Pitfalls and Perils:

A Community Guide to Developing a Renewable Energy Project for the first time.

Contents

Introduction

So, you want to develop a community renewable energy project…

Background

The inspiration for the production of this brochure came largely from the process of developing the promotional brochure for the fourteen projects supported by the Northumberland Strategic Partnership Renewable Energy Capital Grant Scheme, which was made available in 2007-08 to support a number of demonstration schemes. In talking to the recipients of the grant, many of the people involved in developing projects heaved a big sigh and proclaimed that they were glad that they'd got there in the end but "if only I had …." or "if I was to do it again I'd make sure…..". Many of these experiences came from community groups or small businesses who had faced interacting with not only the renewable energy sector, but the whole process of contracting large works for the first time with little more than home renovation experience to go on.

If only I had…..

If I was to do it again I would….

It became apparent that much of the real value of supporting such projects was not only the resulting demonstration of the technology but also the opportunity to capture this learning process that individuals and groups have been through to reach a successful project. It is hoped that by capturing this experience for the benefit of those developing a project for the first time, future projects will be able to better negotiate a smooth path to a successful project and avoid many of the stumbling blocks which have beset forerunning projects in this emergent field.

Policy Steer from central government

Over the last ten years, community empowerment has become a key tenet of UK Government policy with the Sustainable Communities Act (2007), Communities in control: real people, real power (white paper July 2008) and the Local Democracy, Economic Development and Construction Bill (December 2008). In the energy sector in particular there is a move to promote decentralised power at a community scale and to promote opportunities for communities to benefit from renewable energy in terms of potential revenue earned, grant assisted replacement of heating systems, reduced revenue fuel costs, especially in off-gas areas, and increased control over their own generation.

However, the support for the implementation of such schemes has not filtered down through the local government structures; there is little resource dedicated to equip communities to take on this role and the promotion of demonstration projects, by tending to focus only on the success of existing projects, masks the opportunity to learn from the difficulties and challenges experienced by most projects below the surface. This report aims to uncover a more realistic portrayal of projects - a 'warts and all' story which highlights where difficulties were encountered and how they were overcome, what worked and what would be done differently a second time round. The intention is to identify constructive opportunities, not to castigate retrospective blame or challenge the success and worthiness of the below mentioned schemes and their rightly placed

beacon status as good practice examples. Instead, the aim is to allow constructive sharing of knowledges acquired through the process of developing a project, in order that potential project developers are better informed and prepared for what they might encounter and all parties involved may reflect on how things might be done better in future. After all, events reported here are part of a collective learning process through which as an industry we can all learn to get more successful projects off the ground. Smoothing of the project development pathway is in the interests of all parties and if lessons are to be truly learned there are pointers which can be taken away by all parties to improve the process for all involved.

The publication of this document does not pretend to fill the gap in local authority support for communities in this area, as identified above, but aims to go someway towards providing a hitherto uncharted overview of the pitfalls and perils that a community might encounter and provide some signposting to sources of support and assistance which are available through other agencies.

Review of guidance

There have been a number of publications and guidance published on developing a community project, and some guidance available on installing renewable energy, however there is not a lot of guidance available that combines the two in any detail. The two notable exceptions being:

- The Scottish Government's 'Community Renewable Energy Toolkit' 2009, which is a very useful guide to the various technical options available when considering a community scale renewable energy project. If you are looking at generating energy to sell, it has a useful section on the practical considerations required and it also has useful information for those looking to secure community benefit from larger scale commercial developments, and
- The 'Guide to Developing a Community Renewable Energy Project in North America' is particularly strong on developing a project development plan and a business plan, although much of the financing and regulation information is not transferable.

I would recommend that anyone considering a renewable energy project on a community scale should first consult these two documents – links to which can be found at the back of this publication. But what both lack is the anecdotal experiences of individuals who have learnt by going through the process. Far too many publicity materials, which are invariably produced for 'demonstration renewable energy projects', concentrate on championing the successes of the projects and suppressing the difficulties in an effort to encourage their uptake. Whilst fully supporting this process, this publication aims to ensure that difficulties are openly discussed so that mistakes are not repeated. In this sense this publication can be seen as an informal supplement to the formal guides available.

I hope you will find the case studies which follow, both interesting and informative, and will feel in a better position to approach a project in the near future. If you would like further discussions with any of the projects please contact projects individually via the details provided at the back of the booklet. The summary on page ?? describes the stages of developing a project which are discussed and the booklet is designed for you to dip in and out of the chapters as relevant.

Methodology

The contents of this report are based on extensive interviewing with representatives of the five projects selected to be the focus of study. These were undertaken throughout 2009 following recent completion of their projects. Initially the intention was to produce five detailed case studies, which led to some generic conclusions. However due to the nature of some of the internal politics faced within some of the projects, it was thought to be unproductive to revisit each of these in detail as this might cause further difficulties between parties which have recently healed.

As the intention of the study is to offer constructive opportunities for learning, the last intention would be to undo any of this healing process. Instead, the knowledge and understanding gained will be used to examine the generic process of developing a community renewable energy project and frame opportunities for all parties to learn from past experiences, as well as produce a roadmap checklist for use by communities wanting to develop a project for the first time. As a result, this guide focusses on issues which emerge at each stage of the process and stories from the five case studies are used to illustrate these experiences in detail where appropriate. An introduction to each of the case studies offers a frame of reference for these findings.

The projects were selected on the usefulness of the lessons that they might offer to future projects, not on geographical distribution. For a number of reasons, there is a higher concentration of renewable energy projects in the Tynedale area, including the supportiveness of authorities operating in this area. As a result, a high proportion of the projects considered are clustered here. Comments on the involvement of agencies in these projects should be considered within the context that their support has allowed/encouraged such a clustering to develop in the first place.

Map of Northumberland

Thanks must go to everyone who has contributed to the production of this publication, for their time and their frank reflections without which it would not have been possible.

Disclaimer

In attempting to catalogue information on things to avoid, things to do differently, or just things to be aware of, the discussions inevitably focussed on points at which things went wrong or were difficult. It is intended that the portrayal of these moments is honest and fair and all parties have been given the opportunity to comment upon the views held of the varying relationships. However, it may be the case that the relations portrayed are, in some cases, considered by other parties to be inaccurate. All views represented reflect the feelings of those interviewed and must be considered only as opinions of those involved. They therefore do not represent any recommendation or otherwise from either Northumberland County Council or Northumberland Strategic Partnership regarding the parties involved.

The Case Studies

Kielder Biomass District Heating Scheme

The biomass district heating scheme at Kielder was when initiated in 2000, and still is, a forward thinking pioneer in biomass district heating, being the first biomass district heating system in England. The Kielder project offers an insight into some of the challenges experienced through the lack of familiarity with biomass in the UK, and although the findings presented here represent the experience gleaned during very embryonic development of the industry in this country, unfortunately many of these challenges still persist.

***Important lessons learned relate to**: system design, the importance of all parts of the system beyond the boiler, district heating, local ownership and community management.*

Introduction

Kielder Village, comprising 200 people and situated in a remote part of Northumberland, has been a pioneer in the sustainable energy revolution, developing England's first village scale district heating system, powered by a 300 kilowatt Austrian Köb boiler.

The whole system cost around £600,000 which, at the time, was provided by a mix of funding from:

- One North East Single Programme and ERDF Funding (through Northumberland Strategic Partnership)
- Northumberland National Park Sustainable Development Fund
- The former Northumberland County and Tynedale District Councils

Image of Kielder inset into map

Background

The biomass district heating project formed part of a wider initiative looking at the rural development opportunities for Kielder. In the late 1990s and into 2000, Tynedale District Council and the Forestry Commission, driven by the perceived opportunity for rural regeneration, were keen to capture economic benefit from tourism passing through the Kielder forest area on route to Scotland. Both parties worked in partnership to develop

proposed applications to a range of grant schemes. After a few rejections the Rural Development Commission awarded £500,000 to assist with the rural regeneration of Kielder allowing a working group to be formed with Kielder residents and a Kielder Regeneration Officer to be appointed to develop the 'business case' for a series of micro projects, including:

- the adoption of the roads
- establishment of a 40 bed 5* YHA in a redundant wing of the school
- reopening of the fuel filling station
- establishment of a minibus service
- provision of local business support grants

This portfolio of micro-businesses has had mixed success, and towards the end of the funding period attention was turned to what else could benefit Kielder. The obvious raw material was the timber. Timber processing wasn't economically viable, but a nearby resident suggested 'combined heat and power' (CHP). Although the power aspect of this was deemed too complex, the idea of a woodchip district heating system was born.

The scheme was designed to provide heat and hot water to:

- Kielder Castle Visitor Centre
- Kielder Community First School
- Six three-bedroom homes
- Six employment studio workshops and
- Kielder Youth Hostel

Picture of Kielder boiler/ woodchip

This was an ambitious range of buildings scattered throughout the site and involved bridging the river with one of the pipes to get the hot water up to Kielder Castle. The ambition for Kielder biomass district heating scheme was driven by the interest of officers from Tynedale District Council and the Forestry Commission in the opportunity to demonstrate biomass district heating for carbon saving and to provide a cheap heating system for residents and by some members of the community for environmental reasons. However, the interest from most members of the community was in the expectation of cheap heating. he system currently saves 200 tonnes of CO_2 per year but has not delivered the extent of cost savings anticipated. The project is a pioneer, and despite its problems it is a fully operational system whose vision and scope is testament to the commitment of those involved.

Bellingham Station Yard Woodchip Boiler

Bellingham Station Yard is a more recent biomass project delivered by North Tyne and Redesdale Community Partnership and was one of the projects supported by the Northumberland Strategic Partnership Capital grants Scheme which stimulates the idea for this publication. The Bellingham project reflects some of the real challenges of negotiating your way through the procurement process and offers pointers for dealing with different agents and timing your project delivery in relation to grant funding.

***Important lessons learned relate to**: negotiating your way through the procurement process, the importance of a good relationship with your installer and timing your project delivery in relation to grant funding.*

In 2007-0 8 the station house, yard and heritage centre were part of a pilot programme of asset transfer under the national Advancing Assets programme, which promoted the transfer of property assets from local authorities to third sector organisations. Tynedale District Council put in place a support package to assist with repairs and maintenance post transfer from the income received from the building, and this pilot was flagged up as an example of good practice by Hazel Blears, Secretary of State for Communities and Local Government in 2008.

Image of Bellingham inset into map

Following the asset transfer, North Tyne and Redesdale Community Partnership worked with Tynedale District Council to look at future sustainability both of the building and of the Trust and possible further development of the station yard site. The Heritage Centre had overgrown its existing facilities, and the station house, which housed the North Tyne and Redesdale Community Partnership, required the installation of a new suitable heating system. A partnership between the Heritage Group, Tynedale District Council and North Tyne and Redesdale Community Partnership was formed to progress the project.

Project Officer for North Tyne and Redesdale Community Partnership, Lesley Allen describes the context for deciding on biomass:

"When station yard first got going they looked at district heating, but whether it was time, the cultural climate or money, the buildings just got refurbished with oil. The Heritage Centre project provided an opportunity for re-evaluating this decision because the climate had changed".

The station yard project installed a woodchip boiler located in a portacabin at the far end of the yard. This was designed to provide heating but not hot water to the site. The decision was taken not to provide hot water as well as heating because this would alter the sizing of the boiler significantly, but as office space and museum space, the demand was not sufficient to merit the additional capacity. The fuel is delivered by a local fuel supplier less than five miles away, to minimise transport miles and both Station House offices and the Heritage Centre benefit from the central heating that this system provides.

Images of Bellingham project

Although a success, the project has had some significant ‘teething troubles’ and offers some pointers in the project development process which communities new to developing this kind of project will benefit from.

Heatherslaw Mill Hydro Scheme

Although not strictly a community led scheme, this project highlights a different set of challenges faced when developing a hydro electricity project. Heatherslaw Mill demonstrates the challenges of balancing the interests of different parties and negotiating the regulation requirements of the various statutory and non statutory agencies as well as the importance of a full feasibility assessment to predict power generation capability.

Important lessons learned relate to:
The negotiation of permissions between the various regulatory agencies, the importance of good project management, and the accurate forecasting of generation capacity.

The idea for installing hydropower at Heatherslaw Mill began with the refurbishment of the mill for its 700th anniversary. Hydropower offered an opportunity to show what else could be done with the mill and bring contemporary relevance to the history of the site. There is a desire for the mill to be more than a museum and to use heritage to inform a way for the future. There is tremendous opportunity for the border rivers to generate again, they used to provide power to the cloth industry right across the border area. Very quickly it became apparent that a 21st century hydro scheme was subject to many more constraints than in the past – planning permission, listed building consent, environmental assessments etc.

The project was never going to produce a lot of power but it was designed to run the ambient lighting for the mill. It was originally thought that reinstating the weir on the River Till just upstream of the mill (one of many blown up in the 1960s to encourage more salmon for fishing) would produce similar amounts of power as the mill had harnessed in the past. However, neither the Environment Agency nor the River Tweed Commission would not allow reinstatement of the weir and so the generation is now more for demonstration and educational purposes than for its power output.

Picture of Heatherslaw

Gairshields Log gasification Boiler

Gairshields Farm is again not strictly a community scheme itself being a private residence, but is an interesting example of the challenges posed by the current grant schemes and the financial viability of choosing a suitable system for a challenging application.

***Important lessons learned relate to**: the importance on professional technical advice in choosing a system, the challenges of grid connection and the importance of communication in multi-agency working.*

Gairshields Farm is a Northumberland County Council tenanted farm south west of Hexham which had been categorised as being in fuel poverty (i.e. spending more than 10% of the household income on heating their home).

The property was a stone built rural three bedroom farmhouse positioned on open aspect moorland with single glazing and suffering from damp. The house was grade II listed???? and fuelled by a solid fuel Aga and open coal fire in the downstairs room.

In 2004, National Energy Action was involved with a study of fuel poverty in rural areas and worked closely with Warm Zone Ltd to produce a report into the challenges in Tynedale. At the same time, National Energy Action were also exploring opportunities for demonstrating and testing air source heat pumps, solar thermal and wind technologies within such circumstances with NaREC (New and Renewable Energy Centre) and a handful of suppliers, including HeatKing and Genesis.

Picture of Gairshields inset onto map

The opportunity to pilot an air source heat pump at Gairshields farm was discussed with Northumberland County Council and the residents of Gairshields, and both parties were keen for a demonstration project to be developed.

As it turned out, the project experienced many difficulties, largely around the negotiation of technical solutions, the communication, expertise and co-working between different agencies and the challenges of the grant funding schemes available. Finally, in 2008 a biomass wood gasification boiler was installed to provide central heating to the farmhouse. The inclusion of this project offers lessons on how this process might be foreshortened.

