
# THE ENERGY ISSUE WITH HARBOURS

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# CASE STUDY - THE SCALLOWAY HARBOUR

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

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

pure ENERGY CENTRE


## ACKNOWLEDGEMENT

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## GLOSSARY

| | |
|---|---|
| **$CO_2$** | Carbon Dioxide Gas |
| **kWh** | kilowatt hours of energy |
| **MWh** | Megawatt hours of energy (1MWh = 1000kWh) |
| **GWh** | Gigawatt hours of energy (1GWh = 1000MWh) |
| **t** | Metric Tonne |
| **$m^2$** | Square meter |
| **l** | liter |
| **NSR** | North Sea Regions |
| **EU** | European Union |


## 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.

In this report, an overview of the energy issue found in harbours in general, and in small to medium harbours in particular, is discussed.

This document describes the Scalloway Harbour Showcase; a harbour located in the Shetland Islands. This Showcase is one of the seven (07) E-harbour project showcases. A description of the Scalloway Harbour main activities is documented and the different organisations operating in and within the harbour summarised.

## KEY FINDINGS

- Scalloway Harbour is a key showcase in the E-Harbour project.
- Scalloway harbour displays a variety of businesses and that a harbour can be considered as clusters of organisations feeding one another.
- Harbours are energy intensive nodal points and highly dependent on energy for survival.
- Heating and cooling is one of the major expenditures within a harbour.
- Currently there is no widely recognised policy or European-wide agreement on greening harbours.

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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.

The North Sea based Harbour cities are subjected to an unprecedented level of difficulties arising from many different horizons including a record vessel traffic, rise in energy needs, sharp increase in energy costs and intense worldwide pressure on reduction in pollution and emissions. All of these pressures mean that harbours are now being targeted by many to find new and effective solutions to lead to better, more effective and sustainable harbours.

This report aims to provide and disseminate the overall NSR located harbour energy issue with a particular overview of the Scalloway Harbour Showcase, which is one of seven (07) showcases of the E-harbour project. The objective of this showcase is unique as it will have a long lasting impact on the wider harbour community. 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 novel energy policies across the North Sea Region (NSR). The ultimate goal of the Showcase is to devise, test and disseminate a data monitoring strategy as applied to 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 what the different types of organisations can be found in a small harbour set up. This will support them to identify their key future harbour policies.

This report is therefore divided into three (03) sections. The first section of the report provides the aims and objectives of the Showcase. The second section describes the different energy issue as found in a harbour setup. The third and final section describes the Scalloway Harbour with its different organisations and operation.


## AIMS

The E-harbours 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 briefly describe the energy issue facing harbours in the North Sea Region (NSR). More specifically this report describes one of the Shetland Islands' most well known harbours: Scalloway Harbour.

This documents aims at providing an idea as to what type of facilities can be found in a small to medium harbour set up, by summarising each entity located at Scalloway.

The summary of the different facilities, as found in this report, can then be used by decisions makers to develop future harbour's policies for small to medium harbours (and in many cases extrapolate the policies to larger harbours).

## OBJECTIVES

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

1. Understand the major challenges/problems/ difficulties for harbour cities in terms of energy consumption and environmental impact.
2. Have a clearer understanding of the different types of organisations available in a small to medium harbours.
3. Understand which types of organisations uses substantial energy and the reasons why.
4. Have a clear overview of the Scalloway Harbour activities.

## WHAT IS THE ENERGY PROBLEM IN HARBOURS AND HARBOUR CITIES?

The Kyoto protocol was undersigned by a large number of countries to significantly reduce $CO_2$ emissions compared to 1990 levels. Since then, European Union's have published targets to cut $CO_2$ emissions by 20% by 2020 (compared with 1990 levels) and to increase electrical capacity from renewable energy to 20%.

Some NSR countries like Norway, Denmark and Scotland have already overwhelmed other EU countries and have set new targets for 2020. For instance, Scottish targets for electrical generation is to have a record 100% of electricity consumption from renewables by 2020[1].

The harbour areas of the NSR are critical nodal points supporting international transport networks, and preferred locations for a wide variety of industries. These areas transport and transfer large amounts of commodities, including energy related products like coal and oil, and play a central role in the energy system of European countries.

Though harbours are key nodal points for transporting energy type products, they are also large consumers of energy, hence high emitting nodal points too. Factually, one can see that one of the highest outgoing cost for a harbour is energy, which is directly associated with the activities in and around the harbour. This is clearly a problem for harbour based organisations as, if the energy costs continue to rise, could put these organisations out of business.

