Community-led hydro initiatives

Inspiring overview of hydro installations, funding and project profit management

Local United – diffusing practical initiatives in response to climate change and peak oil

Local United brings together and supports community activists who are setting up social enterprises to address the challenges of peak oil and climate change. We aim to speed up the rate at which good ideas are adopted by community groups motivated to build low-carbon economies.

Initially eight 'diffusion packs' have been produced which offer practical suggestions for setting up initiatives in the following areas:

Energy Farms
Community-led Hydro Initiatives
Community-led Wind power
Energy Performance Energy Services Company
Community-led Food Initiatives
Sustainable Community loan Fund
Community-led Reuse of Resources
Community-led Transport Initiatives

NESTA provided funding for the development and dissemination of these information packs which have been written and reviewed by people with first-hand knowledge of the community and climate action sectors they work in. Often the authors will have been involved in the conception of the project idea and in many cases they would now be regarded as experts in their fields. Biographies will soon be available on our websites

All of these packs are intended as on-going 'works-in-progress'. We are hoping that other groups working in these areas will add in their experience. In time they will build into a comprehensive library of good practice case studies. They will become a source of inspiration to community groups. They will provide information on motivational projects which have been carried out by other community groups and they will act as a directional tool to help communities who are ready to take action, to do just that.

These packs are offered to groups who are interested in setting up social enterprises in these areas. They can be downloaded from the many partner websites.

Of course, any information provided is only as up to date as the day it goes to print. Many of the specific examples have worked so well because of the people involved, the skills they possess or the resources that were available to them. Thus these examples will predominantly serve as an inspirational call to arms. However, many of the packs contain useful 'how to' guides, copies of legal templates or list of regulations, all of which may be useful to community groups wishing to set out on their own project. All of the packs contain notes or links on where to find more help.

Feedback on these packs is continually being sought. Community groups who have used the packs to support their own projects are very welcome, and indeed are invited, to provide information on how useful the packs have been, what other information we should be providing or any other feedback which may help us to improve these in the future.

Local United is keen to work with other groups and organisations active in these areas who may be interested in offering the diffusion packs through their websites. We are also actively seeking funding to follow up these packs with a mentoring/buddying system which will provide additional support to emerging social enterprises.

Developing Community Owned Hydro Electric Installations

Introduction

This diffusion 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 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 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. Also the green electricity it produces generate significant revenue through the subsidised ROCs or FiTs program. This 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 and has now developed into a community owned social enterprise that develops, installs and finances hydro electric systems for long term community benefit. TGV CIC is a regional entity that distributes profits to local communityy initiatives but is also the owner of a number of trading subsidiaries. These include TGV Hydro Ltd, which is a registered installer of hydro schemes, and Hydrolite Ltd which manufactures turbines and components for the hydro industry. All profits from the commerical enterprises go back to the regional CIC who invest in low carbon projects for local community benefit. TGV Hydro and Hydrolite can operate commercially anywhere in the UK but all profits are returned to the regional CIC and are spent in accordance with our objectives in the communities of the Brecon Beacons. TGV Hydro Ltd develop high head 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 11 installations in the Brecon Beacons so far, producing about 2% of our regions domestic electricty requirements, and have surveyed over 100 viable sites. We have raised over £1 million in finance for hydro projects and have established a commercial loan facility with lenders that can be accessed by community groups who work with TGV Hydro. TGV anticipate between 10-12 installations will occur per annum in the Brecon Beacons, which is roughly 200 homes of power, and several of our local community groups have devised plans for their villages to become net green energy exporters by 2015.

The TGV social enterprise model is relatively unique as it can finance, manufacture and install complete hydro systems. TGV provide opportunities for local community groups to become equity holders in most of our installations, although in systems in which we act solely for a private landowner the only community benefit is through our trading profits. The variation in the degree of buy in varies considerably from site to site but TGVs structure ensures that any profit from any of the commercial operations will always make its way back to our local communities in the Brecon Beacons.

