Community-led hydro initiatives

Inspiring overview of hydro installations, funding and project profit management
About this action pack

This action pack has been developed as part of a series produced by the Academy of Champions for Energy (Ace). Each pack has been written and reviewed by community activists with first-hand knowledge of what it takes to set up social enterprises to address the challenges of peak oil and climate change. Inside you will find practical suggestions and inspiration for setting up your own community initiative, helping those who are ready to take action to do just that.

This series of action packs was originally funded by NESTA and produced by Local United (www.localunited.net), a co-operative of social entrepreneurs which aims to speed up the rate at which good ideas are adopted by communities. These latest revisions have been produced by Ace, a sustainable energy initiative running in the UK, Ireland, France, Belgium and the Netherlands, funded by the INTERREG IVB NWE programme.

Ace aims to bring together ‘Champions’ of energy transition across the public, private and community sectors to share and disseminate information to increase uptake of renewable energy and energy efficiency measures. The focus is on using resources already available within our communities to build sustainable futures. This means citizens working together to find collaborative solutions which integrate energy transition into our everyday lives. Citizen engagement and community-led action are therefore central to this vision, and these packs aim to demonstrate how to build projects from the bottom up for the benefit of everyone. For more information about Ace visit www.aceforenergy.eu. For more guidance on citizen engagement visit www.aceforcommunities.net.

Each pack provides a useful ‘how to’ guide, illustrated by inspirational stories of what can be achieved when communities come together to act. Many of the packs contain technical advice, links to other information, copies of legal templates or lists of regulations all of which can help communities get their projects off the ground. Of course, any information provided is only as up to date as the day it goes to print.

Downloadable versions of the packs are available on the many partner websites. If your group or organisation would be interested in sharing the packs on your own website, contact the National Energy Foundation via ace@nef.org.uk. Community groups who have used the packs to support their own projects are also invited to provide information on how useful the packs have been, what other information should be provided or any other feedback which may improve future packs.
INTRODUCTION.................................................................................................................................3
OVERVIEW........................................................................................................................................3
BACKGROUND....................................................................................................................................3
PREREQUISITES...................................................................................................................................3
STRATEGY............................................................................................................................................4
  Business planning..............................................................................................................................5
  How can a community group finance themselves? ........................................................................5
  Phases of development ....................................................................................................................6
  An example 15kW business model.................................................................................................8
  Post-construction.............................................................................................................................9
A STEP BY STEP GUIDE TO DELIVERING COMMUNITY HYDRO.........................................................9
  Pre-assessment...............................................................................................................................9
  Feasibility study...............................................................................................................................9
  From planning to commissioning ....................................................................................................10
  Local group engagement and constitution ....................................................................................10
ISSUES AND RISKS................................................................................................................................11
  Planning and EA permission risks................................................................................................11
  Ecological risks ..............................................................................................................................12
  Technology risks.............................................................................................................................12
  Financing risks...............................................................................................................................12
  Management risks.........................................................................................................................12
CONCLUSION......................................................................................................................................12
GLOSSARY........................................................................................................................................13
APPENDICES........................................................................................................................................14
  Appendix A: An Example Of The Type Of Systems TGV Install.........................................................14
  Appendix B: A Basic Guide To Assessing Potential Hydro Sites........................................................16
  Appendix C: Example Community Hydro Planning Statement.........................................................21
  Appendix D: Useful Links................................................................................................................34
  Appendix E: 15kW Community Micro-Hydro Example Site Plans....................................................36

Chris Blake
2015
INTRODUCTION

This action pack is designed to provide an overview of community owned hydro installations. It is intended to inspire community groups to take action and uses many examples from The Green Valleys (TGV), which is a social enterprise that works with community groups to develop community energy projects. Much of what you will find in this pack will be specific to what TGV has done in the past and is intended to educate and inspire, but much of the details will show how your community could emulate these projects.

OVERVIEW

A hydro electric installation isn’t the sort of community initiative that will attract volunteers in droves. It generally involves many months of preparation followed by a lengthy period of obtaining permissions and project finances and finishes with a very short installation phase that has limited opportunities for volunteers. However, a well-designed hydro project can provide the long term revenue to finance a great number of further local community initiatives for years to come.

BACKGROUND

Hydro projects can provide free electricity or electricity which can be sold so as to provide an income for a community group. The green electricity produced also generates significant revenue through the Feed-in Tariff (FiT) program. This action pack is designed to assist community groups in investigating the possibilities open to them for hydroelectrics and to provide advice on where to find further support.

The Green Valleys (TGV) is a Community Interest Company (CIC) that started out as a handful of committed individuals developing their own micro-hydro systems in the Brecon Beacons. It has now developed into a community owned social enterprise that develops, installs and maintains hydroelectric systems for long term community benefit.

TGV CIC is a regional entity that provides support and services to local community initiatives, but is also the owner of a trading subsidiary, TGV Hydro Ltd, which is a registered installer of micro-hydro schemes. TGV Hydro Ltd works closely with Hydrolite Ltd, which manufactures turbines and components for the micro-hydro industry. All profits from TGV Hydro Ltd go back to the regional CIC to invest in low carbon projects for local community benefit. TGV Hydro Ltd develops high head micro-hydro systems (meaning that the water drops over tens of meters rather than just a few, such as on a weir) but much of the detail provided in this pack is applicable to any type of hydro installation.
TGV and its founders have completed 16 installations (as of January 2015) in the Brecon Beacons and more widely across Wales. They are in the process of constructing a further 7 schemes, and have worked to obtain permissions and licences for over 70 schemes in total with a combined potential output of 1.5MW.

The TGV social enterprise model is unique as it can design, install and maintain micro-hydro systems, as well as providing detailed support for communities who want to develop schemes for social benefit. TGV CIC will support a community group to identify potential sites for a hydro scheme, assist with landowner negotiations, support local community engagement and advise on grants and capital raising for construction. See Appendix A for an example of the type of systems TGV install.

**PREREQUISITES**

For high head (head=height) schemes, you simply need water and a fall (and both are equally weighted when calculating power). A typical high head scheme would involve a mountain stream flowing across several farm fields. Low head schemes generally utilise large quantities of water flowing over a relatively small height (such as old mills or weirs). A viable scheme will generally either have a lot of flow over a small height or a little bit of flow with a large amount of height. Whilst the power of these two systems can be the same, the technological, ecological and construction issues will be vastly different. The geography of the local area will dictate which sort of system a community group opts to develop but generally speaking high head systems are cheaper per kW installed due to far less civil engineering being required.

**STRATEGY**

Building a micro-hydro project is not easy. For community groups wishing to exploit the thousands of small hydro assets that exist there are some significant barriers: affordable and accurate feasibility studies, guidance through the planning process, low cost system design and installation, finance, and ultimately the availability of trained engineers. These are all issues which would need to be considered in any serious plan for a hydro system. It is often easier to seek help at an early stage rather than hoping to manage with volunteers and few resources. However, most community groups will have a number of sites in their proximity that may warrant inspection, so this pack contains a brief guide to assessing the viability of sites for community groups without the need to seek finances or technical help (see Appendix B: A Basic Guide to Assessing Potential Hydro Sites).
Business planning

There is a unique opportunity for communities to secure a long term income stream by installing a community owned micro-hydro scheme. The scale of this income stream has the power to make a profound long term difference to the sustainability of some communities. One small village in the Brecon Beacons, Talybont-on-Usk, earn over £30k per annum from their 34kW community hydro scheme. In recent years this has enabled them to invest in electric and biodiesel cars, PV panels on the village hall and energy assessments in homes. Another small village in the Beacons, Llangattock, are presently developing up to 6 small hydros that will generate over £50k per annum for the local social enterprise, Llangattock Green Valleys, providing them with overhead finance and seed capital for future projects. Llangattock have drawn up a business plan to become a carbon negative community by 2015. Even a small hydro earning a few £1,000s per annum could provide essential finance for running the overheads of a small community enterprise.

How can a community group finance themselves?

Historically local groups secured grants to pay for installation costs, a fantastic example being the community turbine in Talybont-on-Usk in the Brecon Beacons (http://talybontenergy.co.uk/). However, since the introduction of FiTs and the consequent reduction in available grants, community projects need to raise finance themselves.