Stonehaugh Community Hall

Stonehaugh Community Hall is an example of a true community led project. The new hall, which has now finally opened after many set backs, is testament to the dedication and determination of individual community members who put so much time and energy into the project. The project experienced problems on a number of different levels, but is now operational and provides important lessons to other communities on the important of project management and contractual agreements.

***Important lessons learned relate to**: the importance of contractual agreements, the importance of appointing a project manager, the need for supporting agencies to be better informed in order to provide the right support, and the interpersonal challenges of community working.*

Stonehaugh, like Kielder is a remote forestry village comprising 35 houses in the upper Tyne Valley in West Northumberland.

Picture of Stonehaugh inset onto map

The project to build Stonehaugh Community Village Hall began in 2000 when Stonehaugh Social Club, which was housed in a 1950s temporary building and desperate for new premises, failed the health and safety hygiene inspection. They were already seeking to build new premises but this crisis point triggered a sense of urgency. Stonehaugh Social Club had a unique role within the village, acting as club, village hall, youth club, talks venue and even a church. However, because the Social Club was a limited company, the usual grant funding was not available to them to rebuild their premises. Instead, a new organisation - Stonehaugh Community Village Hall Committee - could build a village hall to serve the social purposes previously performed at the Social Club and could 'lease' space for the Social Club to utilise.

An application was successfully submitted to the Big Lottery funding stream 'Awards for All', and funding of around £10,000 was granted this enabled the community to lever in further funding from Government Office for the North East.

Architects from The Green Design Group from Brampton were then appointed to produce designs for the new building involving high specifications for insulation, materials and a combination of ground source heating, with the electricity for this being provided by solar photovoltaic panels together with and roof-mounted micro wind turbines. This was a big project for such a small community and many of the difficulties they encountered were simply a result of overstretching community expertise. The project is now a success – the new hall is almost complete and has just received delivery of furnishings. The ground source heating system is operational and the solar

panels provide a contribution to the electricity. However, the community remain divided over the project, this threatens the very spirit of community development and local enterprise that the project aimed to serve.

Photo of Stonehaugh Village Hall

The 8 Stages of developing a Community Energy Project – A summary of the chapters ahead…

Stage 1: Moving from a germ of an idea to establishing feasibility.
Firstly, you need to establish the amount of energy you require and explore a range of options for supplying this. A feasibility study, which is tailored closely to your site specifics, provides an impartial technical assessment and should consider your usage profile, fuel supply availability, logistical and or legal regulatory constraints. The feasibility study, although often costly, is recommended.

Stage 2: Deciding on your system
Once the feasibility of a number of options have been established, your choice of system will also depend on softer factors, such as your preferred maintenance, tolerance, likely future flexibility requirements and preferred visual outcome - for example, do you need/like a visible heat source to cluster around? Deciding upon your choice of system and technology should combine both the hard and soft assessments.

Stage 3: Establishing strong leadership and project management
It is important that an individual/group of individuals with agreed responsibilities is able to provide the leadership and project management for taking the project forwards. This may require external support.

Stage 4: Tendering Process - appointing someone to design/ specify your system
Having decided on a technology, different suppliers often have very different systems to do the same job and is it is usually necessary to tender for the design and build together. Be prepared to consider a range of proposals which may differ technically and try to enlist the help of a technical independent to assess tenders with you.

Stage 5: Installation and on-site works
Many design and build systems are 'turnkey' in their approach and come with named contractors. Do not be afraid to request quality assurance and/or request the use of known local contractors for elements of the work at the contract negotiation stage.

Stage 6: . Managing on-site work
If possible, a designated project manager should be appointed either in a paid or voluntary capacity. It is important not to underestimate the time taken to supervise works on site, especially during construction phase. Most of the case studies examined did not have a named project manager in place and many problems resulted.

Stage 7: Commissioning the system
This refers to the process of assuring that all components of the system are designed, installed and tested according to the operational requirements of the client. This involved the process of accepting responsibility for the installation and is the legal point at which ownership of the plant is established and warranties commence etc.

Stage 8: Operation management and maintenance of the system
These are the mechanisms put in place for managing and maintaining your system once work is complete. Although listed last, this should be considered early on in the

project and so is also and touched on at both the feasibility and design stages reported here.

Discussion of challenges as encountered by the five case studies

What follows is a detailed discussion of these stages as experienced by the five projects studied. This is not designed to be a comprehensive piece which captures all possible problems but should hopefully provide an insight into some of the specific challenges, (some commonplace, others specific) that each project faced during their development and offers reflections from those involved on how things might be done better the second time round.

Stage 1: Procurement of Feasibility Work

The assessment of feasibility is arguably the most important stage of the project. Choosing the 'right' type of renewable energy system is not an easy task for those with little previous knowledge or experience of the options.

Why do a Feasibility Study?

A feasibility study is always recommended as it provides the most comprehensive assessment of not only what is possible but also which solution responds best to the needs of the user and of the site. Different renewable energy technologies vary enormously in:

- Automation - how much user input they require
- How much space they take up
- The type of energy they deliver – heat or electrical
- The way that this is delivered in any time period (generation profile) – e.g. continuous low temperature heat of heat pumps to the intermittent high bursts of a modern biomass boiler utilising hot water storage.

Similarly, users differ in their energy needs, tolerances and site availability. A feasibility study matches the available options to the specific demands of the user.

Procuring a Feasibility Study

Feasibility studies are however, costly pieces of work. Out of the case studies profiled here, those which did conduct a feasibility study as part of their project development, received at least a proportion of the funding for it from a public sector grant.

Kielder's first stage feasibility was funded by The Forestry Commission and Tynedale District Council with Rural Development Programme for England money in 2002. This was later followed up with further detailed work being carried out in 2003 by the same consultants. In the case of Bellingham, one consultant undertook a feasibility report for the overall station yard, whilst another performed a scoping study of the energy needs of both this site and of Bellingham Town Hall (which later progressed separately). Once the recommendation for biomass had been received, the North Tyne and Redesdale

Community Partnership felt that they still didn't know enough about biomass to progress straight to procurement stage so they applied for New Heat funding to do a third, more detailed feasibility study. Having, three bodies involved was not only complicated, but resulted in little substantial increase in the detail provided on each occasion.

In the case of Gairshields Farm, no formal feasibility study was undertaken; the professional bodies involved were driven more by the demonstration of certain technologies than by conducting an objective assessment of the site. Of course the establishment of the suitability of the chosen technologies was assessed although this, as we shall see, was continually challenged as further factors were uncovered.

In the case of Stonehaugh, again no formal feasibility study was undertaken. Instead, the decision to pursue ground source heating was taken after the chair of the newly formed Stonehaugh Community Village Hall Committee had attended a presentation on the topic at a neighbouring town hall. The merits were then weighed up with the appointed surveyor and after several presentations on different technologies. The group took an informed decision to proceed with ground- source heating as this technology appeared to be the best for the environment and the most affordable for the project. As the building was a new build and modelled on a similar building seen elsewhere, the same energy options of ground source heat pumps and solar photovoltaic panels were requested and the original architects drew up designs for the building which included high specification insulation and materials, and a combination of ground source heating with the electricity for this being provided by solar photovoltaic panels and micro wind turbines mounted on the roof. In actual fact, the size of the wind turbines was likely to have been ineffectual and in the end these did not form part of the solution as detailed below. Biomass was not considered because there was no suitable storage space nearby and other neighbouring projects had reported a lot of problems with biomass.

In the case of Heatherslaw Mill, the project aim was to utilise the hydro power at the mill so again no wider ranging feasibility study was undertaken although the university provided technical advice and support, although this was originally based on the generation capacity of a full size weir which was found to be impossible to achieve. The Norfolk Mills Group also visited to provide advisory/consultancy support including a study on the flows and drops of the river. Northumbrian Water also offered some in kind professional assistance to the project. Because the intention was very specific there was not the need for a broad assessment feasibility report in the same way that it would if generation was for power.

Feasibility studies conducted by consultants are often deemed too expensive for community projects and small projects without external funding which then rely on the knowledge of project members to plump for one technology and then engage a specialist to advise on the design of a system. Although understandable in the challenges of securing funding, this is a risky approach and if you get it wrong, the investment required to make an inappropriate solution work may in some cases be greater in the long run, the project will experience substantial delays and the process experienced may be frustrating and challenge your hope of ever reaching a solution.

The problems of progressing without a formal feasibility study can be seen through reflection on Gairshields Farm as our first example:

Case Study Gairshields Farm – The problems resulting from not conducting a site based feasibility study.

National Energy Action, who had been working with Tynedale District Council on fuel poverty, were keen to assist the tenants of this farm to address their worsening energy poverty. The opportunity arose to demonstrate the application of air source heat pump technology to addressing fuel poverty through a partnership arrangement with Genesis who were prepared to donate the air source heat pump and some solar thermal units to the project free of charge, on account of it being a 'trial'. Some professional assessment was undertaken on the viability of this solution, which specified two 8kW air source heat pumps, one upstairs and one downstairs. Apparently small-scale wind was also considered but written off at this time due to the output being considered too variable.

Genesis then wanted to trial a new type of upright air source heat pump that could be mounted on a fence panel. National Energy Action was excited to test this because it had great potential for terraced properties. National Energy Action put a lot of time into developing a holistic approach for the property, supporting the tenants to access Warm Zone support to improve the insulation at the property and advising the tenants on a better contract on their electricity tariffs.

When the Genesis engineer visited the site, he advised that an inline pump was required to regulate the water flow as the spring fed water supply was not sufficiently pressurised and consistent. However, neither Genesis nor Northumberland County Council were prepared to fund the flow regulator. At the same time it was also discovered that an upgrade to the electricity distribution network would be required to cope with the high start up current required for the air source heat pump. In general, a 'three-phase' supply is required for air source and ground source heat pumps to cope with the high electricity demand on start up, although recently this large start up requirement has been significantly reduced. The regulations governing connection to the distribution network mean that if you wanted to connect, you are, as the client, responsible for the cost of upgrading that subsection of the network to enable it to safely cope with your additional load. For Gairshields Farm the outline price for this was cited at around £6000.

At this point Genesis decided that due to these complications they would test their equipment elsewhere, which left National Energy Action without the offer of free equipment. At the time National Energy Action were aware that Community Energy Solutions (CES) were also looking to test ground source heat pumps and were funded to address fuel poverty in off gas areas. So, in November 2007 National Energy Action passed the project over to Community Energy Solutions to resolve, passing over to them the balance of funding that they had for the project.

Upon CES taking over responsibility for the project, discussions with the manufacturer revealed that in the time lapse, larger pumps were now available which it was claimed would be better than the two smaller pumps. A single 12kW peat pump was therefore specified. A Heat Loss calculation was conducted to confirm the size of the heat demand and this together with the electricity distribution network connection was discussed with NEDL, the distribution network operator for the North East region. CES were apparently unaware of the previous discussions between National Energy Action and NEDL over this and an *outline price* (generic price without site investigation) of

around £3000 was cited for the connection. NEDL did not pick up, or did not release, the information that this property had a discussion history and had already been issued with an *accurate quotation* (actual price taking into account site specifics). As a result ,CES based all costings on the £3000 guide price and so got a shock when the detailed quotation came in at £7400. At this point, CES decided that if the costs were going to be as high as that, it would be better to put in a ground source heat pump which had a better 'co-efficient of performance' i.e. more heat would be returned for the same amount of electricity put in to run the pump. However, upon further exploration the bedrock was too close to the surface to make excavation possible and the electricity connection would still have to be upgraded. The outline figure for installing a ground source heat pump without the cost of this connection, the excavation works which were going to be conducted by the tenant, or internal radiator system was £18,000. As a result CES wanted to recommend an oil-fired system but the funding provided by Northumberland Strategic Partnership had been allocated for a renewable energy solution and this was consistent with what the tenants wanted. With assistance from officers at Northumberland County Council, who had taken over the oversight of the NSP grant that had been awarded, CES explored biomass solutions. Finally after further challenges over funding (which will be discussed in detail in section ???? below), a log gasification boiler was prescribed and installed four years after the initial involvement began. A large accumulator tank was also fitted to store the hot water so that the radiator system could be operated independently of the boiler. Had there been a full feasibility assessment from the outside many of these problems would have been discovered in advance.

In the case of Stonehaugh, again no feasibility study was undertaken, but in this instance this caused less of a problem. The decision to pursue ground source heating was taken after a visit to a neighbouring project that had installed ground source heat pumps. The merits were then weighed up with the first surveyor that was employed and after several presentations on different technologies the community took an informed decision to proceed with ground- source heating. Biomass was ruled out for the reasons outlines in section…above. Stonehaugh were lucky that in this instance no complications arose which prevented these solutions being developed such as bedrock or electricity supply requirements. If no feasibility study is possible financially, make sure that these other routes for information are extensively pursued.

To complicate this, a further common problem experienced is that even where a feasibility study is commissioned, the study often does not go far enough in detail to allow direct progression through to system design. In both the Kielder and Bellingham cases, more than one study was required. In Bellingham the three separate studies were a product of the incremental learning about what was required and also responded to the funding streams available for different levels and types of study available. To a certain extent here the funding regimes artificially guided and limited the information gathering process, rather than the studies being driven by a clear identification of what information was required. This resulted in a very inefficient, repetitive and frustrating progression for those involved. It is therefore necessary to have some idea of where you need to get to in order to ensure the brief for any feasibility study undertaken will provide you with sufficient detail to progress and minimise the number of separate studies undertaken.

This is difficult for community groups who don't know what information they will require. All five projects stressed the difficulty of not knowing what you don't know, and so

finding it difficult to pinpoint the questions to ask. "If you don't know what information you will need you don't ask for it. You trust that they're the experts and will provide enough information"[1]. In hindsight, the Bellingham project felt that they needed to talk to a lot more people and ask a lot more questions at this stage. They say it is worth spending some extra time talking to as many people as possible especially other community projects who have gone through the process already but also gaining as much advice from experts as you can, before you start. Too many community projects are disappointed with what the final feasibility report tells them after paying out such a sum of money.

In the interests of minimising costs and the need for further studies it is important to ensure that any study is not only broad enough in the range of options it considers but also provides sufficiently detailed information to progress the project all the way to system design once the required solution is chosen. Much of the initial feasibility work conducted at Bellingham was used to form the basis of tenders and specify the design of the plant. When this occurred, the partnership felt that the information available was not detailed enough to constrain the tender sufficiently. Therefore, when the specification for the tender for the system design went out, it also wasn't detailed enough and so set in motion a chain of problems. The danger with encompassing such detail is that the study becomes very big and therefore expensive, clearly full technical recommendations cannot be given for all the options discussed. A proposed resolution is that a two stage study might be considered whereby a range of options are explored and then after a dialogue with the project the detail for the chosen solution is then worked up as part of the same contract. In general, the Bellingham project flags up the need for feasibility studies to provide more information and consider the solution more holistically and be more tailored to the client's use and need.

