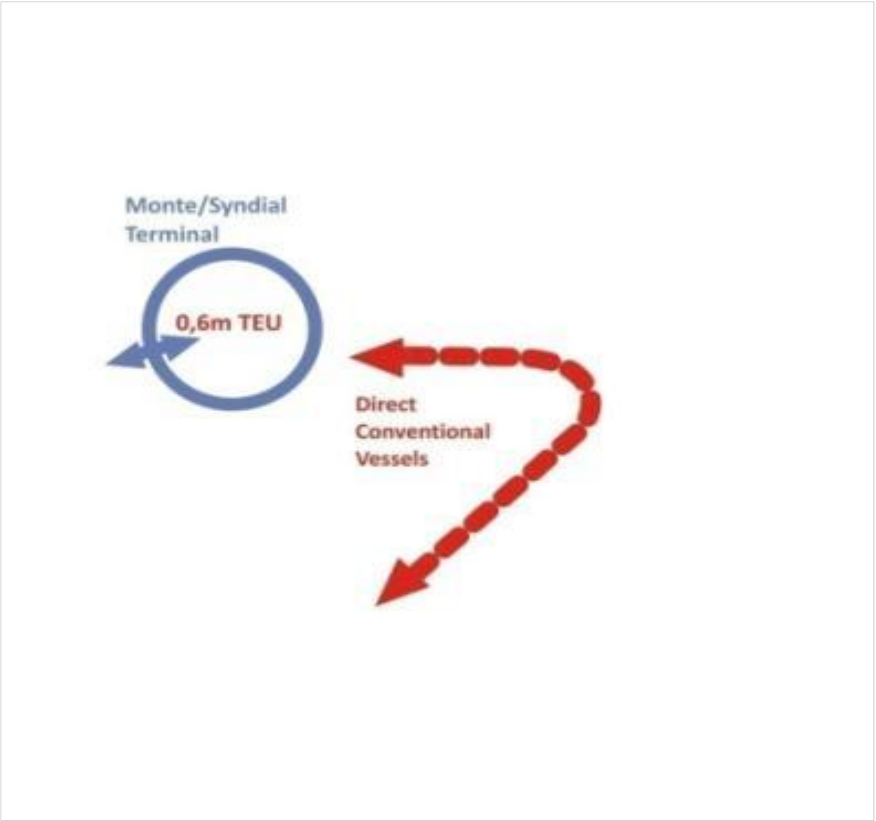

Figure 2-2 Scenario 0 annual throughput

[1] TEU is a twenty foot equivalent unit or one standard container with dimensions 20 feet long by 8 feet wide by 8.5 feet high

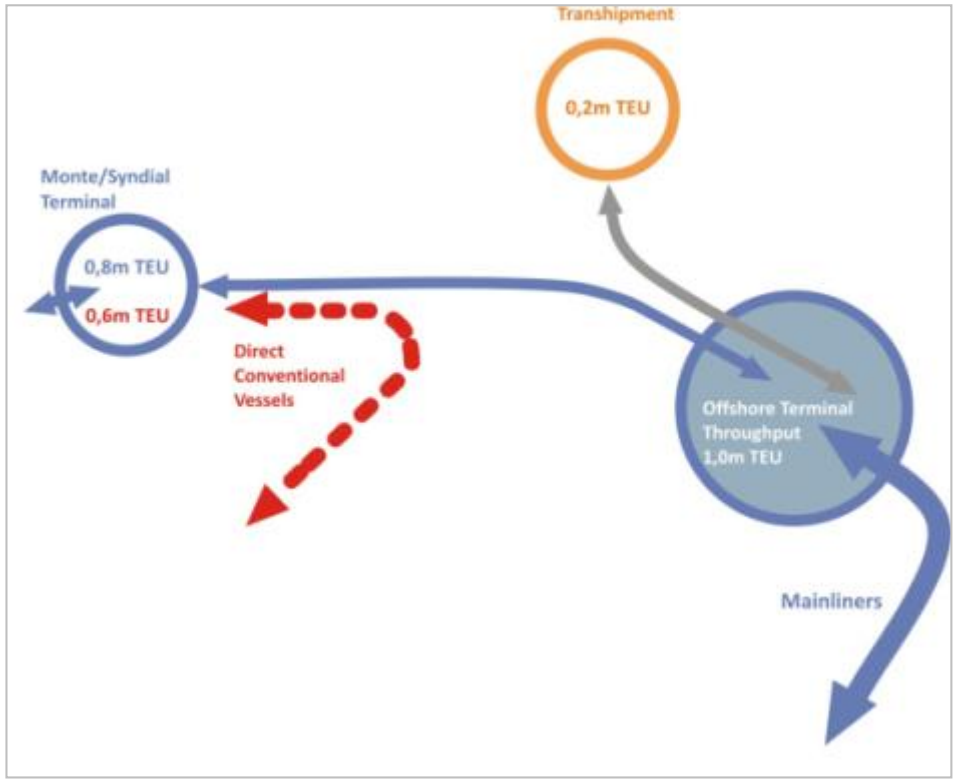

Figure 2-3 Scenario 1 annual throughput

Scenario 1:

This scenario comprises the first phase of the offshore terminal which serves mainline vessels and directs this containerised cargo traffic to the Monte/Syndial terminal.

Key assumptions:

- 1 million TEU offshore terminal + 0.6million TEU at Monte/Syndial by direct vessels,
- 0.8 million TEU offshore-onshore to Monte/Syndial (i.e. total 1.4million TEU at Monte/Syndial),
- remaining 0.2 million TEU in transhipment (0.1 million TEU off + 0.1 million TEU on)

Please refer to Figure 2-3 for a concept image of the throughput traffic for this scenario.

Scenario 2:

This scenario assumes the extension of the offshore terminal to enable a larger annual throughput volume to be handled. This additional throughput is shared between Chioggia Port, Levante Port and another terminal with similar characteristics to Monte/Syndial as well as a transhipment component to other ports.

Key assumptions:

- 2 million TEU offshore terminal plus 0.6million TEU at Monte/Syndial direct
- 0.8 million TEU offshore-onshore to Monte/Syndial (i.e. total 1.4 million TEU at Monte/Syndial)
- 0.2 million TEU offshore-onshore to Chioggia Port
- 0.2 million TEU offshore-onshore to Porto Levante
- 0.3 million TEU to another terminal similar and close to Monte/Syndial
- 0.5 million TEU transshipment (0.25m off plus 0.25m on)

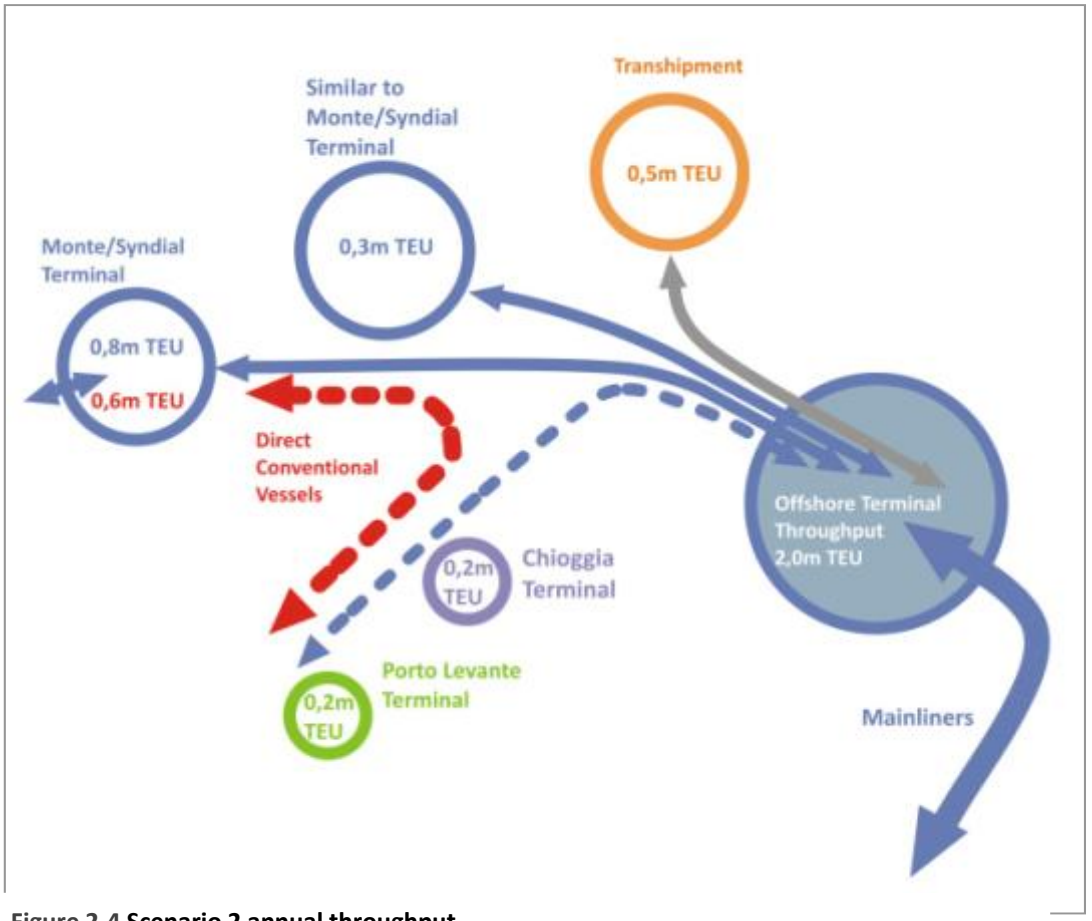

Figure 2-4 Scenario 2 annual throughput

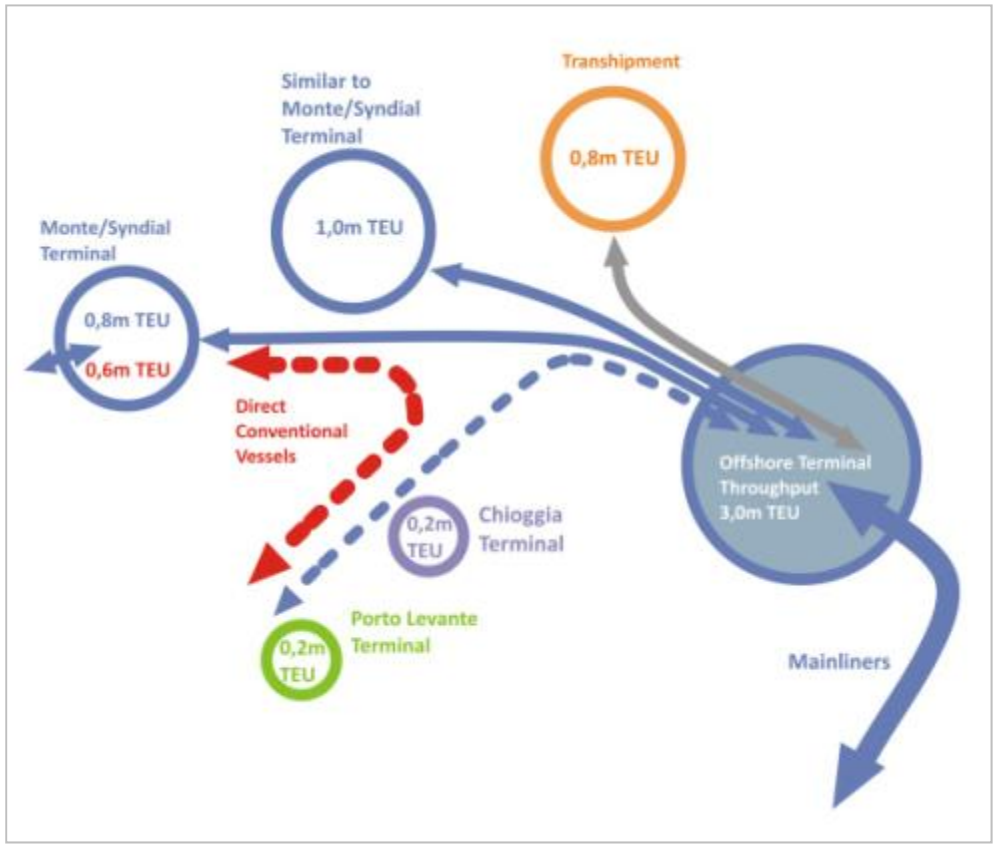

Figure 2-5 Scenario 3 annual throughput

Scenario 3:

This scenario assumes the extension of the offshore terminal to its full envisaged build out to facilitate the handling of 3 million TEU throughput. The additional throughput is shared between Chioggia Port, Levante Port and another terminal with similar characteristics to Monte/Syndial as well as a transhipment component to other ports.

Key assumptions:

- 3 million TEU offshore terminal plus 0.6 million TEU at Monte/Syndial direct
- 0.8 million TEU offshore-onshore to Monte/Syndial
- 0.2 million TEU offshore-onshore to Chioggia Port
- 0.2 million TEU offshore-onshore to Porto Levante
- 1.0 million TEU to another terminal similar and close to Monte/Syndial
- 0.8 million TEU transshipment (0.4m TEU off plus 0.4m TEU on)

Transfer mechanism

The waterway characteristics at the onshore terminals differ significantly, resulting in differing requirements for vessels seeking access. It has been assumed that one type of transfer mechanism will operate between Monte/Syndial and similar onshore terminals and the offshore terminal whereas a similar or different transfer mechanism may operate at Porto Levante and Chioggia.

Key assumptions:

- Total barge transfer load for consideration 0.8 million TEU (Monte/ Syndial) plus 1 million TEU (similar to Monte/ Syndial)
- A waterway system (to be defined) is to transfer 0.2million TEU to Chioggia plus 0.2million TEU to Porto Levante

Figure 2-7 Typical river push-tow barge system

Description	Scenario 0		Scenario 1		Scenario 2		Scenario 3	
	(TEU)	(boxes)	(TEU)	(boxes)	(TEU)	(boxes)	(TEU)	(boxes)
Annual Throughput Offshore Deepsea Berths	0	0	1,000,000	655,000	2,000,000	1,310,000	3,000,000	1,965,000
Annual Throughput Offshore Barge Berths	0	0	800,000	524,000	1,100,000	720,500	1,800,000	1,179,000
Annual Throughput M/S Barge Berths	0	0	800,000	524,000	800,000	524,000	800,000	524,000
Annual Throughput M/S Mainline Berths	600,000	393,000	600,000	393,000	600,000	393,000	600,000	393,000
Average daily throughput Offshore Deepsea Berths	0	0	2,800	1,800	5,500	3,600	8,300	5,400
Average daily throughput Offshore Barge Berths	0	0	2,200	1,400	3,000	2,000	5,000	3,200
Average daily throughput M/S Barge Berths	0	0	2,200	1,400	2,200	1,400	2,200	1,400
Average daily throughput M/S Mainline Berths	1,700	1,100	1,700	1,100	1,700	1,100	1,700	1,100
Peak daily throughput Offshore Deepsea Berths	0	0	5,600	3,700	11,200	7,300	15,900	10,400
Peak daily throughput Offshore Barge Berths	0	0	4,500	2,900	6,200	4,000	9,500	6,200
Peak daily throughput M/S Barge Berths	0	0	4,500	2,900	4,500	2,900	4,200	2,800
Peak daily throughput M/S Mainline Berths	4,400	2,900	4,400	2,900	4,400	2,900	4,400	2,900

Table 2-1 Summary of throughput by scenario and berth for annual, daily average and daily peak volume

Note: Figures rounded to the nearest 100

Average and Peak Throughput

In order to meet the stated annual throughput capacity, any proposed system should be able to cope with the average throughput traffic as well as with peak traffic.

Potential weekly vessel call schedules, container exchange volume and target productivity have been examined to establish the number of berths required offshore, the typical average daily throughput values as well as daily peak throughput values based on the stated scenarios and assumptions provided by VPA as well as experience. Please refer to the Table 2-1 for a summary of throughput by scenario and berth for annual, daily average and daily peak volume.

Offshore the following number of berths are required per scenario:

- Scenario 1 – 2 Mainline Berths
- Scenario 2 – 3 Mainline Berths
- Scenario 3 – 4 Mainline Berths

A potential weekly vessel call schedule for the offshore terminal in scenario 3 is presented in Figure 2-8.

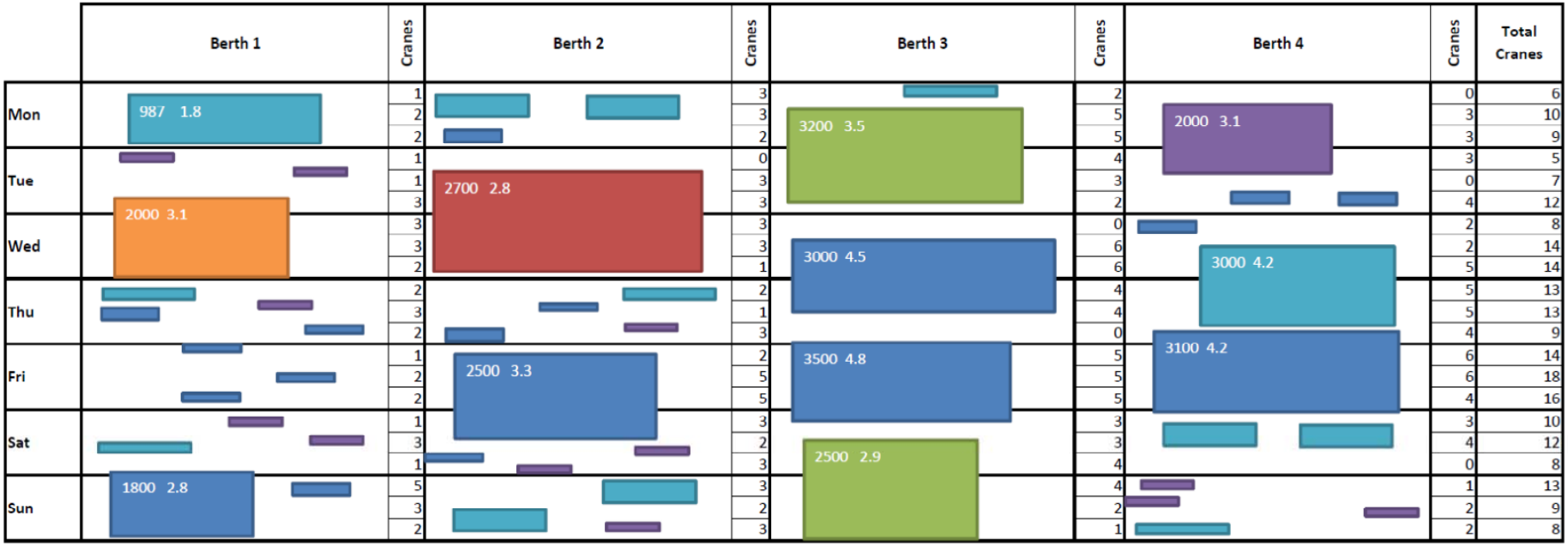

Figure 2-8 Potential berth plan at offshore terminal main berths for scenario 3 based on average weekly throughput

Notes:

Each shaded box represents a vessel, each vessel with numbers in the box represents a mainline vessel, those without a number represent a feeder vessel

The first number in the shaded box represents the number of moves per vessel (assumed single cycle i.e. 1 box = 1 move)

The second number in the shaded box represents the crane split, this is governed by the largest indivisable parcel of boxes which have to be served by a crane for example if a vessel exchanges 2500 boxes and 600 are in an area that can be accessed by one crane only then the crane split is 2500/600=4.1 . This “long” or “heavy” crane determines the overall loading time as other cranes may finish earlier.

Description		Units
Crane productivity	30	mph
Assumed no of cranes on mainline berth	5	no
Crane utilisation	85	%
Mainline productivity	127.5	mph
Feeder productivity	25.5	mph
Mainline in operation at peak	3	No
Feeder cranes in operation at peak	2	No
Hourly throughput	434	Mph
In a peak 24 hour period	~10,400	Moves
In a peak 24 hour period	~15,900	TEU

Table 2-2 Derivation of peak throughput for Scenario 3 for offshore deepsea berths

Note:
mph - moves per hour
no - number

Methodology of deriving peak throughput

Considering the berth plan, it is evident that there are days when three mainline vessels will be present at the berths at the same time, possibly with a feeder vessel berthed as well in Scenario 3.

Further, it is clear that there will be times when mainline vessels will be berthed one after each other on the same berth. This requires continuity of service with no “pile ups due to delays” as the opportunity to catch up with old boxes on the terminal whilst new ones are handled will be limited and carry risk of delay to the mainline vessel.

Thus, the peak scenario has been calculated considering the target productivity at the mainline berths as the shore side equipment, storage and waterway transfer system would need to be able to cope with the main ship to shore crane productivity to avoid delay.

The mainline ship to shore crane productivity is purposefully maximised by terminal operators to achieve fast turn-around times for mainline vessel which is desired by customers.

Table 2-2 provides an overview of the methodology used with the example of scenario 3, other scenario peaks have been determined the same methodology considering a 24 hour period.

The peak scenario for the waterway system is lower as some cargo is transhipped and hence stays at the offshore terminal.

