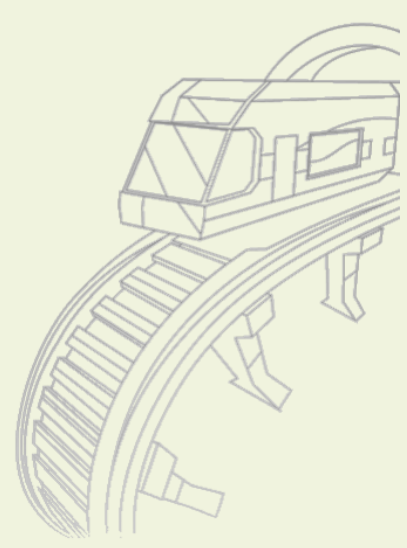


Cold Ironing Implementation at the Port of Piraeus



Key Characteristics

- Data Analysis of Port Traffic
- Technical Implementation of Shore Power Provision Station
- Technical Design of Renewable Power Station
- Investment Appraisal of Project



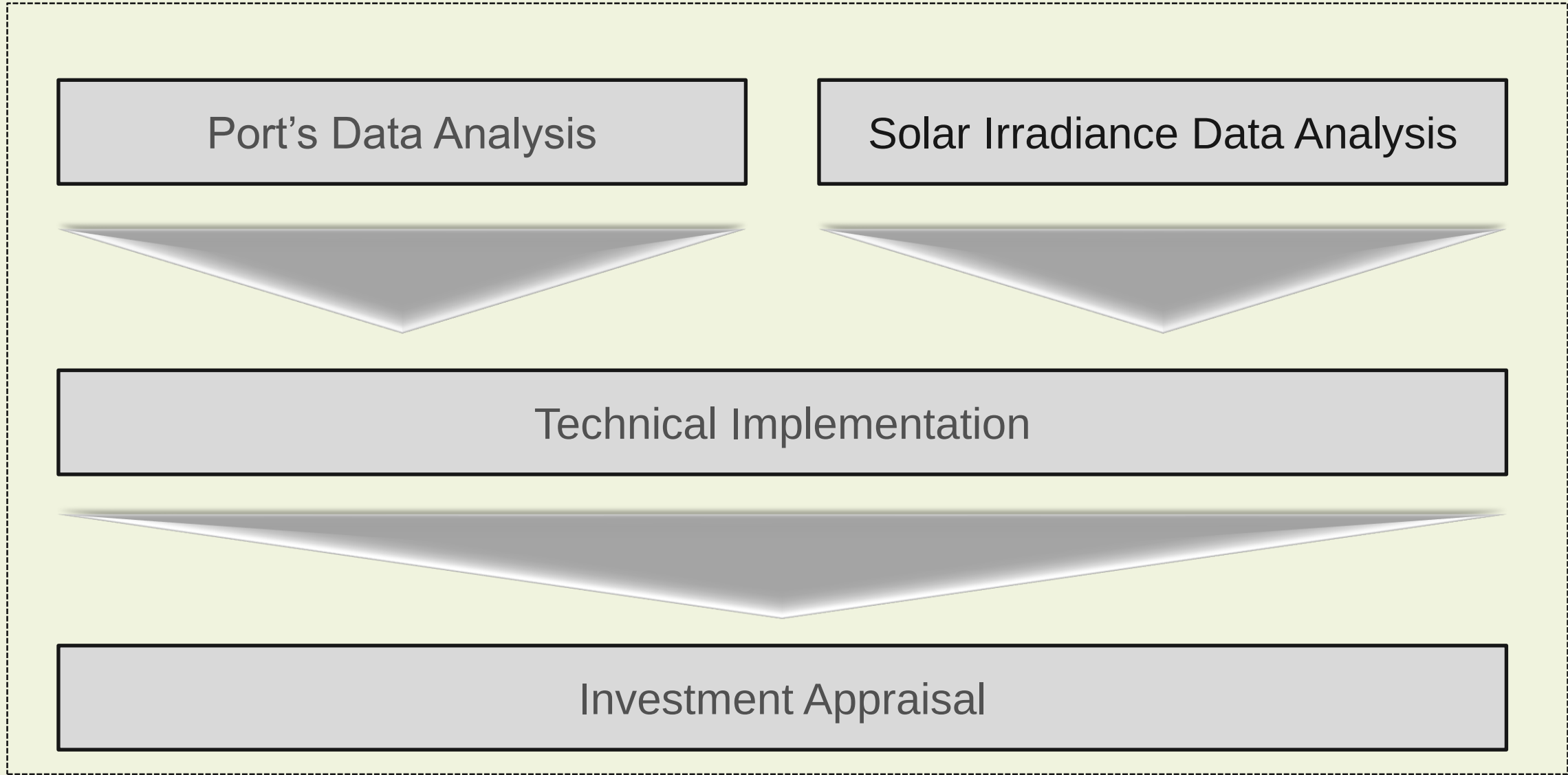
Motivation & Objectives

In recent years, the maritime industry has been constantly attempting to reduce emissions, through the adoption of various new measures and regulations. Undoubtedly, without the measures already adopted, global emissions from shipping would have been significantly higher than what they already are. Nevertheless, more needs to be done to tackle the industry's carbon footprint.

This project will concentrate on cold ironing, a measure that can yield substantial emissions savings of the global fleet. Cold ironing particularly tackles the problem of ship emissions at berth.

A crucial factor that enhances the sustainability of the provision of shore power, is the generation of the power supplied from renewables. Thus, this report evaluates the development of a Photovoltaic power station, while appraising the technical and economic requirements of such project.

Methodology



Results

Power Demand Per Category
By splitting up the vessels into 5 categories, depending on the TEU size, and analysing the power requirements by allocating a sample vessel to each category, the total energy demanded over a 24-hour period was obtained.

Category	Vessel Name	TEUs	Reefers	Number of Ships Per Category over the 24-hour period	Aprox. Hours per category at Port	Total Load (KW) per ship	Total load 24hrs (kWh)
Group 1 (700-1000 TEU)	LIBERTAS-H	724	300	1	12	781	11520
Group 2 (1000-2000 TEU)	VICTORIA L	1304	516	5	68	1267	68000
Group 3 (2000-5000 TEU)	NORDAUTUMN	3586	1000	4	62	2356	111600