PREREQUISITES

For high head (head=height) schemes, simply, you 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 warrent 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 A: 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. 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 six 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 and financing a plan for a 15kW hydro scheme are set out below (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 (£25-100k) 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. To overcome this problem in the Brecon Beacons TGV have secured a £500k facility with Finance Wales after a lengthy period of due diligence. This facility can be drawn down in £20-75k portions to fund individual schemes and the security is provided by TGV. Essentially this enables TGV to provide loan finance to community schemes without a mortgage over the land. This form of loan finance, termed non-recourse, is an option for other community groups and social enterprises but it will be necessary to demonstrate to a commercial lender that they have the technical ability to deliver a scheme (a classic chicken and egg scenario). The alternative source of commercial funding for many other groups is to use designated organisations that raise finance for community groups (Settle Hydro have shown how useful public share offers can be: http://www.thebiggreenidea.org/news/article/micro-hydro-continues-to-prosper-despite-the-credit-crunch/).

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 (upto about 50kW) the total cost of securing all permissions and tenders for system go ahead is typically budgeted at £6,000 by TGV. Unfortunately the present interpretation of the state aid regulations for hydro schemes mean that government money (from a local authority for example) cannot be used for at risk phases leaving many groups that don't already have an income at a significant disadvantage.

The remainder of the capital cost of the scheme, and also for the at risk phase if this has not been secured, 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 and secured the local group £3,500 per year 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, TGV) to enter into a Joint Venture (JV) agreement to develop the scheme. A Joint Venture 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 ongoing maintenance and reporting. Many community groups may want to do all of these 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		FINANCING		PROFIT SHARE	
Permission fees	£6,340	Loan finance	£42,000	Loan annual cost	£10,519
Equipment	£30,595	Landowner	£20,000	Loan term	5
Construction costs	£47,766	Community	£10,000	Discount rate	10%
		Investor equity	£12,701		
Total	£84,701	Total	£84,701		

OUTPUT AND INCOME				With loan	Post loan	IRR%	NPV	Payback
Output (kW)	14,926	Landowner alone	42.20%	£2,571	£7,006	21%	£20,760	
Cost / kW	£5,675	(with home use)		£849	£849		£6,568	
Annual costs	£2,817	Total Landowner		£3,420	£7,855	24%	£27,327	5.8 years
Gross income	£19,433	Community	21.10%	£1,285	£3,501	21%	£10,369	6 years
Home use benefit	£849	Investor	26.80%	£1,632	£4,447	21%	£13,169	6 years
Annual benefit	£17,465	TGV - levy	10.00%	£610	£1,662		£9,235	
Gross payback	4.8 years	Total	100.00%	£6,946	£17,465		£60,101	
Carbon saving	39.5 tonnes/pa							

Post Construction:

Once the project has been installed the majority of the revenue is used to pay off the £42k 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 receive several thousand pounds per annum. TGV always insist on 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 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 YOUR 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 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 A. Its important to note that basic site assessments do not include annual variations in a watercourses 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. From planning, ecology, financing, installing and commissioning.

These will typically include

- Securing the agreement of a landowner(s). It is best to assume from the outset that your group will not secure any longterm 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 (http://www.environment-agency.gov.uk/business/topics/water/32022.aspx)
- 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 Constitution: A community group will need to set up a constituted body that will use the community's share of profits to meet their objectives. 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. They are presently awaiting the abstraction licence before completing the installation. 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 are 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 at the end of this document, 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. 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 risk 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. To qualify for FiTs a community must ensure that the installer and the turbine are accredited through the Microgeneration Certification Scheme. A list, that is regularly updated, of all accredited installers is available through the MCS website. However no Accreditation body has yet been set up for companies looking to gain MCS status (as of Nov 2010) so many hydro companies are presently not on their website. The hydro industry as a whole is deeply hopeful that the regulators can correct this in the coming 12 months. 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.
http://www.microgenerationcertification.org/Home+and+Business+Owners/Microgeneration+Installers/Hydro

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 which includes non-recourse loan finance, investment capital, and a mechanism that makes it attractive for grant donors to support community initiatives.

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. However many of the social enterprise intallations companies (such as TGV and H2OPE) offer flexible packages to support community groups which can maximise the benefits to communities.

