



## E-HARBOURS REPORT 6

# A UNIVERSAL ENERGY BASED REMOTE DATA MONITORING STRATEGY FOR HARBOURS

**E-Harbours towards sustainable, clean and energetic  
innovative harbour cities in the North Sea Region**



## ACKNOWLEDGEMENT

This report has been realised with the support and input of many experts. We thank all those who have provided input and contributions and helped to shape the document. We also tanks The Interreg IVB North sea Region Program for supporting this project.

## GLOSSARY

<b>CO<sub>2</sub></b>	Carbon Dioxide Gas	<b>OPEX</b>	Operating Expense
<b>NSR</b>	North Sea Regions	<b>EV</b>	Electric Vehicle
<b>VPP</b>	Virtual Power Plant	<b>RE</b>	Renewable Energy
<b>EU</b>	European Union	<b>CAPEX</b>	Capital Expenditure



## EXECUTIVE SUMMARY

This report has been carried out as part of a pan European project called **E-Harbours, E-Logistics in NSR Harbour Cities**, awarded by the Interreg IVB North Sea Region Programme.

The report describes a novel and first of its kind **universal energy data monitoring strategy for any harbour**. It presents the set of criteria to be used for the effective monitoring of energy consumption in small, medium and large scale harbours. It also supports harbour organisations to quantify their environmental impact within the harbour complex. The outcomes of the infield application of the universal strategy will allow the harbour community to analyse their energy consumption and behaviour. This will in turn lead to the development of new and effective energy management strategies to reduce harbours energy costs and become more competitive, locally, regionally, nationally and internationally.

Of importance, the monitoring strategy takes into account that the use of renewable energy

within a harbour can lead to a potential unbalancing effect with the local electrical grid network, as the generation of renewable energy often does not match the local energy demand. Therefore, the strategy takes into account the concept of smart grid and virtual power plant (VPP), and the need to introduce controllable loads (dumping loads, energy storage loads) that can be switched on and off as and when renewable energy is available, leading to an effective, efficient, clean balancing of the electrical grid.

In summary, the present energy monitoring strategy will support the uptake of renewable energy in a harbour area, by identifying harbours energy needs and simplifying the investment decision making process. This will be achieved through gathering of key harbour data which shall guide the harbour community in reducing their energy outgoings through renewable, hence directly supporting NSR based Government policy to reach local and regional environmental targets.



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## INTRODUCTION

Harbours are widely recognised as an important, if not a key engine of any country's or island's economy. North Europe hosts some of the largest harbours in the world, which allows the supply of countries and cities in and around the European Continent. At the same time, Europe as a whole, hosts thousands of small to medium harbours, which face similar challenges to their counterpart large scale harbour operations.

This report aims to provide and disseminate a remote monitoring energy strategy for the Scalloway Harbour Showcase, which is one of seven (07) showcases of the e-harbour project. This showcase intends to devise a better understanding of the operation of a small harbour setup and how this can lead to the introduction of a novel energy data monitoring strategy. The ultimate goal is to disseminate the data monitoring strategy findings of the Scalloway Harbour so that, in the future, the findings can be applied to other harbours of

similar size, but also large scale harbours at European level and beyond.

Through this report, harbour masters, harbour owners, harbour policy makers and harbour business organisations will be able to learn and apply an effective energy data monitoring strategy. This will support them to identify their energy consumption and target with great effectiveness their emissions through the different green sustainable energy solutions provided in this document.

This report is therefore divided into five (05) sections. The first section of the report provides the aims and objectives. The second section describes the rationale behind developing an energy monitoring strategy for Scalloway harbour. The third section attempts to answer the following question 'why a data logging strategy?'. The fourth and final section defines the novel energy data monitoring strategy developed for the Scalloway showcase and replicable to other harbour.



## AIMS

The E-harbour Project as a whole aims to create a lasting change towards sustainable energy logistics for North Sea Region harbour cities. It aims at setting innovative energy standards to create a transformation of the energy network in harbour areas.

