Opportunities for promoting and developing community renewable energy projects in Sheffield:

Small Hydroelectric schemes

Report to the Sheffield Community Renewables Group

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Glossary of terms

BHA British Hydropower Association

CLG Company limited by guarantee
A registered company with members rather than shareholders; members guarantee a nominal sum for paying liabilities in the event of insolvent liquidation. Members may also pay a membership subscription.

Company limited by shares
A registered company controlled by its shareholders. Shares may be privately held, or in the case of a public company, shares may be available to trade on the open market.

CIC Community Interest Company
A new legal form proposed for social enterprises. They will combine the features of a company, with some elements from charitable organizations e.g. they will have a lock on assets to prevent them being sold off for private gain. Other proposals include a specialist regulator and an annual social report, explaining how they are delivering community benefits.

DTI Department of Trade and Industry

Efficiency: A percentage obtained by dividing the actual power or energy by the theoretical power or energy. It represents how well the hydropower plant converts the energy of the water into electrical energy.

Equity finance: Funds invested in a business as shares

ESCO: Energy Services Company

EST: Energy Saving Trust

Export: Any electrical power that is generated by a renewable generator, which is not used on site at the property, but passes onto the local electricity distribution network through a settlement export meter.

Half Hourly (HH) Export Meter: An export meter that records the exported units of electricity produced by a generator during every half hour of the day in kWh. HH export meters are required for all generators over 30kW installed capacity, and in some circumstances below 30kW installed capacity.

IPS BenCom: Industrial and Provident Society for the Benefit of the Community. One of two types of Industrial and Provident Society. IPS BenComs must retain all profits for investment in purposes beneficial to the community, normally defined in the organization's constitution.

kWh: Kilowatt-hour: a unit of energy, used to show how much energy is actually generated from a scheme (1 GWh = 1000 MWh = 1,000,000 kWh).

Levy Exemption Certificate (LEC): A LEC proves how the electricity was generated and who generated it, thus ensuring that the power comes from a renewable source. LECs are rewarded by Ofgem with every 1 MWh of power exported from a renewable source.

Local Distribution Company: The owner of your local electricity distribution network, including the wires and the meters that connect your property to the national grid.

LPA: Local Planning Authority

MW: Megawatt: unit of power, which indicates a capacity to generate energy. One MW is equivalent to one million watts.

MWe: Megawatt of electrical output Installed capacity: Maximum power that can be generated if the generator is working at its full potential, also known as its maximum power rating.

OFGEM: Office of Gas and Electricity Markets, the industry regulator.

Ofgem-accredited Total Generation Meter: A Total Generation Meter that has been accredited by Ofgem to receive payment for all renewable benefits, including ROCs.

On site Demand: On site demand is electricity used by any building, normally expressed in kWh or MWh. A normal domestic property would use circa 3.3MWh per year.

Renewable Accreditation: Microgenerators have to be accredited with Ofgem for Renewable Obligation Certificates (ROCs), Levy Exemption Certificates (LECs) and Renewable Energy Guarantee of Origin's (REGOs).

RE: Renewable Energy - energy from a continuously replaced source that is effectively not depleted.

Renewable generator: Electricity generation technologies that use renewable resources, such as wind, wave, solar, biomass and small-scale hydro power to generate electricity.

RO: Renewables Obligation: The Government’s new approach to encouraging renewable energy electricity production.

Renewable Energy Guarantees of Origin (REGOs): Awarded by Ofgem with every 1 MWh of power generated from a renewable source. REGO's currently have no market value.

Renewable Obligation Certificates (ROCs): Awarded by Ofgem with every 1 MWh of power generated from a renewable source. This value varies each year with normal market forces, just like any other tradable commodity.

ROC & REGO register: Ofgem issues ROCs and REGOs to internet-based registers. Each renewable generator can be issued with a ROC and REGO register unless they nominate a supply company to be issued the ROCs and REGOs on their behalf.

RSS: Regional Spatial Strategy

SCR: Sheffield Community Renewables - voluntary environmental group in Sheffield

SHP: Small Hydropower

Social capital/ social equity: A term used to describe the value of social connections and quality social relationships. These non-financial resources - such as trust, partnership, share values - enable a community to thrive and function more effectively.

Executive Summary

Main objectives of the report

Sheffield Community Renewables (SCR) group commissioned Sheffield Hallam University's Environmental department in February 2008 to assess the opportunities for developing and promoting community renewable projects in Sheffield with a special emphasis on small hydroelectric projects. The main aims of the study were to define the possible areas in Sheffield where small hydro schemes could be set up and to outline the whole procedure of implementing such a project. The SCR group was looking for guidelines on the project approach that would enable efficient and community benevolent solutions and at the same time successfully offset any public opposition to renewable technologies in their neighbourhood.

Introduction

In the last few years there have been many projects across the UK, where communities have raised money and bought wind turbines. Through the common management of the turbine operations and the sales of electricity, the communities and individuals were able to generate a lot of benefits. Nowadays, these schemes are proving to be even more popular, not only because of the sound financial investment opportunities but also because they provide an alternative way of generating electricity to the increasing dangers of burning fossil fuels and releasing CO_2 emissions into the atmosphere.

The list of benefits of community owned renewable energy projects is very wide. Benefits of reduced carbon emissions are global, the contribution of an additional energy source improves the nationwide security of energy supplies and there are also plenty of benefits on a local level such as:
- Contribution to the overall regeneration strategy of the deprived local areas,
- The use of local contractors during construction,
- Buying shares or other investment opportunity for local residents and businesses,
- Involvement in the development process by local landowners, groups or individuals,
- Local community facility improvements and
- Improvements to local environment and wildlife habitats to name only a few.

The UK Government is actively committed to combating climate change as well as increasing energy security and is therefore encouraging individuals and community groups in the UK to contribute to UK's CO2 emission reduction targets and set up own renewable energy projects. If those are smaller than 50 kW generating capacity, they are referred to as "microgeneration". Microgeneration technologies include Solar Thermal Hot Water Heating, Solar Photovoltaic (PV) electricity generation, Wind turbines, Micro-Combined Heat and Power (CHP), Heat Pumps, Small-hydro projects, Biomass heating and Fuel-cells. The Government has introduced some market mechanisms to support the creation of such schemes, such as green certificates (ROCs, LECs) and provided grant funding schemes for the development of renewable technologies. In addition, the local councils are also supportive of such projects as they too are trying to reduce their carbon footprints and reach local and regional carbon reduction targets. There is also a growing number of companies like Energy4all on the market that encourage and support the development of microgeneration on all levels.

Since Sheffield's industrial heritage was initially powered by the force of local rivers and weirs, which have been abandoned and polluted in the past decades, the local voluntary environmental group Sheffield Community Renewables (SCR) got an inspiring idea to develop community small hydropower projects on the viable weirs and recreate some of their old magic. The inspiration came from a similar scheme that was developed in New Mills, Derbyshire in 2008 and has been very well accepted by the local people because of its non-profit nature and community contributions. In order to replicate the same community model and re-create the New Mills approach in Sheffield, the requirements of such a project had to be clearly defined and understandable. Only by getting community acceptance and support will the idea have a chance to be successful. A best case approach for a local hydropower project was therefore sought.

Summary of the work undertaken

Work was divided into 3 phases. Phase 1 was a literature review that included collecting information and available data, studies and reports overall associated with the SHP sector. A top down approach was taken, starting from the overview of the UK's general energy market structure, Government's renewable energy policies and targets. The breakdown of policies on a regional and local government level followed, focusing specifically on Yorkshire & Humber region and Sheffield local authority.

Sector specific analysis, where SHP installations and best case examples were compared and a narrower cross-section of consultees from the UK's SHP sector was identified. The information collected through consultations allowed an insight on the specific concerns and perspectives of different stakeholders.

The next stage was the identification of the necessary work, legal procedures, preparation and costs for the implementation of a locally based SHP scheme.

Finally, a sum up of conclusions and recommendations for a "best-case approach" to setting up a challenging community project was made.

Summary of the results

One SHP scheme of 1MW can produce on average 5GWh/year which is enough to supply 1,100 homes and save 2,400 tones of CO_2 each year (ESHA, 2008).

SHP installations can prove to be a very costly investment, associated with many impeding issues that need to be considered before starting a project. On average, the development costs per kilowatt electricity produced, range from £3,000-£5,000/kW

(Western Renewable Energy, 2008) and the total scheme costs can range from £220,000 – £350,000. Economies of scale play an important role with hydro projects because there are certain fixed costs that do not change significantly with the size of the scheme. Therefore, the cost per kilowatt for new schemes increases as size reduces (Sheikh, 2008).

The site choice and preparation process itself is a long lasting procedure that needs to be planned and coordinated carefully. Despite this, long delays can occur in acquiring legal permissions from the local planning authority and the Environment Agency due to different reasons.

The costs of the site preparation and the legal documents are also not negligible and can attribute significantly to the overall cost estimations for the project. But probably the most important decision is choosing the right installer. Ideally, they would not offer just the installation services but also show a level of understanding for community beneficial projects and provide additional support for various aspects of organization and management of the project, like in the case of Water Power Enterprises that has been driving the project in New Mills.

The main benefit from a small hydroelectric scheme is at least 40-years of electricity generation and the cumulative carbon savings equivalent to what another fuel type would produce if used for the generation of the same amount of electricity. A 50kW scheme could save up to 80 tonnes of CO_2[1] each year, which would amount up to 2,080 tonnes in its operating lifetime.

The yearly generated amount of electricity can vary, but there are generally accepted formulae for the calculations of the output. An exemplar project in Sheffield is estimated to be able to generate approximately 190 MWh of green electricity per year, which could be enough to power 48 homes[2]
Community SHP projects however, often have also other functions than just the production of "green" electricity. The revenues from the export of electricity to the national grid can be invested in selected community projects, enabling greater public acceptance of the renewable technologies. Besides ensuring public participation through individual investment, a project like this can further increase public interest and benefit the local community by contributing to local recreation strategy of the area by taking care of the surroundings, removing the trash from the river through screening, serving educational purposes etc. Interdisciplinary and sustainable planning of an SHP project can even increase the flood protection (ESHA, 2007).

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1 based on the grid average emissions 0,43 tCO2/MWh)

2based on average UK electricity consumption figures- 3.880 kWh/yr:

(Energy consumption, 2008: http://www.esru.strath.ac.uk/EandE/Web_sites/01-02/RE_info/hec.htm)

Conclusions and recommendations

A detailed analysis of SHP installations, especially the similar community project in New Mills, Derbyshire has allowed a collection of valuable recommendations for the SCR group. The consultation exercise was the most important part of this report, since there is not a lot of literature covering similar specific community projects. Most of the recommendations in the final section of this report are therefore based mainly on the learning experience and inputs collected from the consultees.

It was concluded that the best organizational form for managing the complexities of the project is the Industrial provident society for the benefit of the community (IPS BenCom). Members of the IPS's Management Board should preferably have a clear dedication and basic understanding of the managerial requirements and skills needed for this scale of projects. IPS BenCom has some characteristics of charitable organizations, which allows it to apply for funding and various grants fairly easily.

An IPS structure also allows equity funding to be raised through a share offer, except that the shares are redeemable and have a fix nominal value of 1£. Investors in such a scheme should be aware that they are making a social investment with limited direct financial returns. Both investors and the IPS Management Board should have a clear understanding of community benefit and how it is realized.

One of the recommendations to the SCR would be to carefully plan and understand the implications of attracting separate funding flows for the operations of IPS, the site preparation and the SHP installation.

It is also vital to carefully select those among the various renewable energy sector contractors (consultants, installers) that bring some added value to the project (provide advice, guidance and support, additional services).

Finally, the choice of the energy supplier is the deciding factor that will determine the level of yearly revenue from the scheme. An IPS should have a good overview over the export prices of electricity for microgenerators on the market and select the supplier that offers the best Power Purchase agreement prices and supporting services. Based on the predicted yearly revenues, the economic benefits and viability of the scheme to pay interest to its investors can be estimated.

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1. Introduction

1.1 Backround to the study

A large number of sites using hydro power were operating in the UK following the invention of the water wheel and its refinements. As water wheels were replaced by turbines, and industry became larger, most small hydro sites were abandoned for a more dependable power supply from the grid. Now there is a renewed interest in the small hydro sector because it represents a small but secure and reliable source of energy that can be used as part of renewable energy strategy promotion. With no CO2 and other greenhouse gas emissions and high energy payback, it supports clean development and is recognised as being fully renewable and sustainable (BHA, 2008)

1.2 Aims of the study

The main aim of the study was to examine the possibilities for SHP schemes development in Sheffield and to outline the basic steps needed for implementing such projects. Since Sheffield's industrial heritage was initially powered by the force of local rivers and weirs, which have been rather abandoned and polluted in the past decades the local non-profit group SCR was inspired by the idea to develop community small hydropower projects on the viable weirs and recreate some of their old magic.

Special focus was given to the provision of community benefit arising from the operation of the SHP scheme. SCR is committed to installing new renewable energy solutions in Sheffield and would simultaneously like to increase the public acceptance of these technologies by enabling the community to participate and benefit from the project. Only by getting community acceptance and support for the idea can it be a success. A best case approach to establishing a local SHP project is therefore sought.

1.3 Summary of the work undertaken

Work was divided into 3 phases. Phase 1 was a literature review that included collecting information and available data, studies and reports overall associated with the SHP sector. A top down approach was taken, starting from the overview of the UK's general energy market structure, Government's renewable energy policies and targets. The breakdown of policies on a regional and local government level followed, focusing specifically on Yorkshire & Humber region and Sheffield local authority.
After the sector specific analysis where SHP installations and best case examples were compared, a narrower cross-section of consultees from the UK's SHP sector was identified. The information collected through consultations allowed an insight on the specific concerns and perspectives of different stakeholders.

The next stage was the identification of the necessary work, legal procedures, preparation and costs for the implementation of a locally based SHP scheme.

Finally, a sum up of conclusions and recommendations for a “best-case approach” to setting up a challenging community project was made

In terms of report structure Chapter 2 introduces the main characteristics of small hydropower sector, its definitions and basic requirements.

Then the overall national policy on renewable energy technology is introduced in Chapter 3, the background for national renewable policy development and the problems it is facing. Though the role of small hydro in the overall national renewable output contribution is not very significant, there are legal framework issues and opportunities that anyone who considers becoming a distributed generator should know. The national targets are then consequently projected onto the regional and local Sheffield scene.

Chapters 4 and 5 look at the procedural requirements for a small scale hydro scheme setup. They aim to give a clearer picture of the extent of detail and complexity of the procedures that need to be undertaken so that the developers understand what will be required of them, how long it might take and how much it could cost.

A best case example of successful community SHP project development is described in Chapter 6. It highlights the main pluses but also the learning points and possible changes that could have been made in the process.

All of those are then transposed to the actual SHP development in Sheffield (Chapter 7) and explained in consequential steps as an action plan of things to do.

Finally, Chapters 8 and 9 conclude and summarize the main points and make recommendations for the contractor.

2 Small hydropower projects

2.1 Definition of small scale hydropower

There is no internationally agreed definition of “small hydro” and each country has its own subdivision of the term. It in the UK one of the possible definitions classifies hydro projects per capacity as follows (IT Power, 2006):
Large hydro: above 2MW
Small hydro: upper limit is 1MW to 2MW[3]
Mini hydro: below 1MW
Micro hydro: 10kW to 100kW
Pico hydro: below 10 kW

3 some literature states the limit is 5MW (TV Energy, 2004)

The Climate Change and Sustainable Energy Act 2006 on the other hand, refers to micro-hydro generating stations – all those having a net capacity of 1.25 MW or less.

British Hydropower Association (BHA, 2008) defined small hydro as ***"one of the most cost-effective and reliable energy technologies to be considered for providing clean electricity generation."***

Particularly, because of its many advantages over wind, wave and solar power:

- A high efficiency (70 - 90%), by far the best of all energy technologies.
- A high capacity factor (typically >50%), compared with 10% for solar and 30% for wind.
- A high level of predictability, varying with annual rainfall patterns.
- Slow rate of change; the output power varies only gradually from day to day (not from minute to minute).
- It is a long-lasting and robust technology; systems can readily be engineered to last for 50 years or more.

For the site to be a promising candidate for SHP development, a substantial flow of water is needed. An average home uses four to five kilowatt hours of electricity per day, which would require a flow of $1m^3$ of water per second falling through 1m (World of renewables, 2008).

In general, SHP projects do not represent major investments that companies would be interested in, therefore it is upon small private investors or local community groups to develop them.

In the past few years, a trend of community groups across the UK has taken on the challenge. Especially in the south of England communities, various energy agencies, local governments and industry became more involved in hydro schemes. Voluntary Hydro groups have been set up in East Anglia, Kent, the Peak District, the Mendips and Dorset. Even HM the Queen has installed a hydroelectric plant on the Thames to supply Windsor Palace (World of renewables, 2008).

2.2 Types of SHP schemes

Schemes that have an available head (height that the water falls through the hydro installation) of less than 5m are referred to as "low head".

In the context of hydropower in Sheffield, almost all possible schemes will fall into the bracket of low head micro hydro.[4]

4 Small sites at old mills are usually considered as pico hydro and are property of the owners of the mill.

Low head hydro schemes are almost always "run-of-river", which means that they do not need any significant storage of water needed in the head pond upstream of the intake. The scheme operates when the river provides enough flow, but may have to shutdown during very dry periods (TV Energy, 2004).

2.3 SHP scheme variables

The power developed at a site is the product of head, water flow and system efficiency.

The general formula for any hydro system's power capacity according to the BHA Guidebook, 2005 is:

$$\mathbf{P} = \boldsymbol{\eta} \times \boldsymbol{\rho} \times \mathbf{g} \times \mathbf{Q} \times \mathbf{H}$$

Where:
a) **P** is the mechanical power produced (Watts),
b) **η** is the hydraulic efficiency of the turbine*
c) **ρ** is the density of water (1000 kg/m3),
d) **g** is the acceleration due to gravity (9.81 m/s2),
e) **Q** is the volume flow rate passing through the turbine (m3/s),**
f) **H** is the head or height through which water falls on the turbine (m).

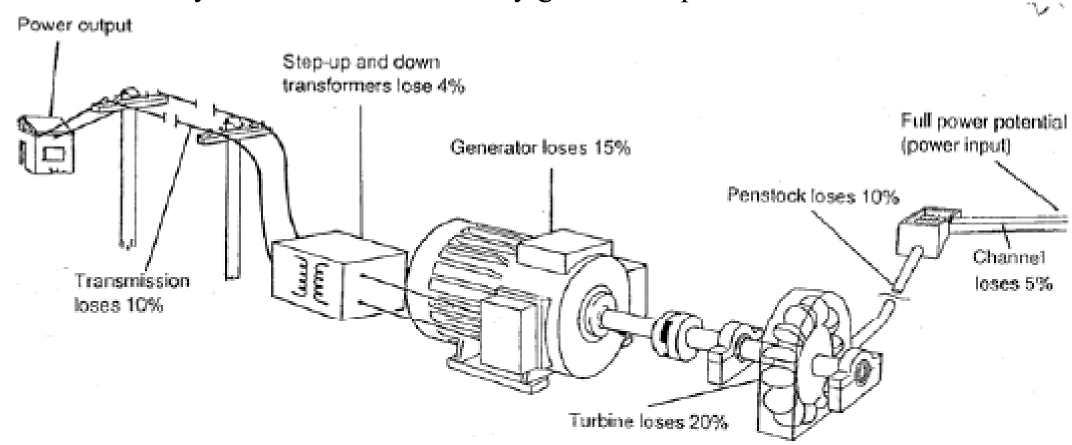
*ad b) A total system efficiency factor shows how efficiently a scheme converts the power of water into electrical power. It is expressed as the total power generated by a system divided by maximum potential power produced if the turbine were to be used continuously (Needle, 2008).