Legal & Compliance risks: To qualify for FiTs all renewable energy systems need to have both MCS (Micro-generation Certification Scheme) accredited installers and equipment which unfortunately means that people can no longer develop installations themselves in a bespoke manner (despite most schemes having being built very successfully without accreditation bodies for years!). Therefore it is essential for all community groups and prospective social enterprises to work closely with accredited companies if the business plan is reliant on FiTs.

CONCLUSION

A community hydro, when operational, becomes a lasting cash cow for grassroots movements. Recent legislative incentives such as FiTs have also 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 twenty years investing in your community's long term sustainability.

GLOSSARY

FIT – Feed in Tariff

ROCs – Renewable Obligation Certificate

TGV – The Green Valleys

CIC – Community Interest Company

JV – A Joint Venture Company

APPENDIX A

Links of Community Groups and Social Enterprises

www.thegreenvalleys.org The Green Valleys - A social enterprise that finance and install community hydros.
talybontenergy.co.uk Talybont on Usk Energy - Owners of Wales' first community owned hydro and the 'B-Bug' – The Rain Powered Car.
www.llangattockgreenvalleys.org Llangattock Green Valleys – Winners of the Wales British Gas Green Streets, and presently developing 6 community hydros.
felintalgarthmill.com Felin Talgarth Mill - Community group developing a community resource centre, flour mill and hydro.
www.crucorneyenergygroup.com Crucorney Energy Group – developing several community hydros.
www.h2ope.org.uk A Low Head Hydro Installation social enterprise.
en.wikipedia.org/wiki/Mendip_Power_Group A group of mill owners dedicated to assiting others and disseminating best practice.
www.nesta.org.uk/areas_of_work/public_services_lab/environment/big_green_challenge/decc_projects/assets/features/river_energy_networks River Energy Networks – A project that aims to provide essential information on setting up micro-hydroelectric projects as well as access to connections with sites that are already up and running.
en.wikipedia.org/wiki/South_Somerset_Hydropower_Group The South Somerset Hydropower Group (SSHG) is a group of 10 owners of former watermills in the South Somerset area of England who are installing micro-hydro turbinles for electricity generation.
www.cse.org.uk/news/view/1284 Telford Mill Community Hydro
www.settlehydro.org.uk/ 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.

Site Assessment Links

www.appropedia.org/How_to_measure_stream_flow_rate How to measure flow in your watercourse.
en.wikipedia.org/wiki/Dumpy_level Description of a site level.

Environment Agency Resources

www.environment-agency.gov.uk/business/topics/water/32022.aspx EA Guide to hydro permitting process and their Guide to Community Hydro.
www.environment-agency.gov.uk/homeandleisure/floods/riverlevels/default.aspx Map of where to find your nearest flow monitoring station (England and Wales only).
www.environment-agency.gov.uk/hiflows/search.aspx EA Flow station information site.
publications.environment-agency.gov.uk/pdf/GEHO0310BRYF-E-E.pdf The Environment Agency: Opportunity and environmental sensitivity mapping for hydropower in England and Wales. This lists all low head hydro opportunities across England and Wales.

Certified Installers and Turbines

www.microgenerationcertification.org/Home+and+Business+Owners/Microgeneration+Installers/Hydro List of Accedited Installers (although doesn't include MCS Standards which does not yet have an accreditation body in place to assess installers).
www.microgenerationcertification.org/Home+and+Business+Owners/Microgeneration+Products/Hydro List of Accedited Turbines (although doesn't include MCS Standards which does not yet have an accreditation body in place to assess turbines).

APPENDIX B: AN EXAMPLE OF THE TYPES OF SYSTEM TGV INSTALL

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. 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.