Typical costs for financing a plan for a 15kW hydro scheme are set out on page 8 (and the costs for a scheme twice this size will be roughly double). FiTs for hydro schemes are guaranteed for 20 years and are index linked making it possible to get commercial loan finance to fund part of the capital cost. However, most small loans (£25-250k) for individual schemes from commercial lenders will require an asset as security of some kind – typically a mortgage over the land. Since most community groups do not have, or do not want to use, assets as security against a loan this can still be a barrier.

Some commercial lenders will lend to community schemes without security other than so called “step-in rights”, which give them the right to receive the FiT income should the borrower default on the loan repayments. However, most commercial lenders will not lend the small amounts (less than say £250k) required by high head micro-hydro schemes. In Wales the Welsh Government’s Ynni’r fro programme does provide a loan scheme for community groups (www.energysavingtrust.org.uk/organisations/con
tent/ynnir-fro-community-programme) and can lend up to £250k at 7% above base rate on a flexible basis and without expensive set-up or due diligence costs.

If commercial or social lending (like the YnNi’r fro programme in Wales) is not available then it is possible to raise cash from either the local community or the wider public through share or bond issues. There are many sources of advice on raising construction capital for community energy schemes. For share issues, independent advice can be obtained from Community Energy Scotland (www.communityenergyscotland.org.uk), Community Energy England (www.communityenergyengland.org) or Community Energy Wales (www.cynnalcymru.com/community-energy-wales), three membership organisations that will be happy to discuss the detail. For information about raising construction capital from the public via bonds (effectively individual loans), contact Abundance Generation (www.abundancegeneration.com). For information about issuing shares in community energy projects then a good first point of contact would be either Sharenergy (www.sharenergy.coop) or Cooperatives UK (www.uk.coop).

**Phases of development**

All schemes that require formal permissions and consents will have an ‘at risk’ phase in which the scheme is not guaranteed to go ahead. For a small hydro scheme (up to about 50kW) the total cost of securing all permissions and tenders for system go ahead is typically budgeted at £15k and this will need to cover landowner agreements, abstraction licences, planning permission and flood defence consent. Under State Aid rules it is usually possible to cover many of the costs of this pre-permission phase with grants from government sources (if available). However, the State Aid rules are complex and you should seek specialist advice from your national community energy organisation to guide you through this difficult area.

There are many steps that need to be achieved before a community is in a position to raise the construction capital. The order of these various stages may vary from scheme to scheme, but as a rough guide the steps you will need to achieve are as follows:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Provider</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial feasibility study</td>
<td>Specialist micro-hydro professional</td>
<td>May be done as a desk study using mapping and flow modelling software.</td>
</tr>
<tr>
<td>Community engagement</td>
<td>Community group</td>
<td>Can be before or after the full feasibility study. You don't want to engage unless you think there is a prospect of having a scheme, but community engagement will help with the landowner discussions.</td>
</tr>
<tr>
<td>Option letter with landowner(s)</td>
<td>There are templates available – consult with your national community energy organisation.</td>
<td>This may not be legally binding at this stage, but does establish a commitment from the landowner to give the community the right to investigate a potential scheme on their land.</td>
</tr>
<tr>
<td>Full or detailed feasibility study</td>
<td>Specialist micro-hydro professional</td>
<td>Will involve a site visit and will include an assessment of grid connectivity, power output, potential system design and indicative costs.</td>
</tr>
<tr>
<td>Agreement or option to lease</td>
<td>Solicitor</td>
<td>A legally binding option signed by the landowner that will confirm that an agreed lease (attached to the option) will be entered into if specific conditions (i.e. obtaining planning permission) are achieved.</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Abstraction licence</td>
<td>Environment Agency (England), Natural Resources Wales (Wales), SEPA (Scotland). These can be technical applications and are often best completed by experienced professionals.</td>
<td>Permission to abstract water (and return it to the watercourse). To obtain a licence it will often be necessary to commission a number of specific ecological or other surveys.</td>
</tr>
<tr>
<td>Planning permission</td>
<td>Local planning authority</td>
<td></td>
</tr>
<tr>
<td>Flood defence consent</td>
<td>Local authority</td>
<td></td>
</tr>
<tr>
<td>Confirm all permissions</td>
<td>Micro-hydro developers</td>
<td>Final check all permissions obtained and conditions met.</td>
</tr>
<tr>
<td>Obtain construction quotes</td>
<td>Micro-hydro developers</td>
<td></td>
</tr>
<tr>
<td>Start construction fundraising</td>
<td>Micro-hydro developers</td>
<td></td>
</tr>
</tbody>
</table>

The relationship with the landowner is crucial and their early involvement in the project and a commitment (through an option or agreement to lease) is vital to secure exclusivity for the site while you are going through the expensive process of obtaining permissions.

For micro-hydro schemes the abstraction licence is likely to be (in most cases) more difficult to secure than the planning permission and therefore is likely to be the critical factor. Micro-hydro schemes, in the experience of TGV, do not typically raise serious planning concerns from residents as they are usually unobtrusive and quiet in operation.

Grants and financial support are available for the pre-permission phases. Again, contact your national community energy organisation for the current position. In early 2015 in England, support is available through DECC’s Rural and
Urban Community Energy Funds, in Scotland through the CARES (www.localenergyscotland.org) programme and in Wales through Ynni'r fro and the Community Energy Fund administered by Robert Owen Community Banking (www.rocbf.co.uk). Many of these schemes work as a “soft loan”. This means the funds are effectively a grant but if the project does end up being financed and built, the grant becomes a loan and is refundable (with a premium which varies with the provider) out of the construction fundraising.

The capital cost for the construction of the scheme can be provided from a number of different sources. The landowner may wish to provide some capital, either as cash or benefit in kind for construction work. The community group can use grant funding (although no state linked grants are allowed if you want FiTs), a local subscription to secure a financial stake in the scheme in the form of a share offer (through an Industrial and Provident Society) or other parties can also invest. In the example below a £10k grant was given to the community which enabled the local group to secure £3,500 per year from the FiT for 20 years (and this income is index linked) illustrating the cumulative positive impact that can be achieved by grant providers. The process for obtaining all permissions and capital will be similar for both low head and high head schemes and the costs associated with ecological assessments will vary more significantly on the geographical location rather than the type of hydro system that is proposed. TGV focus on high head systems, but organisations such as H2OPE offer similar packages to low head schemes (http://www.h2ope.org.uk/).

**An example 15kW business model**

In the example below, TGV assisted all of the parties (landowner, community group, investor – a local charity,) to enter into a Joint Venture (JV) agreement to develop the scheme. A JV agreement is defined as a cooperative enterprise in which two or more parties come together for a commercial activity where the parties agree to share in the profits (or losses) of the enterprise. TGV managed the JV and coordinated the permission processes, obtained quotes for construction, oversaw the installation and managed the on-going maintenance and reporting. Many community groups may want to do all of this themselves but it will require a great deal of expertise, commitment and time. The figures below can be used as a rough guide for very different hydro systems noting that if your kW capacity doubles, your project budget likely will too. Within the project budget it should also be noted that the permission fees, which includes all environmental and structural work, is quite low. This is because TGV rely on a pool of trained ecologists who work with us below market value for the betterment of their communities.

**SCHEME COSTS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permission fees</td>
<td>£12,340</td>
</tr>
<tr>
<td>Equipment</td>
<td>£30,595</td>
</tr>
<tr>
<td>Construction costs</td>
<td>£47,766</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£90,701</strong></td>
</tr>
</tbody>
</table>
OUTPUT AND INCOME

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output (kW)</td>
<td>14,926</td>
</tr>
<tr>
<td>Cost / kW</td>
<td>£5,675</td>
</tr>
<tr>
<td>Annual costs</td>
<td>£2,817</td>
</tr>
<tr>
<td>Gross income</td>
<td>£19,433</td>
</tr>
<tr>
<td>Home use benefit</td>
<td>£849</td>
</tr>
<tr>
<td>Annual benefit</td>
<td>£17,465</td>
</tr>
<tr>
<td>Gross payback</td>
<td>5.2 years</td>
</tr>
<tr>
<td>Carbon saving</td>
<td>39.5 tonnes/pa</td>
</tr>
</tbody>
</table>

Post-construction

Once the project has been installed, the majority of the revenue is used to pay off any loan finance for the scheme, meaning all investors are only receiving a small return. However, after the loan finance has been paid off, the landowner, community group and investors can receive several thousand pounds per annum. TGV typically request a 10% levy of the project revenue which we retain for 20 years and use to provide risk capital in future schemes. If landowners or community groups do not agree to this they are free to explore opportunities with other installers. All profits made by TGV Hydro Ltd in the installation phase are also redistributed to other community hydro projects providing us with essential seed capital for new projects.