Group 4 (5000-10000 TEU)	MAERSK KLEVEN	7403	1406	4	56	3270	168000
Group 5 (10000-22000 TEU)	AL MASHRAB	14993	2000	2	10	4606	41690
Total (kWh)							400810

Table 6: Total Emissions over a 24-hour period

NOx		CO2		SOx	
Group 1	0.17 tonnes	Group 1	6.83 tonnes	Group 1	4.26 kg
Group 2	1.07 tonnes	Group 2	41.86 tonnes	Group 2	26.1 kg
Group 3	1.76 tonnes	Group 3	68.70 tonnes	Group 3	42.8 kg
Group 4	2.63 tonnes	Group 4	102.71 tonnes	Group 4	64.1 kg
Group 5	0.62 tonnes	Group 5	24.19 tonnes	Group 5	15.1 kg
Sum	6.24 tonnes	Sum	244.29 tonnes	Sum	152.4 kg

Emission savings resulted from implementing the cold ironing

Table 7: Realised Emission Savings for 60% of the demand

Emission Species	Emission Savings (tonnes/day)
CO2	146.57
SOx	3.744
NOx	0.09144

Table 12: Payback Period for Cold Ironing Station

Cumulative Cash Flow	
Year 1	€ (25,513,028.00)
Year 2	€ (21,814,382.47)
Year 3	€ (18,115,736.95)
Year 4	€ (14,417,091.42)
Year 5	€ (10,718,445.90)
Year 6	€ (7,019,800.37)
Year 7	€ (3,321,154.85)
Year 8	€ 377,490.68
Payback Period (years)	6.90

Result

Figure 13: Representation of the solar panels placed on location



Research Outlook

For a more accurate appraisal the data regarding the annual traffic of vessels, could be obtained directly from Cosco, rather than using the model that was computed in this report. For a more accurate estimation of the power needs of the vessels data should be extracted directly from the managing company of each vessel over a certain period. Future research could also include solar panels that would track the direction of the sun throughout the day and alter their tilt angle. Finally, an analysis aiming to find a proper discount factor should be done to accurately determine the correct payback period of the project and the return on investment

