Port of Barrow Redevelopment

1. Introduction

Barrow is a port city on the north-west coast of the UK in the county of Cumbria. It is the main urban centre for South West Cumbria with a catchment of over 130,000 people.

Barrow is known throughout the world as a centre of excellence for marine engineering and shipbuilding with major companies such as BAE Systems based in the city. The city came into being when rich seams of iron ore were discovered in the area in the 1850s and became a centre for mining and heavy industries. In the 20th century it was a major shipbuilding centre. However shipbuilding has been in decline in the UK for a number of years, leading to a decline in the prosperity of the city with significant job losses and severe economic difficulties.

There is now a need to stem the decline and regenerate the local area and the local economy in a sustainable manner. Major redevelopments are underway including a plan to develop a large part of the waterfront adjacent to the docks. The new mixed-use development will include: a marina, a housing village, water sports leisure area, wetland wildlife area, business park and cruise terminal. The development is seen as a driver for the regeneration of the whole dock area. A principal objective is to create a major employment opportunity through the development of a 23 Ha Innovation park. The work PV UP-SCALE undertook was an opportunity to see how renewable energy could fit into these new developments.

The docks area has a strong character as a Victorian industrial and residential environment. But it also has a number of current problems with loss of employment, significant areas of vacant and underused land, a decaying built environment, particularly for the declining residential population and poor accessibility. At the same time the commercial port is still an important location in supporting shipbuilding activity, nuclear fuels, natural gas and other offshore activities. The local council is seeking to balance management of the existing activities with regeneration of the area.

Photo 1: Boarded up Victorian building close to the docks

Photo 2: Victorian housing close to the docks, now a declining area

The majority of the population of the area work within 2 km, reflecting the location immediately accessible to both the industrial operations of the port itself and the town centre. This has led to very sustainable travel patterns within the area, with a very high proportion (31%) of workers travelling by foot.

PV UP-SCALE worked with the local regeneration organization, West Lakes Renaissance, and the planning department of Barrow Borough Council to look at the potential for incorporating renewable energy in the development, particularly in the Marina Village housing area. Opportunities to use PV in the Business Park, Leisure Area or Wetland area were also considered.

During the period in which PV UP-SCALE was involved an indicative Master Plan for the site was developed, going through a number of iterations while at the same time Barrow planning department produced the Barrow Port Area Action Plan, Development Plan Document. Towards the end of the period West Lakes Renaissance released a call for proposals and developer briefing pack for developers to design and build the Marina Village Housing Area.

The port area consists of 3 docks:

- Buccleuch Dock is utilised as part of the BAE Systems shipyard while British Nuclear Fuels (BNFL) use the Port to handle specialist vessels.
- Ramsden Dock is used for recreational purposes and is the location for the national power boat grand prix racing and other events attracting significant numbers of visitors.
- Cavendish Dock in contrast is relatively quiet and an important location for migrating birds and wildfowl.

Figure 1: Development Master Plan for the Waterfront

Photo 3: Cavendish dock is in the foreground with the location for the new housing village showing as a green oval next to the top right hand corner of Cavendish dock.

2. Renewable Energy in the Development

During the period in which PV UP-SCALE was involved the role of renewable energy was expanded and clarified. Early site layouts had no particular provision for sustainable or eco-areas. The final call for proposals as eventually released includes an eco-area and set requirements for renewables and sustainable design for the entire site. Meeting these requirements will be a condition of the developers' contracts.