3. PROJECT COST DEVELOPMENT

Introduction

This chapter provides background to all costing elements of the study, explaining the process of cost development, scenarios, methodology and presentation.

Process of cost development

All costs were developed in close co-operation and partnership with VPA and results shared early on for discussion and agreement.

An interim summary of costs was presented in Workshop 5 to the Venice Port Authority (VPA) on 15 December 2011 in Venice and a draft report was submitted on 22 December 2011.

Subsequent to the submission of the draft report, VPA made comments on the financial (costs) model and the supporting analysis in the draft report.

This report addresses the comments and additional information received from VPA and provides analysis of the updated cost model.

Main changes to the model include, amongst others:

- A revised list of capital equipments and associated unit costs, quantities, assumed asset life, and contingencies
- Further details on the cost breakdown for both capital and operating expenditure
- Presentation of cost estimates by phased development to indicate the level of expenditure by scenario.

Development Scenarios	Development at offshore terminal	Development at inland terminal Monte/Syndial	Start	Partial Build	Inter-mediate Build	Full build
Scenario 0	No development proposed No offshore container terminal present, however others may develop breakwaters/ an oil terminal offshore	Development of the conventional RTG container terminal with the first 600m of quay at Monte/Syndial and associated in/out gates, buildings, inspections areas, RTG park, workshop and stores, car parking, access roads,				
Scenario 1	Development of first 2 offshore berths (1,000m) plus associated base infrastructure (helipad, OOG area, buildings, etc.) Breakwaters to be provided by others for this scenario or in the earlier scenario 0	Additional barge berth and remaining infrastructure at Monte/Syndial and associated				
Scenario 2	Extend the development to 3 berths i.e. provision of an additional 500m mainline berth and associated infrastructure	-				
Scenario 3	Extende the development to 4 berths i.e. provision of an additional 500m mainline berth and associated infrastructure	-				

Table 3-1 Scope of Activities by Scenario

Development Scenarios

As noted in Chapter 1, an increasing traffic throughput at the offshore and onshore terminals has been provided by VPA by scenario.

Thus the offshore/ onshore terminals are envisaged to be constructed in phases in line with traffic throughput scenarios. The Table 3-1 summarises the development at the offshore terminal and the Monte/Syndial terminal by phase.

Thus, the costing methodology reflects a phased capital expenditure as the project is developed from Scenario 0 to Scenario 3.

The completion of Scenario 0 and 1, is referred to as a “Partial Build” in this report. Over the next construction phases of Scenario 2 the development is referred to as “intermediate” build. The completion of Scenario 0, 1, 2 and 3 are referred to as the “Full Build” in this report.

VPA provided a timeline to be followed for the scenario development, as illustrated in Table 3-2.

Costs identified in each Scenario have been apportioned equally over the specified years to help smooth the project's overall expenditure profile and to be more realistic in terms of spend profile.

Scope of cost estimation

Costs have been estimated exclusively for the activities related to the development of:

- The offshore terminal i.e. the construction of the berths and the base infrastructure such as the terminal buildings, out of gauge areas etc
- The Monte/Syndial terminal i.e. the set-back of quay by 30m, the development of a conventional RTG terminal over the first 600mof and the development of a barge terminal and associated infrastructure

VPA requested that the estimation of costs exclude a number of items which was agreed. These include:

- Cost for breakwaters and dredging
- Costs for remedial works at the currently contaminated Monte/Syndial site. A clean "Greenfield" site ready for development has been assumed
- Cost associated with vessel operations to/from Chioggia and Levante Port. As well as all associated lift, handling, operational and capital costs at these terminals
- Costs of equipment associated with train operations (locos, wagons etc) and shunting operations to assemble train segments.
- Cost associated with facilitating transhipment operations at the final destination

Year									
1	2	3	4	5	6	7	8	9	10
Scenario 0			Scenario 1			Scenario 2		Scenario 3	

Table 3-2 Scenario Schedule

Cost estimates were developed for the following main cost items at the Offshore terminal and at the Monte/Syndial Terminal:

- Site Development and Civil Works, including all the main infrastructure costs
- A power station at the off-shore terminal
- Equipment required to transfer the throughput traffic
- A vessel fleet, including the mama vessels, barges and tugs
- Information Systems and related software development

Costing Methodology

To evaluate the project costs, Halcrow developed a spreadsheet-based model referred to in this report as the "Logistics-Cost (LogCost) model".

This model analyses the capital and operating cost factors associated with the logistics solution. Further, the LogCost model is structured to reflect the phased terminals development and logistics cycle that containerised cargo to the various destinations is expected to follow.

These cycles are split up into distinct elements that enable the assessment of each key element of the journey. For example these consider the transfer of cargo from the offshore terminal to Monte/Syndial via a waterway link with costs identified for each stage of this transfer.

The LogCost model uses outputs from the operations simulation undertaken in ARENA as well as outputs from a technical cost estimate based on a bill of quantity approach.

In terms of the structure, the LogCost model is built on three main modules, as shown in Figure 3-2.

The INPUT sub-module contains all project cost and traffic input parameter values which are grouped under the following assumption headings:

- General assumptions;
- Capital expenditure (Capex);
- Operating and Maintenance expenditure (Opex); and
- Traffic.

Lastly, an OUTPUT module generates key cost outputs such the cash flow summary over the 40-year appraisal period for the proposed project. Cumulative capital and operational expenditure have been estimated for the whole appraisal period

Furthermore, summary output templates that presents both the cash flow position in undiscounted (i.e. outturn cost) and discounted estimates by Scenarios for the project are also evaluated in the LogCost model.

Thus the model brings together key information and provides an overall perspective of the project cost incurred during the construction and operational phases.

The LogCost model enables the appraisal of the cost implication of:

- Different layouts and infrastructure needs for the proposed terminals development, and their implication on total project costs;
- The incremental cost of the different development phases to increase the terminal's capacity;
- Evaluate the cost of potential bottlenecks and congestion points in the logistics chain.

Presentation of cost estimates

Capital and operating cost estimates in the following sections of this report are presented on an incremental basis to reflect the cost outlay of each Scenario.

The advantage of employing an incremental costing approach is that it allows VPA to make informed business case appraisal at the end of each Scenario whether continued investment is cost-effective (and profitable based on expected revenues) or to remain at status quo.

Figure 3-3 illustrates how costs in each Scenario are aggregated to reach the total "Full Build" cost estimate.

All estimates are provided in 2011 price terms and do not account for indexation. Unless stated otherwise, the costs presented in this report are in undiscounted terms and can be identified in tables with a blue header.

Discounted costs are presented based on a discount rate of 4.5% as agreed with VPA. This rate has been applied to reflect the present value of all fu-

ture capital spends. Tables of results presenting cost estimates in discounted terms are identified in tables with purple headers.

All estimates are rounded to the nearest EUR 10,000.

The analysis of capital expenditure has been made to distinguish between the cost for initial purchase, capital replacement and provisions for maintenance. To appreciate the overall cost of the development, each capital item has been evaluated over the appraisal period. As a result, the cost analysis that follows will present tables illustrating the lifecycle cost of each capital element.

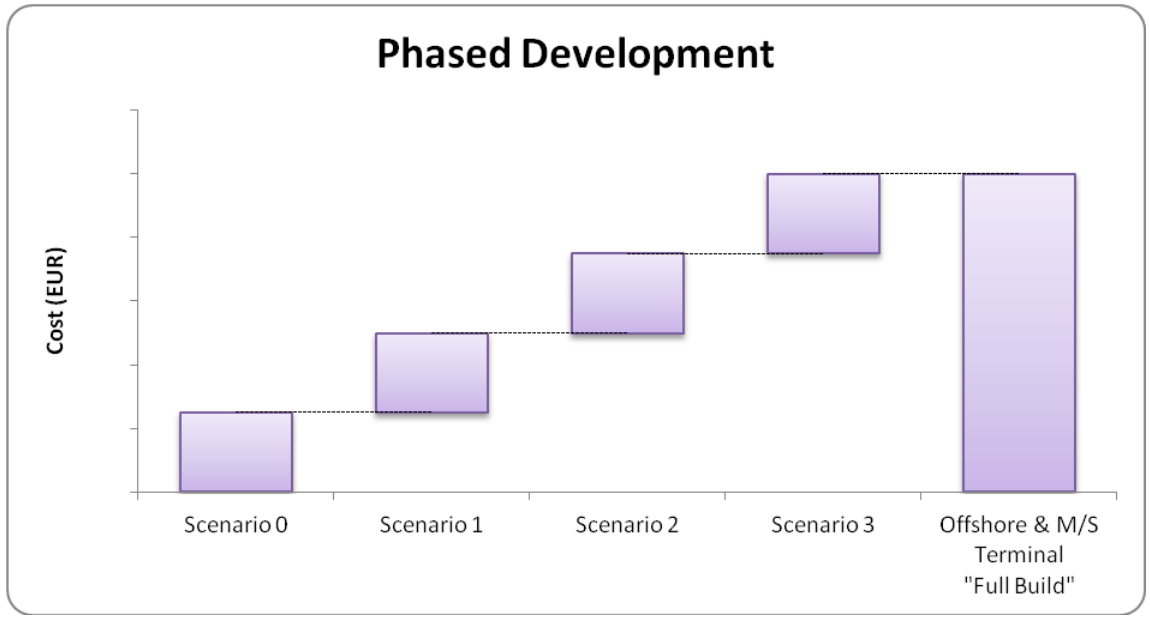

Figure 3-3 Incremental Analysis of Scenario Costs

4. CAPITAL COSTS

Introduction

This chapter presents an evaluation of parameters for the construction costs and an evaluation of the capital costs of facilities and software, meeting the capital cost aspects of scope element A8, A10 and A11. The operating costs of these scope elements are presented in Chapter 5.

Capital cost estimates are presented by both incremental and total cost basis.

Site Development and Civil Works

Costs Methodology

The site and civil costs have been developed with a view to:

- make use of possible scale economies in the construction phase,
- reduce implementation time of the various works and
- minimise the impact of the potential interference between the different construction phases

The site and civil works were divided into strategic areas such as infrastructure, buildings, main urban furniture, underground installations, utilities and special facilities for which typical design concepts were adopted.

A bill of quantity approach to costing has been used, utilising unit cost rates and estimated quantities which are multiplied to develop costs for elements and strategic areas.

Unit cost rates

The unit cost rates utilised in the bill of quantities reflect the local build environment for each element and are consistent with the planned layouts.

An allowance for site-specific considerations was made in the cost development to account for the contextual costs, such as the lagoon location and north Adriatic maritime environmental conditions.

In particular, at the offshore terminal additional costs compared to conventional construction sites will be incurred due to the need to ship:

- transporting equipment
- materials
- prefabricated elements and site personnel

Further, working in adverse conditions at the offshore terminal and resulting downtime increasing costs. Both of these factors have been included in the unit cost rates.

At the onshore construction site the working conditions can be considered as conventional (once soil remediation has been undertaken), due to the fact that the site is accessible from the existing road network.

Cost Exclusions

Costs related to surveys, characterization and remediation of contaminated areas at the Monte/Syndial site were not included.

Moreover, costs for eventual demolition of pre-existing buildings or facilities and the removal and disposal of the related materials were also not included.

Further, the breakwater infrastructure costs were not estimated nor included in the cost analysis.

Offshore Terminal

At the offshore terminal the information available on the geological and soil conditions is limited. Hence, a schematic conceptual design was developed for the offshore quay structures based on local knowledge and concepts adopted for similar schemes.

The cost estimates are based on strategic but preliminary assumptions. Further investigations such as ground testing are essential for the next steps, a design and hence cost validation and verification.

The construction concept chosen offshore was that of concrete caissons that are constructed in a yard, floated into position, sunk and infilled to form the quay structure.

The costs take into consideration the supply and processing of materials for civil engineering works e.g. concrete, reinforcement steel, formwork, stone materials for filling and protection, access roads and yard pavements, materials and dock equipment, fenders, drainage systems, electrical systems, general installations, special lighting systems.

Further the costs take also into account the marine equipment required for the special operations.

The activities considered for estimating the offshore civil works costs include :

- Preparation of the seabed by dredging and provision of rock layers for erosion and subsidence control by floating plant (closed buckets, flow pipes, etc.). The plant cost allowed for is equipped with systems able to contain and reduce the dispersion of dredged material in water
- Construction of the foundation trench and surrounding excavation. This is assumed to be carried out by special equipment that reduces the dispersion of dredged material in water and the eventual consolidation of the soil inside the trench
- Reclamation of the terminal operating areas
- Protection of the immediate surroundings and seabed from excessive turbidity/ suspended dredge material by provision of dredging curtains or similar

- Construction of the cellular caissons at locally-based construction sites
- Transport and placement of floating caissons
- Infill next to the caissons with natural stone and final backfill with dredged material
- Provision of pile foundation and caps in reinforced concrete to support the runways of the cranes loading and unloading container ships and barges
- Wharf and yard pavements
- Supply and installation of fenders and quay furniture
- Construction of office buildings, maintenance and management systems, works in service areas (fuel depot, drainage systems and storm water treatment systems, container inspection and control facilities, service car and vehicle parking)

The cost estimate takes into account the increased costs resulting from the realisation of the offshore terminal in three phases. Thus it has been assumed that material is removed at the beginning of each phase to enable connection between structures.

Further, remobilisation of equipment is assumed. The option of building the offshore terminal at once without phasing to grow in line with demand could enable a cost reduction in the range of 2-3% of total infrastructure costs.

It has been assumed that the service area will be built in the first phase.

Table 4-1 presents the site and civil cost items, unit cost rates and quantities associated with the development of the offshore terminal.

Civil & Site Cost Group	Cost Item	Units	Unit Cost Rate	Quantity	Total Cost
Terminal container (2000 x 200 m)					
Terminal container *	Preparation of the seabed	m^2	€100.00	144,000	€14,400,000
Terminal container *	Caissons (length 30 m)	m3	€400.00	536,160	€214,464,000
Terminal container *	concrete reinforcing steel	Kg	€1.10	158,560,000	€174,416,000
Terminal container *	Filling for caissons	m3	€30.00	1,396,800	€41,904,000
Terminal container *	Concrete slab - Caissons	m3	€400.00	142,080	€56,832,000
Terminal container *	Transfer and sinking	ml	€10,000.00	4,800	€48,000,000
Terminal container *	Fenders (distance 12m)	Cad	€5,000.00	383	€1,915,000
Terminal container *	Quay equipment	Ml	€750.00	4,600	€3,450,000
Terminal container *	Piles (distance 14m dia 120 cm h=30 m) longitudinal cranes	ml	€250.00	7,500	€1,875,000
Terminal container *	concrete reinforcing steel (kg/ml 150)- longitudinal cranes	Kg	€1.10	1,125,000	€1,237,500
Terminal container *	Concrete beams (1.50*1.50 m)- longitudinal cranes	m3	€300.00	4,500	€1,350,000
Terminal container *	concrete reinforcing steel (kg/mc 100)- longitudinal cranes	Kg	€1.10	450,000	€495,000
Terminal container *	Piles (distance 14m dia 120 cm h=30 m) trasversal cranes	ml	€250.00	20,571	€5,142,750
Terminal container *	concrete reinforcing steel(kg/ml 150)-longitudinal cranes	Kg	€1.10	3,085,714	€3,394,285
Terminal container *	Concrete beams (1.50*1.50 m)- longitudinal cranes	m3	€300.00	21,600	€6,480,000
Terminal container *	concrete reinforcing steel (kg/mc 100)- longitudinal cranes	Kg	€1.10	2,160,000	€2,376,000
Terminal container *	Stone backfill (300 mc/ml)	m3	€30.00	1,440,000	€43,200,000
Terminal container *	Sea sand backfill (average h=25 m)	m3	€8.00	6,860,000	€54,880,000
Terminal container *	Subgrade	m^2	€40.00	400,000	€16,000,000
Terminal container *	Paving	m^2	€100.00	400,000	€40,000,000
Terminal container *	Water drainage	m^2	€50.00	400,000	€20,000,000
Terminal container *	Water treatment	m^2	€20.00	400,000	€8,000,000
Terminal container *	Lighting system	m^2	€20.00	400,000	€8,000,000

Table 4-1 Civil Cost Items for Offshore Terminal

* Estimated volume reflects offshore civil work needs which are apportioned over Scenarios 1, 2 and 3. [1] A cost provision of 25% has been included in the capital cost estimate in order to account for adverse working conditions in open sea. Cad = reflects one fender each 12 metres(1/12m).

Civil & Site Cost Group	Cost Item	Units	Unit Cost Rate	Quantity	Total Cost
Terminal container *	Additional works for phasing		€2.00	2,000,000	€4,000,000
Terminal container *	Extra for adverse conditions (working at sea) [1]	-	€1.00	192,953,327	€192,953,327
Terminal logistics (875 x 160 m)					
Terminal logistics	Preparation of the seabed	m2	€ 100.00	62,100	€6,210,000
Terminal logistics	Caissons	m3	€400.00	111,700	€44,680,000
Terminal logistics	Concrete reinforcing steel	Kg	€1.10	33,033,333	€36,336,666
Terminal logistics	Caissons filling	m3	€30.00	291,000	€8,730,000
Terminal logistics	Concrete slab - Caissons	m3	€400.00	29,600	€11,840,000
Terminal logistics	Transfer and sinking	Ml	€10,000.00	1,000	€10,000,000
Terminal logistics	Fenders (distance 12m)	Cad	€5,000.00	85	€425,000
Terminal logistics	Quay equipment	Ml	€750.00	1,002	€751,500
Terminal logistics	Stone backfill	m3	€30.00	300,000	€9,000,000
Terminal logistics	Sea sand backfill (average h=25 m)	m3	€8.00	1,450,000	€11,600,000
Terminal logistics	Subgrade	m2	€40.00	140,000	€5,600,000
Terminal logistics	Paving	m2	€100.00	140,000	€14,000,000
Terminal logistics	Water drainage	m2	€50.00	140,000	€7,000,000
Terminal logistics	Water treatment	m2	€20.00	140,000	€2,800,000
Terminal logistics	Lighting system	m2	€20.00	140,000	€2,800,000
Terminal logistics	Fuel station	n.	€1,000,000.00	1	€1,000,000
Terminal logistics	Buildings	m2	€2,600.00	16,000	€41,600,000
Terminal logistics	Various installations (intrusion control, etc)	m2	€15.00	900,000	€13,500,000
Terminal logistics	Extra for adverse conditions (working at sea) [1]	-	€1.00	56,968,708	€56,968,708

Table 4-1 Civil Cost Items for Offshore Terminal (continued)

Monte/Syndial Terminal

The Monte/Syndial Terminal costs were developed based on a concept scheme of sheetpile quay walls and with reference to similar works in the lagoon area and in particular in the Marghera Port area.

The costs take into account the supply and processing of materials for civil engineering works such as concrete, reinforcement steel, formwork, stone materials for filling and protection, street and yard pavements, materials and dock equipment, fenders, drainage systems, electrical systems, general installations, special lighting systems.

Furthermore, the costs take into account the marine equipment and plant required to carry out the works. The key activities include:

- Excavation and demolition of existing steel ties along the entire length (1,600m) of the future berthline, 30m set back
- Installation of new sheetpile walls along the entire length (1,600m) of the future quay, 30m set back position from the present waterfront,
- Construction of an edge beam
- Installation of ground anchors for the sheetpile walls
- Installation of tie rods linking the sheetpile walls to the anchorage
- Backfill of sheetpile walls and final covering with stone materials with geotextile where appropriate
- Removal of the existing bulkhead and general dredging of the front area, placing of rock for erosion-control, by floating plant
- Supply and installation of fenders
- Installation of pile foundation for crane runways
- Pile foundations and caps in reinforced concrete for the quayside crane runways

- Clearing of the terminal area, removal of waste and excess materials and transport to licensed landfill and or disposal sites for each stage
- Excavation for the formation of subgrade for the paving of the parking and container storage areas and internal roads, built in 3 phases
- Paving for yards, container storage areas and internal roads
- Partial construction of railway sidings in Scenario 0 and full construction of the railway terminal and the connections with the existing network (in Scenario 3)
- Construction of office buildings, maintenance buildings, and associated facilities such as entry-exit control gates, drainage and storm water treatment plant, electrical systems, and special lighting, etc.

Table 4-2 presents the site and civil cost items, unit cost rates and design volumes estimates associated with the development of the inland terminal.