A STEP BY STEP GUIDE TO DELIVERING COMMUNITY HYDRO

Pre-assessment

Do as much research as possible yourselves on all sites before appointing contractors and use the skills and services of local ecology specialists (they respond well to cakes). The most likely risk to any project is unforeseen ecological surveys and the presence of protected species that can make the installation of a hydro system inappropriate.

Feasibility study

It is important that a full feasibility study is undertaken to examine the practicalities of any project, its likely output, cost and environmental impact. A basic assessment of a site can be done without extensive knowledge using the guide in Appendix B. It is important to note that basic site assessments do not include annual variations in a watercourse’s flow regime, but all accredited installers are obliged to provide you with this data.
If the initial survey is favourable then a more detailed feasibility study should be undertaken, one that includes a hydrological survey, ecological surveys, a complete installation budget and a detailed financial forecast and financing options. TGV do all of these functions at cost to local community groups, but most other community groups will likely need to commission a report from a hydro engineering company. The Energy Saving Trust keeps details of companies who may be able to offer assistance.

From planning to commissioning

If a community group makes the decision to go ahead with the project then many more issues will need to be considered, such as planning, ecology, financing, installing and commissioning.

These will typically include:

- Securing the agreement of the landowner(s). It is best to assume from the outset that your group will not secure any long term revenue from the scheme and should look at the installation simply taking place as a significant carbon gain, however TGV will gladly offer advice to groups in these negotiations.
- Preparing and submitting a planning application to the local authority (Appendix C is an example from a community group in the Brecon Beacons)
- Preparing and submitting an application for an abstraction licence to the Environment Agency. These should be referred to early on in the process. See guide to community hydro: www.gov.uk/government/publications/good-practice-guidelines-to-the-environment-agency-hydropower-handbook
- Commissioning any specific hydrological or environmental surveys as required.
- Setting up an appropriate legal entity for the installation. If your community group is the landowner this will be relatively straightforward otherwise a commercial agreement will need to be entered into.
- Managing grant applications, loan finance and capital subscriptions to meet the cost of the project.
- Commissioning, selecting and appointing contracting engineers.
- Overseeing the installation and commissioning of the project.
- Negotiating export tariffs with electricity supply companies and administration of FiTs.
- Ongoing installation management, insurance and servicing.
- Accounting and financial reporting.

Local group engagement and constitution

Many community micro-hydro projects start off with unconstituted bodies. This is ok for the early stages. Becoming a constituted body (if it involves some form of limited liability, e.g. an Industrial and Provident Society, limited company or Community Interest Company) carries with it annual costs and obligations. Setting up an organisation with limited liability will be essential later on, but it can be best to delay setting up the formal entity until you are reasonably sure that it will be needed.
In our experience engaging the community for a micro-hydro scheme is straightforward. There is likely to be little or no local opposition to the development. Mobilising local support is valuable to secure the landowner’s consent. We would typically start with a community meeting and a presentation with images and video to introduce the technology. There are often misconceptions about the size and scale of the plant and a video of a working scheme will allay many concerns. You may also consider a site visit to a working micro-hydro scheme. Many farmers and smallholders are justly proud of their micro-hydro schemes and very willing to show visitors around. Even at the first stages it is helpful to discuss costs, income and issues such as maintenance.

One of the key issues which needs to be addressed early is the long term purpose of the legal entity. What do you want to do with the profits from the hydro scheme? Do you want to place restrictions on future members or directors? It is important to have this debate with a wide section of the community although it would be helpful to scope out the likely profit from the scheme to provide some context. Some people will imagine millions of pounds can be gained from a small micro-hydro scheme. But establishing broad consent for the aims and objectives of the organisation will guide future directors and will avoid disagreements and misunderstandings.

TGV’s first community scheme was with the Dyffryn Crawnon Green Energy, itself a Community Interest Company (CIC). TGV designed the project, achieved planning permission and assisted the setting up of the local CIC to reinvest their profits. The scheme is due to be completed in February 2015. The objectives of this community group are such that they must exclusively invest their profits into low carbon initiatives and biodiversity enhancements for the benefit of the community.

Many different constitutional mechanisms can be appropriate, but careful consideration should be given to whether all the revenue should go back into further projects or whether local people could have the option to earn income as shareholders. There is no right or wrong answer, but TGV generally opt for maximum return back into further green initiatives.

**ISSUES AND RISKS**

For any community project the opportunities and risks must be fully considered. For hydro systems one of the major risks is that an awful lot of time will be required from the very inception of the idea. Many groups may find it easier to ask an organisation, such as those in the links provided in Appendix D, to take on the project rather than taking on the risks themselves.

**Planning and EA permission risks**

It is essential to work closely with the Environment Agency and local planning authorities; this will enable a community social enterprise to streamline and speed up the processing of applications – something in the interests of all parties.
Ecological risks

The ecological risks for different turbine types are considerable (an archimedes screw is widely considered to be fish friendly whereas a turgo turbine will have an almost nil survival rate). However, well-designed schemes can mitigate almost all risks to fish populations regardless of the type of technology that is used. Of greater concern should always be the immediate ecological vitality of the site and aspects of the development should always seek to enhance any special qualities.

Technology risks

Hydroelectric power is an established technology with very little risk if done appropriately. The only major risk that will generally apply to a hydro scheme is the reliability of annual flow regimes in a world with increasingly unreliable climate conditions. You should always ensure there is enough flexibility in a project budget to absorb years with considerably less flow than anticipated.

Financing risks

Opting for non-recourse loan finance removes a great deal of the risk for community groups. Social enterprises such as TGV and H2OPE provide the services which are difficult or impossible for local groups to replicate, including non-recourse loan finance, investment capital, and a mechanism that makes it attractive for grant donors to support community initiatives. Again, contact your relevant national community energy organisation for advice on construction financing, as the support varies by country.

Management risks

A community group will need to establish a team of volunteers with experience in running complex operations, in particular finance, accounting, obtaining permissions from statutory bodies and construction management. TGV has never found it difficult to recruit this team of volunteers. They are typically drawn from the people who attend the first public meeting. Sometimes if particular skills are required (finance for example) you may need to engage with and recruit people with the required skills. Unlike many community projects, renewable energy schemes have the potential to provide income to the community for many decades to come and that promise will inspire many people to assist. Many of the social enterprise installation companies (such as TGV and H2OPE) also offer flexible packages to support community groups which can maximise the benefits to communities.

CONCLUSION

A community hydro scheme, when operational, becomes a lasting cash cow for grassroots movements. FiTs have guaranteed income for 20 years, enabling communities to plan for the long term without having to pander to the changing whims of grant providers. However, this economic incentive has come with many new layers of bureaucracy that make setting up
community hydro considerable more difficult. Our one piece of advice is to keep your head up and keep going. Once you have navigated all of the difficult waters you will be able to spend the next 20 years investing in your community’s long term sustainability.

GLOSSARY

Fit – Feed-in Tariff
TGV – The Green Valleys
CIC – Community Interest Company
JV – A Joint Venture Company
Micro Hydro

Water is a natural resource which has been used to generate power, in one form or another, for centuries. The development of centrally-generated electric power eventually reduced the requirement for small hydro sites. The Green Valleys (TGV) have developed a number of micro-hydro systems with high efficiencies that are aiding the move back towards small distributed sites. Micro-hydro is defined as the generation of electricity from a few hundred watts up to 100kW.

Hydroelectric plants work by converting the potential energy from water at height into electrical energy. This is achieved from water powering a turbine, and using the rotation movement to transfer energy through a shaft to an electric generator. The greater the volume of water stored and the higher up it is, then the more potential energy it contains. To capture this energy in a controlled form, some or all of the water in a natural waterway can be diverted from a watercourse through an intake and into a pipe which will transport the water downhill. The water can then be directed in a focussed jet under pressure onto a turbine wheel. The turbine and controller units convert this energy into electricity that can be exported to the national grid.