Making sure that the brief will take you far enough along the road to be able to take the next step will also help you to ensure that all quotes for the work are offering the same service (a vague brief allows greater scope for price difference in the quotes according to what the consultant intends to include. It is easy to make a tender more competitive by cutting things out).

In the case of a new build projects, for the future the cost of establishing feasibility of meeting the energy needs through renewable generation and the balance of this with energy efficiency and demand reduction should in theory be covered by the main feasibility study for a building project. This is a consideration that should be picked up by the contracted and regulatory bodies in light of the increasing regulation to achieve carbon neutral design.

Also at this point try to get a check on any figures from an independent person who has experience of such systems. At no point in the feasibility study for Kielder was the cost of electricity for pumping the water round the system factored in. This was later reported to be as much as £100 per week (totalling £4-5,000 per year)[2]. North East Community Forest has since been commissioned to investigate possible further renewable electricity generation which might assist to reduce this cost, however did not produce an economically attractive alternative. Part of this high electricity cost, as discussed below, was the result of not specifying variable speed drives in the design process meaning that the motors are running full power constantly. Had the cost of electricity been

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[1] Lesley Allen - Project Officer North Tyne and Redesdale Community Partnership
[2] Chair of Kielder Community Enterprise Limited (September 2006)

explored at an early stage, variable speed drives would likely have been clearly specified.

Also, double check the forward costing of potential revenue generation from electricity and/or heat sales and check with your feasibility consultant how these might vary with differing projections of fuel cost or electricity price. Compare forecast percentages of recoverable heat with average figures to assess whether these look reasonable or whether there are particular reasons why your scheme might recover less or more of the heat. These might seem very specific technical matters, but are likely to have a significant effect on financial viability of the project.

If biomass is being considered, the availability of a local wood fuel supply should be secured early in the process as this will influence or even govern the choice of biomass type – wood pellet, woodchip or logs. Part of the inspiration for the project at Kielder was the local source of timber from Kielder Forest which, for this project, works very well. Timber is chipped in the forest by the Forestry Commission to feed the boiler with around 250-450 tonnes per year. Not every project however will be able to tap into Kielder's resource as most of the timber is produced for an existing market. Research your fuel supply options as early as possible and then as the wood will need at least 18 months seasoning before use, discuss your demand early with your potential supplier so that they can start planning for your projected need. Bellingham secured a local fuel supply from within five miles. This not only maximised the sustainability of a project but cuts down on transport costs and makes delivery arrangements easier.

Lessons Learned

Do try to structure project finance to allow the commissioning of an independent feasibility study wherever possible; make use of grants where available or build this cost into financial borrowing.

Ensure you take time to talk to as many people as possible and find out as much as you can from previous projects as to what information you are likely to need from the feasibility study and which information might be important later on.

Ensure that you make clear in your brief to the feasibility consultants what you want to know and where you feel that you need help in identifying what you need to know. A good consultant will support you through this process.

If possible, as well as making use of a two-stage feasibility model it is useful to establish a critical friend relationship with your feasibility consultants where you can discuss the different elements within the report and check project decisions throughout the development of the project.

If financial calculations are being used to justify economic investment and viability, double and triple check the figures with other experts/previous projects to ensure that a) all costs have been covered and b) you understand how these costs might change with different pricing and regulation structures in the future.

Consider your fuel supply if biomass is being considered. How much fuel will you need? Where can you source material - is a local supply available which can

accommodate your needs? Is there choice in supply? And speak to potential suppliers early about planning for your demand.

Grant providers should be aware of the need for speculative exploratory financing to ensure projects set out on a firm footing and should ensure that funding for these feasibility studies is continued.

Grant providers should provide accompanying guidance to help community groups establish what information a feasibility study should include. If expertise is not held in house, a point of further reference for such advice should be provided in preference to an incomplete statement which communities might then rely on to their detriment.

Related to this where funding interventions are provided, providers should ensure that these interventions have been thought through strategically, to ensure the types of study being supported help people get all the information that they will need and are not only partial.

Providers of such studies should take note of the demand for feasibility studies to be more tailored to the client's individual circumstances and address sufficient detail to be able to move forward directly to specify the design work. Consultants might like to consider the model of a two-stage report where this is not already in place, as this would meet the need for breadth and depth of information simultaneously without the scope of the work becoming unmanageable.

Funding providers, developers and regulatory authorities should consider including a sub-contracted full feasibility study into the supply of renewable energy into all new development design studies to ensure that future development is low carbon, to preclude the need for a separate further study by the client and to reduce complication of design recommendations down the line as a result of a separate study.

Stage 2: Deciding on your System

If a feasibility report has been conducted, the choice of system is likely to be directed by its findings. If this has not already taken into account the various softer considerations such as your preferred maintenance involvement, tolerance to intermittency and/or programmability need to be considered. Deciding upon your choice of system and technology should combine these two aspects adequately and may involve some compromise. Be aware of your expectations and realistic in your decisions.

Is there a need for future flexibility requirements, expansion of the system or a preference for non-dependence on one source of fuel? This is especially important in the domestic setting. For example, with biomass heating, a multi-fuel stove will burn logs, driftwood, deadwood, recycled briquettes and coal; whereas a pellet stove is reliant on a supply of tightly toleranced pellets. If your personal philosophy is opposed to being dependent on a single external supplier, then the flexibility and self-sufficiency might be worth more to you than the increased programmability or efficiency that such a boiler may offer. Conversely if you live a lifestyle in which collecting your own fuel is neither practical nor desirable, then the more convenient pellet boiler is likely to be a much more palatable solution for you. This is a decision that only you can take. It is worth finding out about what living with each system is like before you make the choice.

At this stage be clear what you want the system to provide and get advice as to whether the recommended systems are able to meet this expectation. When project officers at Bellingham first looked at a system they thought it was going to do both hot water and space heating. The system chosen could have provided this but because of the low demand for hot water, the decision was taken that it was not economical to size the system to do both, and so the old oil boiler actually still provides the small amount of hot water they require. There have been problems integrating the two systems which have been solved by investing in a changeover prioritisation device, but it was pure luck that there was enough money left in the budget to do this. Kielder learned the importance of making this economical decision the hard way; Bellingham built this in from the outset but stress the need to pay particular attention to the way different systems are integrated if this is the route chosen.

Alternatively, you need to ask yourself could your group's preference for a visible heat source to cluster round be compromised if it turned out that ground source heating was the most viable solution, or could your budget stretch to an additional a small room stove in addition to fill that need. Remember, however good the system, if your expectation or lifestyle is not aligned to what the system provides, you will be unhappy with the result.

In the case of Bellingham, a fully automatic system was chosen to minimise user involvement. However, in biomass even a fully automated system requires some regular checks, ash emptying and maintenance, which is far more frequent than the conventional annual oil boiler check.

Heatherslaw Case Study – Negotiating the regulatory bodies

Although the choice of system for Heatherslaw was always going to be hydro-generation, the choice of generation – impulse or reaction turbine, mill wheel or

Archimedes screw was still to be decided. The decision was to bolt on the electrical generation to the existing refurbished wheel in the end rather than install a chase and a stream mounted turbine. This was largely a balance of cost, the availability of the miller to maintain and monitor the mechanics and the result of dialogue with the various regulatory agencies. It was too costly to install a chase to supply a retention basin but in any case the head was not significant enough as the mill is undershot not overfed. It is always important to begin such discussions early, but particularly so in the case of hydro where there are many more bodies with which to consult. At Heatherslaw this included:

- Environment Agency
- Natural England – all of the Till is a SSSI
- Planning Authority – Berwick Borough Council
- British Canoeing Union
- River Tweed Commission (– who are charged with statutory duty to migratory fish under The River Tweed Act, the Till being a principal tributary of the Tweed)

All these agencies had something to contribute to the discussion, though some were more constructive than others. Most difficulty was faced with discussions with the River Tweed Commissioners, the Environment Agency and Natural England. For the Environment Agency, these concerns were based on upstream flooding whilst for Natural England it was the biology and habitat of the river. For the River Tweed Commissioners, who had masterminded the removal of the weirs, there was no question of these being reinstated. This meant that the language talked to each body was very different. The comment made was that in actual fact Heatherslaw ended up with too many advisors and it was important to make sure everyone was working to the same hymn-sheet, so to speak. Planning permission and listed building consent were relatively straightforward by comparison, although a bat survey was requested despite the many alternative buildings nearby. There are also significant differences between the Scottish Environmental Protection Agency and the English Environment Agency. If you are on the border it is likely you will need to conform to both. Particular things you should be aware of include:

- Abstraction licence (relating to minimum base flow requirements)
- Water Framework Directive
- Fish Screening and Fish Pass requirements

Further, there is not yet internal consistency within the Environment Agency on what is required which can make agreement a tortuous process. For example, some officers require 12 months of flow measurement data, whilst others are happy for 3 months of data and to utilise existing hydrographs and nearby gauging stations. This is likely to depend very much upon your site. Often, planning officers will not engage until the agreement of the EA has been secured first so it is necessary to construct timescales accordingly.

A further point also arose in further discussions with a similar project at Tarset over the provision of drawings. After a series of constructive discussions with the Environment Agency, when the drawings were submitted for planning permission, there was an immediate objection lodged by the Environment Agency. This was thought strange given the preceding discussions and upon further investigation it turned out that the EA

required engineering drawings whilst the National Park had asked for concept plans which did not fulfil the Environment Agency criteria and so an automatic objection had been logged. Participants stress that you cannot assume that one part of a large organisations talks to another.

Heatherslaw also stress the need to plan for the timescale involved, they took two and a half years of planning to get their small project off the ground and recommend you draw out an expected plan of delivery and then double it to account for resolving problems.

Lessons Learned

Try and research as much as possible about what it is like to live with/operate potential systems.

Be honest about your likely demands on the systems and make your system choice based on the compatibility of your expectations of and tolerance to the requirements of the system in question. Deciding upon your choice of system and technology should combine both technical suitability and the softer 'livability' adequately and may involve some compromise. Be aware of your expectations and realistic in your decisions.

Be aware that even fully automated biomass systems require some involvement; satisfy yourself with the help of your feasibility consultant and with other projects that you are happy with what this involves.

Decide whether it is economical to size the system to cover hot water as well as space heating – this decision will rest on the size of hot water demand.

Pay particular attention to how a new system might integrate with other systems already in place.

Research what permissions you will need, these may extend well beyond planning permission and building control, especially in the case of wind or hydro power. Engage in discussions early and be prepared for the different interests that will be pursued and different languages/ways of thinking about the resource that this may entail.

Allow plenty of time for project development – take your expected timeframe and prepare for it to double.

Stage 3: Leadership and Project Management

As soon as the decision to progress with the project is taken, it is essential to ensure that strong leadership and management for the project is established. Heatherslaw appointed a project manager early on who was excellent and the number one recommendation from Heatherslaw is to get someone in place to perform this project management role and not assume that you can do it yourself. At Kielder, it was intended that the architect for the boiler house as the largest building was to assume project management for the whole system. However, unlike traditional projects where the primary building forms the main cost, the value of the boiler house was only a small proportion of the overall project - £60,000 of £600,000. The scale of project exceeded the regular scale of project conducted by the architect and, in addition, other than the short period on on-site construction, the architects firm were not on site to oversee works in the usual manner. Due to the remoteness of Kielder, it was not easy to just pop in and check on proceedings and so the project management of the project really suffered and timetabling of the various subcontractors was not well organised. This was also a difficulty experienced at Stonehaugh which is worth discussing in more detail:

Case Study Stonehaugh – the importance of good project management

At Stonehaugh, the chair of the Stonehaugh Community Village Hall Committee, who had been a driving force behind the consideration of renewables in the new building, arranged a visit for a couple of the trustees to a nearby ground source heat pump project to see the technology in action. The new Stonehaugh village hall was being designed by an architect to meet the £250,000 funding for the project was already set. However, when the two trustees visited this second project they became so enthusiastic about the construction of the building that they saw (a high quality sustainable forestry Finnish timber design which arrived in kit form) that aspirations about what was possible at Stonehaugh began to soar. These new aspirations changed the scope and direction of the new build proposal and marked the point at which the project started to experience difficulties.

The chair of the committee wasn't supportive of this change of direction because of the fixed funding allocation and the existing design which matched the funding. However, he then took a step back from the development of the project along with the other trustees, partly because of other time commitments and partially because of disagreements over the change of direction. The local architect too parted company with the project and thus these two trustees pushed forward along a new track, largely on their own. A tremendous amount of effort was put in by both individuals to take the project forward but due to inexperience with large construction projects, there were several omissions which had costly implications for the project.

Firstly, a construction company was appointed based on trust with no tendering process and references were not sought. This trust seemed to arise at least partially because the individual had a background in local authority planning. Further, no contract was ever signed with the construction company, against advice from Community Action Northumberland and Social Enterprise Northumberland who were both involved with the project in a support role. Both agencies had little experience with large construction projects but instinctively felt that too much was being done on trust. However neither felt that it was in their professional remit or had the confidence in knowing how it should be done to challenge the situation. Both organisations said they didn't have enough

technical knowledge to know what questions needed to be asked. Advice was given on formalising agreements and avoiding liability risk by both organisations, though this was not always in agreement and was, in any case, not always listened to. The community informed the builder of their bottom line and he agreed verbally to work to that price but then did not honour this agreement – the committee were told that the work was operating under "open book", which they later found out is non standard and usually only applied to insurance jobs. No contract manager was appointed, instead the project was relying on the builder's own contract manager to manage the community side of the contract as well. This left the project open to exploitation from the builder. The architect too was drafted in by the same company and so was not independent. None of the other trustees challenged the way the project was being administered until, all of a sudden, the project was half built, costs had escalated to over £600,000 and there were serious quality issues with the standard of the workmanship together with slippages in the timeframe for delivery which impacted on the funding that was secured. However, there was no contract to hold anyone accountable to.

Both support agencies feel that the advice on renewable energy that was needed wasn't available to them and so, like the community, they too were vulnerable to the information the building company was telling them. Both felt this type of expertise was outside their remit and should be being provided by an architect or project manager, so all they could do was advise that such a person was appointed, but this never happened. There is still disagreement over this as one of the trustees is recorded in the minutes of one meeting as having reported that a contract manager had been appointed, but it was later argued that this was an error in the minute taking. Community Action Northumberland said they were only approached by the community for help at points when things were going wrong, so in the interim they didn't know what advice was being ignored and what had been acted upon until it was too late. The builder claimed that the poor workmanship was the result of delays in the project meaning that the better craftsmen were already employed on other jobs! Finally, the situation deteriorated until both parties were threatening each other with legal action.