SHP systems (<100kW) tend to have a 60 to 80 % efficiency and BHA (2008) normally uses a water-to-wire rate of 70% for the calculations.

Literature states various efficiency factors though, from 45 up to 80%, as there is no standardized figure for the calculations. A rough guide that was found is used in most calculations for SHP output is 50% (factor 0.5)[5] and is explained in Figure 1.

5 used by http://www.ecocentre.org.uk/hydro-power.html, http://www.edc-cu.org/pdf/Micro-Hydro.pdf, http://www.appropedia.org/Original:Microhydro_power et al.

Figure 1: Efficiency losses in SHP electricity generation process



Source: Introduction to Micro Hydro (2008); http://www.edc-cu.org/pdf/Micro-Hydro.pdf

A simplified formula for the output calculation[6] would then be:

P = H x **Q** x **e0***

$$*e0 = e_{\text{civil works}} \times e_{\text{penstock}} \times e_{\text{turbine}} \times e_{\text{generator}} \times e_{\text{transformer}} \times e_{\text{line}}$$
$$= 0.95 \times 0.90 \times 0.80 \times 0.85 \times 0.96 \times 0.90$$
$$= 0.50$$

Where e0 presents the total efficiency of the system (Figure), taking into account the total net loss incurred.

**ad e) Flow rate (Q) information – for a run-of-river project, a high mean flow is the most important factor. Flow is assessed through a flow duration curve (FDC) based on past recorded water flows. An FDC shows the probability of the number of days in a year when a particular flow can be expected and considers the percentage of the flow that can be directed through the turbine[7] (TV Energy, 2004).

The necessary information about flow rates can be obtained from the EA, or from the Centre for Ecology and Hydrology, Wallingford, Oxfordshire[8] (TV Energy, 2004). If no data is available yet for the river predictions can be made using long-term rainfall and evaporation data and discharge records for similar catchment areas[9] (BHA, 2008).

6 http://www.edc-cu.org/pdf/Micro-Hydro.pdf. 7 usually it is estimated as 95% of the time-Q95

8 see http://www.ceh.ac.uk/data/nrfa/index.html: 9 see http://www.british-hydro.co.uk/infopage.asp?infoid=368

This data is very important as it will be the base for the presentations of flow variations throughout the year with a Flow Duration Curve (FDC). A FDC shows how much water power will be available for energy generation in different seasons.
The minimum river flow that is exceeded for 95% (Q95) of the year is usually taken as the characteristic value [10]

2.4 Annual energy output from a SHP scheme

After establishing the potential generating capacity of the site, the yearly output is calculated based on the availability of the flow over the year:

Energy (kWh/year) = Power (kW) × **LF** × 8760 hrs/year

LF: Load Factor

The load factor shows the ratio between the actual quantities of electricity generated against the maximum potential energy output and gives a % of time in which the system is operating at full power (theoretical maximum).
This is not 100% because RE generators are limited by market demand and its changing load (determined outpt), downtime for maintenance and renewable resource availability.[11]

$$\text{Load factor (\%)} = \frac{\text{Energy generated per year (kWh/year)}}{\text{Installed capacity (kW) x 8760 hours/year}}$$

The relationship between the flow and the choice of turbine:

Larger turbine: is more expensive, takes a high flow (available only a % of time during the year), operates at a low load factor, generates more energy when operating, might shut off during low flows.

Smaller turbine: will generate less energy over the year in total, but will be working more constantly throughout the whole year at a higher load factor (constantly generating revenue).

A small hydro scheme would normally need to have from 50% to 70% load factor in order to give a satisfactory return on the investment.

10 see http://www.british-hydro.co.uk/infopage.asp?infoid=368

11 Load factor is used for RE that are capable of following market demand load - all RE but wind. Wind is using "capacity factor" instead. See http://www.windaction.org/documents/6838

It is recommended that the turbine should be able to operate over a range of different flows in order to increase the energy capture and still keep a reduced output and income during the drier months.

2.5 Main obstacles to small hydro development

Despite having many benefits, new hydro plant developments come up against 3 major sets of obstacles (SPLASH, 2005):

- *Economics*;

A small plant is more expensive (in £/ kW) than a large plant and has a longer payback period and the exact same requirements as a large plant in terms of permits and basic fixed costs, which are relatively high.

- *Permits;*

Obtaining all the necessary permits for the SHP is aggravated by the complexity, costs, bureaucratic procedures and high risk of delays in having permits granted, which can potentially create high additional costs for the developer.

- *SHP impact perception;*

Unlike large hydro schemes, small run of the river hydro usually has minimal impact on the river regime and can integrate well into the river ecosystem. It usually doesn't involve new dams or storage reservoirs and ameliorating measures can be made to allow the passage of fish through the system.
The application of the Water Framework Directive (WDF) makes the regulatory requirements much stricter. WDF (2000) is an EU action framework that was implemented in the UK legislation in 2003. WDF is set to restore and protect good ecological status of waters and achieve the benefits of hydro power without causing any environmental harm. It requires that the "ecological quality" of rivers may not be negatively affected (though there are some provisions for SHP) by any modifications done to the water body or river bed.

This imposes new strains on the SHP systems because they will be required to impacts minimize the impacts on river life as much as it is technically and economically possible throughout their lifetimes (SPLASH, 2005).

3 Renewable energy resources in the UK

3.1 Government's renewable policies development

The Government has set the renewables' targets as a proportion of UK's electricity supplies to 10% by 2010 and 20% by 2020 and has identified the development of renewable energy as the key to the strategy of tackling climate change.

The White Paper for Energy (2007) sets out the Government's energy strategy whose focus is the reduction of CO2 emissions and increased energy security. The main strategic policy goals are: establishment of an international framework to tackle climate change, provision of legally binding carbon targets for the whole UK economy, progressive reduction of emissions, encouragement of energy saving by providing better information and support for low carbon technologies through incentives.

Various models for the future energy mix were presented in the 2003 Energy White Paper (DTI, 2003) in order to show, that despite the decommissioning of old thermal and nuclear power stations in the next few years, stability of future energy market supply can be achieved through a non-nuclear energy mix, simultaneously by reducing the carbon emissions and reaching the 60% target by 2050. The models were carried out by the Imperial College and Future Energy Solutions, by the Department for Trade and Industry (DTI), ILEX Energy Consulting, Friends of the Earth, Tyndall Centre and many others.

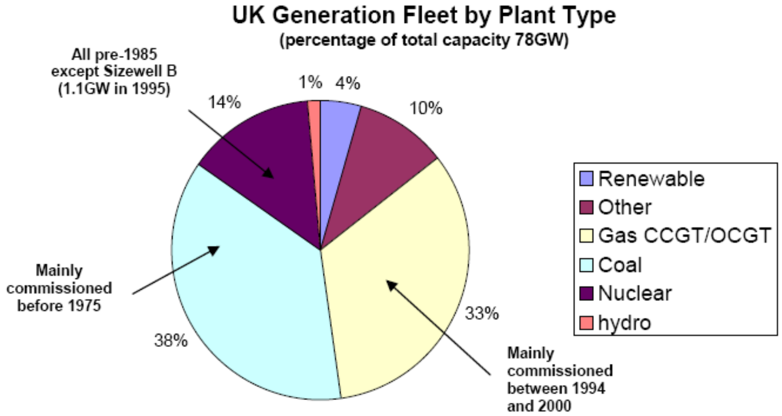
The modeling results showed that a non-nuclear route was feasible, with electricity provided by gas, wind and tidal power, biomass, combined heat-and-power (CHP), and other renewables. These measures would have to be combined with greater energy efficiency, more stringent policy measures, carbon savings in non-electricity sectors, through the use of hydrogen in transport and the necessary investment in technology innovation.

Several studies also looked at the potential of renewable energy to contribute to the electricity production. The government's Interdepartmental Analysts Group report showed that given the right framework, renewables could contribute around 68 per cent of electricity (based on current usage). Small-scale and microgenerated energy could contribute significantly to this goal. According to the Energy Saving Trust microgeneration could contribute 30-40 per cent of the UK's electricity needs, cutting carbon emissions by 15 per cent (DTI, 2003).

Microgeneration technologies include Solar Thermal Hot Water Heating, Solar Photovoltaic (PV) electricity generation, Wind turbines, Micro-Combined Heat and Power (CHP), Heat Pumps, Small-hydro projects, Biomass heating and Fuel-cells.

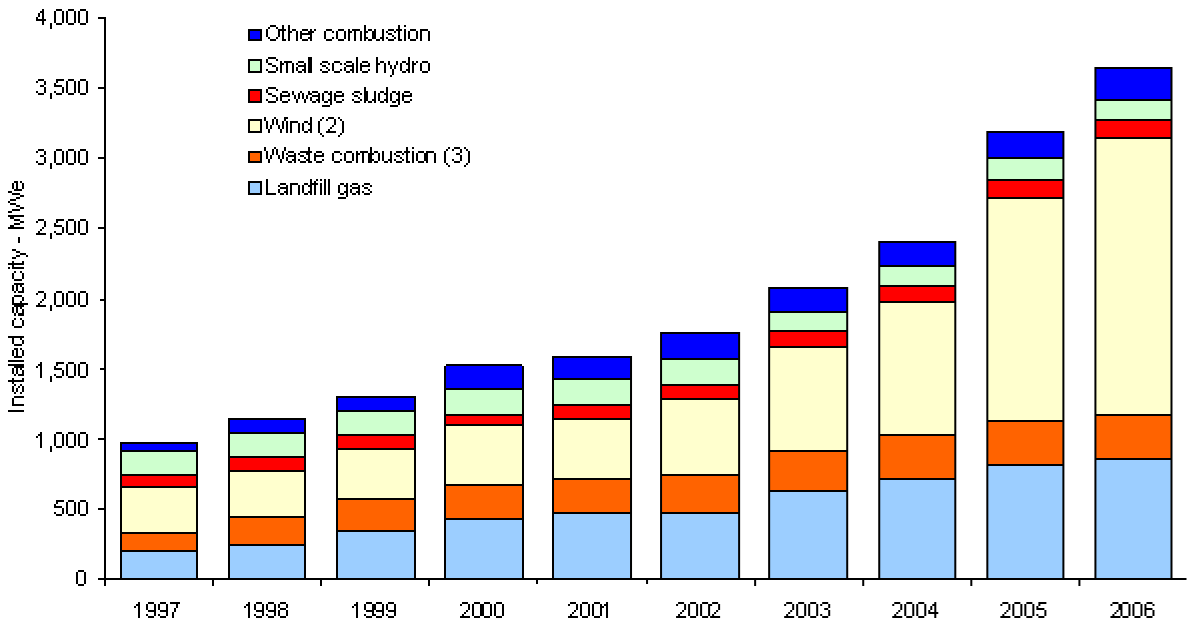
Installed **renewable technologies represented 4% of the total capacity** (without large hydro) **of the UK's energy mix in 2006** (Figure 2) which translates to around 1% of its final energy demand. The total installed RE capacity in 2006 was 3.12 GW (13TWh) out of which only about 100 MW (Figure 3) were represented by small hydropower (Renewable energy – The Investment opportunity, 2007).

Figure 2: UK installed energy capacity per plant type in 2006



Source: Renewable energy – The Investment opportunity, 2007.

Figure 3: Electrical Generating Capacity of Renewables per technology (excluding large scale hydro)



Source: RESTATS (2007). *http://www.restats.org.uk/capacity.htm

3.2 Government's actions

1. Distributed generation

In order to reach the 2020 goals, the Government has committed itself to promoting all renewables development including the increasing number of distributed generators. The current electricity market framework was established to meet the needs of large centralised generation to the disadvantage of smaller distributed generators.

According to DTI (2007), Distributed Generation is defined as any generation which is connected directly into the distribution network and not to the transmission network, which means that the electricity is produced and used locally instead of being transported across the UK.

Government and Ofgem (Review of Distributed Generation, 2007) are dedicated to providing better conditions for DG and stimulate DG growth, enable them to realize a reasonable economic value from their schemes and reduce the complexities of setting up a DG scheme.
Those improvements in terms of market arrangements and changes in policies are:

1. New market and licensing arrangements that will open up the opportunities for individuals and community generation schemes to make better use of local renewable sources of energy;

2. Clearer export rewards achieved through a greater transparency of prices offered by suppliers and encouraging them to invest in technical changes to reduce technical and administration costs and make it easier for new DGs to connect with them;

3. Improved information service and advice on DG.

4. Simplification of unnecessary barriers for DGs making the DNO connection to the Grid; and

5. Establishment of a new Distributed Energy Unit within the DTI that will monitor and help drive the development of distributed market technologies.

In order to further encourage microgeneration and small renewables development, the Government has introduced the Clear Skies fund, now replaced by the Low Carbon Buildings Programme (LCBP) to fund private local and community distributed generation and help break down the barriers to public acceptability of renewables through local ownership schemes. Further focus on microgeneration was confirmed by the Climate Change and Sustainability Act 2006, where the Government stated its future policies on microgeneration will enable easier access to monetary benefits (ROCs), promote community energy projects and support local authorities in taking the same measures. It also introduced a reduced VAT rate of 5% for most microgeneration private owners and exempted very small projects from standard licensing procedures.

3.3 The Renewables Obligation (RO)

RO is the main market mechanism for stimulating the growth of renewables and reducing greenhouse gas emissions at the same time.

RO first came into effect on 1st April 2002 under The Electricity Act 1989. Ofgem (The Gas and Electricity Markets Authority) is responsible for the implementation and administration of this legal obligation on all licensed electricity suppliers. The central objective of the RO was to help UK reach the target under the Kyoto Agreement to reduce greenhouse gas emissions by 12.5% below 1990 levels by 2008 to 2012 and to contribute to Europe's binding target for 20% of the EU's total energy supply to come from renewables by 2020.

It places an obligation on licensed electricity suppliers to source an increasing proportion of their electricity sales from renewable sources or to pay a penalty -the buy-out price[12] In 20007/08 the price is £34.30 per MWh. This is a fixed penalty that an energy supplier pays for each MWh that it falls short of its obligation. Each MWh of generated green electricity is eligible for 1 ROC. ROCs can be traded and their value depends on the demand and supply of ROCs on the open market.[13]
The suppliers pay penalties for missed RO targets into an account administered by Ofgem (the Buy-out Fund) and each year the accumulated Fund is distributed among those suppliers who have fulfilled their targets (Figure 5) .

The combination of the buy-out price and the extent to which suppliers have fallen short of their obligations determines the nominal value of a ROC and the total financial support available for each MWh of renewable electricity under the RO.

The buyout fund is paid out to RE generators in proportion to the ROCs issued to them against all ROCs issued. The greater the shortfall in ROCs issued below the set target, the greater the value of the Buyout Fund premium paid. This way DGs get additional variable income (UK Renewable Energy – The Investment Opportunity, 2007).

12 Buy-out price is linked to the Retail Price Index (RPI) providing renewable generators with a fixed element of income

13 For more details see White Paper for Energy 2007and The Renewables Obligation Order 2006

Figure 4: Example of calculation of ROC value and Buyout Fund Premium (April 2006)

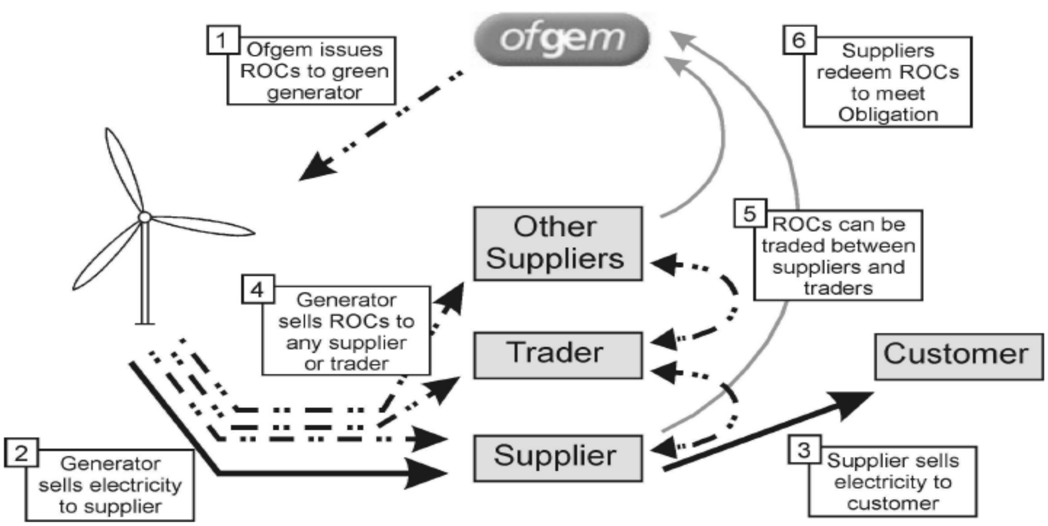
1. ROC Buyout Fund premium 2005/2006			
RO Requirement	16,175,906	MWh	
ROCs submitted	12,232,153	MWh	
Shortfall	3,943,753	MWh	
Buyout Fund Pool	x £32.24		=£127,146,596
Buyout Fund Premium	÷12,455,230		**= £10.21/MWh**

2. ROC Value 2005/2006		
ROC Value	32.33	
+		
Buyout Fund Premium	10.21	
Total	**£42.54**	**/MWh**

Source: Ofgem Renewables Obligation: Annual Report 2005-06 (Feb 2007)

Source: UK Renewable Energy – The Investment Opportunity, 2007

Figure 5: Flows of electricity (solid) and ROCs (broken) in meeting Obligation (grey)



Source: Harisson (2005). Prospects for Hydro in the UK- Between a ROC and a hard place.

In order to strengthen the Obligation, the Government has suggested increasing the RO targets to 20% in 2007 (DTI, 2007) and introducing re-banding of the RO[14] to offer differentiated levels of support to different renewable technologies and microgeneration in general. The Government expects that the re-banding will triple the electricity supplies from renewable sources until 2015 to around 15% of the total electricity supplied (Figure 3). New bands are set to be introduced in 2009 and will ensure double ROCs for all microgeneration technologies up to 50kW.

Figure 6: Estimated RE generation in TWh in order to meet the yearly RO targets

RENEWABLES OBLIGATION		
Obligation Period	**Set Percentage of Total Supplies**	**Estimated Renewable Generation Required in TWh**
2006/2007	6.7	23
2007/2008	7.9	27
2008/2009	9.1	32
2009/2010	9.7	45
2010/2011	10.4	51
2011/2012	11.4	59
2012/2013	12.4	68
2013/2014	13.4	78
2014/2015	14.4	89
2015/2016	15.4	101
Each subsequent period of twelve months ending with the period of twelve months ending on 31st March 2027	15.4	

Source: UK Renewable Energy – The Investment Opportunity, 2007

Figure 7: Indexed ROC values 2007/08 – 2015/16

ROC VALUES	
	£ per MWh
2007/08	34.30
2008/09	35.16
2009/10	36.04
2010/11	36.94
2011/12	37.86
2012/13	38.81
2013/14	39.78
2014/15	40.77
2015/16	41.79

Note: ROC values post 2007/08 are assumed to grow at the same rate as CPI of 2.5% per annum

Source: UK Renewable Energy – The Investment Opportunity, 2007

14 Due to come into effect on 1st April 2009

3.4 Climate Change Levy & LECs

The Climate Change Levy (CCL) was introduced in April 2001. It was designed to encourage the use of environmentally friendly fuel sources to help the UK meet its emissions targets and taxes producers of CO_2 emissions. The scheme is administered by Ofgem.