System Specifications

Most hydro systems developed by TGV involve the use of a turgo turbine. The turgo runner is a small stainless steel disc with cups which can extract the potential energy of small quantities of water very efficiently. The runner is attached to an induction generator and controller unit which will ensure that the current produced is compatible with exportation to the national grid. All of these works are housed within a turbine house and the water is then fed back into the watercourse from which it was abstracted. TGV have an established track record in developing all appropriate grid export licences and negotiating the sale of the electricity to power companies. The new government Feed-in Tariffs (FiT) also provide subsidised revenue for all electricity produced by a hydro system. Presently the payment rate for electricity from hydro is set at 21.12p per kWh for systems under 15kW and 19.72p per kWh for systems over 15kW. This price is index linked and guaranteed for 20 years providing owners of a hydro system with significant income. However, every April the rates
paid will fall by degression but also rise with RPI. This degression doesn't change the rate you get paid for commissioned schemes which will see their payments go up by RPI every year. But it does decrease the initial payment rate for new schemes that are registered with Ofgem. Detailed advice on FiT and registration can be found on the Ofgem website. It is possible to pre-register for FiT in advance of a scheduled FiT degression. You will need planning permission, an abstraction licence and to have pre-paid the grid connection cost in order to pre-register.

### Permissions and Licences

Hydro schemes require a number of licences and permissions before the installation can take place. A hydro scheme will almost always require planning permission from your local planning authority and abstraction licences from the Environment Agency (Natural Resources Wales within Wales). The better prepared your submission documents are the higher the likelihood of a swift and positive decision. In order for your permission processes to be as straightforward as possible you should prepare thoroughly your application documents. We recommend a detailed construction methodology statement, biodiversity assessments, comprehensive planning and access statements and a detailed architectural plan of the scheme. TGV have an established track record in obtaining all relevant licences and permissions.

### Maintenance

Once installed, the scheme will require a small regular amount of inspection and maintenance. This inspection and maintenance forms part of the responsibility for the safe and correct operation of the system. Western Power will not sanction a connection to its system unless it is wholly satisfied with the competence and experience of the energy production system operation. Lifetime of system components will vary with the generator needing to be replaced in around ten years but most other major components can be expected to last around thirty years or longer. The costs of maintaining a micro-hydro system are normally low. TGV offer comprehensive maintenance and insurance packages backed up by our team of experienced engineers.
Appendix B: A Basic Guide To Assessing Potential Hydro Sites

This very brief guide will enable a community group to make a basic analysis of whether a site is viable, what type of system they should look to develop and a generic assumption of how much revenue it is likely to produce.

IS IT A VIABLE SITE FOR DEVELOPMENT?

Many sites will not be suitable for installing a hydro scheme for practical reasons. These could include the site regularly getting flooded, the system is nowhere near the national grid, the site has significant archeological concerns, it is an important habitat for protected species or it is not achievable to get machinery and equipment on to the site etc. Whilst each of these issues does not necessarily rule out the possibility of a hydro it is important to understand these issues bring forth further complications in developing a hydro scheme. These issues are included in the quick checklist at the end of this document.

WHAT IS THE FLOW RATE OF THE WATERCOURSE?

The quantity of water and its variation in flow throughout the year are critical factors in determining the viability of a site. So you will need to estimate both the flow of the watercourse and also the variation of this flow throughout any given calendar year.

More often than not someone that lives nearby will be an invaluable first source of information when it comes to site flow analysis. If they suggest that it always run dry in the summer you can start to make basic assumptions regarding its month-by-month viability. If you opt for onsite flow measurements then you should do so regularly over a long period of time and ensure that you include days that have followed different rainfall levels.

BASIC ASSESSMENT OF FLOW

The cheapest and easiest method to calculate flow of a watercourse is through the bucket method or the float method. The bucket method is only really suitable for streams and will generally be for high head systems, whilst the float method is better for rivers and low head systems. The techniques are well described here: http://www.appropedia.org/How_to_measure_stream_flow_rate

More accurate techniques to assess flow and annual flow regime are available from commercial services such as Wallingford Hydrosolutions (http://www.hydrosolutions.co.uk/). Wallingford Hydrosolutions also sell a computer package that enables you to calculate the predicated flow regime of any watercourse in the UK which is available from their website, but this is quite expensive, is only available on an annual licence and should only be considered if you are going to be assessing a great deal of sites. Analysing the data from your local Environment Agency flow monitoring stations (http://www.environment-agency.gov.uk/homeandleisure/floods/riverlevels/default.aspx) is another useful tool, but will rarely give you accurate data for your exact location. Many of the low head sites in England and Wales have also been assessed and are available here: www.gov.uk/government/uploads/system/uploads/at0tachment_data/file/47950/753-england-wales-hydropower-resource-assess.pdf.
CALCULATING THE HEAD AT A SITE

You will also need to ascertain the height in which the water falls. You will need to calculate both the height of your lowest point (turbine location) and your highest point on the watercourse (intake). In high head systems this will involve using either a GPS unit (ideally with altimeter), site level, altimeter or OS Maps to ascertain the amount of head that the water has over the site. For low head sites you can use simple techniques such as tape measures or with more precision use a site level (sometimes referred to as a dumpy level http://en.wikipedia.org/wiki/Dumpy_level). The generic threshold between low head and high head sites is 9m of head.

CALCULATING THE POTENTIAL POWER

At this stage you will have all of the information you need to estimate the potential power of any given site. The only other value you will need to use is the value of gravity, which for any calculation will always be a constant. Use 9.81 as the value for gravity and then try this equation:

\[
\text{Potential Power} = \text{Flow} \times \text{Head} \times \text{Gravity}
\]

NOTE: you can use litres per second (ls\(^{-1}\)) in your calculations but the potential power will be in watts. Conversely if you use cubic meters per second (m\(^3\)s\(^{-1}\)) your potential power will be in kilowatts.

CALCULATING THE ACTUAL POWER OUTPUT (i.e. what you can sell to the grid)

Once you have ascertained that your hydro site can produce a usable amount of power (all is useful but if it can only produce a couple of hundred watts it will not produce any significant revenue for a community group – so keep looking for a better site) you will need to begin to understand the limitations on how much power you can realistically generate. Specialist hydroelectric firms (contact the Energy Savings Trust for more info) are available to do much of this work for community groups, but it is worthwhile to do some research yourself.

HOW MUCH OF THE FLOW CAN BE USED?

At a site where water is diverted away from the natural watercourse to be fed through a hydropower system, a minimum reserve flow must be left in the watercourse and is usually set by the Environment Agency to ensure that the plant and animal life in the depleted watercourse can be maintained.

This is known as a “Q” value. The “Q” value sets the level at which water may be taken from the watercourse. Typically the “Q” value is set at between 90% and 95%. For an example of 95%, this means that the hydro system can take water from the watercourse when the flow is above the flow of water that is running in the watercourse for 95% of the time. This is referred to as Q95.
The Environment Agency then set a % of the flow above the Q95 level that can be collected. This is typically 75%. When the water level falls below this level the water will stop being diverted into the hydro system. However, this 75% level is a simplification and many ecological factors will need to be considered to ascertain your sites specific abstraction regime.

Having determined the potential power of your watercourse as well as the amount of water available you can start to calculate how much electricity your system can potentially produce. This calculation will need to take into account a number of key variables such as the loss of energy throughout the system from water friction in the pipes, the turbine efficiency and the voltage drop in export cables, amongst other things. To avoid setting the expectations of the power and revenue potential of the system at too high a level you should assume only a 65% efficiency level. This can always be improved through the design process but it is always best to be cautious.

You may well now be thinking that all of these efficiencies and flow variations are starting to sound rather complex, so we shall now revisit the power output calculation in a simple way.

**RESIMPLIFYING YOUR CALCULATIONS**

Rather than estimating power output calculations incorporating individual element efficiencies, down time for maintenance and a plethora of other factors, it is possible to gain a ball park figure assuming that you will only be able to convert about 50% of the potential power of a watercourse into electrical power at any given time, essentially dividing your potential power by 2.

\[
\text{Peak Output power} = \text{Potential power} \times 0.5
\]

Below are the worked examples from two sites, one being high head the other low head.