Civil & Site Cost Group	Cost Item	Units	Unit Cost Rate	Quantity	Total Cost
Quay setback (depth 30 m h=15 m)					
Quay setback	Excavations	m3	€15.00	720,000	€10,800,000
Quay setback	Demolition of the existing bulkhead	ml	€1,500.00	1,600	€2,400,000
Sheet pile walls					
Sheet pile walls	Sheet Piling (h=30m 300 kg/mq)	Kg	€1.50	14,715,000	€22,070,000
Sheet pile walls	Steel ties (l=30m)	ml	€200.00	24,525	€4,910,000
Sheet pile walls	Sheet pile anchor bolts (h=6.00m)	Kg	€1.50	1,962,000	€2,940,000
Sheet pile walls	Edge beam (2,00*2,00m)	m3	€300.00	6,540	€1,960,000
Sheet pile walls	concrete reinforcing steel (kg/mc 100)	Kg	€1.10	654,000	€720,000
Sheet pile walls	Fenders (distance 12m)	Cad	€5,000.00	136	€680,000
Sheet pile walls	Quay equipment	ml	€750.00	1,635	€1,230,000
Bridge crane beams & columns			**8,100.00**		
Bridge crane beams & columns *	Piles (distance 14m dia 120 cm h=30 m)	ml	€250.00	18,643	€4,660,000
Bridge crane beams & columns *	concrete reinforcing steel (kg/ml 150)	Kg	€1.10	2,796,429	€3,080,000
Bridge crane beams & columns *	Concrete curbs (1.50*1.50 m)	m	€300.00	18,077	€5,420,000
Bridge crane beams & columns *	concrete reinforcing steel (kg/mc 100)	kg	€1.10	1,807,725	€1,990,000

Table 4-2 Civil Cost Items for Inshore Terminal

Civil & Site Cost Group	Cost Item	Units	Unit Cost Rate (EUR)	Quantity	Total Cost
Yards (900'000 mq)					
Yards *	Excavation (5 m) for steel ties	m3	€ 12.00	1,030,000	€12,360,000
Yards *	Geotextile - steel ties binding	m2	€5.00	900,000	€4,500,000
Yards	Lean concrete backfill (average h 5 m) - ties binding	m3	€80.00	270,000	€21,600,000
Yards	Excavation (2 m) yard	m3	€12.00	932,000	€11,180,000
Yards	Geotextile - yard	m2	€5.00	466,000	€2,330,000
Yards *	Backfill in soil (average h 2 m) - yard	m3	€15.00	1,692,000	€25,380,000
Yards *	Subgrade	m2	€40.00	900,000	€36,000,000
Yards *	Paving	m2	€90.00	900,000	€81,000,000
Yards	Fences, gates, etc	m	€250.00	4,400	€1,100,000
Yards *	Office Buildings (Customs, Control; etc)	m3	€1,300.00	5,000	€6,500,000
Yards *	Yard furniture	m2	€10.00	900,000	€9,000,000
Yards *	Water drainage	m2	€50.00	900,000	€45,000,000
Yards *	Water treatment	m2	€20.00	900,000	€18,000,000
Yards *	Lighting system	m2	€20.00	900,000	€18,000,000
Yards *	Various installations (intrusion control, etc)	m2	€15.00	900,000	€13,500,000
Yards	Railways terminal and cantilever (Only inside area)		€1.00	10,000,000	€10,000,000

Table 4-2 Civil Cost Items for Inshore Terminal (continued)

Note: * Estimated volume reflects civil work needs which are apportioned over Scenarios 0 and 1.

Site Development & Civil Works Investment Costs

Total estimated cost for civil works and site construction are summarised in Table 4-3. Based on the cost rates and quantities identified in Table 4-1 and Table 4-2, site development and civil costs for the construction of all scenarios is estimated to total EUR 1,628 million in outturn cost terms, equivalent to EUR 1,278 million in discounted terms.

The offshore terminal commands a significant proportion of the project's total site and civil costs, 77% of aggregate site and civil costs, EUR 1,250 million. The site development at the Monte/Syndial terminal accounts for EUR 378 million.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
MONTE/SYNDIAL TERMINAL					
Quay setback (depth 30 m h=15 m)	€13,200,000	-	-	-	€13,200,000
Sheet pile walls	€34,510,000	-	-	-	€34,510,000
Bridge crane beams & columns	€1,560,000	€13,590,000	-	-	€15,150,000
Yards (900'000 mq)	€186,680,000	€128,770,000	-	-	€315,450,000
TOTAL Monte/Syndial terminal	**€235,950,000**	**€142,360,000**			**€378,310,000**
OFFSHORE TERMINAL					
Terminal container (2000 x 200 m)	-	€479,500,000	€242,630,000	€242,630,000	€964,770,000
Terminal logistics (875 x 160 m)	-	**€284,840,000**	-	-	€284,840,000
TOTAL Offshore terminal	**-**	**€764,350,000**	**€242,630,000**	**€242,630,000**	**€1,249,610,000**
TOTAL INSHORE AND OFFSHORE TERMINALS	**€235,950,000**	**€906,710,000**	**€242,630,000**	**€242,630,000**	**€1,627,920,000**

Table 4-3 Estimated Site Development and Civil Work Costs (EUR, undiscounted)

Note: * Estimated figures above do not include lifecycle maintenance costs.

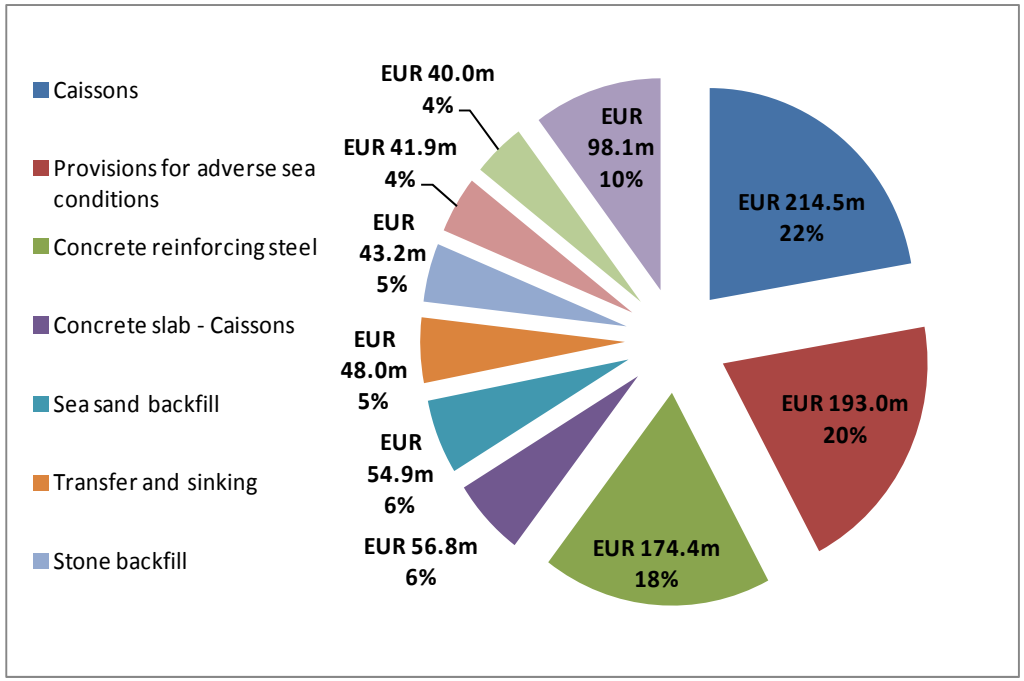

Figure 4-1 Major Site & Civil Cost Items at Offshore Terminal (EUR, undiscounted)

The cost associated with site development and civil works at the offshore terminal is relatively high vis-à-vis the conventional onshore terminal as it reflects the higher construction requirements for the development of the offshore terminal.

For example, the cost of the offshore terminal is driven by sizeable capital provisions for the following capital items:

- Caissons
- Concrete reinforcing steel
- Filling for caissons
- Concrete slab - Caissons
- Stone backfill
- Sea sand backfill
- Transfer and sinking
- Paving

Together the cost items outlined above equate to 70% of the EUR 965 million estimated for offshore terminal container cost (see Figure 4-1). An

cost provision[2] to account for adverse working conditions in open sea accounts for 25% of the total estimated offshore terminal container development cost. Together these nine site and civil cost items account for 90% of the estimated offshore terminal container development cost.

Examining the cost of civil works by Scenario, it can be observed that a majority of capital expenditure are accrued primarily during the initial Scenarios – namely Scenario 0 and Scenario 1. This reflects the required build activities associated with the development of the Monte/Syndial terminal and the initial construction phase of the offshore terminal.

As illustrated in Figure 4-2, site development and civil costs are relatively high during Scenario 1 when the both the offshore container terminal and extension at the Monte/ Syndial terminal is under construction.

Total capital spend during Scenario 1 amounts to EUR 907 million over the three-year period – an equivalent annual capital expenditure over EUR 302 million in un-discounted terms (or EUR 242 million in discounted terms).

The completion of Scenarios 0 and 1 for the partial development of the offshore terminal and the extension of Monte/Syndial to accommodate the offshore traffic via barges represents a total cost of EUR 1,143 million (undiscounted) over 6 years.

The expansion of the Monte/Syndial terminal (Scenarios 0 and 1) represents approximately EUR 378 million out of this total cost. The partial development of the offshore terminal represent approximately EUR 764 million.

Terminal development at the offshore terminal is considered to be fully completed at the end of Scenario 3 after a further capital spend of EUR 485 million for berths 3 and 4 at the offshore terminal.

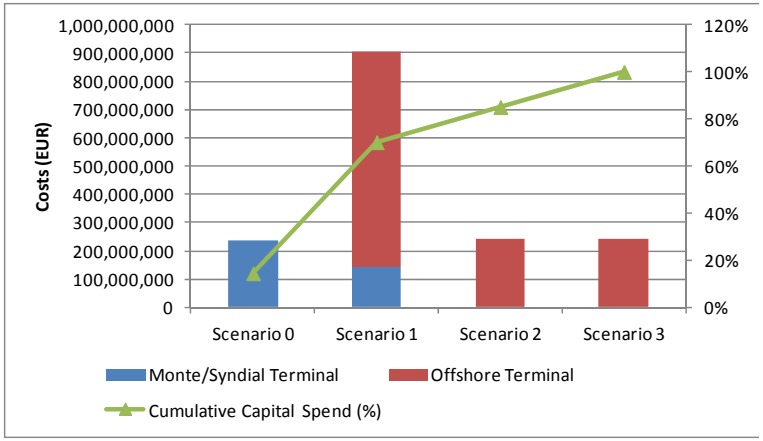

Figure 4-2 Total Civil Spend by Terminal Location and Scenario (EUR, undiscounted)

[2] A cost provision of 25% has been included in the capital cost estimate in order to account for adverse working conditions in open sea

	Scenario 0			Scenario 1		
	2013	2014	2015	2016	2017	2018
MONTE/SYNDIAL TERMINAL						
Quay setback (depth 30 m h=15 m)						
Excavations	€3,600,000	€3,600,000	€3,600,000	-	-	-
Demolition of the existing bulkhead	€800,000	€800,000	€800,000	-	-	-
Sheet pile wall						
Sheet Piling (h=30m 300 kg/mq)	€7,360,000	€7,360,000	€7,360,000	-	-	-
Steel ties (l=30m)	€1,640,000	€1,640,000	€1,640,000	-	-	-
Sheet pile anchor bolts (h=6.00m)	€980,000	€980,000	€980,000	-	-	-
Edge beam (2,00*2,00m)	€650,000	€650,000	€650,000	-	-	-
concrete reinforcing steel (kg/mc 100)	€240,000	€240,000	€240,000	-	-	-
Fenders (distance 12m)	€230,000	€230,000	€230,000	-	-	-
Quay equipment	€410,000	€410,000	€410,000	-	-	-
Bridge crane beams & columns						
Piles (distance 14m dia 120 cm h=30 m)	€160,000	€160,000	€160,000	€1,390,000	€1,390,000	€1,390,000
Concrete reinforcing steel (kg/ml 150)	€110,000	€110,000	€110,000	€920,000	€920,000	€920,000
Concrete curbs (1.50*1.50 m)	€190,000	€190,000	€190,000	€1,620,000	€1,620,000	€1,620,000
concrete reinforcing steel (kg/mc 100)	€70,000	€70,000	€70,000	€590,000	€590,000	€590,000

Table 4-4 Construction Schedule for Civil Work at the Monte/Syndial Terminal (EUR, undiscounted)

Table 4-4 and Table 4-5 present the construction cost schedules for each major cost component of the civil works associated with the development of the Monte/Syndial and Offshore terminal respectively.

Civil engineering costs have been evenly apportioned over the years of each Scenario to help smooth out any large capital spend occurring in a single year.

	Scenario 0			Scenario 1			Scenario 2		Scenario 3	
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Yards										
Excavation (5 m) for steel ties	€1,080,000	€1,080,000	€1,080,000	-	-	-	-	-	-	-
Geotextile - steel ties binding	€870,000	€870,000	€870,000	-	-	-	-	-	-	-
Lean concrete backfill (average h 5 m) - ties binding	€7,200,000	€7,200,000	€7,200,000	-	-	-	-	-	-	-
Excavation (2 m) yard	€3,730,000	€3,730,000	€3,730,000	-	-	-	-	-	-	-
Geotextile - yard	€780,000	€780,000	€780,000	-	-	-	-	-	-	-
Backfill in soil (average h 2 m) - yard	€4,660,000	€4,660,000	€4,660,000	-	-	-	-	-	-	-
Subgrade	€6,930,000	€6,930,000	€6,930,000	-	-	-	-	-	-	-
Paving	€15,600,000	€15,600,000	€15,600,000	-	-	-	-	-	-	-
Fences, gates, etc	€370,000	€370,000	€370,000	-	-	-	-	-	-	-
Office Buildings (Customs, Control; etc)	€1,080,000	€1,080,000	€1,080,000	-	-	-	-	-	-	-
Yard furniture	€1,730,000	€1,730,000	€1,730,000	-	-	-	-	-	-	-
Water drainage	€8,670,000	€8,670,000	€8,670,000	-	-	-	-	-	-	-
Water treatment	€3,470,000	€3,470,000	€3,470,000	-	-	-	-	-	-	-
Lighting system	€3,470,000	€3,470,000	€3,470,000	-	-	-	-	-	-	-
Various installations (intrusion control, etc)	€2,600,000	€2,600,000	€2,600,000	-	-	-	-	-	-	-
Excavation (2 m) yard	-	-	-	€3,040,000	€3,040,000	€3,040,000	-	-	-	-
Geotextile - yard	-	-	-	€630,000	€630,000	€630,000	-	-	-	-
Backfill in soil (average h 2 m) - yard	-	-	-	€3,800,000	€3,800,000	€3,800,000	-	-	-	-
Subgrade	-	-	-	€5,070,000	€5,070,000	€5,070,000	-	-	-	-
Paving	-	-	-	€11,400,000	€11,400,000	€11,400,000	-	-	-	-
Office Buildings (Customs, Control; etc)	-	-	-	€1,080,000	€1,080,000	€1,080,000	-	-	-	-
Yard furniture	-	-	-	€1,270,000	€1,270,000	€1,270,000	-	-	-	-

Table 4-4 Construction Schedule for Civil Work at the Monte/Syndial Terminal (EUR, undiscounted) (continued)

	Scenario 0			Scenario 1			Scenario 2		Scenario 3	
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Water drainage	-	-	-	€6,330,000	€6,330,000	€6,330,000	-	-	-	-
Water treatment	-	-	-	€2,530,000	€2,530,000	€2,530,000	-	-	-	-
Lighting system	-	-	-	€2,530,000	€2,530,000	€2,530,000	-	-	-	-
Various installations (intrusion control, etc)	-	-	-	€1,900,000	€1,900,000	€1,900,000	-	-	-	-
Railways terminal and cantilever (Only inside area)	-	-	-	€3,330,000	€3,330,000	€3,330,000	-	-	-	-

Table 4-4 Construction Schedule for Civil Work at the Monte/Syndial Terminal (EUR, undiscounted) (continued)

	Scenario 0			Scenario 1			Scenario 2		Scenario 3	
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
TERMINAL CONTAINER										
Preparation of the seabed	-	-	-	€2,390,000	€2,390,000	€2,390,000	€1,810,000	€1,810,000	€1,810,000	€1,810,000
Caissons (length 30 m)	-	-	-	€35,530,000	€35,530,000	€35,530,000	€26,970,000	€26,970,000	€26,970,000	€26,970,000
concrete reinforcing steel	-	-	-	€28,900,000	€28,900,000	€28,900,000	€21,930,000	€21,930,000	€21,930,000	€21,930,000
Filling for caissons	-	-	-	€6,940,000	€6,940,000	€6,940,000	€5,270,000	€5,270,000	€5,270,000	€5,270,000
Concrete slab - Caissons	-	-	-	€9,420,000	€9,420,000	€9,420,000	€7,150,000	€7,150,000	€7,150,000	€7,150,000
Transfer and sinking	-	-	-	€7,950,000	€7,950,000	€7,950,000	€6,040,000	€6,040,000	€6,040,000	€6,040,000
Fenders (distance 12m)	-	-	-	€320,000	€320,000	€320,000	€240,000	€240,000	€240,000	€240,000
Quay equipment	-	-	-	€570,000	€570,000	€570,000	€430,000	€430,000	€430,000	€430,000
Piles (distance 14m dia 120 cm h=30 m) longitudinal cranes	-	-	-	€310,000	€310,000	€310,000	€240,000	€240,000	€240,000	€240,000
concrete reinforcing steel (kg/ml 150)- longitudinal cranes	-	-	-	€210,000	€210,000	€210,000	€160,000	€160,000	€160,000	€160,000
Concrete beams (1.50*1.50 m)- longitudinal cranes	-	-	-	€220,000	€220,000	€220,000	€170,000	€170,000	€170,000	€170,000
concrete reinforcing steel (kg/mc 100)- longitudinal cranes	-	-	-	€80,000	€80,000	€80,000	€60,000	€60,000	€60,000	€60,000
Piles (distance 14m dia 120 cm h=30 m) trasversal cranes	-	-	-	€850,000	€850,000	€850,000	€650,000	€650,000	€650,000	€650,000
concrete reinforcing steel(kg/ml 150)-longitudinal cranes	-	-	-	€560,000	€560,000	€560,000	€430,000	€430,000	€430,000	€430,000
Concrete beams (1.50*1.50 m)- longitudinal cranes	-	-	-	€1,070,000	€1,070,000	€1,070,000	€810,000	€810,000	€810,000	€810,000
concrete reinforcing steel (kg/mc 100)- longitudinal cranes	-	-	-	€390,000	€390,000	€390,000	€300,000	€300,000	€300,000	€300,000

Table 4-5 Construction Schedule for Civil Work at Offshore Terminal (EUR, undiscounted)

	Scenario 0			Scenario 1			Scenario 2		Scenario 3	
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
TERMINAL CONTAINER (cont'd)										
Stone backfill (300 mc/ml)	-	-	-	€7,160,000	€7,160,000	€7,160,000	€5,430,000	€5,430,000	€5,430,000	€5,430,000
sea sand backfill (average h=25 m)	-	-	-	€9,090,000	€9,090,000	€9,090,000	€6,900,000	€6,900,000	€6,900,000	€6,900,000
Subgrade	-	-	-	€2,650,000	€2,650,000	€2,650,000	€2,010,000	€2,010,000	€2,010,000	€2,010,000
Paving	-	-	-	€6,630,000	€6,630,000	€6,630,000	€5,030,000	€5,030,000	€5,030,000	€5,030,000
Water drainage	-	-	-	€3,310,000	€3,310,000	€3,310,000	€2,510,000	€2,510,000	€2,510,000	€2,510,000
Water treatment	-	-	-	€1,330,000	€1,330,000	€1,330,000	€1,010,000	€1,010,000	€1,010,000	€1,010,000
Lighting system	-	-	-	€1,330,000	€1,330,000	€1,330,000	€1,010,000	€1,010,000	€1,010,000	€1,010,000
Additional works for phasing	-	-	-	€660,000	€660,000	€660,000	€500,000	€500,000	€500,000	€500,000
Extra for adverse conditions (working at sea)	-	-	-	€31,970,000	€31,970,000	€31,970,000	€24,260,000	€24,260,000	€24,260,000	€24,260,000

Table 4-5 Construction Schedule for Civil Work at Offshore Terminal (EUR, undiscounted) (continued)

	Scenario 0			Scenario 1			Scenario 2		Scenario 3	
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
TERMINAL LOGISTICS										
Preparation of the seabed	-	-	-	€2,070,000	€2,070,000	€2,070,000	-	-	-	-
Caissons	-	-	-	€14,890,000	€14,890,000	€14,890,000	-	-	-	-
Concrete reinforcing steel	-	-	-	€12,110,000	€12,110,000	€12,110,000	-	-	-	-
Caissons filling	-	-	-	€2,910,000	€2,910,000	€2,910,000	-	-	-	-
Concrete slab - Caissons	-	-	-	€3,950,000	€3,950,000	€3,950,000	-	-	-	-
Transfer and sinking	-	-	-	€3,330,000	€3,330,000	€3,330,000	-	-	-	-
Fenders (distance 12m)	-	-	-	€140,000	€140,000	€140,000	-	-	-	-
Quay equipment	-	-	-	€250,000	€250,000	€250,000	-	-	-	-
Stone backfill	-	-	-	€3,000,000	€3,000,000	€3,000,000	-	-	-	-
Sea sand backfill (average h=25 m)	-	-	-	€3,870,000	€3,870,000	€3,870,000	-	-	-	-
Subgrade	-	-	-	€1,870,000	€1,870,000	€1,870,000	-	-	-	-
Paviing	-	-	-	€4,670,000	€4,670,000	€4,670,000	-	-	-	-
Water drainage	-	-	-	€2,330,000	€2,330,000	€2,330,000	-	-	-	-
Water treatment	-	-	-	€930,000	€930,000	€930,000	-	-	-	-
Lighting system	-	-	-	€930,000	€930,000	€930,000	-	-	-	-
Fuel station	-	-	-	€330,000	€330,000	€330,000	-	-	-	-
Buildings	-	-	-	€13,870,000	€13,870,000	€13,870,000	-	-	-	-
Various installations (intrusion control, etc)	-	-	-	€4,500,000	€4,500,000	€4,500,000	-	-	-	-
Extra for adverse conditions (working at sea)	-	-	-	€18,990,000	€18,990,000	€18,990,000	-	-	-	-