The levy for electricity is set at 0.43p/kWh – equivalent to £31 per tonne of carbon. Zero and low carbon technologies (except large hydro and nuclear) are exempt from paying CCL and are issued Levy Exemption Certificates (LECs). LECs can be traded, providing renewable generators with an additional revenue stream (UK Renewable Energy, Investment opportunity, 2008)

Each MW generated is entitled to 1 LEC. Unlike the ROCs, LECs don't have an intrinsic value and have a price of £4.41/MWh, which is subject to yearly indexation in line with RPI. The current legislation applies until 2011, but it is expected to continue thereafter

The revenue received from the sale of LECs through power purchase agreements is typically only 20-55% of their face value, depending on the conditions by the energy supplier (UK Renewable Energy, Investment opportunity, 2008)

3.5 Financial rewards for renewable energy generation

To sum up, in addition to the value of electricity generated DGs are entitled to the payments from:
• Renewable Obligation Certificates (ROCs)- a fixed, indexed linked, payment;
• ROC Recycle Buyout Fund Premium (Buyout Fund Premium)- an additional variable income;
• LECs - an additional index linked payment and
• REGOs.

3.6 Current status of UK's RE sector development

In March 2008 BERR published a report by consultancy Pöyry which for the first time looked at the actual costs of meeting the RE targets and defined the required RE increases per technology. The report indicates that reaching 15 or 20% by 2020 from the current 4% will be an enormous challenge and a huge cost (ENDS 2008).

In order to reach the targets through domestic RE generation the report focused mainly on largely increasing offshore and onshore wind, biomass and biogas. New figures largely surpass any estimated goals that the Government has published before and show the actual scale of the problem. An additional 145 TWh[15] of electricity from renewables would be needed by 2020.

15 See ENDS at: http://www.endsreport.com/index.cfm?action=report.issue

Currently, the UK's yearly renewable generation is only 13TWh (DTI White paper, 2007).

However, the target for small hydro is has been set on current level. It is supposed to be contributing **0,3TWh,** which how much the 100MW installed capacity already produces today[16] (ENDS, 2008). The Government is obviously focusing only on big schemes while smaller ones are left to the private sector to develop.

3.7 Future renewable policy costs

Pöyry's estimate for the sector expansion costs including grid limitations and necessary upgrades is £5.3 billion per year, or some £74 billion in total - equivalent to around £3,000 per household over the next 12 years.

As an answer, UK has already considered scrapping the RO. Now it is widely seen as giving current renewable generators excess profits. According to Ofgem, the export tariffs alone are high enough and the ROCs only present pure profit to distributed generators. New proposals for an alternative bidding system and another one for feed-in tariffs have been introduced in 2008. For now BERR hasn't accepted the proposals as change would too negatively affect investor confidence and energy market stability, so the support for microgeneration remains high at this point but it remains to be seen what future measures the Government will still take.

3.8 Sheffield City Council (SCC) policies

The Local Government White Paper 2006 called upon the local governments to contribute to the national efforts of achieving the environmental targets: CO_2 emissions reductions of 60% by 2050 and production of 10% of electricity from renewable energy sources by 2010, 15% by 2015 and 20% by 2020 (Report to Cabinet, 2007).

Draft Regional Spatial Strategy (RSS) set an additional regional target of 10.6MW of RE installations to be achieved in Sheffield by 2010 and 52,1 MW by 2021.[17] Additionally, a sub regional target for South Yorkshire was set at 160MW by 2021 (Report to Cabinet, 2007).

In 2006 the Cabinet approved the Environmental Excellence strategy and set out the Council's 4 key challenge areas of commitment:
1. Climate change and energy;
2. Transport and mobility;
3. Environmental design;
4. Quality and management; sustainable production and consumption.

16 SHP UK Generatin 2007: 100,000 kW x 0.45 x 8,760h = 394,2 GWh = 0,394 TWh

17 Targets set out in the RSS apply to grid-connected generation only.

To be able to understand and plan the potential RE developments to reach the RSS targets in Sheffield, the SCC commissioned a Scoping and Feasibility Study on Renewable Energy in 2006. Based on the results from the SCC RE Scoping and Feasibility study, 2006 the local targets for carbon emissions reductions and installations of RE were set that exceed those set in the regional Draft Regional Spatial Strategy for Yorkshire and those set by the Government's Energy White Paper 2003 (Report to Cabinet, 2007).

SCC targets are imbedded in the Core City strategy which is a part of the new SDF that will be implemented in 2009/10. SDF will set out the policies that the Council will use to shape its spatial planning and will support the development of both large scale and small-scale renewable energy generation.

According to the Core strategy policy SE5- renewable energy generation the RE capacity in Sheffield is set to exceed 12MW by 2010 and 60MW by 2021.

These local targets will be achieved through the implementation and support of (SCC website, 2008):

- The Merton rule: developments will be required to generate an obligatory minimum 10% of their own energy from renewable sources (and 20% for large and medium developments as set in the Preferred Options of the City Policies) unless they can demonstrate comparable carbon emission reductions through design;
- Encouragement of large scale RE schemes (e.g. Westwood Country Park Wind Farm project);
- Local small-scale generation (especially domestic solar panels, biomass heating and wind turbines) by individuals and local groups.

Key sites that could contribute to the deliverable renewable energy targets have been identified by the SCC study (2006) for wind biomass, and small-hydro developments. According to IT Power, there is significant local potential for microgeneration. From 54 to 109 MW of new capacity could be installed by 2012, depending on the speed and viability of projects.

4 Hydro electric scheme viability within Sheffield

4.1 Project requirements in Sheffield

Before starting a SHP project the following steps need to be undertaken:

1. Identification of possible feasible local sites to be reviewed

2. Identification of stakeholders.

It is important to contact the following stakeholders in the earliest stages of the project regarding the information, support and concerns about new local RE developments:

- Sheffield City Council
- Natural England
- The Environment Agency
- Yorkshire Water
- Sheffield Wildlife Trust
- Campaign to protect Rural England
- Friends of the Peak District
- Development agencies
- Various funding bodies
- YEDL CE Electric (DNO)
- Local community groups and individuals
- Local contractors: (List of)
- Energy and Environmental Consultancies
- Electricity Suppliers
- Hydro power Installers
- Legal service
- Accounting service
- British hydropower association
- Existing stakeholders of similar projects

3. Planning the project

A good project plan should set a clear goal and take into account the identified constraints and possibilities for the project in all phases. It should also give a good overview of the financials, risks, benefits and resource requirements.

4.2 Identification of potential small hydro sites in Sheffield

The SCC study (2006) initially identified 24 potential small hydro sites (Figure 7) for SHP development due to their height of head, flow rates and location. However, a more thorough look at the sites immediately eliminated more than half (Figure 7 - capacity "0") of them due to the main constraints:
a) Head – not viable, too low;
b) Access- it was not possible to reach the site by car/ construction vehicles;
c) Land availability – the landowner not prepared to give consent for the development;
d) Flow –too weak;
e) Environmental impacts – impact on the surrounding landscape is too big;
f) Listed buildings – listed buildings on the site may restrict the scope of the development.
g) Sheffield City boundary- sites which are outside SCC boarders were not looked at.

Figure 7: Potential sites for SHP development in Sheffield

No.	Location	River/Stream	Head (m)	Mean Flow (m3/s)	Est. Inst. Power (kW)	X Co-ord	Y Co-ord
1	Niagara Forge	River Don	3.10	3.55	78	432807	391532
2	Carbrook Weir	River Don	2.15	5.02	76	438718	390175
3	Rivelin Mill	Rivelin Stream	Low head (<1.2 m)	1.10	0	428914	387080
4	Rivelin Valley	Rivelin Stream	1.30	1.10	10	432302	388720
5	Treatment Works	Rivelin Stream	5.00	0.55	19	428736	386897
6	Attercliffe	River Don	1.70	5.02	60	437281	388924
7	Leveston St.	River Don	1.20	5.02	43	436727	388195
8	Effingham St.	River Don	1.30	5.02	46	436230	388140
9	Wicker St.	River Don	1.40	5.02	50	435713	387834
10	Ball St. Weir	River Don	Low head (<1.2 m)	5.02	0	435046	388273
11	Neepsend Weir	River Don	No access	5.02	0	434501	388664
12	Waterford Road	River Don	No access	5.02	0	434254	389127
13	Union Carbide	River Don	1.20	3.55	30	431861	391972
14	Loxley River	Loxley River	2.80	0.56	11	431784	389658
15	Old Wheel Farm 1	Loxley River	Private	0.56	0	429676	389893
16	Olive Mill	Loxley River	Private	0.56	0	430602	389425
17	Old Wheel Farm 2	Loxley River	Private	0.56	0	428746	390349
20	Rivelin Dams	Rivelin Stream	25.00	0.11	19	427642	386922
21	Damflask Dams	Loxley River	25.00	0.28	49	428573	390551
22	Meadowhall	River Don	1.70	5.33	64	439050	391003
24	More Hall Reservoir	Ewden Beck	20.00	0.29	41	428659	395577

Source: IT Power: SCC RE Scoping and Feasibility study, 2006.

Additional sites were noted west of the City on the Upper Don and in the Peak District but were not considered as they are outside Sheffield's borders.

In the SCC Scoping and Feasibility study (2006) 10 possible sites were identified across the City with a total capacity of 0,456 MW and a potential generation output of 1,797 MWh/year.

The best potential sites in Sheffield are according to the SCC study along the river Don because of its size and good flow rate. Developing a site on the Don could potentially have be very beneficial as the Upper an Lower Don Valley are both part of Sheffield's Strategic Regeneration zones and are planed for major economic and environmental improvements in the next 15-20 years.
Although the Council supports private investments into new projects in the area, getting a planning permission is still a risky and complex process even if the planning proposal fits in with the Local Area Strategy. The new SDF (2009/10) however, is set to create more

reassurance for private sector investments, grant easier permissions and encourage developer’s interests more (Upper Don Regeneration Strategy, 2006).

The Upper Don Valley offers a lot of opportunities for the development of community SHP and could greatly benefit from its regeneration effects as it has:

- few public sector land holdings,
- many under-utilized sites.
- major derelict sites in important locations,
- poor perception of the area in market terms,
- old infrastructure.

A local installer of water power projects Waterpower Enterprises (h2oPE) has been cooperating with the SCC on the review of the sites after the scoping study was made I 2006. Based on the findings of the h2oPE report (2007), the conditions affecting these sites have changed in the past 2 years. The floods in the summer 2007 have had a large impact on some of the sites.

H2oPE last visited some of the sites in January 2008 and concluded that four weirs might have good potential: Brightside, Wards End, Meadowhall and Loxley weir. Especially Wards End and Loxley seem like they could be appropriate. Wards End weir is even located near a college that could potentially be powered by a private wire (Welsh, 2008).

In general, all sites would need to be re-evaluated with the main focus remaining on the sites on the Don River. All relevant stakeholders should be contacted and consulted individually in order to give a realistic picture of the viability of the sites in Sheffield today (Welsh, 2008).

4.3 Planning requirements

Relevant planning issues to consider when applying for planning permission with the LPA are material considerations that need to be described in the planning application. They must be related to the development and the use of land in the public interest, including size, layout, design and external appearance of the proposed development, the means of access, landscaping, impact on the neighbourhood and the availability of necessary infrastructure. Unfortunately, community benefits are not considered legitimate material considerations within the planning decision making process because they do not relate directly to planning issues (Wells, 2008).

The planning application must fit within the LPA’s own planning policies and be in accordance with Regional Planning Guidance, the appropriate Local Development Plan as well as relevant National Planning Policy Guidance Notes. SHP plans have a much greater chance of success if they are integrated into the statutory planning documents.

4.4 Sheffield City Council's planning policy framework

The core planning policy document for Sheffield is the Unitary Development Plan (UDP) which was adopted in March 1998. In 2009 it will be replaced by the new series of local policies within Sheffield Development Framework (SDF) and further enforced by the Regional Spatial Strategy for Yorkshire and Humber that will also form part of the SDF. Further planning advice is available in the form of Planning Policy Statements. For an SHP project installation, the relevant Planning policy statements that apply would be PPS1 and PPS 22. PPS1- Delivering sustainable development and its 2007 supplement PPS 1- Planning and Climate Change enforce consistency of development proposals with sustainability strategies and climate change policies, whereas PPS 22 focuses specifically on the renewable energies development policies (Wells, 2008).

4.5 Guidelines for receiving planning permission

1. As soon as an appropriate viable site is chosen for development, the IPS should contact SCC and arrange an appointed development officer to visit the site together with a representative of the IPS (as the developer) and the company that will be chosen as the installer. A development officer will give advice as to what is needed for the planning application and identify and obvious potential problems at the site and make recommendations for the planning application submission. The cost of a planning application is £135 (Wells, 2008).

2. According to the report by the Centre for Sustainable Energy: Delivering Community Benefits from Wind Energy- A Toolkit (2007).[18] Community benefits are generally not part of material considerations of the planning decision and will not influence the outcome of the application. It is recommended to talk about the inclusion of community benefits with the relevant LPA before submitting an application in order to fully understand the local policy. According to the Toolkit (2007) if the IPS wants the local authority (not obligatory) to be involved in any discussions or planning of deliverable community benefits, then there are two options:

(a) The SCC could become involved in discussions about community benefits after it has resolved to grant planning permission.
(b) IPS could separate the planning process from discussions about community benefits and discusses in parallel with two different officers and/or councillors about these issues.

"Early" approach b) is adopted as best practice guidance for by the Protocols for Public Engagement with Proposed Wind Energy Developments, whose approach to the planning permits is very similar (Centre for sustainable energy, 2005).

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18 www.berr.gov.uk/files/file38710.pdf; Pg 14-22

3. After the necessary information has been gathered and prepared the IPS can file a planning application at the council. SCC will check the application to make sure that it is complete and entails all necessary information.[19] The appointed Planner for the area will check the planning policies, consult the statutory consultees, the Environment Agency and English Nature and visit the site.

It usually takes up to 8 weeks to resolve the application. In the meantime, the planning application will be given wide publicity in order to collect the views of local people that are important to the Council. For this purpose, the application will be in a publicly accessible database and any stakeholders that might be affected by the proposed development will be notified in written about it and will have a chance to inspect it. Any objections will have to be put in writing and will be placed on the Planning Application file (Wells, 2008).

After that, Planner will assess the proposal, consider views from other parties and propose any necessary alterations that the applicant should make.

If there is a lot of opposition, this could have high additional costs for the developer and could postpone the delivery of the granted application by a long time or even require re-application (Wells, 2008).

In the end, when the decision to grant or refuse planning permission has been made, the applicant will be sent a "notice" including any conditions. Once permission has been grated, the development can then begin (SCC website, 2008).

4.6 Definition of community benefit

It is very important that the social investors in the IPS scheme understand the concept of community benefit and have realistic expectations towards the scheme. It should be realized that the project is not likely to be able to afford significant financial community benefits in the beginning of its operations and even later on, all of the possible benefits will most likely not be fulfilled.

In the first years the RE project has to primarily offset the fixed costs of development and operation that take up a greater proportion of the income, leaving less money available for returns to shareholders and payments to community funds or other community benefits. Developers can not be expected to agree to the provision of local benefits that may jeopardise the financial viability of a scheme (Centre for Sustainable Energy, 2005).

19 Validation checklist available from SCC planning department's website:http://www.sheffield.gov.uk/planning-and-city-development/development-control/making-an-application/onlineapplications

There is no evidence that the provision of community benefits will in any way influence the turnout of the planning permission applications or speed up the application process. Nor can it be confirmed that the community benefits have a positive effect on the public acceptance of the renewable energy project.

Renewable energy developers that provide community benefits in the UK do not have a standard approach to the delivery of the benefits. According to the Centre for sustainable energy (2007), the most common activity of community groups managing renewable projects in the UK is to accumulate payments into a community fund that is then to be distributed to certain chosen projects locally.

A successful community benefit scheme should have:
1. Clear agreements about the provision of the benefit;
2. Mechanism that ensures the continuity of the scheme;
3. Clearly defined purpose for the funds;
4. Documented and clear approach to managing and distributing the funds.

Centre for sustainable energy (2007) carried out a survey among the community wind farm developments in the UK and found that only 1 in every 4 has a formalized written agreement on the delivery of the community benefits either with the planning authority or with the local community. The survey found that there were no direct advantages to the RE projects arising solely from signing formal agreements. However, a formal agreement is something that is the absolute basis of good practice and can help avoid a lot of misunderstandings, possible disagreements and management issues in the future.

The agreement to provide the community benefits[20] should be set out in a legal document which should state all the details about the purpose and management of the fund, payments, auditing and supervisory roles etc. Therefore, a solicitor should be involved in drawing up the document to ensure it is legally binding and has all the necessary provisions.

Different ways to how link the payment into the community fund to the project:
a) fix the total payment amount without creating any obvious link with the size or operation of the SHP or
b) link the contributions to the scale of the project.

• **An annual payment per megawatt (MW)**
This is a simple, low risk and predictable way to create an ongoing fund which can support initiatives over a long period.

• A lump sum payment
Lump sum payments are larger sums of money that are paid to the fund soon after the project starts operating. This strategy is quite risky for the developer and only relevant if there are immediate funding needs in the community that need to be addressed.

20 Http://www.berr.gov.uk/files/file38710.pdf

• An amount linked to the revenue
Linking the community payments (in %) to the revenue from the scheme significantly reduces the risk for the developer. On the other hand it exposes the community to the risk of poor performance or low renewable electricity prices. An approach like this raises additional auditing and monitoring costs of the amounts paid. A middle way would be to have a fixed minimum payment set.

• A combination of approaches.

4.7 Possible community benefits arising from SHP project

There are a number of possible different types of community benefit arising from a small hydropower scheme that can be classified into four groups;

- Community Funds,
- Benefits in Kind,
- Local Ownership and
- Local Contracting.

In more detail, those benefits can be the following (Centre for sustainable energy, 2007):

- The use of local contractors during construction,
- Buying shares or other investment opportunity for local residents and businesses,
- Potential involvement in the development process by local landowners, groups or individuals,
- Local community facility improvements,
- Community group liaison (talks, support information etc.),
- Sum or regular payments into a fund for the benefit of local residents (e.g. scholarship grants or energy efficiency improvements in socially-deprived areas),
- Contribution to the regeneration strategy of the area,
- Improvements to local environment (landscaping) and wildlife habitats,
- Visitor centres and tourist facilities,
- Education visits and school support,
- Sponsorship of local community groups and team.

4.8 What should the money be used for?

Since there is unlikely that there will be a consensus among the public on what the money in the community fund should be used for, the developer should at least outline if not pre determine its purpose with a legal statement.

Some direct proposals on how to spend the money from the community fund (Centre for sustainable energy, 2005):

• Local community facilities
Community hall improvements, new sports facilities, community gardens or landscaping, church building repairs, road repairs etc.

• Tourism, recreational and educational provision
Footpath improvements, way-marked walks, nature trails, information centre for visitors, viewpoint information, school visits and education materials, etc.

• Environmental improvement
Restoration of derelict land, landscaping, hedge reinstatement, tree and flower planting, cleaning actions, eco days with focus groups, innovative carbon reduction projects, educational programmes etc.

5 Organisational requirements

5.1 Choice of legal structure for a social enterprise

Social enterprises are businesses with primarily social objectives whose gains are reinvested in the business or in the community, rather than maximising profit for shareholders and owners (Business Link, 2008). Social enterprises have no single legal model but can take on a variety of forms:

- Unincorporated associations
- Trusts
- Limited liability companies
- Industrial and provident societies (BenCom)
- Community Interest Companies
- Charitable incorporated organisations and Charities

The choice of the correct form of business that best suit an organisation's intentions is very important, as it will affect the business's:

- Taxes and National Insurance payable;
- Records and accounts that have to be kept;
- Financial liability;
- Way of raising money and
- Way of making management decisions.

5.2 Legal structures suitable for a co-operative community group

In order to establish, which legal form of social enterprise would be the most appropriate to manage the small hydropower project, an overview of the legal forms according to Business Link (2008) is provided below (see Appendix C for a more detailed comparison of legal forms).