This report intends to provide a completely novel and innovative energy data logging strategy to determine the energy usage and behaviour in a harbour set up. Specifically the strategy has been developed to analyse, as part of the e-harbour NSR project, one of Shetland Islands' most well know harbour, that is Scalloway Harbour.

The strategy described can be used by decision makers in any other, NSR, European harbour and beyond to develop the future harbour's energy policy.

The strategy is universally applicable to any small, medium and large harbour.

Of key significance, the strategy has been developed to support an effective decision-making process for prioritising Harbour's investment in renewable energy, smart grid and electric vehicle technologies.

## OBJECTIVES

After reading this report, the reader should be able to:

1. Understand the different defining factors that need monitoring leading to more efficient, cleaner and greener harbours.
2. Have a clearer understanding of the anticipated outcomes in applying the strategy.

3. Have a clear overview of the criteria taken into account when developing the monitoring strategy.
4. Apply the novel data monitoring strategy to prioritise harbour investment in renewable energy, smart grid and electric vehicle technologies.
5. Modify and fine tune the monitoring strategy to a specific NSR harbour requirement.



## DEVELOPMENT OF A STRATEGY FOR THE SCALLOWAY HARBOUR

One of the aims of the Scalloway e-Harbour showcase is to develop an effective energy data logging strategy. The strategy presented here will support the assessment of harbour's activities and energy consumption level by using state-of-the-art data monitoring technologies. The monitoring process in turn enables the lowest disruption for harbour's stakeholders. It also aims to reduce the cost and time of the assessment.

It is anticipated that the development of an effective energy data monitoring strategy during the e-harbour project will make it more attractive technically and financially for future harbours to adopt it.

Most of the information /data gathered using the below proposed data logging strategy can provide the required knowledge to define corrective actions to optimise the energy system within the harbour and increase its sustainability. Corrective actions can be identified as:

- Technical improvements of the existing energy network

- Introduction of renewable energy
- Introduction of Electric vehicles, Smart grid, Virtual Power plant technologies
- Capital replacement of machinery and processes with higher and more efficient equipment
- Training of personnel behaviour on sustainable energy.

Each harbour is unique; harbours are can be different in size, activities, human behaviour and weather condition. Therefore it is crucial to develop a data monitoring strategy for Scalloway showcase that must be universal, so that it could be extended and applied to other small and medium size harbours at later date.

In order for the Scalloway data monitoring project to be successful, it is crucial to involve all harbour stakeholders along with the harbour authority. Meetings have been held to introduce the aim of the E-Harbours project to the Scalloway harbour stakeholders, identify possible achievable benefits and to let all stakeholders understand the commitment required for the success of the project

## WHY THE DATA LOGGING STRATEGY?

The aim is to develop a data logging strategy that can be used across most harbours around the North Sea Region. The strategy will support any size and type of harbours (small / medium / large scale) in prioritising their investment in renewable energy, equipment replacement in more efficient processes, smart grid, VPP,

energy efficiency measures and electric vehicle technologies. It will also allow modelling the most energy intensive equipments. These models can then be used in conjunction with virtual model of smart grid, VPP, and RE to generate a new energy configuration for a harbour.



Any data acquisition system specification is firmly related with the topology and nature of harbour activities, operator habits and technical and economical requirements. These features can differ significantly between small, medium and large harbours. It is therefore crucial to define and implement a universal strategy that can be extended and applied for different harbours.

The strategy proposed here shall support the identification of equipment that can be

controlled using smart grid, the installation of VPP, the development of renewable energy in within a harbour set up and the reduction of CO<sub>2</sub> emissions. The overall aim of the data logging strategy is to reduce the cost of the assessment process (time, CAPEX, OPEX), making it more attractive technically and financially for future harbours. The strategy will also allow for modelling highly consuming equipment and devise a new harbour energy configuration.

