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Goring & Streatley Hydro-Electricity Project: Planning a Community Hydro Scheme

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1 Introduction

This case study was developed as an example of a medium scale hydro project for community groups in South Oxfordshire. It is intended to give an indication of the work required to develop a hydro project to other interested communities with a prospective hydro site. It can be used in conjunction with the TV Energy report *Guidelines for Developing Community Hydro Schemes in South Oxfordshire* (TVR 153), which was produced in parallel to this case study.

2 Background

The Goring and Streatley Hydroelectricity Generation Scheme originated as a result of the 2005 Parish planning process for Goring and Streatley, when it was proposed to generate electricity from the river Thames flowing through the Goring Gap. Some five million tonnes of water flow through the Goring Gap every day. Although this was once used to drive the shafts of two watermills, all of this potential energy is presently being wasted. The project aims to harness this energy to generate electricity.

The project was developed as a joint initiative between the two communities of Goring and Streatley and has been undertaken on a not-for-profit basis. Because of the pioneering nature of the project and the need to apply for grants as the required studies were identified, the progress to date has been relatively slow. However, it is anticipated that, if successful, the project will pave the way for future hydro electricity projects in the region.

Goring and Streatley weirs showing proposed location of the hydroelectricity plant

3 Project Phases

The main stages of the Goring and Streatley hydro scheme can be divided into various categories, as detailed below.

Stage 1: Engagement of the local community

The communities of Goring and Streatley already had an active environmental group (Goring and Streatley Sustainability Group), so the hydro project naturally became one of their targets. Dave Holt was appointed as project leader, together with a number of other dedicated community members as support. The considerable effort of the project leader has been critical to the success of the initiative. All of the roles in the development of this community project were assumed on a voluntary basis. The project leader had a background in engineering as well as possessing excellent communication skills.

Stage 2: Feasibility Study

The feasibility study into the generation of electricity from the low head hydro site was funded equally by Goring Parish Council and South Oxfordshire District Council (SODC) and was completed in July 2006. The study concluded that installing hydropower was a financially and environmentally sound project that could generate in excess of 170kW of clean, sustainable electricity and that this would eliminate over 500 tonnes of CO_2 from the atmosphere per annum.

Stage 3: Stakeholder Meeting

Following the positive outcome of the feasibility study, in March 2007 a stakeholder meeting was held to discuss future prospects for the hydro scheme. The following organisations were represented at the meeting:

- Environment Agency (EA)
- South Oxfordshire District Council (SODC)
- Chilterns AONB (Area of Outstanding Natural Beauty)
- North Wessex Downs AONB
- Streatley Parish Council
- Goring Parish Council
- Goring and Streatley Sustainability Group (GSSG)
- Relevant landowners

As a result of this meeting, it was agreed that funds should be raised to produce an Outline Design Study that would provide more detailed information about the proposed scheme. The Outline Design Study was required to further define the

configuration and mechanical design of the proposed hydro plant. Further information about the levels of water abstraction would also be confirmed by the study. In addition, the Environment Agency representatives at the Stakeholder Meeting indicated that, as a result of previous studies, they would favour the Archimedes screw design on this particular site (a run-of-river scheme).

Archimedes screws originated in the Middle East and have been used for thousands of years to lift fluids uphill**.** Within the last decade German engineering companies have proved that by reversing the flow, energy can also be generated by the weight of water rotating the spirals. Archimedes screws are endorsed by the EA because fish and eels simply swim through them without harm. They are within 4% as efficient as a Kaplan water turbine and maintain their performance over a wide range of flows. This is an important consideration for a run of river scheme such as Goring and Streatley.

Stage 4: Project Publicity

Both the Project Leader and GSSG have undertaken a considerable number of publicity activities to raise the profile of the project. These include establishing a project web-site, which is linked to the GSSG web-site, and which provides regularly updated information about the project as well as information about the share issue. In addition to this, a large number of presentations about the project have been made by the Project Leader to other community groups in Oxfordshire.

Stage 5: Outline Design Study

The outline design study was funded by South Oxfordshire District Council, Chilterns Sustainable Development Fund (SDF), North Wessex Downs SDF and Streatley Parish Council. It was completed in March 2008 and confirmed the viability of the scheme with the Archimedes screw technology.