**WORKED EXAMPLES**

<table>
<thead>
<tr>
<th>Head</th>
<th>Flow</th>
<th>Gravity</th>
<th>Potential Power (kW)</th>
<th>Losses</th>
<th>Output kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Head</td>
<td>1m 3 m³s⁻¹</td>
<td>9.81</td>
<td>29.43</td>
<td>50%</td>
<td>14.715</td>
</tr>
<tr>
<td>High Head</td>
<td>100m 0.03 m³s⁻¹</td>
<td>9.81</td>
<td>29.43</td>
<td>50%</td>
<td>14.715</td>
</tr>
</tbody>
</table>

The net result is that the two very different sites produce the same amount of power!

But each different site brings forth different ecological, construction, licensing and design parameters that will need to be factored in. Once you have ascertained that a site is suitable it is highly recommended that you contact a hydroelectric professional for two main reasons:

1) The nature of the work here on in will require specialist knowledge
2) If you want your system to qualify for Feed-in Tariffs you will need to use an MCS accredited installer (despite the fact that over 50% of hydro installations developed over recent years have been done by enthusiasts).
**OTHER SITE ISSUES TO CONSIDER**

Many a project has been stopped in its tracks by issues that could have been foreseen earlier. The list below is by no means exhaustive but will give you an idea of other issues that you need to consider when making your basic assumptions for a site:

**ACCESS:** Is it achievable to get all required materials to the site including both intake and turbine locations. For example if you have a low head site and need a 3m wide and 8m long Archimedes screw that weighs 10 tonnes, are the access roads or bridges suitable? Similarly is your intake site for a high head system located down a steep gully 1m above a precarious waterfall? Access issues need to be considered carefully otherwise budgets can become hugely inflated.

**SITE RESTRICTIONS:** Is your site part of a historic monument or are there important archeological sites across the route at which you intend to dig your pipeline or export cables? Dialogue with key stakeholders such as your local archeological trusts is imperative.

**PLANNING:** Discuss your proposals as early as possible with your local planning authority. In most cases the officers will not have dealt with a hydro application before and many systems have faced a 5 year battle to secure planning permission. Discuss options with them early and try to work in partnership. If there proposals seem unreasonable discuss these with them honestly.

**GRID CONNECTION:** You may well have found a site capable of producing 200kW of power but if there is only a single phase power line nearby you will be facing some seriously expensive grid infrastructure upgrade prices. Contact your local Distribution Network Operator as early as possible.

**ECOLOGICAL:** This should be at the top of your list for careful consideration. Contact the Environment Agency as early as possible and ask for all members of the permissions team (flood risk, fisheries, lower plants, permitting) to visit your site at the same time. Many of the issues they flag up can then be discussed candidly with you and their colleagues on site. They may well ask for ecological surveys of the watercourse, but always insist that the surveys they do are consummate with the scale of the proposals. Small schemes in the past have been required to spend over £28,000 on surveys alone. An upfront and honest dialogue from the start will reduce the risk of unnecessary surveying (but accept that as the regulators they are the experts).

**LAND OWNERSHIP:** Who owns the land? Are they amenable to the proposal for a community turbine? What do they want from it? Are their multiple landowners for the system including the grid connection? As per everything on this list you will need to discuss options with all interested parties as soon as possible and ensure that regular dialogue is maintained throughout the whole process.
### BASIC SITE ASSESSMENT CHECKLIST

<table>
<thead>
<tr>
<th>On site questions</th>
<th>Further action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Head</strong></td>
<td></td>
</tr>
<tr>
<td>Estimate the head of the site.</td>
<td>Confirm with site level, theodolite, GPS or altimeter.</td>
</tr>
<tr>
<td><strong>Flow</strong></td>
<td></td>
</tr>
<tr>
<td>Estimate the Flow.</td>
<td>Bucket or float technique initially over a period of time. Use either Environment Agency gauging station data or ungauged flow tools (e.g. Low Flows) to provide greater accuracy and expected annual flow variation.</td>
</tr>
<tr>
<td><strong>Grid connection</strong></td>
<td></td>
</tr>
<tr>
<td>Where is the nearest grid connection? Is it single phase or triple phase?</td>
<td>All power line poles have a plate with a reference number. Copy this down. Approach your local grid operator to find out how much power could be exported through this wire and what the likely transformer upgrade costs would be.</td>
</tr>
<tr>
<td><strong>Ecology</strong></td>
<td></td>
</tr>
<tr>
<td>Find a local ecologist to visit the site and give their opinions.</td>
<td>Work with your local planning authority and the Environment Agency staff to ascertain the sensitivity of the site. Other statutory bodies (such as Countryside Council for Wales) will also be of significant use.</td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td></td>
</tr>
<tr>
<td>Is the site accessible for construction? What are the working limitations of the site?</td>
<td>Find out from a hydro engineer or a civil engineer the access implications of any proposal. Contact your local highways department if you believe you may impact the local roads during the construction and afterwards.</td>
</tr>
<tr>
<td><strong>Land ownership</strong></td>
<td></td>
</tr>
<tr>
<td>Who owns the land? Would they be willing to work with a community group? Are their multiple landowners?</td>
<td>Open and honest dialogue with all landowners is essential.</td>
</tr>
<tr>
<td><strong>Archeology</strong></td>
<td></td>
</tr>
<tr>
<td>Is this a site of archeological significance?</td>
<td>Contact your local archeological trust or equivalent.</td>
</tr>
<tr>
<td><strong>Enhancements</strong></td>
<td></td>
</tr>
<tr>
<td>How can you improve the site?</td>
<td>This will form part of your broader enhancement of the scheme and can include soundproofing, replanting of trees, partnership with local wildlife or fisheries groups or the provision of bat boxes etc. This list is extremely site specific.</td>
</tr>
<tr>
<td><strong>Other hydros</strong></td>
<td></td>
</tr>
<tr>
<td>Where is the nearest hydro to this site? What was their experience?</td>
<td>Anyone who has gone through the process of installing their own hydro will have a wealth of knowledge of the dos and don'ts. Speak with them early and absorb all of the information they possess!</td>
</tr>
</tbody>
</table>
Appendix C: Example Community Hydro Planning Statement

Contents

Executive Summary

1. National Policy Context
   1.2 Tan 8: Renewable Energy (2005)
      1.2.1 Hydro-Power
   1.3 Tan 12: Design (2009)
   1.4 Micro Generation Action Plan (Mar 2007)
      1.4.1 Locations off gas-grid

2. Local Policy Context
   2.1 Policy G3: Development in the National Park
   2.2 Policy G4: Development Affecting Trees
   2.3 Policy G6: Design
   2.4 Policy S9: Hydro-electricity
   2.5 Policy Q21: Rights of Way and Long Distance Routes
   2.6 Sustainable Design Guide, Design Statement and Access Statement
      2.6.1 Energy Statement
      2.6.2 Siting and building orientation
      2.6.3 Renewables
      2.6.4 Recycling Facilities
      2.6.5 Materials and Waste Statement
      2.6.6 Efficient reuse of water
      2.6.7 SUDs
      2.6.8 Landscape character
      2.6.9 Protect and Enhance
      2.6.10 Provide a safe route to public transport
      2.6.11 Flexibility for the Future
      2.6.12 Access Statement
Executive Summary

This 15kW micro hydro electric scheme is a community project in the X Valley. It has been developed by local residents and The Green Valleys Community Interest Company. The development itself will generate 82% of the entire communities’ electricity requirements throughout the year and reduce the community’s carbon footprint by an estimated 20%. The installation will provide capital for the community to spend on project management and further local low carbon initiatives. A percentage of the revenue will also go to The Green Valleys Community Interest Company to assist other communities in setting up similar schemes.

The system is to be located on one of the steep slopes of the valley. Access is currently limited to able bodied users mainly because the site is accessed via a traditional style installed by the National Park Authority. However, the turbine house could be viewed by people of all abilities if the style (about 15 metres from the site) were to be replaced with an accessible option which we would very much favour.

Design of the scheme has been determined by its function which is to generate electricity from a non-polluting source. The turbine house is located in such a position as to maximize the energy output of the scheme, increasing its value in terms of energy output against the embodied energy input involved in installation. The aspiration of this project is to prove that zero carbon development can be exceeded rather than aspired to. Indeed this development exceeds the zero carbon aspiration for developments nearly 1,500 times over. Permission has been granted by Western Power Distribution to export up to 16kW.

The turbine building is to be buried in the ground, making use of the topography and creating minimal visual intrusion in the landscape. Local materials have been chosen sensitively to further reduce visual impact. The penstock for the scheme is to be buried and will be unnoticeable within a matter of months. The intake has been designed to resemble a small fall in the stream.