When legal assistance was obtained, the advisor suggested that although it was likely that the judge would favour the Community Trust on account of the poor workmanship, due to the lack of contract this was likely to be a 70/30 allocation and as such they would be responsible for their own costs, which would total around £50,000. In addition, the process would take around three years to settle. At this point they were feeling the pressure from the builder's solicitors but the legal advisors nevertheless managed to agree an out of court settlement of £28,000, which was deducted from the outstanding bill of £60,000 for poor workmanship. At this point, the Trust settled the remaining bill and the building company was subsequently declared bankruptcy.

Unfortunately the two original trustees who had led the project felt unable to continue to be involved with the project in the face of strong disagreements on how the matter should be handled. A project management group was then set up comprising three trustees, the new secretary, the chair and the treasurer of the Stonehaugh Community Hall Trust, an officer from Tynedale District Council and one from Northumberland National Park. Government Office for the North East opted out of a seat. A second construction company Green Energies were then appointed to complete the construction of the building.

In this case there was strong leadership from the two trustees who devoted such time and energy to making the project happen. However, there was a lack of project management and experience of managing contractors and construction projects. Although advice from community development organisations was provided, it is suggested that this was not always consistent and advice was not taken. Had there been stronger project management in place, many of the problems that Stonehaugh was then plagued by would have been avoided.

The responsibility for this must lie not only with Stonehaugh Community Village Hall Committee but also with the grant funding bodies who are happy to provide financial support without the corresponding insistence/support to ensure strong and sound delivery. It has been commented that part of the need of the two trustees to push on with the project without the other members was a result of the funding deadlines imposed by Government Office for the North East who had tight timeframes to spend their European Regional Development Funding. This puts pressure on projects to deliver a system at all costs, which is not in the interests of successful sustainable community skills development or carefully adapted solution deployment. A criticism of the public sector bodies that thus arises from this project would be that if monitoring was more personable and site visits and checks were conducted with sufficient frequency, the project wouldn't have ended up in such a mess. It is not enough to do paper based monitoring at the end of the project spend. However this is a finding that is not unique to Stonehaugh, a more proactive level of involvement would help ensure that community projects did not get into these difficulties in the first place. The advisors who worked to rescue the Stonehaugh project feel very strongly that funding bodies should provide, or at least insist on, suitable consultants (and provide a reputable shortlist) to support communities to progress their ambitions when so much public funding is at stake.

Lessons Learned:

Selection of suitable skills is key - ensure a designated project management team is in place and that this includes suitable experience and skills to ensure sound and watertight project management. This experience should cover the type, extent and scale of project.

Insist on a formal contract for any work agreed or agreement entered into.

Listen to advice from advice/support organisations and projects which have been through the process.

Supporting organisations should ensure that the advice given is not contradictory; if difference occurs then the differences and reasons should be presented clearly to facilitate a decision.

Grant awarding bodies should ensure that suitable support for project management is provided and this should be a condition of the grant. Site visits and checks should be conducted by funding bodies to identify omissions in the robustness of project management at an early stage.

Stage 4: System Design

With strong leadership and project management in place, once you have received your feasibility report and decided on your chosen system based on its recommendations, you will need to commission someone to design the system. This is likely to mean going 'out to a tender' if public funding is being used, as public sector procurement requires that a fair process of contract allocation is evidenced. This is usually either achieved through gaining three quotations for the work or through opening up an invitation to tender depending on the value of the work. This process is good practice regardless of the funding source and requires scoping out a brief for the work required and an invitation for suppliers to offer an outline price and description for the work they will offer.

A) The Tendering Process

With biomass systems in particular, the system designs done by each potential supplier can be quite diverse, as different elements are combined together differently to produce final systems that are often similar in output. As a result of this, procurement for the system design and the physical works tend to be amalgamated. Therefore, rather than going out to tender for a design and then separately for a supplier to implement that design, a single "design and install" quote is sought.

A second particular challenge that this process involves (like other major works) is that procuring a system design and installation quote relies on potential suppliers firstly putting in an outline guide price and then, only when one company has been selected, they submit a detailed design specification with an exact price. This is because of the amount of time and the necessity of a site visit required in drawing up an accurate price. This two-fold complication in the procurement process means that:

a) Quotes are quite difficult to compare because they may not be specifying like for like.

b) The point of your selection is based on the outline price, which can vary from the exact detailed price once the system is drawn up. If applying for grants, it is a common problem that the outline price is used for the grant application and the project does not proceed to accurate costings until the grant is secured by which time increases in price cause other parts of the project to suffer.

Case Study Kielder – Tender Selection

In the case of Kielder, the system design and supply were split, with a mechanical and electrical consultant being appointed to design the district heating system and then a boiler was commissioned separately to deliver that design. Despite the consultants' good reputation for standard projects, there was a lack of experience and knowledge about either biomass or district heating systems and so the system was designed without knowledge of best practice district heating system design. With biomass, one view is that it is better practice to choose a supplier and then work with them to design a system which utilises the strengths and works with an awareness of the limitations of

the chosen boiler/technology. This is likely to encourage a more holistic solution although adequate checks are required to prevent exploitation as Stonehaugh testify.

When all three tenders for the boiler system came in over budget, the tenders that were returned were very varied in price, partially reflecting the different technical options for providing the same output and so this was not a like for like comparison. Without detailed knowledge of the systems, it was hard to judge which was best value for money. The project which Kielder had planned to refer to for advice in western Scotland had just gone bust, so there was no-one to reference the tenders against.

The most competitive tender on price was quoted for a boiler which did not include/require an accumulator tank (also known as a buffer tank) because it utilised the existing oil boiler as back up instead. In the negotiation that followed, the accumulator tank was removed from the design of one of the other tenders, which was finally selected to deliver the project. One party states that the supplier offered to remove the tank in order to compete on price, whilst the supplier states that the client asked for the buffer to be removed and wanted to use the existing oil boiler as back up instead of the buffer tank that had been recommended. As a boiler supplier, they were asked to supply a boiler of a fixed size, not to design the system, and so was just providing what had been requested. In either case, the lack of an accumulator tank/buffer tank in the system is still deemed responsible for many of the problems today. Without technical knowledge on plumbing design, the community felt that they had to take this decision at face value relying on 'the experts' and trust that the overall system would work. To ensure more successful projects, it is important that parties work more constructively together to achieve a system that works rather than sticking rigidly to the boundary of their involvement.

Further, all the tenders returned used the same mechanical and electrical contractors (in this respect the installation problems which occurred were inevitable whichever tender was selected). Ideally this should have been put back out to tender however a combination of lack of available installers prepared to travel to Kielder, the pressure of grant funding deadlines and reluctance to go back to the community without a solution meant that the tenders were considered with the same mechanical and electrical contractors holding a monopoly.

Kielder Community Interest Company members express a need to be very clear in the structuring of the tenders for the feasibility work and for the installation work about which party is responsible for the full system design. The view was expressed that because several parties were involved, there was uncertainty between the parties engaged over the actual system design, and neither would take full ownership for it in the resulting system.

A key problem faced by this pioneering project was that nobody who tendered had done anything like this before. This was particular to the Kielder case in 2002 but unfortunately, although the market has now started to take off, a lot of companies are still new to the field and are still going through a learning process with projects that they take on. This is a consequence of any new technology, but does affect the accuracy of quotations and the experience of those delivering the service, which potential clients need to be aware of. At Kielder, officers at Northumberland County Council wanted to control the pump which delivered heat to the school (within the district heating system).

Schools are not simple places to heat because the traditional pattern of heating requires a large input of heating early in the morning followed by bursts at break and lunchtimes. As a result, NCC created an enormous draw on heat at 6am, which dragged a lot of cold water which had been sitting in the pipes (which had faulty insulation) all night through the system. This meant that other parts of the system did not receive the heat until the boiler had got the whole system back up to temperature. By lunchtime, the school had too much unused heat and so the whole system backed off again. This meant it responded to the evening peak well, but with better controls the system would have operated with greater balance. This involves altering mindsets over the demand and response profiles of heat supply as well as just the technical challenges.

Bellingham experienced the challenges of tendering and also offer some useful lessons:

In Bellingham, the major problem in the project was the complete underestimation of final cost as a result of changes between the guideline quote and the final quote. Bellingham were initially quoted around £40,000 but the end cost was nearer £65,000. Frustration was expressed at this system of first submitting a ballpark cost and then only progressing to a full costing upon selection of a supplier. Although common to most large-scale construction projects, the discrepancy between the two figures stood out starkly next to the traditional building quotations for the rest of the construction work, which were very accurate. The discrepancy in price was in this case largely down to misquoting by the installer, but also reflects an inexperienced market and difficulty in predicting the exchange rate in the current market system. Biomass boilers in particular are largely European in design and manufacture and so subject to the fluctuation in the exchange rate between the Pound and the Euro is a problem, and one which has actually been exacerbated since the completion of Bellingham project.

Because most of the grant schemes won't fund work retrospectively, the applications to grant funding bodies are made on the basis of the outline guide price supplied at the first invitation to tender. In Bellingham, the project costs had been based on the original £40,000 figure, and when the price increased, this therefore left the project £25,000 short. Those interviewed said that if they had known this at outset, they would have seriously considered whether to go ahead with the project, although in fairness, when all the tenders came back higher than this initial £40,000 they did still decide to go ahead.

Project members stress the need to give potential suppliers/installers time between being offered the opportunity to tender and putting the price in to establish exactly what the customer wants. However, because of time pressures of the grant schemes, in this case particularly the County Council's Renewable Energy Capital Grant Scheme, the pressure to spend the money resulted in the tender process being rushed. This was compounded by poor communication between the partnership and New Heat meaning that the invitation to tender was not sent out until two weeks after they thought it had been with the overall result that companies only had a two week period to respond and didn't have time to visit the site. It was felt that this could have been partially responsible for the inaccurate costing and a better relationship might have been built up if there had been this face-to-face engagement to design the system around the client's needs.

This initial (inaccurate) indication of cost also coloured their judging of the tenders because they then approached the appointment of the design and built with the need to

cut costs. Because of a lack of knowledge and experience, North Tyne and Redesdale Community Partnership made a sensible decision and were lucky to be able to ask New Heat to do the tender evaluation, although this did mean that they were relying on the judgement entirely of an external party. In this case this worked well but be aware of the vulnerability to bias that this might create.

When the quotes were then received for detailed costing after choosing the company which was based in Devon, the partnership sat down and talked through the non-binding quotation line by line with salesman. Despite asking lots of questions and feeling that they'd done rather well, they later found out that not enough detail was written into the agreement at this point. As a result, they felt they had dotted every 'i' and crossed every 't'' but only later realised how few i's and t's there were in the document compared to what there should have been. Ideally, they stress, you want a long lead time to allow plenty of time to develop detail in the specification so that you have more ground to hold the contractors to it later. To make matters worse, after explaining their situation verbally to the company representative, as a salesman he then had no further dealings with the project and the partnership were not allowed to talk to that person again. They realised at this point that they should have had New Heat with them when looking through tender, or the future project manager who they would actually be dealing with, but they didn't realise that they would not be dealing with this representative any further. The result was that much of what they thought had been agreed was never documented in the contract, which caused problems further down the line.

At the time though, they were not aware of this and the next step was to sign the binding quotation and to send back a 30% deposit in order for the boiler to be ordered. They were assured that the binding contract was the same as the one that they'd talked through and so were happy to sign it and send it off. This process was done in a rush as it arrived just before Christmas and had to be sent off immediately in order to place the order and achieve delivery before the end of the grant offer. Due to personal circumstances, however, the agreement was returned in early January, which meant that the delivery date was delayed from mid March to the end of May. In addition, the binding contract actually turned out to be different from the non-binding one they had discussed, but neither the Project Officer nor the supporting staff from Northwoods had spotted this.

In addition, the discussion with the salesman had outlined the fact that they had to wait for planning permission and so time would be pushed, but once he was out of the equation the new project manager wasn't so understanding. Part of planning permission was that the container had to be a demure colour - this was discussed with salesman who had agreed to just spray it before delivery, but this hadn't been written in to the binding contract. When the bright blue container arrived, the project manager said it wasn't in contract to change the colour but, after much reluctance, they sent someone out to spray it on site. The partnership reported very poor communication within the company and with the projects. They reported that they only saw project manager once and, in effect, he did not project manage the project at all. This was supported by colleagues at Northwoods. The partnership had repeatedly asked for project plan and had never received one. Finally, they got a delivery date for the boiler but in the end it turned up a day early and so there was no one to unload it. Again, the non-binding version of the contract had said the supplier would be responsible for this but in the final version this wasn't clear. In the end someone on site sorted it and then

the company recompensed them, but this added to the unnecessary hassle. This effect of this on the project was to knock confidence and so those involved began to clutch at advice from anyone they could – the only people they saw were the sub-contractors.

At this point, the relationship with New Heat became strained. North Tyne and Redesdale Community Partnership were frustrated that they knew that they didn't know much about it and so had gone to the people who were supposed to know and trusted they would sort out the issues and yet they were still having difficulties. This reached a head and North Tyne and Redesdale Community Partnership requested a face to face meeting to resolve matters. New Heat have accepted responsibility for some of the lack of information problems arising when they themselves were new to the sector and have since re-looked at how they deliver the service. Since then, relations have gone from strength to strength and New Heat have continued to support the project successfully.

Although the salesman was based in the North East, at the time there was only one project manager for the whole country (this has now changed and there are regional project managers). Bellingham had a particularly bad experience of appointing contractors from the other end of the country without a local representative but as a result they advise that, in this respect, price may not be the only factor you might want to consider here. This geographic disadvantage could have been overcome with adequate communication but the company in question experienced many internal changes during the time this project was conducted and so faces changed, which was very frustrating. The project manager was actually dismissed, partially as a result of this project mismanagement. The project officers stress the need to have a project manager on site to co-ordinate the installation and the pipe-work etc. Even though the pipe-work at Bellingham is much less complicated than at Kielder, the plans for the pipe-work turned out to be incorrect. This is something that they discovered was important to have specified in the original agreement along with every detail about the material of pipes, insulation, location of joints etc. The project assumed that the company would be dealing with all this, and they should have been, but Bellingham advise that this is written into the specification to make sure that it is covered and you don't end up with mis-joints down the line.

Whether any of this could have been resolved in the tender process is unclear. Bellingham certainly seem to have had a bad experience with their appointed supplier which shows the importance of judging tenders on more than just price, of utilising as much prior experience as possible in getting even the finest details specified in the agreed contract, of allowing sufficient time for site based visits and of thoroughly checking the final contract and insisting project management is both built into this agreement or provided locally on site.