A number of issues were considered as part of the outline design study. For example, there were various constraints on the selection of the location and the type of turbine selected for the site. These issues included the Environment Agency restrictions on the amount of water to be extracted from the river (to maintain flows over the rest of the weirs), the effect on fish and eel populations, and the visual and noise impacts of the scheme. As a result of these constraints, the recommended location was adjacent to the lock-keeper's house on the Goring side, which would maximise flow through the turbine whilst remaining within the limits set by the Environment Agency. The technology selected was the Archimedes Screw, as it was recommended by the Environment Agency as a fish friendly turbine design. Furthermore, this design was considered to be visually entrancing and audibly relaxing, thereby satisfying the constraints of visual and noise impacts.

The conclusion of the study was to install three Archimedes Screws next to the lock-keeper's house, with a peak output estimated at 246 kW (equivalent to the average daily consumption of 500 homes).

Goring and Streatley weirs next to the lock-keeper's house with photomontage of three 3.5m diameter Archimedes Screws

Stage 6: Environmental Survey

In April 2008, the Environment Agency stipulated that an Environmental Survey should be undertaken to examine the ecology of the river and to identify any exotic species that could be compromised by the scheme. This would require further significant fund raising by the project team (GSSG).

The first phase of the survey was performed in June 2008 during the breeding season, using an interest free loan made by a member of GSSG. Grant applications were then made to various organisations for further grants, including Chilterns SDF and North Wessex Downs SDF. In addition, funding was sought from Streatley Parish Council, GSSG (voluntary fund raising activities) and Goring Amenity Association. The surveys and report were completed by June 2009. No legally protected exotic species have been found.

Stage 7: Flood Risk Analysis

A further mandatory requirement from the Environment Agency (EA) was a Flood Risk Analysis, as the spirals constitute an obstruction on the overfall weirs. The initial Flood Risk Analysis (FRA) computer modelling was funded and carried out by the EA

in summer 2008. This indicated a slight increase in upstream and downstream river levels when the river is in full spate, i.e. acting as an open river with no sluice gate control possible.

Further modelling was then required by the EA to assess how this increase could be absorbed, for example by better utilisation of the existing Streatley side sluice gates, by using an additional sluice gate and by the existing meadows and flood plains. This phase of flood risk modelling was initiated in October 2009 and completed in July 2010. The modelling indicated that an additional 3m sluice gate will mitigate any additional flood levels and EA approval of the Flood Risk Assessment was subsequently received at the end of summer 2010. Interestingly, in normal conditions the spirals allow more water through (20 tons per second) than the existing weir, thereby improving the flow upstream.

Stage 8: Planning and Licenses

The planning application will be made when the EA is satisfied with the flood risk mitigation methodology.

The planning application will require various documents, including an artist's impression, to be submitted to both the EA and South Oxfordshire District Council (SODC). The SODC Planning Department was informed of the scheme in the early stages of project development, have received the Outline Design Study and have made no objections to the project to date. Formal planning permission will cost approximately £250.

Once planning permission has been approved by SODC, a land drainage consent license and impoundment license must then be obtained from the EA.

Stage 9: Grid Connection Issues and the Feed in Tariff

The electricity produced will be connected to the national grid at Streatley via an underground cable to the Swan Hotel, located adjacent to the river in Streatley. Following meetings and agreement with the Nike Group, owners of the Swan Hotel, the hotel will draw as much electricity as it needs before exporting any surplus electricity to the national grid. In the early hours when the hotel demand is low, the electricity will contribute to the electricity consumed by fridges, freezers and street lights in the local area.

The connection of the hydro plant to a nearby consumer of electricity is advantageous from a financial point of view. The electricity from the hydro scheme will offset electricity normally purchased from the national grid. The owners of the

hotel have negotiated to purchase the electricity from the hydro project at a rate which is lower than the rate at which they normally purchase electricity. This in turn has benefits for the hydro project, as the income received from the hotel is greater than that which would be paid if the electricity were simply exported to the national grid.

In addition to the purchase price paid by the Swan Hotel, the hydro project will received the Feed in Tariff which was introduced in April 2010 and is paid to all micro-generators of renewable electricity (generators with less than 5MW capacity). The Feed in Tariff is banded according to the size of the generating plant, and in the case of Goring and Streatley, will be paid at a rate of 11p/kWh generated, plus an additional 3p/kWh for every unit (kWh) exported to the national grid.