Table 4-5 Construction Schedule for Civil Work at Offshore Terminal (EUR, undiscounted) (continued)

Scenario		Monte/Syndial Terminal	Offshore Terminal	Total Annual Maintenance Provision
Scenario 0		€1,180,000	-	€1,180,000
Scenario 1	(increment)	€710,000	€3,820,000	€4,530,000
Scenario 2	(increment)	-	€1,210,000	€1,210,000
Scenario 3	(increment)	-	€1,210,000	€1,210,000
TOTAL FULL BUILD (Scenarios 0,1,2,3)		**€1,890,000**	**€6,250,000**	**€8,130,000**

Table 4-6 Annual Maintenance Provision for Civil Works by Scenario (EUR, undiscounted)

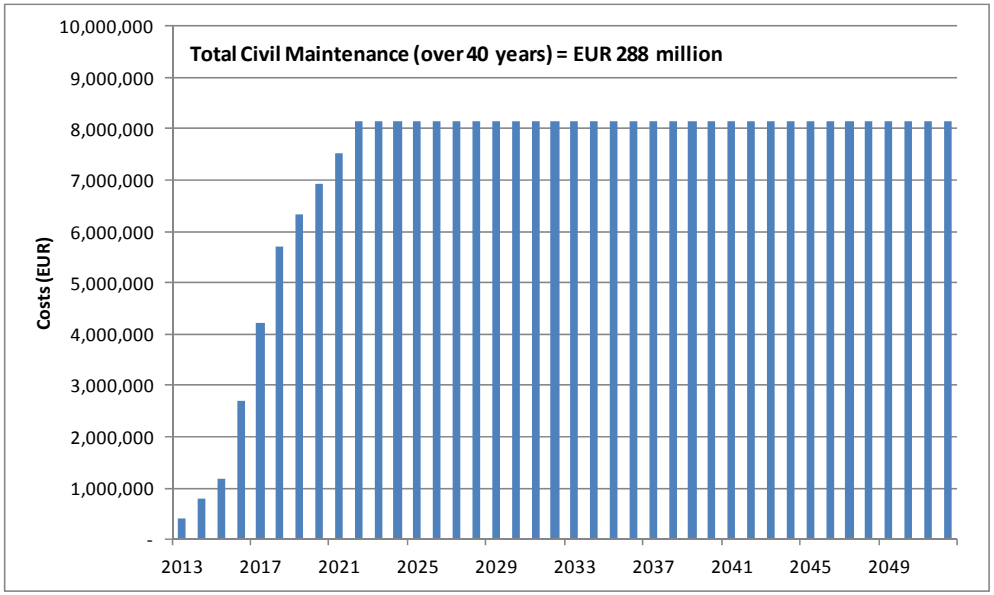

Figure 4-3 Annual Maintenance Provision for Civil Works (EUR, undiscounted)

Site & Civil works Maintenance

Maintenance provisions for offshore and onshore civil works have been calculated based on a target maintenance rate of 0.5% of cumulative capital spend.

Annual maintenance cost at the completion of each Scenario is summarised in Table 4-6. Table 4-7 provides a snapshot of annual maintenance costs by main civil cost categories.

Figure 4-3 illustrates the profile of lifecycle maintenance spend for civil works. Total maintenance for the offshore and onshore civil work over the 40 years of the appraisal period has been estimated at EUR 288 million (undiscounted terms) / EUR 117 million (discounted terms).

	Scenario 0			Scenario 1			Scenario 2		Scenario 3		
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
MONTE/SYNDIAL TERMINAL											
Quay setback (depth 30 m h=15 m)	€20,000	€40,000	€70,000	€70,000	€70,000	€70,000	€70,000	€70,000	€70,000	€70,000	
Sheet pile wall	€60,000	€120,000	€170,000	€170,000	€170,000	€170,000	€170,000	€170,000	€170,000	€170,000	
Bridge crane beams & columns	-	€10,000	€10,000	€30,000	€50,000	€80,000	€80,000	€80,000	€80,000	€80,000	
Yards (900'000 mq)	€310,000	€620,000	€930,000	€1,150,000	€1,360,000	€1,580,000	€1,580,000	€1,580,000	€1,580,000	€1,580,000	Annual civil maintenance remains at 2022 levels for the remainder of the appraisal period
TOTAL Monte/Syndial terminal	**€390,000**	**€790,000**	**€1,180,000**	**€1,420,000**	**€1,650,000**	**€1,890,000**	**€1,890,000**	**€1,890,000**	**€1,890,000**	**€1,890,000**	
	-	-	-	-	-	-	-	-	-	-	
OFFSHORE TERMINAL	-	-	-	-	-	-	-	-	-	-	
Terminal container (2000 x 200 m)	-	-	-	€800,000	€1,600,000	€2,400,000	€3,000,000	€3,610,000	€4,220,000	€4,820,000	
Terminal logistics (875 x 160 m)	-	-	-	€470,000	€950,000	€1,420,000	€1,420,000	€1,420,000	€1,420,000	€1,420,000	
TOTAL Offshore terminal	**-**	**-**	**-**	**€1,270,000**	**€2,550,000**	**€3,820,000**	**€4,430,000**	**€5,030,000**	**€5,640,000**	**€6,250,000**	
TOTAL INSHORE AND OFFSHORE TERMINALS	**€390,000**	**€790,000**	**€1,180,000**	**€2,690,000**	**€4,200,000**	**€5,710,000**	**€6,320,000**	**€6,930,000**	**€7,530,000**	**€8,140,000**	

Table 4-7 Annual Maintenance Provision by Main Civil Costs Items (EUR, undiscounted terms)

	Total Maintenance Undisocunted Costs	Total Maintenance Discounted Cost
Monte/Syndial Terminal	€71,640,000	€31,150,000
Offshore Terminal	€216,440,000	€86,200,000
TOTAL COMBINED	**€288,070,000**	**€117,350,000**

Table 4-8 Total Site & Civil Maintenance over Appraisal Period (EUR)

	Scenario 0	Scenario 1 (increment)	Scenario 2 (increment)	Scenario 3 (increment)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Monte/Syndial Terminal					
Total Capital Build	€235,950,000	€142,360,000	-	-	€378,310,000
Total Maintenance	€46,010,000	€25,620,000	-	-	€71,640,000
Total Lifecycle Cost	**€281,960,000**	**€167,980,000**	**-**	**-**	**€449,950,000**
Offshore Terminal					
Total Capital Build	-	€764,350,000	€242,630,000	€242,630,000	€1,249,610,000
Total Maintenance	-	€137,580,000	€40,640,000	€38,210,000	€216,440,000
Total Lifecycle Cost	-	**€901,930,000**	**€283,270,000**	**€280,850,000**	**€1,466,050,000**
Monte/Syndial and Offshore Terminals					
Total Capital Build	€235,950,000	€906,710,000	€242,630,000	€242,630,000	€1,627,920,000
Total Maintenance	€46,010,000	€163,210,000	€40,640,000	€38,210,000	€288,070,000
Total Lifecycle Cost	**€281,960,000**	**€1,069,910,000**	**€283,270,000**	**€280,850,000**	**€1,916,000,000**

Table 4-9 Total Lifecycle Costs for Site and Civil Works by Scenario (EUR, undiscounted)

Site & Civil works Lifecycle Costs

Table 4-9 and Figure 4-4 summarise the total lifecycle costs for site development and civil works for each Scenario, by capital build and capital maintenance.

The construction of Monte/Syndial terminal and the first phase of the offshore terminal (i.e. Scenarios 0 plus Scenario 1) represent more than 70% of total lifecycle costs, at EUR 1,352 million (i.e. EUR 282 million plus EUR 1,070 million in undiscounted terms). In discounted terms, the lifecycle cost associated with Scenarios 0 and Scenario 1 together totals EUR 1,032 million.

Table 4-9 and Figure 4-4 also reillustrate that civil maintenance for the entire construction project totalling EUR 288 million over the appraisal period. This is approximately 15% of the project's whole lifecycle costs related to site and civil activities.

Table 4-10 summarises total lifecycle costs for site development and civil works in discounted terms based on the discount rate of 4.5%.

	Scenario 0	Scenario 1 (increment)	Scenario 2 (increment)	Scenario 3 (increment)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Monte/Syndial Terminal					
Total Capital Build	€216,210,000	€114,310,000	-	-	€330,520,000
Total Maintenance	€20,600,000	€10,550,000	-	-	€31,150,000
Total Lifecycle Cost	**€236,810,000**	**€124,860,000**	**-**	**-**	**€361,670,000**
Offshore Terminal					
Total Capital Build	€613,750,000	€174,450,000	€159,750,000	€947,950,000	€613,750,000
Total Maintenance	€56,660,000	€15,620,000	€13,910,000	€86,200,000	€56,660,000
Total Lifecycle Cost	**€670,410,000**	**€190,070,000**	**€173,670,000**	**€1,034,150,000**	**€670,410,000**
Monte/Syndial and Offshore Terminals					
Total Capital Build	€216,210,000	€728,060,000	€174,450,000	€159,750,000	€1,278,470,000
Total Maintenance	€20,600,000	€67,210,000	€15,620,000	€13,910,000	€117,350,000
Total Lifecycle Cost	**€236,810,000**	**€795,270,000**	**€190,070,000**	**€173,670,000**	**€1,395,820,000**

Table 4-10 Total Discounted Lifecycle Costs for Site and Civil Works by Scenario (EUR)

Scenarios	Total Power Station Costs	Total Discounted Costs
Scenario 0	-	-
Scenario 1 (increment)	€15,790,000	€12,680,000
Scenario 2 (increment)	€15,790,000	€11,350,000
Scenario 3 (increment)	€21,050,000	€13,860,000
TOTAL FULL BUILD [Scenarios 0,1,2,3]	**€52,630,000**	**€37,890,000**

Table 4-11 Power Station Investment Costs by Scenario (EUR)

Power Station

Power generation for the offshore terminal can be provided offshore on onshore. Primary power is assumed to be generated onshore and distributed to the offshore terminal by an underground power cable.

In line with VPA request, it is assumed that the power cable will be provided by others and will meet all the power needs of the offshore terminal. A secondary power source has been allowed for in the costing, an independent offshore power station in case of emergency or damage to the cable.

The total cost of constructing an independent power plant at the offshore terminal has been estimated at EUR 53 million. Construction of the offshore power station is assumed to be developed over the three scenarios in two stages:

- Scenario 1 and 2- EUR 32 million in total
- Scenario 3, EUR 21 million

These figures include provisions for capital maintenance but do not include asset replacement as the power station is not expected to be replaced during the study appraisal period.

Capital Equipment

Table 4-12 and Table 4-13 present equipment for each Scenario.

As the range and volume of capital equipment differs depending on the terminal location and Scenarios, the tables summarise the incremental required for the operation at the Monte/Syndial and offshore terminal respectively.

The total initial cost for the purchase of capital equipments required for the proposed logistic solution and handling of the estimated traffic throughput amount to EUR 1,367 million (or EUR 1,058 million in discounted terms).

This sum reflects the estimated cost for initial purchase and does not include contingencies, maintenance and replacement costs.

Cost item	Transfer Cycle	No of units	Unit cost (EUR)	Total costs
Offshore Terminal				
SCENARIO 1				
Mobile crane	TC2	1	€5,280,000	€5,280,000
Reachstacker	TC2	1	€440,000	€440,000
Manual mini stradd	TC2	2	€650,000	€1,300,000
Terminal Tractor	TC2	2	€100,000	€200,000
Spare Spreaders	TC2	2	€440,000	€870,000
Spare Bridge Crane Spreader	TC2	2	€2,000,000	€4,000,000
Special Lift Frames	TC2	3	€20,000	€50,000
Ship-to-shore (STS) crane	TC2	7	€8,000,000	€56,000,000
Special Bridge Crane Frame	TC2	8	€32,840,000	€262,710,000
Trailer	TC2	10	€20,000	€200,000
Auto mini stradd	TC2	20	€650,000	€13,000,000
Bridge crane	TC2	32	€2,250,000	€72,000,000
Total Scenario 1 Incremental Cost for Offshore Terminal				**€416,050,000**

Table 4-12 Capital Equipment Purchase Costs by Scenario (EUR, undis-counted)

Cost item	Transfer Cycle	No of units	Unit cost (EUR)	Total costs
SCENARIO 2				
Spare Spreaders	TC2	1	€440,000	€440,000
Spare Bridge Crane Spreader	TC2	1	€2,000,000	€2,000,000
Special Bridge Crane Frame	TC2	4	€32,840,000	€131,350,000
Ship-to-shore (STS) crane	TC2	5	€8,000,000	€40,000,000
Trailer	TC2	5	€20,000	€100,000
Auto mini stradd	TC2	15	€650,000	€9,750,000
Bridge crane	TC2	16	€2,250,000	€36,000,000
Total Scenario 2 Incremental Cost for Offshore Terminal				**€219,640,000**
SCENARIO 3				
Mobile crane	TC2	1	€5,280,000	€5,280,000
Terminal Tractor	TC2	1	€100,000	€100,000
Reachstacker	TC2	1	€440,000	€440,000
Spare Spreaders	TC2	1	€440,000	€440,000
Spare Bridge Crane Spreader	TC2	1	€2,000,000	€2,000,000
Special Bridge Crane Frame	TC2	3	€32,840,000	€98,520,000
Trailer	TC2	5	€20,000	€100,000
Ship-to-shore (STS) crane	TC2	6	€8,000,000	€48,000,000
Bridge crane	TC2	12	€2,250,000	€27,000,000
Auto mini stradd	TC2	17	€650,000	€11,050,000
Total Scenario 3 Incremental Cost for Offshore Terminal				**€192,930,000**

Cost item	Transfer Cycle	No of units	Unit cost (EUR)	Total costs
Monte/Syndial Terminal				
Scenario 0				
Spare Spreader	TC4	1	€440,000	€440,000
Reachstacker	TC4	1	€440,000	€440,000
Rail widespan RMG	TC4	1	€3,520,000	€3,520,000
Empty Handler	TC4	2	€330,000	€660,000
Special Lift Frames	TC4	3	€20,000	€50,000
Ship-to-shore (STS) crane	TC4	4	€8,000,000	€32,000,000
RTG	TC4	16	€1,200,000	€19,200,000
Tractor	TC4	20	€100,000	€2,000,000
Trailer	TC4	24	€20,000	€480,000
Total Scenario 0 Incremental Cost for Monte/Syndial Terminal				**€58,790,000**

Cost item	Transfer Cycle	No of units	Unit cost (EUR)	Total costs
Scenario 1				
Reachstacker	TC4	1	€435,000	€435,000
Spare Bridge Crane Spreader	TC4	1	€2,000,000	€2,000,000
Trailer	TC4	2	€20,000	€40,000
Rail widespan RMG	TC4	2	€3,518,400	€7,036,800
Special Bridge Crane Frame	TC4	6	€57,467,200	€344,803,200
Bridge crane onshore	TC4	24	€2,250,000	€54,000,000
Mobile harbour crane	TC4	1	€5,277,600	€5,277,600
Reachstacker	TC5	1	€435,000	€435,000
Empty Handler	TC5	3	€330,000	€990,000
Multi Trailer Tractor	TC5	5	€175,000	€875,000
Multi Trailer Chassis	TC5	22	€25,000	€550,000
Bridge crane rotating Spreader	TC5	24	€2,650,000	€63,600,000
Total Scenario 1 Incremental Cost for Monte/Syndial Terminal				**€480,040,000**

Table 4-13 Capital Equipment Purchase Costs by Scenario (EUR, undiscounted)

Figure 4-5 presents an overview of the relative cost profile of equipment purchases at each Scenario for the Monte/Syndial and offshore terminals.

Capital equipment expenditure at the Monte/Syndial terminal starts in Scenario 0 with EUR 59 million and increases by EUR 480 million in Scenario 1.

The offshore terminal is forecasted to spend approximately EUR 416 million - half of the terminal's total equipment expenditure, during the first three years of the development of the terminal.

Table 4-14 provides an overview of the incremental capital equipment costs required at the completion of each Scenario (for initial costs outlay only).

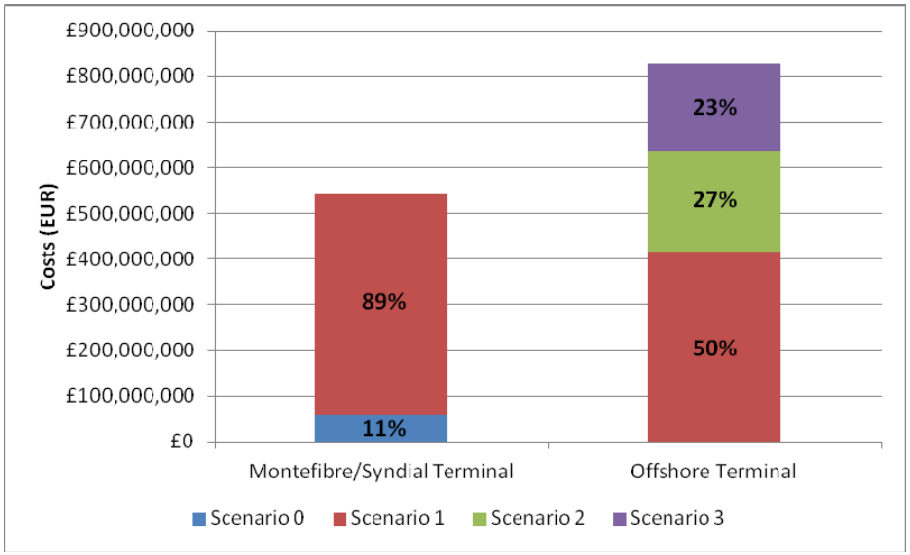

Figure 4-5 Total Initial Equipment Costs by Scenario at the Onshore and Offshore Terminals (EUR, undiscounted)

Scenarios	Capital Equipment Cost [for initial purchase only]	% of total Equipment Capital Spend
Scenario 0	€58,770,000	4%
Scenario 1 (increment)	€896,080,000	66%
Scenario 2 (increment)	€219,640,000	16%
Scenario 3 (increment)	€192,910,000	14%
TOTAL FULL BUILD [Scenarios 0,1,2,3]	€1,367,400,000	**100%**

Table 4-14 Total Initial Capital Equipment Costs, by Scenario (EUR, undiscounted)

Equipment	Asset life (years)	Residual Value (EUR)
Auto mini stradd	10	-
Bridge crane	20	-
Bridge crane rotating Spreader	20	-
Empty Handler	6	€50,000
Manual mini stradd	10	-
Mobile crane	20	-
Mobile harbour crane	20	-
Multi Trailer Tractor	10	-
Multi Trailer Chassis	6	-
Rail widespan RMG	20	-
Reachstacker	6	€100,000
RTG	15	€250,000
Spare Bridge Crane Spreader	10	-
Spare Spreader	10	-
Special Lift Frames	15	-
Special Bridge Crane Frame (offshore)	25	-
Special Bridge Crane Frame (onshore)	25	-
STS	20	€1,000,000
Terminal Tractor	8	€15,000
Terminal Trailer	5	€2,000
Tractor	8	€15,000
Trailer	5	€2,000

Table 4-15 Capital Equipments Asset life (Years) and Residual Value (EUR)

Capital Equipment Renewals

All capital equipments is assumed to be replaced at the end of its asset life.

Table 4-15 presents the asset life and residual values for each equipment item identified earlier in Table 4-12 and Table 4-13. The cost analysis assumes that all assets are replaced in their entirety at the end of their life and that no replacements will be undertaken 5 years before the end of the appraisal period.

Based on the assumed asset lifes, total equipment costs (for initial purchase and for replacements) amounts to EUR 2,598 million over the appraisal period. This sum reflects the estimated cost for initial purchase of EUR 1,367 million and a subsequent EUR 1,231 million for capital replacement costs for aged equipment assets.