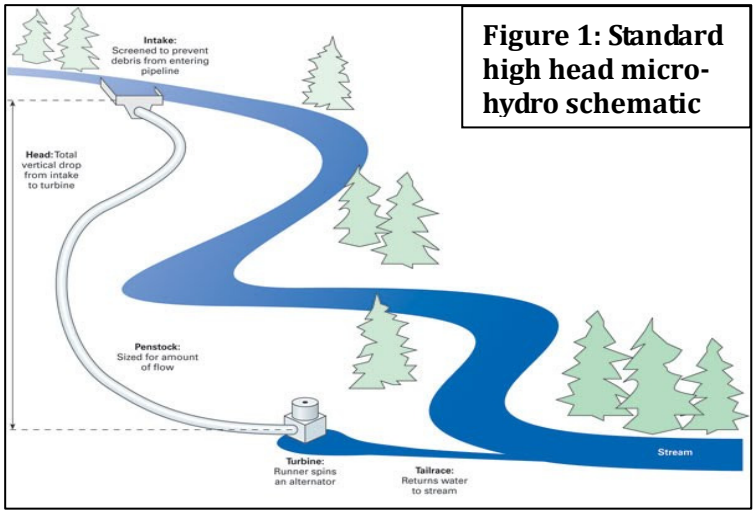


Figure 1: Standard high head micro-hydro schematic

Hydro electric 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 also provide subsidised revenue for all electricity produced by a hydro system. Presently the payment rate for electricity from hydro is set at 19.9p per kWh for systems under 15kW and 17.9p 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.

Permissions and Licenses

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. 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 C – EXAMPLE COMMUNITY HYDRO PLANNING STATEMENT

Contents

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 of 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 licenses required from the Environment agency have also been applied for.

1. National Policy Context:

1.1 Energy White Paper: Our Energy Future - creating a low carbon economy. DTI 2003

"*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 65,000kWh 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 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 license 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 license and impoundment license 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 1500 times over the UKs 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 of 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 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:

G3 Policy	Response in respect to proposed development
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;	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).
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;	The proposed development does not occur within the "white areas" but is a minor engineering works.
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;	All elements have been designed to maintain and enhance the Parks character, landscape and built environment. (Please refer to design statement, architectural plans, and sustainable design guide briefings).
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;	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)
the proposed development does not have an unacceptable impact on the amenity of the area, adjacent properties or the general public;	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 no impact on adjacent properties.

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);	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.
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;	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.
adequate services exist, are reasonably accessible or can be provided without unacceptable detriment to existing users or the environment;	The proposed development will have minimal impact on existing users or the environment.
adequate means of access and parking space can be provided to cater for the traffic generated by the proposal;	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.
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;	No lighting is proposed as part of the development
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;	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.
the proposed development does not have an unacceptable impact on surface waters or groundwater resources in either quality or quantity;	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.
development schemes include facilities for waste recycling and composting appropriate to their scale and type	No waste, recycling or composting will be generated at the proposed development

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:

G4 Policy	Response in respect to proposed development
the trees and their root systems will be retained and adequately protected prior to, during and after, development takes place; and	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.
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.	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)

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:

G6 Policy	Response in respect to proposed development
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;	The proposed developments 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.
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;	All stones used in the building of the turbine house are in keeping with the traditional built environment of the valley and local wild flowers will be seeded on the roof.
promote innovative design in buildings, infrastructure, urban and rural landscape and public art;	As Wales first small scale community owned run-of-stream hydro installation we are indeed promoting innovation.
promote a successful relationship between public and private space by delineating clear boundaries, acknowledging established building lines in new development and enclosing space;	Not applicable
promote high quality in the public realm by ensuring attractive, safe public spaces and routes which are fit for purpose and meet the needs of all members of society;	Not Applicable

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:

Policy S9	Response in respect to proposed development
adversely affect the water quality or the amenity or wildlife value of the watercourse either at the site or downstream;	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.
result in the loss of water flow or an increased risk of flooding upstream or downstream; and/or	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 through our proposed abstraction license.

result in an unacceptable impact on the landscape.	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.

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.

Sustainable design guide	Energy				Materials & Resources		Water		Landscape & Biodiversity		Place & local distinctiveness		Robust Building			
Type of Development	Energy statement.	Siting & building	Renewable target.		Recycling Facilities.	Materials & Waste	Efficient re-use of	SUDs.	Landscape character.	Protect & Enhance.	Consideration of place and Local	Provide a safe route to public transport.	Flexibility for the	Health & Wellbeing	Home Office.	Provide a space for cycles.
			>10 %	>20 %												
Other Minor	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	n/a	n/a	n/a	n/a

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 buildings 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 tradition 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