Stage 10: Raising the Capital Investment for Construction

Several sources of funding have been evaluated for the construction of the actual hydro plant and civil works. These have included

- UK grants (Low Carbon Communities Challenge) and EU grants
- philanthropic contributions from local wealthy individuals
- local share issue, such that residents of both Goring and Streatley communities may participate in the project
- Environmental/Sustainable Development Bank loans

A notification of the possibility of a share issue was publicised in the Goring Gap News in November 2008, resulting in dozens of individuals accessing the web site indicating how much they would be prepared to invest. This exceeded GSSG's expectations.

Total construction costs of the project are estimated to be around £1.2M. It is intended to order the Archimedes screws in autumn 2011 (currently a seven month lead time) for installation in the summer of 2012 when river flows are low.

4 Project costs and timing

The table below shows the approximate costs of the project activities carried out to date, as well as some estimated costs for future activities.

Project Phase	**Date**	**Cost**
Project proposed	October 2005	-
Feasibility study	July 2006	£1,600
Stakeholder meeting	March 2007	-
Outline design study	March 2008	£8,000
Environmental surveys	June 2008 – June 2009	£ 15,000
Flood Risk Assessment (FRA) - initial	July 2008	£2,500
Flood Risk Modelling and FRA approval	Oct 2009 – August 2010	£10,000
Planning permission	Summer 2010	£250
Land drainage consent license	Summer 2010	£50
Impoundment license	Summer 2010	£135
Obtain project funding Select design consultancy Detailed design and specification Select main contractor Approval of DNO (Distribution Network Operator)	Autumn 2010 – Spring 2011 Winter 2010 Spring/Summer 2011 Autumn 2011 Summer 2011	-
Commence civil works	Spring 2012	Estimated £1.2 M
Construction of powerhouse	Spring 2012	
Installation of Archimedes Screws	Summer 2012	
Connection to electricity network	Summer 2012	
Commissioning and operation	Autumn 2012 and beyond	

5 Expected Benefits

The main benefit of the Goring and Streatley hydro project is clean, local and renewable electricity production with no CO_2 emissions for the lifetime of the project – expected to be at least 50 years. Furthermore, the scheme will generate income from the Feed in Tariff and the purchase of electricity by the local hotel of around £120,000 per year, and this will increase in line with inflation. The project will be set up as a not-for-profit community owned entity, which will pay dividends to the local share owners, and then return the remaining profit to the two communities. It is intended that these profits will be invested in other renewable energy projects with the aim of making Goring & Streatley self sufficient in carbon free electricity. In addition, other sustainability projects will be funded, such as economic and social projects with an emphasis on enhancing the diversity of rural businesses in the community.

The existence of the hydro project has already been instrumental to Goring winning South of England Village of Year 2009/10, securing the Sustainability Prize. It is anticipated that there will be greater tourism in the area as a result of the project, as the scheme will be very visible and accessible to the public as well as to river users. More people visiting Goring and Streatley will in turn benefit local businesses. The project will also be used as an educational facility, attracting visits from schools throughout the south of England wanting to see sustainable engineering in practice. Visual displays will be installed explaining the scheme and showing in real-time how much electricity is being generated. In this way, the project will raise awareness about sustainability and low carbon living.

Finally it is hoped that the project will be a catalyst for other hydro projects in the Thames Valley area and beyond. It shows the power of communities working together, providing inspiration to other community groups and demonstrating what they can achieve by co-operating as a group.

6 Lessons Learned

During the course of the project development to date a number of key lessons have been learned which can be used to assist other communities to plan their hydro projects effectively.

First of all, it is important to have a project leader and / or project team able to steer the project through to successful implementation. This person / team will need a considerable amount of determination as well as the necessary time and energy required to manage the project for the duration of the planning and development process. As there are a number of different tasks involved, e.g. legal, communication, technical and financial, it may be advantageous to share the roles between a number of people.

It is important to open dialogue with the EA at early stages in the project, in order to obtain their support and comments regarding the development of the scheme. The project team should also engage the local community to get them involved from the beginning – this can be achieved through public meetings, presentations to parish groups and by networking at local and regional events.

Grants may be available but these are generally small and can only support part of the project set-up. At some stage the project will need to secure investment by local community. It will also be necessary to set up some form of community interest group in order to gain access to grant funding as well as to manage any future share holding in the project.

Through careful planning, it is possible that the timing of phases may be scheduled in such a way as to minimise the delays, for example waiting for studies to be completed or grants to be received. (See project plan in other report) For example, some activities may only be undertaken when the river is at low flow, and Environmental Surveys will need to be conducted during certain seasons of the year.