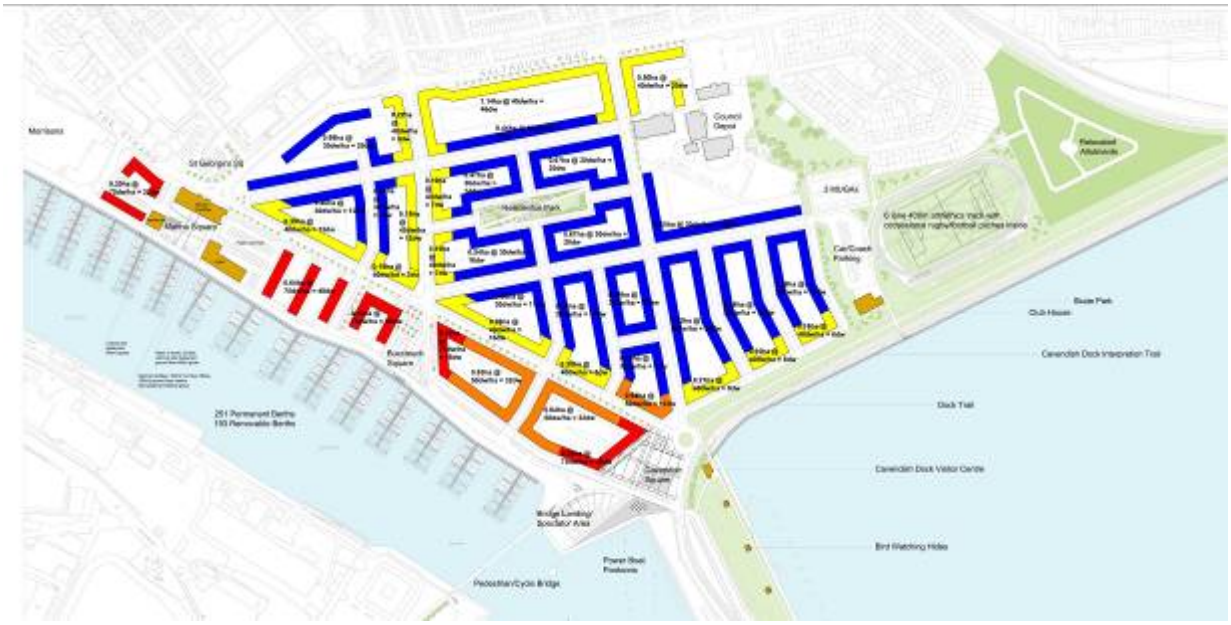

Figure 2: Marina Housing Village showing an early site layout with no eco-area. Solar access was not considered in this initial layout.

Figure 3: A later site layout for Marina Housing Village.

A guide to the possible use of renewables in the development, and methods of meeting the requirements, was prepared by PV UP-SCALE and issued with the developer briefing pack. Developers are now being sought to develop the area on a commercial basis.

The renewable energy requirements that were developed are based on two mechanisms, both important drivers for renewable energy in the UK:

- The first are environmental building codes. For housing the Code for Sustainable Homes, and for office buildings the Building Research Establishment's Environmental Assessment Method (BREEAM). These systems work on a point scoring basis and various levels can be achieved.
- The other mechanism, developed in the London Borough of Merton, and hence known as the Merton Rule, is a planning requirement that can be set by local councils requiring all new developments over a certain size within their area to provide a certain percentage of the predicted energy consumption through the installation of on-site renewable energy generation capacity. The percentage is normally set at 10% although higher percentages have been set in some areas.

The requirements set for the Barrow Waterfront were:

1. All new housing developments above 30 homes will be required to achieve a minimum of level 3 of the Code for Sustainable Homes.
2. The Dockside area in Marina Village will be required to achieve a minimum of level 4 of the Code for Sustainable Homes.
3. A BREEAM Assessment must be carried out for all new commercial development with a floor space above 1000 square metres and a rating of Very Good or better achieved.
4. Minimising energy consumption requirements of new development through innovative and efficient design and alignment and expecting the use of renewable energy technologies to be incorporated into new development wherever practicable as follows:
    - All residential development of 10 units or more should incorporate renewable energy production to cover at least 10% of predicted energy requirements.
    - All non-residential development of 1000 m^2 floor space or over should incorporate renewable energy production to cover at least 10% of predicted energy requirements.
    - Small-scale community and on-site renewable energy projects will be encouraged.

The use of renewable energy is both an explicit requirement (with a 10% target) as well as providing assistance in meeting the code for sustainable homes.