Scenarios	Initial Costs of Equipments	Replacement Costs of Equipments	Total Capital Equipment Costs (Initials & Replacement)
Offshore Terminal			
Scenario 0	-	-	-
Scenario 1 (incremental)	€416,030,000	€429,100,000	€845,140,000
Scenario 2 (incremental)	€219,640,000	€161,310,000	€380,950,000
Scenario 3 (incremental)	€192,910,000	€102,570,000	€295,480,000
Total Offshore Terminal (All Scenarios)	**€828,590,000**	**€692,980,000**	**€1,521,570,000**
Monte/Syndial Terminal			
Scenario 0	€58,770,000	€51,410,000	€110,180,000
Scenario 1 (incremental)	€480,040,000	€486,400,000	€966,440,000
Scenario 2 (incremental)	-	-	-
Scenario 3 (incremental)	-	-	-
Total Monte/Syndial Terminal (All Scenarios)	**€538,820,000**	**€537,810,000**	**€1,076,620,000**
TOTAL MONTE/SYNDIAL & OFFSHORE TERMINALS			
Total Scenario 0	€58,770,000	€51,410,000	€110,180,000
Total Scenario 1 (incremental)	€896,080,000	€915,510,000	€1,811,580,000
Total Scenario 2 (incremental)	€219,640,000	€161,310,000	€380,950,000
Total Scenario 3 (incremental)	€192,910,000	€102,570,000	€295,480,000
TOTAL FULL BUILD [Scenarios 0,1,2,3]	**€1,367,400,000**	**€1,230,790,000**	**€2,598,190,000**

Table 4-16 Capital Equipment Initial and Replacement Costs by Scenario (EUR, undiscounted)

Scenario	Average Annual Equipment Maintenance Cost
Scenario 0	€830,000
Scenario 1 (incremental)	€13,350,000
Scenario 2 (incremental)	€3,350,000
Scenario 3 (incremental)	€3,080,000

Table 4-17 Annual Maintenance Provision for Capital Equipment by Scenario (EUR, undiscounted)

Scenario	Total Undiscounted Cost	Total Discounted Cost
Scenario 0	€33,260,000	€14,990,000
Scenario 1 (incremental)	€494,050,000	€205,570,000
Scenario 2 (incremental)	€113,780,000	€45,110,000
Scenario 3 (incremental)	€98,410,000	€35,920,000
Total Equipment Maintenance	**€739,500,000**	**€301,590,000**

Table 4-18 Total Equipment Maintenance over Appraisal Period (EUR)

Capital Equipment Maintenance

Maintenance provisions for capital equipments have been calculated based on a target rate of 1.5% of the cumulative capital spend. Double-counting for both initial and replacement investments has been avoided.

Table 4-17 presentes annual maintenance provision by scenario.

Table 4-18 presents a summary of total capital maintenance provisions for equipments over the appraisal period.

Total equipment maintenance over the appraisal period is estimated to be in the region of EUR 740 million (undiscounted terms) / EUR 302 million (discounted terms). Cumulative maintenance of Scenario 0 and 1 together totals EUR 527 million (undiscounted) / EUR 221 million, representing over 70% of maintenance provision at full build.

Capital Equipment Lifecycle Costs

Table 4-19 and Figure 4-6 present total lifecycle equipment costs by Scenario.

Total lifecycle equipment cost in Scenario 0 is estimated to be EUR 143 million (undiscounted terms). Scenario 1 is estimated to increase lifecycle cost by EUR 2,306 million reflecting the equipment needs to operate the newly developed offshore terminal.

Jointly, lifecycle equipment costs at the end of Scenarios 1 totals EUR 2,448 million which accounts for 73% of overall lifecycle costs at full build (i.e. completion of all Scenarios).

Incremental increases in lifecycle equipment cost by EUR 495 million and EUR 394 million are expected as the construction of Scenario 2 and Scenario 3 are implemented. Overall lifecycle equipment cost at full build is estimated to total EUR 3,338 million.

Table 4-20 and Figure 4-6 present the summary lifecycle equipment cost in discounted terms.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Total Initial Purchase	€58,770,000	€896,080,000	€219,640,000	€192,910,000	€1,367,400,000
Total Renewals	€51,410,000	€915,510,000	€161,310,000	€102,570,000	€1,230,790,000
Total Maintenance	€33,260,000	€494,050,000	€113,780,000	€98,410,000	€739,500,000
Total Lifecycle Cost	**€143,430,000**	**€2,305,630,000**	**€494,730,000**	**€393,890,000**	**€3,337,690,000**

Table 4-19 Total Lifecycle Equipment, by Scenario (EUR, undiscounted)

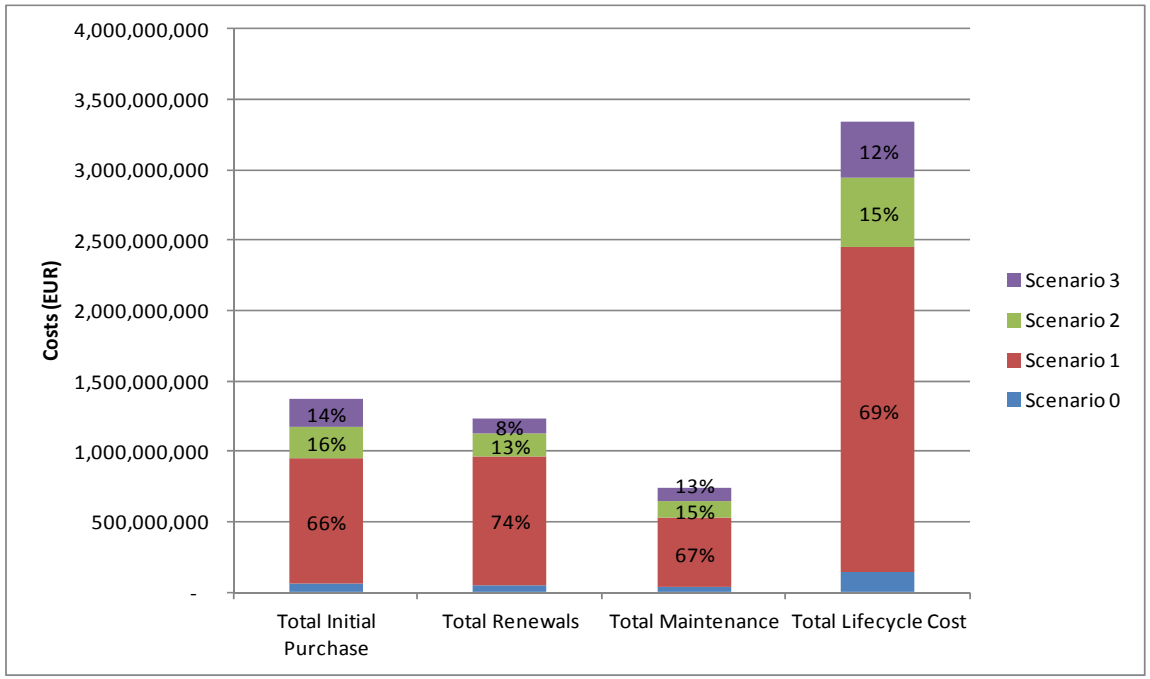

Figure 4-6 Cumulative Lifecycle Equipment Spend, by Scenario (EUR, undiscounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Total Initial Purchase	€53,860,000	€719,520,000	€157,890,000	€127,020,000	€1,058,280,000
Total Renewals	€19,450,000	€235,440,000	€42,350,000	€27,260,000	€324,500,000
Total Maintenance	€14,990,000	€205,570,000	€45,110,000	€35,920,000	€301,590,000
Total Lifecycle Cost	**€88,290,000**	**€1,160,540,000**	**€245,350,000**	**€190,200,000**	**€1,684,370,000**

Table 4-20 Total Lifecycle Costs for Capital Equipment by Scenario (EUR, discounted terms)

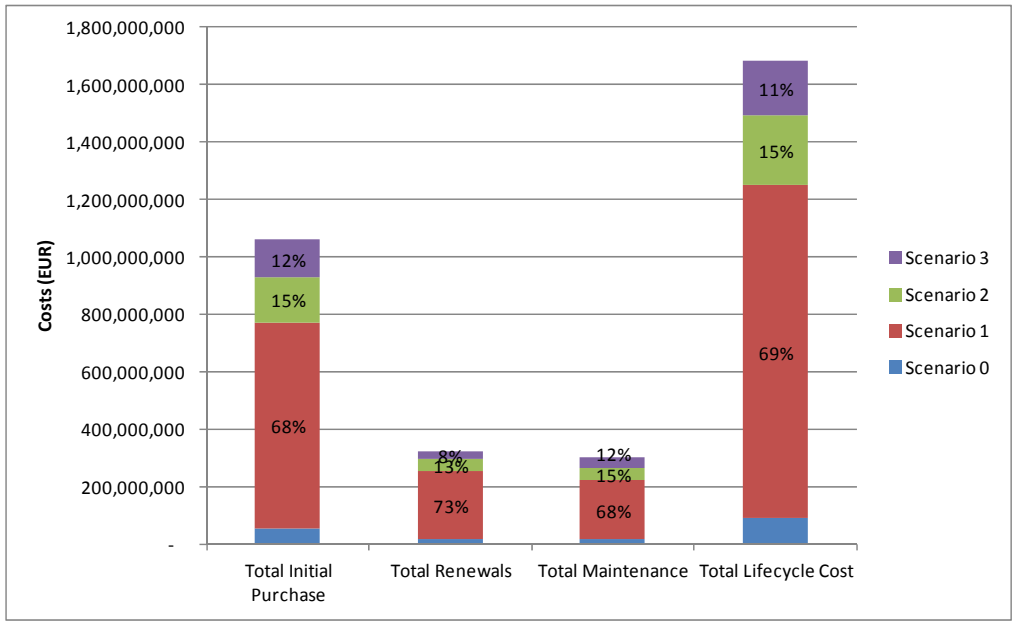

Figure 4-7 Cumulative Lifecycle Equipment Spend, by Scenario (EUR, discounted terms)

Vessel Fleet

The number of vessels required for the operation of the offshore and land terminals have been estimated through the operational simulations presented in Report Volume 1.

The tables below summarise the fleet requirements for the preferred vessel option E+ in incremental steps for each scenario for:

- Barges;
- Mama vessels; and
- Tug vessels.

Barges

Table 4-21 presents the number of barges required to move traffic through the logistic chain.

As observed in Table 4-21, a total acquisition of 22[3] barges will be required to operate the facilities when the offshore terminal is at full built.

[3] 20 barges (from ARENA) + 2 spare vessels

Table 4-23 presents the unit cost for barges and the initial investment costs by Scenario. It is assumed that barges have an estimated asset life of 20-years and thus will need to be replaced every 21st year.

Overall, estimated costs associated with the purchase of the initial fleet of barges total EUR 62 million in undiscounted terms and EUR 44 million in discounted terms.

Table 4-23 which presents total cost of barges over the appraisal period indicates that barge vessels are replaced once over the period. Total cost for the provision of barges (initial and replacement) in Scenario 1 amount to EUR 68 million. This equates to approximately 54% of total lifecycle barge costs at full operational capacity.

	Scenario 1	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Barges	12	2	8	22

Table 4-21 Number of Barges Vessels by Scenario (incremental volumes)

Note: No barge vessels have been accounted for in Scenario 0 as the offshore platform has not yet been constructed.

Figures reflect the number of barges required to handle throughput during peak periods.

A provision of two extra barges have been included in the above total as spare vessels.

	Unit cost per vessel	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Total Barge Cost (Undiscounted)	€2,810,000	€33,750,000	€5,630,000	€22,500,000	€61,880,000
Total Barge Cost (Discounted)	€2,810,000	€25,920,000	€3,960,000	€14,490,000	€44,360,000

Table 4-23 Barge Vessels Costs by Scenario (initial costs only) (EUR, undiscounted)

	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Initial Purchase	€33,750,000	€5,630,000	€22,500,000	€61,880,000
Replacement	€33,750,000	€5,630,000	€22,500,000	€61,880,000
Total	€67,500,000	€11,250,000	€45,000,000	€123,750,000

Table 4-22 Total Initial and Replacement Barge Costs over Appraisal Period (EUR, undiscounted)

Mama vessels

Table 4-24 presents the number of mama vessels required to transport barges between the offshore and the Monte/Syndial terminals. The estimated fleet of mama vessels required are based on the operational simulation plus one extra mama vessel as spare in each Scenario.

In the early years when the offshore terminal operates at a limited capacity (i.e. at Scenario 1), only 4 mama vessels are required to handle the traffic throughput. On completion of Scenario 3, a total of seven[4] mama vessels are required.

The unit cost of a mama vessel designed to transport two Barge E+ vessels simultaneously has been estimated to fall in the region of EUR 18 million[5]. This is based on the estimated steelweight for the transport vessel)[6] and the required propulsive power.

Mama vessels have an expected asset life of 25 years and thus will be replaced every 26th year.

Table 4-25 presents the incremental cost of additional mama vessels by Scenario indicates a total expenditure of EUR 128 million (or EUR 92 million in discounted terms) for the fleet of seven mama vessels. The purchase of four vessels at Scenario 1 represents the minimum fleet required to operate the waterway transfer system. The investment of EUR 73 million (or EUR 56 million in discounted terms) approximately equates to 57% of total vessel cost at full build.

	Scenario 1	Scenario 2	Scenario 3	Total
Mama vessels	4	1	2	7

Table 4-24 Number of Mama Vessels by Scenario (incremental volume)

Note: No mama vessels have been accounted for in Scenario 0 as the offshore platform has not yet been constructed.

Figures reflect the number of mama vessels required to handle throughput during peak periods.

A provision of one extra mama vessel have been included in the above total as a spare vessels.

[4] Six vessels (from ARENA) plus one spare vessel.

[5] Estimated build cost for the hull of 13.75 million Euros, plus propulsion package of approximately 2.5 million Euros, plus outfit equipment of 2 million Euros, total cost of 18.25 million Euros.

[6] Circa 5,500 tonnes

	Unit cost per Mama Vessel	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	Total Cost for Mama vessels [All scenarios]
Total mama vessel cost (undiscounted)	€18,250,000	€73,000,000	€18,250,000	€36,500,000	€127,750,000
Total mama vessel cost (discounted)	€12,830,000	€56,060,000	€12,830,000	€23,500,000	€92,390,000

Table 4-25 Number of Mama Vessels by Scenario (incremental volume)

	Scenario 1	Scenario 2	Scenario 3	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Initials	€73,000,000	€18,250,000	€36,500,000	€127,750,000
Replacement	€73,000,000	€18,250,000	€36,500,000	€127,750,000
Total	€146,000,000	€36,500,000	€73,000,000	€255,500,000

Table 4-26 Total Cost (Initial and Replacement) of Mama Vessels over Appraisal Period (EUR), Undiscounted terms

Total capital expenditure for both the initial acquisition and replacement of the fleet of mama vessels over the appraisal period is presented in Table 4-26.

Total lifecycle costs to acquire and replace mama vessels are estimated to reach EUR 255 million (undiscounted terms) at the completion of all Scenarios.

Tug vessels

Table 4-27 presents the number of tug vessels required to support the movement of barges to-and-from the Mama vessels at the offshore terminal and the inland terminal. A total of five[7] tugs are required at full build out.

The cost per tug vessel is estimated at EUR 2.9 million. Tug vessels are assumed to have an asset life of 25 years and thus are assumed to be replaced every 26th year.

Table 4-28 presents the total cost of acquiring tug vessels for the offshore and onshore terminal operations. The purchase of tugs occurs primarily in Scenario 1 following construction of the initial phase of the offshore terminal. Expenditure on tug purchase in Scenario 1 totals EUR 12 million (or EUR 9 million in discounted terms), which equates to 80% of total tug expenditure.

The implementation of Scenario 2 will bring forth an additional tug being purchase to efficiently aide the waterway transfer system. It is assumed that no further tugs are required as part of Scenario 3.

The cost of initial purchase and replacement of tug vessels are presented in Table 4-29. Similar to other vessels discussed above, tug vessels are also expected to be replaced only once during the appraisal period.

As a result, capital expenditure for tug vessels is expected to total EUR 24 million in Scenario 1 and EUR 6 million in Scneario 2. The overall cost of purchasing tugs vessels over the 40 year appraisal period is estimated to reach EUR 29 million.

	Scenario 1	Scenario 2	Scenario 3	Total all Scenarios
No. Of Tugs	4	1	-	**5**

Table 4-27 Number of Tug Vessels by Scenario (incremental volume)

Table 4-28 Cost of Tug Vessels by Scenario (incremental cost, initials only)

		Scenario (incremental)			
	Unit cost per Tug Vessel	1	2	3	Total Tug Cost [All Scenarios]
Cost of Tugs (undiscounted)	€2,930,000	€11,730,000	€2,930,000	-	€14,660,000
Cost of Tugs (discounted)	€2,930,000	€9,010,000	€2,060,000	-	€11,070,000

	Scenario 1	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD [Scenarios 0,1,2,3]
Initials	€11,728,000	€2,932,000	-	€14,660,000
Replacement	€11,728,000	€2,932,000	-	€14,660,000
Total	€23,456,000	€5,864,000	-	€29,320,000

Table 4-29 Total Tug Vessel Costs (Initial & Replacement) over Appraisal Period (EUR, undiscounted)

[7] Four tugs plus one spare vessel

Vessel Type	Scenario 1 (incremental)	Scenario 2 (incremental)
Barges	€840,000	€140,000
Mama Vessels	€1,460,000	€370,000
Tugs	€230,000	€60,000
Annual Total Cost	**€2,540,000**	**€560,000**

Vessel Type	Scenario 3 (incremental)	Total Annual Maintenance (at Full Build)
Barges	€560,000	€1,550,000
Mama Vessels	€730,000	€2,560,000
Tugs	-	€290,000
Annual Total Cost	**€1,290,000**	**€4,400,000**

Table 4-31 Annual Maintenance Provision for Barges, Mama Vessel and Tugs (EUR, undiscounted)

	Total Undiscounted Costs	Total Discounted Cost
Barge	€50,060,000	€18,730,000
Mama Vessel	€83,220,000	€31,300,000
Tugs	€9,850,000	€3,800,000
Vessel Total	**€143,130,000**	**€53,840,000**

Table 4-30 Total Vessel Maintenance over Appraisal Period (EUR)

Vessel Maintenance

Annual maintenance for each vessel type has been calculated assuming that total cumulative maintenance does not exceed 50% of total initial capital cost. As a result, the annual maintenance rate is estimated as follows:

Annual maintenance rate = 1/Asset Life * 50%

Based on the above formula, the annual maintenance rate of 2.5%[8] for barges and 2.0%[9] for mama vessels and tugs have been assumed.

As vessels are maintained on an annual basis and also replaced periodically (every 20 years for barges and every 25 years for Mama vessels and tugs), no additional major dry dock maintenance provision has been assumed for the vessels.

[8] Annual maintenance rate for barges = 1/20 * 50% = 2.5% per annum

[9] Annual maintenance rate for Mama/Tugs = 1/25 * 50% = 2.0% per annum

Table 4-30 presents annual maintenance cost by Scenario for the three types of vessels. At full build, annual maintenance provision for vessels amount to EUR 4 million. The main maintenance cost relates to mama vessels, at EUR 3 million (58% of total annual maintenance) per year. Operation at partial terminal capacity in Scenario 1 would generate an annual maintenance cost of EUR 3 million. This is significantly high in comparison to the other Scenarios and reflects the large upfront costs for vessel purchase at Scenario 1.

Table 4-31 illustrates the profile of lifecycle maintenance spend for each vessel type, i.e. barges, mama vessels and tugs. Overall, provision for vessel lifecycle maintenance totals EUR 143 million in undiscounted terms (or EUR 54 million discounted) over the appraisal period.

Vessel Lifecycle Costs

Table 4-33 below summarise vessel lifecycle costs for each development Scenario. The overall cost of initial purchase, capital renewal and maintenance costs for the entire vessel fleet is estimated to cost EUR 552 million (or EUR 252 million in discounted terms) over the appraisal period.

In the situation where the logistic solution reaches Scenario 1, the estimated lifecycle cost totals EUR 323 million (or EUR 156 in discounted terms).

	Total Undiscounted Maintenance Costs	Total Discounted Maintenance Cost
Scenario 1	€86,300,000	€33,620,000
Scenario 2 (incremental)	€18,060,000	€6,660,000
Scenario 3 (incremental)	€38,780,000	€13,560,000
Total All Scenarios	**€143,130,000**	**€53,840,000**

Table 4-32 Total Vessel Maintenance over Appraisal Period (EUR)

	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Total Initial	€118,480,000	€26,810,000	€59,000,000	€204,290,000
Total Renewals	€118,480,000	€26,810,000	€59,000,000	€204,290,000
Total Maintenance	€86,300,000	€18,060,000	€38,780,000	€143,130,000
Total Lifecycle Cost	**€323,260,000**	**€71,670,000**	**€156,780,000**	**€551,700,000**

Table 4-33 Total Lifecycle Vessel Spend, by Scenario (EUR, undiscounted)

	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Total Initial	€90,980,000	€18,850,000	€37,990,000	€147,820,000
Total Renewals	€31,000,000	€6,310,000	€13,230,000	€50,540,000
Total Maintenance	€33,620,000	€6,660,000	€13,560,000	€53,840,000
Total Lifecycle Cost	**€155,590,000**	**€31,820,000**	**€64,780,000**	**€252,200,000**

Table 4-34 Total Lifecycle Vessel Spend, by Scenario (EUR, discounted)

Terminal IT/ Information Systems

To estimate the overall software costs of a Terminal Operating System (TOS) solution, a break down in subsystems was needed. The overall TOS solution consists of several systems, modules, components and interfaces.