From the very outset potential impacts on biodiversity have been considered and detailed recommendations of all ecological considerations can be found in Appendix 1. The National Parks Biodiversity Officer has provided us with a wealth of knowledge in terms of mitigating the effects of this proposed development and we are looking to continually learn and develop better ways of installing hydro electric systems and minimize their impact on the environment and landscape. We have also taken the initiative and commissioned a full white-clawed crayfish survey for the site. We have also consulted with the Biodiversity Information Service for Powys and have contacted the Countryside Council for Wales. All relevant licences required from the Environment Agency have also been applied for.

1. National Policy Context


“The provision of electricity from renewable sources is an important component of the UK energy policy, which has an established target of producing 10% of electricity production from renewable energy sources by 2010.”
There are 23 homes situated in the community. The proposed hydro system will produce an estimated 65,000 kWh per annum (source: project feasibility study). Average electrical consumption per household in the community is 3,300 kWh per annum (source: DTI). The proposed hydro installation will therefore provide renewable electricity for 19.7 homes per annum, or, **82% of the communities' electrical requirements**. This is well above the present recommendations for the UK and is in line with the UK commitments for 2050.

**1.2 Tan 8: Renewable Energy (2005)**

**1.2.1 Hydro-Power**

“Most new hydro-power structures involve “run-of-river” schemes are by far the most likely for developments in Wales. These are relatively small, with some flexibility in siting along a length of river or stream, although as with any power generation scheme, there should be cost-effective access to the electricity network”.

The scheme is very much of the type and scale envisioned by Tan 8 insofar as it being a run-of-stream system. The system has gained permission from Western Power Distribution to export electricity to the National Grid. The cost of the necessary transformer upgrade and ancillary works is quoted at £7,500 and is both reasonable and cost effective in relation to the proposed development.

“Though generally supported, there could be occasions where some hydro schemes are unacceptable because of potential ecological damage. All of the parties involved should work constructively to find acceptable solutions. Adequate technical advice on the relevant issues should be sought when a proposal is being considered. A water abstraction licence is also required to operate a hydro scheme and close liaison with the Environment Agency, as the licensing authority, is strongly advised”.

The detailed ecological assessments undertaken for this scheme by the National Park Biodiversity Officer and a registered crayfish surveyor have stated that there is low ecological impact from this development (see Appendices 1 & 2). A number of design and installation recommendations have been highlighted in these assessments will be adopted in the construction and operational phases of the proposed development. A water abstraction licence and impoundment licence have been applied for from the Environment Agency.

**1.3 Tan 12: Design (2009)**

**Design is defined in Planning Policy Wales as:** “the relationship between all elements of the natural and built environment. To create sustainable development, design must go beyond aesthetics and include the social, environmental and economic aspects of the development, including its construction, operation and management, and its relationship to its surroundings.”

The proposed development is sustainable development in its purest context. Where possible local materials have been used, it generates over 1,500 times over the UK’s aspirations for the efficiency of built developments, it incorporates the creation of local wild flower habitats,
has sustainable drainage designs and from a social and economic perspective it is owned by the community and provides both revenue and a sense of community cohesion through its very function.

“To effectively mitigate the causes of climate change in the design of a development a clear approach to reducing carbon and other greenhouse gas emissions associated with the development should be taken…. including opportunities to move towards zero carbon”

The proposed development will:

- show that zero carbon energy technologies can be made feasible
- use green roofs to insulate against heat gains, reduce surface water runoff and facilitate biodiversity
- use recycled materials in its construction
- use sustainable construction processes which avoid or reduce waste and other environmental, health, or social effects during construction

“Movement and ease of access for all to and from development should be appraised at the strategic and local level, with a view to supporting a shift from car use to walking, cycling and public transport and recognising the need for better connectivity within areas and with the surrounding areas. Consideration should be given to the volume and relative ease of pedestrian movements, including people with mobility or sensory impairments. Similar consideration of volume and ease of movement should be given to cycle, public transport and car movements, while areas of conflict, congestion and connections should be identified throughout the area surrounding the site”. (p.14)

The proposed development will:

- not have vehicular access and will encourage local residents to walk or cycle to its location
- have no detrimental impact on the present ease of pedestrian movements, including people with mobility and sensory impairments.

1.4 Micro Generation Action Plan (Mar 2007)

1.4.1 Locations off gas-grid

“One third of Wales' population of 2.9 million live in the predominantly rural areas of central and west wales (sic). Many of these rural areas have no access to mains gas and may also be more susceptible to electricity power cuts in adverse weather…. As with other initiatives, a community focus may be the appropriate way forward in some situations.”

The proposed development is an exemplar type of activity envisioned for rural communities in the Micro Generation Action Plan.
## 2. Local Policy Context

### 2.1 Policy G3: Development in the National Park

All proposals for development or change of use of land or buildings in the National Park must comply with the following criteria, where they are relevant to the proposal:

<table>
<thead>
<tr>
<th>G3 Policy</th>
<th>Response in respect to proposed development</th>
</tr>
</thead>
<tbody>
<tr>
<td>the proposed development does not have an unacceptable impact on, nor detract from or prevent the enjoyment of, the special qualities, natural beauty, wildlife and cultural heritage of the National Park;</td>
<td>We believe that the proposed development is of a small enough scale to not have an unacceptable impact in reference to the adjacent statements. Great effort has been made to minimize any form of impact throughout the development and design process (refer to design statements, architectural plans and biodiversity assessment).</td>
</tr>
<tr>
<td>the proposed development lies within the “white areas” of settlements as shown on the Proposals Map, with the exception of those developments covered by policies which enable development in the countryside;</td>
<td>The proposed development does not occur within the “white areas” but is a minor engineering works.</td>
</tr>
<tr>
<td>the scale, form, design, layout, density, intensity of use and use of materials will be appropriate to the surroundings and will maintain or enhance the quality and character of the Park’s landscape and built environment;</td>
<td>All elements have been designed to maintain and enhance the Park’s character, landscape and built environment. (Please refer to design statement, architectural plans, and sustainable design guide briefings).</td>
</tr>
<tr>
<td>the proposed development is integrated into the landscape to the satisfaction of the NPA through planting and appropriate management of native species or through the construction of appropriate boundary features. Where landscaping schemes are required, they must involve a design in keeping with the site, using native plant species of local provenance suitable for the National Park as listed in Appendix 3;</td>
<td>The proposed development is predominantly built into an existing earth bank. The roof of the building is cover with grass and will be seeded with a wild flower mix supplied by the BBNPA ecology team in accordance with the recommendations of our biodiversity assessment (see Appendix 1)</td>
</tr>
<tr>
<td>the proposed development does not have an unacceptable impact on the amenity of the area, adjacent properties or the general public;</td>
<td>The proposed development is of a small scale and is made from local stone in keeping with the local area. The turbine itself will generate a small amount of noise, but this will only be heard within the building itself and will have</td>
</tr>
<tr>
<td><strong>the proposed development does not have an unacceptable impact on the economic, social, cultural and linguistic vitality and identity of any community, either in its own right or through cumulative impact (See Policy ES33);</strong></td>
<td><strong>no impact on adjacent properties.</strong></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>The proposed development will provide revenue for the local community to spend on assisting the economic, environmental, social and cultural development of the local community.</td>
<td></td>
</tr>
<tr>
<td><strong>The proposed development is compatible with the National Park road hierarchy in that it is within the capacity of existing approach roads, and does not have an unacceptable impact on traffic circulation or highway safety;</strong></td>
<td><strong>The proposed development will have no impact on the road hierarchy other than on the few occasions in which materials will be delivered during the construction phase.</strong></td>
</tr>
<tr>
<td>The proposed development will have minimal impact on existing users or the environment.</td>
<td></td>
</tr>
<tr>
<td><strong>adequate services exist, are reasonably accessible or can be provided without unacceptable detriment to existing users or the environment;</strong></td>
<td><strong>The proposed development will have minimal impact on surface waters or groundwater resources in either quality or quantity;</strong></td>
</tr>
<tr>
<td>The proposed development will have almost no impact on surface waters as all works are either within the stream bed or covered in a living roof. Groundwater will be affected minimally along the route of the system, but this will be negligible. This will form part of the assessment done by the Environment Agency as part of our licensing applications.</td>
<td></td>
</tr>
<tr>
<td>The proposed development will have no impact on the economic, social, cultural and linguistic vitality and identity of any community, either in its own right or through cumulative impact (See Policy ES33);</td>
<td><strong>adequate means of access and parking space can be provided to cater for the traffic generated by the proposal;</strong></td>
</tr>
<tr>
<td>No traffic will be generated by the proposed development. All maintenance and upkeep of the development will be done by local residents who could most likely walk to the site.</td>
<td></td>
</tr>
<tr>
<td>No lighting is proposed as part of the development</td>
<td></td>
</tr>
<tr>
<td><strong>where lighting is proposed as part of the development, the proposal must ensure that the design and operation of lighting systems has minimal impact in terms of light pollution;</strong></td>
<td><strong>adequate consideration is given to the needs of those with limited mobility such as wheelchair users, elderly people, and people with young children in the design and layout of the development;</strong></td>
</tr>
<tr>
<td>The one limiting factor for access to the proposed development is that the only access is via a style placed by the BBNPA. If an accessible gate were to be placed on the entrance to the public right of way the proposed development would be accessible to all.</td>
<td></td>
</tr>
<tr>
<td><strong>development schemes include facilities for waste recycling and composting appropriate to their scale and type.</strong></td>
<td><strong>No waste, recycling or composting will be generated at the proposed development.</strong></td>
</tr>
<tr>
<td>No waste, recycling or composting will be generated at the proposed development.</td>
<td></td>
</tr>
</tbody>
</table>
2.2 Policy G4: Development Affecting Trees