To this end, it is obvious that the use of energy in the harbour cities can be very intense, and in many instances energy efficiency measures remain low due to the use of 'inefficient' industrial machineries. In addition, though the Government's renewable targets have been clearly stated, the share of renewable energy sources in a harbour set up is still very low.

Therefore, one can conclude that some of the main issues in a harbour are four fold: (a) economic (the energy costs are too high and continue to rise), (b) machines are in many cases not efficient (older machines not being replaced often), (c) $CO_2$ emissions, as well as other greenhouse gases, are excessive (high consumption means high emissions), and (d) there is a lack of information as of what can be done to change the situation (harbours have not been a real targets for Government policy implementation for renewable and energy efficiency).

**In summary, there is an urgent need to improve the energy credentials of harbours, which shall include a combination of energy efficiency measure, renewable energy, smart grid and others. If no action is taken, then this could put many harbour organisations at financial risk and in jeopardy to losing business due to uncompetitive bids and/or costs.**

[1] Draft Electricity Generation Policy Statement (EGPS) November 2010.: Scottish government http://www.scotland.gov.uk/Topics/Business-Industry/Energy

## Harbours to become uncompetitive if no action is taken to reduce energy costs

Scotland has large number of harbours, with its majority being small to medium in size. Amongst these harbours, Scalloway is a good example of a small to medium sized harbour situated on the west side of the Shetland Islands. Figure 1, illustrates an aerial view of the Scalloway Harbour.

The main characteristics of the Scalloway site are that it is a relatively small to medium size harbour associated with a large variety of activities. This makes the harbour a site of particular interest for investigating the relation between energy and a harbour. Scalloway, can in essence be used as a showcase to clearly define and investigate the different type of energy sources (electrical, oil, etc), to quantify the energy profiles and $CO_2$ issues related to a harbour. The findings from the showcase can then be used to devise a potential set of scenario solution(s) for the uptake of smart grid and renewable energy solutions into a harbour area, thereby reducing emissions and dependence on brown electricity, while reducing in parallel the energy expenditures. The findings can also support larger harbours in defining their energy strategies.

**Figure 1** - Panoramic view of Scalloway Harbour[2]

[2] http://www.shetland.gov.uk/ports/scalloway/

## SCALLOWAY HARBOUR

Scalloway Harbour is an important Scotland based fishing harbour situated on the west side of the Shetland Islands. It is the third largest harbour in the Shetlands. Figure 2 shows the location of the harbour on the Shetland mainland.

The intensity and the large variety of activities in a relative small footprint make Scalloway Harbour a unique case study for the investigating the energy issues encountered within a harbour setup through the development of an **energy monitoring strategy**.

The aim of the strategy would be to collect energy data and use the findings to reduce/stabilise the harbour's energy consumption, thereby increasing the sustainability of the Harbour.

**Scalloway Harbour is the first selected showcase within the E-Harbours Project that is able to assess and potentially improve the environmental and energetic condition of the entire harbour. All other showcases within the E-harbour focus on small areas of harbours due the very large footprint sizes.**


**Figure 2** – Shetland Island and Scalloway Harbour[3]

[3] http://maps.google.co.uk

Despite its small size, counting a footprint of only 50,000 $m^2$, it was found that Scalloway Harbour is an intensive energy consumer. Being a high energy consumer, the harbour related carbon emissions are, in turn, extremely high. **To put this into context, the average yearly electricity consumption for Scalloway Harbour has been found to be 1.8 GWh/year. Heating fuel is another large energy source used within the harbour, with average annual energy consumption for heating oil typically around 643 MWh/year. As result, the overall $CO_2$ emission for stationary energy consumption has been found to be 1350 t/year.**

**Scalloway harbour consumes 1.8GWh of electrical energy per year**

**Scalloway harbour consumes 363MWh of heating energy per year**

**Scalloway harbour emits 1350 tonnes/year of $CO_2$**

Looking at the aforementioned large electrical and heating energy consumption figures for such a small to medium harbour, one needs to understand the energy impact, usage and/or pattern of each organisation in this harbour setup. To do so, it is initially critical to understand the different types of organisations that are operating within the harbour. It is only on comprehension of the type of organisations operating in a harbour that a mental picture of the different energy requirements for each business could be depicted. The sections below provide such a summary and understanding of the different organisations as found in Scalloway Harbour.