## THE UNIVERSAL REMOTE MONITORING STRATEGY

The proposed energy data monitoring strategy is based on the following criteria:

- Identify the potential investment priorities available from stakeholders
- Identify all the high energy consumption processes
- Identification of the ability to accommodate changes by stakeholders/users
- Defining potential improvements that can be achieved by modifying the process
- Summarise if there is potential for implementing: Energy efficiency measures, Smart grid, Renewable energy or VPP.

An initial comprehensive site analysis (usually achieved by visiting the site) is required to assess the most important features of the harbours energy consumption profile. The site visit allows identifying processes and activities within the harbour. Information to be gathered on site can be summarised as follows:

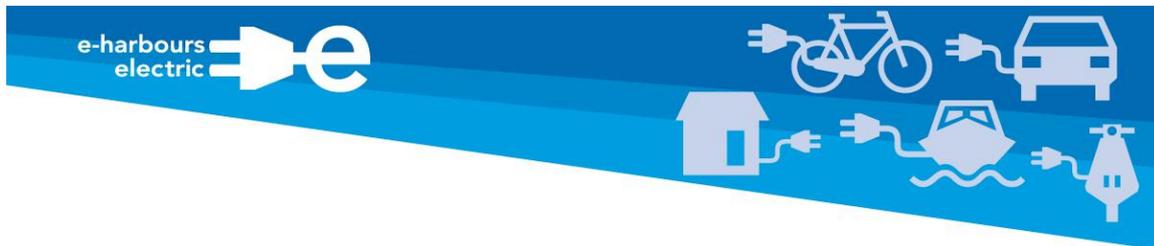
- By collecting technical data, such as specification of plant and machinery,

utilities characteristics, electrical meters position, electrical diagrams, it is possible to define a clear picture of the harbour activities and electrical network features.

- Obtain energy consumption figures, such as electricity & oil bills and records.
- Obtain process production figures, such ice production, fish processing, etc.
- Identify organisations ability and requirement to replace machinery and process plant in order to improve the efficiency.
- Identify electrical loads that can be used for peak shaving and load smoothing.
- Obtain weather data if available.

**The initial methodology selected for the monitoring of the harbour energy intensive processes is based on collection of energy bills and internal records.**

With the collection of energy bills and internal records, data are in sufficient number to shortlist the high consumption processes (also called points to be monitored). When the equipment consuming the most energy are



defined and the equipment fits the above criteria/pillars, data loggers and monitoring equipment is installed to acquire the missing information and reduce some of the uncertainty acquired from energy bills and report.

The rationale for choosing the energy bills method for creating an initial shortlist of energy data monitoring points is that they provide a good compromise between the energy impact of the process, the possible integration with Smart Grid and Virtual Power Plant, capital replacement and cost reduction of the monitoring equipment. This method can therefore be directly applicable to other harbours.

The below proposed strategy will provide the following outcomes:

- Reduce the cost of the assessment process (as data monitoring points are shortlisted upfront from the energy bills analysis).

- Making the data logging more attractive for future harbours as there is no need to purchase a substantial number of data loggers to monitor all of the potential energy points.
- Allow to identify, prioritise and target quickly how to reduce the harbour energy consumption
- Allow the quantification of harbour's emissions.
- Allow modelling the most energy intense equipment
- Allow the reconfiguration of the harbour's energy system and profile by a better control of the energy intense equipment (with Smart grid, VPP, etc).
- Identify training and educational requirements for staff on energy efficiency measures.

## THE STRATEGY IN 10 POINTS

A 10 points universal energy data logging strategy for Scalloway Harbour has been developed and is summarised below:

1. Site analysis of processes/equipment sizes and their locations.
2. Collection of energy bills, production figures, and analysis for each organisation.
3. Short listing energy intense equipment with an energy consumption footprint.
4. Identification of equipment that can be used in conjunction with smart grid, VPP, etc
5. Short listing equipment that have high positive improvement / impact on energy consumption if replaced
6. Assessment of willingness of stakeholders to invest into new equipment
7. Install monitoring equipment
8. Develop a model of the most energy intense equipment and generate a new energy configuration of the harbour.



9. Estimate contribution of Renewable energy.

10. Training of staff on energy efficiency measures.



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