Port of Ramsgate

Low Carbon Plan Strategy
Executive Summary Report

Version 1.0A

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Port of Ramsgate Royal Harbour Marina

LO·PINOD LOGISTICS OPTIMISATION FOR PORTS

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

thanet district council

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1.0	17.12.14	Draft Issue	MH
1.0A	18.12.14	First Issue	MH

1.0 Introduction

1.1 Thanet District Council owns and operates the Port of Ramsgate. The Port combines two adjacent but diverse maritime harbour sites. The first is a 35 year old commercial ferry port with three Ro-Ro berths, aggregate handling capabilities and modern facilities for Windfarm maintenance operations. The second is a busy historic 18th century Royal harbour incorporating 700+ berths for leisure and fishing craft, within Grade 2 listed stone walled infrastructure. The sites have a combined total area of 67 hectares.

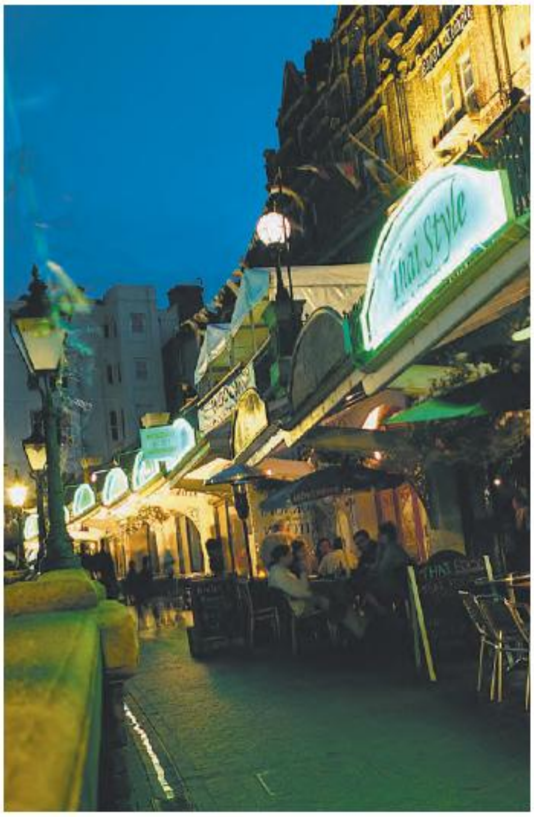
1.2 The Council has a strong corporate vision for the future with a focus on making the District cleaner and greener and leading by example on environmental management issues. The need to manage energy use, promote efficiency and reduce the Council's carbon footprint features strongly in its values.

1.3 The Port of Ramsgate is served by a combination of 6 electrical sub-stations and relies upon heavy industrial infrastructure in its day-to-day function to deliver maritime related services. Its attributes also include a high density of lighting, wide spread power hook-up services for leisure berths, comprehensive amenity buildings, and vessel maintenance facilities consistent with a modern high quality marina. The site also accommodates a number of small maritime related independent businesses. It is therefore no surprise that the annual electricity running costs for the combined site are relatively high, (in the region of £250,000 in recent years).

1.4 A project brief for a stage 1 (scoping) study to inform a Low Carbon Strategy was developed early in 2014 for the Port of Ramsgate. The project seeks to realise opportunities to incorporate renewable energy technologies in the Port and Harbour environment and at the same time reduce energy usage through the adoption of modern apparatus and innovative thinking on power management.

1.5 This executive summary report provides details of energy production and energy saving opportunities. These opportunities have been identified through study work undertaken by two independent consultants in combination with in-house engineers, all in accordance with an agreed project brief. The primary drivers for this project are as follows:

- Investigate opportunities to produce energy (through renewable technologies)
- Investigate opportunities to reduce energy consumption
- Seek to reduce carbon emissions associated with services provided and used at the Port of Ramsgate
- Seek to reduce long term expenditure on energy charges along with costs associated with electrical infrastructure maintenance
- Develop a more sustainable approach to energy usage in alignment with the Port of Ramsgate's Environmental Policy and Environmental Practice Statement



2.0 Energy Production Opportunities

2.1 Use of Photovoltaic Solar Panels

2.1.1 Solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells don't need direct sunlight to work – they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting. The power of a PV cell is measured in kilowatts peak (kWp). That's the rate at which it generates energy at peak performance in full direct sunlight during the summer.

2.1.2 The study work included an analysis of energy generation potential using solar panels mounted in a number of locations which were identified from existing site surveys and record data. These include on building roofs, on bespoke frames over car parking areas, and on walls. A summary of the generation potential of this opportunity can be found in section 5.

2.1.3 The study also considers maximising the generation potential using hybrid technology known as Photo Voltaic Thermal PVT which combines water cooling of the solar panel to optimise output, and heating of the water for use in hot water systems for showers. However this arrangement would only be effective if the panels were located adjacent to an amenity block or other building requiring a hot water supply.

2.1.4 Further consideration should also be given to floating PV arrays located in periphery areas of the harbour marinas where berthing is not suitable due to shallow water depths. This reduces the burden on valuable land space which has other income generation potential. This technology is now commercially available in France using bespoke interlocking rafts to support the frames and allow for differential movement due to small wave activity.