The most complicated part of the suggested software solution is the Terminal Control System. This System contains all logistical optimisation and synchronisation capabilities including the terminal link functionality. Advanced optimisation is required in all of the components no matter whether the Auto Straddles´ assignments have to be optimised or the slot takings in the yard.

The modules are sometimes used several times as e.g. the Yard Control (2 x Auto, RTG, OOG, Empty). Other modules like the RTG Control are used only once. This was taken into account within the cost calculation.

As the Terminal Control System (TCS) is highly complex and crucial for the productivity of the container terminal, substantial cross functions for the adaptation of existing components are needed.

Moreover, as the Barge module has to be newly developed and the rail planning needs some level of adaptation because of the lack of good standard solution on the market, the cross function calculation covers also these two planning modules which are not part of the core TCS.

The driver for the barge planning development should be in any case the TCS supplier, the same could apply for rail planning. Hence, cross functions costs were calculated in one package. This team should also take the lead for the integration and architecture designs.

Table 4-35 presents a summary breakdown of the software and overhead costs by Scenarios. Due to the nature of the stepwise installation, costs are estimated to be rising slightly between Scenario 0 and Scenario 1. Cross functional costs are 15% higher because of the two phases.

Costs for the systems, components and modules do not change. The selected software should have such a modular structure that it can be delivered stepwise without additional development.

Also procurement, training and Go-Live support should come in packages without additional costs for the client. The effort in organisation and project management were not calculated and are expected to be covered by the increase of the cross functions costs.

Scenario 0 and 1 are estimated to be where capital outlay for the Information System primarily occurs. Within Scenario 0 some modules are not needed like the Barge Planning, Auto Yard Control, Advanced Housekeeping, Bridge Crane Control, Auto Straddle Control, the Terminal-Link Processes and the corresponding interfaces. Other components of the Terminal Control System are needed but with lower complexity, e.g. the Waterside Manager, Reefer Control, Chassis Control and the RMG Rail Control.

Less efforts are also required in the graphical user interface (GUI) and statistics.

At the stage of Scenario 1 all software components and interfaces are needed to run the two terminals in full complexity. Therefore all components were calculated with full man days required for the software production.

In Scenarios 2 and 3, only the throughput is increasing which is leading to higher licence fees for the standard systems. Adding ship-to-shore cranes, bridge cranes etc. at these steps are not affecting the costs of the appointment system, the autotest environment, the rail planning, barge planning, the TCS and interfaces anymore.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	Total FULL BUILD cost (by component)
TOS Admin	€760,000	€580,000	€240,000	€240,000	€1,820,000
Ship Planning	€860,000	€660,000	€280,000	€280,000	€2,070,000
Appointment System	€480,000	€230,000	-	-	€710,000
Roster Control	€250,000	€190,000	€70,000	€70,000	€580,000
Autotest Environment	€470,000	€490,000	-	-	€960,000
Rail Planning	€1,040,000	€250,000	-	-	€1,290,000
Barge Planning and Auto Stow	-	€1,660,000	-	-	€1,660,000
Terminal Control System (TCS)	€6,830,000	€11,710,000	-	-	€18,530,000
Interfaces	€4,750,000	€730,000	-	-	€5,480,000
Total (by Scenario)	**€15,430,000**	**€16,500,000**	**€590,000**	**€590,000**	**€33,110,000**

Table 4-35 Total Cost of Information Systems, by Component and Scenario (EUR, undiscounted)

It should be noted that for Scenario 0 a much cheaper standard software package could be used which reduces the costs for Scenario 0 significantly. But these standard packages are not extendable to Scenario 1. Changing the software solution for Scenario 1 would lead to higher total costs and a breakdown of the already running terminal for some time. Furthermore, in Scenario 0 a lot of design, architecture and interface preparation work have been invested for Scenario 1. Therefore this option was not taken into account.

Information Systems Maintenance

Maintenance provision for Information Systems mirrors the expenditure profile for the software costs. Capital spend for the Information System occurs primarily in Scenario 0 and 1 with little additional costs for Scenario 2 and 3 due to increases in licence fees for the standard systems. As a result, maintenance provision for the Information System reflects this stepwise approach.

Annual maintenance cost at the completion of each Scenario is summarised in Table 4-36. Examining Table 4-36, we observe that annual maintenance cost for Information System totals EUR 3 million after full build (i.e. completion of Scenario 3).

Overall, maintenance cost for Information Systems totals EUR 117 million over the full appraisal period (see Table 4-37). As for initial investment costs, maintenance costs sharply increase after the completion of Scenario 1, at EUR 3 million per annum (i.e. Scenarios 0 and 1 together).

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
TOS Admin	€90,000	€70,000	€30,000	€30,000	€230,000
Ship Planning	€100,000	€80,000	€40,000	€40,000	€260,000
Appointment System	€70,000	€30,000	-	-	€100,000
Roster Control	€30,000	€30,000	€10,000	€10,000	€80,000
Autotest Environment	€30,000	€30,000	-	-	€70,000
Rail Planning	€120,000	€30,000	-	-	€150,000
Barge Planning and Auto Stow	-	€180,000	-	-	€180,000
Terminal Control System (TCS)	€840,000	€1,180,000	-	-	€840,000
Interfaces	-	-	-	-	-
Total IT Systems Maintenance Cost	**€1,290,000**	**€1,620,000**	**€90,000**	**€90,000**	**€3,090,000**

Table 4-36 Annual Maintenance Provision for Information System by Scenario

	Total Undiscounted Costs	Total Discounted Cost
Scenario 0	€51,720,000	€23,790,000
Scenario 1 (incremental)	€60,090,000	€25,420,000
Scenario 2 (incremental)	€2,900,000	€1,130,000
Scenario 3 (incremental)	€2,730,000	€1,010,000
TOTAL FULL BUILD (Scenarios 0,1,2,3)	**€117,450,000**	**€51,350,000**

Table 4-37 Total Information System Maintenance over Appraisal Period (EUR, undiscounted)

Information Systems Total Lifecycle Costs

Table 4-38 and Table 4-39 present total lifecycle costs for Information Systems by Scenario. It can be observed that 95% of the lifecycle cost is incurred in Scenarios 0 and 1 combined, with EUR 144 million (undiscounted) / EUR 77 million (discounted prices) estimated for both scenarios combined.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Total Initial	€15,430,000	€16,500,000	€590,000	€590,000	€33,110,000
Total Maintenance	€51,720,000	€60,090,000	€2,900,000	€2,730,000	€117,450,000
Total IT Systems Cost	**€67,150,000**	**€76,590,000**	**€3,490,000**	**€3,320,000**	**€150,550,000**

Table 4-38 Total Lifecycle Costs for Information System by Scenario (EUR, undiscounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Total Initial	€14,140,000	€13,250,000	€420,000	€390,000	€28,200,000
Total Maintenance	€23,790,000	€25,420,000	€1,130,000	€1,010,000	€51,350,000
Total IT Systems Cost	**€37,930,000**	**€38,670,000**	**€1,550,000**	**€1,400,000**	**€79,550,000**

Table 4-39 Total Lifecycle Costs for Information System by Scenario (EUR, discounted)

Capital Expenditure Summary

Table 4-40 and Table 4-41 summarize total lifecycle capital expenditure over the appraisal period (in undiscounted and discounted terms) split by main capital expenditure.

The cost figures reflect the purchase of a fleet of **mama and barge E+** vessels capable of handling the peak traffic scenario described in the previous section.

As agreed with the Venice Port Authority, a discount rate of 4.5% has been applied to reflect the present value of the capital spend.

Table 4-40 and Table 4-41 reflect the Base Capital Cost and *exclude* provisions for capital contingencies.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
CIVILS					
Monte/Syndial Terminal	€235,950,000	€142,360,000	-	-	€378,310,000
Offshore Terminal	-	€764,350,000	€242,630,000	€242,630,000	€1,249,610,000
Civil Maintenance Provision	€46,010,000	€163,210,000	€40,640,000	€38,210,000	€288,070,000
Total Civils Cost	**€281,960,000**	**€1,069,910,000**	**€283,270,000**	**€280,850,000**	**€1,916,000,000**
CAPITAL EQUIPMENTS, INFORMATION SYSTEMS & OFFSHORE POWER STATION					
(a) Information Systems					
Information Systems (Initials)	€15,430,000	€16,500,000	€590,000	€590,000	€33,110,000
Information Systems Maintenance	€51,720,000	€60,090,000	€2,900,000	€2,730,000	€117,450,000
Total Information Systems	**€67,150,000**	**€76,590,000**	**€3,490,000**	**€3,320,000**	**€150,550,000**
(b) Capital Equipments					
Capital Equipment (Initials & Replacement)	€110,180,000	€1,811,590,000	€380,950,000	€295,480,000	€2,598,190,000
Provision for maintenance	€33,260,000	€494,050,000	€113,780,000	€98,410,000	€739,500,000
Total Capital Equipments (Initials & Replacements)	**€143,440,000**	**€2,305,640,000**	**€494,730,000**	**€393,890,000**	**€3,337,690,000**
(c) Offshore Power Station (Initials)	-	€15,790,000	€15,790,000	€21,050,000	€52,630,000
TOTAL EQUIPMENT, INFORMATION SYSTEMS & OFFSHORE POWER STATION COST	**€210,590,000**	**€2,398,020,000**	**€514,010,000**	**€418,260,000**	**€3,540,870,000**

Table 4-40 Summary of lifecycle Capital Expenditure (EUR, undiscounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
VESSEL FLEET					
(a) Barges					
Cost of barges (Initials & Replacement)	-	€67,500,000	€11,250,000	€45,000,000	€123,750,000
Provision for barge maintenance	-	€28,690,000	€4,500,000	€16,880,000	€50,060,000
Total barge cost	**-**	**€96,190,000**	**€15,750,000**	**€61,880,000**	**€173,810,000**
(b) Mama Vessels					
Cost of mama vessels (Initials & Replacement)	-	€146,000,000	€36,500,000	€73,000,000	€255,500,000
Provision for mama vessel maintenance	-	€49,640,000	€11,680,000	€21,900,000	€83,220,000
Total mama vessel cost	**-**	**€195,640,000**	**€48,180,000**	**€94,900,000**	**€338,720,000**
(c) Tugs					
Cost of tug vessels (Initials & Replacement)	-	€23,460,000	€5,860,000	-	€29,320,000
Provision for tug maintenance	-	€7,980,000	€1,880,000	-	€9,850,000
Total tug vessel cost	-	€31,430,000	€7,740,000	-	€39,170,000
TOTAL VESSEL FLEET COST	**-**	**€323,260,000**	**€71,670,000**	**€156,780,000**	**€551,700,000**
TOTAL CAPITAL EXPENDITURE	**€492,550,000**	**€3,791,190,000**	**€868,950,000**	**€855,890,000**	**€6,008,570,000**

Table 4-40 Summary of lifecycle Capital Expenditure (EUR, undiscounted) (continued)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
CIVILS					
Monte/Syndial Terminal	€216,210,000	€114,310,000	-	-	€330,520,000
Offshore Terminal	-	€613,750,000	€174,450,000	€159,750,000	€947,950,000
Civil Maintenance Provision	€20,600,000	€67,210,000	€15,620,000	€13,910,000	€117,350,000
Total Civils Cost	**€236,810,000**	**€795,270,000**	**€190,070,000**	**€173,670,000**	**€1,395,820,000**
CAPITAL EQUIPMENTS, INFORMATION SYSTEMS & OFFSHORE POWER STATION					
(a) Information Systems					
Information Systems (Initials)	€14,140,000	€13,250,000	€420,000	€390,000	€28,200,000
Information Systems Maintenance	€23,790,000	€25,420,000	€1,130,000	€1,010,000	€51,350,000
Total Information Systems	**€37,930,000**	**€38,670,000**	**€1,550,000**	**€1,400,000**	**€79,550,000**
(b) Capital Equipments					
Capital Equipment (Initials & Replacement)	€73,310,000	€954,960,000	€200,240,000	€154,280,000	€1,382,780,000
Provision for maintenance	€14,990,000	€205,570,000	€45,110,000	€35,920,000	€301,590,000
Total Capital Equipments (Initials & Replacements)	**€88,300,000**	**€1,160,530,000**	**€245,350,000**	**€190,200,000**	**€1,684,370,000**
(c) Offshore Power Station (Initials)	-	€12,680,000	€11,350,000	€13,860,000	€39,170,000
TOTAL EQUIPMENT, INFORMATION SYSTEMS & OFFSHORE POWER STATION COST	**€126,230,000**	**€1,211,880,000**	**€258,260,000**	**€205,460,000**	**€1,803,090,000**

Table 4-41 Summary of Capital Expenditure (EUR, discounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
VESSEL FLEET					
(a) Barges					
Cost of barges (Initials & Replacement)	-	€36,200,000	€5,520,000	€20,240,000	€61,960,000
Provision for barge maintenance	-	€11,170,000	€1,660,000	€5,900,000	€18,730,000
Total barge cost	-	**€47,370,000**	**€7,190,000**	**€26,140,000**	**€80,700,000**
(b) Mama Vessels					
Cost of mama vessels (Initials & Replacement)	-	€73,900,000	€16,920,000	€30,990,000	€121,810,000
Provision for mama vessel maintenance	-	€19,340,000	€4,310,000	€7,660,000	€31,300,000
Total mama vessel cost	-	**€93,240,000**	**€21,230,000**	**€38,640,000**	**€153,110,000**
(c) Tugs					
Cost of tug vessels (Initials & Replacement)	-	€11,870,000	€2,720,000	-	€14,590,000
Provision for tug maintenance	-	€3,110,000	€690,000	-	€3,800,000
Total tug vessel cost	-	**€14,980,000**	**€3,410,000**	-	**€18,390,000**
TOTAL VESSEL FLEET COST	-	**€155,590,000**	**€31,820,000**	**€64,780,000**	**€252,200,000**
TOTAL CAPITAL EXPENDITURE	**€363,040,000**	**€2,162,740,000**	**€480,160,000**	**€443,910,000**	**€3,451,110,000**

Table 4-41 Summary of Capital Expenditure (EUR, discounted) (continued)

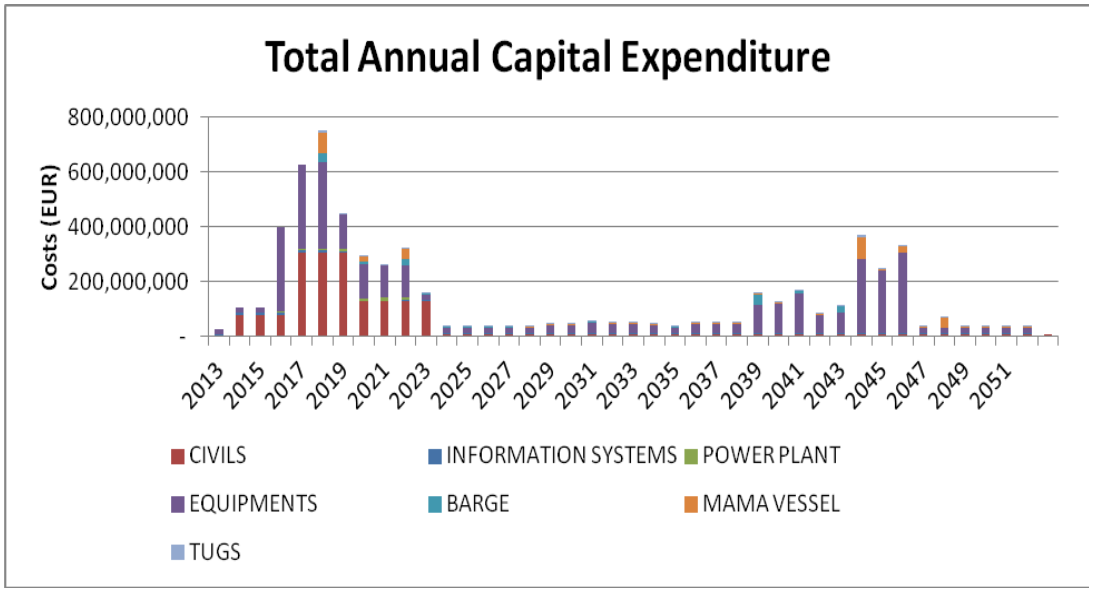

Figure 4-8 Total Annual Capital Expenditure (EUR, undiscounted)

Total lifecycle capital expenditure during the 40 year appraisal period equates to EUR 6,009 million (or EUR 3,451 million discounted). This includes asset replacement and maintenance costs for the provision of the equipments required for the operation of the full logistic solution. Through regular maintenance, it has been assumed that the site development and civil works (infrastructure and structures) will not require major replacements.

As illustrated in Figure 4-8, the largest proportion of capital spend (approx. 48% of total lifecycle capital cost) occurs in Years 4, 5 and 6 (i.e. Scenario 1) and corresponds to the construction and provision of equipments for the offshore terminal and the expansion at Monte/Syndial terminal.

A subsequent peak in capital spend occurs in Year 6, due primarily to the purchase of the vessel fleet.

Asset replacement and maintenance expenditure from the first year of full operation (Year 10) are relatively stable over the appraisal period, apart from Years 32 to 34 (2044 – 2046)

where capital renewal provisions for the replacement of the steel frame for crane installations acquired under Scenario 1 and the barges and mama vessels are required.

Figure 4-9 which presents the split of (discounted) capital costs between the main cost categories. Capital equipments account for the largest proportion of capital investment expenditure, at 49% of total project capital expenditure, and estimated at EUR 1,684 million (i.e. total includes the cost of equipment replacement and maintenance over the appraisal period).

Site development and civil works, estimated at EUR 1,396 million, and mama vessels, estimated at EUR 153 million, represent respectively the second and third largest investment categories. Together these three cost groups represents over 94% of total cumulative capital spend over the appraisal period.

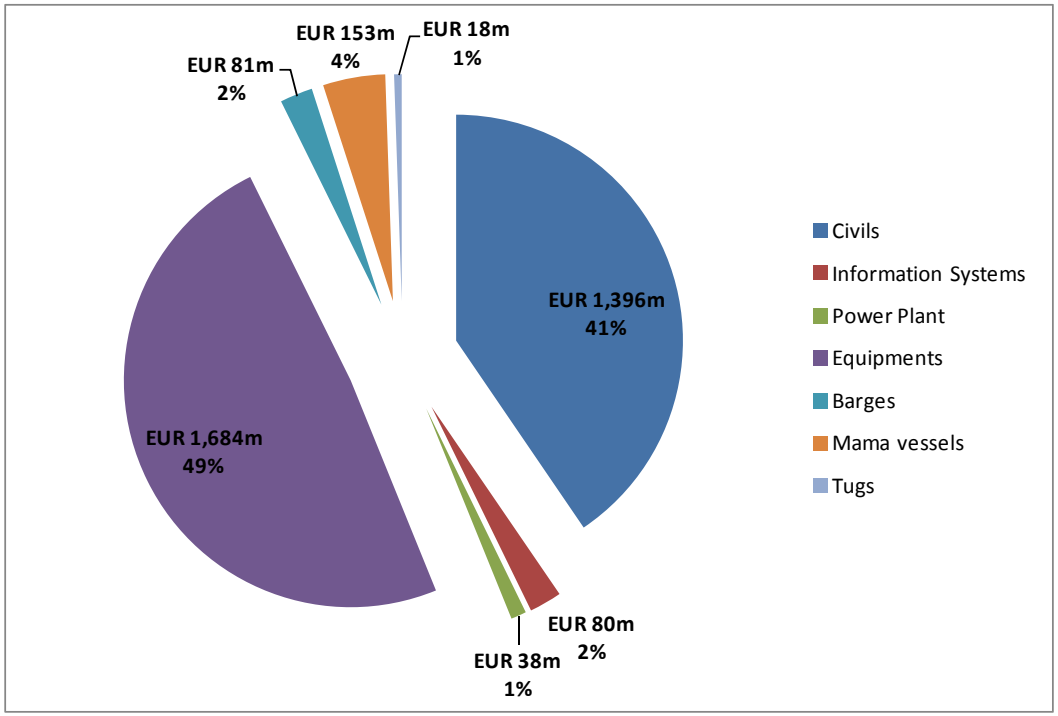

Figure 4-9 Total Discounted Capital Expenditure by Cost Category (EUR, percent)

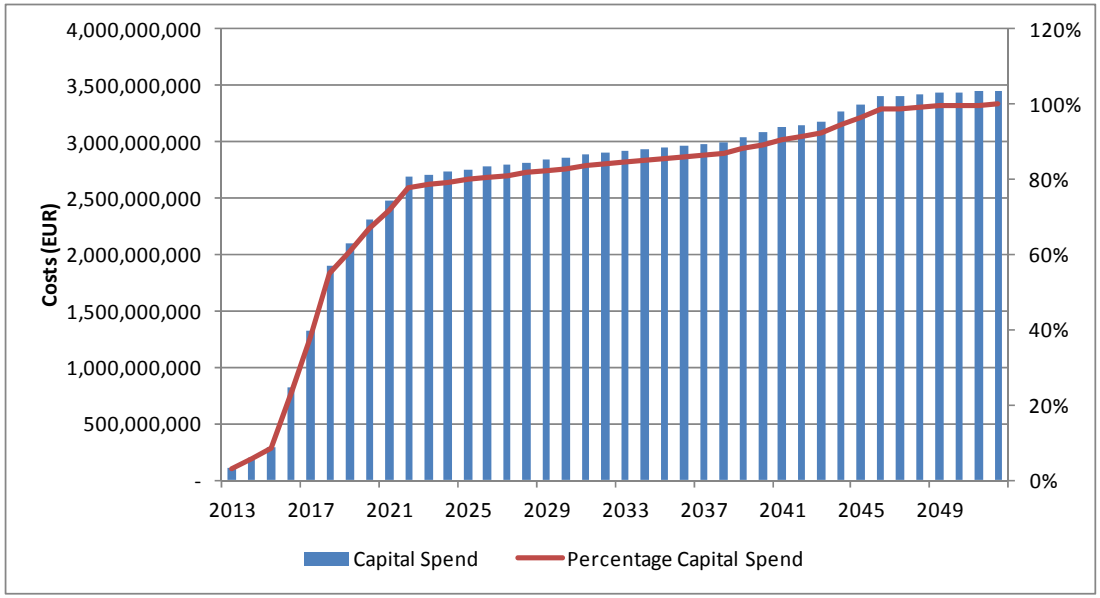

Figure 4-10 Cumulative Capital Expenditure (EUR, discounted)

Figure 4-10 which presents the cumulative capital expenditure over the appraisal period illustrates that almost 58% of total capital expenditure is spent by the completion of Scenario 3. This reflects a high level of upfront capital costs.