Where planning applications are submitted on sites containing trees which are considered valuable to the amenity of the area the NPA will seek to ensure that:

<table>
<thead>
<tr>
<th>G4 Policy</th>
<th>Response in respect to proposed development</th>
</tr>
</thead>
<tbody>
<tr>
<td>the trees and their root systems will be retained and adequately protected prior to, during and after, development takes place; and</td>
<td>A full response to the impact on trees is detailed in our biodiversity assessment (see Appendix 1). Key recommendations state that all works to commence after 30th Sept.</td>
</tr>
<tr>
<td>where it is agreed that trees are to be removed, replacements will be required, where appropriate. A scheme for replacement shall be agreed with the NPA prior to the commencement of development.</td>
<td>All of the development has been purposefully designed to avoid the felling of trees. A number of trees will be coppiced as part of the construction process. Full details are available in our biodiversity assessment (see Appendix 1).</td>
</tr>
</tbody>
</table>

2.3 Policy G6: Design

Applications for development will be expected to meet the WAG’s key design objectives and respond to the local context. Proposals will be required to demonstrate where appropriate how they:

<table>
<thead>
<tr>
<th>G6 Policy</th>
<th>Response in respect to proposed development</th>
</tr>
</thead>
<tbody>
<tr>
<td>achieve sustainable design solutions representing best value by making prudent use of natural resources, incorporate sustainable energy use and waste control measures and provide the means for effective long-term maintenance, efficient operation and management;</td>
<td>The proposed development’s key feature is that it utilizes natural resources, i.e. water, in its primary function. Locally sourced stone (unearthed from laying the pipeline) will be used to build the turbine house. A detailed project management plan for the long term running of the project has been developed by the community and The Green Valleys CIC.</td>
</tr>
<tr>
<td>sustain or enhance character in townscape and landscape by responding to and reinforcing, where appropriate, locally distinctive patterns and form of development, landscape, culture and biodiversity;</td>
<td>All stones used in the building of the turbine house are in keeping with the traditional built environment of the valley and local wildflowers will be seeded on the roof.</td>
</tr>
<tr>
<td>promote innovative design in buildings, infrastructure, urban and rural landscape and public art;</td>
<td>As Wales’ first small scale community owned run-of-stream hydro installation we are indeed promoting innovation.</td>
</tr>
<tr>
<td>promote a successful relationship between public and private space by delineating clear boundaries, acknowledging established building lines in new development and enclosing space;</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>promote high quality in the public realm by ensuring attractive, safe public spaces and routes which are fit for purpose and</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>
meet the needs of all members of society;

ensure ease of access for all by adopting inclusive design principles including safe and clear connections, integrating development with existing footpaths, cycle ways and public and private transport infrastructure and by ensuring adequate provision for people with disabilities and others;

The only issue in terms of access is that the existing footpath (public right of way) can only be accessed via a style placed by the BBNPA. We would very much encourage the installation of accessible access to the site for the educational benefit that the proposed development provides.

promote "legible" development that includes easily recognizable and understood features and landmarks;

Not applicable.

design for change by promoting adaptable development that can respond to social, technological, economic and environmental conditions over time; and

In most regards this is not applicable, but in terms of climatic change, in particular the reduction of rainfall, the system is designed as such to be able to run on lower quantities of water and is therefore future proofed for the predicted impacts of climate change. In terms of extreme drought, and in accordance with Environment Agency stipulations, the plant will cease operating until sufficient water levels have been achieved within the Nant-y-Wenynen stream.

promote quality, choice and variety by lifting the standard of development, by promoting mixed use and densities of development that assist viability and respond to local needs.

Not applicable.

2.4 Policy S9: Hydro-electricity

Proposals for the generation of hydro-electricity will be permitted where, either through construction or operation, they would not:

<table>
<thead>
<tr>
<th>Policy S9</th>
<th>Response in respect to proposed development</th>
</tr>
</thead>
<tbody>
<tr>
<td>adversely affect the water quality or the amenity or wildlife value of the watercourse either at the site or downstream;</td>
<td>According to our biodiversity assessment it is envisioned that there will be minimal impact on water quality above or downstream. During the construction period when we are working directly in the watercourse it is our intension to place sheep fleece in the stream for short periods to catch all dislodged sediment so as to mitigate any impact the works may have.</td>
</tr>
<tr>
<td>result in the loss of water flow or an increased risk of flooding upstream or downstream; and/or</td>
<td>There will be no loss of water flow upstream or downstream of the development – only in the intermediate operations of the site which will be adhered to strictly from the agreements laid down by the Environment Agency.</td>
</tr>
</tbody>
</table>
result in an unacceptable impact on the landscape.

<table>
<thead>
<tr>
<th>Agency through our proposed abstraction licence.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The design of the turbine house will have minimal impact on the landscape. The removal of the top layer of turf before laying the pipeline and replacing it once laid will ensure that visual impact will be only for a very short time. The intake site is very small and will incorporate local stream bed stones as part of its construction and will look very much like a small fall in the watercourse.</td>
</tr>
</tbody>
</table>

## 2.5 Policy Q21: Rights of Way and Long Distance Routes

Development that would prevent or adversely affect the use of a public right of way or route with potential to form a long-distance walking, riding or cycling path will only be permitted where an equivalent alternative route can be provided.

The turbine house and a small portion of the Penstock are close to a Public Right of Way. We will place signs at either end of the operations warning members of the public that there may be small obstacles in the way (such as the trench). All reasonable attempts will be made to put tape up around hazards to mitigate the risk of injury and there will be enough space on the existing Public Right of Way for safe passage. We have spoken to National Park Rights of Way Officers who have stated that our mitigation methods would be their preferred course of action and that because the turbine house is further than 1.5 m from the public right of way they do not foresee it causing any issues in the longer term.

## 2.6 Sustainable Design Guide, Design Statement and Access Statement

The Design and Access of the proposal complies with all National and Local Planning policies and the following statements, linked closely to the recommendations of the Brecon Beacons Sustainable Design Guide illustrate the extent to which best practice has been aspired to. The table below is a graphic representation of all the considerations laid out in the Brecon Beacons Sustainable Design Guide. The following statements describe in full the extent to which the proposed development has attempted to meet, and exceed, the guidance from a design perspective.
2.6.1 Energy Statement

The building requires only a small amount of energy in its usage which is supplied by an underground cable from a nearby electricity transmission pole. All internal meters and transformers are designed to use the minimum amount of electricity. No heating is required in the development. When the system is operating the development will export up to 16kW of electricity to the National Grid. This is the equivalent of about 5,000 times its energy use requirements. By its very essence this proposed development is about as energy efficient as a development can be and is an exemplar development. As a result we have taken the step of not including a SAP report.