A further warning on system design from Stonehaugh is related to the criticism that the availability of grant funding often acts to deflect energy and focus from what is initially planned. Instead the project design inevitably tries to morph to encompass the various elements eligible for support. Representatives from the project claim that it is easy to get carried away by this and go where the apples are ripest, rather than concentrating on the most appropriate solution for the situation. Although wise to seek grant funding where possible be careful that this does not become the driving force in system design.

Lessons Learned - The Tender Process

1. It is good practice regardless of the funding source to invite tenders for the work you require.

2. Do some research about the experience and reputation of those submitting a tender for the work, if possible speak to projects which have used them previously – did they do a good job, did the final cost increase much from the original price, did the specified system serve their requirement?

3. Seek advice on judging tenders – if something is omitted from one design ask what effect this will have on the performance of the system from a qualified independent. Don't just mix and match elements from different proposals.

4. If in doubt don't be afraid to re-tender.

5. Ask how much experience the mechanical and electrical contractors being used have had of the renewable system in question – such systems are different from other plumbing or electrical jobs – are they familiar with the system in question and have they undergone training or installed similar systems elsewhere? Beware if they have not and say it can't be that different from what they usually do for other domestic systems.

6. Be prepared for the outline prices not to be accurate and ensure that this is built into grant applications so that if costs increase you are not left with a deficit which impacts on other areas of the project. If this occurs do not be tempted to cut what might appear to be minor details, instead talk to your funders and or seek further funding if possible.

7. If you are a funding body, be aware of this challenge or moving from an outline price to a detailed costing and try and be flexible over your offer or the timing of the decision on the amount.

8. Allow plenty of time in the invitation to tender for potential suppliers to conduct a site visit and to discuss with you the solution they are proposing.

9. Seek external help with judging tenders if you are in need of technical support to interpret the best value design.

10. Be alert to factors other than cost which might impact on the success of the project and ensure they are taken into account in your decision.

11. Ensure you read the binding quotation from the chosen contractor and double check to ensure nothing has changed.

12. Establish who will be project managing the installation and request an early meeting to ensure continuity. Alternatively, write to them outlining discussions to date highlighting key agreements that have been discussed in the tender process.

13. Don't get carried away with capturing grant funding - ensure that performance of the system governs system design, not the availability of support.

14. Where several parties are involved (especially in feasibility and preliminary work) ensure there is clarity over who produces and is responsible for the final system design.

B) Sizing the boiler/system

Boiler sizing is applicable only to biomass, though sizing the system is an important consideration for all projects. For heat-based systems this should be based on a heat loss calculation, and for electricity generation this should be based on a balanced combination of energy need and generation capacity. Sizing is more crucial where you are looking to supply all of your load, this is more common in the case of heating, and thus biomass boilers than with electricity generation where in most cases this may be supplemented by the national grid. In off grid applications, a combination of technologies is likely to be required to meet the electricity need and so how they interrelate and how each are sized will be of vital importance.

At Kielder, some bodies report that the wood-chip boiler ended up being oversized although there were reportedly no plans to do so[3]. This means that a large system is running with only a low level of heat 'sales' to the consumer. The financial returns from lower levels of heat sale therefore struggle to meet the costs of running the boiler and the boiler runs on tick over mode for most of the time and so will be running less efficiently than if it was running at its optimum power output. In actual fact, at Kielder this is fortunate as six new houses are presently under construction and will be added into the system. This will help to provide suitable demand to better balance the system. The supplier confirms that the boiler is not oversized but rather the controls and lack of a buffer tank mean that the system is operating inefficiently.

At Kielder, one of the recommendations of the TNEI study into the efficiency of the system concluded that the boiler be shut down in summer. This was never suggested as an option at the system design boiler sizing stage when solar thermal hot water systems and/or immersion heaters could have been integrated to provide for summer hot water needs. This is because the initial feasibility study suggested a boiler with thermal buffer tanks. Buffer tanks are used in the UK because, unlike Austria where most of the boilers originate, summers are not warm enough to shut down the system completely and winter is not always cold enough to have the boiler running continuously. As a result of the recommendation buffer tanks have been retrofitted at cost, although the supplier claims that they are unlikely to work due the design of the system already in place. The economics for the sale of heat compared to cost of operating the boiler throughout the summer season needs to be taken into consideration at the feasibility stage and the option of providing summer hot water needs via a complementary solar thermal array rather than having to keep the boiler running should be strongly considered if the thermal performance of the building is sufficient that heating in summer is not necessary.

Bellingham found that when approaching a project for the first time you tend to focus on the importance of boiler sizing while, in actual fact, although important it seems that this

[3] Andy Hugman Kielder Partnership Regeneration Officer

is quite well understood and, with supplier information, was, in this case, straightforward. Rather, it is all the little things around this - like how it integrates with other parts of the system and the problem of the trades 'drawing lines around systems' in terms of what they are prepared to consider, which causes difficulties. In the case of Bellingham, there was some vagueness about how much wood chip a boiler of that size would go through and thus sizing the fuel store was more problematic. This was complicated by misunderstandings which resulted in North Tyne and Redesdale Community Partnership thinking that they would be getting a system that reduced fuel delivery frequency but in actual fact, of course woodchip requires significantly more deliveries in comparison to oil because the calorific energy density is lower and the product more bulky. In hindsight they say they should have gone for a bigger fuel store but were basing decisions on what would create minimal disruption and hassle in the construction phase rather than the long-term system use. This is an easy mistake to make. Those involved in Bellingham also stress the need to consider the fuel store alongside and integral to the boiler at the design stage. For Bellingham, the delivery load and storage sizes were indicated in a separate contract to that specifying the boiler. It was stated that the boiler contract, the fuel supply contract and the fuel store need to be interrelated, not split up in order to ensure easy correspondence and communication between these facets of the same system.

Lessons Learned – Boiler Sizing

1. Be careful to size the boiler correctly and accurately for the demand. With biomass, an oversized boiler is not desirable. Biomass boilers run most efficiently when running nearly flat out; on tick over, the system will run at a poorer overall efficiency and so the cost per unit of heat produced will be higher. This should usually be based on a heat-loss calculation, however also be aware that with the boiler supplier's guidance this is unlikely to be the main challenge you face. Instead, be alert to how this boiler will integrate with the rest of the system especially the fuel store/supply.

2. In the case of biomass, carefully consider the economics of running the boiler all year round or whether, if the primary summer requirement is hot water, consider utilising solar thermal or other heating sources in parallel to the biomass so that the boiler does not need to be run continually all year round. Alternatively use an accumulator tank to store the heat allowing the boiler to run for short bursts only in summer.

3. In the case of off-grid electricity where several technologies may be utilised, pay special attention (and seek professional advice) to their relative performance together and the required sizing and configuration of each part of the whole.

C) Design of district heating system

In the case on Kielder, the only major case of district heating from the case studies chosen, this was the part of this project that caused most difficulties, despite these problems being largely incidental to the fact that the fuel is biomass and more to do with the unfamiliarity of providing district heating networks full stop. In this sense district heating provides a new set of challenges. However, it is useful to review

some of these here as ongoing difficulties over the pipe-work of the district heating system have compromised the financial viability of the whole system and increasingly district heating is being considered in renewable energy installations due to the increased efficiency that it offers.

At Kielder, the district heating system design was very ambitious with over 5-600m pipe on the village side of the river alone and a pipe that crosses the river to reach and heat Kielder Castle. The buildings are widely spaced and the subsequent length of pipes in the scheme do not help its financial viability (either in costs of laying pipes or the subsequent loses in the system). However, the length of the pipes is itself not a technical problem, as in Stockholm's district heating system in Norway the district heating pipes actually pass under Riddarfjärden Stockholm's largest fjord. At Kielder, hot water is piped from the central boiler at 85˚C to the surrounding buildings by super insulated Flexalen underground plastic pipes. The diameter of which varies depending on the flow rate required. Once at the buildings Alfa Lavel stainless steel heat exchangers transfer the heat energy into domestic hot water heating systems (radiators) and hot water (hot water tanks) and a heat meter measures the amount of heat energy drawn by each household measured in kWh. In theory, the heat lost in these superinsulated underground pipes should be low – around 0.01 degree per 100m. However in Kielder, local experience has shown that snow lying on the ground under which the pipes run, melts and excavation works for the new housing removed earth warmed to 40˚C. Somehow the heat is escaping. This is discussed in detail below under 'on-site works'.

There are technical problems in the design of the Kielder system which is detailed for future avoidance. However , with regard to of the pipe-work, it is unclear whether this is the result of errors in the design or whether they are errors in the installation of pipes as a result of a lack of specification in the design or from not following any specification that was in place. Usually installation specification diagrams are passed to the main contractor/project manager who ensures they are issued to all relevant contractors. It is unclear whether, not being active on site this was carried out by the project managers. In either case, very clear design drawings specifying the exact pipe alignment would have overcome these errors. In particular, the district heating network at Kielder has a spurred arrangement with a flow and return from each building. This should have been a looped system with each pipe having a looped end allowing free flow of water. Instead the pipes have dead-ends which affects the circulation of the water at the ends of the system. The balance of the water flow in the system across these loops is also not good meaning there are pressure differences in the system.

The controls which record the transfer of heat from the district heating pipes to the individual household in Kielder are located within each property. Upon arrival there were eight meters with slightly different rated capacities, specifically ordered for the range of buildings being connected to the system. However, the difference in capacity was not recognised by the contractors who installed the meters randomly. The positioning of these meters also means that each resident actually has one room's worth of heat before the reading is recorded which does not help with the revenue collection for the scheme, and the positioning of these meters inside the property means that meter reading is intrusive to the tenants. In future system designs it would be best to ensure that the heat exchangers and, therefore heat

meters, are located at the entry wall to the property to ensure accurate charging and increase accessibility for maintenance and meter reading.

Further, the meters that were used at Kielder, were not actually payment heat meters but monitoring heat meters and so are not tamper resistant. This decision was due to the difference in cost between the two meters. A recommendation from the Community Interest Company who ran the scheme was that, in future, meters should be electronically linked to the boiler room so that an accurate reading could be recorded remotely. Flow meters which regulated the flow and return from various buildings were also wrongly installed meaning that system readings were incorrect. Variable speed drives are usually installed to minimise electricity consumption, however due to lack of knowledge these were not specified by the consultant system designer.

Lessons Learned – Designing District Heating:

1. Be realistic in the design as to what the system can provide for – plan for buildings within a reasonable close proximity to the boiler to keep length of pipe runs down.

2. Locate automatic meter monitoring (connected electronically to the central control panel in the boiler room) at the very boundary of each property to allow remote and accurate billing of heat. If not automatic, at least position payment meters at the first point of entry to the property and accessible externally.

3. Check whether your funding stream covers pipe work external to the actual boiler.

4. Ensure that precise instruction (in the way of accurate diagrams) is provided by the district heating system designer for the pipe-work installer to ensure that installation of the system does not cause any errors which once buried will be hard to identify.

5. Don't cut corners over relatively small costs in the specification. Once buried the overall long term efficiency will rely on the quality of the system installed. It is better to pay a little more for a system that works well over many years than make short term minor cost cuts and end up with a problematic system that requires far more to rectify. It is recognised that this is very difficult for community finances under pressure and so it is absolutely essential that such costs are represented accurately at the initial design and feasibility stage and so are built into funding applications and budgets from the start. It is often the case that schemes do cover such costs in the early stages but then are cut out/compromised as the project progresses. This is usually the result of other costs rising. Ensure that estimates of cost are sound across the project to prevent this occurring.

6. Ensure variable speed drives are specified in the design.

D) Fuel Supply and Storage

Fuel supply should be the first consideration if biomass is being considered. Ensure that the type and quality of supply is considered alongside where it will come from as this should be taken into account when specifying the type of boiler.

The boiler in the case of Kielder was chosen to be able to handle fuel of a range of moisture contents (due to the rotating firebox which enables it to burn a variety of sizes and moisture content fuels). There is a range of boilers on the market each with different tolerances to their fuel quality. In your choice of boiler, bear in mind your fuel supply and chose your boiler to match the likely level of tolerance required. Seek advice where required.

At Kielder, woodchips are supplied by the Forestry Commission to the boiler store at a specified moisture content of 25-35% and diameter of approximately 25mm. It is worth noting that delivery arrangements for woodchip today are more commonly based on an measure of KWh of heat (through the use of a heat meter). This encourages good quality dry wood chip to be delivered because there is less volume and weight for better heat return (with charging by tonne wetter wood is heavier so you might be receiving a very poor heat return for the price). However, at the time that the Kielder project was developed, this system had not been devised, and so because chips were bought by the tonne it was important to have the moisture content specified. It is fair to say that the system has worked well for Kielder and the Forestry Commission have not only provided a trustworthy supply of fuel but were very accommodating in only charging for every other load to help the scheme's viability. However, future projects are recommended to work on the basis of charging per KWh for the reasons above.

The storage of the fuel is also of primary importance. At Kielder, the woodchip is stored in a purpose built storage facility which also houses the boiler. This unit has a moving floor which automatically feeds the boiler and the store is designed so that the wood chip is delivered by a 2-3 tonne trailer which fills up the store 3-4 times a year. The store has front front-loading access through opening double doors and the trailer has a Fleigl hydraulic ram whose push action empties the load evenly onto the floor. This system is very effective and works well but it was a costly option necessitated by the stringent planning requirements. More stringent planning requirements were imposed because the boiler house, a retrofit to the site, was positioned in a prominent central location in front of the workshops rather than tucked away behind them. This precluded any top-loading store (with roof opening) that could have received the chip from standard machinery, or the now common, hook-bin stores (containers filled up off site). An underground store was not possible due to proximity to the river and surface groundwater.

Although this system works very well it added approximately ….. to the cost and required a special trailer costing £13,000. One comment received was that not enough thought had been put into the design of the boiler house/fuel store because if there was ever a burst and an outflow, the water would flood into the fuel store pit and not only soil the fuel but mix with the electric motor. This stresses a very generic importance of detail in design and the need to foresee circumstances and design the system to minimise risk.

At Belllingham, on the other hand, a hook bin system was preferred – this is a metal container which can be transported on a lorry for refilling or filled on site with a tip bucket. Bellingham did experience some problems of the woodchip getting damp. Advisors thought that it was to do with condensation on lid on storage unit. Apparently some are lined, The one at Bellingham was not lined and so after complaints, a cowl has been installed to let moisture escape. The project officer felt that this should be anticipated by the supplier in advance and not left for client to discover problems after purchase. This fuel supply is also from locally sourced biomass. A tree surgeon from Allerwash provides wood on the basis of projected tonnage of wood used in a year - he has to have his supply sorted a year in advance so you need to get your supplier sorted right from the beginning and tell him you're going to need x tonnes ready seasoned. The fuel supply arrangement should be the first thing you set up - do not expect to ring up and have it delivered once the boiler is in place, like you would with oil or other.