Under the Code for Sustainable Homes, the minimum performance standards for Level 3 require a 25% reduction in carbon dioxide emissions, in comparison to the relevant Target Emissions Rate (TER) set out in Building Regulations 2006 Part L, while Level 4 requires a 45% reduction. The reduction in carbon dioxide emissions can be achieved by energy efficiency measures or the use of renewable energy or a combination of both. The use of renewable energy provides extra points under the scoring system used in the Code for Sustainable Homes.

Guidance prepared within PV UP-SCALE was provided to potential developers on how the use of renewable energy, and solar energy in particular, could contribute to meeting the sustainability/renewables requirements within Marina Village.

3. Marina Housing Village

The marina housing village is divided into 4 housing areas, one of these, Dockside, is the Green Quarter, with a Code Level 4 minimum requirement, the other areas have to meet Code level 3. A minimum of 10% of predicted energy demand for all the housing has to be generated by renewables. This renewables generation can be spread evenly over all the houses or can be concentrated into a smaller number of bigger systems. Some of these bigger systems need not even be on the housing, but for example could be part of a flagship renewable energy design for one of the other buildings on site.

The main options for renewable supply of power considered applicable in the area were:

- Solar water heating
- Solar photovoltaics
- Wind power
- Biomass heating
- Heat pumps
- District heating with CHP or heat pumps

Calculations were performed to estimate the quantity of renewable energy needed to meet the requirements. Due to the complexity of the calculation method in the code only estimates could be given without a final design for the houses. These concluded that a 4m^2 flat panel solar water heater with PV powered pump was a reasonable estimate of the amount to solar power required to reach Level 3 and the addition of 0.45 – 1 kWp of PV could take a property up to Level 4.

The 10% requirements of 1,000 kWh per year, assuming standard housing, could be met by a solar water heating system of about 3.5 m^2 or a 1.25 kWp PV system.

Photo 4: View of the Marina Village Housing site from across Ramsden dock, a new waterfront will be created with shops, restaurants and housing

It was suggested that a reasonable approach to meeting the requirements for Level 3 housing would be to focus on energy efficiency and passive solar design along with either solar water heating or heat pumps.

In the green quarter where Level 4 or above is required it was suggested that a reasonable approach would be to ensure:

- All houses have good solar access and make use of passive solar design
- Solar water heating on all family houses
- 1 – 2 kWp PV systems on some houses
- PV on apartment blocks supplying communal areas or individual apartments. However small PV systems of under 0.5 kWp each supplying an apartment are avoided as they are likely to be more expensive in terms of installation and maintenance costs.
- For all apartment blocks communal water or space heating systems, may be gas, solar or biomass based.

Photo 5: *View across housing village site with docks in background*

Photo 6: View of Ramsden dock from housing village site

Photo 7: View of northern corner of housing village site with town centre in background

Photo 8: View of Cavendish dock from eco-housing location

In addition recommendations were made that:

- The houses are future proofed i.e. built so that renewable energy systems could be added in the future with reasonable ease. "If renewable energy is not installed on a dwelling, dwellings should be designed and constructed to facilitate the installation of renewable energy technologies during their design life. For example by including roof structure with identified fixing locations (PV and solar hot water), space for enlarged hot water cylinder (solar hot water), roofs orientated to face between south east and south west with minimal over shading and provision of identified and accessible electrical cable ductwork between

electrical consumer unit and proposed location of generating equipment (small scale wind and PV)."

- The approach taken for different properties should differentiate between the different types of expected occupants and building sizes. For example properties likely to end up in the commercial rented sector with a high turnover of occupants may not be best suited to individual renewable energy systems where information on how to get the best out of them has to be passed on from one occupier to the next.
- Photovoltaics generate in the daytime and surplus power is not stored for later use, as is the case with solar water heating, but exported, so residents who are generally at home in the daytime will benefit most directly from PV systems. Retired people or families with young children tend to be in more during the day and can get maximum benefit from a PV system. Provision for such groups could focus on Dockside.