2.2 Hydro Power

2.2.1 The Inner Marina at Ramsgate was created by John Smeaton through the construction of a 'cross wall' circa 1780 which bisected the Royal Harbour. It comprised a masonry structure in which 7No. sets of sluice gates were installed with a lock gate to retain tidal waters. The intended function of the cross wall was twofold; i) to create a sheltered inner basin where vessels could remain afloat at all states of the tide to facilitate cargo operations and ii) to retain a head of water at low tide that could be utilised to purge the seaward side of the harbour of sediment and sand, thus significantly reducing the amount of mechanical dredging. This aforementioned function ceased to be a possibility when the commercial port was developed in the 1980s as flushed spoil would deposit within the new commercial port. The inner marina is now predominantly used for leisure craft and pontoons provide the facilities for permanent and long stay berth holders.

2.2.2 The current sluice gates have all been blocked up and are not functional. However the Flap Gate with a Bascule Bridge and a Mitre Gate all remain functional and are opened/lifted approximately 2hrs before High Water (HW) and subsequently closed 2hrs after HW, subject to the actual tidal conditions which are effected by both moon phase and prevailing atmospheric conditions.

2.2.3 Over this period tidal flows on a flood and ebbing tide ensure a sufficient water level is maintained to keep moored vessels afloat, and allow safe passage for access and egress to and from the inner basin to the outer marinas and harbour mouth.

2.2.4 The existing infrastructure has the potential to create electricity in much the same way as a hydrodam. Since the current structure was originally designed to create high volume discharges of water for dredging, turbines could be installed within one or more of the existing outfall sluice tunnels to generate electricity. The original design of the harbour lends itself to the design concept of a static head created through a differential in water level. Since the tide is constantly rising and falling through the influence of the moon, the potential energy is naturally created and can be harnessed for energy generation purposes.

2.2.5 The study work has suggested two potential design solutions to enable the generation of power using Ramsgate Harbour's historic maritime infrastructure. It is clear from the work to date that the business case for both options is sensitive to unit output and capital costs. The work to date certainly indicates that the concept warrants further investigation. This should focus initially on refining cost and output estimates. Indirect costs and benefits should also be considered in further detail in order to assess the overall attractiveness of the scheme.

3.0 Energy Saving Opportunities

3.1 LED lighting

3.1.1 LED lighting technology provides a significant opportunity to reduce energy consumption. The study has identified a large number of lamps at the Port and Harbour that present an opportunity for replacement with efficient LED alternatives. Consultation has suggested an LED specification for lamps which will deliver the same or in many cases increased lighting while at the same time still reducing the total electricity consumption to a significant degree.

3.1.2 The replacement lamps also demonstrate opportunities for financial savings and carbon emission reduction. The life span of each lamp is significantly higher and as such savings on maintenance and improved amenity present an opportunity for key added value with these upgrades. All of the payback and return on investment calculations (section 5) have been based upon the current prices for electricity and lamp replacement. The LED lamps significantly increased life span which would effectively remove the need for storing replacement lamps. In addition when LED's fail they gradually fade in light output over a long period of time, thus they provide a warning for a number of years before they completely go out. This is helpful when it comes to planning for replacements.

3.2 Voltage Optimisation

3.2.1 Voltage Optimisation works by reducing the incoming mains voltage to the minimum level that is required by the connected electrical equipment, this is often much lower than the national grid's average output of 242V. The higher the voltage the higher the power consumption, hence the opportunity for this technology to reduce energy consumption.

3.3 Meter-MACS SMART Utility Metering

3.3.1 Much of the leisure Marina already has this form of smart metering installed. This workstream is firstly about reducing energy consumption, this is on the basis that accurate metering and billing leads to more careful energy usage by customers when compared with usage of unmetered supplies. Smart metering also allows for more robust billing and therefore less risk of financial loss associated with excess unbilled customer usage. Smart metering is steadily becoming a standard tool of any facility that want's to understand where utilities are being consumed as the data enables much greater levels of management control and cost management.

3.3.2 The study work proposes further investment in this technology to improve the customer experience and further reinforce the robust system that has been developed which reduces wasteful energy usage and allows for fairer and more accurate billing. The majority of customers using the smart metered system pay in advance which both reduces financial risk to our organisation and removes the requirement to both read meters and generate invoices.

4.0 Discounted Opportunities

4.1 The following opportunities were investigated as part of the study but discounted for the reasons briefly described against each item. This may represent abortive work but it was considered important to explore a multitude of renewable technologies at this scoping stage and the study would not have been complete without exploring such opportunities for energy capture or reduced consumption:

- **Anaerobic Digestion (AD) -** *The organic waste volumes at the Port of Ramsgate appear to be insufficient to justify the investment required to deliver a financially viable AD system at this point in time.*

- **Combined Heat and Power (CHP) –** *The low volumes of waste oil supplies, minimal and variable heat demands and the high capital costs of purchasing and maintaining a CHP plant make this option unviable.*

- **Biomass Heating -** *The minimal and variable heat demands and the high capital costs of installing a heat distribution main and purchasing/maintaining a biomass plant make this option unviable.*