## ENTITIES WITHIN SCALLOWAY HARBOUR

In essence, Scalloway harbour regroups several private organisations and a harbour head office. Figure 3 below illustrates an aerial[3] view of the harbour with the different businesses operating within the site. Colour codes are used to identify the different businesses with their associated nomenclature.

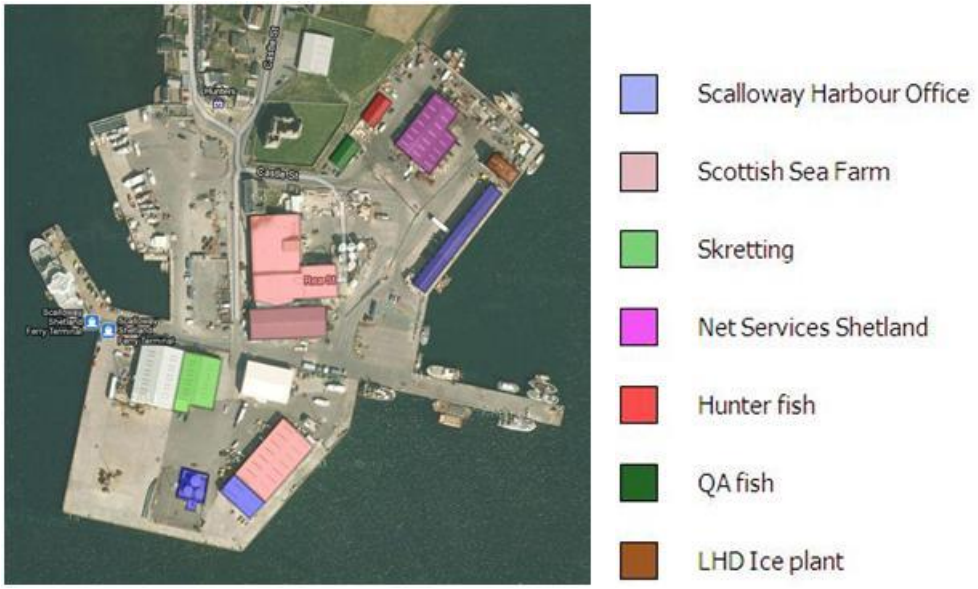


**Figure 3 –** Scalloway Harbour`s organisations

Scalloway Harbour consists of seven main organisations. Below is the list of those organisations, each of which is described in the following sections:

1. Scalloway Harbour Office
2. Scottish Sea Farms (SSF)
3. Skretting
4. Net Services Shetland Ltd (NSS)
5. LHD Ice Factory
6. Hunter Fish
7. QA Fish

## SCALLOWAY HARBOUR OFFICE

Scalloway Harbour office is the main authority of the harbour; it is responsible for the operation and traffic control of the harbour.

Scalloway Harbour office controls both land and sea traffic on the site. The main office is equipped with the latest communication and radar systems for safe navigation in the harbour area, such as the Automatic Identification System (AIS) that provide an accurate navigation system for locating, identifying and tracking marine vessels.

Regarding the on-land activity, Scalloway Harbour office manages the following facilities:

- **Fish market**: it is dedicated to wholesale trade between fishermen and fish merchants. The fish market is equipped with an intensive cold storage facility in order to preserve the quality of the fish during the storage period.

- **Shore power:** the pier is equipped with a system of bollards and an electrical power source that are used to power marine vessels while moored at the harbour.
- **Fuelling station**: the harbour is equipped with a fuelling station for dispensing oil to the marine vessels.

In addition to the above, the Scalloway Harbour office is equipped with a weather station that monitors continuously weather parameters since 2008; such as wind speed, wind direction and tidal height.

**Figure 4 –** Fish Market

## SCOTTISH SEA FARMS

Scottish Sea Farms (SSF) is one of Scotland's leading fish farming businesses. It is the biggest private organisation within the harbour in terms of size, facility and energy consumption. Scottish Sea Farms support and run the complete supply chain for the production of salmon. From the growing of the salmon alevin in farmed cages around Shetland, to the final fish processing.

Scottish Sea Farms is based in Scalloway Harbour with two main facilities:

- **Fish processing plant:** this facility deals with the processing of fish and the preparation of dispatched lots to the market. Figure 5 illustrates the Scottish Sea Farms facility located at Scalloway Harbour. Technologically advanced industrial machines are used for gutting and filleting the salmon. This facility includes an ice production system used during the processing stage, a box packaging system and several cold store facilities for storing fish for short periods before dispatch.

- **Marine services plant**: this facility provides technical and mechanical support for boats and vehicles needing repair. In addition, a large storage facility is available for storing nets for salmon cages and food.