Anyone who has been to the Barrow waterfront will be able to tell you that it is a very windy location. However there is a lot of wind power already in the vicinity of Barrow ranging from the parking meters to a number of on-shore and one off-shore wind farm. There is a certain amount of local concern about increasing amounts of wind power in the area. Partly for this reason and partly because of the ecological sensitivity of Cavendish Dock, particularly with regard to bird life, wind power was not considered to a large extent.

Photo 9: Wind and solar powered parking meter in Barrow
Photo 10: Work starting on the Waterfront Business Park with off-shore wind-farm in the distance

Most of the discussion focussed on the buildings. However, the Marina Village also requires public footpaths and cycleways, public open spaces and public art. These can also provide opportunities for the use of renewable energy and can be a very visible symbol of the achievements in energy terms. Solar sculptures, clock towers and fountains have all been created in the past and solar street lights or bus stop lighting, are now widely commercially available. The use of PV to power non-building facilities can lead to cost savings if it avoids the need to provide a standard electricity supply. It can also provide a cost-effective means of improving security through increased lighting on footpaths and cycle ways that are not close to grid connection points.

4. Problems, barriers, solutions and recommendations

Can genuine sustainability be imposed for new developments?
A workshop was held in Barrow during which concerns were expressed about the real level of sustainability achieved by mechanisms such as the Code for Sustainable Homes. It was feared that developers would simply aim to achieve the minimum score required with the lowest cost approach. This was a particular concern where points were achieved by replaceable fittings such as low energy lighting and appliances or low water consumption taps. It was feared that these could either be replaced by the developer once assessment was complete or by the householder over time.

This is a strong argument for incorporating a large proportion of the energy measures into the fabric and form of the building using passive solar design and insulation. Planning restrictions could also be put into place to limit house extensions and alterations over time that would reduce solar access to other houses.

Solutions to the issue of removing low energy appliances are hard to develop but may lie in convincing house purchasers of the benefits of low energy consumption and promoting pride in the sustainable and low energy characteristics of developments that meet the Code for Sustainable homes. Information on the appliances that assessment results are based on should be provided both to the original house purchaser and to subsequent purchasers. It should be clear that the original rating no longer applies if lower quality appliances have been substituted.

A particular risk for PV, where its installation has been driven by mechanisms such as the Code for Sustainable Homes and the Merton rule, is that insufficient thought may be given to the successful operation of the system. PV systems operate silently and inconspicuously. It may not be obvious to building occupants whether or not they are operating correctly. The current funding and legislative arrangements in the UK promote installation of systems with little incentive to ensure correct performance. One solution may lie in a feed-in tariff for renewables which would provide a more significant financial return to householders for the electricity produced and hence an incentive to ensure correct operation. This approach is proposed in the current UK government renewables consultation. To be effective it must be teamed with providing clear information to occupants and access to technical assistance and maintenance. Recommendations from PV UP-SCALE include:

- Ensure information is provided to occupants (in a sturdy format), including guarantee documents.
- Ensure interface/display confirming PV operation is available and understood by user (visual signal for operating or problem and electricity generation data). If displays are not clear problems are not picked up.
- Provide information about expected power and yields to allow poor performance to be detected.
- Providing good metering and feedback to occupants helps to keep them aware of energy saving and can result in extra energy savings.
- For larger non-domestic systems responsibility for checking performance needs to be specifically assigned.
- A reliable point of contact for queries and maintenance is needed.

Energy Service Companies (EsCos) may offer one solution to ensuring that on-site renewable systems operate effectively for the long-term. They would have a commercial incentive to maximise energy production and responsibility for holding information on the systems. Checking performance and organizing maintenance would be part of their role.

How important are renewables for Barrow?

The main aim of the organizations involved in the Waterfront development is the commercial regeneration of the area with the provision of jobs and good quality housing. While environmental sustainability is on the agenda there are higher priorities and subsequently limited awareness of the potential for renewables to have a positive impact on the wider issues of jobs and quality of the built environment.