Lessons Learned – Fuel Supply

1. Research the two options for agreeing a supply contract – payment by KWh or payment by tonne with moisture specified. It is recommended that you use payment by KWh system.

2. Research your fuel supply options as early as possible to establish likely cost, availability, frequency of delivery and moisture content quality. This will play a large part in the way you specify the boiler, position the plant, build your store and agree your supply contract. Most of all - choose your boiler to suit to your fuel source.

3. Ensure that the fuel store is well thought out – accessible, watertight, requires minimal handling and optimises cost and visual design, and that it is positioned sensibly in relation to the boiler to minimise complicated design.

4. Be aware of the different storage options and assess what works best for your site with consideration to planning permissions as well as technical operation.

5. In designing your fuel store, consider firstly whether an underground store, hook-bin store, or front loading store is most suitable for the site from a logistical point of view. An underground store, separate from the boiler room, will be more costly initially but may enable greater volume storage and thus lower cost of less frequent deliveries. However, this may not be possible in every case. Hook and bin systems tend to be cheaper but are more unsightly so may need careful positioning.

6. Be aware that as the largest structure in the project, the fuel store (which may or may not also house the boiler plant room) is the most likely part of the project to be affected by planning constraints. Early on explore ways in which a store could be masked – by positioning, chosen colour, or planting to minimise its visual impact from a planning point of view.

7. Insist on informed design of the store so that it is suitable for purpose – watertight, flood risk proofed, accessible etc. Many of the bad news stories around biomass have been the result of damp storage of the chip!

Stage 5: Installation and On-Site Works

The first warning that almost all the projects flagged up was to be aware that once all the decisions are made and the grant agreement put in place, the construction and installation process then occurs very quickly. This is often also put under pressure by tight funding timeframes. It is worth paying extra attention to the installation process and not rushing unfamiliar procedures. Many of the problems at Kielder were as a result of errors made by the contractors during the physical site works, due to a lack of knowledge and familiarity with the technology and the system. This is case studied below:

Case Study: Kielder's Leaky Pipes.

The district heating system has never performed as effectively as the 85% heat recovery efficiency forecast in the initial feasibility. This was suspected to be a result of leaking heat from the pipe-work and the fact that the boiler had to be run all the time, whether or not heat was being drawn by the end users.

In 2007 TNEI were appointed to review the performance after the M&E contractors disputed the claim of poor workmanship and the possibility of the system ever operating at the forecast recovery rate. The report concluded that although there were many instances of minor errors in the pipe-work there was no one major factor that could account for the poor heat recovery and therefore no one solution to fix the issue. Instead they suspected a systemic error in the pipe-work, however this could not be proven without digging the whole system up and the decision was taken by Tynedale District Council and the Forestry Commission that this would not be economically beneficial.

Some of these errors include:

- The Flexalen plastic pipes for the district heating are designed to be joined with Eurofusion ensuring that they are bonded at a molecular level and so are leakproof. However, this process was not done successfully on site; crucial rubber seals were missed and the pipes were not tested before being buried. Leakage then occurred underground and saturated the insulation in the pipes channels making the insulation ineffectual meaning that heat is continually lost to the ground. This took some time to be discovered because the pipes had already been buried. This fault still affects the operation of the system to this day and in the recent construction for the new housing the earth removed was found to be at 40˚C.

- Further, the pipe insulation had major gaps, the fact that there was never any insulation installed on the pipe that crossed the river under the bridge was not noticed until some routine maintenance was carried out and this was spotted. This would have been responsible for a large amount of the heat lost.

- The problem of either pipes being wrongly configured, whether this is due to no/inaccurate pipe installation diagrams or these not being followed properly, means that the water backs up against dead ends which occur in the system layout, which affects the water's circulation. As a result, the houses at the end of the

system aren't getting enough heat, which affects the operation and reputation of the system.

- The rubber ends of the pipes were designed to be left above ground, however these were buried at Kielder meaning that…..

- Silt filters which should be emptied quarterly, were positioned under people's sinks requiring the cupboard to be emptied every time it was checked and so checks were performed too infrequently. Similarly, a filter positioned in the boiler house had been covered by insulation so no-one knew it was there. Corrosion of particles in the system was one of the findings of TNEI's report; it is likely that infrequent emptying of filters may have contributed to this.

- The original feasibility study had specified variable speed drives were fitted for the pumping system. Instead at some point during installation, these were exchanged for fixed speed drives – possibly in response to cost reductions, this is unclear. However this has introduced inefficiency into the system and increased electricity usage.

Many of these errors stem from the fact that right from day 1 there had been disagreements over who was project managing the installation. On paper the pipe-work contractor had the largest share of the contract but the builder was the named lead and Tynedale District Council had understood the architects were to project manage the capital build, in actual fact the architects claim never to have agreed to this. The result was that the project was not sufficiently closely project managed. Related to this, the progress on work was intermittent, the chair of Kielder Community Enterprises Ltd commented that people only showed up once a week and so it was difficult to keep tabs on things. He stressed that the boiler itself caused little difficulty and most problems could easily be resolved by a call to the supplier and over the phone instructions. He supports the assertion that the main problems were with the work done by the mechanical and electrical contractors for the work, however, he says they have never admitted responsibility for these errors. It is true that remedial work has since been done to the pipe network to correct incorrectly fitted joints and meters have been tested and replaced where necessary but heat recovery has not significantly improved.

A technical review of the whole system was commissioned by Tynedale District Council in 2007 and undertaken by Sustainable Energy Limited. They concluded although the system was experiencing 42% higher heat loss than the design specified, no single error in the system was responsible but rather there were distributed defects across the system both in the pipe-work and in the detail of the system: mal fitting of thermostats, insulation, not attaching the foam barrier to the internal pipes properly, lack of an isolation control on the existing oil boiler meaning the hot water was passing through a cold boiler before circulating through the system etc. There were significant pipe losses but without digging the pipes up it was hard to pinpoint exactly where and how this was occurring. It was postulated that pipes could have split or otherwise there was a systematic defect in the pipe-work. Most of the heat loses were found to be to the YHA and school, where heat loss around joints were considerably higher than expected. Further, the system over-sizing and low user demand in summer was responsible for a greater degree of inefficiency than the heat lost. A thermal store (which was taken out of the design specification) would increase seasonal efficiency from 61 – 80%.

At Gairshields, although one company was appointed by Community Energy Solutions to deliver a turnkey solution, different people came to do different parts of the work and although the project manager was pleasant, when the contractors arrived to do the work, the tenants felt that the manner in which the work was carried out in the property was poor. They described instances in which the workmen were rude and careless in their approach and refused to give any indication of when they would return to continue the work with frequent long lapses between visits. Because the tenants were not paying for the work and were very grateful to finally get a solution to their problem, they felt that they had no grounds to complain. The quality of the external boiler house was also not up to standard. Community Energy Solutions were unaware of the situation until this review of the project took place and brought it to their attention and they were then able to follow the matter up with the contractor. The external boiler house works have now been rectified as a result. A further problem was encountered as the project managers had not reckoned on building control permission being required and so the additional cost of £50 and delay of gaining approval for the works was encountered. Similarly there was some confusion at Bellingham, where at first the Development Trust had been led to believe that planning permission was not required but then found out that it was. This caused a delay in the project whilst waiting for planning permission which, then delayed the issue of tenders and pushed the delivery up close to the funding deadlines.

At Stonehaugh, the original design the proposals included two micro wind turbines which were roof mounted. In fact it was unlikely that these would ever provide any significant power except a contribution of the electrical input to the ground source heat pump. However, having paid for and installed these (receipts were obtained from the original building contractor) the supplier, who had never been paid for the equipment saw fit to remove them during remedial work on the solar photovoltaic panels. Upon legal advice that although legally the turbines were unlawfully removed, there was little the community could do other than refuse to pay for the remedial work which they did and have heard nothing since. The National Park were keen that the windows for the building were sourced locally as to support the local economy. However, when commissioned the windows were badly fitting and leaked, the wood looked out of place with the rest of the design and the joinery was of poor quality. Further, because the wood was different to that of the rest of the building it dries out at a different rate, causing warping. The estimated cost for rectifying the problem was around £24,000 which was outside the budget of the project so the decision was to 'make good and mend' for a lower figure of £9,000. This shows how easily good intentions can cause expensive difficulties if not thought through.

On the installation side, Stonehaugh experienced frustrations not only with the intermittent arrival of the construction company but also with getting both Northumbrian Water and NEDL (CE Electric) to conduct the works scheduled in the project plan. Payment was requested up front and then little indication of when the work would be conducted was given meaning that it was difficult to plan other work around this. In addition people didn't turn up on site when they said they would. This was particularly difficult for those who had to book time off work to meet people on site and then had their time wasted. Progress was reportedly only achieved upon requests for compensation for project delays.

At Heatherslaw Mill, although there was little funding pressure and most of the funding came from private capital, the works had to be timed not only with the off peak visitor season as expected but with the avoidance of times of biological sensitivity in the river. This gave a very narrow window of opportunity for the work. Even despite the existence of a project manager, there was confusion over the completion date which caused a temporary panic as one party had been working to a different completion date.

Heatherslaw were very lucky to benefit from a skilled local electrical engineer with a lot of experience who was a perfectionist in his work. He was prepared to adapt things and use non-standard 'bits and bobs' for the job in order to create a system that really worked. The project officers cannot stress enough how helpful it was to have someone as flexible and accommodating who was prepared to come up with creative solutions to make the system, which was itself quite challenging, work. This further demonstrates the importance of choosing the right people for the job. In many cases, it is better to get a skilled craftsman who is committed to the outcome of the work and is prepared to adapt and learn where necessary, than a 'by the book' installer who has no local ownership of the work or ability to adapt to non-standard applications.

Lessons Learned:

Appoint a specific project manager for the installation who is going to be available on site to manage the installation and associated works. Ensure this project management is clear and that the project manager keeps a comprehensive oversight on the work being carried out so that they are aware of when things go wrong.

Ask for a timetable of works so that you know when contractors will be on site and how the work will be spaced out.

Ensure that the contactors appointed are familiar and experienced with the materials in question. Be wary of installers who claim that one pipe is much like another, especially when district heating success relies on good workmanship in the design and construction of the pipe work connections. (The difficulty at Kielder was that even if this had been written into the tender, they wouldn't have got it because the industry wasn't experienced enough to provide it). Consider choosing local craftsmen with flexible skills as well as standard tradesmen but note this needs to be balanced with experience and understanding of particular systems and specialist knowledge. Needs will differ between systems.

In general a good rule of thumb is to keep pipe runs as short as possible and the boiler in close proximity to the end user buildings to reduce system losses.

Ensure a detailed plan is provided by the system designer for the contractors to follow and that the pipe-work is checked for leakages before burial.

Check that all parts of the pipe-run are fully insulated to the letter of the plan provided by the system designer. Make sure you get a warranty for the pipe work.

Understand that you will be pushing people outside their traditional field of expertise and don't rely on/trust them to know all the answers. Try to appoint on the basis of

good recommendation and question contractors and seek advice if you feel something is going wrong.

Ensure parts which need ongoing attention or access are positioned conveniently so that maintenance is easy to perform e.g. silt filters or meters.

Funding pressures push people through the process too quickly. Try to builtdsufficient time into your programme to address and problems that emerge. If necessary go back and talk to your funders if there is a problem – they may be able to offer some flexibility for an exceptional circumstance. Don't be tempted to rush things.

Discuss building control permission as well as planning permission before works commence to ensure all permissions have been already secured to avoid project delays part way through

Be aware of natural and social as well as funding related restrictions which might dictate the timing of the site work.

Stage 6: Commissioning

The process of commissioning involves making sure the whole system is working as it should and includes safety checks, programming of the appliance and training on the operation of your boiler. Do not agree/ sign for commissioning until you are happy with the operation of the system and confident that you or a member of your team is comfortable in the operational requirements of the system and has received sufficient training in maintenance. The Chartered Institution of Building Services Engineers provide a Commissioning Code B, which presents current standards for good commissioning practice in the form of recommendations and guidance, dealing with the work stages required to commission boilers. In the case of Kielder, the boiler itself has performed exactly as expected and as promised by the supplier with very few problems, but this good technology has been let down by the rest of the industry in terms of the resultant system performance.

The Commissioning process at Stonehaugh was complicated by the fact that half of the installation had been done by the first rogue company and then had been completed by a second company who had to do much remedial work from the first contractor. For example, the whole electrical wiring system had to be taken out and redone at cost, in order to make the project safe to continue. Although this took a lot of work, it was done very effectively and the systems now work together very well. However this involved a risk by the second company in terms of commissioning, as this involved signing off another company's work which was known to be problematic. Warranties on workmanship are still a particular challenge as the original bogus company have now ceased trading and so there are no warranties valid for this work, the work conducted by the second company during phase two comes with the usual warranties but where the two systems merge there is a grey area as to what is covered by whom. Like Stonehaugh, Bellingham stresses the importance of establishing exactly what the warranties cover and for how long. If a company ceases trading, the warrantee is likely to be void unless the original manufacturer will cover it.

Lessons Learned

Do not agree/ sign for commissioning until you are happy with the operation of the system and confident that you or a member of your team is comfortable in the operational requirements of the system and has received sufficient training in maintenance.

Always insist of warranties for any work undertaken and ensure that you are clear on what is covered and for how long.

Stage 7: Operation and Management

Of all the stages of developing a project, 'Operation and Management' tends to be taken for granted. If the installation is in a community building or building in co-ownership or management, this issue is particularly important to address early on. Questions such as:

- Have the right people received training in how to operate the system?
- Who is responsible for the regular maintenance?
- If heating is sub-charged who is responsible for billing and revenue collection?
- What financial system needs to be in place to manage any revenue received? (This could be district heating – sub metering or income from electricity sale to the grid etc)
- What support for ongoing maintenance can be agreed with the installer? Are they able to respond to local call outs and if not can an arrangement be made with a separate local company? What effect would this have on warrantees etc?

System Operation

The works at Gairshields Farm were finally completed in December 2008 and the tenants are pleased with the solution. However no post installation training was offered to the tenants on the operation of the system. As a result they were unaware of the ability to operate the radiator system independently of the boiler and felt they needed to light and run the boiler every day. The consumption of logs was therefore much higher than expected and the advantage of the system over a regular log burning stove was lost. Upon post project review, Community Energy Solutions said they were unaware of the lack of training provided by the supplier and so were surprised when they heard that the tenants were not delighted with the running of the new system. This has now been rectified but shows the important of post installation support.