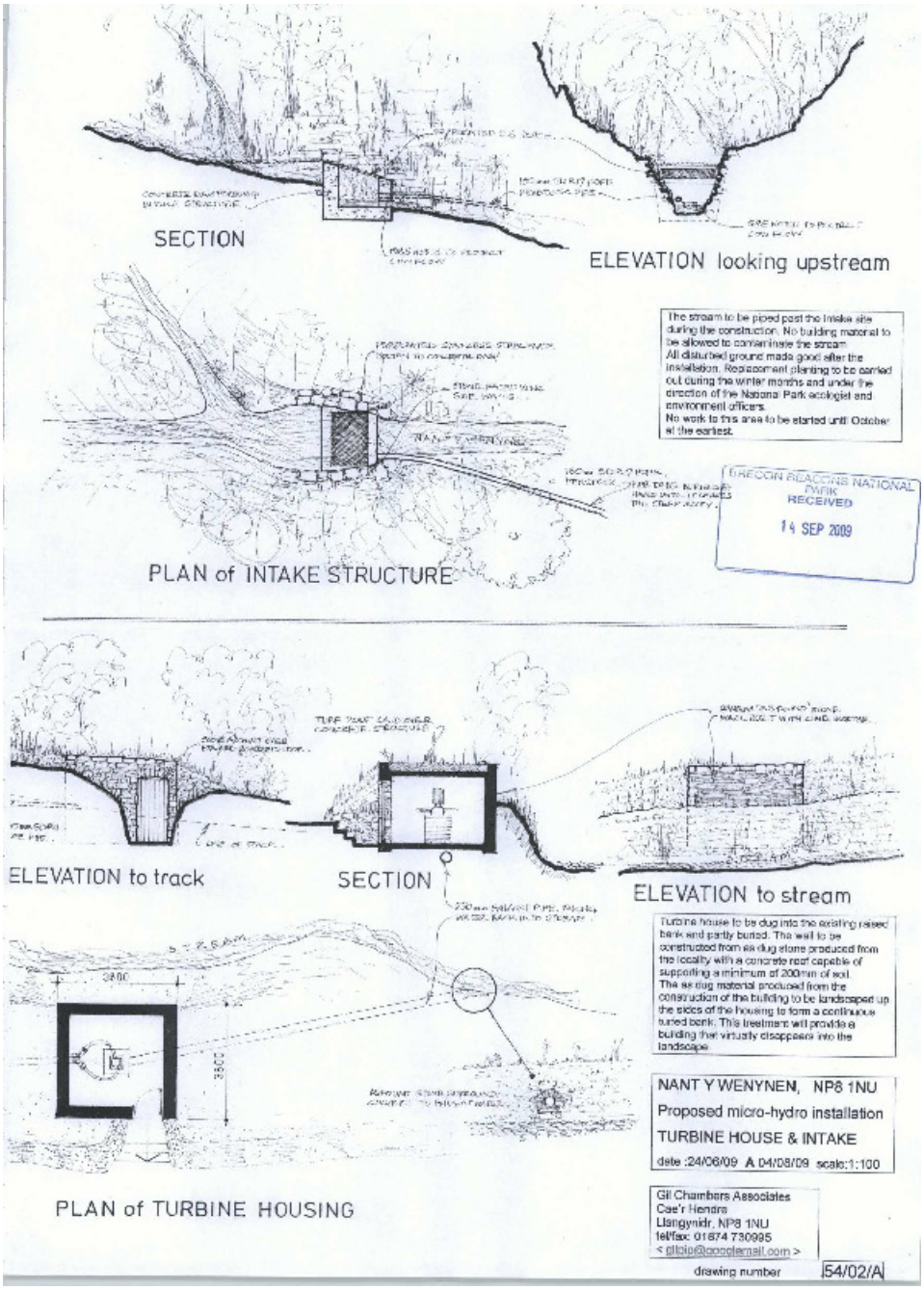
2.6.11 Flexibility for the Future – Not applicable - It will remain a hydro electric generator.