5. OPERATING COSTS

The following chapter provide details of the operating expenditures considered for the proposed logistic arrangement at the Monte/Syndial and offshore terminals, and the waterway transfer solution between the two terminals in line with scope element A8, A10 and A11.

Operating costs on the following elements have been analysed in this report:

- Land rent;
- Staffing / labour provision;
- Specialist subcontracted maintenance;
- Mechanical & Electrical (M&E); and
- Fuel consumption.

The methodology employed to estimate operating expenditure assumes that there are sufficient resourcing (i.e. labour, fuel and power) capacity to facilitate at a minimum the average throughput levels envisaged at the onshore and offshore terminals. Operating costs in peak periods are expected to increase reflecting the need to deploy additional resources to maintain the efficiency of the proposed logistic solution.

Land Rent

It is assumed that the Monte/Syndial site identified for development will be rented to the project developer for a annual fee. In line with a request by VPA an annual rental fee of EUR 7 million was utilised as an operating cost.

Labour

This section provides details on:

- The assumptions used to estimate labour costs;
- The staffing requirements to operate and maintain the deep water and Monte/Syndial terminals, the voyage between these two terminals, and all associated

lifting and handling activities at the terminals; and

- The breakdown of labour costs per scenario.

Labour costs associated with vessel operations to/from Chioggia & Levante and all lifting and handling activities at these terminals are ***not included*** in this study.

Hourly costs rates have been estimated based on similar operations and personnel grades in other Italian ports. The hourly cost rates presented below are inclusive of:

- Employer's labour taxes, i.e. all employer's social contributions;
- Night shift premiums for operators on the offshore and onshore platforms;
- Overtime work required for the operation of the two platforms;
- Contingencies for wages and number of hours worked; and
- Premiums for staff working offshore.

The general management team is assumed to be based onshore, as well as most yard, ship and berth planning tasks.

Table 5-1 presents the hourly cost rate for each staff grade (and annual salary for General Management) at the offshore and onshore terminals.

All labour activities are assumed to be carried out by employees of the operator of the terminal. In practice, activities such as lashing may be subcontracted to an external provider and as a result the labour costs related to this activity may be lowered through negotiations.

Grade	Onshore	Offshore
General Management		
General Manager	€310,000 per annum	
Sales and Marketing Manager	€118,000 per annum	
Head of Health, Safety and Security	€137,000 per annum	
Finance Manager	€150,000 per annum	
HR Manager	€215,000 per annum	
Accounts Manager	€137,000 per annum	
IT		
IT Manager	€134,000 per annum	
IT Staff	€28	€28
Marine Operations		
Marine Manager	-	€40
Mama Vessel Crew/Clerks	-	€24
Tug Crew	€33	€33
Operations		
Operations Director	€190,000 per annum	
Operations Manager	€55	€61
Berth Supervision	€40	€44
Planning Manager	€40	
Lashing		€43
Barge Berth Supervisor	€37	

Table 5-1 Staff Grades and Hourly Cost Rates (EUR)

Grade	Onshore	Offshore
Control Manager	€30	€37
Control Staff	€33	
Control Barges/Planning		€39
Crane Drivers / Barge Cranes	€28	€29
Checker/Deckmen/Lashing/Tractor/Reachstacker/Straddle	€26	€27
RTG	€27	
Bridge Crane Operator	€28	
Multi-trailer	€25	
Yard Supervisor	€30	
Yard Staff	€26	
Rail Staff	€26	
Health & Safety		
Safety/Security/Paramedics	€26	€28
Catering		
Catering Manager		€23
Accommodation/Catering Staff		€22
Maintenance		
Maintenance Manager	€87	
Maintenance Supervision		€36
Maintenance Foreman	€31	€31

Table 5-1 Staff Grades and Hourly Cost Rates (EUR) (continued)

Grade	Onshore	Offshore
Maintenance Technicians (Mechanical/Electrical/Electronic)	€28	€28
Maintenance Clericals/Stores	€23	€21
Planning		
Berth Planning Head/Gate Supervisor/Ship Planning Head/Yard Planning Head	€37	
Berth Planning Staff/Ship Planners/Yard Planners	€33	
Gate Clerks/Ship Planning Clerks	€24	
Power Plant		
Plant Manager		€40
Operator		€29
Assistant Operator		€27
Technician		€28
Mate		€21

Table 5-1 Staff Grades and Hourly Cost Rates (EUR) (continued)

Contracted worked hours and the number of staff required for the operational activities are based on the following assumptions:

- Terminals and barge transfers are operated on a basis of 24 hours per day, 363 days per year, with no operation on Christmas day and January 1st.
- At the offshore platform, operators work on the basis of 5-day periods with 12 hours per shift patterns. Staff numbers account for two squads working offshore whilst two squads are resting onshore, with provisions for extra staff in order to cover breaks during the 12-hour shifts.
- Onshore operations are based on 6-hour shifts with four teams for each type of activity in order to cover operations on a 24-hour basis.
- Each squad includes an extra headcount allowance to cover annual leave, any other absence (e.g. sickness) and provide sufficient rest days between shifts.
- A rest factor is also assumed in the labour estimates to reflect compliance with the EU Working Time Directive.

Staffing arrangements are respectful of EU and Italian labour legislation. Working agreements are assumed to be flexible.

Type of Activity / Staff Group	Staffing Requirement (Man-equivalent)
General Management	1 General Manager, 3 Admin Staff, 1 Sales and Marketing Manager, 5 Sales and Marketing Staff, 1 H&S and Security, 1 Finance Manager, 14 Finance Staff, 1 HR Manager, 24 HR Staff, 1 Management Accountant, 7 Accounts Staff
Operations Management, Marine & Supporting Staff	1 Operations Director, 1 IT Manager, 1 Marine Manager, 3 Marine Clerks, 6 IT Staff onshore / 4 offshore, 24 H&S onshore / 10 offshore
Onshore – Supervision	1 Onshore Operations Director, 11 Berth Supv, 5 Yard Supervisors, 1 Planning Manager
Onshore - Quay Operations	16 Crane Drivers, 16 Checkers, 16 Deckmen, 49 Lashing Staff, 65 Tractor drivers
Onshore - Control and Planning	1 Control Room Head, 11 Controllers, 1 Berth Planing Head, 3 Berth Planning, 1 Ship Planning Head, 15 Ship Planners, 8 Ship Planning Clerk, 1 Yard Planning Head, 5 Yard Planners, 1 Gate Supervisor, 31 Gate Clerks
Onshore - Yard / Rail	60 Yard Staff, 54 RTG staff, 63 Rail Staff
Onshore - Barge Berth	5 Barge Berth Supervisors, 30 Bridge Crane Operators, 22 Multi-Trailer Staff
Onshore – Maintenance	1 Maintenance Manager, 5 Maint Foreman, 24 Mechanical, 11 Electrical, 5 Electronic, 3 Stores, 3 Claricals
Offshore - Operation Superv & Supporting Staff	2 Offshore Terminal Managers, 19 Berth Supv, 5 Lashing Staff, 5 Controllers, 5 Stores, 5 Clerical, 2 Paramed
Offshore – Operations	15 Control Planning, 10 Control Barges, 82 Crane Drivers, 48 Barge Cranes, 165 Checkers/Deckmen, 97 Lashing Staff, 10 Barge controllers, 10 Tractor Drivers, 5 Reachstacker, 10 Straddle
Offshore – Maintenance	2 Maintenance Supervisors, 10 Maintenance Foreman, 48 Mechanical, 48 Electrical, 15 Electronic
Offshore – Catering	2 Catering Managers, 19 Accommodation (Cleaning, etc.), 24 Catering Staff
Offshore – Power Plant	1 Plant Manager, 4 Operators, 4 Assistant Operators, 2 Mechanicals, 2 Electricals
Tug Crew	16 onshore, 29 offshore
Waterway Transfer	141 mama vessels crew

Table 5-2 Staff Numbers by Type of Activity for Scenario 3 (man-equivalent)

Table 5-2 provides a summary of the number of staff required for the efficient operation of Scenario 3. Further information on staffing levels is detailed in Chapter 11 of Volume 1 Report.

In allocating staff numbers to the different tasks, it has been assumed that maintenance activities are split equally between ship-to-shore and barge operations. Some of the capital equipment is assumed to be fully or partly automated and only requires a limited number of operators. This includes:

- Mini straddle carrier operations;
- Barge cranes (partially automated);
- Bridge cranes (partially automated).

Labour Costs

The methodology used to estimate labour costs is based on there being a sufficient sized workforce to facilitate average throughput at the Monte/Syndial and offshore terminals. During peak periods, some labour cost such as the staffing of the mama vessels are expected to increase to help maintain efficiency in the waterway transfer system.

Table 5-3 presents the estimated incremental and total annual labour costs at each Scenario. Examining Table 5-3, it can be observed that labour costs increase significantly between Scenario 0 and Scenario 1. This cost increase reflects the first phase development of the offshore terminal and therefore additional staffing is required to facilitate the operation at the offshore terminal, the waterway transfer system, and also increased capacity at Monte/Syndial to accommodate the new traffic volumes.

Further staffing needs (and thus costs) for Scenario 2 and 3 reflect additional operators and maintenance staffs at the offshore terminal and the employment of extra crew members to handle the additional vessels acquired for the waterway transfer system.

Over the appraisal period, labour costs are estimated to total EUR 2,916 million (or EUR 1,187 million in discounted terms). In comparison with other operating costs, labour costs represent 62% of total operating expenditure and is the largest single operating expenditure for the development.

	Incremental Annual Labour Costs	Total Annual Labour Cost
Scenario 0	€28,450,000	€28,450,000
Scenario 1	€36,700,000	€65,150,000
Scenario 2	€8,420,000	€73,570,000
Scenario 3	€8,780,000	€82,350,000

Table 5-3 Annual Labour Costs, by Scenario (EUR, undiscounted)

	Total Undiscounted Lifecycle Costs	Total Lifecycle Discounted Costs
Scenario 0	€1,081,280,000	€470,330,000
Scenario 1	€1,284,360,000	€514,170,000
Scenario 2	€277,740,000	€105,280,000
Scenario 3	€272,330,000	€97,800,000
Total Labour Costs	**€2,915,710,000**	**€1,187,580,000**

Table 5-4 Total Lifecycle Labour Costs (EUR)

Scenario	Increment Annual Cost	Total Annual Cost
Scenario 0	€2,400,000	€2,400,000
Scenario 1	€3,000,000	€5,400,000
Scenario 2	€3,000,000	€8,400,000
Scenario 3	€3,000,000	€11,400,000

Table 5-5 Annual Cost of Specialised Subcontracted Maintenance (EUR, undiscounted)

Scenario	Total Lifecycle Cost	Total Lifecycle Discounted Cost
Scenario 0	€91,200,000	€39,669,400
Scenario 1	€105,000,000	€42,034,823
Scenario 2	€99,000,000	€37,526,650
Scenario 3	€93,000,000	€33,398,382
Total Subcontracted Maintenance	**€388,200,000**	**€152,629,255**

Table 5-6 Total Lifecycle Cost of Subcontracted Maintenance (EUR)

Specialised subcontracted maintenance

In addition to the provision of maintenance for capital items and a small unit of maintenance workforce, it is assumed that there will need to be a provision for specialised subcontracted maintenance at both terminals.

This cost provision reflects the consumables spares and materials required for breakdown works, preventive maintenance and overhauling of equipments identified in the previous section.

Based on comparable benchmarked figures in other Italian ports, specialised subcontracted maintenance has been included as a variable cost that varies with the number of TEUs handled. An onshore variable rate of EUR 4 per TEU and a offshore rate of EUR 3 per TEU has been assumed respectively.

The maintenance rate assumed for onshore relates to direct-call traffic to the onshore Monte/Syndial terminal whereas the offshore rate relates to container throughput handled via the offshore terminal.

Table 5-5 provides an estimate of the cost of specialised subcontracted maintenance on an annual incremental basis. In Scenario 0, provision for specialised subcontracted maintenance totals EUR 2 million per annum reflecting solely the direct-called container trade to the onshore terminal at Monte/Syndial. As the offshore terminal is developed over Scenario 1, 2 and 3, this cost provision increases by EUR 3 million per annum to account for the offshore container trade.

It is estimated that at full operation of Scenario 3, the provision for specialised subcontracted maintenance will total EUR 11 million per annum.

Specialised subcontracted maintenance is estimated to reach EUR 388 million (or EUR 153 million in discounted terms) over the appraisal period, which represents 8% of total operating cost in the period.

Mechanical and Electrical (M&E)

Mechanical and Electrical (M&E) consumption and costs have been estimated for key capital items such as quay cranes, bridge cranes, reefers and buildings. Calculation of annual M&E costs is based on the estimated power consumption for each item, number of items, operational period and the unit cost of electricity.

Table 5-7 presents the power consumption (in kW) assumptions for each of the key capital items.

Power consumption figures for cranes are based on a 'per lift' basis and therefore total power consumption is estimated based on the power consumed per lift multiplied by the number of lifts which is in turn directly relates to the terminal throughput.

In the case of reefers, these are assumed to run only 50% of the time.

Power consumption (in kWh) for each equipment type is then multiplied by the number of units identified in each Scenario to arrive at the annul power demand.

Table 5-8 below provides the number of quay and bridge cranes, reefer units and building area used to assess the total power cost. Table 5-8 reflects the required equipment and building needs across both the offshore and onshore terminals.

Equipment	Power Consumption per lift/area
Quay Crane	16kW
Bridge Crane	4kW
Reefer	10kW
Building	0.45kW

Table 5-7 Power Consumption by Capital Equipments (per Lift/area)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Quay Crane	4	7	5	6	22
Bridge Crane	0	80	16	12	108
Reefers	38,400	102,400	166,400	230,400	537,600
Buildings (Area)	0	9,806	1,652	0	11,458

Table 5-8 Equipment Consuming Electricity (EUR, undiscounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Quay Crane	€900,000	€1,490,000	€1,490,000	€1,490,000	€5,370,000
Bridge Crane	€0	€2,390,000	€1,490,000	€1,490,000	€5,370,000
Reefer	€0	€30,000	€30,000	€30,000	€110,000
Building	€0	€5,380,000	€910,000	€0	€6,290,000
Total Annual Costs	€900,000	€9,290,000	€3,920,000	€3,010,000	€17,140,000

Table 5-9 Annual M&E Costs (EUR, undiscounted)

	Total Lifecycle Cost	Total Lifecycle Discounted Cost
Scenario 0	€34,710,000	€15,100,000
Scenario 1	€325,130,000	€130,160,000
Scenario 2	€129,390,000	€49,050,000
Scenario 3	€93,460,000	€33,560,000
Total M&E Costs	**€582,690,000**	**€227,870,000**

Table 5-10 Total Lifecycle M&E Cost (EUR)

As indicated previously, it is assumed that both the offshore and onshore terminals operate 363 days a year and 24 hours per day.

Unit cost for power has been estimated based on similar container ports at EUR 0.14 per kWh.

Based on the above assumptions, Table 5-10 presents the annual M&E cost by type of equipment and for each Scenario. Table 5-11 presents M&E consumption costs over the appraisal period. Mechanical and electrical cost amount to EUR 582 million (or EUR 228 million in discounted terms) and represent approximately 12% of the total operating costs for the appraisal period.

Fuel Consumption

Fuel consumption costs have been calculated for the fleet of tug and mama vessels, as the barges for this operation are non-motorised vessels.

Mama vessels

The estimation of fuel consumption for mama vessels has been based on the following assumptions:

- Estimated fuel consumption of 0.28 litres per second during vessel operation at high-speeds (i.e. 14 knots or higher). If the transit speeds are reduced, fuel savings of up to 25% could be achieved[10].
- Vessels are operating 85% of time at speeds of less than 10knots. This is reflecting the slower transit speed as the Mama vessels travels in the lagoon vicinity where there is a speed restriction in force and during loading/unloading at terminal berths.
- Cost of diesel is EUR 0.8 per litre, based on existing contracted rates to the Port Authority
- A vessel capacity of 432 TEU for mama vessel type E+ as indicated in the operational simulation (see Technical Report)
- Average estimated operating time for the waterway transfer between the offshore terminal and land terminal – as indicated in Table 5-11

Fuel costs are derived based on the cost of operating a fully loaded vessel from the offshore terminal to the onshore terminal. Based on this implied vessel running cost, a unitary 'fuel cost per TEU' is computed. Annual fuel cost is estimated based on this unitary average multiplied by the annual traffic throughput.

[10] Assuming that the operational profile permits

	Scenario 1	Scenario 2	Scenario 3
Mama Vessel	152	152	152

[1] The average transit time reflects a single jouney from from offshore to the inland terminal.

Table 5-11 Average Transit Time for waterway transfer by Mama Vessel (minutes)[1]

	Fuel cost per TEU (EUR)
High-speeds	€4.69
Low-speeds	€3.52

Table 5-14 Fuel Cost per TEU (incremental) (EUR)

	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
Fuel Cost	€2,960,000	€4,060,000	€6,650,000	€13,670,000

Table 5-12 Annual Fuel Cost per Scenario (EUR, undiscounted)

	Total Lifecycle Cost	Total Discounted Lifecycle Cost
Scenario 1	€103,440,000	€41,410,000
Scenario 2	€134,110,000	€50,830,000
Scenario 3	€206,150,000	€74,030,000
Mama vessel fuel costs	**€443,700,000**	**€166,280,000**

Table 5-13 Total Fuel Lifecycle Costs for Mama Vessels (EUR, undiscounted)

Average fuel cost per TEU is derived as follows:

Fuel cost per TEU = Average vessel fuel cost / Vessel carrying capacity

Table 5-14 presents the fuel cost per TEU when the vessel is travelling at high- and low-speeds.

Table 5-12 presents the annual fuel consumption cost for each Scenario using the unit fuel cost per TEU calculated above.

Table 5-13 presents the total lifecycle fuel consumption costs for the fleet of mama vessel in each Scenario. Over the appraisal period, fuel costs for the operation of mama vessels amount to EUR 444 million (or EUR 166 million in discounted terms) and represent approximately 12% of the total operating costs for the appraisal period.

Tug vessels

The estimation of fuel consumption for tug vessels is based on the same methodology as used for Mama vessels. Fuel cost for tugs are based on the following assumptions:

- Estimated fuel consumption of 0.15 litres per second during vessel operation.
- Tug vessels engines are operating 90% of usage time to reflect periods where the vessels are stationary or operating in slow speeds
- Cost of diesel is EUR 0.8 per litre, based on existing contracted rates to the Port Authority
- Average estimated operating time for the transfer between the berth and unloading/loading onto the mama vessel– as indicated in Table 5-15

Table 5-16 presents the total lifecycle fuel consumption costs for the fleet of tug vessels in each Scenario. Total lifeycle cost of fuel for the operation of tugs over the appraisal period is estimated to total EUR 144 million (or EUR 54 million in discounted terms).

Table 5-17 presents lifecycle fuel costs for the fleet of mama and tug vessels over the appraisal period. Fuel costs amount to EUR 588 million (or EUR 220 million in discounted terms) and represent approximately 12% of the total operating costs for the appraisal period.