2.6.2 Siting and building orientation

The turbine house is designed to have no windows, mainly as a security precaution. As a result there will be no solar gain achieved, but as the building will not be habited this is an irrelevancy. To operate effectively the building needs to be kept cool regardless, and the lack of solar gain actually improves the building’s efficiency as no heating or cooling elements are required. The siting of the structure is built into an existing mound and as a result its ambient temperature will remain constant.

2.6.3 Renewables

The Sustainable Design Guide states that all new developments should aim for 20% of its energy requirements to come from renewable sources. The electrical requirements of the building are about 100w, which over the course of the year equates to 876kWh. Because the system will run at approximately 95% of the time this means that only 43.8kWh of electricity will need to be drawn from the grid (i.e. non renewable). The system will generate on average per annum 65,000kWh of renewable electricity, which equates to 1,484 times its use of non renewable electricity. In summary, the Welsh Assembly Government aspires to zero carbon developments, and this development produces nearly 1500 times over the proposal of a 100% zero carbon development.
2.6.4 Recycling Facilities

There are no recycling elements incorporated in the design as the proposed development is a zero waste site.

2.6.5 Materials and Waste Statement

The proposed development has three key components; the intake; the penstock; and the turbine house. A minerals and waste statement will describe each in isolation.

The Intake: A total volume of 1.5 cubic metres of concrete and a 3mm thick perforated steel sheet (circa 1.5 m x 60 cm) are required for the construction and cannot be sourced locally. As part of our biodiversity assessment we have been recommended to remove moss covered boulders carefully from the stream by hand and placed upstream within the channel. Once the dam is completed boulders will be replaced within the stream, taking care to ensure moss covered sides remain uppermost. The stone faced wing side walls will offer a suitable location for growth of new moss. It is anticipated that the intake structure will last for at least 50 years, although the steel sheet may need replacing every ten years or so. All waste associated with the building of the intake will be removed from the site upon completion and disposed of through the relevant routes. The embodied carbon associated with the use of these unsustainable materials will be displaced within a matter of months through the generation of green electricity.

The Penstock: Because of the high head a very robust pipe is required for this system. The penstock will consist of two types of pipe. The first section will be 300 metres in length, 160mm in diameter and made from SDR17 HDPE (high-density polyethylene) which can withstand up to 10 bar of pressure, whilst the second section will be the same length and diameter but made from SDR11 HDPE due to the higher bar rating required further down the penstock (up to 16 bar). It is expected that the penstock will last for at least 100 years. The pipes will arrive in 50m coils and will be connected through electrically welded joints. It is not possible to utilize local materials in this section of the proposed development. All waste associated with the building of the penstock will be removed from the site upon completion and disposed of through the relevant routes. The embodied carbon associated with the use of these unsustainable materials will be displaced within a matter of months through the generation of green electricity.

The Turbine House: The turbine house will be dug into the existing raised bank and will be partly buried. The walls will be constructed from the dug stones unearthed in the burying of the penstock. The use of these local stones, which have traditionally contributed to local distinctiveness and sense of place, will assist the landscape quality and visual impact of the proposed development. The use of local materials is, therefore, encouraged, whenever possible. The roof and floor of the turbine house will be made out of sheet concrete – this is the most cost effective solution for this development as we are reliant on grants for the installation. The choice of concrete for the roof was also important as it will be supporting a minimum of 200mm of soil. It is anticipated that the turbine house will last for at least 25 years. The stones and earth dug up during construction will be landscaped into the existing bank to form a continuous turfed bank and to reduce visual impact to the extent to which the
building virtually disappears into the landscape. We will then reseed any bare ground and turf roof with locally sourced wildflower seed mix provided by BBNPA. All waste associated with the building of the penstock will be removed from the site upon completion and disposed of through the relevant routes. The embodied carbon associated with the use of these unsustainable materials will be displaced within a matter of months through the generation of green electricity.

**2.6.6 Efficient reuse of water**

Water is a resource, not only for drinking and irrigation, but sometimes for producing energy. Generating energy through utilising water has a long history, as moving water’s energy can be employed for various tasks. Small scale hydro power has been recognised as being extremely efficient and has a low environmental impact.

**2.6.7 SUDs**

The only element of the proposed development that can be classified under the aspect of sustainable urban drainage is the roof of the turbine house. This is to be grass and wild flower covered and therefore an example of best practice SUD techniques.

**2.6.8 Landscape character**

The development contributes to the landscape character through the utilization of traditional local stone in the turbine house, and all effort has been put into minimizing any impact on the landscape through sensitively building the turbine house into the ground and covering with a green roof. It is anticipated that the proposed development will become almost unnoticeable.

**2.6.9 Protect and Enhance**

Please refer to Appendix 1 and 2 for a full biodiversity assessment of the proposed development. The Countryside Council for Wales has been approached, and we are told that officers have visited the site. A Biodiversity Information Service for Powys request for recorded species was returned on May 14th. No Tree Preservation Orders are present on the site. This information has formed part of the full biodiversity assessment (Appendix 1).

**2.6.10 Provide a safe route to public transport**

Not applicable.

**2.6.11 Flexibility for the Future**

Not applicable – it will remain a hydro electric generator.

**2.6.12 Access Statement**

Access to the site will be limited. The only access presently to the site available to the public is over a BBNPA style situated approximately 15m from the turbine house. Ideally this would
be replaced with an easy access substitute but the group does not have the finances to do this at present. If the style could be replaced access to the site would be greatly improved. Access into the turbine house is also limited as you have to go down two steps to enter. However, it is designed for functionality as means of generating electricity. Access to the intake site will remain difficult as it is at the top of a very steep climb through farmers’ fields and woodland and is not on any form of public right of way.
Appendix D: Useful Links

Community Groups and Social Enterprises

The Green Valleys - A social enterprise based in Wales that finances and installs community hydros: [www.thegreenvalleys.org](http://www.thegreenvalleys.org)

Talybont on Usk Energy - Owners of Wales' first community owned hydro and the ‘B-Bug’ – The Rain Powered Car: [talybontenergy.co.uk](http://talybontenergy.co.uk)

Llangattock Green Valleys – Winners of the Wales British Gas Green Streets, and presently developing six community hydros: [www.llangattockgreenvalleys.org](http://www.llangattockgreenvalleys.org)

Felin Talgarth Mill - Community group in Wales developing a community resource centre, flour mill and hydro: [talgarthmill.com](http://talgarthmill.com)


H2OPE – A Low Head Hydro Installation social enterprise based in Yorkshire: [www.h2ope.org.uk](http://www.h2ope.org.uk)

Mendip Power Group – A group of mill owners dedicated to assisting others and disseminating best practice – currently installing micro-hydroelectric turbines in a number of historic former watermills in the Mendip area of Somerset: [en.wikipedia.org/wiki/Mendip_Power_Group](http://en.wikipedia.org/wiki/Mendip_Power_Group)

The South Somerset Hydropower Group (SSHG) – a group of 10 owners of former watermills in the South Somerset area of England who are installing micro-hydro turbines for electricity generation: [en.wikipedia.org/wiki/South_Somerset_Hydropower_Group](http://en.wikipedia.org/wiki/South_Somerset_Hydropower_Group)


Settle Hydro - an ‘Industrial and Provident Society for the Benefit of the Community’ with the specific purpose of owning the Settle Weir Hydro Electric Scheme: [www.settlehydro.org.uk](http://www.settlehydro.org.uk)

Site Assessment Links

How to measure flow in your watercourse: [www.appropedia.org/How_to_measure_stream_flow_rate](http://www.appropedia.org/How_to_measure_stream_flow_rate)

Description of a site level: [en.wikipedia.org/wiki/Dumpy_level](http://en.wikipedia.org/wiki/Dumpy_level)

Environment Agency Resources

EA guide to the hydro permitting process and community hydro: [www.gov.uk/harnessing-hydroelectric-power](http://www.gov.uk/harnessing-hydroelectric-power)
Map of where to find your nearest flow monitoring station (England and Wales only):
www.environment-agency.gov.uk/homeandleisure/floods/riverlevels/default.aspx

EA flow station information site: www.environment-agency.gov.uk/hiflows/search.aspx

The Scottish Environment Protection Agency (SEPA) has responsibility for Scotland:
http://www.sepa.org.uk/
Appendix E: 15kW Community Micro-Hydro Example Site Plans

Please note that all of the architectural plans for this application were drawn by one of the community group directors. It would be very useful for all communities aspiring for a community turbine to search for a willing architect to join the team as a volunteer!