In addition, SCR should also seek further advice about legal structures and their implications from a body like local Co-operative Development Agency, or a solicitor who understands community development.

5.2.1 Unincorporated Associations

Unincorporated associations are run informally and are put together by a group of individuals for a common purpose. They cost nothing to set up and enjoy a lot of operating freedom compared to a company as they do not need to register with or be regulated by either Companies Registry or the Financial Services Authority. They have their own governing, which are written in a democratic constitution and a management committee that runs the organisation on behalf of the members. Unincorporated associations can apply for charitable status to the Charity Commission, have trading or business objectives or carry on commercial activities but they cannot own property though it is possible to set up a trust to legally hold ownership of property and assets for the community. The other negative characteristic of unincorporated associations apart from not being able to own property is that members carry the risk of full personal liability for any of the organisations activities (Making the net work, 2008).

Community groups normally start operating as unincorporated societies. If they wish to hold valuable assets, negotiate a lease, sign a contract or employ people, then they need to adopt a legal structure and become incorporated. That way the responsibility for the group's actions can be limited to the incorporated society and the group's members are legally protected from personal liability for the group's debts, any breaches of law or contractual obligations (Making the net work, 2008).

In the case of SCR, where the group would be the owner of a costly investment such as a small hydropower scheme, a legal structure would be advised in order to avoid any personal liabilities.

5.2.2 Trusts

Trusts are unincorporated companies that are managed by trustees who act on behalf of the community for whose benefit the trust is set up. A "trust deed" covers the terms for an individual or organisation to receive assets and lists the conditions under which the trust's assets may be used. A trust can act as sister company to unincorporated associations and hold ownership of property or assets for the community.

As unincorporated associations trusts are simple and cost-effective to set up, but legal advice should be sought on whether the Trust needs to be registered trust with Companies Registry. The trustees are personally liable for the trust's liabilities. They may include an asset lock into their rules to secure assets for their intended community.

Advantages of a trust

- Continuity - founder group chooses the trustees for a permanent /fix period- non electuary process
- Confidentiality -disclose of any documents or details is not public
- Cost –no charge to set up and run a trust (no annual fees and no accounts audits)

Disadvantages of a trust

- Inflexibility – a trust deed can only be altered by a court order
- Personal Liability
- Transfer of assets to new appointees – when new trustees are appointed, property of the trust is transferred onto them
- Lack of control – a trust is composed of the trustees who are not accountable to anyone; it does not have members
- Therefore, this is not a suitable form for democratic involvement and control over the actions of an accountable management group.

Unincorporated organisations are unlikely to offer long-term operating solutions though. If an organisation intends to:

- take on employees,
- raise finance, apply for grants or open bank accounts,
- issue shares,
- enter into large contracts,
- manage a large project or
- take on a lease or buy property

it should consider incorporation to help it gain access to a wide range of financing sources that will not put members' personal assets at risk. Incorporation brings also some disadvantages, such as stricter controls and lack of privacy as there is a statutory requirement to have company documents available for public inspection (Business Link, 2008).

5.2.3 Limited Companies

a) by guarantee (CLG)

In companies limited by guarantee (CLG) members agree to guarantee any future debts of the organisation, up to an agreed amount. CLGs are registered at Companies House under the Companies Act 1985 and have the ability to be registered as a Charity if they met the requirements. Both CLG and IPS BenCom can apply for charitable status but then they would be heavily regulated from the Charity Commission and subject to extremely complex Charity law.

A company limited by guarantee is a legal form used primarily for non-profit organisations such as clubs, membership organisations, sports associations and charities that require corporate status. It does not have share capital, but has members who are guarantors instead of shareholders who undertake to contribute a nominal amount towards the winding up of the company's assets (a very small amount 1£ or up to 100£). Any profits made by the CLG cannot be distributed to its members therefore; it could be eligible to apply for charitable status.

Benefits

- CLG has a more recognizable legal structure than an IPS or CIC,
- A CLG registration process is quick and cheap,
- Flexibility to alter the objects and the regulations of a company.

Disadvantages

- Structure of a CLG restricts employee involvement in the Membership and Management Committee structure- could be an issue if an organisation is to deliver services direct to the public/ for wider benefit; There is a clear hierarchy-distinction between Members and Directors (this can have an impact on democratic structures like co-operatives) (Making the net work, 2008).
- Commercial trading activities require a set up of separate management committees, accounts and VAT structures, adding to the overheads and the administrative burden of the organisation (Leisure Trust members' Steering Group, 2003).
- It is difficult for a CLG to ensure that their assets are dedicated to public benefit. There is no simple, clear way of locking assets of CLG to a public benefit purpose other than applying for charitable status, but that brings also a lot of complications.

b) by shares (CLS)

A company limited by shares may be either private or public (public limited company = PLC). Someone can become a member by acquiring shares and therefore investing in the company with the expectation of a financial reward. A co-operative company can offer membership to everyone who shares a particular relationship with the company and who act within the interests of the company. By promoting active membership and paying out profits a CLS can encourage members' participation.

Traditional share-capital companies have voting rights are appointed in accordance with the number of equity shares each member holds (one share, one vote). A public limited company (PLC) is quite difficult and expensive to establish because the share prospectus is more expensive than in the case of a CIC or IPS. Profits can be distributed to members through dividends but it is not obligatory. A share capital company may be an appropriate legal form for a group of voluntary or community organisation that carries out business for profit (Co-operatives UK, 2008).

5.2.4 Community interest companies (CIC)

By using business solutions to achieve public good, social enterprises have a valuable role to play in helping create a strong, sustainable and socially inclusive economy. Community Interest Companies (CICs) were first introduced in the UK in 2005 as an alternative to charities.
Those who set up a CIC are expected to be philanthropic entrepreneurs who want to do good in a form other than charity and their definition of public interest is wider than the charities'.

CICs are limited companies (either by guarantee or by shares) that provide benefits to a community, or a specific section of a community.
The structure has relative freedom of the non-charitable company, is easy to set up and enables access to a wide range of financing options but has some special key features to ensure the benefit of the community. Those include an asset lock and a community interest statement describing social purpose, which needs to be provided when registering a CIC at Companies Registry. The structure of a CIC limited by shares is very similar to an IPS BenCom with an asset lock. The main difference between the CIC and IPS structure is, that CIC promotes social benefit and the IPS promotes democratic accountability the through the co-operative structure more (Circleregulator, 2008).

CIC's features (Circleregulator, 2008):

- An "Asset lock" must be included in a CIC's memorandum or articles of association. It limits the options for transferring profits, assets or any other surpluses from CIC's activities and ensures they are used for the benefit of the community. It also protects any remaining assets for the community if the CIC is dissolved;
- CICs can only issue capped investor shares to raise equity. The CIC Regulator sets the cap to protect the asset lock;
- The Cap has three elements/ basic restrictions:
    - i) Maximum dividend per share: Bank of England base lending rate + 5%.
    - ii) Maximum aggregate profits available for distribution to dividends: 35% of the distributable profits.
    - iii) Transfer of unused dividend capacity from year to year: max. 5 years extent.
- Annual accounts and an annual report of community interest must be available for public record;
- Members of the board can be paid (in a Charity they may only be paid if the constitution allows it and it is in the best interests of the charity);
- The definition of community interest that applies to CICs is wider than charity's;

- CICs are specifically identified as social enterprises, which is for some organisations more suitable than charitable status;
- A CIC is only allowed to convert to a charity and no other legal business form.

5.2.5 Industrial provident societies

Voluntary community groups usually operate on the principles of a co-operative. A co-operative is an organisation that is owned and democratically controlled by its members. The key to co-operative identity of co-operative enterprises is to apply their values and principles of honesty, openness, social responsibility and caring for others in practice. In the United Kingdom, co-operative enterprises come in a variety of legal forms. The most common community co-operatives are incorporated as Industrial and Provident Societies or as Companies - either limited by guarantee or by shares (Co-operatives UK, 2008).

An industrial and provident society in the UK is regulated by the FSA and has all the benefits of the incorporated societies:

- a written set of rules;
- a legal identity;
- the ability to own property;
- the ability to enter into contracts;
- additional legal requirements e.g. company law;
- limited liability i.e. its members are usually limited to a nominal amount;
- a profit-making ability, which is put back into the organisation.

An IPS also has some specific characteristics:

- FSA is the registrating body but this function is separate from FSA's financial regulating functions;
- Subject to The Industrial and Provident Societies Act 1965/2002 plus a number of other statutes applying to societies (e.g. the Insolvency Act, the Co-operatives and Community Benefit Societies Act 2003;
- It is set up for the purposes of permanent trading;
- Both types of IPS have share capital; Special form of equity: par value 1£ shares, which do not appreciate or fall in value with the success of the enterprise that issues them;
- "One share-one member-one vote" principle allowing democratic and active participatory role of members in running the IPS; Staff is allowed to play a significant role in the management and delivery of the business. They have the ability to be Members of the Society (via a share) and to occupy seats on the Management Board;

- Investors /share holders feel more engaged in the business if they expect a financial return on their investment. IPS dividends are called interest payments; A co-operative usually has not limit for paying out yearly interest to its members but in an IPS BenCom the primary focus is on social investments; re-investing the profit into the community is the priority; only small interest can be expected from investors (Co-operatives UK, 2008).
- It is relatively cheap for small co-operatives to raise funding - shares are issued by a prospectus which must be approved by the Financial Services Authority. Special rules apply regarding the publication of a prospectus.
- Shares are withdrawable and therefore cannot ensure capital adequacy requirements are continuously met;
- The minimum individual shareholding is £250 and the maximum is £20,000 (only another IPSs may hold more shares than this);
- The activities undertaken by an IPS including commercial trading can be carried out by the parent organisation.
- The profits and losses of an IPS are common property of the members;
- Asset lock can be applied to prevent specified assets being used for unintended purposes (under The Co-operatives and Community Benefit Societies Act 2003).

There are two types of IPS:

a) IPS for the benefit of the members (Bona-fide; Co-operative)[21]

Co-operatives operate for the mutual benefit of their members, They may or may not be a social enterprise, depending on their activities and how they distribute their profits. Some of the most common co-operative types are consumer, agricultural and housing co-operatives, mutual investment companies, friendly societies etc. The registration process is facilitated by applying "model rules" developed by FSA, which can significantly reduce the legal costs of the set up. Co-operative principles are considered as base law for the co-op’s actions.

An IPS is less well known and more expensive to set up compared to other social enterprises but it has become a model adopted by the co-operatives due to its advantage of allowing a business to raise money from the community by issuing shares in return. The other main advantage is that profits can be re-invested in the organisation to provide better services and facilities and are not necessarily given to shareholders (A Comparison of Legal Options for Social Enterprise, 2008).

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21 For more information see Co-operatives; http://www.cooperatives-uk.coop, FSA (Financial Services Authority); http://www.fsa.gov.uk.

b) IPS for the benefit of the community (BenCom)

This type of IPS conducts business or trade for the benefit of community. Profits are invested in the community instead of being distributed amongst members or external shareholders. FSA is the regulating and registering body. Reasons for registering the business as a society, rather than a company must be submitted. It can cost between £40 and £950 to register a BenCom with the FSA. Annual fees depend on the BenCom's assets and whether it registers under self-written rules or FSA model rules. Any changes in rules are quite costly.

It is possible for members to vote to change an IPS's objectives and convert it into a company.

Non-charitable BenComs can apply an asset lock to protect their assets for the future benefit of the community. In fact, if an IPS BenCom imposes itself to an asset lock, its form becomes very analogous to a Community interest company.[22]

5.2.6 Charitable incorporated organisations (CIO)[23]

From early 2008 new organisations and existing charities that do not want to use the charity form, are able to set up charitable incorporated organisations (CIO). A CIO is designed for charities wanting the business benefits of a legal personality (limited liability) without the disadvantage of dual regulation under both company and charity law.

For an organisation to be a charity it must be set up for public benefit and it must have purposes that the law regards as exclusively charitable. Many voluntary organisations and community groups are unable to meet the criteria for charitable status. Being a charity brings a lot of bureocratic and legal additional responsibilities and restictions associated with charity law. But it also has benefits such as tax exemptions, higher potential to attract funding and recognition that the organisation's work is for the benefit of others..

Differences between CIOs and traditional charities:

- CIOs are closer to companies than charities are;
- Traditional charities may or may not be incorporated, CIOs are always incorporated- members have either no liability or limited liability;
- Assets are locked in for the benefit of the community;
- CIOs report only to the Charity Commission, not to Companies House or the Financial Services Authority like Charities;
- Various formats and administration is available to suit organisations of all sizes, with or without a membership structure.

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22 see Community Benefit Society (Restriction on Use of Assets) Regulations 2006 and Cooperatives and Community Benefit Societies Act 2003

23 For more information about the CIO and Charities in England, see Charity Act 2006 and Charity Commissions website (2008) http://www.charity-commission.gov.uk/registration/charcio.asp#1

5.2.7 Conclusion

The most appropriate and common legal structure for a non-profit community group business activity in the UK are either a company limited by guarantee, a community interest company or an industrial provident society. All structures have a lot of overlapping characteristics but there are significant differences that set them apart.

The deciding factors that were considered when choosing the right legal form for the social enterprise that would manage an SHP were in line with the aims that SCR has set out for this project:

a) Member and public democratic participation is of high importance;
b) Provision of local community benefit;
c) Support for non-profit activity;
d) Motivate the community to be actively involved in the project by investing in it;
e) Promotion of social rather than financial gains;
f) Attractiveness to external funding sources (grants, loans);
g) Should enable the promotion regeneration and environmental sustainability strategies.

Based on the above comparison of the main attributes of all structures, both CLG and IPS legal structures demonstrate benefits for community groups but the fundamental difference between the Membership and Management Board of an IPS compared to a CLG, is that members of an IPS have the ability to be involved at the highest level by being Board members (Leisure Trust members' Steering Group, 2003).

In case where a project should deliver benefits from the generation of electricity to the local community it is important that the organisation managing the project will be able to represent community interest well. Successful implementation of a small hydropower project relies heavily on the commitment and motivation of members, where involvement is considered to be a significant factor. Many community groups in England are already using the IPS form and have reported that this involvement has had a positive effect on the performance of their organisations. (Leisure Trust members' Steering Group, 2003). There are also many examples of successful co-operative IPS companies owning wind turbines set up by Energy4all across UK (Malone, 2008).

If the members were actively involved in the ownership and management process of the SHP, they could express their opinions but also have the opportunity to understand the governing requirements of such a project and its needs better. An IPS structure is more suitable for this type of a project as the CLG model restricts employee involvement and their representation on the Board.

Participation is further encouraged by profit distribution. The concept of distribution of dividends to shareholders is contradictory to the concept of a non-profit company.

A CIC has the ability to issue shares and pay dividends in order to attract investors but at the same time, these are capped to protect the finance of the CIC and meet the statutory requirement for an asset lock. In comparison, an IPS BenCom can do the same: pay interest on shares to keep investor's capital in the company and provide community benefit, but the statutory restrictions in this case are milder. The distributable profit limit depends on the Rules and the decision of the members. In general, both models are committed to establishing a balance between the flexibility needed to raise finance by giving investors the possibility of making a modest return and being beneficiary to the wider community.

A CIC limited by guarantee has the same the disadvantages of a CLG but is subject to stricter regulations and an asset lock. Directors of the company can be paid but the amounts are limited and do not encourage participation in the same way that both IPS structures can. Activities undertaken by an IPS include also flexible commercial trading under the parent organisation while the CLG model requires separate management committees, accounts and VAT structures, adding to the overheads and the administrative burden of the organisation (Leisure Trust members' Steering Group, 2003).

In an IPS BenCom, an asset lock can be applied or not, depending on the decision of the members who have the power to democratically vote against the Rules. While a Co-operative IPS operates solely for the purpose of maximising the interest of the members and distributes its profits, therefore actively encouraging their engagement, the IPS BenCom can do both: provide community benefit and benefit for the members through democratic involvement.

In the end, of the two IPS models, an IPS BenCom is the one that can help benefit a community project and its investors the most. It is also the legal form that can support all of the SHP project aim and is for this reason the most appropriate structure to manage a small hydro scheme.

5.3 Economic viability- Costing of the project

The BHA Guidelines have split the SHP investment costs into four categories:

1. Machinery costs
   - Includes turbine, gearbox, generator and water inlet control valve costs
2. Civil works
   - Largely site specific costs, depending on the height of the weir's head
   - Includes intake, forebay tank and screen, the channel to carry the water to the turbine, turbine house and machinery foundations, and the tailrace channel to return the water to the river

3. Electrical works
   - Costs depend on the maximum expected output of the scheme
   - Includes control panel, control system, the wiring within the turbine house, transformer (if required), cost of connection to the electricity (set by local DNO - *for the South Yorkshire Region is YEDL –CE Electric http://www.ce-electricuk.com/)*

4. External costs
- professional engineering service fees for the project management and installation, costs of obtaining planning and abstraction license etc.

Table 1: Range of estimated costs for a comparable 100kW small hydro scheme

	Low head	**High head**
	In £ 1000s	
Machinery	60 – 120	30 - 60
Civil works	30 – 100	30 – 80
Electrical works (without grid connection)	15 -30	15 – 30
External costs	10 – 30	10 - 30
Total	**115 -280**	**85 - 200**

Source: BHA (2008). SHP Guidelines

There are certain fixed costs that do not change significantly with the size of the scheme and therefore, the larger the hydro project, the lower are its development costs due to the accumulated economies of scale (Sheikh, 2008).

Additionally, the running costs for the scheme have to be considered as well:

5. Leasing of the land

An annual (or monthly) rent will probably need to be paid to the owner of the hydro site, whether it is owned by a private landlord or by Sheffield City Council or a company (e.g. Yorkshire Water). It is recommended to negotiate the rent as low as possible and link it to the revenue from the scheme. The best solution for both parties is if the rent is made of two parts: a fixed minimum amount plus a variable bonus from the yearly revenue. All together, the rent should not surpass 4% of the turnover (Malone, 2008).

6. Maintenance and servicing

No major servicing costs or repairs are expected to occur in the first 10 years of the scheme's operating lifetime, as the equipment is quite technically advanced and SHP schemes in general do not require much maintenance besides routine inspections and an annual service. Altogether this should not be more than 1-2% of the capital cost of the scheme, depending on the installer's O&M fees and the warranty period[24]

24 h20PE yearly servicing contract: £3.000 (Welsh, 2008)

7. Insurance

The following insurance policies are recommended:
- Material damage insurance (covering the cost of damage caused by fire and special perils);
- Business interruption insurance (covering profit loss caused by fire or special perils);
- Public and employer's liability insurance (required by law);
- Separate flood insurance may be also needed (needs to be checked with the Environment Agency for the specific site).

8. Metering

An Ofgem accredited export meter is needed on the site to measure consumption. The meter readings are sent to the supplier and upon them the supplier pays the export price for the electricity.

Distributed generators with the capacity above 30kW are metered on a half hourly basis, allowing suppliers the ability to offer tariffs linked to the actual time of supply. Half hourly meters have many benefits although they are more costly to install. There is no charge for the meter reading company as the supplier can access the data electronically, which is not possible with the hourly meter (Williams, 2008).

This can be achieved through the installation of a smart meter that offers also many other additional metering services. [25]

The purpose half hourly and smart meters is to provide the generators with a better and more accurate overview of the actual electricity production and tariffs which could be linked to the Grid demand patterns (Energywatch, 2008).

The generator will have to pay for the meter and its installation as well as cover costs for maintenance and ensure an accredited meter operator is appointed (Energywatch ,2008). Normally a half hourly export meter costs around £1,500 and the metering company services could be from £350-1,000/ year. However, the prices vary and usually the energy supplier makes a quote for the meter installation and services and arranges everything on the site as part of their service package for new customers (Malone, 2008).