The development team is very busy and has an enormous range of issues to consider from the bird life on one side of the docks to the security of the nuclear facilities on the other side of the docks. PV UP-SCALE was able to focus on renewable energy in the development, however this was over a limited period of time and had only a limited amount of success in involving others in the development team in issues relating to renewable energy. A development team member with their remit expanded to include renewable energy would provide significantly enhanced support for sustainable development

Site layout and solar accessibility

The indicative layout of the buildings on the site was prepared taking into account the docks to the south of the site and the strong prevailing winds from the south west. This led towards an urban layout with taller buildings along the water edge to provide a public frontage with facilities such as restaurants and shops and to provide a wind screen. However it will also shade the buildings behind. Efforts were made in the layout to minimize shade problems but solar accessibility was not at the top of the priority list. One possible solution would be to perform shading simulations, similar to those performed for the Gelsenkirchen-Bismark study within PV UP-SCALE.

Breaks in the chain

The standard approach in the UK is for developers to be responsible for much of the design and development of new urban developments. Local authorities and regeneration agencies set guidelines and limits but at a certain point responsibility for leading the design and development is handed over to a commercial developer. This break in the chain makes it hard to include detailed planning for renewables into early work before a developer is identified and at the same time gives a developer a limited amount of time to consider renewables. The possibility of considering various site layouts and issues such a solar accessibility over various iterations can be hindered by these breaks in the chain. This problem has been recognized by the UK government which has proposed a more team based approach for new eco-towns which are planned in the UK.

The final urban design for the Barrow Waterfront development will be prepared by the developer, who is not yet identified. The developer may propose designs that are significantly different from the indicative designs prepared. The renewables experience of the developer is not known and there are no requirements for renewables experts in the development team. It is hoped that the information provided will assist the developer in coming up with a truly sustainable new development.

Understanding the Code for Sustainable Homes

The scoring system and energy calculations in the Code for Sustainable Homes are extremely complex. They are designed to be assessed using computer models that include all details of the building fabric. This means that it is not easy for planners to see exactly what it means to ask that houses meet Level 3 or Level 4. It is also difficult to consider the effects of various design options and approaches to renewables at an early site layout stage. There is a lack of current benchmark data or rules of thumb and a very limited amount of practical experience in designing to the standard.

The complexity of the system and the costs involved in getting designs assessed may make it harder for smaller builders to compete against national developers who can employ their own specialists. For all developers and builders there is a risk that the impacts of various design decisions, particularly those made at the early stages, may not be appreciated.

An accumulation of experience over time should help to address these problems as would the development of some current benchmark data. The other key factor in solving this issue is access to advice and information.

Provision of information

The provision of information on renewables is a key factor in the successful implementation of renewables. The Code for Sustainable Homes in very new and there is a limited amount of experience in building such developments. Renewable energy and photovoltaics are an unknown quantity to many developers and builders. The question of how to provide practical technical information on renewables is a concern of the planning department. There is no environment department in the Council who could provide advice. Cumbria's energy advice centre is at the far end of the county from Barrow and is not seen as having much contact with organizations in Barrow. There is no local provision of advice to developers on renewables.

Possible solutions include:

- Working with existing organizations in Cumbria to target their services towards this gap more effectively.
- Gathering a group of experts to provide advice. An informal group has been successfully created in Lyon, France to assist developers in the Lyon-Confluence development with issues relating to renewables. This approach could be considered.
- Strengthening the expertise available in house from the Borough Council or the regeneration agency.

Sources of further information

Barrow Borough Council: http://www.barrowbc.gov.uk/default.aspx?page=515
Gives information on the proposed Barrow Docks Redevelopment Project and provides a copy of "The Barrow Port Area Action Plan - Development Plan Document"

West Lakes Renaissance: http://www.westlakesrenaissance.co.uk
Includes information on the Waterfront Project – Barrow in Furness, under the heading Furness Projects

The Code For Sustainable Homes: http://www.breeam.org/page.jsp?id=86

The Merton Rule: http://www.themertonrule.org/

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