**Figure 5 –** Scottish Sea Farm facility at Scalloway Harbour

Scottish Sea Farms is not only the highest energy consumer of the harbour, but it is also the main waste producer too. Substantial fish waste is produced at the fish processing plant. This waste is then periodically collected to be used in the fish meal factory in Bressay, on the east side of Shetland. Fish waste is treated in order to extract oil (usually used for cosmetics) and produces fish meal as base for domestic animals` food and high-quality organic fertiliser.

Scottish Sea Farms is equipped with a water treatment plant that is able to recover and purify any impurities in the waste processing water before the final disposal.

## SKRETTING

Skretting is the UK and Ireland's largest aquaculture feeds producer. The company supplies mainly salmon and trout feeds for most of the fish factories based in the Shetland Islands. Skretting is based on the west side of Scalloway Harbour with a large storage facility for fish food. The company's facilities are shown in Figure 6. The energy consumption of Skretting is fairly small when compared to the other industrial premises within the Harbour. This is due to the fact that that no industrial processing is required for storing the food.

Figure 6 – Skretting facilities at Scalloway Harbour

## NET SERVICES SHETLAND

Net Services Shetland is based in the northern side of Scalloway Harbour. This business specialises on making nets for the fish farming industry. The organisation is the major supplier of net and net services for most of the fish farm market in the Shetland Islands. The Figure below (7) illustrates some of Net Services facilities.

**Figure 7 –** Net Services Shetland facility; sewing facility (left), drying room (right).

This business has a wide range of activities, from the complete construction of nets, to the periodical maintenance of used fish nets. The organisation can be grouped into two main facilities:

- **Net sewing facility**: this facility is dedicated to the sewing of new nets or to the mending and repairing of used nets. This facility is equipped with an intense lighting system specifically designed to operate the sewing activities with the highest standards in the field.

- **Net washing facility:** this facility is dedicated to the periodic maintenance of used nets. Nets used for fish farming require a periodic maintenance to ensure integrity and cleaning from algae and other aquatic organisms after a prolonged period immersion at the sea. Nets are required to be washed and painted with anti-fouling varnish to reduce the growth of organisms that attach to the net which can affect performance and durability. The drying process, required after each wash and painting, requires a substantial amount of energy. The heating system used for the drying process requires about 5200 L of oil per month, with an average cost of £3,300.00 per month.

Net Services Shetland is the third larger energy consumer of Scalloway Harbour. This is due to the large use of heavy industrial machineries for the movement, washing and drying of the nets.

The organisation is equipped with a water treatment system that is able to purify the water used during the washing process and recover any impurity or organism present in the nets. The waste contains residual from previous painting process, metals and organic material - all of which is discarded in landfill. The average waste for each net cleaned is around 2 tonnes for a net of 2500 $m^2$ surface area.

## HUNTER FISH

Hunter Fish is a fish company located at the north side of Scalloway Harbour. Until June 2011 it was dealing with both fish and shellfish processing. However since then, the activity of the organisation has been reduced to shellfish processing only.

The energy consumption is low compared to other bigger organisations within the harbour, as only small industrial processes are conducted in the premises and especially after the reduction of its operation.

A small office with standard electrical appliances is present inside the facilities and used for administrative activities. See Figure 8.

Figure 8 – Hunter Fish

## QA FISH

QA Fish is a fish company located at the north side of Scalloway Harbour. The QA Fish facilities are shown in Figure 9. This company deals with fish processing and packaging for UK and international markets.

Most of the fish processes are done by hand; therefore no heavy industrial machines are used within the organisation. An office with standard electrical appliances is present inside the facilities and used for administrative activities.

The electrical consumption is relative small in comparison to other organisations nearby. The consumption is mostly from a cold storage facility used for storing fish and the standard electrical appliance used in the administration office.

Figure 9 – QA Fish facility at Scalloway Harbour.

## LHD ICE FACTORY

LHD Ice Factory is an ice producing company located on the east side of the harbour. The factory has the potential to supply and satisfy the ice needs for the entire harbour and the surrounding industrial premises outside Scalloway. Figure 10 below illustrates the ice factory.

The operation of the factory is strongly related to the fishing activity of the harbour, therefore the operation is mostly on call and on demand.

The LHD ice factory is a high energy consumer. The facility is equipped with two large ice machines that could operate in parallel during a high request of ice. The total ice production of the facility is between 2000 – 7000 t per year.


Figure 10 – LHD Ice factory plant a**t Scalloway Harbour.**


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