5.4 Funding of the project

A typical small hydro project financing structure involves a mixture of equity, provided by the owners of the scheme (investors), debt secured by a bank and grants, given by national, regional and local public or private development agencies, bodies or trust funds.

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25 *see Energywatch website http://www.energywatch.org.uk/your_questions/index.asp for more information on smart meters;*

Equity investors

Private involvement in the energy sector is becoming increasingly important as public funding diminishes.

In order to collect the necessary start up capital and based on the expected amounts of loans and grants, the IPS can make a public share offering and invite the community to become social investors in the project.

For this purpose an IPS issues a Prospectus, where the exact conditions to the offer are described. An issue of a Prospectus for an IPS is a bit different than for a regular company limited by shares. Though the share issue is also regulated by the FSA, a subsidized fee for IPS companies applies to it. Shares are not conventional investor shares, but par value 1£ shares that do not change their value or appreciate with the success of the company. An individual investor can invest at least £250 but not more than £20.000, unless it is a separate IPS company that is investing.

Each investor should also be aware that an investment in an IPS BenCom is considered to be a social investment and it will not provide high financial benefits despite a certain amount of risk is connected to the it. The IPS Management Board may decide to grant some small financial returns, but those will then be at the expense of the money that could be invested in the community fund. In the end, it is the members' decision how the money will be distributed.

The IPS shares have some additional features. They are redeemable, which contributes to the risk of capital instability and therefore, the IPS companies usually do pay their investors yearly interest. Other instruments, like EIS status, can be applied too to make the investment more appealing and ensure that the investors don't withdraw their capital (Welsh, 2008).

The ratio between loans, equity and grants influences the profitability of the business; ideally the more external funding -grants and loans- a business can get, the more profitable the investors shares can be. The so called "level of gearing" heavily influences the returns earned by shareholders. If there is more debt to finance the project, then the rest of the money can be invested in another, more profitable investment. In general, shareholders benefit more where a project has a high proportion of debt.

Loans

Typically, a bank debt is used to fund 25 – 40% of the total cost of the project. Community benefit and environmental non-profit projects are usually eligible for the so called "soft loans". Soft loans are also known as unsecured finance and are a type of business loans where little or no personal collateral is required by banks or commercial lenders as security demand placed on borrowers for the loan. Soft loans usually have little or no interest. In the UK, Triodos Bank and Co-operative Bank are the two biggest soft-loan providers for community groups. Triodos bank has dedicated funding schemes available for small to medium sized renewable energy projects and Co-operative Bank provides free banking accounts for community groups with additional interest. Bank debts can be obtained at relatively low cost (typically 2-2.5% above base rates) and are tax efficient – unlike dividends, repayments and interest on bank loans are paid before tax. However, bank debts carry some risk as well. Large debts take usually 10 years or more to repay and if the project cannot repay the interest with its earnings, then the bank can take full ownership of the project.

Grants

There are a number of agencies and bodies providing funding for renewable or community projects (see Appendix C). Mostly, the various grants can be matched. The IPS should check the requirements connected to each grant and apply to those it is eligible for. The more grant funding the project can collect, the better. The remaining needed starting capital will be collected through equity investments.

5.5 Expected revenues & returns

Based on the expected yearly output from the scheme, an expected return can be calculated based on the quote from chosen electricity supplier for the export of electricity. The export tariff for green energy depends on the ratio between average export and import tariffs for electricity on the market and market regulating mechanisms – price of green certificates. Particularly ROCs could contribute significantly to the earnings from the scheme, if the double banding for microgeneration technologies up to 50 kW will be introduced in 2009. It would mean that every MW of green electricity produced would be entitled to receive a double amount of ROCs it is getting now.

A good financial plan should be made for each year of the planned operation of the scheme that will show how much money will be left after the deduction of fix costs, loan interest repayments and planned operational costs. The disposable funds left, should cover the planned payments into the community fund and /or be distributed among investors.

5.6 Taxation issues

An IPS BenCom is treated as a small company for tax purposes, unless it has exempt charity status under which it is entitled to the same benefits as a regular charity registered with the Charity Commission. [26]

26 (e.g. do not normally have to pay income/corporation tax (in the case of some types of income), exempt from capital gains tax, stamp duty, gifts to charities are free of inheritance tax, min 80% exemption of normal business rates and special VAT treatment in some circumstances).

Exempt charity status generally can be awarded to IPS BenCom companies, but not if they are conducting a commercial activity at the same time, which in the case of SCR would be the sales of generated electricity through the power purchase agreement with a supplier.

As a small company in the UK SCR would be subject to the following taxes and obligations:

5.6.1 Corporation tax

1. Corporation tax is paid by limited companies and unincorporated associations on their profits each year. The corporate rate payable for small companies that are making up to 300.000£ profit is since April 2008 21% (Business Link, 2008). An IPS BenCom will be able to offset the payments of interest to shareholders and grants to the community against profit [27] but will have to pay tax on any profits that will be made after interest and grants to community have been paid (Body, 2008).

5.6.2 Business rates

Businesses that occupy non-domestic premises pay business rates. The premises are given a rateable value and business rates payable are calculated using the rateable value[28] set by the Valuation Office Agency[29] (VOA) and the multiplier, which is set by the government. Local authorities calculate business rates using the VOA's assessment. However, small businesses are entitled to a tax relief if the rateable value of their premises is less than £15,000. The amount of relief depends on the rateable value (Business Link, 2008).

However, charities, community amateur sports clubs and other non-profit organisations can apply to get their business rates reduced for a so-called discretionary relief by 80 to 100% (Business Link, 2008).

SCR should contact Sheffield City Council for more information on which business rates would actually apply, based on the value of the premises where the SHP will be set up, and how an IPS BenCom could claim the relief.

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27 *exception for IPS BenCom - normally those are paid from the profits after corporation tax had been deducted will be liable*

28 *based on the likely annual open market rent for the premises at a particular date*

29 *see VOA website for current rateable value of a property in England*

5.6.3 VAT

Businesses that reach a certain level of taxable turnover have to register for VAT to HM Revenue & Customs (HMRC) and keep proper VAT records on incoming and outgoing transactions. VAT registration thresholds have changed in April 2008. New annual taxable turnover threshold for 2008/09 is £67,000 for VAT registration and £65,000 for deregistration.

In the construction phase of the hydro scheme the incomes will be very high due to the fund raising activity and SCR will have to register the IPS to HMRC. Later on, if the revenues from the electricity sales are below the threshold, it can deregister or stay registered voluntarily. Registration requires sending tax returns (usually on a three month basis) to HMRC for the received and paid out VAT amounts and if the VAT payments are higher than the received amounts, then HMRC will refund the difference (HMRC, 2008).

The standard VAT rate is 17,5% and the reduced rate is 5%. Non- commercial and domestic owners are eligible to a reduced rate, if the hydro plant supplies buildings, which are either residential or used for charitable purposes (BHA, 2005).

5.6.4 Capital allowances

Capital allowances can be claimed on certain purchases or an investment, which means that a company's tax bill can be reduced for a proportion of those costs. The amount of the allowance depends on what they are claimed for.

From April 2008, first year capital allowances (claimed in the year of the investment) were changed from 50 per cent for qualifying investments to an Annual Investment Allowance (AIA) of £50,000 of expenditure on plant and machinery for all businesses[30].

AIA could reduce the tax bill costs for the purchase of machinery and equipment for the SHP.

30 Companies registered for VAT can claim capital allowances on the net cost of the asset after VAT, otherwise they are claimed on the total cost including VAT.

5.6.5 Enterprise Investment Scheme

Like Torrs Hydro New Mills Ltd. an IPS in Sheffield should also apply for Enterprise Investment Scheme by the HMRc in order to ensure higher security of the investments in the SHP project. A company with EIS status is namely obliged to a three year fix period in which shares cannot be withdrawn and increases capital and business stability of the IPS in the beginning.

At the same time, the investors benefit from the scheme's tax relieves. If an individual made a minimum investment of £500 worth of shares, then the relief is 20% of the cost of the shares, to be set against the individual's income tax liability for the tax year in which the investment was made.

5.7 Accounting and auditing

Small sized companies do not have to prepare generally required full, audited accounts for Companies House but can prepare abbreviated versions of balance sheet with detailed explanations and an auditor's report that confirms accordance with the Companies Act 2006 [31] (Business Link, 2008).

In the end, SCR should still seek additional professional advice on tax liability issues in order not to become subject to penalties imposed by the Inland Revenue inspectors. Especially, since it will be raising funds through donations and grants. SCR should also seek advice from an accountant on how to correctly declare its expenses and manage its finances. This advice can be obtained through memberships in community companies' supporting organizations like the local Chamber of Commerce and Industry or the Co-operative UK (Geiger 2008).

5.8 Possible risks associated with SHP schemes

Different factors can influence the commercial success and profitability of a small hydro project. A range of national and international factors could have a negative impact on the project's profitability. The developers need to be aware of these risk factors and try to implement prevention measures and impact mitigation strategies.
There are three main phases of development of a SHP project that pose certain financial risks:

1. Site development and planning phase

At this starting stage, the developing company - IPS BenCom – will have no earnings of its own but will need to cover the costs of site surveys, planning applications, abstraction license applications, design plans etc. These accumulated costs per site could range from 7.500£ or more per site (Welsh, 2008).

31 since April 2008

The IPS should apply for a development grant as it would be very risky to take a loan only to finance this stage of the project. The planning permission may not be granted and the IPS would not be able to generate income from the scheme but still have a debt to repay.

Additional costs may occur in this phase, if the environment agency establishes, that the site needs an Environmental impact assessment or if the planning application receives public opposition in which case the cost of legal fees, public consultation and possible re-submission of the application to the LPA all need to be considered. Altogether that could be an additional few 10.000£ (Wells, 2008).

2. Construction phase

Construction of a small hydro project carries risks too. The installation of the equipment on the river weir can be quite complex and must be done at the appropriate time of the year, when the water levels and the weather conditions allow construction. Summertime months from June to end of August are the best in terms of good construction conditions (Welsh, 2008).

Planning permission, grants and Environment Agency licenses all need to be granted beforehand, the site needs to be adequately prepared for implementation and the water turbine needs to be available and delivered by the supplier in the agreed time in order to carry out the project successfully.

Full project funding should have already been approved by this stage and the equity investments made. However, if the construction process is seriously delayed by poor management or unexpected site conditions and additional costs incur, then the IPS should have a back up strategy where to get the extra money. It could be very dangerous to take out even more loans, but there are development agencies and social investors that could guarantee finances towards the completion of the project.

A large additional cost may prove to be the grid connection costs. If the SHP site is far away from the nearest grid connection point, then a construction of an additional substation might be necessary. The costs of connection rise with the distance from the nearest connection point. It's recommended to have a detailed grid connection feasibility study done together with the site feasibility study in the site preparation phase in order to avoid later unexpected project cost increases.

3. Operation phase

Operating and maintenance costs of hydro projects are relatively low and the risks are fewer and well understood in this stage. The main risks are that:

(a) Revenues from the sales of electricity generated will be much lower than expected;
The reason could be low export tariffs or the change in financial reward schemes

for microgenerators.

(b) The installation experiences technical difficulties (unlikely);
The installer guarantees for the construction process and takes appropriate insurance

(c) Flooding & damages incurred via a third person (e.g. vandalism);
A flood risk plan and insurance should be prepared, as well as basic insurance against damage to the turbine.

5.9 Factors that influence SHP profitability

There are many different factors which affect how profitable a hydro power scheme is likely to be. Financial viability of the scheme is more sensitive to ones than the others but in general can be grouped into:
1. Site specific factors: average flow rate, grid connection costs, weir characteristics, etc.
2. Construction or operation related factors: water turbine prices, exchange rates, steel prices, bank interest and discount rates, grant funding availability, additional planning inquiries that increase developer's costs and reduce returns, export tariffs and stability of market support mechanisms (ROCs, LECs) for microgeneration, the actual turbine efficiency and the actual water levels throughout the year (Sheikh, 2008).

5.10 Carbon savings

Renewable energy provides for savings of pollutants - greenhouse gas (GHG) emissions that would be emitted if the same amount of energy would be produced by burning of another fuel type.

Emissions rise with the intensity of the activity and the correct emission factor:

Emissions = Activity * Emission Factor

There are many different greenhouse gasses[32] but only carbon dioxide CO2 and sulphur dioxide SO2 can be estimated with a great certainty due to a highly precise known content of carbon and sulphur in the fuel.

Carbon dioxide is the most common GHG gas and its emissions are now widely monitored and reported due to climate change targets. Carbon emissions factors have been calculated for different fuel types and the corresponding emissions established. Those can be converted into more understandable measurements if we compare the amount of energy used to produce them to the amount of energy that is needed to power an activity (Information on greenhouse gasses sources and sinks, 2008).

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32 *GHG gasses are also Methane CH4, Nitrous oxide N2O, Perfluorocarbons PFC, Sulphur Hexafluoride SF6, Hydrofluorocarbons HFC and others but the emission levels of those are more difficult to estimate*

In order to calculate the amount of emissions saved from a particular GHG gas it is important to know how much carbon per kilowatt hour is emitted per certain fuel type. Small hydropower itself emits zero CO2, therefore the net saving of using hydro power instead of an alternative resource are the CO2 emissions from the alternative resource. Most of the time, an average grid emission factor (0.43 kg/kWh) is used for carbon offsetting calculations (DEFRA, 2007).[33]

For example: an SHP project of 50 kW capacity and an estimated annual production of 188 MWh, would offset approximately 85 tonnes of CO2[34] (see Appendix D for calculations and savings equivalent to other activities).

Taking into account that the average annual UK household electricity consumption is 3.880 kWh[35] that would be enough to supply 48 homes and save[36] 80,1 tonnes CO_2.

5.11 Nature conservation impacts

The Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 require all new developments that are likely to have significant effects on the environment, to produce an Environmental statement (ES). An ES lists any likely environmental effects in various stages of the development and proposes measures that should be taken in order to minimize them. The areas covered in an ES are usually landscape, flora, fauna, noise levels, traffic, land use, archaeology recreation, air and water quality depending on the scope of the development.
The planning department may ask for an ES to be inserted with a planning application for the SHP project but it is very unlikely that this will be a planning requirement, since SHP projects are not environmentally that controversial (Welsh, 2008).

The Environment Agency however, may look at the environmental effects more closely. A developer might have to employ an environmental consultancy if he does not have a general hydro consultant with an appropriate track record or a turnkey installer, who can carry out an environmental assessment.

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33 see DEFRA (2007). Guidelines to Defra's GHG conversion factors for company reporting for detailed emission factors per fuel type http://www.defra.gov.uk/environment/business/envrp/pdf/conversion-factors.pdf. Many organisations' websites enable online carbon emission calculations and promote greater energy efficiency: www.stopglobalwarming.org/carboncalculator.asp, www.carbonneutralconcrete.ie/carbon_calculator.php & www.carbonuk.co.uk.

34 based on RETSCREEN average CO2 emission factor 0,45 kg/kWh

35 taken from: http://www.esru.strath.ac.uk/EandE/Web_sites/01-02/RE_info/hec.htm

*36 3,880 kWh * 0,43 kg CO2/kWh * 48*

The SHP scheme's effect on the following topics will almost certainly have to be assessed (EA, 2008):

• General watercourse character
• All flora, including wet grasslands and woodlands around the wider river corridor
• Vegetation and animal species and communities
• Ditches and dykes
• Trees
• Invertebrates
• Birds
• Mammals [37]
• Amphibians and reptiles
• Fish
• Geomorphology

Fish are the most affected by SHP installations and the EA will be strict about the mitigation measures taken for their protection. The best solution is to implement a turbine that allows a free pass of the fish through the SHP scheme, like the turbine that was used in New Mills. The Archimedean screw is environmentally friendlier and has the lowest impact on fish among the known technologies. As such it is recognized by the EA as more likely to be granted the environmental permits (Welsh, 2008).

5.12 Applying for an abstraction licence

The Agency will treat works for a hydropower proposal the same as any other proposed structure or works in a watercourse. EA officers are in general sympathetic towards renewable energy installation and can give further advice on the necessary measures that need to be taken. However, SHP schemes create several areas of potential conflict with flood defence policies and will be thoroughly inspected before having a license granted. Modelling may be used to help optimise design and overcome possible impacts (EA, 2003).

The EA issues licenses connected to the hydro power schemes for removal of water from the river (Abstraction license), changes caused to the structure of the weirs (Impoundment license) and works carried out in the main channel (Land drainage consent). A small hydro scheme generally requires only an Abstraction license. The guidelines on how to how to successfully apply for a license are described in the EA handbook (2003).[38]

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37 important to identify and protected species in the area and act in accordance with the UK wildlife legislation and the local Biodiversity action plan

38 see Environment Agency (2003). Hydropower. A Handbook for Agency staff

Under The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 any developments that are likely to have a significant impact on the environment must produce an Environmental impact assessment but the law requires the EIA only for schemes above 500kW. Normally, the EA is satisfied with an Environmental report for the smaller schemes but depending on the sensitivity of the site, it may also require an EIA or the following (EA, 2003):

- Screening of the intake and outfall and in certain circumstances a fish pass;
- Reliable, direct measurement and control of the abstracted volumes;
- Robust and fail-safe scheme design, so that in the event of a problem the river is not prejudiced;
- To agree a volume by which the hydropower authorised volumes may be derogated, in order to safeguard future water resource management
- Environmental monitoring where the potential impact is uncertain.

The IPS should contact the EA at an early stage of the development, preferably at the same time as the LPA in order to establish a good working relationship and be fully prepared for all the necessary measures that might need to be undertaken before the project is granted to go ahead. The costs of an Abstraction licence application are 150£ and the costs of a base Environmental Report for the EA costs around £2.500 (Welsh, 2008).

It is important to note that Abstraction licenses are time limited and are issued in accordance with the Agency's policy for 12 years with a "presumption of renewal", however this could be a potential additional risk for the SHP scheme in the future (BHA, 2005).

<u>5.13 Built environment and landscape</u>

Heritage

An additional obstruction to getting the all the permits for the development is the presence of listed buildings on the site. These are the buildings that have special architectural or historical interest or both, and its details become part of a public record. Most significantly, they are protected by law, and require listed building consent before any changes can be made to them. Structures that can be listed are buildings, bridges, monuments, sculptures, war memorials etc. Refurbishing and upgrading of any construction on the weirs or around them due to a new SHP development can contribute to the protection of cultural heritage.

A listed building may not be demolished, extended or altered without special permission from the local planning authority, who will consult English Heritage or Natural England on the matter.

Grades of listed buildings show their relative importance:

Grade I - those of exceptional interest
Grade II* - particularly important buildings of more than special interest

Grade II - of special interest, warranting every effort to preserve them
Over 92% of protected buildings in England are Grade II. Grade I and II* buildings may be eligible for English Heritage grants for urgent major repairs (English Heritage, 2008).

Landscape

Any possible environmental mitigation techniques that are technically and economically viable should be applied to mitigate the impact of the SHP on the landscape. For example, the visual impacts of SHP schemes on the landscape can be reduced by the use of local materials and local architectural techniques to integrate SHP plant into the area.

One of the legal reponsibilities of the SHP developer is the construction of fish passes at the diversion works of hydropower plants. But even despite this fish can suffer serious injuries or even die in the passage through the turbine if they cannot find the fish pass to go downstream to the weir. It is recommended to se the new "fish friendlier" turbines that have been designed in the past years with adjusted blunter blade profiles in order to reduce the percentage of fish killed passing through the turbine. Nevertheless, the only turbine that is really entirely harmless to the fish is the Archimedean screw (see Appendix F).

Sometimes walls and embankments need to be built to consolidate the river banks. This can include both the construction of new embankments or increasing the height of existing ones to allow the plant to operate in different hydraulic conditions. This is often the case when the construction is on a river flood plain. These works normally have a significant visual impact even if modern techniques of natural engineering are applied (SPLASH, 2005).