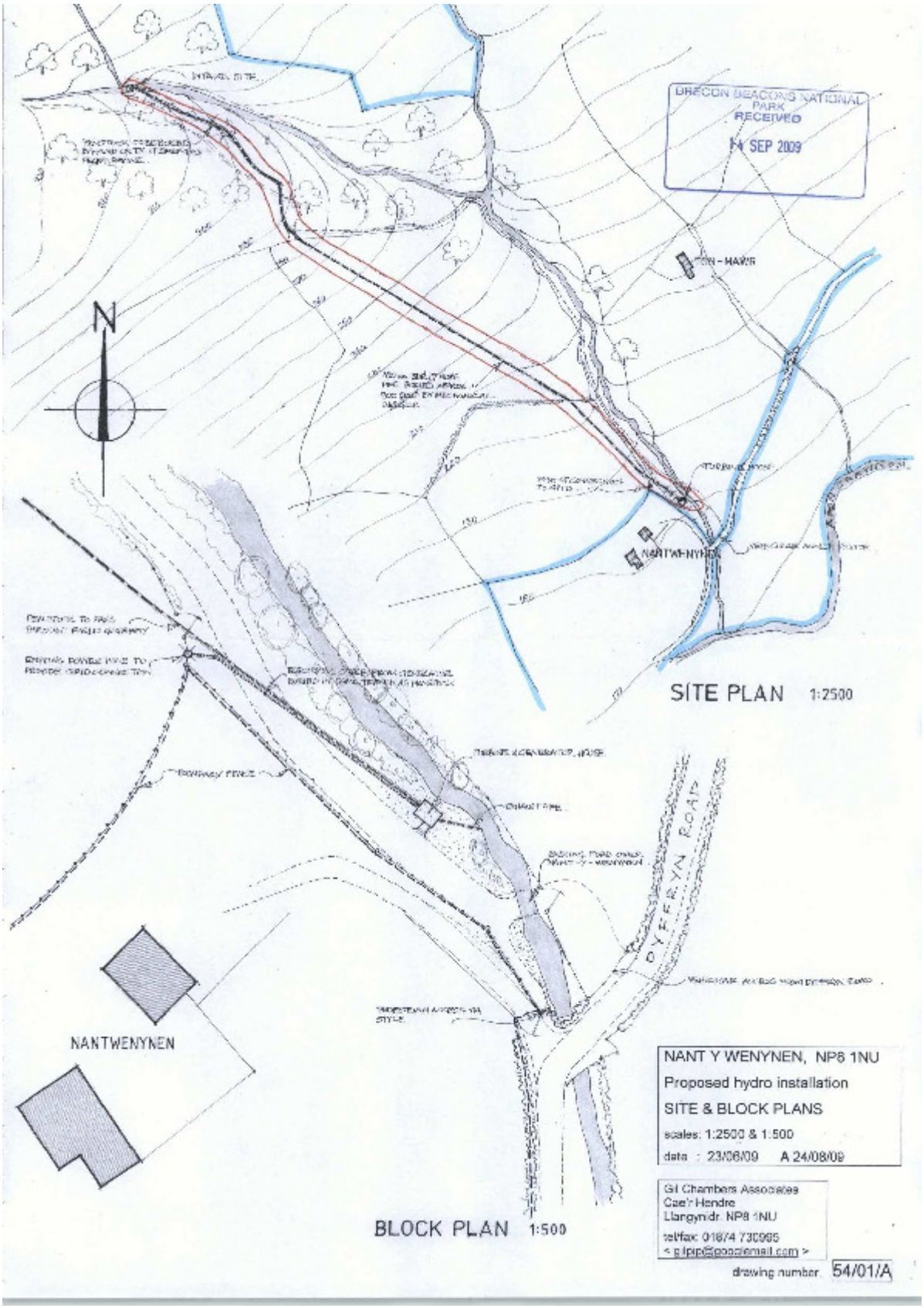
2.6.12 Access Statement - Access to the site will be limited. The only access presently to the site available to the public is over a BBNPA style situated approximately 15 m from the turbine house. Ideally this would be replaced with an easy access substitute but the group does not have the finances 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, woodland and is not on any form of public right of way.

15kW Community Micro Hydro Electric Installation

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!




BRECON BEACONS NATIONAL PARK
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SITE PLAN 1:2500
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BLOCK PLAN 1:500
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Proposed hydro installation
SITE & BLOCK PLANS
scales: 1:2500 & 1:500
data : 23/06/09 A 24/08/09
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drawing number 54/01/A