- **Membrane Bioreactor (MBR) -** *The water requirements at the Port of Ramsgate appear to be insufficient to justify the investment required to deliver a financially viable MBR system at this point in time. If a manufacturing facility were to be built at the site that required large volumes of water then a MBR could prove viable.*
- **Battery Backup -** *The costs of introducing backup battery systems would be very high at the moment with little benefit/gain, as such this solution does not currently appear to be viable.*

Although currently discounted the following opportunities may be investigated further subject to a review of payback and ROI assumptions

- **Heat Matts –** *The minimal and variable heat demands may make this option unviable.* ***however water source heat pumps in conjunction with an under floor heating system can be an effective way of extracting heat from source based on a net gain (Coefficient of Performance) of 4:1. UK water temperatures range from 8 – 18 degrees centigrade seasonally however the temperature of the inner basin is likely to be 2-3 degrees higher than average due to its protected location. Further investigation of this technology should be combined with any new building development.***

- **Wind turbines** – *Large scale onshore wind turbine generators will be unlikely to gain planning permission,* ***however small scale vertical axis wind energy generators should be further considered. These are roughly a 1/3 of the footprint of a conventional turbine, have low start up and operational speeds, with consequently low noise and reduced visual impact.***

5.0 Overview of Energy Saving and Generation Opportunities

5.1 The figures in the tables below are based on a significant level of assumption due to the high level (scoping) nature of this stage 1 study. The figures assume full adoption of the opportunities highlighted for each option.

5.2 The tables are considered to provide a very useful insight into the potential value and scale of the options considered along with an important indication of return on investment. This will inform the direction of more detailed studies.

Table 5.2

Energy Saving Measures	Estimated savings PA	Estimated Cost	Payback (yrs)	ROI
LED Lighting Upgrades	£17,169	£62,792	3.7	27.3%
Voltage Optimisation	£20,152	£90,685	4.5	22.2%
Totals	£37,321	£153,477	4.1	24.3%

Table 5.3

Renewable Energy Production Measures	Estimated savings/income PA	Estimated Capital Cost	Payback (yrs)	ROI
Photo Voltaic Systems	£137,913	£805,690	5.8	17.1%
Hydro Power	£45,891	£416,512	9.1	11.0%
Totals	£183,804	£1,222,202	6.6	15.0%

Table 5.4

Actions	Annual Savings	Total Cost	Payback (yrs)	ROI
Energy Saving	£37,321	£153,477	4.1	24.3%
Energy Generation	£183,804	£1,222,202	6.6	15.0%
All Measures	£221,125	£1,375,679	6.2	16.0%

6.0 Conclusions

6.1 This study has yielded some exciting information on the feasibility of a number of opportunities to improve the sustainability of energy management at the Port of Ramsgate. The study work to date has deliberately targeted high level conclusions to ensure that a wide range of options are explored based upon currently available renewable energy, and energy efficient technologies.

6.2 All options for improvements to current electrical infrastructure do of course require wide ranging levels of financial investment. This study has produced outline capital cost and savings figures but in most cases these are based upon a number of assumptions due to the high level nature of the work to date. The study work has however provided a basis to recommend stage 2 (detailed) studies to focus on particular options with more focussed project briefs. The critical data areas required to inform the detailed business cases for these options are summarised below:

- return on investment (full economic analysis)
- grant and funding mechanisms
- potential for carbon emissions reduction
- local environmental impact
- customer (social) impact and consultation
- permissions processes and requirements

7.0 Action Plan

7.1 A brief action plan indicates the likely route of the stage 2 study work to improve the quality and accuracy of the data on the project options thought to have the most potential to deliver improvements to energy usage and management.

Option	Action	Action type	Responsibility	Timescale	Funding
LED Lighting Upgrade	Electrical suppliers to provide costs for replacement lamps	Systematic upgrade of lighting units in maintenance programme.	Maintenance Section	2015 - 2017	• EU Interreg V • grant funding Department of Energy and Climate Change (DECC) • TDC
Voltage Optimisation	Engage with Consultant to provide detailed report.	Installation at each supply substation	Engineers & Maritime Operations	2015-2016	• EU Interreg V • DECC • Technology Strategy Board (TSB) • TDC.
Hydro Power	Engage with Consultant to further investigate suitable turbines and type followed by detailed design and report.	Detailed design for civil and mechanical installations	Engineers & Maritime Operations	2015	• EU Interreg V • DECC • TSB • TDC
Photo Voltaic Systems	Engage with Solar PV supplier/ consultant to established supply cost and precise ROI	Systematic installation	Engineers and Maritime Operations	2015-2020	• EU Interreg V • , DECC • TSB • TDC

8.0 Appendices

Appendix 1	Energy and Carbon Audit of the Port of Ramsgate – Newform Energy
Appendix 2	The Hydropower Potential of the Port of Ramsgate – KGAL Consulting Engineers
Appendix 3	LED Lighting Proposal - Marina – Minimise Energy
Appendix 4	LED Lighting Proposal – Flood Lights – Minimise Energy
Appendix 5	Hydropower Feasibility Study – Renewables First