The penstock (with the pipe and coating) should be placed underground whenever possible. The construction is very reliable and requires practically no maintenance for decades. At the same time the impact on the environment, especially the visual impact, is greatly reduced. Where a penstock cannot be placed underground the developer should consult with an environmental engineer in order to find the best solution. To further reduce the visual impacts of the SHP plant some other measures could also be taken if the financial returns from the project allow such an investment (SPLASH, 2005):

-Facing the building with local stone;
-Construction of underground powerhouses;
-Creation of tourist infrastructure; or the
-Creation of a low water river-bed.

Any open channels, which can represent a danger of accidents will have to be are fenced in. This also applies to the intake and powerhouse areas, where access must be restricted to personnel. Fencing usually doesn't have a disturbing visual impact and solutions can be adopted for better integration into the surrounding environment.

Some areas of hard standing are also needed to permit access to the site and construction by a car or truck (SPLASH, 2005).

Further improvements to the site can be made by decorative planting of flowers, trees or hedges. It is also important to ensure that the site is clean and tidy. Local cleaning actions of the river banks might be another good opportunity for voluntary public involvement.

6 Case study report

6.1 Torrs Hydro New Mills project description

In order to promote the sustainability of the New Mills[39] community in Derbyshire and enhance the area's natural resources, a local community group and a hydropower installation company Water Power Enterprises (h2OPE) agreed to develop a small hydropower plant for the benefit of the community on the local river Goyt.

A decision was taken to install a 70kW Reverse Archimedean Screw with a 2.4m diameter and an expected life of 40 years. This is the first community small hydro project in the UK using this type of technology to generate the electricity.[40]

The idea was first introduced to the public of New Mills through a series of meetings by H2OPE, who needed local support in raising funding and project ownership and management. The full scheme plan was publicly introduced at an information weekend in January 2007 and things progressed very rapidly over the next 18 months: it took 5 months to get the planning permission, an IPS BenCom was formed in September, launched the share offer and obtained the funding and began construction in March. It is expected that the project will be commissioned in July 2008.

6.2 Organizational setup

H2oPE is a CIC limited by shares that has been established with the purpose to develop small hydropower plants through local ownership schemes. Promotion of these projects is in line with the company's corporate strategy of being a community company. It was their initial idea to develop the scheme by forming a local IPS and having a contractual relationship with them.

39 http://www.torrshydro.co.uk/

40 One more privately owned Archimedean screw was installed at the River Dart Country Park, Ashburton, UK in 2007. http://www.westernrenew.co.uk/Archimedes%20screw%20turbines.html

H2oPE delivered a turnkey service through the close working partnership with H2OPE and their direct contractors. It also involved full commitment and support to the IPS as well as taking responsibility for all the risks associated with the development and operation phases. The whole site preparation process, planning permission, the abstraction license and the lease agreement with the New Mills Council were all arranged by h2oPE on behalf of THNM. H2oPE also led the process and supported the applications for grants and loan and was involved in most of the processes concerning the scheme development. On the other hand, THNM was given the freedom of choosing its own directors and making its own choices concerning management issues.

The group of individuals, who formed Torrs Hydro New Mills Ltd. (THNM) registered it as an IPS for the benefit of the community. This legal status enabled THNM eligibility for grants and a long term soft loan in addition to the possibility of raising additional equity through a share issue. This way the IPS BenCom shareholders have the chance to participate not only in the ownership but also in the management of the plant and it was agreed that this legal form was the most appropriate for this project since it has community specific focus (THNM Ltd. 2008).

6.3 Community benefits

THNM has not made an official document where it states what kind of community activities will be funded through the scheme. It has also not applied an asset lock on the assets or profit distribution, meaning that it is the policy of the management board that will be deciding how much money will go to the community fund.

6.4 Economic viability- Revenues and returns

The scheme is estimated to generate 260MWh /year. The power will be sold to the grid since there are no major appropriate consumers close to the site in order to set up a private wire. The estimated returns from the scheme will depend on the export tariff that will be negotiated. THNM expects to generate about £22,000 revenue/year and have profits of £11,000-15,000/ year (THNM Ltd. Prospectus, 2007).

Until year three, the shareholders cannot expect to get any returns, which is in line with the EIS status. EIS exempts shareholders to have to pay the capital gains tax on their shares three years after the commencement of trade. That way any profits made in the first 3 years after the loan repayments could go straight into the community fund. Since THNM has not committed itself to what exactly they would spend the money collected in the community fund on, this will be decided on the annual shareholders meetings.

If the management board decides, they can distribute a share of the revenue as interest payments to its shareholders though it is not a legal obligation. Normally, shareholders would expect only a minimal return, since this is a social investment without the financial focus which was mentioned also in THNM Prospectus The upper interest level limit for IPS BenComs is set at 7,5%.

Expected yearly profits from operations are from £11,000-15,000 and with the scheme's lifetime expectancy of 40 years that could be a great contribution to the community. A rough estimation of the payback of the scheme is about 20 years.

6.5 Costing of the project

The total cost of the project estimated in the Prospectus was £226,000 out of which was:

- Capital expenditure - £ 200,000.

Capital costs cover the total site development and construction costs including the price of the screw and equipment.

- Technical service agreement between h2oPE and THNM Ltd. - £ 15,000.

The technical service agreement covered the project completion and arrangement of a Power Purchase agreement on behalf of THNM Ltd.

- Consultancy fees - £ 6,000.

Fees include the costs of feasibility and pre-feasibility studies, the environmental and hydrology reports.

- Total IPS setup costs - £5,000.

THNM Ltd. registered as an IPS BenCom with the FSA for a fee of £ 700[41] and paid £1,500 to Coffin Mew LLP, a legal company that offers tailored service for the needs of social enterprises and other voluntary and not-for-profit organisations throughout the UK. They provided the IPS BenCom adopted model rules for community projects and offered professional legal advice and assurance of procedures.

The Prospectus was issued for the value of £126,000 and the issue cost £500. Additional fees of just under £3,000 were paid for the PR company to distribute the Prospectus and promote and the share offer as widely as possible.

- Yearly servicing contract with h2oPE covering any repairs, costs of insurances, rent, servicing and operational maintenance - £3,000.

- Yearly fee contract with h2oPE of 10% of the gross profit as fee for the delivered service.

41 base IPS BenCom registration fee in the UK (Business Link, 2007)

- ❖ Unexpected costs : +/- 10 -20% of initial capital costs variations.

6.6 Funding of the project

The plan how to finance £226,000 expected capital costs was split between in grants, loan and social equity shares. In the end the capital costs will probably be 10% higher than this estimate, which had to be taken into consideration. They were already quite heavily influenced by the appreciation of the Euro and the consequential impact on the exchange rate of £10,000, as the screw is imported from Germany and more unexpected costs might still arise throughout the construction phase.

THNM received £135,000 of grant funding from East Midlands Development Agency, Co-op fund and Peak District National Park. Additionally, it secured a special £60,000 loan from the Co-op Bank and managed to raise £97,000 from private investors, 50% of which came from local community members (THNM, 2008).

6.7 Risk Assessment

THNM calculated with the risk of cost sensitivity to changes in various variables like the exchange rate and secured more funding than the initial capital cost estimations were.
There are risks connected to securing the funding, offering shares, obtaining licences and public acceptance and the whole construction process. Some of them could be financially secured against, like the risk of damage or flooding. Public opposition was not considered to be an issue in this case as the project is located in a valley, outside the residential area. The risks associated with lacking professional management, technical, operational and negotiation skills were avoided by THNM by handing over the project entirely to h2oPE in return for a nominal fee of 10% of gross profit/year.

6.8 Carbon savings

The scheme's expected 260 MWh electricity/ year would be equivalent to the yearly consumption of approximately 70 average households. This is equivalent to 112 tonnes of CO2 saved per year and 4,480 tonnes of CO2 in the next 40 years (THNM, 2008).

6.9 Nature and landscape conservation

The weir is located in a valley just outside the New Mills residential area. The site is surrounded by high cliffs and with a few older houses and there is an old abandoned mil further up the river. The mill that was present on the current construction site was demolished years ago and the site had no additional special designations. The disturbance of the scheme will be minimal as the visual impact is not obviously disturbing to anyone and the noise levels in the valley are already quite high due to the sounds of the river being enhanced by the echoes of surrounding cliffs. The Environment Agency did not identify any major obstacles in its environmental statement. The use of the Archimedean screw made it even easier for THNM to get the necessary permissions as it is a low impact turbine recognized by the EA.

5.10 SWOT analysis of THNM Ltd. IPS BenCom approach

To sum up the learning points of New Mills project in all stages of the development from the THNM Ltd. point of view, the findings are presented in a SWOT analysis:

Table 2: SWOT Analysis of THNM

STRENGTHS	***WEAKNESSESS***
• Strengthening community cohesion and engagement • Production of green electricity • 112 tonnes of carbon savings per year • Pioneering community project with Archimedean screw • 40 years of community benefits • Close working relationship and cooperation with installer h2oPE • Coffin Mew solicitors supporting community projects • Turnkey installer service plus extra benefits (coverage of all risks, support and technical assistance) • Only second Archimedean screw installed in UK –novelty in the SHP sector • Minimal environmental impact • Memberships in supportive organisations	• High risks involved • Low returns on investment • Long payback period • High initial costs • Sensitivity of capital costs to changes in variables e.g. exchange rates, prices of steel, transport costs etc. • Dependence on h2oPE for the whole project delivery • Dependence on water flow • No funds of its own for THNM in the beginning of operation – difficulties paying legal services, accounting, membership fees etc.

OPPORTUNITIES	*THREATS*
• Possible eligibility for double ROCs from April 2009 • Benchmark for communities and raising awareness for community projects and RE importance • Funding provided for most urgent issues with focus on preferential topics • New opportunities for community engagement • Good PR for the area	• Flooding & damage • Exceptionally dry weather resulting in lower income • Not enough social investors for the share offer • Problems with obtaining grants • Many shareholders deciding to withdraw shares in a short period • Inability to pay off debt • Changes in government policy of subsidizing small RE generators • Delays & complications in construction

7 Project implementation guidelines

Based on the consultations and information reviewed, the following procedure is advised, when planning a complex project such as managing a community owned hydroelectric scheme. Recommendations are addressed directly to SCR as it will the one organizing the project, regardless of the fact if it will manage it itself by converting into an IPS BenCom, or find other individuals who will set up a managing body.

7.1 Small community grant application

SCR is currently operating as an unincorporated society and has adopted a constitution and nominated a board of members. It also has its own bank account. It has no income from its own operations, therefore it is advised that the Membership Board applies to the Sheffield City Council for a grant in order to be financially more viable to carry out its operations. The Council has financial support schemes designed to support local voluntary organizations, as do some regional development agencies (see Appendix C for more details).

When applying for a small grant at the Council it might prove to be helpful to present The Project Assessment Matrix (P.A.M) along with the application (see Appendix E). A P.A.M helps project sponsors and managers choose appropriate levels of controls based on the characteristics of their project in terms of cost, timescale, importance to strategic targets, connections with external policy or legislation requirements, complexity of contracts required with external suppliers and assessing the project type (Sheffield City Council, 2008)

For a minimum grant application it should be accounted for that the grant should cover not only the registration fees of the IPS BenCom but also the costs of accompanying legal and PR services and/or membership fees in supporting organisations. It is advised to raise as much money as possible for the start up operations in order to be more flexible in organizing future actions.

7.2 Forming an IPS BenCom

The recommended next step would be to seek out dedicated members and individuals with an understanding of the managerial requirements of a community SHP project in terms of time invested and skills needed. These members should then nominate a Management Board.

The basis for any further project developments is a clear project plan in terms of time, resources needed and money. Development of a SHP scheme can be full of interrelated actions that might require a lot of effort to coordinate therefore, it should be well prepared. In order to build the plan on realistic expectations, a company should start with a good business plan.

According to Business Link (2008), a business plan is a written document that describes a business, its objectives, strategies and the market it operates in. Most importantly, it shows the financial forecasts of the future business actions. Among its many functions are securing external funding, measuring success within the business, giving an understanding of the business and finances, setting work priorities and correct resource allocation. Most importantly though: a business plan serves as a communications tool by presenting different angles and pulling internal and external stakeholders in the same direction.

For SCR, the most important parts of the business plan would be the financial forecasts, the CO2 emissions savings calculations, and estimations of available and needed resources throughout the lifetime of the SHP project. However, subjects like a description of the aims, current and future strategies and planed operations as well as a clear definition of how community benefits will be realized, should not be left out of the business plan. After all, the plan will serve as a tool for guaranteeing development and construction grants and loans and should therefore bring as much added value as possible.[41]

In fact, the community benefits should be formalized also in a separate legal document, stating the binding intent and obligation of the project to deliver them. Formalization of the benefits will provide more certainty for the social investors and enable SCR / IPS to fund the chosen projects in the community without facing disagreement from the other shareholders.

41 Additional information about writing business plans can be found online from websites (eg. http://www.businesslink.gov.uk, http://www.business-plans.co.uk) or from Co-operatives UK)

Since SCR is dedicated to providing green energy and innovation to Sheffield, it would be best to identify projects in Sheffield connected with innovative energy efficiency methods and carbon savings and fund those. Especially the ones that normally are not part of the Council's or development agencies' funding schemes.

The financial report is the most important part of the business plan. It should be as detailed and reliable as possible. Many specialized free computer programmes are available online prepared for hydro project assessments and some enable also assessments of project attractiveness in terms of financial returns. RETScreen is probably the best and most comprehensive one of all and can be prove to be a very useful support in planning.

Figure 8: Assessment software tools for hydro projects

Assessment Tool		**Assessment topics & features**				
Product	**Applicable Countries**	**Hydrology**	**Power & Energy**	**Costing**	**Economic Evaluation**	**Preliminary Design**
Hydra □	**Europe**	✔	✔			
IMP □	**International**	✔	✔			
PEACH □	**France**	✔		✔		✔
PROPHETE □	**France**	✔	✔		✔	
Remote Small Hydro □	**Canada**	✔	✔		✔	
RETScreen® □	**International**	✔	✔	✔	✔	

Source: International Small Hydro Atlas, 2008

After the business plan is ready, an IPS BenCom and can be registered at the registering authority, which is the FSA.[42] The costs of registration are minimum 700 £ if unchanged Model Rules are adopted (A Comparison of Legal Options for Social Enterprise, 2008). All the application forms and information about the fees can be found on the FSA website.[43]

Advice from a solicitor is advised in this case. THNM has worked with Coffin Mew Solicitors and has recommended their services (Geiger, 2008).

42 for further details and authorization exemptions under the Financial Services and Markets Act 2000 see FSA website; 43 *http://www.fsa.gov.uk*

7.3 Membership in supportive organisations

Once set up and registered, the IPS should consider applying for memberships in social enterprise supporting organizations such as Co-operative UK and Sheffield Chamber of Commerce and Industry. Memberships in these organisations provide a large number of benefits in return for a fix annual fee.

In the case of Co-operatives UK, the annual fee is 50£ +VAT (2007 prices). Below are some of the benefits of membership (Co-operatives UK Recruitment leaflet, 2007):

- ✓ Expert legal advice and business information (e.g.: help with constitutional issues and policy creation, help with funding applications)
- ✓ Lobbying and raising awareness for the co-op in the UK, Europe and beyond;
- ✓ Public Relations Support;
- ✓ Access to an on-line directory of UK co-operatives to facilitate contacts and networking with co-operatives in any specific area;
- ✓ A free point-and-click starter website to ensure presence of the company on the internet with continued advice, training and support;
- ✓ Access to a tailored package of accounting services, from management accounts through to liaison with an external auditor;
- ✓ Partnership with the Co-operative Bank, which enables members quick and easy access to bank loans and services, free business banking and commercial insurance schemes.

Membership costs for joining the Sheffield Chamber of Commerce & Industry[43] are 99£ +VAT for the first year of trading and a minimum of 145£ + VAT[44] in the next years. Members are eligible to a wide range of services such as:

- ✓ Lobbying & representation through a dedicated Policy & Representation team (eg. for securing loans, applying for funding)
- ✓ Access to Members' Newsletters, Magazines, Directory and online resources
- ✓ Access to regular networking events
- ✓ Access to all relevant business documentation
- ✓ Business trainings etc.

Probably the most important additional services the IPS should consider acquiring in the beginning of its operations are professional legal and PR services. Both can be very costly if sought independently, but membership in an organisation such as the Co-operative UK brings a lot of added value to small companies by providing a package of different services at one place for a subsidized fee. Professional legal advice is crucial in order to fully understand the legal requirements of the partnerships the IPS will be forming with different stakeholders and the implications and liabilities arising from its operations.

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43 http://www.scci.org.uk/, *44 see SCCI website: membership prices at http://www.scci.org.uk/content/category/6/92/147/*

Formalized agreements and verified contractual relationships with all future partners are advised despite the legal fees in order to avoid any future mishandlings or potential liability questions. If SCR will not have access to Co-operatives services, it should still consider investing in legal services from a solicitor, who understands community company law and operations and can give best professional advice on how to proceed with the operations as an IPS BenCom[45] (Geiger, 2008).

Secondly, since the IPS will act in the best interest of the community, it should also raise awareness for its profile among the public. This will be important in the future, when the BenCom will need sufficient support from social investors for raising funds for its projects by issuing shares.

A clever and well thought through PR strategy should target the potential ethical shareholders in the local areas. PR actions and organized events can be costly and it can prove difficult to target the right audience without having access to a good network of contacts. It is advised that SCR/ IPS BenCom sets up an internet website where it will introduce its plans and ideas to a wider audience and allow direct interaction with the readers.

For all those purposes it is advisory to consider working with a specialized PR agency. However, the biggest benefits could be realized through memberships in SCCI and Co-operatives UK.

PR services offered by those organisations are well organized, affordable and professional and can also provide the facilities where various public meetings and seminars can be held. Additionally, IPS BenCom Board Members would be able to attend regular social, business and networking events such as Members Evenings, South Yorkshire Chamber Breakfasts, seminars and workshops that reflect current business issues, hospitality events etc., where there would be plenty of opportunity for direct promotion.

Sheffield Chamber of Commerce & Industry offers members a wide range of tailored training and development programmes[46] that are largely recognised by a range of accredited awarding bodies. This could be a good opportunity for the members to gain additional necessary knowledge in the field of
exclusive cost saving schemes, sponsorship opportunities to promote the IPS in association with the Chamber and many others. Enhanced knowledge of members could contribute to a better management service of the SHP and to the personal development of the IPS members, possibly inspiring new ideas for future community projects.

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45 *THNM Ltd. used Coffin Mew solicitors because of their experience of working with community groups and forming IPSs,* 46 a full Prospects of courses is available from the SCCI website

7.4 Preparation of the site

After establishing the IPS BenCom as a formal organisation with clear aims and a wide network of local contacts, it might be easier to take on a project like the SHP sheme.

In the next stage, the IPS should apply for a development grant (see Appendix C for a list of development grant sources). Those are usually up to £5,000 grants that are meant to cover the starting costs of developing a project. In the case of SCR, those funds should cover the costs of site preparation. This includes a pre-feasibility study- desk study, a feasibility study and a detailed design plan, a granted planning permission from the Sheffield City Council and granted abstraction licence from the Environment Agency including all associated costs of applications (Welsh, 2008).

The costs of choosing preparing a site for an installation of a SHP can vary. SCR should therefore carefully compare different quotes for developing a site independently from the costs of construction and request quotes from various SHP installers that provide site development services as well as independent consultancies.

If the comparison of fees between the preferred suppliers and independent consultancies is not too big, it is recommended to contract the work to an SHP installer delivering a turnkey contract.