At Stonehaugh the operation and management of the renewable energy system will fall to the 13 trustees. The agreement is that one person will be nominated to monitor the system as part of the wider building maintenance though at the time of writing this has not yet been finalised. Already, there has been a problem with the ground source heat pumps which has necessitated a call to the original supplier in Coventry as the installer is no longer trading so there are no warranties on the work.

One point worth noting (although again not connected to the renewable energy side of the project) was the confusion that arose out of the term 'lease'. Stonehaugh Social Club, who had gifted the land to the project, had understood that they would receive in return a 'lease' on the building for 25 years. But once again no lease was drawn up. The Stonehaugh Community Hall Trust claimed that the term 'lease' was being used in a loose sense to refer to an agreement on use and relied on advice from the solicitor and the charity commission which suggested that this should be a 'hire agreement'. This advice was provided on the account of a relationship between Stonehaugh Social Club and the brewery that supplied them, for if Stonehaugh Social Club were to go into liquidation the brewery may be able to seize the lease as an asset and therefore a hire agreement was deemed a less risky arrangement for the future of the hall five years. This highlights the importance of the establishment of contracts and written agreements early on and a thorough assessment of the legal implications of these arrangements if

anything should go wrong. If the building had been tenanted, this confusion could equally have applied to a renewable energy installation so it is worth noting.

The latest arrangement is that Stonehaugh Social Club and Institute Ltd use the hall four nights a week, all bank holidays and five extra days for £30,000 pa. They also have built in office space to lease and have had interest from local organisations and course providers. This provides the hall with a regular income and therefore makes it in financially sustainable. However, the extent of community disagreement has meant that a lot of people in the village won't have anything to do with the project any more and so won't use the new hall. It is hoped that in going forward, the success of the project and the wonderful facility that has been created will encourage people to come out and use the building but it will be a challenge for the Stonehaugh Community Village Hall Committee to overcome such a divide and for the whole community to put the negativity into the background so that the community can move forward from the unpleasantness that has surrounded the construction phase.

Managing District Heating Revenue

Originally, the Kielder District Heating Scheme was set up to be managed and administered by Kielder Community Enterprise Limited a 'Community Interest Company' set up by Kielder Regeneration Initiative to manage the suite of micro businesses listed above. If this had worked the project would have been a very attractive income source for the community and a true example of community empowerment. Unfortunately, there were significant problems with the financial management of the project which meant that recently, operation of the scheme has been transferred to the Forestry Commission, who now provide the management, financial administration, fuel supply and maintenance of the scheme. The capital assets are still owned by Northumberland County Council after being transferred from Tynedale District Council upon creation of a Unitary Authority. The intention was that the assets would originally be transferred to Kielder Community Enterprise Limited this was never possible due to ongoing management concerns.

The first analysis of why this didn't work has to look at the fact that the project was driven by the public sector, particularly the vision of Tynedale District Council and the Forestry Commission (which in itself is to their credit). Early on in the process, North Energy Associates acting as feasibility consultants, held a public meeting to inform everyone of the proposal and gather feedback. Initial community reactions were mixed with many expressing antagonism because they thought it was going to look like Egger (a large scale industrial timber processing plant nearby in Hexham). There was some enthusiasm but this was from a few key individuals who were focused on the carbon argument. It is the dedication and commitment of these individuals as well as the strength of support from Tynedale District Council (who bankrolled the project to the tune of £60,000) that has made the project a success, but the sense of local ownership was not widespread.

Although representatives from the Parish Council were reportedly involved at the earliest stages, Kielder Community Enterprise Ltd (who were responsible for managing the scheme) feel that they were not involved in the scheme until it was "almost up and running". They felt that they had little knowledge about the system design or the site works which had taken place and so taking over the management of the scheme was not easy. In reflecting on the scheme key individuals said that they needed to be

involved in the project from the outset in order to better understand the system and felt that there was inadequate training provided by the boiler supplier at the outset. Although the boiler is fully automated someone still checks on the boiler every day. Don't underestimate the input and maintenance required and prepare and train someone to do this. The chair of the KCEL reports that when they agreed to take it on, it was understood that somebody could be employed to check the boiler every day, but no money materialised and so the chair did this on a voluntary basis for years. Now this is performed by a Forestry Commission employee. Knowledge about the importance of a good quality, low moisture content wood supply was at one point not transferred with the change of face and so there was a glitch in the smooth operation until the fuel supply quality was re-established.

There was some tension between the Forestry Commission and Kielder Community Enterprises Limited (KCEL) over the perceived capacity to manage and administrate the scheme successfully. Operationally, there have been issues with billing (by July 2005 nobody had yet received a bill for the energy used) and calculating the proportionality of the heating allocated to each of the six workshops which causes bad feeling amongst the tenants. This meant that bills when they did come seemed high and there wasn't confidence in the absoluteness of billing method. Subsequently, some of the tenants didn't have 'buy-in' to the system – they felt it had been imposed on them. They had been sold the idea based on 'dirt cheap' heating and although the heating is a bit cheaper, it didn't meet the artificial expectations. Additionally because of the timing of the project, in their minds they compare the price to the oil costs of the past not today's prices and so don't see it as that much cheaper. The situation then wasn't helped by the loss of the key account manager half way through who had been a focal point for knowledge on administration - the replacement lacked this expertise. KCEL also experienced some further staff management issues which affected financial record keeping and are the first to admit that the project needed better management. In addition, there were small scale interpersonal relations as in any small community. However, it is felt that this is often difficult to enforce when most are working for the village as volunteers in addition to their day job. It's important to stress the scale of what the Community Enterprise Company took on in terms of the whole portfolio of projects was an enormous challenge to the skills set of any community, let alone a small remote purpose built forestry village. It was commented that someone independent should have been employed; both to bring experience and external validity which might have helped overcome personal relationship issues. Further, it was expressed that managing the portfolio of initiatives in such circumstances would still have been a challenge for people with experience and to this end credit should be given to a valiant attempt.

The maintenance of such systems is often underestimated. There is a significant need for funding bodies to include some revenue budget for the long term maintenance of the system as well as the initial capital cost.

Physical Maintenance

Bellingham, like Kielder, stress the need to be aware of the additional maintenance that biomass requires over traditional energy sources. In Bellingham they specified a turnkey system which was fully automated and the project officer made clear that she wanted little to do other than ring up and report a problem. Although the system that they installed is fully automated, this actually requires more involvement than the

concept of a fully automated system might imply. As the project officer describes "it's all about expectations over what a turnkey project consists of. With oil, it was set, came on, and was delivered automatically with very little to do until something goes wrong – although biomass is not difficult, the system does need more interaction"[4]. As a result, the project officer has to play a bigger role than initially envisaged and although she doesn't mind the involvement on a personal level, she is aware of the difficulty that this poses to the partnership as their next employee might not be so happy with the expectation to take on duties so far outside the role's job description. You need to be more hands on and to check different bits – this isn't covered under the description of the project as turnkey by the supplier. There were some elements of the maintenance that the project officer did not want to do - ash emptying and the greasing –weekly and monthly checks etc. This is the type of role would be covered by a caretaker's contract, but no such person exists within the Bellingham project. As part of their service arranged for the fuel supply which New Heat drew up the fuel supplier is paid to do a certain level of maintenance to the boiler. If the arrangement is a set price this offers the additional advantage that the supplier will have an interest in supplying good quality fuel in order to reduce potential maintenance work. As previously mentioned, the supplier also charges per KWh heat delivered so payment is for the amount of heat not the volume of wood delivered encouraging maximum efficiency.

It is essential to be clear how much involvement you want – if there's a problem how and who do you call in resolve the fault? The chair of Kielder Community Enterprises Limited expressed dissatisfaction with the control system and the support provided by the company who charge a driving charge £35/hr to get to Kielder then £55/hr to do any work. This is a particular factor in remote rural locations. He raised the suggestion that a local electrician should be involved in the training provided by the boiler installer, and made aware of how control panels operate and how to fix them. To facilitate this, the panels themselves should be manufactured to be more universally intelligible. The boiler computer can be controlled and monitored remotely via a modem. This was not chosen at Kielder but may have helped alleviate some of the control panel call out difficulties. The boiler supplier provided some on site training but throughout the period of the project, the three people who had been trained up and who were keen and eager to look after the system gradually left and knowledge and understanding of the history and operation was not always transferred.

Unfortunately, the Heatherslaw hydro generator was flooded in the September 2008 floods which were two and a half feet higher than the highest ever maximum recorded in the mill cellar of 1948 and reached the granary, which must be unheard of because they wouldn't have built the granary anywhere near flood level. Flood precautions have not been raised to this level and although they are hoping it was a one-off, if climate change predictions materialise, such floods are likely to be a more frequent occurrence. In this sense river based generation is more resilient as the flood water damaged the electrics and repairs were needed. However, because the electrician was local, this did not pose a significant problem.

Lessons Learned

As with other community initiatives, community instigated and led initiatives do not suffer from the lack of ownership that public sector led initiatives can. In the case of

[4] Lesley Allen – Project Officer, Bellingham and North Redesdale Community Development Trust

Kielder the public sector organisations involved could not have done more to help make the project a success but this does not replace community buy-in and this project suffered from a lack of local ownership.

If the project is public sector facilitated, ensure key bodies are involved from the earliest discussions right through the system design and installation and everyone else has the opportunity to be involved.

Ensure that there is clearly defined and agreed accountability for the management and maintenance of the district heating preferably in the form of a maintenance agreement and ensure that this is properly costed.

Ensure that billing is undertaken competently and accounting is transparent. If upon honest appraisal, there aren't the relevant skills, experience, time or impartiality available to deliver this within the community, the function might be better delivered by an external body. Seek advice on the availability of organisations which can take on this responsibility and offer an Energy Service Company (ESCo) arrangement.

Ensure training is provided for at least one named person to assume a caretaker role and ensure that either telephone or other after sales support is built in as part of the package. Biomass boilers are more like living organisms and so need some ongoing care and attention. If this is not possible ask a local electrician to be present during this operational training and try to establish an agreement with the installer over the warrantee coverage over external workmanship.

Install tamper resistant remote metering for each building on the district heating network which can be read remotely from the boiler house to avoid invasive meter readings and potential for tampering.

In the billing charge, it was suggested that a standing charge was included to cover cost of running biomass facility even when houses were not using the heat - as electricity was still being used to pump the water and biomass still used to heat it – all other utilities do this.

Particularly if the project is in a rural area, consider remote access to the ECU to allow the supplier to assess fault messages or errors by modem rather than necessitating a site visit.

Personal relations are key to community projects. Involvement of outside organisations often give a project validity in the eyes of the community and may encourage involvement of community members who would otherwise be discouraged by poor personal relations with internal members core to a project.

Manage expectations especially over cost and pricing. In your project publicity and planning it is better to undersell and for people to be pleasantly surprised than expect the world and be disappointed.
.
Funding bodies should consider providing a proportion of the capital funding for long term maintenance.

8. Project Finance

Cash Flow

Although renewable energy projects are often eligible for some grant funding, boilers are expensive items to purchase and once entering a contract on purchase, the organisation is committed to a timetable of expenditure which may not be reclaimed for several months. In the case of Kielder, Tynedale District Council ended up bankrolling Kielder Community Enterprise Limited to the tune of £60,000 which effectively acted as an interest free loan. For organisations without such strong financial support from the local authority this could present severe difficulties. A particular challenge was dealing with what is referred to as the 'funding window'. Much of the design work had to be prepared in advance of the funding application because when funding is granted in April of one year and has to be spent by April the next year and there is a nine-month build period, the project has to be ready to go. This impacts on the tender process and often causes problems for inexperienced project delivery agents.

Bellingham Station Yard in particular stresses the important for businesses and community groups to think about cash flow. They faced a huge issue of payment up front - for example, a 30% deposit was required for the boiler and this was not able to be reclaimed from grant providers for some months. The project officer suggests that there is a strong case for grants not to be paid on receipt in order to accommodate these challenges. Bellingham secured a mixed bag of funding for from New Heat, Tynedale District Council, the Parish Council and the Heritage Group, Low Carbon Buildings Programme, the local County Councillors' allocation and Northumberland Strategic Partnership's Northumberland Renewable Energy Capital Grant Scheme run by. Managing the various deadlines of delivery for these different agencies was challenging and resulted in some parts of the project being rushed through to meet these externally imposed deadlines.

Working with grant funding

The challenge of working with grant funding schemes is exemplified by Gairshields Farm. After Community Energy Solutions took over the project in 2007 and it was established that ground source heating/air source heating was not going to provide the most cost effective solution – biomass heating was explored. Woodchip is not suitable for the domestic scale and wood pellet is the most expensive of the three biomass options, so was not seen to offer a significant saving over the existing heating system. Given the primary driver being the need to reduce fuel poverty this was not seen as suitable and so three quotes were sought for log gasification units which would allow the tenants to utilise waste wood on the farm and have flexibility on the sourcing of the fuel from local suppliers.

Through the connection at Northumberland County Council, the opportunity arose to take advantage of the Low Carbon Buildings Programme 50% grant scheme as the property was council owned and so an application began to be prepared. However, it was found to be very difficult to get the requisite three quotes from the suppliers listed on the Low Carbon Buildings Programme Framework Supplier list. Only two quotes were returned – and the cost quoted were even higher than for the ground source heating – around £21,000 with the internal radiator system on top which would furthermore not be supported by the grant scheme. Also, Community Energy Solutions

particularly wanted a turnkey project and this was not offered by the suppliers who responded. Even with the Low Carbon Buildings Programme 50% grant deducted, this would have still cost £10,500 plus internal radiator system of around £3,000.

As a result of this, Community Energy Solutions decided not to utilise the Low Carbon Building Programme Grant but to turn to a supplier that they'd used previously – Barrier Energy and progress without grant assistance. At the time this supplier was not registered on the Framework Suppliers approved list and so Low Carbon Buildings Programme could not be sought. This company were able to provide a turnkey project for £15,000. As this was a turnkey project, it included everything from preparation work to boiler installation, flue installation and installation of a radiator system.

Community Energy Solutions felt that by not going through the grant funding available, they got better value for money and a better solution for their clients. It is worth a full assessment of this when considering which grants to apply to. This situation is likely to change with the introduction of Feed in Tariffs which are likely to replace some of the grant assistance as the primary financial support mechanism and should help reduce this complexity. For more details on what the Feed in Tariff will involve please see the reference section at the back of this document.