	Scenario 1	Scenario 2	Scenario 3
Tugs	40	40	40

[1] The average tug usage time from from barge berth to the Mama vessel

Table 5-15 Average Transit Time for waterway transfer by Tug Vessel (minutes)[1]

	Total Lifecycle Cost	Total Discounted Lifecycle Cost
Scenario 1	€33,600,000	€13,450,000
Scenario 2	€43,560,000	€16,510,000
Scenario 3	€66,960,000	€24,050,000
Tug Vessel Fuel Costs	**€144,120,000**	**€54,010,000**

Table 5-16 Total Lifecycle Tug Fuel Cost, by Scenario (EUR)

	Total Lifecycle Cost	Total Lifecycle Discounted Cost
Scenario 1	€137,040,000	€54,860,000
Scenario 2	€177,670,000	€67,350,000
Scenario 3	€273,110,000	€98,080,000
Total Vessel Fleet Fuel Costs	**€587,820,000**	**€220,290,000**

Table 5-17 Total Lifecycle Fuel Cost for Vessel Fleet (Mama and Tugs) (EUR)

Operating Expenditure Summary

Table 5-18 and Table 5-19 present a summary of the total lifecycle operaitng expenditure over the appraisal period in undiscounted and discounted[11] terms respectively.

The figures reflect the purchase of a fleet of **mama and barge E+** vessels capable of handling the peak traffic scenario described in the previous section.

Total lifecycle capital expenditure during the 40 year appraisal period equates to EUR 4,740 million (or EUR 1,901 million discounted). As identified in the operating cost analysis above, Scenarios 0 and 1 jointly accounts for the largest share of operating costs for the project. Together they account for 73% of the total lifecycle operating expenditure.

Figure 5-1 below presents the split of operating costs (discounted) between the main cost categories. Examining operating costs in discounted term, we observe that labour costs account for the largest proportion of the project's operating expenditure, at 62% of total project operating expenditure, and estimated at EUR 1,188 million (discounted) over the period.

[11] Using the agreed discount rate of 4.5%

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
(a) Labour					
Total Labour Cost	€1,081,280,000	€1,284,360,000	€277,740,000	€272,330,000	€2,915,710,000
(b) Specialist Subcontracted Maintenance					
Total Specialist Subcontracted Maintenance Cost	€91,200,000	€105,000,000	€99,000,000	€93,000,000	€388,200,000
(c) Mechanical & Electrical (M&E)					
Total Mechanical & Electrical (M&E) Cost	€34,710,000	€325,130,000	€129,390,000	€93,460,000	€582,690,000
(d) Fuel Consumption					
Total Fuel Consumption Cost	-	€137,040,000	€177,670,000	€273,110,000	€587,820,000
(e) Land Rental Fee					
Total Land Rental Fee	-	€266,400,000	-	-	€266,400,000
TOTAL OPERATING EXPENDITURE	**€1,207,190,000**	**€2,117,930,000**	**€683,800,000**	**€731,900,000**	**€4,740,820,000**

Table 5-18 Summary of Operating Expenditure (EUR, undiscounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
(a) Labour					
Total Labour Cost	€470,330,000	€514,170,000	€105,280,000	€97,800,000	€1,187,580,000
(b) Specialist Subcontracted Maintenance					
Total Specialist Subcontracted Maintenance Cost	€39,670,000	€42,030,000	€37,530,000	€33,400,000	€152,630,000
(c) Mechanical & Electrical (M&E)					
Total Mechanical & Electrical (M&E) Cost	€15,100,000	€130,160,000	€49,050,000	€33,560,000	€227,870,000
(d) Fuel Consumption					
Total Fuel Consumption Cost	-	€54,860,000	€67,350,000	€98,080,000	€220,290,000
(e) Land Rental Fee					
Total Land Rental Fee	-	€112,700,000	-	-	€112,700,000
TOTAL OPERATING EXPENDITURE	**€525,100,000**	**€853,920,000**	**€259,210,000**	**€262,840,000**	**€1,901,070,000**

Table 5-19 Summary of Operating Expenditure (EUR, discounted)

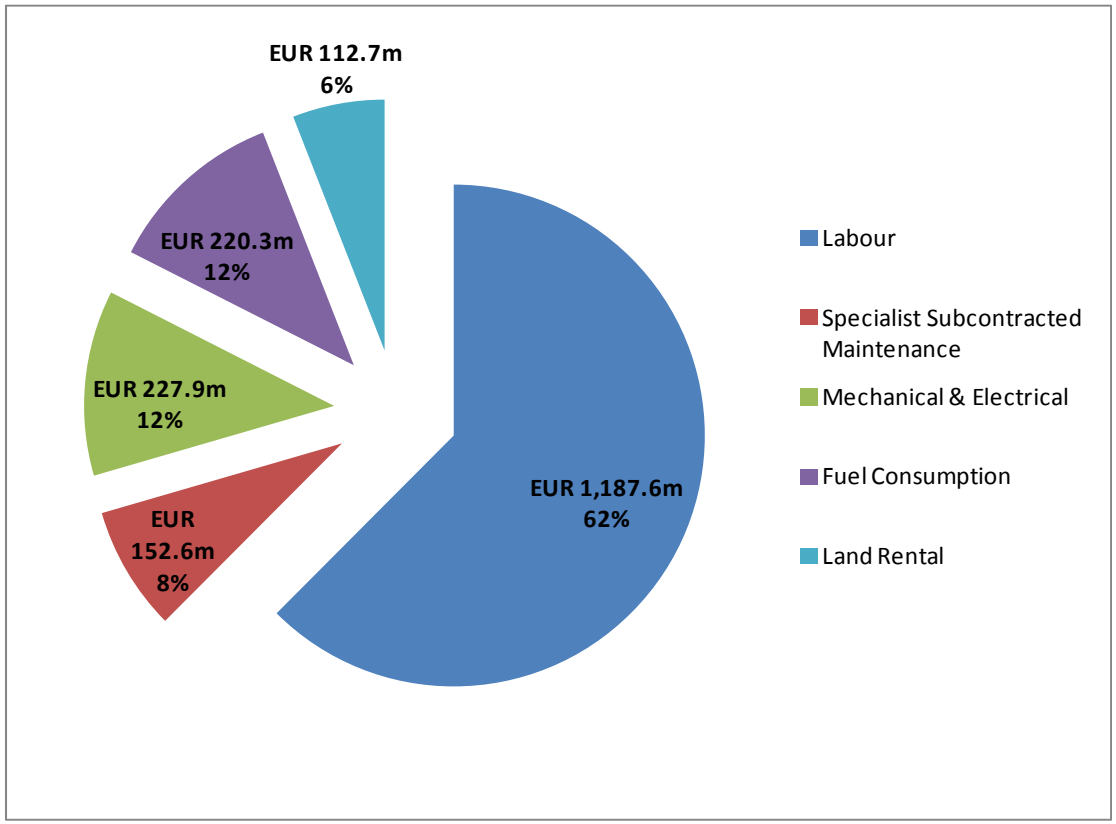

Figure 5-1 Cumulative Capital Expenditure (EUR / Percent, discounted)

Overall Lifecycle Cost Summary

Table 5-20 summarises the overall lifecycle capital and operating costs of the project by Scenario. Overall project cost (i.e. capital and operating) associated with the full terminal developments is estimated to total EUR 12,134 million (or EUR 5,899 million in discounted terms).

With the exception of Scenario 0, it can be observed that capital expenditure in all later Scenarios accounts for the majority share of overall project cost. Capital cost accounts for over 50% of total project cost in Scenarios 1, 2 and 3 reflecting the development of the offshore terminal.

Capital cost as a proportion of overall project costs in Scenario 0 only accounts for 28%. This reflects the lower capital development relating to the Monte/Syndial terminal.

In contrast, total operating cost for Scenario 0 reaches 72% of overall project lifecycle cost reflecting the operational demands and upfront costs associated to the employment of the labour workforce for the respective onshore and offshore terminals.

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
CAPITAL EXPENDITURE (Initials, Replacement, Maintenance):					
Civil	€281,960,000	€1,069,910,000	€283,270,000	€280,850,000	€1,916,000,000
Information Systems	€67,150,000	€76,590,000	€3,490,000	€3,320,000	€150,550,000
Offshore Power Plant	-	€15,790,000	€15,790,000	€21,050,000	€52,630,000
Capital Equipments	€143,430,000	€2,305,630,000	€494,730,000	€393,890,000	€3,337,690,000
Vessel (Mama vessel, Barges & Tugs)	-	€323,260,000	€71,670,000	€156,780,000	€551,700,000
TOTAL CAPITAL EXPENDITURE	**€492,550,000**	**€3,791,180,000**	**€868,950,000**	**€855,890,000**	**€6,008,570,000**
OPERATING EXPENDITURE:					
Labour	€1,081,280,000	€1,284,360,000	€277,740,000	€272,330,000	€2,915,710,000
Specialist Subcontracted Maintenance	€91,200,000	€105,000,000	€99,000,000	€93,000,000	€388,200,000
Mechanical & Electrical	€34,710,000	€325,130,000	€129,390,000	€93,460,000	€582,690,000
Fuel Consumption	-	€137,040,000	€177,670,000	€273,110,000	€587,820,000
Land Rental	-	€266,400,000	-	-	€266,400,000
TOTAL OPERATING EXPENDITURE	**€1,207,190,000**	**€2,117,930,000**	**€683,800,000**	**€731,900,000**	**€4,740,820,000**
OVERALL PROJECT LIFECYCLE COST	**€1,699,740,000**	**€5,909,110,000**	**€1,552,750,000**	**€1,587,790,000**	**€10,749,390,000**

Table 5-20 Summary of Lifecycle Capital and Operating Expenditure (EUR, undiscounted)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
CAPITAL EXPENDITURE (Initials, Replacement, Maintenance):					
Civil	€236,810,000	€795,270,000	€190,070,000	€173,670,000	€1,395,820,000
Information Systems	€37,930,000	€38,670,000	€1,550,000	€1,400,000	€79,550,000
Offshore Power Plant	-	€12,680,000	€11,350,000	€13,860,000	€37,890,000
Capital Equipments	€88,290,000	€1,160,540,000	€245,350,000	€190,200,000	€1,684,370,000
Vessel (Mama vessel, Barges & Tugs)	-	€155,590,000	€31,820,000	€64,780,000	€252,200,000
TOTAL CAPITAL EXPENDITURE	**€363,030,000**	**€2,162,750,000**	**€480,150,000**	**€443,900,000**	**€3,449,830,000**
OPERATING EXPENDITURE:					
Labour	€470,330,000	€514,170,000	€105,280,000	€97,800,000	€1,187,580,000
Specialist Subcontracted Maintenance	€39,670,000	€42,030,000	€37,530,000	€33,400,000	€152,630,000
Mechanical & Electrical	€15,100,000	€130,160,000	€49,050,000	€33,560,000	€227,870,000
Fuel Consumption	-	€54,860,000	€67,350,000	€98,080,000	€220,290,000
Land Rental	-	€112,700,000	-	-	€112,700,000
TOTAL OPERATING EXPENDITURE	**€525,100,000**	**€853,920,000**	**€259,210,000**	**€262,840,000**	**€1,901,070,000**
OVERALL PROJECT LIFECYCLE COST	**€888,130,000**	**€3,016,670,000**	**€739,360,000**	**€706,740,000**	**€5,350,900,000**

Table 5-22 Summary of Lifecycle Capital and Operating Expenditure (EUR, discounted)

6. PROJECT COST BY TRANSFER CYCLE

Introduction

This chapter responds to the scope element A12:

(A12) Evaluation of the costs of the individual operations in the transfer cycle

The proposed logistic solution comprises of three distinct transfer cycles. These are:

- **Transfer cycle 1** ('Offshore Development') – relating to all lifting, handling operations & capital equipment required to enable mainliners to dock at the offshore terminal and also to enable the proposed stack arrangement before discharge onto the barge vessels.

- **Transfer cycle 2** ('Waterway Transfer') - Capital and operational costs for waterway transfer operation to/ from the Monte/Syndial terminal.

- **Transfer cycle 3** ('Monte/Syndial Development') - All lifting/ handling and operations & capital costs at Monte/Syndial to get cargo to/from the barge vessels onto the landside terminal yard and to get cargo to/from the gate (this includes any provisions for intermodal facilities to lift cargo onto trucks & rail).

The following section presents the identified costs in Chapters 4 and 5 by transfer cycles as defined above.

Capital Expenditure by Transfer Cycles

Table 6-1 presents a summary of the total lifecycle capital expenditure over the appraisal period by transfer cycle.

It can be observed that Transfer cycle 1 (i.e. offshore terminal ship and barge interface respectively) constitutes the largest proportion of the project's lifecycle capital spend. This transfer cycle contributes towards 58% of total lifecycle capital expenditure – EUR 3,483 million of a total EUR 6,009 million expenditure (or EUR 2,050 million of EUR 3,450 million discounted).

Transfer cycle 2 (i.e. waterway transfer connection between offshore-inshore terminal) accounts for fraction of the total cost – at 9% of total lifecycle capital expenditure. Transfer cycle 3 (i.e. capital interface between barge vessels onto the land-side terminal yard at Monte/Syndial and to get cargo to/from the gate) including any provisions for intermodal facilities to lift cargo onto trucks & rail) accounts for the remaining 33% of total project capex – EUR 1,974 million (or EUR 1,147 million discounted).

As discussed previously in Chapter 4, capital expenditure is weighted heavily during the initial 10-year development period reflecting the capital build of the (offshore and inshore) terminals according to Scenario 0 to 3.

Moreover, the tables below also re-iterate the capital intensity of the transfer cycles associated with the re-spective terminal developments.

[Figures are in undiscounted terms]	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
CAPITAL EXPENDITURE (Initials, Replacement, Maintenance):					
Transfer Cycle 1 – Offshore Development	-	€1,993,340,000	€793,790,000	€695,790,000	€3,482,920,000
Transfer Cycle 2 – Waterway Transfer	-	€323,260,000	€71,670,000	€156,780,000	€551,700,000
Transfer Cycle 3 – Monte/Syndial Terminal	€492,550,000	€1,474,580,000	€3,490,000	€3,320,000	€1,973,940,000
TOTAL	**€492,550,000**	**€3,791,180,000**	**€868,950,000**	**€855,890,000**	**€6,008,570,000**

[Figures are in discounted terms]	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
CAPITAL EXPENDITURE (Initials, Replacement, Maintenance):					
Transfer Cycle 1 – Offshore Development	-	€1,225,740,000	€446,770,000	€377,730,000	€2,050,240,000
Transfer Cycle 2 – Waterway Transfer	-	€155,590,000	€31,820,000	€64,780,000	€252,200,000
Transfer Cycle 3 – Monte/Syndial Terminal	€363,030,000	€781,420,000	€1,550,000	€1,400,000	€1,147,400,000
TOTAL	**€363,030,000**	**€2,162,750,000**	**€480,150,000**	**€443,900,000**	**€3,449,830,000**

Table 6-1 Lifecycle Capital Cost, by Transfer Cycle and Scenario (EUR)

Operating Expenditure by Transfer Cycles

Table 6-2 presents a summary of the total lifecycle operating expenditure over the appraisal period by transfer cycles.

In contrast to capital expenditure, it is observed that Transfer cycles 3 constitute the largest proportion of the project's lifecycle operating spend. This transfer cycle totals 42% of the project's lifecycle operating expenditure – EUR 1,998 million of the total EUR 4,740 million (or EUR 839 million of EUR 1,901 million discounted).

Transfer cycles 1 (i.e. offshore terminal ship and barge interface respectively) accounts for next highest shares at 36% of total lifecycle operating respectively.

Transfer cycle 2 which relates to the waterway transfer operating accounts for the remaining 22% of total project capex – EUR 1,010 million (or EUR 389 million discounted).

[Figures are in undiscounted terms]	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD [(Scenarios 0,1,2,3)
OPERATING EXPENDITURE:					
Transfer Cycle 1 – Offshore Development	€0	€1,015,440,000	€393,600,000	€324,670,000	€1,733,710,000
Transfer Cycle 2 – Waterway Transfer	€92,080,000	€379,360,000	€197,220,000	€340,920,000	€1,009,580,000
Transfer Cycle 3 – Monte/Syndial Terminal	€1,115,110,000	€723,130,000	€92,980,000	€66,310,000	€1,997,530,000
TOTAL	**€1,207,190,000**	**€2,117,930,000**	**€683,800,000**	**€731,900,000**	**€4,740,820,000**

[Figures are in discounted terms]	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD ((Scenarios 0,1,2,3)
OPERATING EXPENDITURE:					
Transfer Cycle 1 – Offshore Development	€0	€406,510,000	€149,200,000	€116,600,000	€672,310,000
Transfer Cycle 2 – Waterway Transfer	€40,050,000	€151,870,000	€74,760,000	€122,430,000	€389,110,000
Transfer Cycle 3 – Monte/Syndial Terminal	€485,040,000	€295,540,000	€35,250,000	€23,810,000	€839,640,000
TOTAL	**€525,090,000**	**€853,920,000**	**€259,200,000**	**€262,840,000**	**€1,901,060,000**

Table 6-2 Lifecycle Operating Cost, by Transfer Cycle and Scenario (EUR)

Total Project Expenditure by Transfer Cycles

Table 6-3 presents a summary of the total project lifecycle expenditure (for capital and operating expenditure) over the appraisal period by transfer cycles.

Transfer cycle 1 (i.e. the offshore development) constitute the largest proportion of the project's lifecycle spend. Total project expenditure for capital and operating cost in this transfer cycle totals almost 50% of total lifecycle expenditure – EUR 5,217 million of EUR 10,749 million (or EUR 2,773 million of EUR 5,350 million discounted).

Transfer cycle 3 (i.e. the Monte/Syndial terminal development) accounts for next highest share of total project expenditure at 37% of total lifecycle cost respectively.

Using the cost information identified, we are able to present an average cost per unit of container (TEU) handled distinguishing by the transfer cycle and scenario employed.

The advantage of calculating such metric is that it allows VPA to make informed business case appraisal at the end of each Scenario whether continued investment is cost-effective and profitable based on the expected charge per container (TEU) received or to remain at status quo.

Table 6-4 presents the average annual throughput (in TEUs) for each transfer cycle and by Scenario. Employing the cost information from Table 6-3, we derived an average unit cost for a container handled by transfer cycle and Scenario. This is summarised in Table 6-5 below.

Examining Table 6-5, average unit cost for Scenario 0 and 1 have a tendency to be higher relative to later Scenarios (and for all transfer cycles). This is due to upfront investment which has been naturally skewed towards the earlier development phases.

Moreover, the reduction in the average cost per container (TEU) handled is attributable to the growth in throughput thereby providing scale economies for the the capital asset purchased.

It should be noted that average cost per TEU is highly dependent on the capital (and to a lesser extent operating) expenditure profiles. In the case where identified capital expenditure is apportioned over a longer period (greater than the 10-year build assumed) then average cost per TEU is likely to be relatively lower.

[Figures in undiscounted terms]	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3]
TOTAL PROJECT COST (CAPITAL + OPERATING) EXPENDITURE:					
Transfer Cycle 1 – Offshore Development	-	€3,008,780,000	€1,187,390,000	€1,020,460,000	€5,216,630,000
Transfer Cycle 2 – Waterway Transfer	€92,080,000	€702,620,000	€268,890,000	€497,700,000	€1,561,280,000
Transfer Cycle 3 – Monte/Syndial Terminal	€1,607,660,000	€2,197,710,000	€96,470,000	€69,630,000	€3,971,470,000
TOTAL	**€1,699,740,000**	**€5,909,110,000**	**€1,552,750,000**	**€1,587,790,000**	**€10,749,390,000**

[Figures in discounted terms]	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)	TOTAL FULL BUILD (Scenarios 0,1,2,3)
TOTAL PROJECT COST (CAPITAL + OPERATING) EXPENDITURE:					
Transfer Cycle 1 – Offshore Development	-	€1,632,250,000	€595,970,000	€494,330,000	€2,722,550,000
Transfer Cycle 2 – Waterway Transfer	€40,050,000	€307,460,000	€106,580,000	€187,210,000	€641,310,000
Transfer Cycle 3 – Monte/Syndial Terminal	€848,070,000	€1,076,960,000	€36,800,000	€25,210,000	€1,987,040,000
TOTAL	**€888,120,000**	**€3,016,670,000**	**€739,350,000**	**€706,740,000**	**€5,350,890,000**

Table 6-3 Total Project Lifecycle Cost, by Transfer Cycle and Scenario (EUR)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)
TRAFFIC THROUGHPUT, TEU:				
Transfer Cycle 1 – Offshore Development	-	1,000,000	2,000,000	3,000,000
Transfer Cycle 2 – Waterway Transfer	-	800,000	1,100,000	1,800,000
Transfer Cycle 3 – Monte/Syndial Terminal	600,000	1,400,000	1,400,000	1,400,000

Table 6-4 Annual Traffic Throughput, by Transfer Cycle and Scenario (TEU)

	Scenario 0	Scenario 1 (incremental)	Scenario 2 (incremental)	Scenario 3 (incremental)
Average Cost per TEU				
Transfer Cycle 1 – Offshore Development	-	€81	€17	€11
Transfer Cycle 2 – Waterway Transfer	-	€24	€7	€9
Transfer Cycle 3 – Monte/Syndial Terminal	€67	€42	€2	€2
TOTAL	**€69**	**€147**	**€27**	**€21**

Table 6-5 Average Cost of Handling, by Transfer Cycle and Scenario (TEU)