Even though the project phases are considered separately, it is still important that one contractor supervises and is present throughout the whole development process. That way the IPS BenCom Board would be able to build a close and trustworthy working relationship with the installer and ensure a better understanding of the project characteristics. Price should not be the only deciding factor in this case but additional services provided to the IPS BenCom (e.g.: experience and understanding of community projects, support with planning applications, support with Environment Agency negotiations, with managing the IPS, with funding applications and negotiations with the site owner, liaison with the Council, leverage of risks etc.). Additional services play a big role where Members of the Board are individuals who have never undertaken a similar project like this before.

When comparing quotes from different installers, the IPS should also look at the time estimated for completing one phase and consider how that fits in line with the whole project plan.

See the 3 installers' quotes overview in Appendix G. The comparison was made between Derwent, Segen Hydropower and h2oPE.

Further links can be used for finding SHP installers in the UK:

- ✓ http://www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/hydroelectricity ;
- ✓ http://www.lowcarbonbuildings.org.uk/info/installers/find/installerfind ;

- ✓ http://www.british-hydro.org/hydrosearch.asp .

The amount of work the IPS will have to face when applying for grants, negotiating the lease agreements and securing permissions depends on the level of service provided by supplier. Based on the Appendix G comparison, the best choice of installer would be h2oPE.

It is recommended to start working with the installer as early on in the project as possible and to include one of the members of installer's company in the IPS Ben Com management board, even if only as a "sleeping member" with limited rights for a short period of time. Best case examples from Energy4all community models have proven that this type of involvements can be very supportive and successful (Malone, 2008). It is not necessary but it has many pluses. It is easier for the two companies to build a trusting relationship and understand each other's issues and limitations in regard to certain decisions. Additionally, the first hand expert advice is always available.

There is no "right" fix sequence of events and actions that need to be taken. Most of the activities prior that are prior to the construction will be overlapping in practice but it is important for the IPS to understand where in the process they are.

After acquiring all the licenses and securing the funding, the construction phase can start. The most appropriate choice of technology will be defined in the design plan and fill fit the characteristics of the weir. Archimedean screw turbines are perfect for run-of –river projects for lower heads and the sites in Sheffield are appropriate for its installation (Welsh, 2008). In comparison to other turbines, the screw is not just environmentally the friendliest but also the cheapest technology available (see Appendix F for turbine technologies comparison).

The installation process needs to be carried out in the summer months, when the water levels in the weir are the lowest. Installers carry the risk of completing the construction and could potentially also negotiate a power purchase agreement on the IPS's behalf.

7.5 Selling electricity

There are several options on what to do with the generated electricity:

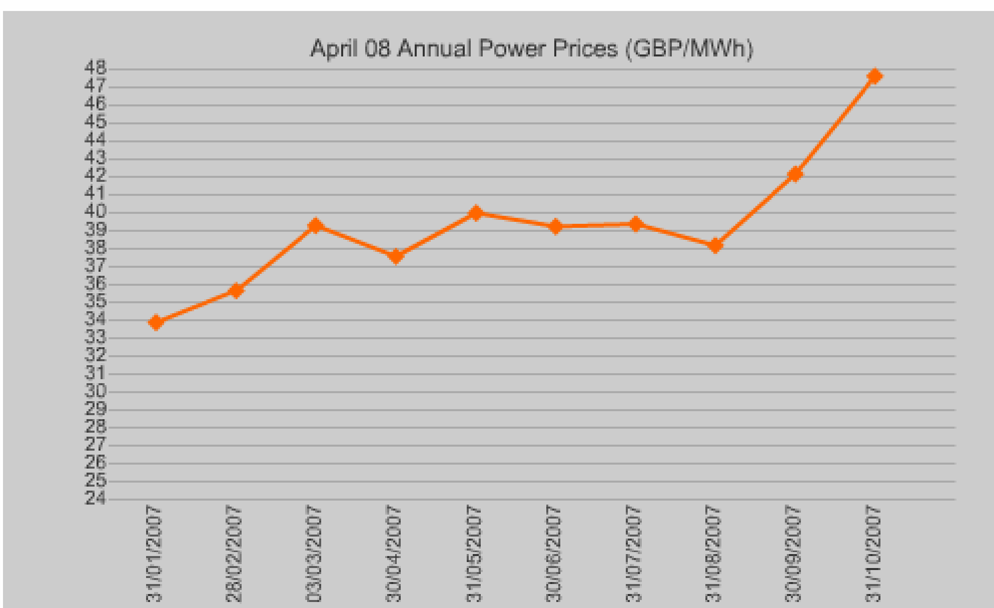
1. Sell it to the grid via a Power purchase agreement with a certified supplier company (most common). A supplier would offer an export price for the generated output that would include the fee for electricity and the payment of ROCs, LECs and REGOs at the same time. Companies buying green electricity in the UK are Ecotricity Ltd, Green Energy Plc, Good Energy Ltd, Smartest Energy, NPower Juice, EDF Energy etc.

It is very difficult to create a clear overview on the export tariffs of different suppliers as they all have their own conditions and ways of including the renewable certificates in the price. In general, the prices for the ROCs reflect the average market prices and the price for REGOs and LECs are set. The differences are in the tariffs for the export of green electricity. Wholesale prices can be much lower than the actual import/market prices that are charged to the end consumers, because they incorporate the sales margin, which is supplier specific. This area of the market is quite new and larger suppliers are not very flexible in taking on additional exporters as it requires a lot of bureaucratic and technical adjustments. Most of them do not have the adequate IT systems to manage the connection of small exporters even though they would benefit from the additional ROCs. That is why some companies specialized in the purchase and supply of distributed green energy and can offer competitive Power purchase agreements.

It's advised that the IPS Board is actively involved in the process of choosing the right supplier. As many as possible should be asked for quotes in order to find the best package of conditions (see Appendix for installer quotes).

As is seen from the Graph in Figure 1, the export prices on the market have risen significantly in the past year from 33.90 to 47.70 £/MW (equivalent to 3.39 -4.77 p/kW). This creates a good opportunity for microgenerators, as they will be able to maximize their revenues, if they are at the same time also eligible for the double ROCs for below 50kW schemes.

Figure 9: Annual wholesale electricity price curve in 2007



Source: Smartest Energy, 2008

2. Private networks

Having a large customer near by (e.g. a school, a factory, public building) that could buy the electricity via private wire without connecting it to the Grid. Through this option the generator could charge a higher price for the electricity (on the level of suppliers' offered import market tariffs, which would be higher than the wholesale price of electricity). The distributed generator is still entitled to the ROCs for his generation but would need to sell the green certificates separately to a trading company like Tradelink Solutions or another generator in the UK that would be prepared to buy them.

Private wires are much less complex and a recommended option where possible. The interface with the licensed market is reduced to a minimum as most electricity flows are on the private network and invisible to the wider market.

3. On-site use

Using the electricity on the site and saving on the costs of purchase. Excess electricity can still be sold to the grid.

7.6 Grid connection procedure

1. The supplier that offers the best quote for the export of electricity and also offers the best conditions including length of agreement, yearly charges, additional support and benefits will be chosen for a Power purchase agreement.

2. All licensed generators must be registered with the system operator- National Grid (NGET). Ofgem needs to be contacted to register the microgenerator as an accredited renewable generator. As such, the IPS will be entitled to receive ROCs, LECs and REGOs. In order to receive accreditation, an Ofgem approved total generation meter must be installed at the inverter (YEDL, 2008).

Some suppliers like NPower offer their customers a full service and carry out the accreditation procedure with Ofgem on their behalf as well as arrange for all the compliance conditions to be met. This is the provision of the new legislation that came into force in April 2007 and allows customers to appoint an agent for themselves (NPower, 2008).

Upon accreditation Ofgem issues the ROCs into an account on the ROC register, administered by Ofgem. In order to make the sales process as easy as possible, the IPS should contract a supplier who will also set up and manage the ROC account on their behalf.

The obligation period runs from 1st April to 31st March next year. The market price of ROCs will be fixed for every ROC received/ MWh produced (NPower, 2008) and will be based on the buy-out price issued by Ofgem, please plus an administration fee charged by the supplier (NPower,2008).

3. Creating a new connection to the Grid

a) The IPS or the installer on their behalf should contact the local DNO that regulates the local distribution networks as early as possible. If the capacity of the SHP surpasses 30kW, then a generation and distribution license will be needed. The DNO for South Yorkshire and Humber is YEDL (Yorkshire Electricity Distribution plc) CE Electric.

They will and make sure that the site meets the prescribed regulations before issuing a distribution license and connecting the distributed generator to the network.

b) It's important to know the costs of the new connection on the site. It is advised to have a special network and design assessment done (this should be done in the scope of the full feasibility study of the site).

YEDL can offer a complete connection service from initial discussions, design, detailed proposals and planning through to installation and commissioning. The network assessment study carried out by YEDL costs up to £1,400 (YEDL, 2008)

However, there is also an option to contract the work to an independent company - e.g. Grid Connection (Web site: https://www.gridconnection.co.uk/) that specialises in the provision of information for the feasibility and connection of renewable energy projects and charges £950+VAT per report. .

c) There are a range of activities that need to be carried out in order to establish a new connection/ an extension of the electricity distribution system. They are split into: contestable - those that are open to competition and may be carried out in total by YEDL or by an IPS chosen electricity supplier (to a design and specification approved by YEDL) if he is suitably qualified; and non-contestable.

In general: cable laying, jointing and plant installation are contestable items and can be carried out by an electricity supplier or contractor who is accredited and approved by Lloyds Register.

Non-contestable works are: Point of connection determination, design approval, statutory consents, quality assurance and final connection (YEDL, 2008).

According to the YEDL (2008) report, the costs of a new Grid connection for a commercial generator up to 1,000 kVA are just under £40,000 (see Appendix J).

d) Installations of the right meter and technical services prior to beginning of electricity exports can be negotiated with the supplier. If not, they will provide guidance on which company to turn to. Final energisation is the responsibility of the chosen electricity supplier.

For more information about the actual connection costs and quotes see YEDL April 2008 report Connection charging methodology and statement. Version1.2. or see YEDL website: http://ceelectricuk.com/

8 Conclusions

In a short overview, the guidelines for a new Sheffield IPS would be in terms of tasks per phase:

Phase 1: **Organisational setup**

- ✓ Data collection
- ✓ Pre-feasibility study
- ✓ Choice of turnkey installer
- ✓ Demand assessment
- ✓ Site's suitability & alternatives evaluation: FDC, load factor, output
- ✓ PR & networking
- ✓ Small grant/ development grant application

Phase 2: **Site preparation**

- ✓ Site inspection
- ✓ Hydrological modelling
- ✓ Detailed Costing
- ✓ Social & environmental assessment
- ✓ Hydropower assessment & design plan
- ✓ Financial analysis
- ✓ IPS setup → Prospectus issue
- ✓ Grants & Loans
- ✓ Permits and licences

Phase 3: **Implementation**

- ✓ Construction
- ✓ Choice of supplier
- ✓ Grid connection setup
- ✓ Metering arrangements
- ✓ Operation

9 Recommendations

The recommendations were made following the conclusions made while preparing this report:

• A small hydro project has different stages which should be considered separately in terms of planning and allocating resources: organizational setup, site preparation and implementation phase.

• Obtaining all available existing data and information is critical in pre-feasibility phase and later in the feasibility study. A good assessment of energy production potential and a sound financial plan will contribute significantly to the certainty of the project's success. Use of assessment/ planning tools (e.g. RETScreen) is advised.

• A demand assessment and a detailed grid assessment study must be made to determine the ability of the generated load and expected distribution costs.

• A very close working relationship between contactors based on trust is the best way to develop the project quickly and without conflicts of interest. Some form of installer's representation on IPS Board is advised.

• Costing should be assessed to an accuracy of +/- 10%, and a 20% contingency should be applied to the capital costs. Sensitive to changes in prices of steel and exchange rates, due to import from German supplier Ritz Atro.

• Engineering and project management costs are likely to equate to 10-36% of the total capital cost. Get a specific site based quote in advance.

• Possible risk factors affecting the project should be identified and considered in the plans.

• Community benefits plan written in a legal document provides more security for attracting investments and financing the preferred projects.

• Contacting the stakeholders at an early development stage and building contacts / relationships.

• Advised installer to be working with the Sheffield IPS is h2oPE. They have experience working in non-profit sector, are familiar with the sites in Sheffield, have a good working relationship with the Council and the EA, support the local development in Sheffield with a range of additional services and help manage the IPS and project risks for the lowest comparable costs.

• Among suppliers, Smartest Energy is recommended as it offers the best prices for the export. A half hourly meter should be installed at own cost - see Switch2 company website (http://www.switch2.com/3.1.4.html) for the correct choice of meter and installation options.

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11 Appendices

APPENDIX A

List of consultees:

- Zoë Newton-Heys, National Customer Contact Centre, The Environment Agency
- Emma Wells, Sheffield City Council, Planning & Development
- Andy Nolan, Sheffield City Council, Head of Environmental Department
- John Malone, Regional Energy Consultant, Energy4all
- Jamie Needle, Engineer, Derwent Hydro Power
- Steve Welsh, H_2OPE, member of management board, Water Power Enterprises
- Dr. Till Geiger, member of management board, Torrs Hydro New Mills Ltd.
- Richard Brody, member of management board, Torrs Hydro New Mills Ltd.
- Mark Sheikh, Engineer, Segen - Hydropower Enterprises
- John Paul Taylor, Energy Consultant, ESD consultancy
- Phil Woodhead, Consultant in facilities management, Turner and Townsend Construction and Management Consultants
- Susannah Brown, Customer Service Advisor, Future Energy Yorkshire
- Rebecca Brown, Trading Analyst, Good Energy
- Nigel Williams, Business Development Manager, Smartest Energy

APPENDIX B

Statement of work

PROJECT BRIEF:	**Commence:**	**8 February 2008**
	Finish:	**9 May 2008**
	Contract period:	**12 weeks**

Organisation: **Sheffield Hallam University &**
Sheffield Community Renewables (SCR) Group

Client Contact: **Rob Pilling**
31 Tullibardine Road
Sheffield, S11 7GL

Email: **RobJPilling@yahoo.co.uk**

Telephone Contact: **0777 273 0137**
Student Consultant: **Spela Zeleznikar**

Subject:

"Opportunities for promoting and developing community renewable energy projects (Hydro Electric Schemes) in Sheffield"

Context:

About Sheffield Community Renewables (SCR)

SCR is a small local community group set up in 2007 with the aim of supporting, promoting and developing renewable energy projects in and around Sheffield. It is affiliated to Sheffield Climate Action (www.SheffieldClimateAction.org), a local partnership working with COIN to stimulate and support collective local action on climate change. Sheffield Climate Action is supported by funding from Artist's Project Earth (APE).

SCR group is particularly interested in community based approaches, which provide added local benefits in addition to direct carbon savings.

SCR is dedicated to the following actions:

1. Advancing the education and raising awareness of the public for the importance of clean energy resources in a modern society;

2. Promoting research and investment in renewable energy resources in Sheffield by gathering information and identifying possible low carbon solutions;

3. Seeking funding & support for local projects with interested partners.

Aims:

This project will explore opportunities for the development of new community based renewable energy schemes, especially Hydro electric schemes, in Sheffield. The intention is to identify an exemplar approach applied elsewhere in the UK and, using this as a case study, to explore opportunities for replication locally.

In contracting this work SCR seek advice as to how they can best support the development of community based renewable energy schemes in Sheffield.

SCR group is therefore keen to understand more about the local renewable energy context and to receive a preliminary assessment of the broader impacts of the scheme. These include on overview of the planning procedures and permissions needed, economic and community benefits, energy savings and any direct and potential impacts on the landscape that would arise from the project.

Student Output:

- Report on the current level of development of Sheffield renewable energy resources, with specific focus on hydro electric schemes, and future outlook;
- Report on a case study of an exemplar community based renewable energy hydro electric scheme;
- Report on the evaluation of opportunities and procedures needed for replicating the exemplar approach within Sheffield;
- Provide a list of recommendations for SCR.

The final report should provide an insight on the following key factors:

a) Economic viability;
b) Carbon savings;
c) Community benefits;
d) Nature conservation with identification of possible mitigation options;
e) Built environment and landscape;
f) Organizational setup (business model);
g) Planning & regulatory permissions;
h) Perspectives and views of different stakeholders.

Client Input:

- Provision of background reports, bibliography and sources of further information (including contacts list of local stakeholders).
- Provision of information on the development of SCR projects to date.
- Attend inception meeting on Thursday 6 February at 1 p.m. at 31 Tullibardine Road to discuss brief with student.
- Arrange progress meetings with student every three weeks, or as required, discuss and resolve issues arising from the study.

Deadlines:

- Copies of the draft report will be handed to the client and the module tutor by 16.00 on Monday, 10th March 2008.
- Feedback on the draft report by both the tutor and the client will be given as soon as possible during the week commencing 7th April 2008.
- The final student outputs will be handed in on 9th May 2008.
- An oral presentation will take place on Thursday 21st May 2008.

APPENDIX C

List of available funding sources for grants & soft loans

GRANTS

- SYFAB, http://www.syfab.org.uk/form-full-enquiry.php - Service for voluntary and community groups in SY;
- Community Sustainable Energy Programme, www.communitysustainable.org.uk:
- http://www.ecofinancing.co.uk/eco-community-groups.html;
- Barclays Bank http://www.personal.barclays.co.uk/BRC1/jsp/brccontrol?task=articlesocial&value=3184&site=pfs;
- E.ON Source (35% installation grants for their customers) http://www.eon-uk.com/about/2654.aspx;
- Scottish Power- Green Energy Trust (contact Alison Mckeen 0141/5683964) http://www.scottishpower.co.uk/Home_Energy/Product_Information/Green_Energy/;
- LCBP Phase 2: http://www.lowcarbonbuildingsphase2.org.uk/;
- Scottish Green Energy Trust; http://freight.quix.co.uk/;
- EDF Green Energy Fund (contact Nigel French 01273428641);
- Energy Saving Trust -Cafe (Community action for energy) http://www.energysavingtrust.org.uk/what_can_i_do_today/energy_saving_grants_and_offers;
- The Carbon Trust
- Sheffield City Council, Small community group grants, http://www.sheffield.gov.uk/smallgrants;
- Co-op Community Dividend (small grants) (Co-operative UK)
- Peak Park Sustainable Development Fund, www.peakdistrict.org/sdf
- **GRA - UK Grants: (Recommended link)** http://www.google.co.uk/search?hl=en&q=gra+uk+grants&meta=
- Awards for All - Lottery Grants for Local Groups www.awardsforall.org.uk;
- Co-op Community Dividend- helping local voluntary community groups by the provision of equipment; http://www.co-op.co.uk/membership.

SOFT LOANS

- TRIODOS Bank, ; http://www.triodos.co.uk;
- Co-operative Bank; http://www.co-operativebank.co.uk/.

APPENDIX D

Carbon savings calculations from SHP scheme with the following estimated values:

Capacity: 50kW
Yearly estimated output: 188 MWh
Load factor: 0,45

Table1: Carbon saving per fuel type and equivalent savings realized (in tonnes/MWh)

	TYPE OF FUEL	**EMISSIONS FACTOR (tCO_2/ MWh)**	**tCO_2 SAVINGS**
1.	Natural gas	0,376	70,8
2.	Oil	0,446	84,0
3.	Coal	0,896	169,0
4.	All types (grid factor)	0,455	85,7

Equivalent activity per fuel type (in tonnes of CO_2 saved)	**Natural gas**	**Oil**	**Coal**	**All types (grid factor)**
Cars & light trucks not used	14,4	17,1	34,4	17,4
Liters of gasoline not consumed	28.787	34.154	68.715	34.846
Barrels of crude oil not consumed	147	174	351	178
Acres of forest absorbing carbon	60,2	71,4	144	72,8
Hectares of forest absorbing carbon	24,4	28,9	58,1	29,5
Tonnes of waste recycled	23,8	28,3	56,9	28,9

Source: RETSCREEN, 2004

*Note: The calculations were made using the Canadian international computer model **RETSCREEN**. Slight variations to in emission factors to **Defra's Guidelines to Defra's GHG conversion factors for company reporting for detailed emission factors per fuel type (2007)** at:
http://www.defra.gov.uk/environment/business/envrp/pdf/conversion-factors.pdf

APPENDIX E

Table 2: Project risk assessment matrix

Project Assessment Matrix

How to Use: This is to help you judge the risk in you project. Look at the criteria and discuss with others which best applies to your project, and enter that in the score column. For example, if it has to be completed in 3 months, it would get 2. Add the scores to get an overall score which should help you judge the risk facing your project, and therefore how much control it needs.