The solution at Gairshield took four years in total to complete. This reflects a) The restricted technical solutions available in the first instance which have since improved (for example the availability of second generation heat pumps which now require lower electrical loads has lessened although not completely removed the challenges over three phase supply) but also b) the need for better knowledge and expertise among the support agencies. At the time there was a need for an expert technical assessment over the best solution for the site but the bodies involved admit that they were learning as they went so the process was inevitably more contorted. All the agencies involved now have more knowledge about the technologies on offer but this knowledge needs to be developed across the board and mainstreamed into training so that communities do not have to provide the learning experience.

At Stonehaugh, project finance was a major challenge as with the change of direction in the project delivery and the open-ended arrangement with the corrupt construction company, the project costs doubled. The final Stonehaugh project cost was over £600,000 and it is a minor miracle that all parties were able to pull together successfully to be able to meet this extension from the original £250,000 budget. Participants stress not to forget all the little pots of funding that can be pieced together. In combination these turn out to be invaluable for levering in larger funds. However, future projects should ensure adequate project costing and project management are in place to avoid the stress of this fundraising effort.

Ongoing fund raising is now needed to finish off minor aspects of the building and furnishing inside although these are mostly unrelated to the renewable energy aspect and include external groundwork planting, wheelchair ramps etc. There was no allocation of costs in the project planning stage for these even though they knew all along that they'd have to do them. Participants stress that this is easier to let slip than might be realised in the consideration of larger costs. A lesson learned would be to make sure you allocate a justifiable and accurate cost to every single part of the project and not just run with the flow on the main costs hoping to resolve what seem like minor

costs later. It is far more likely that costs escalate and so these minor costs will be increasingly difficult to find. This is also a message that emerged from the Bellingham project.

Officers from Government Office for the North East and Tynedale District Council – two of the main funders, were very supportive of Stonehaugh and went through the breakdown of costs with a fine tooth comb to try and offer as much as they could towards what was eligible. It is reported that both parties offered more than just financial support and clearly really wanted to see through the success of the project. There was some disagreement between officers of Tynedale and GONE over communication and perceived support, but the chair of Stonehaugh Community Village Hall Trust couldn't fault either party for offering as much hep as they could within their bounds. GONE even asked for a record of hours that Trust members had spent on the project to try and secure as match funding to draw in additional resources. Unfortunately the community at Stonehaugh were split over the decision not to take the original construction company to court, with half the community feeling injustice at the way they had been treated by the builder and considered the 'out of court settlement' to be a buy out and the other half feeling that the £50,000 and three years, would have compromised completion of the project. As a result of this, many of those originally involved in the project refused to record their hours which GONE advised cost the project £30,000 of lost additional funding that could have been drawn down.

Insurance

In the case of Bellingham, the group couldn't draw down money from the NSP grant until the system was insured but they couldn't insure it until they legally owned it and it wasn't in their legal ownership until it had been commissioned. However, the system couldn't be commissioned until it was fully working because as they suggest you wouldn't want to accept responsibility for it until all the little teething problems had been rectified as things might go wrong. This caused further problems with cash flow and the project officer stresses that grant providers need to talk to the suppliers of these products and be more understanding and flexible about payments arrangements – she feels that this is a problem of administrators playing by the book rather than working with a community to achieve the shared outcome.

Utility Infrastructure Costs

At Gairshields, other than the £6653 awarded by NSP Northumberland Renewable Energy Capital Grant Scheme, Community Energy Solutions and National Energy Action footed the rest of the bill. The cost of upgrading the substation was a major obstacle to the project design. If the project was repeated the first thing the project manager stresses to check would be the scope of the existing electricity supply and ensuring an accurate price for the upgrade was sought if an upgrade was required.

To get an accurate quotation you need to supply details including the 'MPAN' number from the household's personal bill and fill in a series of forms online which have a three week turn around as an individual but if the applicant is an organisation who is seeking permission for bulk properties the turn around for a price is three months. This needs to be built into timescales for feasibility. A question arose as to whether this application process was conducted by the installers of technologies on behalf of the household or whether households were even aware they'd have to fill such an application in. In such

instances connections may be being made without the knowledge of the distribution network operator (NEDL) which might impact on network safety.

National Energy Action strongly feel that individual households should not be responsible for upgrading parts of the distribution network, Northern Energy Distribution Limited feel that if a household wants to connect a new piece of equipment with higher demand than the network is currently set up to cater for, they as a provider should not have to bear the cost of this freely made individual decision. NEDL blame central government for not fast tracking upgrades to the network. At present this is a contentious issue that has reached stalemate.

Revenue Generation

The need to accurately predict revenue returns has already been mentioned. This should become easier with the introduction of 'Feed In Tariffs' but understanding should cover the effect of price fluctuations, supply and demand effects and exchange rate variation which may all affect the long term revenue of a project. In addition, opportunities for additional revenue generation can be explored. Some say that as the first biomass district heating scheme in England, Kielder Community Enterprises Ltd missed an opportunity by not charging for tours of the plant. As the first operational system in the UK they have attracted a lot of interest and this would have provided additional revenue for the project and possibly even increased the sense of pride the project.

Lessons Learned

Consider how your project might manage its cash flow. Even if grants are obtained these are usually paid on receipt of invoice so you will need the money in the bank to start with or a loan to cover the interim payments.

Be aware of different funding deadlines and the pressures to met deadlines might have on the timing of your project. This increases the more funding streams that are utilised so minimising the number of different streams might help. Otherwise try to structure the different sources of funding to match the consecutive development of the project to avoid rushing delivery or muddling commitments.

Allow plenty of time in planning your project and committing timeframes for funding bodies to allow for considered decisions and to account for things going wrong. Do not be tempted to rush importance decisions or fact-finding and speak to funding bodies early about possible extensions in the instances where hold ups arise.

Don't miss opportunities to showcase your project, and explore additional revenue income sources which might help financial viability.

Be vigilant about costing every last aspect of the project, if anything costs are more likely to escalate making later fundraising more and more challenging.

Ensure that you have a good understanding of how forecast revenue costs might change throughout the lifetime of the project and how these might affect the viability of the project.

Try not to let costs escalate, if they do increase, seek additional funding rather than compromising costs in other parts of the project.

Consider carefully whether a particular funding stream will assist you get best value for money, sometimes trusted individual suppliers can offer better value for money but be aware of the additional validity that framework suppliers usually offer if things go wrong.

Be aware of the challenge over insuring projects and the delays that commissioning might cause to this process. Allow plenty of time in the delivery timescale to resolve problems and technical hitches at the commissioning stage so that sign off is not rushed.

If you are connecting to the electricity grid, investigate early the technical capacity that your part of the network has and the costs involved in upgrading it. Check whether there is any planned upgrading to the network. Even if this is planned it is often difficult to get an accurate estimation of when this work might occur. Distributed Network Operators should endeavour to provide as accurate information as possible to those wanting to connect. The regulations ????????? should assist with this process.

Conclusions

Many of the projects examined in the preparation of this publication began many years ago in a climate of knowledge that is very different to the one we are in today. They were ambitious pilots providing pioneering examples of what was possible. Although the Kielder scheme still has technical challenges to overcome it should be given credit as still today being the beacon example of a community district heating scheme in Northumberland and in 2000 was well ahead of its time. Stonehaugh in particular is a fantastic example of a community driven large scale building project. All the schemes are sound projects which serve their rural development, fuel poverty and carbon reduction aims well. It is fantastic that such remote rural villages in Northumberland are able to achieve projects of the scale and significance that they have.

A key feature of all of these projects is the vision and persistence of certain key figures were key to the success of the project and without which such schemes would probably not have gone ahead. However, in terms of community empowerment there are some clear emerging features. Many of these are recurrent themes which have been rehearsed in community development circles for some time, but it seems have still not been fully addressed.

- Kielder has never fully been able to be transferred into community ownership and as such failed to realise its potential. Such failings however were not the result of the energy source – biomass - but a more generic feature of the handling of community capacity and support in isolated rural settlements.

- It is important to remember that the complexities of dealing with a newer or unfamiliar technology is likely to strain relations, capabilities and time allocations in any situation and so any community embarking on this journey should be prepared for this.

- In the case of Gairshields, all parties have agreed that communication between parties throughout this project was not as good as it could have been. Paperwork was lost in some cases and in others not transferred which added to project delays and misunderstandings. As a result of the findings of this and other projects, NEA have developed some guidance fore installers and a series of training courses to increase awareness of suitable application of different technologies. Both parties stress the need for good communication between all parties, to send each other regular updates, be open about problems encountered, delays expected or lack of expertise encountered. The earlier this is identified, the easier the problem can be overcome.

- There is a skills shortage in both communities and support agencies which needs to be addressed.

    - In the case of Stonehaugh and of Kielder, the scale of the projects exceeded the skills and experience sets within these small rural villages. It is in fact unlikely that any remote village of this size would have all the skills that would be required for such a project and so participants have reflected that a dedicated team is really required to support communities through this process. However, the support organisations that are in place

> have admitted that they do not have the expertise in the field of renewable energy to be able to offer support in this area and in some cases the generic advice that is provided by different organisations is contradictory. In going forwards, it is essential that this gap is addressed and a decision as to which sector has responsibility to provide this support needs to be taken.

All the projects spoke of being pleased with the system but glad they've come out the other end of the process. Bellingham in particular speak of the challenges of a lack of knowledge with renewable energy, "It is still a very new industry and people are encouraged to do things with renewables and then get drowned by what is involved and the complexity – it is a minefield, we don't have knowledge or information to negotiate. The system works so on the surface all is in order and the outcomes are good, all our targets have been hit but it's been like a duck paddling frantically under the surface to made it work, we need to find a way of slowing the paddles down so it's not such a panic"[5]. It is hoped that this document provides a start in highlighting some of these issues, it is now imperative that the issues start to be addressed by the relevant agencies and individuals in order that future projects run more smoothly.

[5] Lesley Allen – Project Officer North Tyne and Redesdale Community Development Trust

Recommendations for specific sectors involved for future projects:

For Communities:

- Do try to structure project finance to allow commissioning of an independent feasibility study and make use of grants where available to do this.
- Be honest about your demands of the system, the chosen technology's compatibility with this and your tolerance to the greater involvement that is often required. Pay particular attention to how the system will integrate with other systems already in place.
- Ensure provision for community training is built into bid applications and some form of shadowing/mentoring is undertaken by those involved in developing the project. At least try to talk to as many people who have been through the process as possible.
- Research your fuel supply options (if required) as early as possible and let this guide your system design.
- Consider how you might manage cash flow in advance and discuss this with your funding body.
- Strong leadership to ensure proper project management and financial accountability is in place. Communities need to be very self analytical about their skills set and their internal personalities profiles. Ideally, a session should be convened to assess what each individual can bring to the project, where the gaps are and what their individual potential weaknesses might be. This honest appraisal should lead to the identification of gaps so that the procurement of external skills may be factored into any costing. The temptation to 'make do' in the interests of financial saving should be avoided. This session may require an impartial facilitator.
- Appoint on the basis of recommendations, experience of similar installations and always insist on contracts.
- Appoint a project manager to oversee on site works and ask for a timetable on site works so you know who is on site at any given time.
- Be vigilant about costing every last element of the project. Be prepared for costs to change and don't be tempted to cut corners in the specification when they do.
- Do not sign off the commissioning until you are happy with the work, confident in the operation, have received sufficient training and have repair and warrantee arrangements in place.

- Manage expectations over costs savings/revenue – work on a worst case scenario and be pleasantly surprised rather than disappointed

For Public Sector Authorities:

- Make further support available on the community development side and provide a better signposting service to enable communities to acquire the required skills and learn from previous examples. Funding providers should ensure strong project management is in place as a condition of the funding and monitor this more closely to pick up problems earlier as a responsible lender/spender.

- Grant providers should ensure that guidance is provided on what information is needed from a feasibility study and where funding interventions are made, both grant support and advice provided needs to be thought through strategically to ensure they are complementary and comprehensive and advice is not contradictory.

- A full feasibility of the application of renewable energy should be required in all new developments as part of the regulatory function to facilitate the delivery of national government targets and to preclude the need for the client to conduct a separate study.

- Be as flexible as possible in grant giving situations to allow time to overcome setbacks and get the right system in place.

- The role of local authority support is very important. In many of the examples studied here projects were, to a greater or lesser extent, dependent on the local authority for funding and/or project support. In many cases communities speak of the real sense that officers wanted to see the project through to success and the authority put in many hours of time Where this does occur, it is very positive and reflects very well on the community development function performed. However, support is not always so forthcoming. It is important to recognise the value of this support to a community and to make it available wherever possible. This may not always be in the form of officer support but might also involve referral to an independent facilitator who might find it easier to be frank about the identification of community skills (not the regular development worker) and/or provide a mentoring support role. Supportive staff makes all the difference to the success of a project but be aware that this can never substitute for local ownership.

- Some projects however commented on public sector bodies being prepared to put more and more funding into projects without the necessary support. There is an identified need to develop an 'enabling risk analysis', which avoids the risk averse, bureaucratic reluctance that besets so many public sector bodies but ensures that sufficient support processes and project monitoring are put in place around that funding to allow intervention at the first sign of things going wrong. Several commented on the need for a friendly face coming out to visit the site to conduct project monitoring rather than just relying on self written reports without further follow up, which simply served to tick the box rather than ensure projects were executed well. Such financial support is gratefully received and is very important allowing innovative projects to come forward and flexibility over financial provision is in many

cases important to ensuring that a project succeeds, but this must be complemented by an insistence that sound management processes are in place from the outset.

For Private Sector Suppliers

- For feasibility studies, when discussing the brief, ensure that the work agreed will take the client far enough to progress to the next step. Do not be tempted to tender for work that you know will only go half way – explain to the client why you feel a larger study is required, and stick to this even if they take the work elsewhere. Your reputation is worth more than any individual job.

- Provide training and after-sales care as part of the package – the better the experience of the customer the more recommendations you will receive. Maintain an interest in the success of your product and provide after-sales care, a happy client is key to business development.

- Gain experience in the system installation and ensure you have detailed understanding and experience of the requirements of each system and how different parts interrelate before tendering for a job.

- In the venture into new markets, ensure you have the experience in the products that you are selling. If you do not, be honest with your clients and take steps to fill the knowledge gap through discussion with other market players. Don't over-egg experience to win contracts. If you don't have experience but want to gain it, be honest about this with the client and/or partner with an experienced third party.

- Do not restrict your expertise to the boundary of the system which you are supplying/installing; before you offer a product or service gain sufficient knowledge to integrate it into at least the most common, if not any system that will be encountered. Discuss with other contractors as to how the system will work together overall. Remember your reputation will depend upon the satisfaction of the client with the overall system not just your part of it.

List of Potential Further Advice/ Assistance