Criteria / Score	2	4	8	16	Score
Strategic Targets	No links to strategic targets	Contributing to other work that is linked to a strategic target	Direct contribution to strategic target	Direct contribution to more than one strategic target	8
Potential impact on Council's reputation if anything goes wrong	No risk to Council's reputation	Short-term, limited damage to reputation	Widespread, but relatively short term damage	Significant, long-lasting damage to reputation (nationally)	2
Impact on organisation	None	May require some new business processes & possibly some retraining	Significant restructure of process & work areas	Transfer of staff or out sourcing	4
External policy or legislation	No links to other work	Some link to other work that is delivering policy or legislation	Direct link to policy or legislation	Fundamental to achievement of policy or legislation	8
Stakeholders	Internal & within single service area	Internal across more than one service area may involve an external partner	Internal and external	Mainly external	8
Cost	<£3000	£3000 - £50000	£50000 -£ 400000	>£400,000 or EU Procedure applies	8
Contract Complexity	May have a service level agreement, but no formal contract/low risk	Single contract know suppliers or three quotes/medium risk	Competitive Tender required – but most likely to be known supplier / medium risk	Tendered contract with new unknown supplier / high risk	4
Timescale in months	<6 months	6 - 12 months	12 - 18 months	> 18 months	8

Total Score	16 –55	56-99	100+
Level of Risk	Low	Medium	High
Type of Project	1	2	3

Total = 50

Source: Sheffield City Council (2008). http://www.sheffield.gov.uk/?pgid=107446&fs=b

APPENDIX F

Although the technology for high and medium head hydropower sites is now mature, this is **not** the case for low head technology (<5m head). **Projects of a few 100kW and smaller (the large majority of unexploited low-head sites in the UK)** still have room for innovation and optimisation to develop technology that is suitable for the remaining low head resource.

The main turbine options which are currently applied to low head schemes are:

1. Propeller-type turbines

- *Basic propeller turbine (fixed rotor blades, fixed guide vanes)*
- *Kapellar (fixed propeller rotor, adjustable guide-vanes).*
- *Semi-Kaplan (fixed guide vanes, adjustable rotor blades)*
- *Full Kaplan (adjustable guide vanes, adjustable rotor blades)*

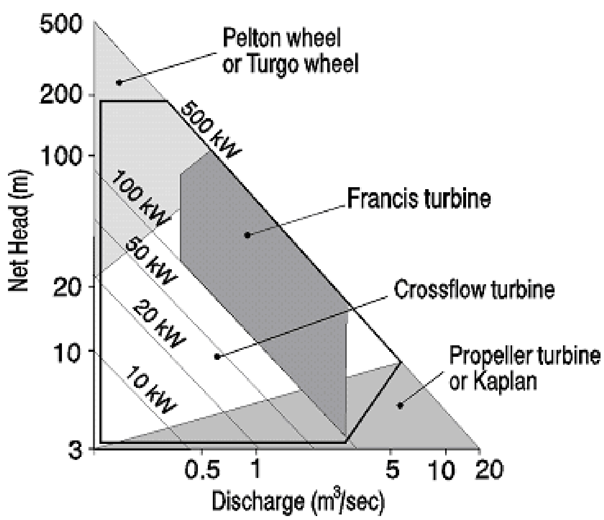
2. Crossflow (Banki) turbines (adjustable inlet vane)

3. Open-flume Francis turbines (adjustable guide vanes)

Turbines are divided by their principle of operation and can be either impulse or reaction turbines. The propeller/Kaplan and Francis turbines are *reaction* turbines which run full of water and create pressure differences across the blades to extract energy from the available head. The crossflow turbine is principally an *impulse* turbine, rotated by the high velocity jet created by the pressure head.

Source: *http://www.tvenergy.org/pdfs/Final%20Hydro%20Report%2022April04.pdf*

Figure 1: Head-flow ranges of small hydro turbines



Source : http://www.british-hydro.co.uk/infopage.asp?infoid=362

Table 3: Comparison of different turbine technologies

Turbine system	Head range	Capacity range	Types of site	Cost	Advantages
Waterwheel-Overshot	Up to 5 m	Up to 500kW	Old mills	High	Visual attraction – compatible with historic features. Acceptable efficiency
Waterwheel-Undershot	Up to 2 m	Low	Old mills with very low head	High	Visual attraction – compatible with historic features.
Kaplan	0.5-10m	wide	Dams in rivers	High	
Matrix	3-30m	200kW+ units in banks (usu-ally in MW sites)	Dams, locks, intakes	Rel high	Easy access for maintenance (re-movable)
Bulb plus impulse turbine on riverbank	0-5m?	Unknown – primarily small sites	Structures in rivers, free running rivers	Probably rel. High	
Archimedes	0.5-10m	3-300kW	Weirs and dams, mill sites	Unknown – possibly rel. low	Fish friendly, Novelty
Parallel or modular pro-peller turbines	0.5-10m	1.5kW – MW scale (by mod-ular increase)	Weirs, dams, mill sites, sluices, etc.	Low – but civils depend on site	Can have higher ca-pacity than Kaplan
Stempressure turbine	0.5-5m	20kW upwards (perhaps to several MW)	Weirs, dams, etc.	Unknown, but claimed low	Fish friendly, Picturesque
Crossflow	1-200m	Wide	Varied – dams, new construction, leats, penstocks, pipework etc.	Low	Easy to maintain

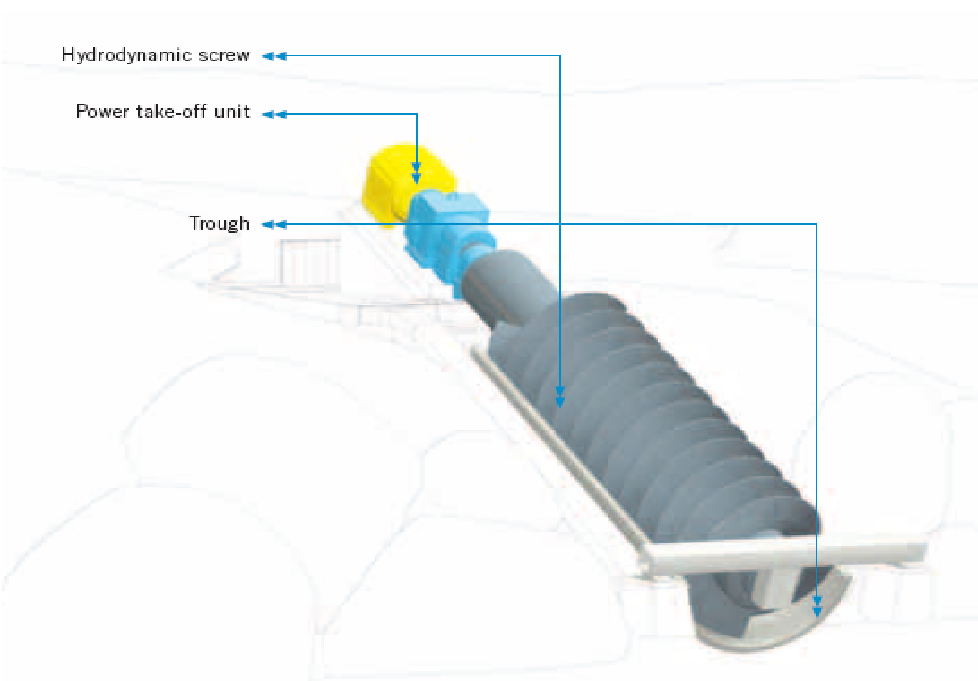
Source: SPLASH (2005). Guidelines for micro hydropower development

Archimedean screw

Archimedean screws are a new type of turbine in this country, though they have been known since antiquity as a simple machine for lifting water. Today, Archimedean screws are still in widespread use as pumps for sewage and grain. It was recently noticed that the screw could also—in its reverse role—be employed as an energy converter and they have a number of advantages over conventional turbines:

- They require very little fish and debris screening.
- Their installation costs can be lower than comparable Kaplan turbines.
- They are mechanically simple - less to go wrong.
- They have good visibility - people can see the water generating the power.
- Fish screening can be a stumbling block with many systems, and can contribute to both the capital costs and the ongoing costs. The usual need is to exclude all fish as far as reasonably possible - sometimes meaning screen mesh sizing of as little as 3mm is requested. This can make a conventional turbine unworkable, but with the slow turning Screw turbine it is possible to simply let the fish through. There are no trapping points for the fish and no pressure discontinuities which can upset them also.
- Installation can be relatively simple, and costs can tend to be lower on low head sites, for instance on the many river weirs which exist.
- There are few moving parts, so less parts to get damaged and go wrong.
- Unlike nearly all turbines, you can see the water doing the work.

Figure 2: Archimedean screw



Source: Ritz Atro (2005). Hydro-dynamic screws.

For more information on these machines see ***http://www.mannpower-hydro.co.uk.***
Ritz-Atro manufacture a range of Archimedean screw systems, their UK agent MannPower Consulting offer a wide range of hydro-power services on sites suitable for such systems.

Western Renewable Energy, with other hydro-electric specialists GP Electronics and Castleford Engineering, has commissioned the installation of the UK's first Archimedean screw for power generation at the River Dart Country Park, Ashburton. Work was carried out by Western Renewable Energy, together with Castleford Engineering and GP Electronics. The site is in the Dartmoor National Park, and construction took approximately four months. Commissioning happened in January 2007.

Source: *http://www.westernrenew.co.uk/Archimedes%20screw%20turbines.html#nogo*

APPENDIX G

Comparison of quotes

a) Suppliers:

Table 4: Comparison of supplier quotes per activity for the sales of a 188 MWh generation/ year, 45% load factor

Activity	**Electricity supplier costs & export tariffs in £**		
	Good Energy (Smart Generation)	**Smartest Energy**	**Ecotricity (Renewable Rewards)**
Export benefit price	57,51 £/MWh[2]	60 -63 £/MWH[1]	90 £/MWh
ROC & REGO price	46,04 £/MWh	£35.76 +buyout fund price 2009[3]	-
LEC	-	4 £/ MWH	-
Annual metering and administration charge	£519,83	£600	-
Total export benefit	**103,55 £/MWh**	min **99,76£/MWh + buy-out fund**	**90 £/MWh**

[1]"Wholesale power prices are currently around £70/MWh for an annual term out of April 2009. The market has transparency for a further 2-3 years beyond that with prices within about 10 per cent of this figure. Hydro power does not afford a supplier the same 'firmness' as that purchased from more traditional sources and in light of that we would apply a discount to wholesale in the order of say 10-15 per cent (£7-10/MWh at current rates)" (Williams, 2008).
[2] Including energy, LEC and Embedded Benefits (Brown, 2008).
[3]The value of the buyout fund changes every year based on the level of obligation met by suppliers on the market: expected at around 10£/MWh.

Source: Brown and Williams, 2008
Ecotricity website, 2008. http://www.ecotricity.co.uk/about/microgeneration-renewable- rewards/pdf/RR_q_and_a.pdf

b) Installers

Table 5: Comparison of Installer's approximate quotes per activity for the development of a hypothetic 50kW site, 2m head, 188 MWh generation/year, 45% load factor

Activity[i]	Turnkey Installer of Hydropower costs in £		
	h2oPE	**Derwent**	**Segen Hydropower**
Desk study/ Pre-feasibility study	600	695 + travel costs (0,5£/mile)	300 -1,000[2]
Feasibility study/ site	2,000 – 6,000	4,000 - 10,000 [1]	2,000 + Travel cost 45 pence/mile + VAT
Design report		1,500 - 4,000	3,000[2]
Planning permission[3]	(135)	(135)	135
EA permits[3]	(150 + (0-5,000[6]))	(150)	150
Installer fee	10% of gross profit	-	-
Grid connection	40,000	30,000 - 40,000	40,000
Supply and install electromechanical elements[4]	50,000-100,000	50,000 -100,000	50,000-100,000
Insurance	3,000/ year	500 - 2,000 / year	-
Servicing and maintenance		500,-5,000 / year	-

[i] All costs are site specific
[1] including planning and EA license
[2] Average industry prices where Segen quote not available (BHA, 2008)
[3] Negotiated by installer
[4] Depending on the screw diameter, prices of steel and exchange rate with EUR
[5] Including planning, EA license and design report
[6] EA Report costs per site on average £2,500 (Welsh, 2008)

Source: Welsh, Needle, Sheikh & BHA, 2008

APPENDIX H

Table 1: Legal structure options for a social enterprise in England

Legal structure / Attributes	Unincorporated association	Trust (unincorporated)	Limited company a) by guarantee b) by shares	Community interest company (CIC)	Industrial & Provident Society (IPS) (Co-operative)	Industrial & Provident Society (IPS) (BenCom)[3]	Incorporated Charitable Organisation (CIO)[1]
Summary: most typical features	Informal, no general regulation of this structure, need to make own rules	A way of holding assets- separate legal ownership from economic interest	Most commonly adopted legal structure- can be adopted to suit most purposes	New structure for social enterprises, ltd company, secure asset lock, focus on community benefit	Trading/ operating for serving members' interests by supplying them with goods /services	Trading/ operating for the benefit of wider community, not just own members	Operating for the benefit of wider community, heavily regulated, significant tax benefits
Regulating body	None	None	DTI	DTI	FSA	FSA	DTI & Charity Commission
Ownership, management structure, governance	No owners; Run informally,	Assets owned b trustees and managed in interests of beneficiaries on the terms of the trust; Run informally	Directors manage business on behalf of members. Considerable flexibility over internal rules	Same as limited companies but subject to additional regulation to ensure community benefits	Committee manages on behalf of members. One member-one vote, regardless of size of shareholdings	Like IPS Co-op but with option of a more secure form of asset lock	Similar as with companies, but Directors in this case are Charity Trustees
Type of regulation	Free	Free	Heavy	Heavy	Hands on but supportive	Hands on but supportive	Heavy
Governing document /	Governed according to own	Governed according to own	Memorandum and articles of	Memorandum and articles of	Rules	Rules	Memorandum and articles of

constitution	rules	rules	association	association			association
Governing body	Management Board	Board of Trustees	The Directors /Board of Directors	The Directors /Board of Directors	Management Board	Management Board	Board of Directors/ Trustees
Membership	Participatory & democratic; depending on own regulations	Usually closed membership, only by invitation/special conditions; depending on own regulations	Non-participatory; a) Wider or Participating membership; have voting rights b) Membership by acquisition of membership share; voting power related to level of shares owned;	Same as company limited by guarantee or by shares; depending on CIC structure	Members support the objectives, buy a nominal share, 1 share 1 vote; participatory	Members support the objectives, buy a nominal share, 1 share 1 vote; participatory	Can have participation membership but usually does not
Trading limitations	Not allowed	Not allowed	None	None	None	None, except where there's "exempt charity status"	Up to 25% of annual income can be non charitable (if primary purpose is not trading)
Potential to attract funding	- Medium - small community/ voluntary group grants - donations	-Low	a) Medium-commercial loans b) Low-investment shares, commercial loans	Medium/ High Shares, grants, loans (soft)	Low 2 ways of raising funding: shares, commercial loans	High 3 ways of attracting funding: shares (social equity), grants/donations , loans (soft)	High Attracting grants and donations
Share issue to	No	No	a) No	Yes-investment	Yes (nominal	Yes (nominal	No

raise capital			b) Yes – investment shares	shares, if it is a CIC Ltd. by shares	value shares 1£; 1share , 1 vote)	value shares 1£; 1share , 1 vote)	
Asset lock for community benefit	Would need bespoke drafting to achieve this	Yes, if trust is established for community benefit	Would need bespoke drafting in articles to achieve this	Yes, through standard provisions which all CICs must include in their constitutions	Yes, if written in the Rules (bespoke drafting)	Yes	Yes
Changes in governing document	Easy	Easy	Easy	Difficult	Difficult &expensive-but greater protection	Difficult &expensive-but greater protection	Difficult and expensive
Charitable status and charitable status tax benefits	Yes, if it meets the criteria for charities	Yes, if it meets the criteria for charities	a) Yes, if it meets the criteria b) No	No	No	May qualify as an "exempt charity" with the Inland Revenue	Yes; exempt from income tax, corporation tax and capital gains tax, 80-100% reduced business rates and VAT benefits
Profit distribution to members permitted?	Yes, according its own regulations	Yes, according to its own regulations	Yes or No - determined by the Articles a) amounts set b) dividends on investment shares	No (except capped return on dividend for CICs ltd. by shares)	Yes; paying interest on nominal shares	According to the Rules; some interest on the nominal shares might be paid out	No
Minimum number of Directors	1 Director, 1 Secretary, 1 Treasurer	3	1 Director, 1 Secretary	1 Director, 1 Secretary	3 Directors, 1 Secretary	3 Directors, 1 Secretary	1 Director, 1 Secretary
Registration	None	None	20£ basic	Incorporation	Registration by	Registration by	At least 200£

costs			registration with Companies House. Model rules suitable for social enterprise from 300£	35£, conversion 25£, recommended use of model rules from 500£	model rules 400£, more expensive for bespoke rules	model rules 700£, more expensive for bespoke rules	
Annual filing fees	None	None	30£ annually	Annual accounts and community interest report 45£	60£→370£, depending on size of assets (must submit annual accounts)	60£→370£, depending on size of assets (must submit annual accounts)	30£ annually to Companies House[2]
Liability of members	Personal/full liability; cannot hold property, difficult to create contracts	Personal /full liability of trustees	Members' liability limited to amount unpaid on shares or by guarantee	Members' liability limited to amount unpaid on shares or by guarantee	Members' liability limited to amount unpaid on shares	Members' liability limited to amount unpaid on shares	Members' liability either limited to amount unpaid by guarantee or no liability
Can its activities benefit those who own and/or run it?	Depends on own rules	Trustees/Directors no, unless having Trust, Court or Charity Commission permit	a) no b) yes, dividends to members etc.	Yes, but must benefit wider community as well. Can pay limited dividends to private investors	Yes, but should do so mostly by members trading with society, using its facilities etc, not as a result of shareholdings	Must primarily benefit non-members; asset lock applies	Members: no; Charity trustees: only if Constitution, Court or Charity Commission permit
Administration	Low	Low	High	High	Low once set up	Low once set up	High
Main advantage/ disadvantage	-personal liability - own set of rules - very flexible	-personal liability -governing freedom -continuity of trustees	-common and flexible forms, very adaptable a) for voluntary/ non-profit groups b) for profit making	-subject to stricter regulations than IPS (limited profit distribution, asset lock, community	-run and managed by the members (not necessarily a social enterprise)	-run and managed by the members - requirements for audits are less stiff than for Companies	-strict reporting rules -tax benefits

			businesses	interest tests, annual reports, can only convert to charity etc.)		- acceptable with grant giving bodies	

Source: Business Link, 2007 & Co-operative futures, 2006

[1]*information refers to CIOs and Charities together; see Charity Act 2006 and Charity Commissions website (2008) for more detail about the two structures (http://www.charity-commission.gov.uk/registration/charcio.asp#1).*

[2] *only applies to registered charities*

[3](further information can be found on the FSA external website *http://www.fsa.gov.uk/Pages/Doing/small_firms/MSR/Societies/index.shtml* and Co-operativesUK Legal Services